APPENDIX A - WIND TURBINE CHARACTERISTICS

Palmer's Creek Wind Turbine Characteristics

	GE 2.3	GE 2.5
Turbine Make	General Electric	General Electric
Nameplate Capacity and Model	2.3 MW - 116	2.5 MW - 116
Base Height	77.3 m	87.5 m
Base Width at Bottom	4.56 m	4.56 m
Base Width at Top	3.09 m	3.09 m
Nacelle Length	9.09 m	9.09 m
Blade Length	56.9 m	56.9 m
Blade Width	2.4 m	2.4 m
Rotor Diameter	380 feet (116 meters)	380 feet (116 meters)
Total Height	452 feet (150 meters)	485 feet (146 meters)
Swept Area	113,411 feet (10,568 meters)	113,411 feet (10,568 meters)
Cut-in Wind Speed	6.7 mph (3 m/s)	6.7 mph (3 m/s)
Cut-out Wind Speed	56 mph (25 m/s)	56 mph (25 m/s)
Rated Wind Speed	85 mph (38 m/s)	85 mph (38 m/s)
Rotor Speed	8-15.7 rpm	8-15.7 rpm

APPENDIX B – NOISE ANALYSIS: PROPOSED PALMER'S CREEK WIND FARM

Noise Analysis

Proposed Palmer's Creek Wind Farm

Prepared for:

Palmer’s Creek Wind Farm, LLC

February 12, 2018

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Definitions

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Definitions

A-Weighting: A-weighting is applied to instrument-measured sound levels in an effort to account for the relative loudness perceived by the human ear

C-Weighting: C-weighting measures uniformly over the frequency range of 30 to 10,000 Hz. This weighting scale is useful for monitoring sources such as engines, and machinery

dBA: A-weighted decibel level

dBC: C-weighted decibel level

L_{10}: Statistical noise level that is exceeded 10% of the time in a defined time frame

L_{50}: Statistical noise level that is exceeded 50% of the time in a defined time frame, or the arithmetic mean of all data in a defined time frame.

L_{eq}: When a noise varies over time, the Leq is the equivalent continuous sound which would contain the same sound energy as the time varying sound

LA_{eq}: A-weighted equivalent continuous sound

LC_{eq}: C-weighted equivalent continuous sound

MW: Megawatt, unit of power equivalent to 1 million watts, commonly used for classifying outputs of wind turbines.

NOAA: National Oceanic and Atmospheric Administration

Pascal (Pa): Unit of air pressure, normal atmosphere is equal to 101,325 Pa

I. Purpose

Palmer's Creek Wind Farm, LLC has proposed the installation of 18 wind turbines for the Palmer's Creek Wind Farm Project just north of Granite Falls, MN. The boundaries of the proposed wind farm are 100th Street SE to the north, 30th Avenue SE to the east, Palmer Creek Road to the south, and Palmer Creek to the west. The area of study can be found in **Figure 1**. This report details the existing conditions found within the proposed project limits and also the modeled results for a single configuration of turbines upon the identified receptors.

II. Noise

Any unwanted sound is called noise. Sound is carried through the air in compression waves of measurable frequency and amplitude. Sound can be tonal, predominating at a few frequencies, or it can contain a random mix of a broad range of frequencies and lack any tonal quality. This type of noise is often called white noise.

The human ear is sensitive to only a relatively narrow frequency range of air pressure changes – approximately 20-20,000 cycles per second or Hertz (Hz). Sub-audible frequency sound is often called infrasound. It cannot be heard, but it may be sensed as a vibration. Humans are also sensitive to changes in the amplitude of the air compression waves. Increasing amplitude, or increasing sound pressure, is perceived as increasing volume or loudness. The sound pressure level (SPL) is measured in micro Pascals (μPa). SPLs are typically converted to decibels (dB), which is a log scale, relative to a reference air pressure value of 20 μPa. When measuring sound, A-weighted decibels (dBA) are typically used to normalize readings to equal loudness over the audible range of frequencies at low loudness. **Table 1** shows a range of sound pressure levels and the associated Noise sources.

Table 1 – Decibel Levels of Common Noise Sources

Sound Pressure Level (dBA)	Noise Source
140	Jet Engine (at 25 meters)
130	Jet Aircraft (at 100 meters)
120	Rock and Roll Concert
110	Pneumatic Chipper
100	Jointer/Planer
90	Chainsaw
80	Heavy Truck Traffic
70	Business Office
60	Conversational Speech
50	Library
40	Bedroom
30	Secluded Woods
20	Whisper
Source: "A Guide to Noise Control in Minnesota," MPCA	

Along with the volume of the noise source there are other factors (such as topography of the area) that contribute to the loudness of noise. The distance of a receptor from a sound's source is also an important factor. Sound levels decrease as distance from a source increases. The following rule of thumb regarding sound decreases due to distance is commonly used: beyond approximately 50 feet, each time the distance between a source and a receptor is doubled, sound levels decrease by three decibels over hard ground (such as pavement or water) and by 4.5 decibels over vegetated areas.

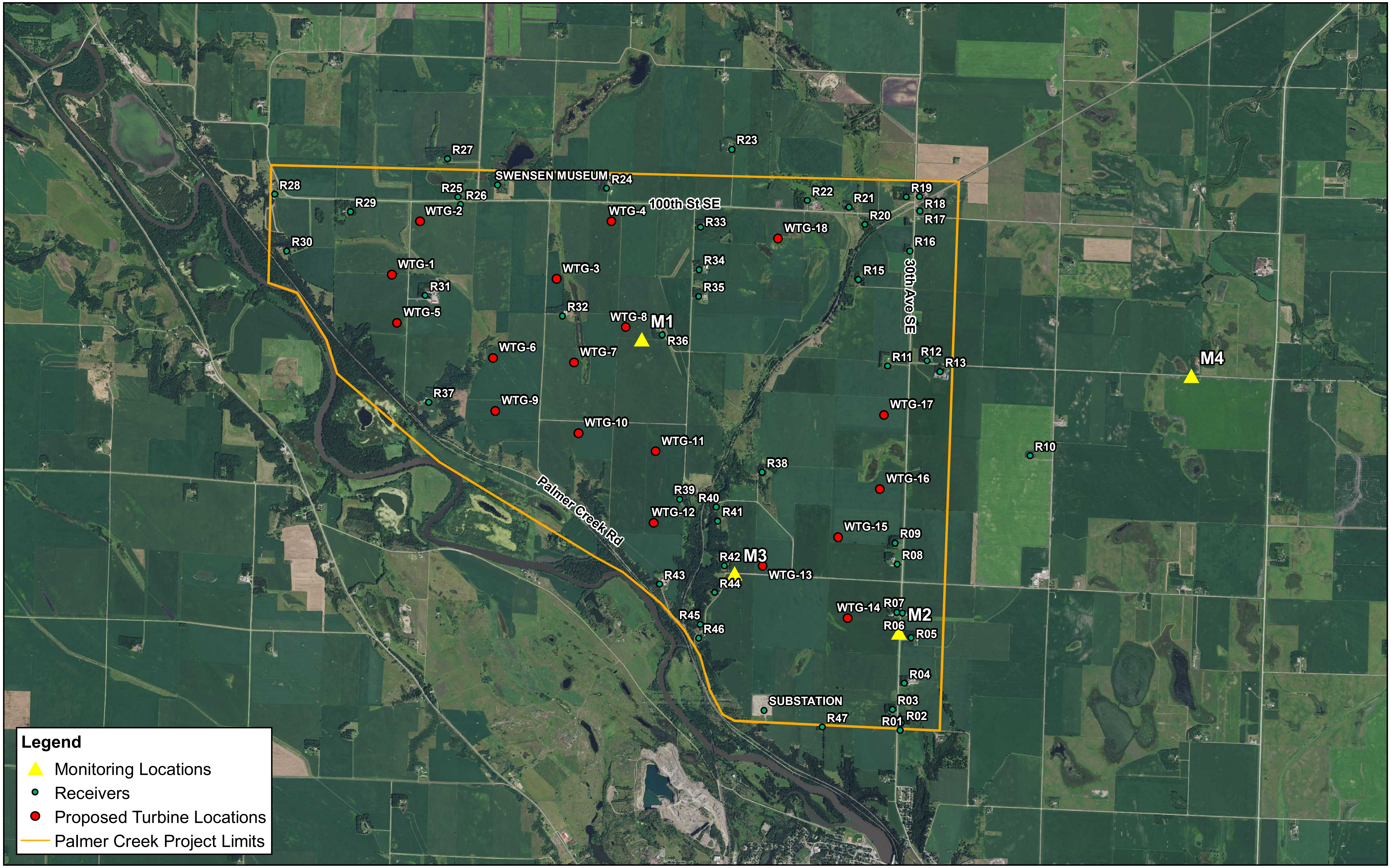

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Figure 1 - Project Limits & Monitoring Locations

Palmer's Creek Wind Farm

Fagen Engineering

N

0 3,600 Feet

1 inch = 3,781 feet

WSB

A. Noise from Wind Turbines

Mechanical Noise

Mechanical noise from a wind turbine is sound that originates in the generator, gearbox, yaw motors (that intermittently turn the nacelle and blades to face the wind), tower ventilation system, and transformer. Generally, theses sounds are limited in new wind turbines so that they are a negligible fraction of the aerodynamic noise. Mechanical noise from the turbine or gearbox would only be heard above aerodynamic noise when they are not functioning properly.

Aerodynamic Noise

Aerodynamic noise is caused by wind passing over the blade of the wind turbine. As wind passes over a moving blade, the blade interrupts the laminar flow of air, causing turbulence and noise. Unexpectedly high aerodynamic noise can be caused by improper blade angle or improper alignment of the rotor to the wind. This is correctable and is usually adjusted during the turbine break-in period. This is the primary source of noise produced by wind turbines. Wind turbines are generally quiet enough for people to hold a normal conversation while standing at the base of the tower.

Modulation of Aerodynamic Noise

Rhythmic modulation of noise, especially low frequency noise, is also perceptible by the human ear. To a receptor on the ground in front of the wind turbine, the detected blade noise is loudest as the blade is at the bottom of its rotation, and quietest when the blade is at the top of its rotation. For a modern 3-blade turbine, this distance-to-blade effect can cause a pulsing of the blade noise about once per second (1 Hz). The distance-to-blade effect diminishes as receptor distance increases because the relative difference in distance from the receptor to the top or bottom of the blade becomes smaller.

Another source of rhythmic modulation may occur if the wind through the rotor is not uniform. Horizontal layers with different wind speeds or directions can form in the atmosphere. This wind condition is called shear. If the winds at the top and bottom of the blade rotation are different, blade noise will vary between the top and bottom of blade rotation, causing modulation of aerodynamic noise.

Wind Farm Noise

The noise from multiple turbines similarly distant from a residence can be noticeably louder than a lone turbine through the addition of multiple noise sources. Under steady wind conditions, noise from a wind turbine farm may be greater than noise from the nearest turbine due to synchrony between noise from more than one turbine. If the dominant frequencies of different turbines vary by small amounts, an audible dissonance may be heard when wind conditions are stable.

B. Assessment and Regulation

The Minnesota Pollution Control Agency (MPCA) is given power to adopt noise standards in Minnesota Statute 116.07 Subd. 2. The adopted standards are given in Minnesota Administrative Rules Chapter 7030. The MPCA standards require A-weighted noise measurements. Different standards are specified for daytime (7:00 AM – 10:00 PM) and nighttime (10:00 PM – 7:00 AM) hours. The noise standards specify the maximum allowable noise volumes that may not be exceeded for more than 10 percent of any hour (L_{10}) and 50 percent of any hour (L_{50}). Household units, including farm houses, are included in Noise Area Classification (NAC)-1. **Table 2** shows the MPCA State noise standards. All the land within the project area is considered NAC-1.

Table 2 - MPCA State Noise Standards – Hourly A-Weighted Sound Levels

Land Use	NAC: Noise Area Classification	Exterior Hourly Noise Livel Limit, dBA			
		Daytime		Nighttime	
		7:00 am to 10:00 pm		10:00 pm to 7:00 am	
		L10	L50	L10	L50
Residential	NAC-1	65	60	55	50
Commercial	NAC-2	70	65	70	65
Industrial	NAC-3	80	75	80	75
Notes,					
1. NAC-1 includes household units, transient lodging and hotels, educational, religious, cultural entertainment, camping, and picnicking land uses					
2. NAC-2 includes retail and resturants, transportation terminals, professional offices, parks, recreational and amusement land uses					
3. NAC-3 includes industrial, manufacturing, transportation facilities (except terminals), and utilities land uses					
4. From Minnesota Pollution Control Agency, Minn. Rules sec 7030.0040					

Since wind farms generate a relatively constant noise volume, the anticipated noise from wind farms are typically reported in terms of an equivalent sound level (L_{eq}) that has the same energy and A-weighted level as the community noise over a given time interval rather than reporting both L_{10} and L_{50}. When describing relatively constant sound levels, the L_{10} and L_{50} values will be roughly equal. This equivalent sound level is most appropriately compared to the State L_{50} standards. The difference between L_{eq} and L_{50} is mathematically similar to the difference between the mean and the median for a data set. These values will be roughly equal for data sets without extreme values or statistical outliers (such as wind turbine noise).

III. Monitoring Conditions & Methodology

Noise monitoring was conducted at four sites; three within the project area and a fourth that is outside (but nearby) the project area. All four noise monitors were left to collect data for seven days (January 3 to January 10, 2017) at locations that represent the receptors within the project area. The monitoring locations can be found in **Figure 1**. The conditions for the seven days were typical of a Minnesota winter, with temperatures in the single digits and snow on two of the seven days.

Each of the three locations within the project limits (M1-M3) was picked to represent typical distances from receptors to the proposed turbines and were all within public road right-of-way. As required by the LWECS Guidance for Noise Study Protocol and Report, one of the monitoring locations (M1) was located in proximity to the worst-case receptor as predicted by the model (R36). Since the topographical surroundings of the project area are predominately flat, distance from the proposed turbines was the most important factor in collecting the existing conditions. Monitoring location M2 was selected because it represents a total of six receptors in proximity to five proposed turbines on the east edge of the project boundary. Monitoring location M3 was selected because it represents a receptor that may be impacted by at least six proposed turbines. Monitoring location M4 was selected for its similarity to the existing conditions found at the other three monitoring locations, such as near an impacted receptor on a township road.

Each of the monitoring sites was equipped with a Larson Davis 831 Precision Integrating Sound Level Meter that meets compliance with the following American National Standards Institute (ANSI) regulations:

- S1.4-1983 (R2006) Type1
- S1.4A-185 (10Hz-26kHz)
- S1.43-1997 (R2007) Type 1

- S1.11-2004: 1/1 & 1/3 Octave Band Class 0
- S1.25-1991 (R2002)

The microphones attached to the monitoring units were mounted to tripods at a height of at least 3 feet above the ground. Monitoring units were calibrated prior to, and following, the monitoring period. A Vaisala weather station was attached to each of the monitoring locations to record not only wind speed and direction, but also temperature, barometric pressure, humidity, and precipitation. The weather data are included in each of the noise measurements recorded by the Larson Davis 831 units. The average wind speed for the one-hour measurement histories varied between calm conditions and 19 miles per hour with gusts over 30 miles per hour in some cases. Wind direction was typically out of the west or west-southwest. Temperatures remained low and varied from -16°F to 27°F with the coldest conditions in the first three days of collection. There was no rain recorded but the M1 weather station recorded trace amounts of precipitation on January 10. NOAA data reported up to an inch of snow falling in the area between January 9 and January 10.

The instrumentation was set up to collect the following noise values:

- 1/3 Octave Band Data
- A – Weighted Time History (60 second)
- A-Weighted Measurement History (1 hour)
- C-Weighted Time History (60 second, L_{min}, L_{max} and L_{eq} only)
- C-Weighted Measurement History (1 hour, L_{min}, L_{max} and L_{eq} only)

All data from the noise monitors were downloaded and exported to Excel spreadsheets for analysis. Data points were collected every 60 seconds and supplemented with a 60-minute measurement history that is used to represent the monitoring data results.

Graphs were created from the seven days of data for each monitoring location to compare noise levels to wind speed and create a reasonable expectation for background noise while modeling the proposed turbine locations. The following values were used for the graphs based on protocol found in the Minnesota Department of Commerce's LWECS Guidance for Noise Study Protocol and Report:

- LA_{eq}
- LC_{eq}
- L_{10} (A-Weighted)
- L_{50} (A-Weighted)
- L_{90} (A-Weighted)
- Wind Speed

The graphs can be found in **Figures 2, 3, 4,** and **5.**

The 21-amp batteries powering the noise monitors had to be replaced on January 7 due to the extreme cold conditions experienced at each of the sites. During this process, it was found that the off-site monitor (site M4) had stopped recording data for a period of nearly 54 hours. This was due to battery failure caused by the cold conditions. The unit was able to resume recording data after the batteries were exchanged, but then failed again during the afternoon of January 9. The data in **Figure 5** indicates these gaps. Data gaps are not uncommon when monitoring noise for long periods of time. These gaps in data can be caused by natural events that the MPCA requests be removed from data analysis (e.g., wind speeds in excess of 11 mph, rain events) or mechanical failure. Although some data loss was experienced, there was enough data collected on January 3, 4, 7, 8 and 9 to provide an accurate portrayal of ambient noise for this off-site location. Site M1 also experienced a short gap in data near the end of the collection period on the afternoon of January 9 and during the morning of January 10. This was found to be also due to low battery power caused by cold weather over the course of the final three days of data collection. The data collected during between January 3 and January 9 is sufficient to provide an accurate portrayal of the ambient noise in that location.

Figure 2 – Noise Monitoring Results, Site M1

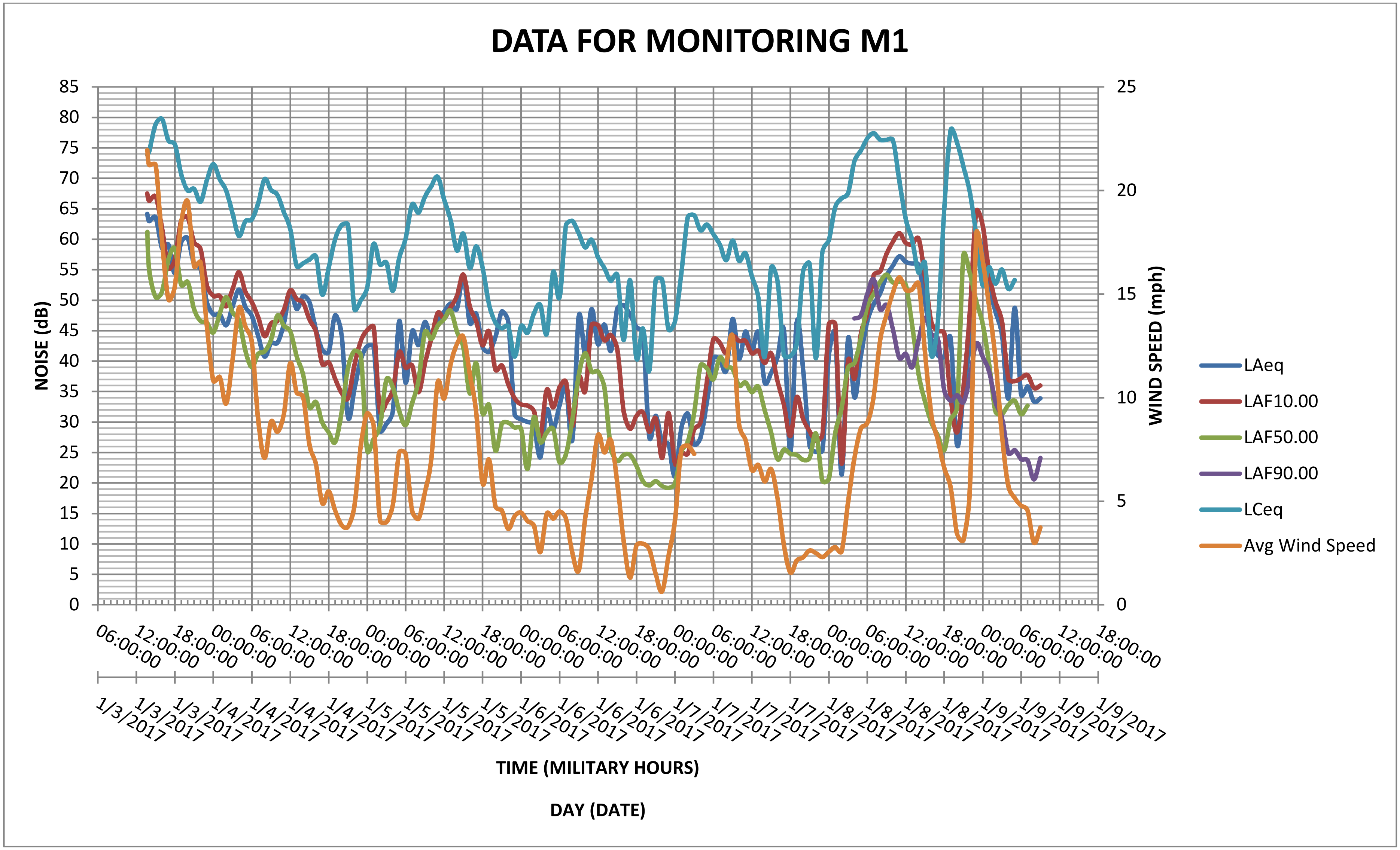


Figure 3 – Noise Monitoring Results, Site M2

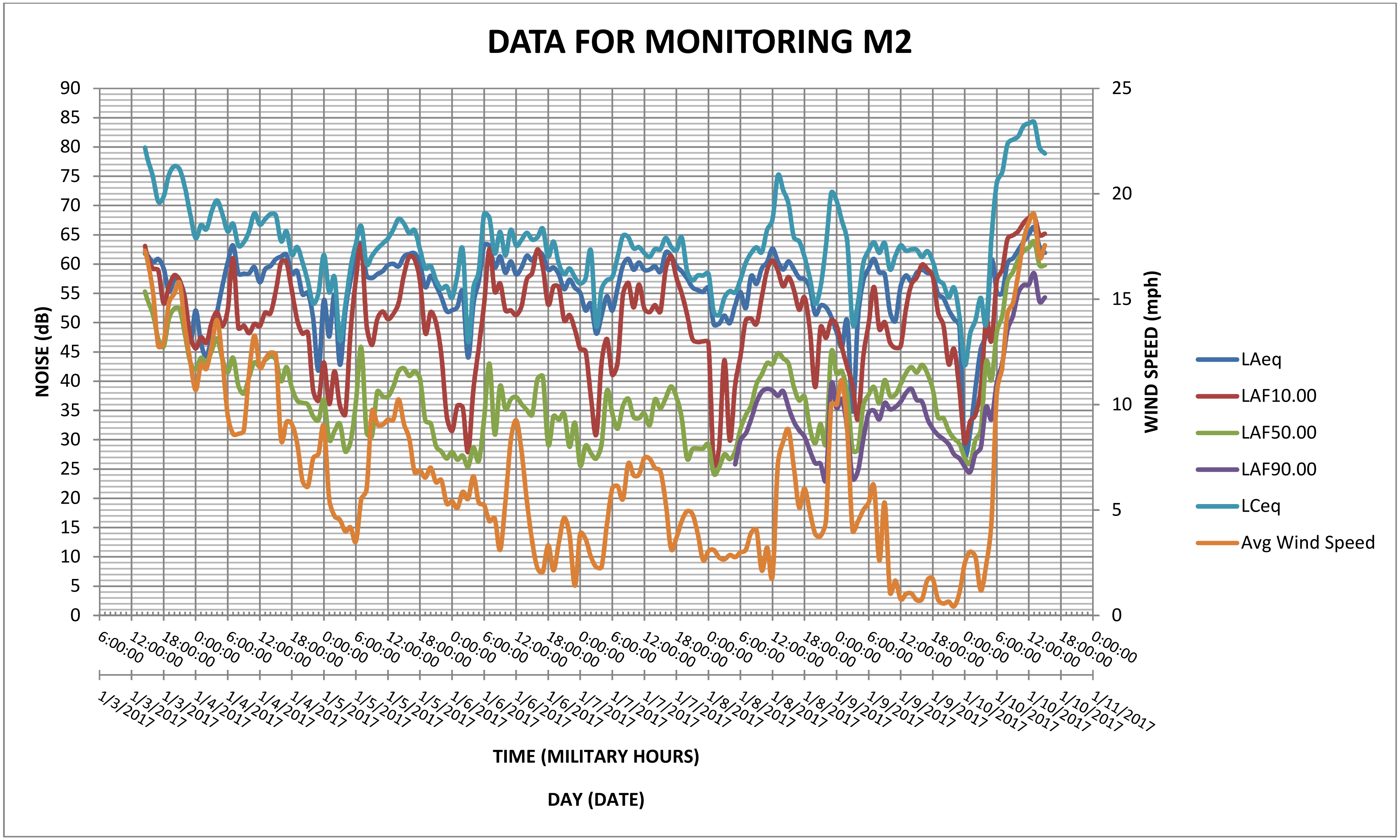


Figure 4 – Noise Monitoring Results, Site M3

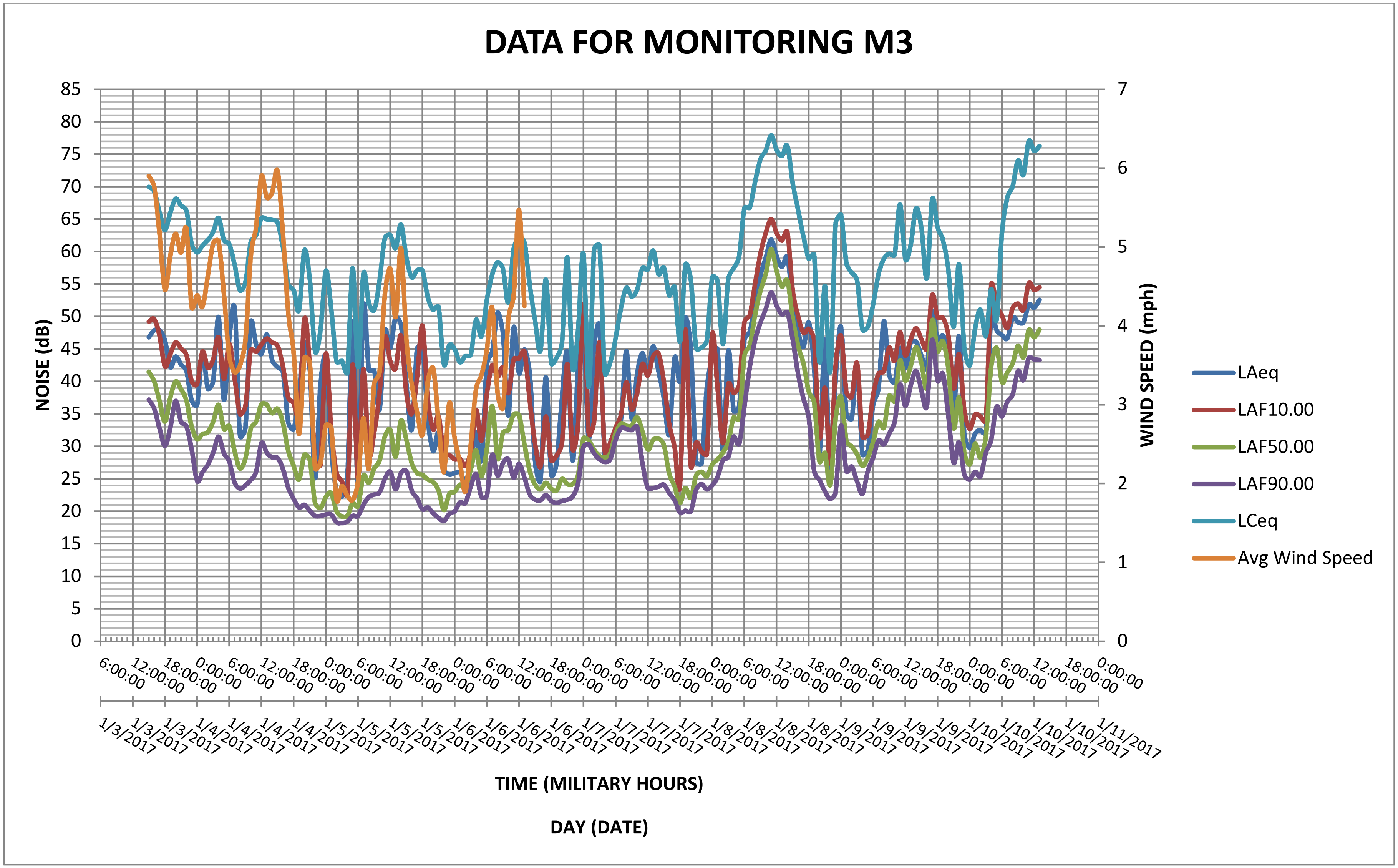
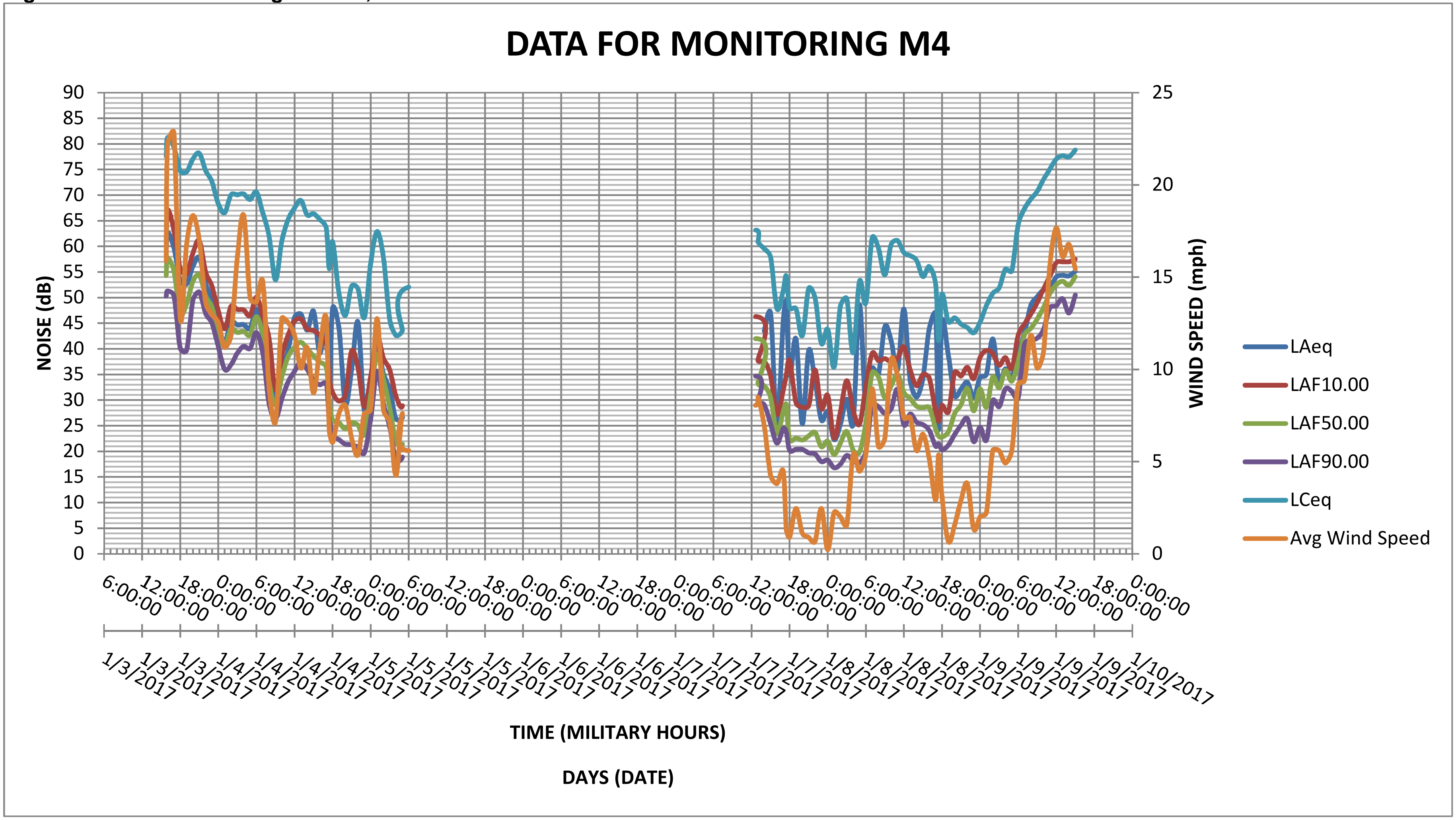


Figure 5 – Noise Monitoring Results, Site M4



IV. Comparison to Minnesota Noise Standards

Figures 6, 7, 8 and **9** show the hourly L_{10} and L_{50} values over the seven days with any measurements indicating wind speeds over 11 miles-per-hour (mph) removed. Wind speeds in excess of 11 mph may distort sound; therefore those measurements are removed at the request of MPCA. With a few exceptions, the existing sound levels at most sites are below Minnesota standards for daytime and nighttime L_{10} and L_{50} values. Site M1 experienced a spike at 3:00 PM on January 3. The Granite Falls area experienced nearly 3.5 inches of snowfall on January 1 and January 2. This spike could be attributed to snowplows operating near the monitoring equipment. Site M3 experienced a spike in noise around noon on January 8. The spike in noise reached the threshold for the daytime L_{10} standard and exceeded the L_{50} standard. This spike could be explained by the proximity of railroad tracks to the site. Nighttime L_{50} standards are also already exceeded at Site M1 during the early morning hours of January 9. The spike could also be attributed to snow removal equipment since Granite Falls experienced 6.5 inches of snowfall between January 9 and January 10. The L_{10} and L_{50} range for each of the monitoring sites is found below in **Table 3**. Existing sound levels that exceed the State Noise Standards are bolded.

Table 3 – Daytime and Nighttime Noise Monitoring Results

Time Period	Location	L_{10} Range (dBA)	L_{50} Range (dBA)	L_{eq} Range (dBA)
Daytime 7:00 AM to 10:00 PM	M1	27.7 - **67**	20.3 – **61.2**	25.1-63.6
	M2	39 - 63.1	26.8 - 45.8	50.3-66.3
	M3	24 - 65	21.3 - **60.4**	24.8-61.9
	M4	25.9 - 51.7	22.2 - 48.1	25.4-62.7
Nighttime 10:00 PM to 7:00 AM	M1	23.2 - **57.7**	18.2 - **51.2**	21.1-60.3
	M2	25.9 - **57.4**	24.2 - 48.4	27.6-63.2
	M3	22.6 - 54.8	19.2 - 45.2	22.3-50.1
	M4	22.6 - 42.6	19.4 - 37.5	22.3-52.7
MN State Standards		L_{10}	L_{50}	L_{eq}
Daytime		65	60	N/A
Nighttime		55	50	N/A

Figure 6 - Noise Monitoring Results, Site M1 L_{10} and L_{50} Values Only

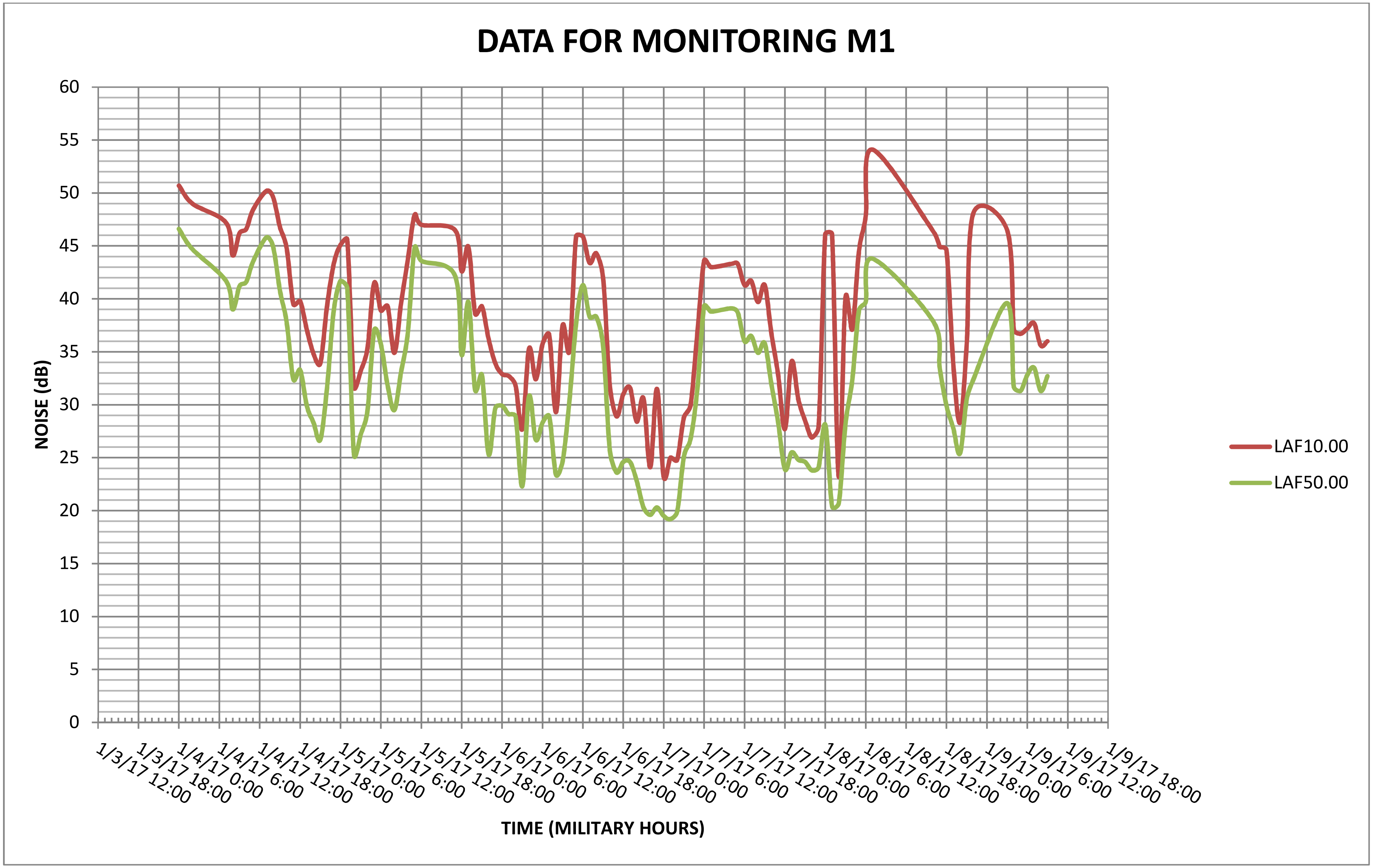


Figure 7 - Noise Monitoring Results, Site M2 L_{10} and L_{50} Values Only

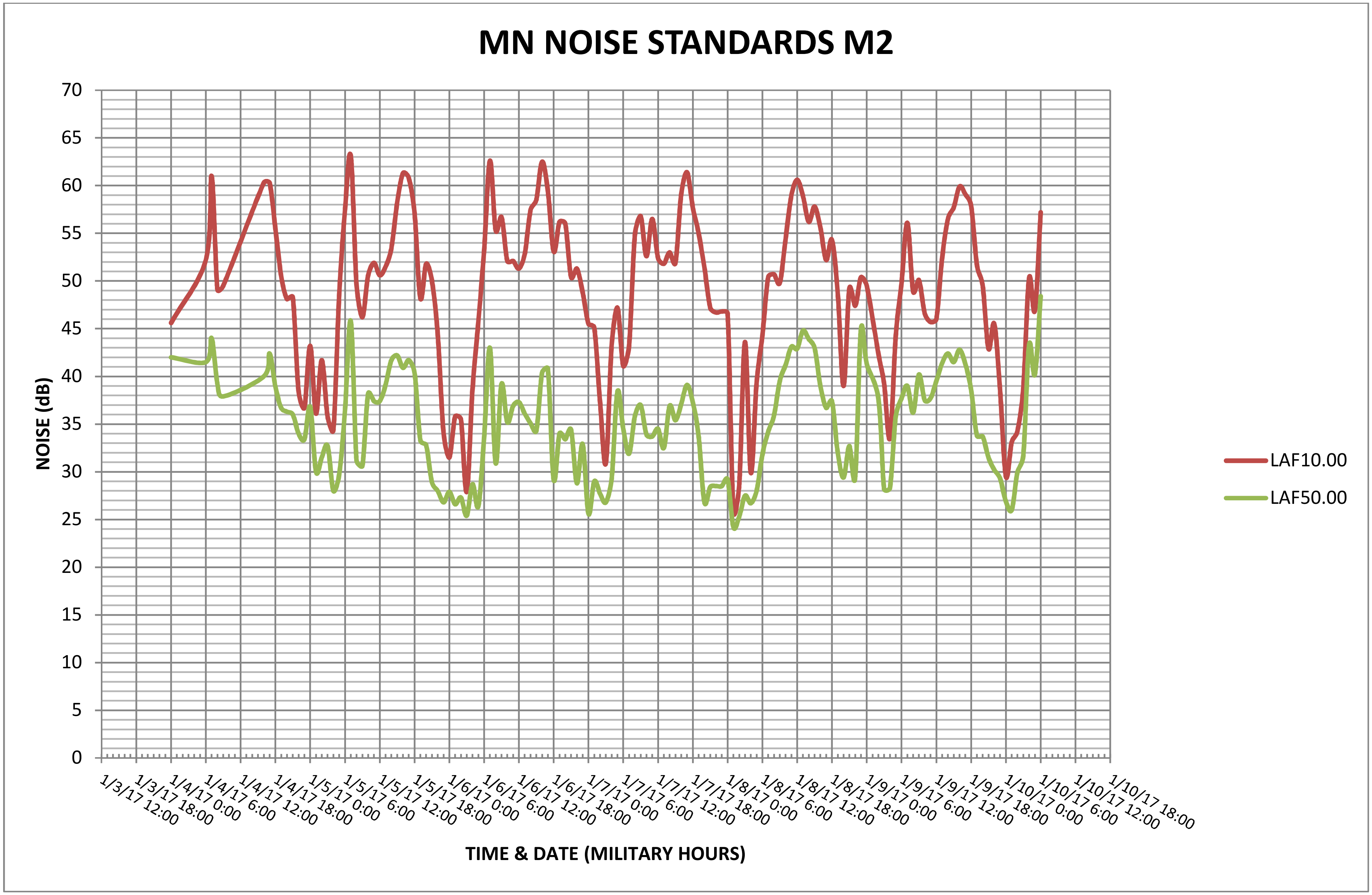


Figure 8 - Noise Monitoring Results, Site M3 L_{10} and L_{50} Values Only

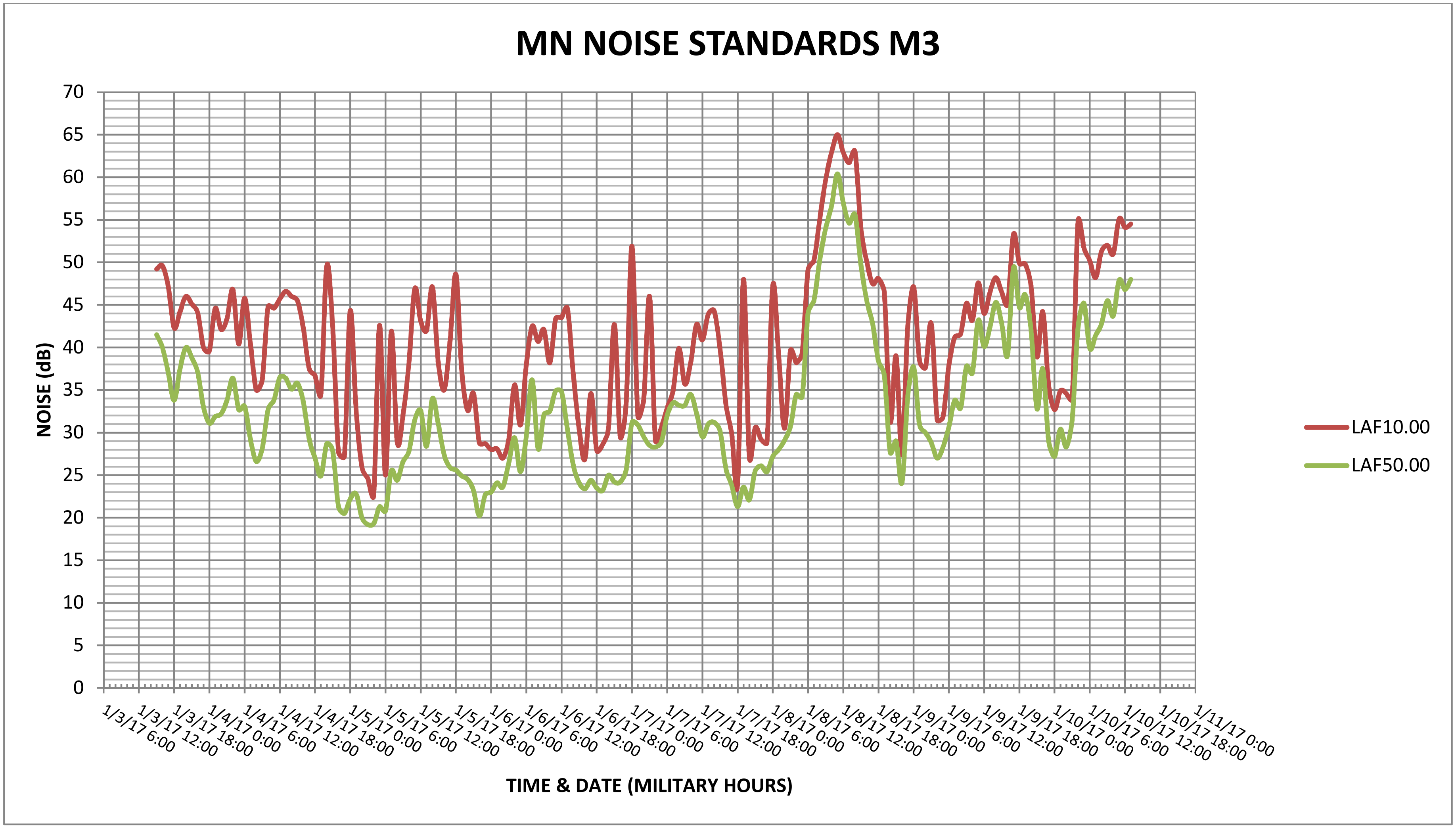
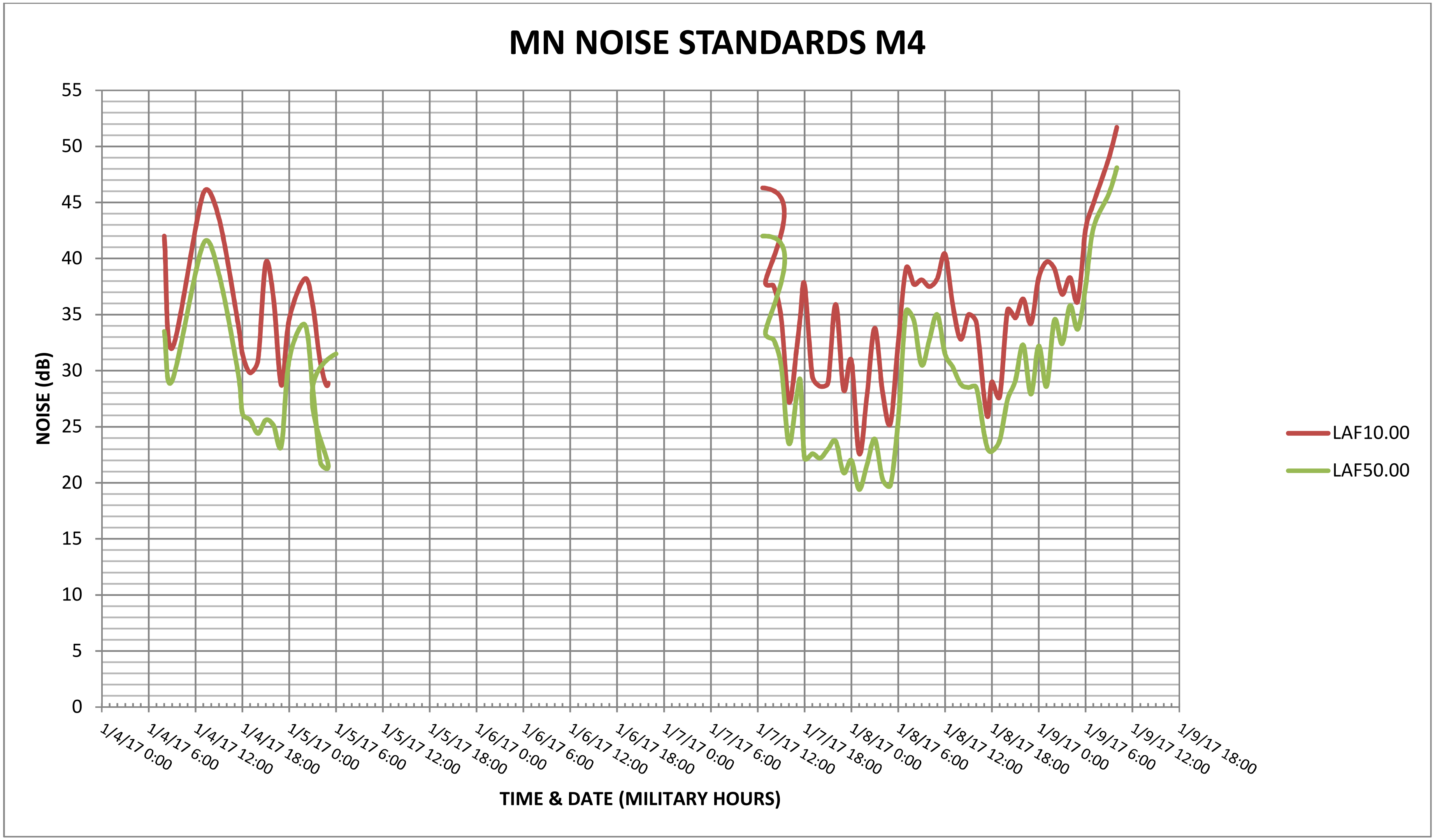


Figure 9 - Noise Monitoring Results, Site M4 L_{10} and L_{50} Values Only



V. Modeling and Results

Along with the noise data collected in the field, a model of the proposed turbines and existing receptors was created to determine the impact of the proposed wind farm. CadnaA software was used for analysis and assumes the attenuation of sound propagation as specified by the International Organization for Standardization (ISO) Standard 9613-2 and a ground attenuation factor of 0.5. Turbine locations were provided by Palmer's Creek Wind Farm, LLC. The turbines modeled were 16 General Electric (GE) 2.5-116 and two GE 2.3-116 that produce 2.5 and 2.3 MW respectively. The model included the following scenario:

1. Two 2.3 MW turbines at an 80-meter hub-height (WTG-14 and WTG-15) with the remaining 2.5 MW turbines at a 90-meter hub-height.

The 2.5 MW turbines are projected to generate an apparent maximum sound level of 107 dB per the manufacturer's specifications adjacent to the turbine hub, and the 2.3 MW turbines will generate a maximum 107.5 dB output per the manufacturer's specifications (also adjacent to the turbine hub). All conditions were modeled slightly above these specifications at 109 dB.

The worst-case noise output would produce the sound contours found in **Figure 10**. The resultant noise produced drops below 50 dBA at distances greater than approximately 160 meters (500 feet). Turbines WTG-3, WTG-7 and WTG-8 will generate the greatest noise impact on Receptor R32. The overall noise at Receptor R32 was predicted to be 45.1 dBA. This is due to Receptor R32's proximity to three turbines; 1,355 feet to WTG-3, 1,740 feet to WTG-7 and 2,335 feet to WTG-8.

Figure 11 and represents the sound contours predicted by the construction of the 18 turbines in the single scenario. These contours only represent the turbine-generated sound and do not include any cumulative noise from existing background sources. The existing background noise is not known for each specific receptor. Due to this unknown, values of 25, 30 35, 40, 45, 50, 55 and 60 dBA were used to depict varying degrees of existing noise. This is consistent with the results of the noise monitoring data in the previous section of the report, which showed the existing hourly L_{eq} noise levels at monitoring locations within the project area to range between 24.8-66.3 dBA during the day and 22.3-63.2 dBA during the night. The resultant noise from the turbines on each receptor was added to the eight projected background noise levels, and the summary of Scenario 1 can be found in **Table 4**.

The largest noise increase possible within the model was to be 20.1 dBA at R32 if the existing hourly L_{eq} is 25 dBA. This means that in exceptionally quiet hours, the model shows turbine noise is very noticeable. However, the model is based on maximum output from the turbines which is associated with high wind speeds. In this condition, ambient noise from the wind will be much higher. When looking at the wind speed data collected at site M1 (closest to R32), wind speeds were less than 3 mph during the quietest measured Leq values (<30 dBA). Typically, these wind speeds would be below the cut-in wind speed (6.7 mph or 3 m/s) required for turbine operation. When higher wind speeds of 8-9 miles per hour at microphone height were examined, the background L_{eq} noise was approximately 45-50 dBA. This wind speed is below conditions that would produce maximum turbine noise. Even when maximum noise output is added to a background L_{eq} noise of 45 dBA, the difference is calculated to be 3.1 dBA, which is just slightly greater than increases in noise that are perceptible to the human ear (3.0 dBA).

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Figure 10 - Closest Reciever to Turbine Impact
Palmer's Creek Wind Farm
Fagen Engineering

N

0 650 Feet
1 inch = 936 feet

WSB

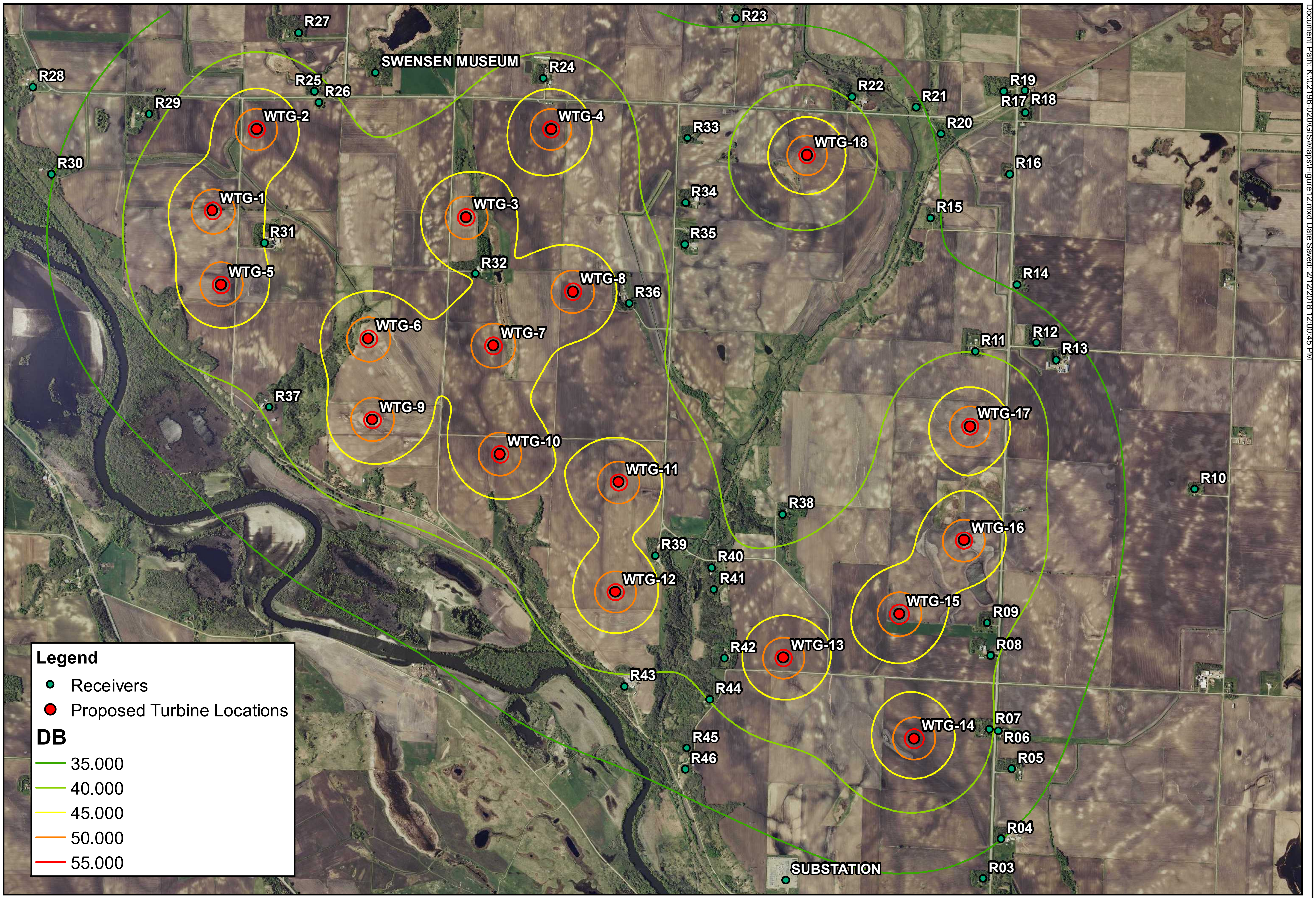

Figure 11 - Turbine Scenario 1

2.3 WM Turbines at 80m Hub Height, 2.5 MW Turbines at 90m Hub Height

Palmer's Creek Wind Farm

Fagen Engineering

N

0 3,000 Feet

1 inch = 3,000 feet

WSB

Table 4 – Noise Modeling Results (Scenario 1)

Receptor ID	Turbine Impact (Calculated)	Background Sound Levels + Turbine Impact (dBA)							
		25.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0
R01	31.7	32.5	33.9	36.7	40.6	45.2	50.1	55.0	60.0
R02	32.2	33.0	34.2	36.8	40.7	45.2	50.1	55.0	60.0
R03	33.5	34.1	35.1	37.3	40.9	45.3	50.1	55.0	60.0
R04	35	35.4	36.2	38.0	41.2	45.4	50.1	55.0	60.0
R05	37.6	37.8	38.3	39.5	42.0	45.7	50.2	55.1	60.0
R06	39.6	39.7	40.1	40.9	42.8	46.1	50.4	55.1	60.0
R07	40.4	40.5	40.8	41.5	43.2	46.3	50.5	55.1	60.0
R08	40.5	40.6	40.9	41.6	43.3	46.3	50.5	55.2	60.0
R09	41.6	41.7	41.9	42.5	43.9	46.6	50.6	55.2	60.1
R10	31.6	32.5	33.9	36.6	40.6	45.2	50.1	55.0	60.0
R11	39.9	40.0	40.3	41.1	43.0	46.2	50.4	55.1	60.0
R12	37	37.3	37.8	39.1	41.8	45.6	50.2	55.1	60.0
R13	36.9	37.2	37.7	39.1	41.7	45.6	50.2	55.1	60.0
R14	34.7	35.1	36.0	37.9	41.1	45.4	50.1	55.0	60.0
R15	35.4	35.8	36.5	38.2	41.3	45.5	50.1	55.0	60.0
R16	32.2	33.0	34.2	36.8	40.7	45.2	50.1	55.0	60.0
R17	30.6	31.7	33.3	36.3	40.5	45.2	50.0	55.0	60.0
R18	30.1	31.3	33.1	36.2	40.4	45.1	50.0	55.0	60.0
R19	30.9	31.9	33.5	36.4	40.5	45.2	50.1	55.0	60.0
R20	34.6	35.1	35.9	37.8	41.1	45.4	50.1	55.0	60.0
R21	35.5	35.9	36.6	38.3	41.3	45.5	50.2	55.0	60.0
R22	39.5	39.7	40.0	40.8	42.8	46.1	50.4	55.1	60.0
R23	34.6	35.1	35.9	37.8	41.1	45.4	50.1	55.0	60.0
R24	43.1	43.2	43.3	43.7	44.8	47.2	50.8	55.3	60.1
SWENSEN MUSEUM	38	38.2	38.6	39.8	42.1	45.8	50.3	55.1	60.0
R25	41.3	41.4	41.6	42.2	43.7	46.5	50.5	55.2	60.1
R26	41.5	41.6	41.8	42.4	43.8	46.6	50.6	55.2	60.1
R27	37.8	38.0	38.5	39.6	42.0	45.8	50.3	55.1	60.0
R28	32.4	33.1	34.4	36.9	40.7	45.2	50.1	55.0	60.0
R29	39	39.2	39.5	40.5	42.5	46.0	50.3	55.1	60.0
R30	34.8	35.2	36.0	37.9	41.1	45.4	50.1	55.0	60.0
R31	44.9	44.9	45.0	45.3	46.1	48.0	51.2	55.4	60.1
R32	45.1	45.1	45.2	45.5	46.3	48.1	51.2	55.4	60.1
R33	38.4	38.6	39.0	40.0	42.3	45.9	50.3	55.1	60.0
R34	38.8	39.0	39.3	40.3	42.5	45.9	50.3	55.1	60.0
R35	39	39.2	39.5	40.5	42.5	46.0	50.3	55.1	60.0

Receptor ID	Turbine Impact (Calculated)	Background Sound Levels + Turbine Impact (dBA)							
		25.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0
R36	43.2	43.3	43.4	43.8	44.9	47.2	50.8	55.3	60.1
R37	40.5	40.6	40.9	41.6	43.3	46.3	50.5	55.2	60.0
R38	39.2	39.4	39.7	40.6	42.6	46.0	50.3	55.1	60.0
R39	44.1	44.2	44.3	44.6	45.5	47.6	51.0	55.3	60.1
R40	40.9	41.0	41.2	41.9	43.5	46.4	50.5	55.2	60.1
R41	41.2	41.3	41.5	42.1	43.7	46.5	50.5	55.2	60.1
R42	42.7	42.8	42.9	43.4	44.6	47.0	50.7	55.2	60.1
R43	39.1	39.3	39.6	40.5	42.6	46.0	50.3	55.1	60.0
R44	40.1	40.2	40.5	41.3	43.1	46.2	50.4	55.1	60.0
R45	37	37.3	37.8	39.1	41.8	45.6	50.2	55.1	60.0
R46	36.1	36.4	37.1	38.6	41.5	45.5	50.2	55.1	60.0
R47	33.1	33.7	34.8	37.2	40.8	45.3	50.1	55.0	60.0
SUBSTATION	33.3	33.9	35.0	37.2	40.8	45.3	50.1	55.0	60.0

VI. Conclusion

WSB collected noise and meteorological data at four different sites representing the proposed Palmer's Creek Wind Farm. For monitoring locations within the proposed project area, the existing hourly L_{eq} noise levels range between 24.8-66.3 dBA during the day and 22.3-63.2 dBA during the night. The existing sound levels met or exceeded State daytime noise standards at monitoring location 3, and met or exceeded nighttime noise standards at monitoring locations 1 and 2.

The worst case receptor scenario was modeled to determine the sound-related impact of the proposed wind farm. **Table 5** provides a summary of the sound impacts predicted under the worst case receptor scenario. The highest predicted increase in L_{eq} sound level is shown as 20.1 dBA. However, this is misleading as turbine noise would be reduced or absent in calm conditions associated with these quieter time periods. A more realistic condition would be a background L_{eq} value of 45 dBA or greater associated with wind speeds needed for normal turbine operation. For background L_{eq} values of 45 dBA, the increase in noise when the maximum turbine output is applied is calculated to be 3.1 dBA at Receptor 32. Changes in sound levels less than 3 dBA are barely perceptible to the human ear (Bolt, Beranek and Newman, Inc., 1973). With an increase of 3.1 dBA, the turbines may be noticeable to the human ear, but are close to physical perception limits.

Table 5: Summary of Scenario 1 Noise Impacts

Background Sound L_{eq} (dBA)	Highest Cumulative Sound L_{eq} (dBA)	Change in Sound Level (dBA)
25	45.1	20.1
30	45.2	15.2
35	45.5	10.5
40	46.3	6.3
45	48.1	3.1
50	51.2	1.2
55	55.4	0.4
60	60.1	0.1

In Minnesota, the MPCA State Noise Standards (L_{50}) restrict noise levels to 60 dBA during the daytime and 50 dBA during the nighttime. The analysis indicates that construction of the Palmer's Creek Wind Farm project will not have an impact of 60 dBA or greater on any modeled receptor, nor will the cumulative impact on any receptor exceed 60 dBA when assuming a 35 dBA, 40 dBA, 45 dBA, 50 dBA, or 55 dBA background sound level. During the daytime, and only with a background sound level already approaching or exceeding the 60 dBA threshold would the cumulative sound level (background and wind turbine sound) exceed 60 dBA. The same is true for the nighttime threshold; only with a background sound level already approaching or exceeding the 50 dBA threshold would the cumulative sound level exceed 50 dBA.

VII. References

Bolt, Beranek and Newman, Inc., Fundamentals and Abatement of Highway Traffic Noise, Report No. PB-222-703. Prepared for Federal Highway Administration, June 1973.

APPENDIX C – WILDLIFE ASSESSMENT AND FIELD STUDIES REPORT

Wenck File #B2759-0005-02
January 2018

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

Prepared by:

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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 a final report that contains data collected from June 29, 2016 to June 16, 2017 for avian surveys and from fall 2015 through October 16, 2017 for the bat acoustic monitoring.

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 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 were conducted by a qualified biologist and were conducted for one calendar year to capture temporal variation in eagle use of the study area.

1.4 RAPTOR AND EAGLE NEST SURVEYS

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

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 experienced 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).

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 predict 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 was collected in 1-minute intervals so that the data could 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 sampling point consisted 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 was collected within 800-m-radius plots, but flight lines were documented across line-of-sight and were not limited to the 800-m-redius survey plot. Detailed protocol study-specific data sheets and a data management plan were utilized in the field.

Surveys were conducted once per month during the non-migration months (April-August), and conducted at a minimum of twice per month during the migration months (September-March) starting July 2016 and concluded in June 2017 for a total of 20 survey weeks. Individual surveys consisted 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 occurred in all weather conditions except when visibility was poor. The eagle use surveys were 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 2017	
Survey Number	*Survey Date*	*Survey Number*	*Survey Date*	*Survey Number*	*Survey Date*	*Survey Number*	*Survey Date*	*Survey Number*	*Survey Date*
1	7/28/2016	3	9/7/2016	10	12/14/2016	16	3/7/2017	19	5/18/2017
2	8/22/2016	4	9/22/2016	11	12/27/2016	17	3/21/2017	20	6/16/2017
		5	10/6/2016	12	1/9/2017	18	4/13/2017		
		6	10/17/2016	13	1/26/2017				
		7	10/31/2016	14	2/9/2017				
		8	11/15/2016	15	2/24/2017				
		9	11/29/2016						

2.2.1 Eagle Fatality Estimates

Data collected from the eagle use surveys was analyzed to determine the probability of eagle collision. The project-specific and turbine-specific estimates of eagle fatality followed the Eagle Conservation Plan Guidance Module 1- Land-based Wind Energy, Version 2 from the U.S. Fish and Wildlife Service (FWS) Division of Migratory Bird Management, April 2013. The survey data and the hazardous area were used to estimate eagle fatalities per year.

The probability of raptor collision assuming the eagle occupies the same cell as a wind turbine is:

$$P_{col} = P_{fh} \times P_{rsa} \times P_{BAND} \times (1 - P_{av})$$

Where:

- $P_{col} = Probability\ of\ bald\ eagle\ collision$
- $P_{fh} = Probability\ of\ flying\ at\ a\ height\ of\ the\ rotor$
- $P_{rsa} = \ Probability\ of\ the\ eagle\ passing\ the\ area\ affected\ by\ the\ rotor$: $\frac{\pi \times r^2}{2r \times w}$ with r = rotor radius and w = cell width, assumed to be 100m
- $P_{BAND} = Probability\ of\ being\ hit\ while\ flying\ through\ the\ rotor$
- $P_{av} = Probability\ that\ the\ eagle\ recognizs\ the\ threat\ and\ actively\ avoids\ colision$

2.2.2 Eagle Mean Internest Distance

Eagle pairs that nest within one-half the mean project-area inter-nest distance are potentially susceptible to disturbance take and blade strike mortality, as these pairs and offspring may use the project footprint (USFWS 2013). The Eagle Conservation Plan Guidance (ECPG) recommends using the ½-MID to delineate territories and associated breeding eagles at risk of mortality or disturbance.

The eagle mean internest distance (MID) is defined as the mean nearest-neighbor distance between simultaneously occupied eagle nests (USFWS 2013). This was calculated by measuring the distance between the three (3) active eagle nests observed during the aerial surveys and the historical nest identified by the MN DNR, this resulted in four (4) nests analyzed to calculate the MID (**Figures 5** and **6**). All distances were added (four total) and divided by four (4) to determine the MID, that number was divided in half to determine the ½ MID.

2.3 GROUND AND AERIAL RAPTOR AND EAGLE NEST SURVEYS

2.3.1 Ground Raptor and Eagle Nest Surveys

During spring 2016 and 2017, a ground raptor nest survey was conducted to locate raptor nests, and determine nest activity status and the species using those nests. The initial surveys were conducted before trees leaf out to locate nests and identify early breeding species. The project area and a 1-mile buffer was surveyed from a vehicle using binoculars and spotting scopes. All raptor nest locations were documented with Global Positioning System (GPS) coordinates. Raptor species, height of nest, nest activity status, nest condition, substrate, and other relevant data were recorded for each nest. An additional visit was conducted if nests were 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 (*Buteo swainsoni*). 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. One of these nests (located in T116N, R40W, Section 11) was previously identified by the MNDNR as a historical bald eagle nest. During the 2017 nesting season, this nest was occupied by a red-tailed hawk.

An additional bald eagle nest was located Spring 2016 by Fagen. This nest was active in 2016 and 2017 and located in T116N R39W Section 20, outside of the project area boundary. Fagen staff monitored this nest in 2016 and 2017 until all eaglets fledged (Michael Rutledge, Fagen, Inc., Personal Communication, December 2017). This nest was monitored for two 8-hour days/week during nesting season. "Local" flight data was recorded but not reported. "Local" flights were those where the birds merely changed perching locations within the immediate area. Flight vectors were reported for 8 compass points with the nest area at the center point (N, NE, E, SE, S, SW, W, NW). "A non-local" flight reported as being in any given vector when the flight either originated in the nest area and terminated out of view, or originated out of view and terminated in the nest area. Two data points are reported for each vector: Total Flights and Food Bearing Flights.

2.3.2 Aerial Raptor and Eagle Nest Surveys

The objective of the aerial eagle nest surveys is to locate and record nests that may be in the proximity of the project area, identify concentration and density of eagle nests, and identify nests that may be vulnerable to disturbance and/or displacement effects by the Project. The intent of the nest survey is to gather information on species nesting in the area, including nest locations, nesting season (timing), and nest success.

The survey was conducted within a ten-mile buffer from the project area (defined as the analysis area). Eagle Aviation Inc. was contracted to fly an aerial survey of the project area on April 20, 2017. A Cessna Skyhawk with two observers (Ray Jilek, Eagle Aviation Pilot and Justin Askim, Wenck biologist) were used during the survey. Complete coverage of the project area was obtained by systematically flying over the landscape and visually scanning all areas for potential roosting, nesting and foraging eagles (**Figure 4**). Aerial surveys were conducted using a fixed-wing aircraft, flying over relatively even terrain at approximately 250 – 500 feet above ground level and at speeds of 85 to 125 miles per hour.

2.4 ACOUSTIC BAT SURVEYS

2.4.1 2015 and 2016 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.

2.4.2 2017 Surveys

Data was gathered in the field within the study area from four different Anabat acoustic detectors and two Wildlife Acoustics SM3BAT full spectrum bat detectors. The detectors gathered data from March 27, 2017 through October 16, 2017. 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 were 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.

3.1.1 Species Composition

The summer 2016 and summer 2017 surveys consisted of 875 avian individuals (46 different species) that were recorded during the eight fixed-PC surveys (**Table 3a**). The most frequently observed birds were brown-headed cowbird (*Molothrus bonariensis*), (15.54 percent of all birds observed), red-winged blackbird (*Agelaius phoeniceus*), (14.74 percent) and barn swallow (*Hirundo rustica*), (12.79 percent) (**Table 3a**). The remaining 43 species comprised approximately 57.03 percent of the total birds observed.

The fall 2016 survey consisted of 1,702 avian individuals (39 different species) that were recorded during the eight fixed-PC surveys (**Table 3b**). The most frequently observed birds were American crow (*Corvus brachyrhynchos*), (14.63 percent of all birds observed), red-winged blackbird, (12.04 percent), and brown-headed cowbird, (11.69 percent) (**Table 3b**). The remaining 36 species comprised approximately 61.63 percent of the total birds observed.

The winter 2016-2017 survey consisted of 822 avian individuals (18 different species) that were recorded during the eight fixed-PC surveys (**Table 3c**). The most frequently observed birds were European starling (*Sturnus vulgaris*), (41.24 percent of all birds observed), snow bunting, (*Plectrophenax nivalis*) (13.26 percent), and wild turkey, (*Meleagris gallopavo*) (11.19 percent) (**Table 3c**). The remaining 15 species comprised approximately 34.31 percent of the total birds observed.

The spring 2017 survey consisted of 1,714 avian individuals (42 different species) that were recorded during the eight fixed-PC surveys (**Table 3d**). The most frequently observed birds were European starling, (28.80 percent of all birds observed), red-winged blackbird, (17.98 percent), American crow (11.22 percent), and Canada goose (*Branta canadensis*), (10.56 percent) (**Table 3d**). The remaining 36 species comprised approximately 31.44 percent of the total birds observed.

Cumulatively, surveys identified 5,368 avian individuals (64 different species) that were recorded during the eight fixed-PC surveys (**Table 4**). The most frequently observed birds were European starling, (19.63 percent of all birds observed/1,054 individuals), red-winged blackbird, (12.82 percent/688 individuals), American crow, (10.54 percent/566 individuals), brown-headed cowbird, (6.99 percent/375 individuals), and Canada goose, (6.48

percent/348 individuals) (**Table 4**). The remaining 59 species comprised approximately 43.54 percent of the total birds observed.

3.1.2 Avian Use

Summer 2016 and summer 2017 overall mean bird use was 13.67 birds/20 min (**Table 5**). The overall mean use by non-raptors was 13.53 birds/20 min; the highest mean use was brown-headed cowbird (2.13 birds/20 min), red-winged blackbird (2.02 birds/20 min), and barn swallow (1.73 birds/20 min) (**Table 5**). 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 0.14 birds/20 min; the highest mean use was turkey vulture (*Cathartes aura*) (0.08 birds/20 min), red-tailed hawk (*Buteo jamaicensis*) (0.05 birds/20 min), and Swainson's hawk (*Buteo swainsoni*) (0.02 birds/20 min) (**Table 5**). For the species groups, overall mean use was highest for songbirds (10.97 birds/20 min) (**Table 5**).

Fall 2016 overall mean bird use was 17.73 birds/20 min (**Table 5**). The overall mean use by non-raptors was 17.27 birds/20 min; the highest mean use was American crow (2.59 birds/20 min), red-winged blackbird (2.14 birds/20 min), and brown-headed cowbird (2.07 birds/20 min) (**Table 5**). The mean use for raptors/vultures/owls was 0.46 birds/20 min; the highest mean use was red-tailed hawk (0.20 birds/20 min), bald eagle (*Haliaeetus leucocephalus*) (0.10 birds/20 min), and turkey vulture (0.07 birds/20 min) (**Table 5**). For the species groups, overall mean use was highest for songbirds (10.73 birds/20 min) (**Table 5**).

Winter 2016-2017 overall mean bird use was 17.13 birds/20 min (**Table 5**). The overall mean use by non-raptors was 16.96 birds/20 min; the highest mean use was European starling (7.06 birds/20 min), snow bunting (2.27 birds/20 min), and wild turkey (1.92 birds/20 min) (**Table 5**). The mean use for raptors/vultures/owls was 0.17 birds/20 min; the highest mean use was red-tailed hawk (0.13 birds/20 min), Swainson's hawk (0.02 birds/20 min), and northern harrier (*Circus hudsonius*) (0.02 birds/20 min) (**Table 5**). For the species groups, overall mean use was highest for songbirds (11.44 birds/20 min) (**Table 5**).

Spring 2017 overall mean bird use was 24.61 birds/20 min (**Table 5**). The overall mean use by non-raptors was 23.96 birds/20 min; the highest mean use was European starling (7.09 birds/20 min), red-winged blackbird (4.43 birds/20 min), American crow (2.76 birds/20 min), and Canada goose (2.60 birds/20 min) (**Table 5**). The mean use for raptors/vultures/owls was 0.65 birds/20 min; the highest mean use was red-tailed hawk (0.21 birds/20 min), bald eagle (0.21 birds/20 min), and turkey vulture (0.20 birds/20 min) (**Table 5**). For the species groups, overall mean use was highest for songbirds (15.95 birds/20 min) (**Table 5**).

Cumulative overall mean bird use for all surveys was 18.64 birds/20 min (**Table 5**). The overall mean use by non-raptors was 18.25 birds/20 min; the highest mean use was European starling (3.66 birds/20 min), red-winged blackbird (2.39 birds/20 min), American crow (1.97 birds/20 min), brown-headed cowbird (1.30 birds/20 min), and Canada goose (1.21 birds/20 min) (**Table 5**). The mean use for raptors/vultures/owls was 0.39 birds/20 min; the highest mean use was red-tailed hawk (0.16 birds/20 min), turkey vulture (0.10 birds/20 min), and bald eagle (0.09 birds/20 min) (**Table 5**). For the species groups, overall mean use was highest for songbirds (12.35 birds/20 min) (**Table 5**).

3.1.3 Frequency of Occurrence

During the summer 2016 and summer 2017 surveys, the most common species present during the surveys was the red-winged blackbird (34.38 percent of all surveys), which was widely distributed throughout the project area (**Tables 6** and **7a**). Other frequently occurring species included barn swallow (32.81 percent of all surveys), American goldfinch (*Spinus tristis*) (29.69 percent of all surveys), and field sparrow (*Spizella pusilla*) (26.56 percent of all surveys) (**Table 6**).

During the fall 2016 surveys, the most common species present during the surveys was the blue jay (*Cyanocitta cristata*) (27.08 percent of all surveys), which was widely distributed throughout the project area (**Tables 6** and **7b**). Other frequently occurring species included American crow (23.96 percent of all surveys), field sparrow (22.92 percent of all surveys), and rock pigeon (*Columba livia*) (17.71 percent of all surveys) (**Table 6**).

During the winter 2016-2017 surveys, the most common species present during the surveys was the American crow (31.25 percent of all surveys), which was widely distributed throughout the project area (**Tables 6** and **7c**). Other frequently occurring species included European starling (20.83 percent of all surveys), rock pigeon (20.83 percent of all surveys), and blue jay (18.75 percent of all surveys) (**Table 6**).

During the spring 2017 surveys, the most common species present during the surveys was the horned lark (*Eremophila alpestris*) (37.50 percent of all surveys), which was widely distributed throughout the project area (**Tables 6** and **7b**). Other frequently occurring species included Canada goose (25.00 percent of all surveys), and American crow (23.75 percent of all surveys (**Table 6**).

Cumulatively, the most common species present during the surveys was the field sparrow (13.54 percent of all surveys (**Tables 6** and **8**). Other frequently occurring species included blue jay (13.19 percent of all surveys), red-winged blackbird (11.81 percent of all surveys), American goldfinch (11.46 percent of all surveys), and American crow (10.07 percent of all surveys (**Table 6**).

3.1.4 Flight Height and Encounter Rate

During the summer 2016 and summer 2017 surveys, 73.14 percent of all individuals observed were flying (**Table 10**). Flight height and flight direction data was recorded for all the flying birds (**Table 11**). Approximately 0.00 percent of flying raptor species flew above the RSA, 44.44 percent flew below the RSA, and 55.56 percent flew within the RSA. For all other species, 0.00 percent flew above the RSA, 98.89 percent flew below the RSA, and 1.11 percent flew within the RSA (**Table 9**). The turkey vulture and American white pelican (*Pelecanus erythrorhynchos*) were the two highest encounter rates of 0.06 respectively (**Table 10**).

During the fall 2016 surveys, 81.43 percent of all individuals observed were flying (**Table 10**). Flight height and flight direction data was recorded for all the flying birds (**Table 11**). Approximately 34.21 percent of flying raptor species flew above the RSA, 39.47 percent flew below the RSA, and 26.32 percent flew within the RSA. For all other species, 4.47 percent flew above the RSA, 85.88 percent flew below the RSA, and 9.65 percent flew within the RSA (**Table 9**). Species with the highest encounter rate were as follows:

unknown blackbird (*Turdus sp.*) (0.42), red-winged blackbird (0.27), American crow (0.23) and ring-billed gull (*Larus delawarensis*) (0.18) (**Table 10**).

During the winter 2016-2017 surveys, 80.78 percent of all individuals observed were flying (**Table 10**). Flight height and flight direction data was recorded for all the flying birds (**Table 11**). Approximately 12.50 percent of flying raptor species flew above the RSA, 62.50 percent flew below the RSA, and 25.00 percent flew within the RSA. For all other species, 1.07 percent flew above the RSA, 91.77 percent flew below the RSA, and 7.16 percent flew within the RSA (**Table 9**). The species with the highest encounter rate was the unknown duck (*Anatidae sp.*) (0.96) (**Table 10**).

During the spring 2017 surveys, 87.05 percent of all individuals observed were flying (**Table 10**). Flight height and flight direction data was recorded for all the flying birds (**Table 11**). Approximately 11.54 percent of flying raptor species flew above the RSA, 23.08 percent flew below the RSA, and 65.38 percent flew within the RSA. For all other species, 1.14 percent flew above the RSA, 85.32 percent flew below the RSA, and 13.54 percent flew within the RSA (**Table 9**). The Canada goose and American crow were the two highest encounter rates of 1.44 and 0.61 respectively (**Table 10**).

Cumulatively, 82.04 percent of all individuals observed were flying (**Table 10**). Flight height and flight direction data was recorded for all the flying birds (**Table 11**). Approximately 18.52 percent of flying raptor species flew above the RSA, 33.33 percent flew below the RSA, and 48.15 percent flew within the RSA. For all other species, 3.21 percent flew above the RSA, 87.73 percent flew below the RSA, and 9.05 percent flew within the RSA (**Table 9**). Species with the highest encounter rate were as follows: Canada goose (0.40), American crow (0.25), unknown duck (0.18) and unknown blackbird (0.14) (**Table 10**).

3.1.5 Sensitive Species Observations

Protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act, the Bald Eagle had 21 observations that included 27 individuals within the project area during the avian point count surveys and 7 observations that included 8 individuals within the project area recorded during the incidental surveys (**Table 4** and **Table 12**). During aerial nest surveys, 2 eagle nests were observed just to the west of the project area.

The Minnesota State Wildlife Action Plan (SWAP) Species of Greatest Conservation Need List (SGNL) includes several bird species observed in the project area (MNDNR 2015). No federal or state listed species were present in the project area. The American white pelican, a Species of Special Concern (SPC), was observed (3 observations, 16 individuals) during the avian surveys. The pelicans were flying within the RSA (**Table 4**). Several studies have shown the American white pelican has increased in abundance across its range over the past 20-25 years (Wires et al. 2005; Evans and Knopf 1993). This species is a colonial nesting species that selects large, shallow bodies of water with flat bare islands isolated from human disturbance (Coffin and Pfannmueller 1988). Nonlisted species (NL) are included on the SWAP for reasons of population decline or significant breeding or winter populations in Minnesota. Species that are NL that were observed within the project area include bobolink (*Dolichonyx oryzivorus*), belted kingfisher (*Megaceryle alcyon*), field sparrow (*Spizella pusilla*), northern harrier (*Circus cyaneus*), sedge wren (*Cistothorus platensis*), Swainson's hawk (*Buteo swainsoni*), upland sandpiper (*Bartramia longicauda*), western meadowlark (*Sturnella neglecta*), and the yellow-headed blackbird (*Xanthocephalus xanthocephalus*) (**Table 4**).

IPaC identified seventeen (17) Birds of Conversation Concern that have the probability of using the project area. During the avian point count surveys only one these species was observed within the project area. This species was the bobolink (1 observation, 1 individual) (USFWS 2017).

3.1.6 Flight Direction

The summer 2016 and summer 2017 surveys indicated that birds were generally flying in variable directions (60.94 percent). Specific directions of flight and respective percentages are as follows: northwest (8.13 percent), west (7.97 percent), north (5.16 percent), south (4.84 percent), southeast (4.22 percent), east (3.44 percent), northeast (3.28 percent), and southwest (2.03 percent) (**Table 11**).

The fall 2016 surveys indicated that birds were generally flying in variable directions (31.17 percent). Specific directions of flight and respective percentages are as follows: south (20.20 percent), southeast (14.29 percent), southwest (10.25 percent), north (7.50 percent), west (6.13 percent), east (5.84 percent), northwest (3.03 percent), and northeast (1.59 percent) (**Table 11**).

The winter 2016-2017 surveys indicated that birds were generally flying in variable directions (65.96 percent). Specific directions of flight and respective percentages are as follows: north (10.39 percent), southeast (8.28 percent), south (5.12 percent), west (4.37 percent), northeast (2.56 percent), northwest (1.81 percent), southwest (0.90 percent), and east (0.60 percent) (**Table 11**).

The spring 2017 surveys indicated that birds were generally flying in variable directions (51.55 percent). Specific directions of flight and respective percentages are as follows: west (14.36 percent), northwest (9.40 percent), north (8.17 percent), south (5.90 percent), southeast (3.39 percent), east (3.09 percent), northeast (2.36 percent), and southwest (1.52 percent) (**Table 11**).

Cumulatively, the surveys indicated that birds were generally flying in variable directions (48.67 percent). Specific directions of flight and respective percentages are as follows: south (10.13 percent), west (9.33 percent), north (7.86 percent), southeast (7.68 percent), northwest (6.06 percent), southwest (4.25 percent), east (3.63 percent), and northeast (2.38 percent) (**Table 11**).

3.1.7 Incidental Surveys

Staff documented seven species and a total of 45 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 12** below.

Table 12. Cumulative Palmer's Creek Incidental Point Count Data										
Species	Summer 2016 & 2017		Fall 2016		Winter 2016-2017		Spring 2017		Cumulative	
	Observations	Individuals	Observations	Individuals	Observations	Individuals	Observations	Individuals	Observations	Individuals
Red-tailed Hawk	4	4	8	8	0	0	9	9	21	21
American Kestrel	0	0	1	1	0	0	2	3	3	4
Bald Eagle	1	1	1	1	1	1	4	5	7	8
Northern Harrier	1	1	1	1	0	0	4	4	6	6
Northern Pintail	0	0	1	1	0	0	0	0	1	1
American White Pelican	0	0	0	0	0	0	1	6	1	6
Turkey Vulture	3	5	1	1	0	0	2	2	6	8
Totals	**9**	**11**	**13**	**13**	**1**	**1**	**22**	**29**	**45**	**54**

3.2 EAGLE USE SURVEYS

Eagle use surveys documented 19 bald eagles with 87 flight minutes, and 78.9 percent of the individuals were flying within the RSA. Most of these eagles have been observed within one mile of the Minnesota River along point count locations 1, 2, 3 and 4 (**Figure 2** and **Table 13**).

Table 13. Eagle Point Count Results									
	Points								Totals
	1	2	3	4	5	6	7	8	
Total Individuals	1	1	10	7	0	0	0	0	19
Individuals Flying	1	1	10	7	0	0	0	0	19
IndividualsFlying Above RSA	0	0	0	0	0	0	0	0	0
Individuals Flying Within RSA	0	1	9	5	0	0	0	0	15
Individuals Flying Below RSA	1	0	1	2	0	0	0	0	4
Total Flight Minutes	2	3	65	17	0	0	0	0	87

Eagles were observed less than 1 percent of the survey time period (87 minutes observed/9,600 survey minutes). Of the 87 minutes in which eagles were observed, 78 minutes of observations were made with eagles flying within the RSA. The eagle point count surveys are reflective of the eagle data collected during the avian point count surveys, with a relatively low encounter rate of 0.03 respectively (**Table 10**).

3.2.1 Eagle Fatality Estimates

Based on 160 1-hour surveys from July 28, 2016, through June 16, 2017, Wenck observed 19 Bald Eagles during the eagle use surveys. Project-specific and turbine-specific estimates of eagle fatality were calculated following the Eagle Conservation Plan Guidance Module 1- Land-based Wind Energy, Version 2 from the U.S. Fish and Wildlife Service (FWS) Division of Migratory Bird Management, April 2013. Using survey data, the hazardous area, Wenck estimated a potential eagle fatality amount of 0.1-0.5 fatalities per year. This constitutes a Stage 2 Assessment of potential project impacts to bald eagles. Note that these calculations do not account for the proportion of the project area that is hazardous. The 18 turbines represent a hazardous area of 0.14-0.76% of the 6,150-acre project footprint.

All the observed eagles were within or below the rotor sweep area (RSA) and are considered in the eagle fatality calculations. The turbine is assumed to be 80-90 meters tall with a rotor diameter of 116 meters. The radius is therefore approximately 58 meters. There were an additional eight incidental observations of bald eagles over the surveys. Most of the bald eagles were observed along the Minnesota River and all from point count locations 1, 2, 3, and 4.

Based on the eagle survey, the probability of flying at a height of the rotor is 78.95%, equivalent to 15 of the 19 eagles observed flying within the rotor sweep area height.

Using a rotor radius of 58 meters, P_{rsa} was calculated to be 0.911. This is higher than the example from Eichhorn 2012 of $P_{rsa} = 0.65$ due to the rotor length being longer for the Palmer's Creek site than in the example.

To estimate the probability of a bird being hit when flying through the rotor, we used a spreadsheet Band Collision Risk Model published by the Scottish National Heritage and calculated the probability of collision both upwind and downwind. Since the upwind probability of collision is higher, it was used in the final analysis as a conservative measure. Inputs to the model include 3 turbine blades, a maximum chord length of 2.431 m, 30^{o} pitch, bird length of 0.9144 m, wingspan of 1.9812 m, assuming a gliding eagle at 13.4 m/s. The upwind P_{BAND} is 0.167.

The probability of avoidance is high for bald eagles (USFWS 2009 and 2013). We included values of 95%, 98%, and 99%.

The calculated P_{col} ranges from 0.0007 for the downwind condition at 99% avoidance to 0.006 for the upwind condition with 95% avoidance. The P_{col} without including the probability of avoidance is 0.12. For the final eagle fatality analysis, a 98% probability of avoidance was used.

3.2.1.1 Exposure Rate

The next step is to determine the exposure rate. During the 160 counts consisting of 20 1-hour surveys at each of 8 locations, 19 eagles were observed with a total of 87 minutes of flying. Each count covered an 800-meter radius circle. The total time and area sampled was 321.7 km^2-hr, during which 87 exposure events (eagle-min) were observed. The exposure rate is therefore 0.27 eagle-min/km^2-hr.

A point estimate was used for the exposure rate instead of a calculation of the posterior distribution for the exposure rate. The results are similar. Using a gamma distribution with inputs α=0.97 + 87 eagle minutes = 87.97 and β=2.76+321.7 km2-hr yields a distribution with a mean of 0.2711 and standard deviation of 0.0289.

3.2.1.2 Hazardous Area

The total turbine hazardous area is the area of a circle with a 25-meter radius around the base of each turbine, following the example in the Eagle Plan Conservation Guidance. A high-end estimate was generated using the rotor-swept radius of 58 meters. For the 18 turbines of the project, the total hazardous area is 0.035 km^2 over a total project area of 6150 acres or 24.9 km^2. This is equivalent to 0.14% of the project area that is considered hazardous. Using the 58-meter radius, the total hazardous area is 0.19 km^2 and 0.76% of the project area is considered hazardous.

The expansion rate is the number of daylight hours in a year multiplied by the hazardous area around the turbines:

$$4{,}383\ daylight\ hours * 0.035\ km^2 = 154.9\ hr - km^2$$

3.2.1.3 Fatalities Calculation

To estimate the number of fatalities per year, we multiply the exposure rate by the expansion rate and the probability of collision:

$$0.2711 \frac{eagle - min}{km^2 - hr} \times 154.9\ hr - km^2 \times (0.1199 \times (1 - .98)) = 0.102$$

The probability of avoidance is high for bald eagles (USFWS 2009 and 2013). The exposure rate for PCWF is 0.27 eagle-min/km^2-hr. Estimated eagle fatalities per year is 0.102. Over a 30-year project life, this equates to 3 eagle fatalities. Using a hazardous area equal to the rotor swept area instead of the default 25m radius yields a high-end annual fatality rate of 0.6 eagles or 16.5 over the life of the project.

3.2.1.4 Categorization

This annual eagle fatality rate means that the project area qualifies as a Category 2 – High or Moderate Risk to Eagles (USFWS 2013). A project qualifies for Category 2 if it:

1. Has an important eagle-use area or migration concentration site within the project area but not in the project footprint; or
2. Has an annual eagle fatality rate estimate between 0.03 eagles per year and 5% of the estimated local-area population size; or
3. Causes cumulative annual take of the local area population of less than 5% of the estimated local population size.

The annual eagle fatality estimate is above 0.03 eagles per year. The project site is located within the Bald Eagle Management Unit 3: Great Lakes area with an approximate eagle density from the 2009 US Fish and Wildlife Service Final Environmental Assessment: Proposal to Permit Take as Provided Under the Bald and Golden Eagle Protection Act of 0.062 bald eagles per square mile. When a 53-mile buffer is used, the 5% benchmark level is 6.9 eagles per year. Therefore, even using the conservative estimate of a 58-m radius hazardous area, the project would cause a cumulative annual take of less than 5% of the local area population.

3.2.2 Eagle Mean Internest Distance

The 3 active bald eagle nests identified in the April 2017 aerial raptor survey (**Figure 4**) and the 1 active red-tailed hawk nest located in T116N R40W Section 11 (USFWS considers this an active eagle nest since it was historically documented as an eagle nest) were considered in this MID analysis following the ECPG.

The MID and ½ MID was calculated by measuring the distance between the three (3) active eagle nests observed during the aerial surveys and the historical nest identified by the MN DNR, this resulted in four (4) nest analyzed to calculate the MID (**Figures 5** and **6**). The distances between the nests represent the territorial range for nests within the analysis area. All distances between each nest were summed (9,965m+3,990m+3,990m+13,214m) to equal 31,159m and divided by four (4) to determine the MID which is 7,789.75m (**Figures 5** and **6**). The MID was divided in half to determine the ½ MID which is 3,894.88m (**Figures 5** and **6**).

The analysis reveals the project area is situated within projected eagle territories. ½-MID boundaries covered all turbines, except WTG-18. These nesting eagles may be susceptible to mortality or disturbance. However, nearest eagle nest (red-tailed hawk nest in 2017) is situated 2,552 feet (0.48 miles) from the closest turbine (WTG-5). The nearest active eagle nest is located 4,662 feet (0.88 miles) from WTG-12.

3.3 GROUND AND AERIAL RAPTOR AND EAGLE NEST SURVEYS

An aerial (fixed-wing) raptor/eagle nest survey was conducted on April 20, 2017 that encompassed a 10-mile buffer of the project area. Three active nests, three inactive nests and ten individuals (three on nest and seven in flight or perched) were observed during the April 20, 2017 aerial survey (**Figure 4** and **Table 14**).

Table 14: Eagle Nests Within Palmer's Creek Analysis Area				
Nest Number	Status	Distance from Project Area	Latitude	Longitude
1	Active	4.9 miles	44.90855599	-95.70717782
2	Inactive	8.5 miles	44.73293894	-95.42223611
3	Active	0.3 miles	44.83149047	-95.56799484
4	Active	7.0 miles	44.72996346	-95.48105437
5	Inactive	10.0 miles	44.67489358	-95.53845803
6	Inactive	9.0 miles	44.68952578	-95.53443812

Eagle nest density within the analysis area is approximately one active nest per 102,000 acres.

See **Appendix C** for the *Aerial Eagle/Raptor Nest Survey Report.*

Two active red-tailed hawk nests were located within the project area during the ground surveys (**Figure 4**).

Fagen monitored the bald eagle nest located in T116N, R39W, Section 20 during the 2016 and 2017 nesting seasons. The non-local flights occurred most often to the northwest of the nest in 2016 and southeast of the nest in 2017, see **Table 15** below.

Table 15. Eagle Nest Monitoring (T116N, R39W, Section 20)				
Direction	2016 Nesting Season June 9 to August 25		2017 Nesting Season April 4 to August 10	
	Total Flights	Food Bearing Flights	Total Flights	Food Bearing Flights
North	17	1	8	1
Northeast	12	1	9	0
East	7	0	33	7
Southeast	15	1	96	14
South	24	0	75	11
Southwest	6	0	33	4
West	13	0	38	3
Northwest	90	4	25	1
Totals	**184**	**7**	**317**	**41**

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.

3.4.1 2015 and 2016 Surveys

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.

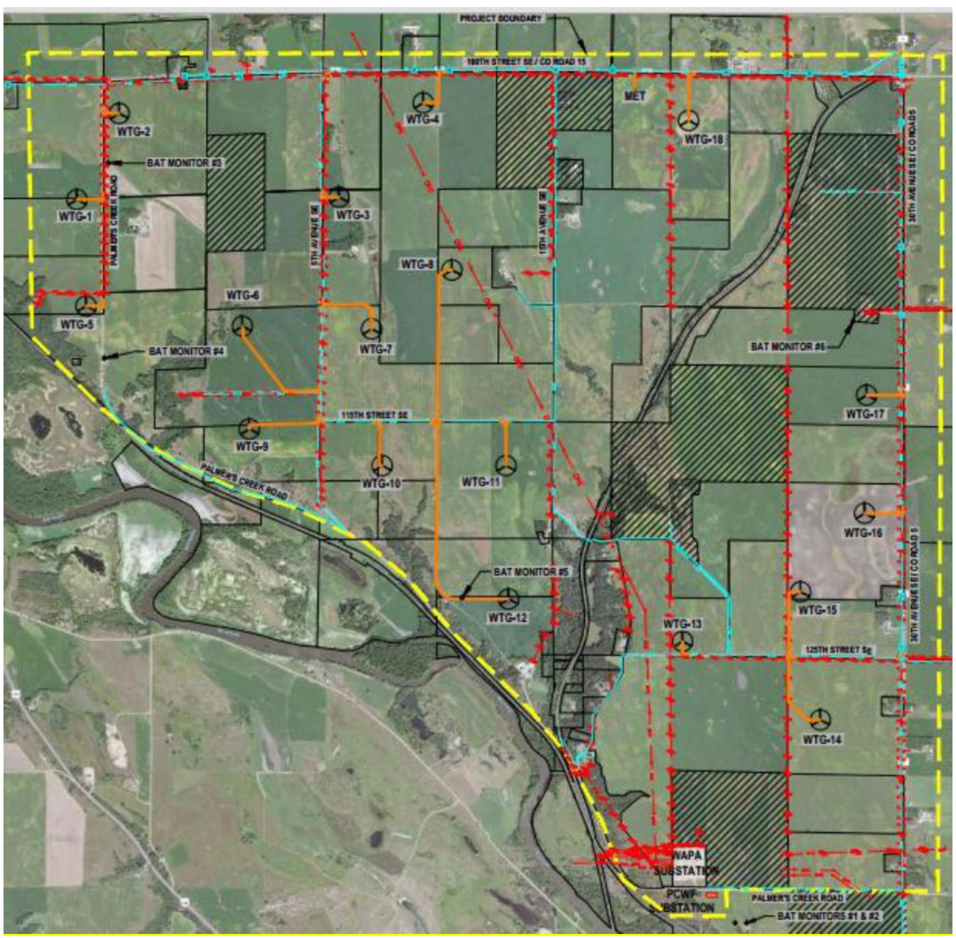

Figure 3. Bat Monitor (BM) Locations. BM-1 is not shown on the map but lies next to BM-2.

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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 D** for the entire *Interim Acoustic Bat Summary Report.*

3.4.2 2017 Surveys

Staff of Fagen Engineering deployed four separate zero-crossing systems (**Figure 3**: Monitors 1, 2, 4 and 5) and two Wildlife Acoustics SM3 full-spectrum systems (**Figure 3**: Monitors 3 and 6) to record bat activity throughout the study area from March 27, 2017 through October 16, 2017. The data collected by Fagen Engineering was sent to NCE, where it was analyzed, as appropriate, with either Kaleidoscope version 3.1.8 (in zero-crossing mode) or Sonobat 3 (full-spectrum only) to evaluate diversity and abundance of bat species at the Palmer's Creek site. 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. Each detector had a total of 203 functioning detector nights (for a total of 1218 detector nights), with a preliminary average bat pass per detector night at 143.93 detected. This average is subject to some adjustment due to inter-related technological and ecological issues.

The four Anabat and two SM3 full spectrum recording system visual examination and filtering of files to eliminate extraneous noise (e.g., wind, insects, etc.) resulted in a total of 15,511 sound files classified as bat detection passes as of data collected through Jun 29, 2017.

Monitor 1 was located on the lower end of a met tower surrounded by agriculture with some roosting trees nearby. The monitor recorded 10,447 files that Kaleidoscope Pro was able to classify as bat passes. The silver haired bat was the most common species at this site being 32% of total detections. The big brown bat was the second most common being 21% of total detections. The federally threatened northern long-eared myotis was detected 11 times (0.1%), but had a P-value of 1 which almost certainly means it was nonexistent at this site. The tri-colored bat (eastern pipistrelle) had a total of 16 (0.8%) detections.

Monitor 2 was located on the upper end of the same met tower as monitor 1, total elevation of 55 m. The monitor recorded 1,681 files that Kaleidoscope Pro was able to classify as bat passes. The hoary bat was the dominant species at this with 90 (72%) total bat passes. The second most detected species was the big-brown bat with 26 (23%) total bat passes.

Monitor 3 was one of two SM3 ultrasonic detector which is located along a creek bank, just off of the road surrounded by a combination of agriculture and roosting tree habitat. The monitor recorded 8,160 files that Kaleidoscope Pro was able to classify as bat passes. The silver haired bat was the most common species at this site being 37% of total detections. The big brown bat was the second most common being 32% of total detections. The federally threatened northern long-eared myotis was detected 1 time (0.01%), but had a P-value of 1 which almost certainly means it was nonexistent at this site.

Monitor 4 was located within a corn field and is surrounded by agriculture, with a creek with roosting habitat located near the site. The monitor recorded 70,225 files Kaleidoscope Pro classified as bat passes. The most common species at this site was the hoary bat being 94% of total detections, for a total of 66,657 total detections. The second most common was the silver-haired bat being 2.9% of total detections. The northern long-eared myotis was not recorded at this site. Activity recorded at this station had numerus false positives likely explained by the use of the SM3BAT detector, which detected significantly more bat activity then other detectors.

Monitor 5 was located along the fence line in an agriculturally dominated landscape, the monitor recorded 66,003 files Kaleidoscope Pro classified as bat passes. The most common species at this site was the hoary bat being 94% of total detections, for a total of 61,681 total detections. The second most common species was the silver haired bat at 3.5% detections. The northern long-eared myotis was not recorded at this site. Activity recorded at this station had numerus false positives likely explained by the use of the SM3BAT detector, which detected significantly more bat activity then other detectors.

Monitor 6 was located within a tree line near a farm house, this is the second of the SM3 full spectrum devices. The monitor recorded a total of 18,455 files Kaleidoscope Pro classified as bat passes. The most common species was the big brown bat (36% of total detections), followed closely by the silver haired bat (34% of total detections). The federally threatened northern long-eared myotis was detected 1 time (0.001%), but had a P-value of 1 which almost certainly means it was nonexistent at this site.

See **Appendix D** for the entire *Final Acoustic Bat Report (November 2017).*

4.0 Discussion and Impact Assessment

4.1 DISCUSSION

Based on the point count surveys, the avian community currently using the project area is characterized by species associated with typical midwestern agricultural lands, mixed-grass prairie vegetation and riparian areas. Most of the project area and its vicinity have been developed for agricultural use, specifically row crops such as corn, sunflower and soybeans. Within disturbed habitats such as these, the greatest potential impact of wind facilities to avian species is risk of collisions with turbines. The close proximity of the Minnesota River may serve as an attractant to migratory bird species, especially waterfowl, which pass through the area during the spring and fall migration. 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 totaled 113 individual raptors observed for an annual mean use of 0.39 raptors/20 minute (**Table 5**). This rate was compared to a study of 37 other wind facilities that implemented similar protocols. The raptor annual mean use at these wind facilities ranged from 0.09 to 2.34 raptors/20 min survey. Based on the results from these wind 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 at the wind facility.

Based on 52 of 108 individuals observed flying within the RSA/20 minutes during the surveys (**Table 9**), raptor encounter rates in the project area are considered moderate. Approximately 48.15 percent of all raptor observations were within the RSA. The highest raptor encounter rate was red-tailed hawk and turkey vulture with each having 0.07 individuals flying within the RSA/20 minutes and bald eagle at 0.03 individuals flying within the RSA/20 minutes (**Table 10**).

High numbers of raptor fatalities have been documented at wind facilities (e.g. Altamont Pass); however other studies at wind 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 survey results for species occurrence/abundance and encounter rates within the Palmer's Creek project area, red-tailed hawks, turkey vultures 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 facilities. Conversely, raptor fatality appears to be low when raptor use is low (less than 1.0 birds/20 min; AWWI 2014), which is the case for raptor use in the project area. Currently the project area has a raptor use of 0.39 birds/20 minutes (**Table 5**).

Turkey vultures and red-tailed hawks were the raptor species with the highest mean use and were also among the most frequently observed 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 facilities, 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. 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 low level of use. Project-related fatalities of red-tailed hawks, should they occur, are unlikely to have 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 facilities outside California (Erickson et al. 2001 and 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 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 Canada goose, American crow, unknown duck, unknown blackbird and red-winged blackbird are likely to be exposed to collisions from wind turbines in the project area (**Table 4** and **10**). 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 appear 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 10**).

4.4 LISTED AND SENSITIVE SPECIES RISK

The sensitive species observed in the project area are summarized in Section 3.1.5. No federally listed threatened, endangered or candidate species were observed during the surveys to date. The American white pelican (*Pelecanus erythrorhynchos*) is the only species of special concern included on the MN SWAP that was observed during the avian surveys (MNDNR 2015). Ten (10) other NL species were observed in the project area during avian surveys. The bobolink, Bird of Conversation Concern, was also identified during the avian surveys.

4.5 EAGLE FATALITY ESTIMATES

Protected under the Bald and Golden Eagle Protection Act, 19 bald eagles were observed within one mile of the Minnesota River along point count locations 1, 2, 3 and 4 (**Figure 2** and **Table 13**). Estimates for bald eagle fatality rates were calculated for the Project following the Eagle Conservation Plan Guidance Module 1- Land-based Wind Energy, Version 2 (USFWS 2013), which constitutes a Stage 2 Assessment of potential project impacts to bald eagles. All the observed eagles were within or below the rotor sweep area (RSA) and are considered in the eagle fatality calculations. Based on available data for the project site, the estimated bald eagle fatalities per year is approximately 0.102. Over a 30-year project life, this equates to 3 eagle fatalities. Using a hazardous area equal to the rotor swept area instead of the default 25m radius yields a high-end annual fatality rate of 0.6 eagles or 16.5 over the life of the project.

The annual eagle fatality estimate is above 0.03 eagles per year. The project site is located in the Bald Eagle Management Unit 3: Great Lakes area with an approximate eagle density from the 2009 US Fish and Wildlife Service Final Environmental Assessment: Proposal to Permit Take as Provided Under the Bald and Golden Eagle Protection Act of 0.062 bald eagles per square mile. When a 53-mile buffer is used, the 5% benchmark level is 6.9 eagles per year. Therefore, even using the conservative estimate of a 58-m radius hazardous area, the project would cause a cumulative annual take of less than 5% of the local area population.

4.6 GROUND AND AERIAL RAPTOR AND EAGLE NEST SURVEYS

An aerial (fixed-wing) raptor/eagle nest survey identified three active eagle nests and three inactive nests (**Figure 4** and **Table 14**). Except for Nest 3, which is near the project area, all nests are approximately five miles or greater from the project area.

Ground surveys identified two active red-tailed hawk nests were located within the project area during the ground surveys (**Figure 4**). One of these nests (located in T116N, R40W, Section 11) was previously identified by the MNDNR as a historical bald eagle nest. During the 2017 nesting season, a nesting red-tailed hawk occupied this nest.

4.7 ACOUSTIC BAT SURVEYS

4.7.1 2015 and 2016 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 D** *Interim Acoustic Bat Summary Report*).

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).

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 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*).

4.7.2 2017 Surveys

There was a total of seven bat species documented at this point in time during the course of the study. 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. 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 13 passes 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 seven-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 eastern red bat (*Lasiurus borealis*) and the little brown bat (*Myotis lucifugus*).

A corrected bat passes per detector night (BPDN) of between 50.7 and 34.8 is high for pre-construction surveys of potential wind energy sites in Minnesota, and is in the ballpark for what might be expected of the best bat habitat (Johnson et al. 2003). However, as the site's sampling is heavily biased toward the best bat habitat within or near the projected project footprint (due in part to regulator requests for sampling at specific sites), this is not too surprising, and it is reasonable to expect that the bat activity characteristic of the rotor area will be as much as 15 times less (Johnson et al. 2003). In total, if the net effect of accounting for the known high bias in habitat quality and the potential high bias due to improved data capture of new technology is taken into account, the Palmer's Creek site could have an adjusted BPDN <10. Consequently, bat mortality from the construction and operation of the proposed facility is likely within the normal range of such facilities in Minnesota (NCE 2017).

5.0 Conclusions

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

Data collected suggest an overall low impact in the project area on the local avian community as compared to other upper Midwest wind facilities. 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 Canada goose, American crow, unknown duck, unknown blackbird and red-winged blackbird, 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) which is comparable to other Midwest wind facilities.

No federally-listed endangered, threatened, or candidate species were observed within the project area. Protected under the Bald and Eagle Protection Act, 19 bald eagles were observed within the project area during the eagle-use surveys. Using USFWS Guidance, the estimated bald eagle fatalities per year is approximately 0.102, Palmer's Creek qualifies as a Category 2 – High or Moderate Risk to Eagles (USFWS 2013). Over a 30-year project life, this equates to 3 eagle fatalities. Using a hazardous area equal to the rotor swept area instead of the default 25m radius yields a high-end annual fatality rate of 0.6 eagles or 16.5 over the life of the project.

One other species, the (American white pelican), is a species of concern on the Minnesota SWAP that was observed during the avian surveys. All migratory avian species are protected by the Migratory Bird Treaty Act of 1918, which requires a project proposer to work with the U.S. Fish and Wildlife Service to identify and implement measures to avoid and minimize impacts to migratory bird species.

The site has significant bat activity from species shown to be at high risk of mortality at wind energy facilities in carcass surveys: the hoary, silver-haired, and eastern red bats, and the big and little brown bats (e.g., Gruver and Bishop-Boros 2015). Additionally, the big brown bat and little brown bat are also species of special conservation concern in Minnesota. The northern long-eared myotis is absent from the site, and the tricolored bat (which is also a species of special conservation concern in Minnesota) appears to be rare in the Palmer's Creek area (NCE 2017).

Assuming the general relationship between bat activity and bat mortality observed at other sites is broadly applicable to locations with similar characteristics, levels of turbine-related bat mortality from the construction and operation of Palmer's Creek Wind Farm is within the normal range of such facilities in Minnesota.

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Appendix A

Appendix B

Appendix C

Aerial Eagle/Raptor Nest Survey Report; Palmer's Creek Wind Farm

Appendix D

Interim Acoustic Bat Summary Report (2015-2016); Palmer’s Creek Wind Farm

Final Acoustic Bat Report (November 2017); Palmer’s Creek Wind Farm

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Appendix A

Table 3a. Palmer's Creek Point Count Data by Season (Summer 2016 & 2017)																						
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
Brown-headed Cowbird	SB	13	136	122	2.13	15.54%	13	20.31%	89.71%	100.00%	0.00%	0.00%	0.00	2.46%	0.00%	5.74%	2.46%	0.00%	0.00%	27.87%	11.48%	50.00%
Red-winged Blackbird	SB	22	129	117	2.02	14.74%	22	34.38%	90.70%	100.00%	0.00%	0.00%	0.00	0.85%	3.42%	0.00%	4.27%	0.85%	0.00%	0.85%	2.56%	87.18%
Barn Swallow	SB	21	111	111	1.73	12.69%	21	32.81%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	1.80%	0.00%	0.00%	0.00%	0.00%	0.00%	98.20%
American Goldfinch	SB	20	44	44	0.69	5.03%	19	29.69%	100.00%	100.00%	0.00%	0.00%	0.00	25.00%	4.55%	9.09%	18.18%	18.18%	6.82%	6.82%	2.27%	9.09%
European Starling	SB	3	44	44	0.69	5.03%	3	4.69%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	13.64%	86.36%
American Crow	C	8	39	32	0.61	4.46%	8	12.50%	82.05%	100.00%	0.00%	0.00%	0.00	12.50%	3.13%	0.00%	0.00%	0.00%	15.63%	15.63%	53.13%	0.00%
Field Sparrow	SB	17	35	12	0.55	4.00%	17	26.56%	34.29%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Blue Jay	C	12	28	8	0.44	3.20%	12	18.75%	28.57%	100.00%	0.00%	0.00%	0.00	37.50%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	62.50%
Horned Lark	SB	13	26	21	0.41	2.97%	13	20.31%	80.77%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	4.76%	0.00%	4.76%	9.52%	0.00%	80.95%
Tree Swallow	SB	9	23	23	0.36	2.63%	9	14.06%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	13.04%	86.96%
Rock Pigeon	PD	9	22	16	0.34	2.51%	9	14.06%	72.73%	93.75%	6.25%	0.00%	0.02	6.25%	62.50%	12.50%	0.00%	6.25%	0.00%	12.50%	0.00%	0.00%
Common Yellowthroat	SB	10	20	0	0.31	2.29%	10	15.63%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow Warbler	SB	4	20	13	0.31	2.29%	3	4.69%	65.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Clay-colored Sparrow	SB	12	16	0	0.25	1.83%	12	18.75%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Mourning Dove	PD	9	14	11	0.22	1.60%	9	14.06%	78.57%	90.91%	9.09%	0.00%	0.02	54.55%	0.00%	18.18%	9.09%	0.00%	0.00%	18.18%	0.00%	0.00%
American Robin	SB	8	14	6	0.22	1.60%	8	12.50%	42.86%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	16.67%	50.00%	0.00%	33.33%	0.00%	0.00%	0.00%
Killdeer	SH	9	12	5	0.19	1.37%	9	14.06%	41.67%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	40.00%	0.00%	0.00%	0.00%	0.00%	0.00%	60.00%
Ring-necked Pheasant	GB	8	12	0	0.19	1.37%	8	12.50%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bank Swallow	SB	1	12	12	0.19	1.37%	1	1.56%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Common Grackle	SB	4	11	11	0.17	1.26%	4	6.25%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	36.36%	9.09%	36.36%	18.18%	0.00%	0.00%	0.00%	0.00%
Unknown Duck	WF	2	11	0	0.17	1.26%	2	3.13%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Vesper Sparrow	SB	6	10	0	0.16	1.14%	6	9.38%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Chipping Sparrow	SB	8	9	5	0.14	1.03%	8	12.50%	55.56%	100.00%	0.00%	0.00%	0.00	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	80.00%
Mallard	WF	4	9	0	0.14	1.03%	4	6.25%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Song Sparrow	SB	5	7	0	0.11	0.80%	5	7.81%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cedar Waxwing	SB	3	6	4	0.09	0.69%	3	4.69%	66.67%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Sedge Wren	SB	5	5	0	0.08	0.57%	5	7.81%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Turkey Vulture	RVO	4	5	5	0.08	0.57%	4	6.25%	100.00%	20.00%	80.00%	0.00%	0.06	0.00%	0.00%	0.00%	0.00%	20.00%	0.00%	40.00%	0.00%	40.00%
Eastern Kingbird	SB	3	4	2	0.06	0.46%	3	4.69%	50.00%	100.00%	0.00%	0.00%	0.00	50.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Least Flycatcher	SB	3	4	0	0.06	0.46%	3	4.69%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ring-billed Gull	GT	2	4	4	0.06	0.46%	2	3.13%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	25.00%	0.00%	0.00%	0.00%	75.00%	0.00%
Black-capped Chickadee	SB	2	4	0	0.06	0.46%	2	3.13%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American White Pelican	WB	1	4	4	0.06	0.46%	1	1.56%	100.00%	0.00%	100.00%	0.00%	0.06	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Red-tailed Hawk	RVO	3	3	3	0.05	0.34%	3	4.69%	100.00%	66.67%	33.33%	0.00%	0.02	33.33%	0.00%	33.33%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%
Eastern Wood-Pewee	SB	3	3	0	0.05	0.34%	3	4.69%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Downy Woodpecker	WP	3	3	0	0.05	0.34%	3	4.69%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Canada Goose	WF	2	3	0	0.05	0.34%	2	3.13%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Belted Kingfisher	SB	2	2	1	0.03	0.23%	2	3.13%	50.00%	100.00%	0.00%	0.00%	0.00	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Great Blue Heron	WA	2	2	2	0.03	0.23%	2	3.13%	100.00%	50.00%	50.00%	0.00%	0.02	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	50.00%	0.00%
Grasshopper Sparrow	SB	2	2	0	0.03	0.23%	2	3.13%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow-headed Blackbird	SB	2	2	1	0.03	0.23%	2	3.13%	50.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Swainson's Hawk	RVO	1	1	1	0.02	0.11%	1	1.56%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%
Bobolink	SB	1	1	0	0.02	0.11%	1	1.56%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Willow Flycatcher	SB	1	1	0	0.02	0.11%	1	1.56%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Marsh Wren	SB	1	1	0	0.02	0.11%	1	1.56%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wild Turkey	GB	1	1	0	0.02	0.11%	1	1.56%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		284	**875**	**640**	**13.67**	**100.00%**			**73.14%**				**0.19**	**5.16%**	**3.28%**	**3.44%**	**4.22%**	**4.84%**	**2.03%**	**7.97%**	**8.13%**	**60.94%**

Table 3b. Palmer's Creek Point Count Data by Season (Fall 2016)																						
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**
American Crow	C	27	249	70	2.59	14.63%	23	23.96%	28.11%	68.57%	31.43%	0.00%	0.23	14.29%	2.86%	4.29%	10.00%	12.86%	0.00%	0.00%	10.00%	45.71%
Red-winged Blackbird	SB	12	205	205	2.14	12.04%	12	12.50%	100.00%	87.32%	12.68%	0.00%	0.27	0.00%	0.00%	0.00%	26.34%	23.90%	18.54%	0.00%	0.00%	31.22%
Brown-headed Cowbird	SB	15	199	164	2.07	11.69%	14	14.58%	82.41%	100.00%	0.00%	0.00%	0.00	7.32%	0.00%	0.61%	9.15%	23.78%	32.32%	8.54%	0.00%	18.29%
Canada Goose	WF	10	130	124	1.35	7.64%	10	10.42%	95.38%	24.19%	0.00%	75.81%	0.00	0.81%	0.00%	0.00%	41.94%	42.74%	14.52%	0.00%	0.00%	0.00%
European Starling	SB	6	104	75	1.08	6.11%	6	6.25%	72.12%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	58.67%	0.00%	0.00%	0.00%	41.33%
American Goldfinch	SB	15	90	90	0.94	5.29%	14	14.58%	100.00%	97.78%	2.22%	0.00%	0.02	2.22%	2.22%	46.67%	7.78%	18.89%	5.56%	0.00%	0.00%	16.67%
Blue Jay	C	26	80	55	0.83	4.70%	26	27.08%	68.75%	100.00%	0.00%	0.00%	0.00	10.91%	18.18%	18.18%	7.27%	16.36%	12.73%	14.55%	0.00%	1.82%
Rock Pigeon	PD	17	79	79	0.82	4.64%	17	17.71%	100.00%	97.47%	2.53%	0.00%	0.02	26.58%	0.00%	10.13%	0.00%	2.53%	0.00%	6.33%	13.92%	40.51%
Barn Swallow	SB	5	77	77	0.80	4.52%	5	5.21%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Field Sparrow	SB	22	61	48	0.64	3.58%	22	22.92%	78.69%	100.00%	0.00%	0.00%	0.00	8.33%	0.00%	4.17%	0.00%	4.17%	4.17%	2.08%	0.00%	77.08%
Dark-eyed Junco	SB	6	54	54	0.56	3.17%	6	6.25%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	29.63%	0.00%	70.37%
Horned Lark	SB	5	47	43	0.49	2.76%	5	5.21%	91.49%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	34.88%	0.00%	53.49%	0.00%	11.63%
Unknown Blackbird	SB	1	40	40	0.42	2.35%	1	1.04%	100.00%	0.00%	100.00%	0.00%	0.42	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Tree Sparrow	SB	5	38	37	0.40	2.23%	5	5.21%	97.37%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	35.14%	64.86%
Black-capped Chickadee	SB	7	36	36	0.38	2.12%	7	7.29%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	5.56%	0.00%	0.00%	22.22%	13.89%	0.00%	58.33%
Common Grackle	SB	4	25	25	0.26	1.47%	4	4.17%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	8.00%	68.00%	20.00%	0.00%	4.00%	0.00%
Ring-billed Gull	GT	4	21	21	0.22	1.23%	4	4.17%	100.00%	19.05%	80.95%	0.00%	0.18	0.00%	0.00%	0.00%	0.00%	9.52%	0.00%	9.52%	0.00%	80.95%
Snow Goose	WF	2	20	20	0.21	1.18%	2	2.08%	100.00%	10.00%	0.00%	90.00%	0.00	0.00%	0.00%	0.00%	90.00%	10.00%	0.00%	0.00%	0.00%	0.00%
Red-tailed Hawk	RVO	16	19	17	0.20	1.12%	15	15.63%	89.47%	52.94%	23.53%	23.53%	0.04	5.88%	0.00%	0.00%	29.41%	29.41%	5.88%	11.76%	5.88%	11.76%
American Robin	SB	8	15	11	0.16	0.88%	8	8.33%	73.33%	100.00%	0.00%	0.00%	0.00	18.18%	0.00%	0.00%	9.09%	18.18%	0.00%	0.00%	27.27%	27.27%
Northern Flicker	WP	6	15	15	0.16	0.88%	6	6.25%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	26.67%	0.00%	20.00%	33.33%	20.00%	0.00%	0.00%	0.00%
Cedar Waxwing	SB	3	15	15	0.16	0.88%	3	3.13%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	53.33%	46.67%	0.00%	0.00%	0.00%	0.00%	0.00%
Western Meadowlark	SB	3	14	14	0.15	0.82%	3	3.13%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	50.00%	35.71%	0.00%	14.29%	0.00%	0.00%
Mourning Dove	PD	8	13	10	0.14	0.76%	8	8.33%	76.92%	100.00%	0.00%	0.00%	0.00	30.00%	0.00%	10.00%	0.00%	10.00%	10.00%	40.00%	0.00%	0.00%
Bald Eagle	RVO	8	10	9	0.10	0.59%	6	6.25%	90.00%	11.11%	33.33%	55.56%	0.03	0.00%	33.33%	0.00%	44.44%	11.11%	0.00%	0.00%	0.00%	11.11%
Downy Woodpecker	WP	7	7	7	0.07	0.41%	7	7.29%	100.00%	100.00%	0.00%	0.00%	0.00	14.29%	0.00%	14.29%	28.57%	0.00%	14.29%	28.57%	0.00%	0.00%
Turkey Vulture	RVO	5	7	7	0.07	0.41%	5	5.21%	100.00%	42.86%	28.57%	28.57%	0.02	0.00%	0.00%	42.86%	57.14%	0.00%	0.00%	0.00%	0.00%	0.00%
Unknown Duck	WF	3	7	1	0.07	0.41%	3	3.13%	14.29%	0.00%	100.00%	0.00%	0.01	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eastern Bluebird	SB	2	6	6	0.06	0.35%	2	2.08%	100.00%	100.00%	0.00%	0.00%	0.00	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	83.33%	0.00%
Rough-legged Hawk	RVO	3	4	4	0.04	0.24%	2	2.08%	100.00%	25.00%	25.00%	50.00%	0.01	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Killdeer	SH	2	3	2	0.03	0.18%	2	2.08%	66.67%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Swainson's Hawk	RVO	2	3	1	0.03	0.18%	2	2.08%	33.33%	0.00%	100.00%	0.00%	0.01	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Common Yellowthroat	SB	2	2	0	0.02	0.12%	2	2.08%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ring-necked Pheasant	GB	2	2	1	0.02	0.12%	2	2.08%	50.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%
American Kestrel	RVO	1	1	1	0.01	0.06%	1	1.04%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Belted Kingfisher	SB	1	1	1	0.01	0.06%	1	1.04%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Least Flycatcher	SB	1	1	1	0.01	0.06%	1	1.04%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wild Turkey	GB	1	1	0	0.01	0.06%	1	1.04%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wilson's Snipe	SH	1	1	0	0.01	0.06%	1	1.04%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		274	**1,702**	**1,386**	**17.73**	**100.00%**			**81.43%**				**1.26**	**7.50%**	**1.59%**	**5.84%**	**14.29%**	**20.20%**	**10.25%**	**6.13%**	**3.03%**	**31.17%**

Table 3c. Palmer's Creek Point Count Data by Season (Winter 2016-2017)																						
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	10	339	309	7.06	41.24%	10	20.83%	91.15%	100.00%	0.00%	0.00%	0.00	10.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	89.97%
Snow Bunting	SB	6	109	109	2.27	13.26%	6	12.50%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	15.60%	0.00%	0.00%	15.60%	0.00%	18.35%	0.00%	50.46%
Wild Turkey	GB	4	92	0	1.92	11.19%	4	8.33%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Crow	C	15	57	44	1.19	6.93%	15	31.25%	77.19%	97.73%	2.27%	0.00%	0.02	43.18%	0.00%	0.00%	29.55%	13.64%	11.36%	2.27%	0.00%	0.00%
Unknown Duck	WF	2	46	46	0.96	5.60%	2	4.17%	100.00%	0.00%	100.00%	0.00%	0.96	30.43%	0.00%	0.00%	69.57%	0.00%	0.00%	0.00%	0.00%	0.00%
Unidentified Sparrow	SB	4	35	34	0.73	4.26%	4	8.33%	97.14%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.94%	0.00%	97.06%
Rock Pigeon	PD	10	31	31	0.65	3.77%	10	20.83%	100.00%	100.00%	0.00%	0.00%	0.00	6.45%	0.00%	6.45%	0.00%	0.00%	0.00%	16.13%	9.68%	61.29%
Black-capped Chickadee	SB	5	28	28	0.58	3.41%	5	10.42%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Dark-eyed Junco	SB	4	28	28	0.58	3.41%	4	8.33%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	17.86%	82.14%
Blue Jay	C	9	18	11	0.38	2.19%	9	18.75%	61.11%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	9.09%	27.27%	9.09%	0.00%	18.18%	36.36%	0.00%
Ring-necked Pheasant	GB	4	12	6	0.25	1.46%	4	8.33%	50.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Savannah Sparrow	SB	1	8	0	0.17	0.97%	1	2.08%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Canada Goose	WF	1	7	7	0.15	0.85%	1	2.08%	100.00%	0.00%	0.00%	100.00%	0.00	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Red-tailed Hawk	RVO	6	6	6	0.13	0.73%	5	10.42%	100.00%	50.00%	33.33%	16.67%	0.04	50.00%	0.00%	0.00%	16.67%	16.67%	16.67%	0.00%	0.00%	0.00%
Downy Woodpecker	WP	2	2	1	0.04	0.24%	2	4.17%	50.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Horned Lark	SB	1	2	2	0.04	0.24%	1	2.08%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Northern Harrier	RVO	1	1	1	0.02	0.12%	1	2.08%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Swainson's Hawk	RVO	1	1	1	0.02	0.12%	1	2.08%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
		86	**822**	**664**	**17.13**	**100.00%**			**80.78%**				**0.00**	**10.39%**	**2.56%**	**0.60%**	**8.28%**	**5.12%**	**0.90%**	**4.37%**	**1.81%**	**65.96%**

Table 3d. Palmer's Creek Point Count Data by Season (Spring 2017)																					
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	567	562	7.09	28.80%	15	18.75%	99.12%	97.69%	2.31%	0.00%	0.16	0.00%	0.00%	0.00%	0.00%	2.31%	0.00%	0.00%	0.00%	97.69%
Red-winged Blackbird	SB	18	354	354	4.43	17.98%	15	18.75%	100.00%	98.31%	1.69%	0.00%	0.08	0.00%	0.00%	0.00%	1.13%	0.56%	3.95%	44.35%	0.28%	49.72%
American Crow	C	23	221	214	2.76	11.22%	19	23.75%	96.83%	77.10%	22.90%	0.00%	0.61	23.36%	9.35%	15.89%	0.00%	27.10%	3.27%	20.09%	0.93%	0.00%
Canada Goose	WF	21	208	119	2.60	10.56%	20	25.00%	57.21%	0.00%	96.64%	3.36%	1.44	14.29%	0.00%	5.04%	8.40%	0.00%	0.00%	0.00%	72.27%	0.00%
Horned Lark	SB	34	124	105	1.55	6.30%	30	37.50%	84.68%	100.00%	0.00%	0.00%	0.00	4.76%	1.90%	2.86%	0.95%	3.81%	0.00%	2.86%	5.71%	77.14%
Common Grackle	SB	6	53	53	0.66	2.69%	6	7.50%	100.00%	73.58%	26.42%	0.00%	0.18	3.77%	0.00%	0.00%	32.08%	0.00%	0.00%	9.43%	54.72%	0.00%
Mallard	WF	13	51	31	0.64	2.59%	11	13.75%	60.78%	45.16%	6.45%	48.39%	0.03	58.06%	19.35%	0.00%	3.23%	6.45%	0.00%	0.00%	9.68%	0.00%
Wild Turkey	GB	4	45	0	0.56	2.29%	4	5.00%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Rock Pigeon	PD	13	40	40	0.50	2.03%	12	15.00%	100.00%	77.50%	22.50%	0.00%	0.11	40.00%	0.00%	0.00%	32.50%	10.00%	2.50%	0.00%	0.00%	15.00%
Brown-headed Cowbird	SB	5	40	39	0.50	2.03%	5	6.25%	97.50%	100.00%	0.00%	0.00%	0.00	0.00%	15.38%	0.00%	0.00%	7.69%	0.00%	0.00%	0.00%	76.92%
Unidentified Sparrow	SB	1	25	25	0.31	1.27%	1	1.25%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%
American Robin	SB	10	24	13	0.30	1.22%	10	12.50%	54.17%	100.00%	0.00%	0.00%	0.00	15.38%	0.00%	46.15%	0.00%	30.77%	0.00%	7.69%	0.00%	0.00%
Blue Jay	C	11	22	7	0.28	1.12%	11	13.75%	31.82%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	14.29%	0.00%	14.29%	42.86%	28.57%
Dark-eyed Junco	SB	3	18	18	0.23	0.91%	3	3.75%	100.00%	100.00%	0.00%	0.00%	0.00	38.89%	0.00%	0.00%	0.00%	0.00%	0.00%	22.22%	0.00%	38.89%
Red-tailed Hawk	RVO	16	17	17	0.21	0.86%	15	18.75%	100.00%	17.65%	76.47%	5.88%	0.16	11.76%	23.53%	5.88%	23.53%	5.88%	0.00%	11.76%	17.65%	0.00%
Bald Eagle	RVO	13	17	17	0.21	0.86%	8	10.00%	100.00%	47.06%	29.41%	23.53%	0.06	29.41%	0.00%	0.00%	5.88%	29.41%	5.88%	0.00%	23.53%	5.88%
Turkey Vulture	RVO	6	16	16	0.20	0.81%	5	6.25%	100.00%	0.00%	93.75%	6.25%	0.19	0.00%	0.00%	18.75%	0.00%	0.00%	0.00%	0.00%	81.25%	0.00%
American Goldfinch	SB	3	12	12	0.15	0.61%	3	3.75%	100.00%	100.00%	0.00%	0.00%	0.00	66.67%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Black-capped Chickadee	SB	2	12	12	0.15	0.61%	2	2.50%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
American White Pelican	WB	2	12	12	0.15	0.61%	2	2.50%	100.00%	0.00%	100.00%	0.00%	0.15	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	25.00%	75.00%	0.00%
Ring-necked Pheasant	GB	9	11	1	0.14	0.56%	9	11.25%	9.09%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%
Field Sparrow	SB	5	11	2	0.14	0.56%	5	6.25%	18.18%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Unknown Duck	WF	5	10	5	0.13	0.51%	5	6.25%	50.00%	0.00%	100.00%	0.00%	0.06	0.00%	0.00%	0.00%	80.00%	0.00%	20.00%	0.00%	0.00%	0.00%
Killdeer	SH	5	8	4	0.10	0.41%	5	6.25%	50.00%	100.00%	0.00%	0.00%	0.00	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Mourning Dove	PD	6	7	3	0.09	0.36%	6	7.50%	42.86%	100.00%	0.00%	0.00%	0.00	66.67%	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%
Tree Swallow	SB	4	7	7	0.09	0.36%	4	5.00%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	14.29%	0.00%	85.71%
Savannah Sparrow	SB	1	7	7	0.09	0.36%	1	1.25%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Cedar Waxwing	SB	2	6	3	0.08	0.30%	2	2.50%	50.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Yellow-headed Blackbird	SB	2	6	6	0.08	0.30%	2	2.50%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Chipping Sparrow	SB	2	2	1	0.03	0.10%	2	2.50%	50.00%	100.00%	0.00%	0.00%	0.00	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Song Sparrow	SB	2	2	0	0.03	0.10%	2	2.50%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Flicker	WP	2	2	2	0.03	0.10%	2	2.50%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%
Downy Woodpecker	WP	2	2	1	0.03	0.10%	2	2.50%	50.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eastern Bluebird	SB	1	2	2	0.03	0.10%	1	1.25%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Western Meadowlark	SB	1	1	0	0.01	0.05%	1	1.25%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Harrier	RVO	1	1	1	0.01	0.05%	1	1.25%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Cooper's Hawk	RVO	1	1	1	0.01	0.05%	1	1.25%	100.00%	0.00%	100.00%	0.00%	0.01	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Belted Kingfisher	SB	1	1	1	0.01	0.05%	1	1.25%	100.00%	100.00%	0.00%	0.00%	0.00	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Upland Sandpiper	SH	1	1	0	0.01	0.05%	1	1.25%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Blue-winged teal	WF	1	1	0	0.01	0.05%	1	1.25%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Clay-colored Sparrow	SB	1	1	0	0.01	0.05%	1	1.25%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow Warbler	SB	1	1	1	0.01	0.05%	1	1.25%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
		275	**1,969**	**1,714**	**24.61**	**100.00%**			**87.05%**				**0.00**	**8.17%**	**2.63%**	**3.09%**	**3.39%**	**5.90%**	**1.52%**	**14.36%**	**9.40%**	**51.55%**

Table 4. Cumulative Palmer's Creek Point Count Data (Summer 2016-Summer 2017)																						
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	34	1054	990	3.66	19.63%	8	2.78%	93.93%	98.69%	1.31%	0.00%	0.05	3.13%	0.00%	0.00%	0.00%	5.76%	0.00%	0.00%	0.61%	90.51%
Red-winged Blackbird	SB	52	688	676	2.39	12.82%	34	11.81%	98.26%	95.27%	4.73%	0.00%	0.11	0.15%	0.59%	0.00%	9.32%	7.69%	7.69%	23.37%	0.59%	50.59%
American Crow	C	73	566	360	1.97	10.54%	29	10.07%	63.60%	80.00%	20.00%	0.00%	0.25	23.06%	6.39%	10.28%	5.56%	20.28%	4.72%	13.61%	7.22%	8.89%
Brown-headed Cowbird	SB	33	375	325	1.30	6.99%	27	9.38%	86.67%	100.00%	0.00%	0.00%	0.00	4.62%	1.85%	2.46%	5.54%	12.92%	16.31%	14.77%	4.31%	37.23%
Canada Goose	WF	34	348	250	1.21	6.48%	12	4.17%	71.84%	12.00%	46.00%	42.00%	0.40	7.20%	0.00%	2.40%	24.80%	24.00%	7.20%	0.00%	34.40%	0.00%
Horned Lark	SB	53	199	171	0.69	3.71%	18	6.25%	85.93%	100.00%	0.00%	0.00%	0.00	2.92%	1.17%	1.75%	1.17%	11.11%	0.58%	16.37%	3.51%	61.40%
Barn Swallow	SB	26	188	188	0.65	3.50%	26	9.03%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	1.06%	0.00%	0.00%	0.00%	0.00%	0.00%	98.94%
Rock Pigeon	PD	49	172	166	0.60	3.20%	26	9.03%	96.51%	92.77%	7.23%	0.00%	0.04	24.10%	6.02%	7.23%	7.83%	4.22%	0.60%	7.23%	8.43%	34.34%
Blue Jay	C	58	148	81	0.51	2.76%	38	13.19%	54.73%	100.00%	0.00%	0.00%	0.00	11.11%	12.35%	13.58%	8.64%	13.58%	8.64%	13.58%	8.64%	9.88%
American Goldfinch	SB	38	146	146	0.51	2.72%	33	11.46%	100.00%	98.63%	1.37%	0.00%	0.01	14.38%	5.48%	31.51%	10.27%	17.12%	5.48%	2.05%	0.68%	13.01%
Wild Turkey	GB	10	139	0	0.48	2.59%	2	0.69%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Snow Bunting	SB	6	109	109	0.38	2.03%	0	0.00%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	15.60%	0.00%	0.00%	15.60%	0.00%	18.35%	0.00%	50.46%
Field Sparrow	SB	44	107	62	0.37	1.99%	39	13.54%	57.94%	100.00%	0.00%	0.00%	0.00	6.45%	0.00%	3.23%	3.23%	3.23%	3.23%	1.61%	0.00%	79.03%
Dark-eyed Junco	SB	13	100	100	0.35	1.86%	6	2.08%	100.00%	100.00%	0.00%	0.00%	0.00	7.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%	5.00%	68.00%
Common Grackle	SB	14	89	89	0.31	1.66%	8	2.78%	100.00%	84.27%	15.73%	0.00%	0.05	2.25%	4.49%	1.12%	25.84%	21.35%	5.62%	5.62%	33.71%	0.00%
Black-capped Chickadee	SB	16	80	76	0.28	1.49%	9	3.13%	95.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	2.63%	0.00%	0.00%	10.53%	6.58%	0.00%	80.26%
Unknown Duck	WF	12	74	52	0.26	1.38%	5	1.74%	70.27%	0.00%	100.00%	0.00%	0.18	26.92%	0.00%	0.00%	71.15%	0.00%	1.92%	0.00%	0.00%	0.00%
Mallard	WF	17	60	31	0.21	1.12%	4	1.39%	51.67%	45.16%	6.45%	48.39%	0.01	58.06%	19.35%	0.00%	3.23%	6.45%	0.00%	0.00%	9.68%	0.00%
Unidentified Sparrow	SB	5	60	59	0.21	1.12%	0	0.00%	98.33%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	44.07%	0.00%	55.93%
American Robin	SB	26	53	30	0.18	0.99%	16	5.56%	56.60%	100.00%	0.00%	0.00%	0.00	13.33%	0.00%	23.33%	13.33%	20.00%	6.67%	3.33%	10.00%	10.00%
Red-tailed Hawk	RVO	41	45	43	0.16	0.84%	18	6.25%	95.56%	39.53%	46.51%	13.95%	0.07	16.28%	9.30%	4.65%	23.26%	16.28%	6.98%	9.30%	9.30%	4.65%
Unknown Blackbird	SB	1	40	40	0.14	0.75%	1	0.35%	100.00%	0.00%	100.00%	0.00%	0.14	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Tree Sparrow	SB	5	38	37	0.13	0.71%	5	1.74%	97.37%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	35.14%	64.86%
Ring-necked Pheasant	GB	23	37	8	0.13	0.69%	10	3.47%	21.62%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	75.00%	0.00%	12.50%	12.50%	0.00%	0.00%
Mourning Dove	PD	23	34	24	0.12	0.63%	17	5.90%	70.59%	95.83%	4.17%	0.00%	0.00	45.83%	0.00%	12.50%	4.17%	4.17%	8.33%	25.00%	0.00%	0.00%
Tree Swallow	SB	13	30	30	0.10	0.56%	9	3.13%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.33%	10.00%	86.67%
Turkey Vulture	RVO	15	28	28	0.10	0.52%	9	3.13%	100.00%	14.29%	75.00%	10.71%	0.07	0.00%	0.00%	21.43%	14.29%	3.57%	0.00%	7.14%	46.43%	7.14%
Bald Eagle	RVO	21	27	26	0.09	0.50%	6	2.08%	96.30%	34.62%	30.77%	34.62%	0.03	19.23%	11.54%	0.00%	19.23%	23.08%	3.85%	0.00%	15.38%	7.69%
Cedar Waxwing	SB	8	27	22	0.09	0.50%	6	2.08%	81.48%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	36.36%	31.82%	31.82%	0.00%	0.00%	0.00%	0.00%
Ring-billed Gull	GT	6	25	25	0.09	0.47%	6	2.08%	100.00%	32.00%	68.00%	0.00%	0.06	0.00%	0.00%	0.00%	4.00%	8.00%	0.00%	8.00%	12.00%	68.00%
Killdeer	SH	16	23	11	0.08	0.43%	11	3.82%	47.83%	100.00%	0.00%	0.00%	0.00	36.36%	0.00%	18.18%	0.00%	0.00%	0.00%	0.00%	0.00%	45.45%
Common Yellowthroat	SB	12	22	0	0.08	0.41%	12	4.17%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow Warbler	SB	5	21	14	0.07	0.39%	3	1.04%	66.67%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	92.86%	0.00%	0.00%	7.14%	0.00%
Snow Goose	WF	2	20	20	0.07	0.37%	2	0.69%	100.00%	10.00%	0.00%	90.00%	0.00	0.00%	0.00%	0.00%	90.00%	10.00%	0.00%	0.00%	0.00%	0.00%
Clay-colored Sparrow	SB	13	17	0	0.06	0.32%	12	4.17%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Flicker	WP	8	17	17	0.06	0.32%	6	2.08%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	29.41%	0.00%	17.65%	29.41%	17.65%	5.88%	0.00%	0.00%
American White Pelican	WB	3	16	16	0.06	0.30%	1	0.35%	100.00%	0.00%	100.00%	0.00%	0.06	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	18.75%	81.25%	0.00%
Western Meadowlark	SB	4	15	14	0.05	0.28%	3	1.04%	93.33%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	50.00%	35.71%	0.00%	14.29%	0.00%	0.00%
Savannah Sparrow	SB	2	15	7	0.05	0.28%	0	0.00%	46.67%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Downy Woodpecker	WP	14	14	9	0.05	0.26%	10	3.47%	64.29%	100.00%	0.00%	0.00%	0.00	11.11%	0.00%	11.11%	33.33%	11.11%	11.11%	22.22%	0.00%	0.00%
Bank Swallow	SB	1	12	12	0.04	0.22%	1	0.35%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Chipping Sparrow	SB	10	11	6	0.04	0.20%	8	2.78%	54.55%	100.00%	0.00%	0.00%	0.00	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	66.67%
Vesper Sparrow	SB	6	10	0	0.03	0.19%	6	2.08%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Song Sparrow	SB	7	9	0	0.03	0.17%	5	1.74%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow-headed Blackbird	SB	4	8	7	0.03	0.15%	2	0.69%	87.50%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Eastern Bluebird	SB	3	8	8	0.03	0.15%	2	0.69%	100.00%	100.00%	0.00%	0.00%	0.00	12.50%	25.00%	0.00%	0.00%	0.00%	0.00%	0.00%	62.50%	0.00%
Sedge Wren	SB	5	5	0	0.02	0.09%	5	1.74%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Least Flycatcher	SB	4	5	1	0.02	0.09%	4	1.39%	20.00%	100.00%	0.00%	0.00%	0.00	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Swainson's Hawk	RVO	4	5	3	0.02	0.09%	3	1.04%	60.00%	66.67%	33.33%	0.00%	0.00	0.00%	0.00%	0.00%	33.33%	33.33%	33.33%	0.00%	0.00%	0.00%
Belted Kingfisher	SB	4	4	3	0.01	0.07%	3	1.04%	75.00%	100.00%	0.00%	0.00%	0.00	66.67%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	0.00%
Eastern Kingbird	SB	3	4	2	0.01	0.07%	3	1.04%	50.00%	100.00%	0.00%	0.00%	0.00	50.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Rough-legged Hawk	RVO	3	4	4	0.01	0.07%	2	0.69%	100.00%	25.00%	25.00%	50.00%	0.00	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eastern Wood-Pewee	SB	3	3	0	0.01	0.06%	3	1.04%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Grasshopper Sparrow	SB	2	2	0	0.01	0.04%	2	0.69%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Great Blue Heron	WA	2	2	2	0.01	0.04%	2	0.69%	100.00%	50.00%	50.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	50.00%	0.00%
Northern Harrier	RVO	2	2	2	0.01	0.04%	0	0.00%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	50.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%
American Kestrel	RVO	1	1	1	0.00	0.02%	1	0.35%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Blue-winged teal	WF	1	1	0	0.00	0.02%	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bobolink	SB	1	1	0	0.00	0.02%	1	0.35%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cooper's Hawk	RVO	1	1	1	0.00	0.02%	0	0.00%	100.00%	0.00%	100.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Marsh Wren	SB	1	1	0	0.00	0.02%	1	0.35%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Upland Sandpiper	SH	1	1	0	0.00	0.02%	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Willow Flycatcher	SB	1	1	0	0.00	0.02%	1	0.35%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wilson's Snipe	SH	1	1	0	0.00	0.02%	1	0.35%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		919	**5,368**	**4,404**	**18.64**	**100.00%**			**82.04%**				**1.53**	**7.86%**	**2.38%**	**3.63%**	**7.68%**	**10.13%**	**4.25%**	**9.33%**	**6.06%**	**48.67%**

Table 5. Cumulative Palmer's Creek Point Count Avian Species by Group															
Species	Summer 2016 & 2017			Fall 2016			Winter 2016-2017			Spring 2017			Cumulative		
	Ind	Obs	Mean Use per 20 min	Ind	Obs	Mean Use per 20 min	Ind	Obs	Mean Use per 20 min	Ind	Obs	Mean Use per 20 min	Ind	Obs	Mean Use per 20 min
Songbirds															
European Starling	44	3	0.69	104	6	1.08	339	10	7.06	567	15	7.09	1,054	34	3.66
Red-winged Blackbird	129	22	2.02	205	12	2.14	0	0	0.00	354	18	4.43	688	52	2.39
Brown-headed Cowbird	136	13	2.13	199	15	2.07	0	0	0.00	40	5	0.50	375	33	1.30
Horned Lark	26	13	0.41	47	5	0.49	2	1	0.04	124	34	1.55	199	53	0.69
Barn Swallow	111	21	1.73	77	5	0.80	0	0	0.00	0	0	0.00	188	26	0.65
American Goldfinch	44	20	0.69	90	15	0.94	0	0	0.00	12	3	0.15	146	38	0.51
Snow Bunting	0	0	0.00	0	0	0.00	109	6	2.27	0	0	0.00	109	6	0.38
Field Sparrow	35	17	0.55	61	22	0.64	0	0	0.00	11	5	0.14	107	44	0.37
Dark-eyed Junco	0	0	0.00	54	6	0.56	28	4	0.58	18	3	0.23	100	13	0.35
Common Grackle	11	4	0.17	25	4	0.26	0	0	0.00	53	6	0.66	89	14	0.31
Black-capped Chickadee	4	2	0.06	36	7	0.38	28	5	0.58	12	2	0.15	80	16	0.28
Unidentified Sparrow	0	0	0.00	0	0	0.00	35	4	0.73	25	1	0.31	60	5	0.21
American Robin	14	8	0.22	15	8	0.16	0	0	0.00	24	10	0.30	53	26	0.18
Unknown Blackbird	0	0	0.00	40	1	0.42	0	0	0.00	0	0	0.00	40	1	0.14
American Tree Sparrow	0	0	0.00	38	5	0.40	0	0	0.00	0	0	0.00	38	5	0.13
Tree Swallow	23	9	0.36	0	0	0.00	0	0	0.00	7	4	0.09	30	13	0.10
Cedar Waxwing	6	3	0.09	15	3	0.16	0	0	0.00	6	2	0.08	27	8	0.09
Common Yellowthroat	20	10	0.31	2	2	0.02	0	0	0.00	0	0	0.00	22	12	0.08
Yellow Warbler	20	4	0.31	0	0	0.00	0	0	0.00	1	1	0.01	21	5	0.07
Clay-colored Sparrow	16	12	0.25	0	0	0.00	0	0	0.00	1	1	0.01	17	13	0.06
Western Meadowlark	0	0	0.00	14	3	0.15	0	0	0.00	1	1	0.01	15	4	0.05
Savannah Sparrow	0	0	0.00	0	0	0.00	8	1	0.17	7	1	0.09	15	2	0.05
Bank Swallow	12	1	0.19	0	0	0.00	0	0	0.00	0	0	0.00	12	1	0.04
Chipping Sparrow	9	8	0.14	0	0	0.00	0	0	0.00	2	2	0.03	11	10	0.04
Vesper Sparrow	10	6	0.16	0	0	0.00	0	0	0.00	0	0	0.00	10	6	0.03
Song Sparrow	7	5	0.11	0	0	0.00	0	0	0.00	2	2	0.03	9	7	0.03
Yellow-headed Blackbird	2	2	0.03	0	0	0.00	0	0	0.00	6	2	0.08	8	4	0.03
Eastern Bluebird	0	0	0.00	6	2	0.06	0	0	0.00	2	1	0.03	8	3	0.03
Sedge Wren	5	5	0.08	0	0	0.00	0	0	0.00	0	0	0.00	5	5	0.02
Least Flycatcher	4	3	0.06	1	1	0.01	0	0	0.00	0	0	0.00	5	4	0.02
Belted Kingfisher	2	2	0.03	1	1	0.01	0	0	0.00	1	1	0.01	4	4	0.01
Eastern Kingbird	4	3	0.06	0	0	0.00	0	0	0.00	0	0	0.00	4	3	0.01
Eastern Wood-Pewee	3	3	0.05	0	0	0.00	0	0	0.00	0	0	0.00	3	3	0.01
Grasshopper Sparrow	2	2	0.03	0	0	0.00	0	0	0.00	0	0	0.00	2	2	0.01
Bobolink	1	1	0.02	0	0	0.00	0	0	0.00	0	0	0.00	1	1	0.00
Marsh Wren	1	1	0.02	0	0	0.00	0	0	0.00	0	0	0.00	1	1	0.00
Willow Flycatcher	1	1	0.02	0	0	0.00	0	0	0.00	0	0	0.00	1	1	0.00
Totals	**702**	**204**	**10.97**	**1,030**	**123**	**10.73**	**549**	**31**	**11.44**	**1,276**	**120**	**15.95**	**3,557**	**478**	**12.35**
Raptors/Vultures/Owls															
Red-tailed Hawk	3	3	0.05	19	16	0.20	6	6	0.13	17	16	0.21	45	41	0.16
Turkey Vulture	5	4	0.08	7	5	0.07	0	0	0.00	16	6	0.20	28	15	0.10
Bald Eagle	0	0	0.00	10	8	0.10	0	0	0.00	17	13	0.21	27	21	0.09
Swainson's Hawk	1	1	0.02	3	2	0.03	1	1	0.02	0	0	0.00	5	4	0.02
Rough-legged Hawk	0	0	0.00	4	3	0.04	0	0	0.00	0	0	0.00	4	3	0.01
Northern Harrier	0	0	0.00	0	0	0.00	1	1	0.02	1	1	0.01	2	2	0.01
American Kestrel	0	0	0.00	1	1	0.01	0	0	0.00	0	0	0.00	1	1	0.00
Cooper's Hawk	0	0	0.00	0	0	0.00	0	0	0.00	1	1	0.01	1	1	0.00
Totals	**9**	**8**	**0.14**	**44**	**35**	**0.46**	**8**	**8**	**0.17**	**52**	**37**	**0.65**	**113**	**88**	**0.39**
Waterfowl															
Canada Goose	3	2	0.05	130	10	1.35	7	1	0.15	208	21	2.60	348	34	1.21
Unknown Duck	11	2	0.17	7	3	0.07	46	2	0.96	10	5	0.13	74	12	0.26
Mallard	9	4	0.14	0	0	0.00	0	0	0.00	51	13	0.64	60	17	0.21
Snow Goose	0	0	0.00	20	2	0.21	0	0	0.00	0	0	0.00	20	2	0.07
Blue-winged teal	0	0	0.00	0	0	0.00	0	0	0.00	1	1	0.01	1	1	0.00
Totals	**23**	**8**	**0.36**	**157**	**15**	**1.64**	**53**	**3**	**1.10**	**270**	**40**	**3.38**	**503**	**66**	**1.75**
Shorebirds															
Killdeer	12	9	0.19	3	2	0.03	0	0	0.00	8	5	0.10	23	16	0.08
Upland Sandpiper	0	0	0.00	0	0	0.00	0	0	0.00	1	1	0.01	1	1	0.00
Wilson's Snipe	0	0	0.00	1	1	0.01	0	0	0.00	0	0	0.00	1	1	0.00
Totals	**12**	**9**	**0.19**	**4**	**3**	**0.04**	**0**	**0**	**0.00**	**9**	**6**	**0.11**	**25**	**18**	**0.09**
Gamebirds															
Wild Turkey	1	1	0.02	1	1	0.01	92	4	1.92	45	4	0.56	139	10	0.48
Ring-necked Pheasant	12	8	0.19	2	2	0.02	12	4	0.25	11	9	0.14	37	23	0.13
Totals	**13**	**9**	**0.20**	**3**	**3**	**0.03**	**104**	**8**	**2.17**	**56**	**13**	**0.70**	**176**	**33**	**0.61**
Woodpecker															
Northern Flicker	0	0	0.00	15	6	0.16	0	0	0.00	2	2	0.03	17	8	0.06
Downy Woodpecker	3	3	0.05	7	7	0.07	2	2	0.04	2	2	0.03	14	14	0.05
Totals	**3**	**3**	**0.05**	**22**	**13**	**0.23**	**2**	**2**	**0.04**	**4**	**4**	**0.05**	**31**	**22**	**0.11**
Crows and Allies															
American Crow	39	8	0.61	249	27	2.59	57	15	1.19	221	23	2.76	566	73	1.97
Blue Jay	28	12	0.44	80	26	0.83	18	9	0.38	22	11	0.28	148	58	0.51
Totals	**67**	**20**	**1.05**	**329**	**53**	**3.43**	**75**	**24**	**1.56**	**243**	**34**	**3.04**	**714**	**131**	**2.48**
Pigeons & Doves															
Rock Pigeon	22	9	0.34	79	17	0.82	31	10	0.65	40	13	0.50	172	49	0.60
Mourning Dove	14	9	0.22	13	8	0.14	0	0	0.00	7	6	0.09	34	23	0.12
Totals	**36**	**18**	**0.56**	**92**	**25**	**0.96**	**31**	**10**	**0.65**	**47**	**19**	**0.59**	**206**	**72**	**0.72**
Wadingbirds															
Great Blue Heron	2	2	0.03	0	0	0.00	0	0	0.00	0	0	0.00	2	2	0.01
Totals	**2**	**2**	**0.03**	**0**	**0**	**0.00**	**0**	**0**	**0.00**	**0**	**0**	**0.00**	**2**	**2**	**0.01**
Waterbirds															
American White Pelican	4	1	0.06	0	0	0.00	0	0	0.00	12	2	0.15	16	3	0.06
Totals	**4**	**1**	**0.06**	**0**	**0**	**0.00**	**0**	**0**	**0.00**	**12**	**2**	**0.15**	**16**	**3**	**0.06**
Gulls/Terns															
Ring-billed Gull	4	2	0.06	21	4	0.22	0	0	0.00	0	0	0.00	25	6	0.09
Totals	**4**	**2**	**0.06**	**21**	**4**	**0.22**	**0**	**0**	**0.00**	**0**	**0**	**0.00**	**25**	**6**	**0.09**
Grand Totals	**875**	**284**	**13.67**	**1,702**	**274**	**17.73**	**822**	**86**	**17.13**	**1,969**	**275**	**24.61**	**5,368**	**919**	**18.64**

Table 6. Cumulative Palmer's Creek Point Count Percent Composition and Frequency by Species Group										
Species	Summer 2016 & 2017		Fall 2016		Winter 2016-2017		Spring 2017		Cumulative	
	Percent (%) Composition	Percent (%) Frequency	Percent (%) Composition	Percent (%) Frequency	Percent (%) Composition	Percent (%) Frequency	Percent (%) Composition	Percent (%) Frequency	Percent (%) Composition	Percent (%) Frequency
Songbirds										
European Starling	5.03%	4.69%	6.11%	6.25%	41.24%	20.83%	28.80%	18.75%	19.63%	2.78%
Red-winged Blackbird	14.74%	34.38%	12.04%	12.50%	0.00%	0.00%	17.98%	18.75%	12.82%	11.81%
Brown-headed Cowbird	15.54%	20.31%	11.69%	14.58%	0.00%	0.00%	2.03%	6.25%	6.99%	9.38%
Horned Lark	2.97%	20.31%	2.76%	5.21%	0.24%	2.08%	6.30%	37.50%	3.71%	6.25%
Barn Swallow	12.69%	32.81%	4.52%	5.21%	0.00%	0.00%	0.00%	0.00%	3.50%	9.03%
American Goldfinch	5.03%	29.69%	5.29%	14.58%	0.00%	0.00%	0.61%	3.75%	2.72%	11.46%
Snow Bunting	0.00%	0.00%	0.00%	0.00%	13.26%	12.50%	0.00%	0.00%	2.03%	0.00%
Field Sparrow	4.00%	26.56%	3.58%	22.92%	0.00%	0.00%	0.56%	6.25%	1.99%	13.54%
Dark-eyed Junco	0.00%	0.00%	3.17%	6.25%	3.41%	8.33%	0.91%	3.75%	1.86%	2.08%
Common Grackle	1.26%	6.25%	1.47%	4.17%	0.00%	0.00%	2.69%	7.50%	1.66%	2.78%
Black-capped Chickadee	0.46%	3.13%	2.12%	7.29%	3.41%	10.42%	0.61%	2.50%	1.49%	3.13%
Unidentified Sparrow	0.00%	0.00%	0.00%	0.00%	4.26%	8.33%	1.27%	1.25%	1.12%	0.00%
American Robin	1.60%	12.50%	0.88%	8.33%	0.00%	0.00%	1.22%	12.50%	0.99%	5.56%
Unknown Blackbird	0.00%	0.00%	2.35%	1.04%	0.00%	0.00%	0.00%	0.00%	0.75%	0.35%
American Tree Sparrow	0.00%	0.00%	2.23%	5.21%	0.00%	0.00%	0.00%	0.00%	0.71%	1.74%
Tree Swallow	2.63%	14.06%	0.00%	0.00%	0.00%	0.00%	0.36%	5.00%	0.56%	3.13%
Cedar Waxwing	0.69%	4.69%	0.88%	3.13%	0.00%	0.00%	0.30%	2.50%	0.50%	2.08%
Common Yellowthroat	2.29%	15.63%	0.12%	2.08%	0.00%	0.00%	0.00%	0.00%	0.41%	4.17%
Yellow Warbler	2.29%	4.69%	0.00%	0.00%	0.00%	0.00%	0.05%	1.25%	0.39%	1.04%
Clay-colored Sparrow	1.83%	18.75%	0.00%	0.00%	0.00%	0.00%	0.05%	1.25%	0.32%	4.17%
Western Meadowlark	0.00%	0.00%	0.82%	3.13%	0.00%	0.00%	0.05%	1.25%	0.28%	1.04%
Savannah Sparrow	0.00%	0.00%	0.00%	0.00%	0.97%	2.08%	0.36%	1.25%	0.28%	0.00%
Bank Swallow	1.37%	1.56%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.22%	0.35%
Chipping Sparrow	1.03%	12.50%	0.00%	0.00%	0.00%	0.00%	0.10%	2.50%	0.20%	2.78%
Vesper Sparrow	1.14%	9.38%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.19%	2.08%
Song Sparrow	0.80%	7.81%	0.00%	0.00%	0.00%	0.00%	0.10%	2.50%	0.17%	1.74%
Yellow-headed Blackbird	0.23%	3.13%	0.00%	0.00%	0.00%	0.00%	0.30%	2.50%	0.15%	0.69%
Eastern Bluebird	0.00%	0.00%	0.35%	2.08%	0.00%	0.00%	0.10%	1.25%	0.15%	0.69%
Sedge Wren	0.57%	7.81%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.09%	1.74%
Least Flycatcher	0.46%	4.69%	0.06%	1.04%	0.00%	0.00%	0.00%	0.00%	0.09%	1.39%
Belted Kingfisher	0.23%	3.13%	0.06%	1.04%	0.00%	0.00%	0.05%	1.25%	0.07%	1.04%
Eastern Kingbird	0.46%	4.69%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	1.04%
Eastern Wood-Pewee	0.34%	4.69%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.06%	1.04%
Grasshopper Sparrow	0.23%	3.13%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.04%	0.69%
Bobolink	0.11%	1.56%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.35%
Marsh Wren	0.11%	1.56%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.35%
Willow Flycatcher	0.11%	1.56%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.35%
Totals	**80.23%**		**60.52%**		**66.79%**		**64.80%**		**66.26%**	
Raptors/Vultures/Owls										
Red-tailed Hawk	0.34%	4.69%	1.12%	15.63%	0.73%	10.42%	0.86%	18.75%	0.84%	6.25%
Turkey Vulture	0.57%	6.25%	0.41%	5.21%	0.00%	0.00%	0.81%	6.25%	0.52%	3.13%
Bald Eagle	0.00%	0.00%	0.59%	6.25%	0.00%	0.00%	0.86%	10.00%	0.50%	2.08%
Swainson's Hawk	0.11%	1.56%	0.18%	2.08%	0.12%	2.08%	0.00%	0.00%	0.09%	1.04%
Rough-legged Hawk	0.00%	0.00%	0.24%	2.08%	0.00%	0.00%	0.00%	0.00%	0.07%	0.69%
Northern Harrier	0.00%	0.00%	0.00%	0.00%	0.12%	2.08%	0.05%	1.25%	0.04%	0.00%
American Kestrel	0.00%	0.00%	0.06%	1.04%	0.00%	0.00%	0.00%	0.00%	0.02%	0.35%
Cooper's Hawk	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	1.25%	0.02%	0.00%
Totals	**1.03%**		**2.59%**		**0.97%**		**2.64%**		**2.11%**	
Waterfowl										
Canada Goose	0.00%	0.00%	7.64%	10.42%	0.85%	2.08%	10.56%	25.00%	6.48%	4.17%
Unknown Duck	1.26%	3.13%	0.41%	3.13%	5.60%	4.17%	0.51%	6.25%	1.38%	1.74%
Mallard	1.03%	6.25%	0.00%	0.00%	0.00%	0.00%	2.59%	13.75%	1.12%	1.39%
Snow Goose	0.34%	3.13%	1.18%	2.08%	0.00%	0.00%	0.00%	0.00%	0.37%	0.69%
Blue-winged teal	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	1.25%	0.02%	0.00%
Totals	**2.63%**		**9.22%**		**6.45%**		**13.71%**		**9.37%**	
Shorebirds										
Killdeer	1.37%	14.06%	0.18%	2.08%	0.00%	0.00%	0.41%	6.25%	0.43%	3.82%
Upland Sandpiper	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	1.25%	0.02%	0.00%
Wilson's Snipe	0.00%	0.00%	0.06%	1.04%	0.00%	0.00%	0.00%	0.00%	0.02%	0.35%
Totals	**1.37%**		**0.24%**		**0.00%**		**0.46%**		**0.47%**	
Gamebirds										
Wild Turkey	0.11%	1.56%	0.06%	1.04%	11.19%	8.33%	2.29%	5.00%	2.59%	0.69%
Ring-necked Pheasant	1.37%	12.50%	0.12%	2.08%	1.46%	8.33%	0.56%	11.25%	0.69%	3.47%
Totals	**1.49%**		**0.18%**		**12.65%**		**2.84%**		**3.28%**	
Woodpecker										
Northern Flicker	0.00%	0.00%	0.88%	6.25%	0.00%	0.00%	0.10%	2.50%	0.32%	2.08%
Downy Woodpecker	0.34%	4.69%	0.41%	7.29%	0.24%	4.17%	0.10%	2.50%	0.26%	3.47%
Totals	**0.34%**		**1.29%**		**0.24%**		**0.20%**		**0.58%**	
Crows and Allies										
American Crow	4.46%	12.50%	14.63%	23.96%	6.93%	31.25%	11.22%	23.75%	10.54%	10.07%
Blue Jay	3.20%	18.75%	4.70%	27.08%	2.19%	18.75%	1.12%	13.75%	2.76%	13.19%
Totals	**7.66%**		**19.33%**		**9.12%**		**12.34%**		**13.30%**	
Pigeons & Doves										
Rock Pigeon	2.51%	14.06%	4.64%	17.71%	3.77%	20.83%	2.03%	15.00%	3.20%	9.03%
Mourning Dove	1.60%	14.06%	0.76%	8.33%	0.00%	0.00%	0.36%	7.50%	0.63%	5.90%
Totals	**4.11%**		**5.41%**		**3.77%**		**2.39%**		**3.84%**	
Wadingbirds										
Great Blue Heron	0.23%	3.13%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.04%	0.69%
Totals	**0.23%**		**0.00%**		**0.00%**		**0.00%**		**0.04%**	
Waterbirds										
American White Pelican	0.46%	1.56%	0.00%	0.00%	0.00%	0.00%	0.61%	2.50%	0.30%	0.35%
Totals	**0.46%**		**0.00%**		**0.00%**		**0.61%**		**0.30%**	
Gulls/Terns										
Ring-billed Gull	0.46%	3.13%	1.23%	4.17%	0.00%	0.00%	0.00%	0.00%	0.47%	2.08%
Totals	**0.46%**		**1.23%**		**0.00%**		**0.00%**		**0.47%**	
Grand Totals	**100.00%**		**100.00%**		**100.00%**		**100.00%**		**100.00%**	

Table 7a. Avian Species Observed by Point Count at Palmer's Creek (Summer 2016 & Summer 2017)										
Species	**Number of Observations**	**Number of Individuals**	**Points**							
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Songbirds										
European Starling	3	44	0	0	0	0	0	0	6	38
Red-winged Blackbird	22	129	0	3	90	3	5	7	14	7
Brown-headed Cowbird	13	136	12	2	3	1	0	7	3	108
Horned Lark	13	26	3	2	0	11	5	3	0	2
Barn Swallow	21	111	7	24	3	14	3	38	1	21
American Goldfinch	20	44	5	7	9	8	2	6	5	2
Field Sparrow	17	35	4	3	7	7	6	2	5	1
Common Grackle	4	11	0	0	0	2	0	4	5	0
Black-capped Chickadee	2	4	1	0	3	0	0	0	0	0
American Robin	8	14	3	0	1	4	0	2	0	4
Tree Swallow	9	23	0	5	2	2	1	0	5	8
Cedar Waxwing	3	6	0	2	1	3	0	0	0	0
Common Yellowthroat	10	20	0	5	6	0	2	1	3	3
Yellow Warbler	4	20	0	0	18	0	0	0	0	2
Clay-colored Sparrow	12	16	1	5	4	1	1	1	2	1
Bank Swallow	1	12	0	0	0	0	0	0	0	12
Chipping Sparrow	8	9	1	1	4	0	0	0	1	2
Vesper Sparrow	6	10	6	1	0	0	2	1	0	0
Song Sparrow	5	7	0	1	4	0	1	0	0	1
Yellow-headed Blackbird	2	2	0	0	2	0	0	0	0	0
Sedge Wren	5	5	0	0	3	0	2	0	0	0
Least Flycatcher	3	4	0	0	1	2	1	0	0	0
Belted Kingfisher	2	2	0	0	1	0	0	0	0	1
Eastern Kingbird	3	4	0	1	0	0	2	0	1	0
Eastern Wood-Pewee	3	3	2	0	0	1	0	0	0	0
Grasshopper Sparrow	2	2	1	1	0	0	0	0	0	0
Bobolink	1	1	0	0	0	0	0	0	0	1
Marsh Wren	1	1	0	0	1	0	0	0	0	0
Willow Flycatcher	1	1	0	0	0	1	0	0	0	0
Raptors/Vultures/Owls										
Red-tailed Hawk	3	3	0	1	0	1	0	0	0	1
Turkey Vulture	4	5	0	3	0	1	0	1	0	0
Swainson's Hawk	1	1	0	0	1	0	0	0	0	0
Waterfowl										
Canada Goose	2	3	0	0	3	0	0	0	0	0
Unknown Duck	2	11	0	0	11	0	0	0	0	0
Mallard	4	9	0	0	6	0	0	0	0	3
Shorebirds										
Killdeer	9	12	2	1	0	1	2	0	1	5
Gamebirds										
Wild Turkey	1	1	1	0	0	0	0	0	0	0
Ring-necked Pheasant	8	12	4	1	0	0	2	3	2	0
Woodpecker										
Downy Woodpecker	3	3	0	0	0	0	1	1	0	1
Crows and Allies										
American Crow	8	39	11	21	5	2	0	0	0	0
Blue Jay	12	28	9	1	0	9	0	1	3	5
Pigeons & Doves										
Rock Pigeon	9	22	1	0	0	11	0	3	2	5
Mourning Dove	9	14	0	3	0	4	0	7	0	0
Wadingbirds										
Great Blue Heron	2	2	0	0	1	1	0	0	0	0
Waterbirds										
American White Pelican	1	4	4	0	0	0	0	0	0	0
Gulls/Terns										
Ring-billed Gull	2	4	0	0	1	0	0	3	0	0
Totals	**284**	**875**	**78**	**94**	**191**	**90**	**38**	**91**	**59**	**234**
Mean Use		**13.67**	**9.75**	**11.75**	**23.88**	**11.25**	**4.75**	**11.38**	**7.38**	**29.25**

Table 7b. Avian Species Observed by Point Count at Palmer's Creek (Fall 2016)										
Species	Number of Observations	Number of Individuals	Points							
			1	2	3	4	5	6	7	8
Songbirds										
European Starling	6	104	75	0	0	0	0	0	0	29
Red-winged Blackbird	12	205	0	0	81	7	11	74	32	0
Brown-headed Cowbird	15	199	13	32	0	14	8	18	15	99
Horned Lark	5	47	0	23	15	0	0	3	1	5
Barn Swallow	5	77	0	1	38	0	0	0	0	38
American Goldfinch	15	90	37	9	18	0	5	1	9	11
Field Sparrow	22	61	19	2	23	3	5	3	5	1
Dark-eyed Junco	6	54	0	0	36	0	14	0	0	4
Common Grackle	4	25	2	0	6	0	0	17	0	0
Black-capped Chickadee	7	36	0	0	8	0	26	0	0	2
American Robin	8	15	2	5	0	0	0	3	1	4
Unknown Blackbird	1	40	0	0	0	0	0	40	0	0
American Tree Sparrow	5	38	0	4	10	18	6	0	0	0
Cedar Waxwing	3	15	3	0	0	0	0	5	7	0
Common Yellowthroat	2	2	1	0	0	0	1	0	0	0
Western Meadowlark	3	14	0	0	5	0	0	0	2	7
Eastern Bluebird	2	6	0	5	1	0	0	0	0	0
Least Flycatcher	1	1	0	0	0	1	0	0	0	0
Belted Kingfisher	1	1	0	0	1	0	0	0	0	0
Raptors/Vultures/Owls										
Red-tailed Hawk	16	19	1	3	5	4	1	1	2	2
Turkey Vulture	5	7	0	2	2	0	2	1	0	0
Bald Eagle	8	10	5	1	0	2	0	1	1	0
Swainson's Hawk	2	3	0	0	2	1	0	0	0	0
Rough-legged Hawk	3	4	0	0	1	0	0	0	3	0
American Kestrel	1	1	0	1	0	0	0	0	0	0
Waterfowl										
Canada Goose	10	130	27	3	64	21	0	3	12	0
Unknown Duck	3	7	0	0	6	0	0	1	0	0
Snow Goose	2	20	2	0	18	0	0	0	0	0
Shorebirds										
Killdeer	2	3	2	0	0	0	0	0	0	1
Wilson's Snipe	1	1	1	0	0	0	0	0	0	0
Gamebirds										
Wild Turkey	1	1	1	0	0	0	0	0	0	0
Ring-necked Pheasant	2	2	0	1	0	0	1	0	0	0
Woodpecker										
Northern Flicker	6	15	0	4	0	3	4	0	4	0
Downy Woodpecker	7	7	1	1	0	1	0	3	1	0
Crows and Allies										
American Crow	27	249	180	24	0	8	5	8	2	22
Blue Jay	26	80	16	17	10	5	12	8	3	9
Pigeons & Doves										
Rock Pigeon	17	79	22	10	7	3	3	6	12	16
Mourning Dove	8	13	0	1	0	5	3	3	1	0
Gulls/Terns										
Ring-billed Gull	4	21	0	0	0	16	1	0	2	2
Totals	**274**	**1,702**	**410**	**149**	**357**	**112**	**108**	**199**	**115**	**252**
Mean Use		**17.73**	**34.17**	**12.42**	**29.75**	**9.33**	**9.00**	**16.58**	**9.58**	**21.00**

Table 7c. Avian Species Observed by Point Count at Palmer's Creek (Winter 2016-2017)										
Species	**Number of Observations**	**Number of Individuals**	**Points**							
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Songbirds										
European Starling	10	339	51	0	0	0	0	31	0	257
Horned Lark	1	2	0	0	2	0	0	0	0	0
Snow Bunting	6	109	0	48	0	0	20	0	0	41
Dark-eyed Junco	4	28	0	0	10	0	18	0	0	0
Black-capped Chickadee	5	28	0	0	9	0	19	0	0	0
Unidentified Sparrow	4	35	0	0	1	16	0	0	18	0
Savannah Sparrow	1	8	0	0	0	8	0	0	0	0
Raptors/Vultures/Owls										
Red-tailed Hawk	6	6	0	2	1	0	0	1	1	1
Swainson's Hawk	1	1	0	0	1	0	0	0	0	0
Northern Harrier	1	1	1	0	0	0	0	0	0	0
Waterfowl										
Canada Goose	1	7	0	7	0	0	0	0	0	0
Unknown Duck	2	46	0	14	32	0	0	0	0	0
Gamebirds										
Wild Turkey	4	92	89	3	0	0	0	0	0	0
Ring-necked Pheasant	4	12	0	0	6	5	1	0	0	0
Woodpecker										
Downy Woodpecker	2	2	0	0	0	0	0	1	1	0
Crows and Allies										
American Crow	15	57	17	12	10	1	1	0	15	1
Blue Jay	9	18	4	11	0	2	1	0	0	0
Pigeons & Doves										
Rock Pigeon	10	31	0	12	0	3	0	6	6	4
Totals	**86**	**822**	**162**	**109**	**72**	**35**	**60**	**39**	**41**	**304**
Mean Use		**17.13**	**27.00**	**18.17**	**12.00**	**5.83**	**10.00**	**6.50**	**6.83**	**50.67**

Table 7d. Avian Species Observed by Point Count at Palmer's Creek (Spring 2017)										
Species	Number of Observations	Number of Individuals	Points							
			1	2	3	4	5	6	7	8
Songbirds										
European Starling	15	567	104	0	0	0	8	5	0	450
Red-winged Blackbird	18	354	0	0	324	5	10	8	4	3
Brown-headed Cowbird	5	40	0	0	1	3	0	6	0	30
Horned Lark	34	124	10	20	14	32	8	22	14	4
American Goldfinch	3	12	0	8	0	0	0	0	0	4
Field Sparrow	5	11	0	4	2	5	0	0	0	0
Dark-eyed Junco	3	18	0	7	4	0	7	0	0	0
Common Grackle	6	53	6	14	14	0	0	17	2	0
Black-capped Chickadee	2	12	0	0	0	0	12	0	0	0
Unidentified Sparrow	1	25	0	0	0	25	0	0	0	0
American Robin	10	24	3	8	3	0	4	2	2	2
Tree Swallow	4	7	4	2	0	0	0	1	0	0
Cedar Waxwing	2	6	0	6	0	0	0	0	0	0
Yellow Warbler	1	1	0	0	1	0	0	0	0	0
Clay-colored Sparrow	1	1	0	1	0	0	0	0	0	0
Western Meadowlark	1	1	0	1	0	0	0	0	0	0
Savannah Sparrow	1	7	0	0	0	7	0	0	0	0
Chipping Sparrow	2	2	0	1	1	0	0	0	0	0
Song Sparrow	2	2	0	0	0	1	1	0	0	0
Yellow-headed Blackbird	2	6	0	0	6	0	0	0	0	0
Eastern Bluebird	1	2	0	0	0	0	0	0	2	0
Belted Kingfisher	1	1	0	0	0	0	0	0	0	1
Raptors/Vultures/Owls										
Red-tailed Hawk	16	17	2	1	6	4	1	0	2	1
Turkey Vulture	6	16	0	0	2	11	2	0	0	1
Bald Eagle	13	17	3	0	5	8	0	0	1	0
Northern Harrier	1	1	0	1	0	0	0	0	0	0
Cooper's Hawk	1	1	0	0	0	0	1	0	0	0
Waterfowl										
Canada Goose	21	208	21	10	98	0	6	62	11	0
Unknown Duck	5	10	0	0	9	0	1	0	0	0
Mallard	13	51	0	0	25	6	6	0	12	2
Blue-winged teal	1	1	0	0	1	0	0	0	0	0
Shorebirds										
Killdeer	5	8	0	0	0	1	0	0	0	7
Upland Sandpiper	1	1	0	0	0	0	0	0	0	1
Gamebirds										
Wild Turkey	4	45	45	0	0	0	0	0	0	0
Ring-necked Pheasant	9	11	0	3	1	0	6	0	1	0
Woodpecker										
Northern Flicker	2	2	1	0	0	1	0	0	0	0
Downy Woodpecker	2	2	0	0	1	0	0	0	0	1
Crows and Allies										
American Crow	23	221	30	24	72	49	12	22	0	12
Blue Jay	11	22	5	2	2	7	0	5	0	1
Pigeons & Doves										
Rock Pigeon	13	40	0	0	0	3	1	16	9	11
Mourning Dove	6	7	2	0	0	2	1	1	0	1
Waterbirds										
American White Pelican	2	12	0	0	3	9	0	0	0	0
Totals	**275**	**1,969**	**236**	**113**	**595**	**179**	**87**	**167**	**60**	**532**
Mean Use		**24.61**	**23.60**	**11.30**	**59.50**	**17.90**	**8.70**	**16.70**	**6.00**	**53.20**

Table 8. Cumulative Avian Species Observed by Point Count at Palmer's Creek										
Species	Number of Observations	Number of Individuals	Points							
			1	2	3	4	5	6	7	8
Songbirds										
European Starling	34	1,054	230	0	0	0	8	36	6	774
Red-winged Blackbird	52	688	0	3	495	15	26	89	50	10
Brown-headed Cowbird	33	375	25	34	4	18	8	31	18	237
Horned Lark	53	199	13	45	31	43	13	28	15	11
Barn Swallow	26	188	7	25	41	14	3	38	1	59
American Goldfinch	38	146	42	24	27	8	7	7	14	17
Snow Bunting	6	109	0	48	0	0	20	0	0	41
Field Sparrow	44	107	23	9	32	15	11	5	10	2
Dark-eyed Junco	13	100	0	7	50	0	39	0	0	4
Common Grackle	14	89	8	14	20	2	0	38	7	0
Black-capped Chickadee	16	80	1	0	20	0	57	0	0	2
Unidentified Sparrow	5	60	0	0	1	41	0	0	18	0
American Robin	26	53	8	13	4	4	4	7	3	10
Unknown Blackbird	1	40	0	0	0	0	0	40	0	0
American Tree Sparrow	5	38	0	4	10	18	6	0	0	0
Tree Swallow	13	30	4	7	2	2	1	1	5	8
Cedar Waxwing	8	27	3	8	1	3	0	5	7	0
Common Yellowthroat	12	22	1	5	6	0	3	1	3	3
Yellow Warbler	5	21	0	0	19	0	0	0	0	2
Clay-colored Sparrow	13	17	1	6	4	1	1	1	2	1
Western Meadowlark	4	15	0	1	5	0	0	0	2	7
Savannah Sparrow	2	15	0	0	0	15	0	0	0	0
Bank Swallow	1	12	0	0	0	0	0	0	0	12
Chipping Sparrow	10	11	1	2	5	0	0	0	1	2
Vesper Sparrow	6	10	6	1	0	0	2	1	0	0
Song Sparrow	7	9	0	1	4	1	2	0	0	1
Yellow-headed Blackbird	4	8	0	0	8	0	0	0	0	0
Eastern Bluebird	3	8	0	5	1	0	0	0	2	0
Sedge Wren	5	5	0	0	3	0	2	0	0	0
Least Flycatcher	4	5	0	0	1	3	1	0	0	0
Belted Kingfisher	4	4	0	0	2	0	0	0	0	2
Eastern Kingbird	3	4	0	1	0	0	2	0	1	0
Eastern Wood-Pewee	3	3	2	0	0	1	0	0	0	0
Grasshopper Sparrow	2	2	1	1	0	0	0	0	0	0
Bobolink	1	1	0	0	0	0	0	0	0	1
Marsh Wren	1	1	0	0	1	0	0	0	0	0
Willow Flycatcher	1	1	0	0	0	1	0	0	0	0
Raptors/Vultures/Owls										
Red-tailed Hawk	41	45	3	7	12	9	2	2	5	5
Turkey Vulture	15	28	0	5	4	12	4	2	0	1
Bald Eagle	21	27	8	1	5	10	0	1	2	0
Swainson's Hawk	4	5	0	0	4	1	0	0	0	0
Rough-legged Hawk	3	4	0	0	1	0	0	0	3	0
Northern Harrier	2	2	1	1	0	0	0	0	0	0
American Kestrel	1	1	0	1	0	0	0	0	0	0
Cooper's Hawk	1	1	0	0	0	0	1	0	0	0
Waterfowl										
Canada Goose	34	348	48	20	165	21	6	65	23	0
Unknown Duck	12	74	0	14	58	0	1	1	0	0
Mallard	17	60	0	0	31	6	6	0	12	5
Snow Goose	2	20	2	0	18	0	0	0	0	0
Blue-winged teal	1	1	0	0	1	0	0	0	0	0
Shorebirds										
Killdeer	16	23	4	1	0	2	2	0	1	13
Upland Sandpiper	1	1	0	0	0	0	0	0	0	1
Wilson's Snipe	1	1	1	0	0	0	0	0	0	0
Gamebirds										
Wild Turkey	10	139	136	3	0	0	0	0	0	0
Ring-necked Pheasant	23	37	4	5	7	5	10	3	3	0
Woodpecker										
Northern Flicker	8	17	1	4	0	4	4	0	4	0
Downy Woodpecker	14	14	1	1	1	1	1	5	2	2
Crows and Allies										
American Crow	73	566	238	81	87	60	18	30	17	35
Blue Jay	58	148	34	31	12	23	13	14	6	15
Pigeons & Doves										
Rock Pigeon	49	172	23	22	7	20	4	31	29	36
Mourning Dove	23	34	2	4	0	11	4	11	1	1
Wadingbirds										
Great Blue Heron	2	2	0	0	1	1	0	0	0	0
Waterbirds										
American White Pelican	3	16	4	0	3	9	0	0	0	0
Gulls/Terns										
Ring-billed Gull	6	25	0	0	1	16	1	3	2	2
Totals	**919**	**5,368**	**886**	**465**	**1,215**	**416**	**293**	**496**	**275**	**1,322**
Mean Use		**18.64**	**24.61**	**12.92**	**33.75**	**11.56**	**8.14**	**13.78**	**7.64**	**36.72**

Table 9. Avian Flight Heights at Palmer's Creek																				
Species	Summer 2016 & 2017				Fall 2016				Winter 2016-2017				Spring 2017				Cumulative			
	Observation		Individuals		Observation		Individuals		Observation		Individuals		Observation		Individuals		Observation		Individuals	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Non-Raptors																				
Above RSA (>148m)	0	0.00%	0	0.00%	5	3.05%	51	4.47%	1	1.79%	7	1.07%	5	3.01%	19	1.14%	13	2.38%	138	3.21%
Below RSA (<22m)	138	97.18%	624	98.89%	145	88.41%	979	85.88%	52	92.86%	602	91.77%	129	77.71%	1418	85.32%	480	87.91%	3769	87.73%
Within RSA (≥22m and ≤148m)	4	2.82%	7	1.11%	14	8.54%	110	9.65%	3	5.36%	47	7.16%	32	19.28%	225	13.54%	53	9.71%	389	9.05%
Raptors/Vultures/Owls																				
Above RSA (>148m)	0	0.00%	0	0.00%	8	26.67%	13	34.21%	1	12.50%	1	12.50%	4	10.81%	6	11.54%	13	15.48%	20	18.52%
Below RSA (<22m)	4	50.00%	4	44.44%	13	43.33%	15	39.47%	5	62.50%	5	62.50%	10	27.03%	12	23.08%	32	38.10%	36	33.33%
Within RSA (≥22m and ≤148m)	4	50.00%	5	55.56%	9	30.00%	10	26.32%	2	25.00%	2	25.00%	23	62.16%	34	65.38%	39	46.43%	52	48.15%

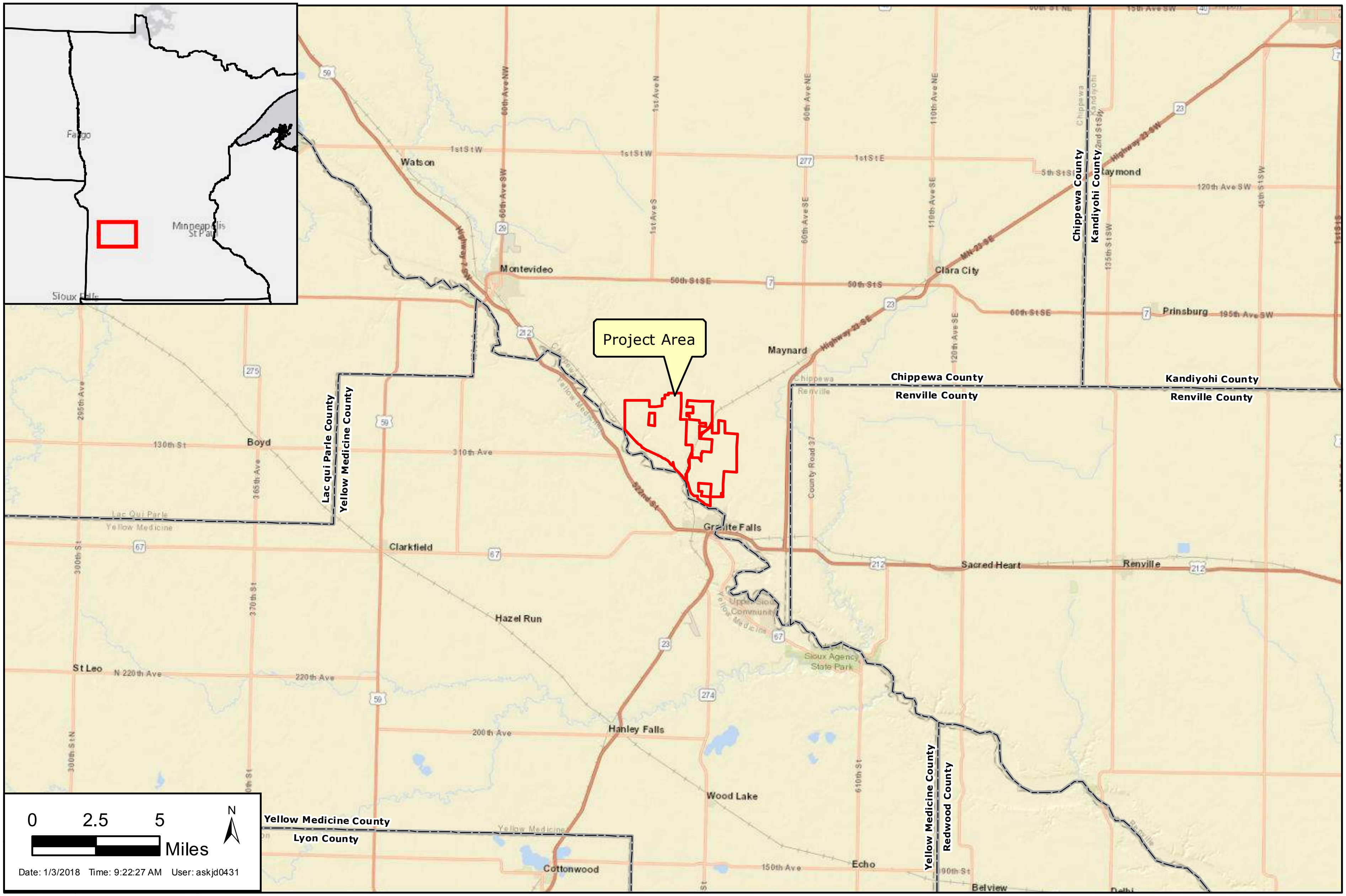
Table 10. Point Count Individuals and RSA at Palmer's Creek

Species	Summer 2016 & 2017						Fall 2016						Winter 2016-2017						Spring 2017						Cumulative					
	Encounter Rate	Mean Use (# birds/20 min)	Flying (%)	Percent (%) Flying Below RSA	Percent (%) Flying Within RSA	Percent (%) Flying Above RSA	Encounter Rate	Mean Use (# birds/20 min)	Flying (%)	Percent (%) Flying Below RSA	Percent (%) Flying Within RSA	Percent (%) Flying Above RSA	Encounter Rate	Mean Use (# birds/20 min)	Flying (%)	Percent (%) Flying Below RSA	Percent (%) Flying Within RSA	Percent (%) Flying Above RSA	Encounter Rate	Mean Use (# birds/20 min)	Flying (%)	Percent (%) Flying Below RSA	Percent (%) Flying Within RSA	Percent (%) Flying Above RSA	Encounter Rate	Mean Use (# birds/20 min)	Flying (%)	Percent (%) Flying Below RSA	Percent (%) Flying Within RSA	Percent (%) Flying Above RSA
Songbirds																														
European Starling	0.00	0.69	100.00%	100.00%	0.00%	0.00%	0.00	1.08	72.12%	100.00%	0.00%	0.00%	0.00	7.06	91.15%	100.00%	0.00%	0.00%	0.16	7.09	99.12%	97.69%	2.31%	0.00%	0.05	3.66	93.93%	98.69%	1.31%	0.00%
Red-winged Blackbird	0.00	2.02	90.70%	100.00%	0.00%	0.00%	0.27	2.14	100.00%	87.32%	12.68%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.08	4.43	100.00%	98.31%	1.69%	0.00%	0.11	2.39	98.26%	95.27%	4.73%	0.00%
Brown-headed Cowbird	0.00	2.13	89.71%	100.00%	0.00%	0.00%	0.00	2.07	82.41%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.50	97.50%	100.00%	0.00%	0.00%	0.00	1.30	86.67%	100.00%	0.00%	0.00%
Horned Lark	0.00	0.41	80.77%	100.00%	0.00%	0.00%	0.00	0.49	91.49%	100.00%	0.00%	0.00%	0.00	0.04	100.00%	100.00%	0.00%	0.00%	0.00	1.55	84.68%	100.00%	0.00%	0.00%	0.00	0.69	85.93%	100.00%	0.00%	0.00%
Barn Swallow	0.00	1.73	100.00%	100.00%	0.00%	0.00%	0.00	0.80	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.65	100.00%	100.00%	0.00%	0.00%
American Goldfinch	0.00	0.69	100.00%	100.00%	0.00%	0.00%	0.02	0.94	100.00%	97.78%	2.22%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.15	100.00%	100.00%	0.00%	0.00%	0.01	0.51	100.00%	98.63%	1.37%	0.00%
Snow Bunting	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	2.27	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.38	100.00%	100.00%	0.00%	0.00%
Field Sparrow	0.00	0.55	34.29%	100.00%	0.00%	0.00%	0.00	0.64	78.69%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.14	18.18%	100.00%	0.00%	0.00%	0.00	0.37	57.94%	100.00%	0.00%	0.00%
Dark-eyed Junco	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.56	100.00%	100.00%	0.00%	0.00%	0.00	0.58	100.00%	100.00%	0.00%	0.00%	0.00	0.23	100.00%	100.00%	0.00%	0.00%	0.00	0.35	100.00%	100.00%	0.00%	0.00%
Common Grackle	0.00	0.17	100.00%	100.00%	0.00%	0.00%	0.00	0.26	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.18	0.66	100.00%	73.58%	26.42%	0.00%	0.05	0.31	100.00%	84.27%	15.73%	0.00%
Black-capped Chickadee	0.00	0.06	0.00%	0.00%	0.00%	0.00%	0.00	0.38	100.00%	100.00%	0.00%	0.00%	0.00	0.58	100.00%	100.00%	0.00%	0.00%	0.00	0.15	100.00%	100.00%	0.00%	0.00%	0.00	0.28	95.00%	100.00%	0.00%	0.00%
Unidentified Sparrow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.73	97.14%	100.00%	0.00%	0.00%	0.00	0.31	100.00%	100.00%	0.00%	0.00%	0.00	0.21	98.33%	100.00%	0.00%	0.00%
American Robin	0.00	0.22	42.86%	100.00%	0.00%	0.00%	0.00	0.16	73.33%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.30	54.17%	100.00%	0.00%	0.00%	0.00	0.18	56.60%	100.00%	0.00%	0.00%
Unknown Blackbird	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.42	0.42	100.00%	0.00%	100.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.14	0.14	100.00%	0.00%	100.00%	0.00%
American Tree Sparrow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.40	97.37%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.13	97.37%	100.00%	0.00%	0.00%
Tree Swallow	0.00	0.36	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.09	100.00%	100.00%	0.00%	0.00%	0.00	0.10	100.00%	100.00%	0.00%	0.00%
Cedar Waxwing	0.00	0.09	66.67%	100.00%	0.00%	0.00%	0.00	0.16	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.08	50.00%	100.00%	0.00%	0.00%	0.00	0.09	81.48%	100.00%	0.00%	0.00%
Common Yellowthroat	0.00	0.31	0.00%	0.00%	0.00%	0.00%	0.00	0.02	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.08	0.00%	0.00%	0.00%	0.00%
Yellow Warbler	0.00	0.31	65.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%	0.00	0.07	66.67%	100.00%	0.00%	0.00%
Clay-colored Sparrow	0.00	0.25	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.06	0.00%	0.00%	0.00%	0.00%
Western Meadowlark	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.15	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.05	93.33%	100.00%	0.00%	0.00%
Savannah Sparrow	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.17	0.00%	0.00%	0.00%	0.00%	0.00	0.09	100.00%	100.00%	0.00%	0.00%	0.00	0.05	46.67%	100.00%	0.00%	0.00%
Bank Swallow	0.00	0.19	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.04	100.00%	100.00%	0.00%	0.00%
Chipping Sparrow	0.00	0.14	55.56%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	50.00%	100.00%	0.00%	0.00%	0.00	0.04	54.55%	100.00%	0.00%	0.00%
Vesper Sparrow	0.00	0.16	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	0.00%	0.00%	0.00%	0.00%
Song Sparrow	0.00	0.11	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	0.00%	0.00%	0.00%	0.00%	0.00	0.03	0.00%	0.00%	0.00%	0.00%
Yellow-headed Blackbird	0.00	0.03	50.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.08	100.00%	100.00%	0.00%	0.00%	0.00	0.03	87.50%	100.00%	0.00%	0.00%
Eastern Bluebird	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.06	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	100.00%	100.00%	0.00%	0.00%	0.00	0.03	100.00%	100.00%	0.00%	0.00%
Sedge Wren	0.00	0.08	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	0.00%	0.00%	0.00%	0.00%
Least Flycatcher	0.00	0.06	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	20.00%	100.00%	0.00%	0.00%
Belted Kingfisher	0.00	0.03	50.00%	100.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%	0.00	0.01	75.00%	100.00%	0.00%	0.00%
Eastern Kingbird	0.00	0.06	50.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	50.00%	100.00%	0.00%	0.00%
Eastern Wood-Pewee	0.00	0.05	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Grasshopper Sparrow	0.00	0.03	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%
Bobolink	0.00	0.02	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Marsh Wren	0.00	0.02	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Willow Flycatcher	0.00	0.02	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Raptors/Vultures/Owls																														
Red-tailed Hawk	0.02	0.05	100.00%	66.67%	33.33%	0.00%	0.04	0.20	89.47%	52.94%	23.53%	23.53%	0.04	0.13	100.00%	50.00%	33.33%	16.67%	0.16	0.21	100.00%	17.65%	76.47%	5.88%	0.07	0.16	95.56%	39.53%	46.51%	13.95%
Turkey Vulture	0.06	0.08	100.00%	20.00%	80.00%	0.00%	0.02	0.07	100.00%	42.86%	28.57%	28.57%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.19	0.20	100.00%	0.00%	93.75%	6.25%	0.07	0.10	100.00%	14.29%	75.00%	10.71%
Bald Eagle	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.03	0.10	90.00%	11.11%	33.33%	55.56%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.06	0.21	100.00%	47.06%	29.41%	23.53%	0.03	0.09	96.30%	34.62%	30.77%	34.62%
Swainson's Hawk	0.00	0.02	100.00%	100.00%	0.00%	0.00%	0.01	0.03	33.33%	0.00%	100.00%	0.00%	0.00	0.02	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	60.00%	66.67%	33.33%	0.00%
Rough-legged Hawk	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.01	0.04	100.00%	25.00%	25.00%	50.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	25.00%	25.00%	50.00%
Northern Harrier	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.02	100.00%	100.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%
American Kestrel	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	100.00%	100.00%	0.00%	0.00%
Cooper's Hawk	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.01	0.01	100.00%	0.00%	100.00%	0.00%	0.00	0.00	100.00%	0.00%	100.00%	0.00%
Waterfowl																														
Canada Goose	0.00	0.05	0.00%	0.00%	0.00%	0.00%	0.00	1.35	95.38%	24.19%	0.00%	75.81%	0.00	0.15	100.00%	0.00%	0.00%	100.00%	1.44	2.60	57.21%	0.00%	96.64%	3.36%	0.40	1.21	71.84%	12.00%	46.00%	42.00%
Unknown Duck	0.00	0.17	0.00%	0.00%	0.00%	0.00%	0.01	0.07	14.29%	0.00%	100.00%	0.00%	0.96	0.96	100.00%	0.00%	100.00%	0.00%	0.06	0.13	50.00%	0.00%	100.00%	0.00%	0.18	0.26	70.27%	0.00%	100.00%	0.00%
Mallard	0.00	0.14	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.03	0.64	60.78%	45.16%	6.45%	48.39%	0.01	0.21	51.67%	45.16%	6.45%	48.39%
Snow Goose	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.21	100.00%	10.00%	0.00%	90.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.07	100.00%	10.00%	0.00%	90.00%
Blue-winged teal	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Shorebirds																														
Killdeer	0.00	0.19	41.67%	100.00%	0.00%	0.00%	0.00	0.03	66.67%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.10	50.00%	100.00%	0.00%	0.00%	0.00	0.08	47.83%	100.00%	0.00%	0.00%
Upland Sandpiper	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Wilson's Snipe	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
Gamebirds																														
Wild Turkey	0.00	0.02	0.00%	0.00%	0.00%	0.00%	0.00	0.01	0.00%	0.00%	0.00%	0.00%	0.00	1.92	0.00%	0.00%	0.00%	0.00%	0.00	0.56	0.00%	0.00%	0.00%	0.00%	0.00	0.48	0.00%	0.00%	0.00%	0.00%
Ring-necked Pheasant	0.00	0.19	0.00%	0.00%	0.00%	0.00%	0.00	0.02	50.00%	100.00%	0.00%	0.00%	0.00	0.25	50.00%	100.00%	0.00%	0.00%	0.00	0.14	9.09%	100.00%	0.00%	0.00%	0.00	0.13	21.62%	100.00%	0.00%	0.00%
Woodpecker																														
Northern Flicker	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.16	100.00%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.03	100.00%	100.00%	0.00%	0.00%	0.00	0.06	100.00%	100.00%	0.00%	0.00%
Downy Woodpecker	0.00	0.05	0.00%	0.00%	0.00%	0.00%	0.00	0.07	100.00%	100.00%	0.00%	0.00%	0.00	0.04	50.00%	100.00%	0.00%	0.00%	0.00	0.03	50.00%	100.00%	0.00%	0.00%	0.00	0.05	64.29%	100.00%	0.00%	0.00%
Crows and Allies																														
American Crow	0.00	0.61	82.05%	100.00%	0.00%	0.00%	0.23	2.59	28.11%	68.57%	31.43%	0.00%	0.02	1.19	77.19%	97.73%	2.27%	0.00%	0.61	2.76	96.83%	77.10%	22.90%	0.00%	0.25	1.97	63.60%	80.00%	20.00%	0.00%
Blue Jay	0.00	0.44	28.57%	100.00%	0.00%	0.00%	0.00	0.83	68.75%	100.00%	0.00%	0.00%	0.00	0.38	61.11%	100.00%	0.00%	0.00%	0.00	0.28	31.82%	100.00%	0.00%	0.00%	0.00	0.51	54.73%	100.00%	0.00%	0.00%
Pigeons & Doves																														
Rock Pigeon	0.02	0.34	72.73%	93.75%	6.25%	0.00%	0.02	0.82	100.00%	97.47%	2.53%	0.00%	0.00	0.65	100.00%	100.00%	0.00%	0.00%	0.11	0.50	100.00%	77.50%	22.50%	0.00%	0.04	0.60	96.51%	92.77%	7.23%	0.00%
Mourning Dove	0.02	0.22	78.57%	90.91%	9.09%	0.00%	0.00	0.14	76.92%	100.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.09	42.86%	100.00%	0.00%	0.00%	0.00	0.12	70.59%	95.83%	4.17%	0.00%
Wadingbirds																														
Great Blue Heron	0.02	0.03	100.00%	50.00%	50.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.01	100.00%	50.00%	50.00%	0.00%
Waterbirds																														
American White Pelican	0.06	0.06	100.00%	0.00%	100.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.15	0.15	100.00%	0.00%	100.00%	0.00%	0.06	0.06	100.00%	0.00%	100.00%	0.00%
Gulls/Terns																														
Ring-billed Gull	0.00	0.06	100.00%	100.00%	0.00%	0.00%	0.18	0.22	100.00%	19.05%	80.95%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%	0.06	0.09	100.00%	32.00%	68.00%	0.00%
Totals	**0.19**	**13.67**	**73.14%**				**1.26**	**17.73**	**81.43%**				**1.02**	**17.13**	**80.78%**				**3.24**	**24.61**	**87.05%**				**1.53**	**18.64**	**82.04%**			

Table 11. Cumulative Point Count Individuals and RSA at Palmer's Creek

Species	Number Flying	Number of Observations	Summer 2016 & 2017									Fall 2016									Winter 2016-2017									Spring 2017									Cumulative								
			N	NE	E	SE	S	SW	W	NW	Var	N	NE	E	SE	S	SW	W	NW	Var	N	NE	E	SE	S	SW	W	NW	Var	N	NE	E	SE	S	SW	W	NW	Var	N	NE	E	SE	S	SW	W	NW	Var
Songbirds																																															
European Starling	990	34	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	13.64%	86.36%	0.00%	0.00%	0.00%	0.00%	58.67%	0.00%	0.00%	0.00%	41.33%	10.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	89.97%	0.00%	0.00%	0.00%	0.00%	2.31%	0.00%	0.00%	0.00%	97.69%	3.13%	0.00%	0.00%	0.00%	5.76%	0.00%	0.00%	0.61%	90.51%
Red-winged Blackbird	676	52	0.85%	3.42%	0.00%	4.27%	0.85%	0.00%	0.85%	2.56%	87.18%	0.00%	0.00%	0.00%	26.34%	23.90%	18.54%	0.00%	0.00%	31.22%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.13%	0.56%	3.95%	44.35%	0.28%	49.72%	0.15%	0.59%	0.00%	9.32%	7.69%	7.69%	23.37%	0.59%	50.59%
Brown-headed Cowbird	325	33	2.46%	0.00%	5.74%	2.46%	0.00%	0.00%	27.87%	11.48%	50.00%	7.32%	0.00%	0.61%	9.15%	23.78%	32.32%	8.54%	0.00%	18.29%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	15.38%	0.00%	0.00%	7.69%	0.00%	0.00%	0.00%	76.92%	4.62%	1.85%	2.46%	5.54%	12.92%	16.31%	14.77%	4.31%	37.23%
Horned Lark	171	53	0.00%	0.00%	0.00%	4.76%	0.00%	4.76%	9.52%	0.00%	80.95%	0.00%	0.00%	0.00%	0.00%	34.88%	0.00%	53.49%	0.00%	11.63%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	4.76%	1.90%	2.86%	0.95%	3.81%	0.00%	2.86%	5.71%	77.14%	2.92%	1.17%	1.75%	1.17%	11.11%	0.58%	16.37%	3.51%	61.40%
Barn Swallow	188	26	0.00%	0.00%	1.80%	0.00%	0.00%	0.00%	0.00%	0.00%	98.20%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.06%	0.00%	0.00%	0.00%	0.00%	0.00%	98.94%
American Goldfinch	146	38	25.00%	4.55%	9.09%	18.18%	18.18%	6.82%	6.82%	2.27%	9.09%	2.22%	2.22%	46.67%	7.78%	18.89%	5.56%	0.00%	0.00%	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	66.67%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	14.38%	5.48%	31.51%	10.27%	17.12%	5.48%	2.05%	0.68%	13.01%
Snow Bunting	109	6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	15.60%	0.00%	0.00%	15.60%	0.00%	18.35%	0.00%	50.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	15.60%	0.00%	0.00%	15.60%	0.00%	18.35%	0.00%	50.46%
Field Sparrow	62	44	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	8.33%	0.00%	4.17%	0.00%	4.17%	4.17%	2.08%	0.00%	77.08%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	6.45%	0.00%	3.23%	3.23%	3.23%	3.23%	1.61%	0.00%	79.03%
Dark-eyed Junco	100	13	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	29.63%	0.00%	70.37%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	17.86%	82.14%	38.89%	0.00%	0.00%	0.00%	0.00%	0.00%	22.22%	0.00%	38.89%	7.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%	5.00%	68.00%
Common Grackle	89	14	0.00%	36.36%	9.09%	36.36%	18.18%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	8.00%	68.00%	20.00%	0.00%	4.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.77%	0.00%	0.00%	32.08%	0.00%	0.00%	9.43%	54.72%	0.00%	2.25%	4.49%	1.12%	25.84%	21.35%	5.62%	5.62%	33.71%	0.00%
Black-capped Chickadee	76	16	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	5.56%	0.00%	0.00%	22.22%	13.89%	0.00%	58.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	2.63%	0.00%	0.00%	10.53%	6.58%	0.00%	80.26%
Unidentified Sparrow	59	5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.94%	0.00%	97.06%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	44.07%	0.00%	55.93%
American Robin	30	26	0.00%	0.00%	16.67%	50.00%	0.00%	33.33%	0.00%	0.00%	0.00%	18.18%	0.00%	0.00%	9.09%	18.18%	0.00%	0.00%	27.27%	27.27%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	15.38%	0.00%	46.15%	0.00%	30.77%	0.00%	7.69%	0.00%	0.00%	13.33%	0.00%	23.33%	13.33%	20.00%	6.67%	3.33%	10.00%	10.00%
Unknown Blackbird	40	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Tree Sparrow	37	5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	35.14%	64.86%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	35.14%	64.86%
Tree Swallow	30	13	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	13.04%	86.96%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	14.29%	0.00%	85.71%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.33%	10.00%	86.67%
Cedar Waxwing	22	8	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	53.33%	46.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	36.36%	31.82%	31.82%	0.00%	0.00%	0.00%	0.00%
Common Yellowthroat	0	12	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow Warbler	14	5	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	92.86%	0.00%	0.00%	7.14%	0.00%
Clay-colored Sparrow	0	13	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Western Meadowlark	14	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	35.71%	0.00%	14.29%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	35.71%	0.00%	14.29%	0.00%	0.00%
Savannah Sparrow	7	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Bank Swallow	12	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Chipping Sparrow	6	10	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	80.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	66.67%
Vesper Sparrow	0	6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Song Sparrow	0	7	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow-headed Blackbird	7	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Eastern Bluebird	8	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	83.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	12.50%	25.00%	0.00%	0.00%	0.00%	0.00%	0.00%	62.50%	0.00%
Sedge Wren	0	5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Least Flycatcher	1	4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Belted Kingfisher	3	4	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	66.67%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	0.00%
Eastern Kingbird	2	3	50.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eastern Wood-Pewee	0	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Grasshopper Sparrow	0	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bobolink	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Marsh Wren	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Willow Flycatcher	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Raptors/Vultures/Owls																																															
Red-tailed Hawk	43	41	33.33%	0.00%	33.33%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	5.88%	0.00%	0.00%	29.41%	29.41%	5.88%	11.76%	5.88%	11.76%	50.00%	0.00%	0.00%	16.67%	16.67%	16.67%	0.00%	0.00%	0.00%	11.76%	23.53%	5.88%	23.53%	5.88%	0.00%	11.76%	17.65%	0.00%	16.28%	9.30%	4.65%	23.26%	16.28%	6.98%	9.30%	9.30%	4.65%
Turkey Vulture	28	15	0.00%	0.00%	0.00%	0.00%	20.00%	0.00%	40.00%	0.00%	40.00%	0.00%	0.00%	42.86%	57.14%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	18.75%	0.00%	0.00%	0.00%	0.00%	81.25%	0.00%	0.00%	0.00%	21.43%	14.29%	3.57%	0.00%	7.14%	46.43%	7.14%
Bald Eagle	26	21	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%	44.44%	11.11%	0.00%	0.00%	0.00%	11.11%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	29.41%	0.00%	0.00%	5.88%	29.41%	5.88%	0.00%	23.53%	5.88%	19.23%	11.54%	0.00%	19.23%	23.08%	3.85%	0.00%	15.38%	7.69%
Swainson's Hawk	3	4	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	33.33%	33.33%	33.33%	0.00%	0.00%	0.00%
Rough-legged Hawk	4	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Harrier	2	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%
American Kestrel	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Cooper's Hawk	1	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Waterfowl																																															
Canada Goose	250	34	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.81%	0.00%	0.00%	41.94%	42.74%	14.52%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	14.29%	0.00%	5.04%	8.40%	0.00%	0.00%	0.00%	72.27%	0.00%	7.20%	0.00%	2.40%	24.80%	24.00%	7.20%	0.00%	34.40%	0.00%
Unknown Duck	52	12	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	30.43%	0.00%	0.00%	69.57%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	80.00%	0.00%	20.00%	0.00%	0.00%	0.00%	26.92%	0.00%	0.00%	71.15%	0.00%	1.92%	0.00%	0.00%	0.00%
Mallard	31	17	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	58.06%	19.35%	0.00%	3.23%	6.45%	0.00%	0.00%	9.68%	0.00%	58.06%	19.35%	0.00%	3.23%	6.45%	0.00%	0.00%	9.68%	0.00%
Snow Goose	20	2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	90.00%	10.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	90.00%	10.00%	0.00%	0.00%	0.00%	0.00%
Blue-winged teal	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Shorebirds																																															
Killdeer	11	16	0.00%	0.00%	40.00%	0.00%	0.00%	0.00%	0.00%	0.00%	60.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	36.36%	0.00%	18.18%	0.00%	0.00%	0.00%	0.00%	0.00%	45.45%
Upland Sandpiper	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wilson's Snipe	0	1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gamebirds																																															
Wild Turkey	0	10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ring-necked Pheasant	8	23	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	75.00%	0.00%	12.50%	12.50%	0.00%	0.00%
Woodpecker																																															
Northern Flicker	17	8	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	26.67%	0.00%	20.00%	33.33%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	29.41%	0.00%	17.65%	29.41%	17.65%	5.88%	0.00%	0.00%
Downy Woodpecker	9	14	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	14.29%	0.00%	14.29%	28.57%	0.00%	14.29%	28.57%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	11.11%	0.00%	11.11%	33.33%	11.11%	11.11%	22.22%	0.00%	0.00%
Crows and Allies																																															
American Crow	360	73	12.50%	3.13%	0.00%	0.00%	0.00%	15.63%	15.63%	53.13%	0.00%	14.29%	2.86%	4.29%	10.00%	12.86%	0.00%	0.00%	10.00%	45.71%	43.18%	0.00%	0.00%	29.55%	13.64%	11.36%	2.27%	0.00%	0.00%	23.36%	9.35%	15.89%	0.00%	27.10%	3.27%	20.09%	0.93%	0.00%	23.06%	6.39%	10.28%	5.56%	20.28%	4.72%	13.61%	7.22%	8.89%
Blue Jay	81	58	37.50%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	62.50%	10.91%	18.18%	18.18%	7.27%	16.36%	12.73%	14.55%	0.00%	1.82%	0.00%	0.00%	9.09%	27.27%	9.09%	0.00%	18.18%	36.36%	0.00%	0.00%	0.00%	0.00%	0.00%	14.29%	0.00%	14.29%	42.86%	28.57%	11.11%	12.35%	13.58%	8.64%	13.58%	8.64%	13.58%	8.64%	9.88%
Pigeons & Doves																																															
Rock Pigeon	166	49	6.25%	62.50%	12.50%	0.00%	6.25%	0.00%	12.50%	0.00%	0.00%	26.58%	0.00%	10.13%	0.00%	2.53%	0.00%	6.33%	13.92%	40.51%	6.45%	0.00%	6.45%	0.00%	0.00%	0.00%	16.13%	9.68%	61.29%	40.00%	0.00%	0.00%	32.50%	10.00%	2.50%	0.00%	0.00%	15.00%	24.10%	6.02%	7.23%	7.83%	4.22%	0.60%	7.23%	8.43%	34.34%
Mourning Dove	24	23	54.55%	0.00%	18.18%	9.09%	0.00%	0.00%	18.18%	0.00%	0.00%	30.00%	0.00%	10.00%	0.00%	10.00%	10.00%	40.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	66.67%	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	45.83%	0.00%	12.50%	4.17%	4.17%	8.33%	25.00%	0.00%	0.00%
Wadingbirds																																															
Great Blue Heron	2	2	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	50.00%	0.00%
Waterbirds																																															
American White Pelican	16	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	25.00%	75.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	18.75%	81.25%	0.00%
Gulls/Terns																																															
Ring-billed Gull	25	6	0.00%	0.00%	0.00%	25.00%	0.00%	0.00%	0.00%	75.00%	0.00%	0.00%	0.00%	0.00%	0.00%	9.52%	0.00%	9.52%	0.00%	80.95%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.00%	8.00%	0.00%	8.00%	12.00%	68.00%
Totals			**5.16%**	**3.28%**	**3.44%**	**4.22%**	**4.84%**	**2.03%**	**7.97%**	**8.13%**	**60.94%**	**7.50%**	**1.59%**	**5.84%**	**14.29%**	**20.20%**	**10.25%**	**6.13%**	**3.03%**	**31.17%**	**10.39%**	**2.56%**	**0.60%**	**8.28%**	**5.12%**	**0.90%**	**4.37%**	**1.81%**	**65.96%**	**8.17%**	**2.63%**	**3.09%**	**3.39%**	**5.90%**	**1.52%**	**14.36%**	**9.40%**	**51.55%**	**7.86%**	**2.38%**	**3.63%**	**7.68%**	**10.13%**	**4.25%**	**9.33%**	**6.06%**	**48.67%**

Appendix B



Path: J:\GIS\2759\05 Palmers Creek Wind Farm\09 Site Permit Application\MXD\Site Location.mxd

PALMER'S CREEK WIND FARM, LLC

Site Location Map

WENCK

Responsive partner. Exceptional outcomes.

JAN 2018

Figure 1

Project Area
Point Count Locations
800 Meter Radius
County Boundaries

Note:
Project features are approximate. Once final design is completed, area will be surveyed prior to construction for Project feature placement.

N

4,000 2,000 0 4,000
Feet

Path: J:\GIS\2759\05 Palmers Creek Wind Farm\01 Avian PC Surveys\MXD\F2_PC Locations.mxd
Date: 1/3/2018 Time: 9:28:01 AM User: askjd0431

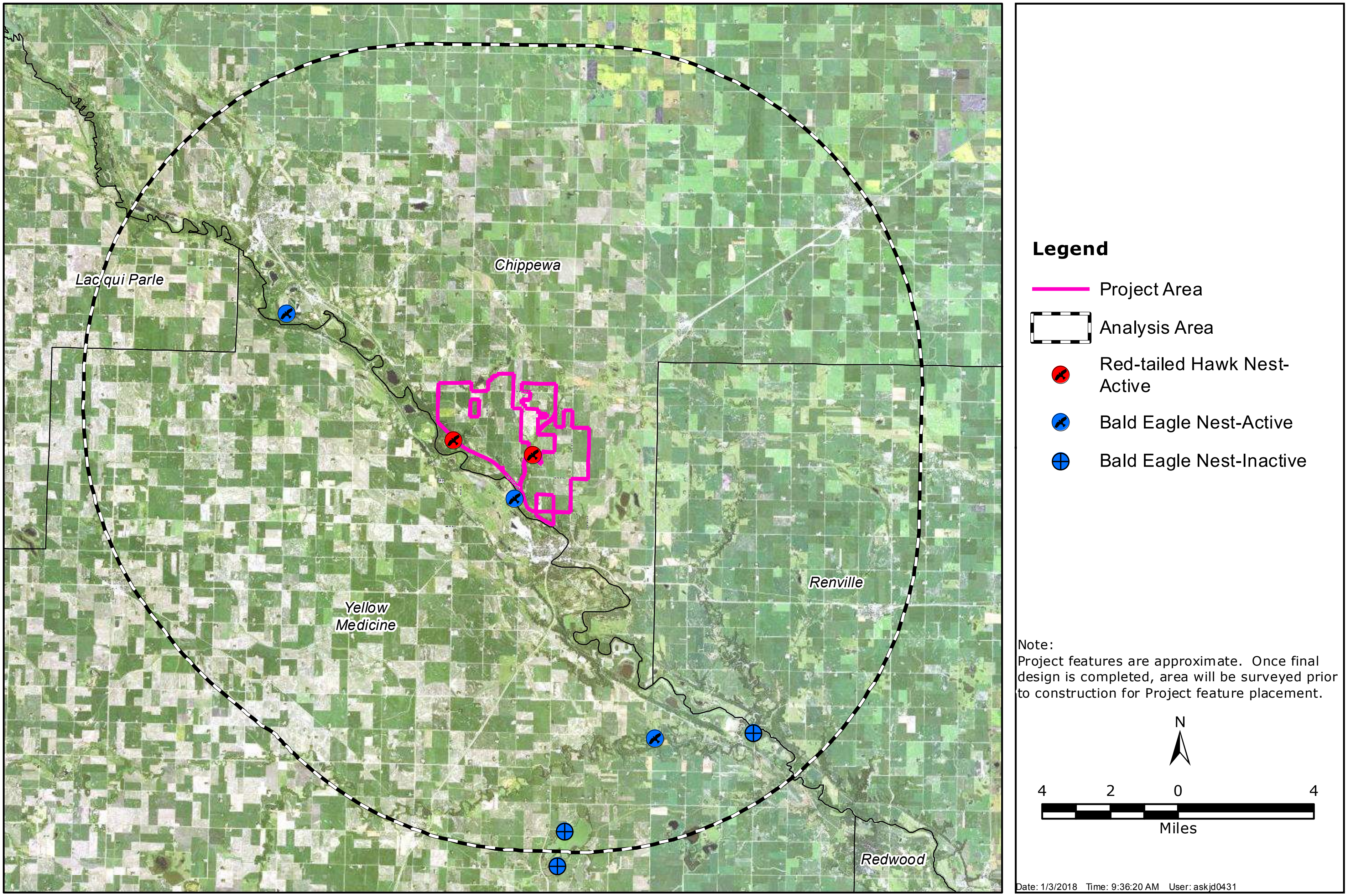
PALMER'S CREEK WIND FARM, LLC

Avian Point Count Locations

WENCK
Responsive partner. Exceptional outcomes.

JAN 2018

Figure 2

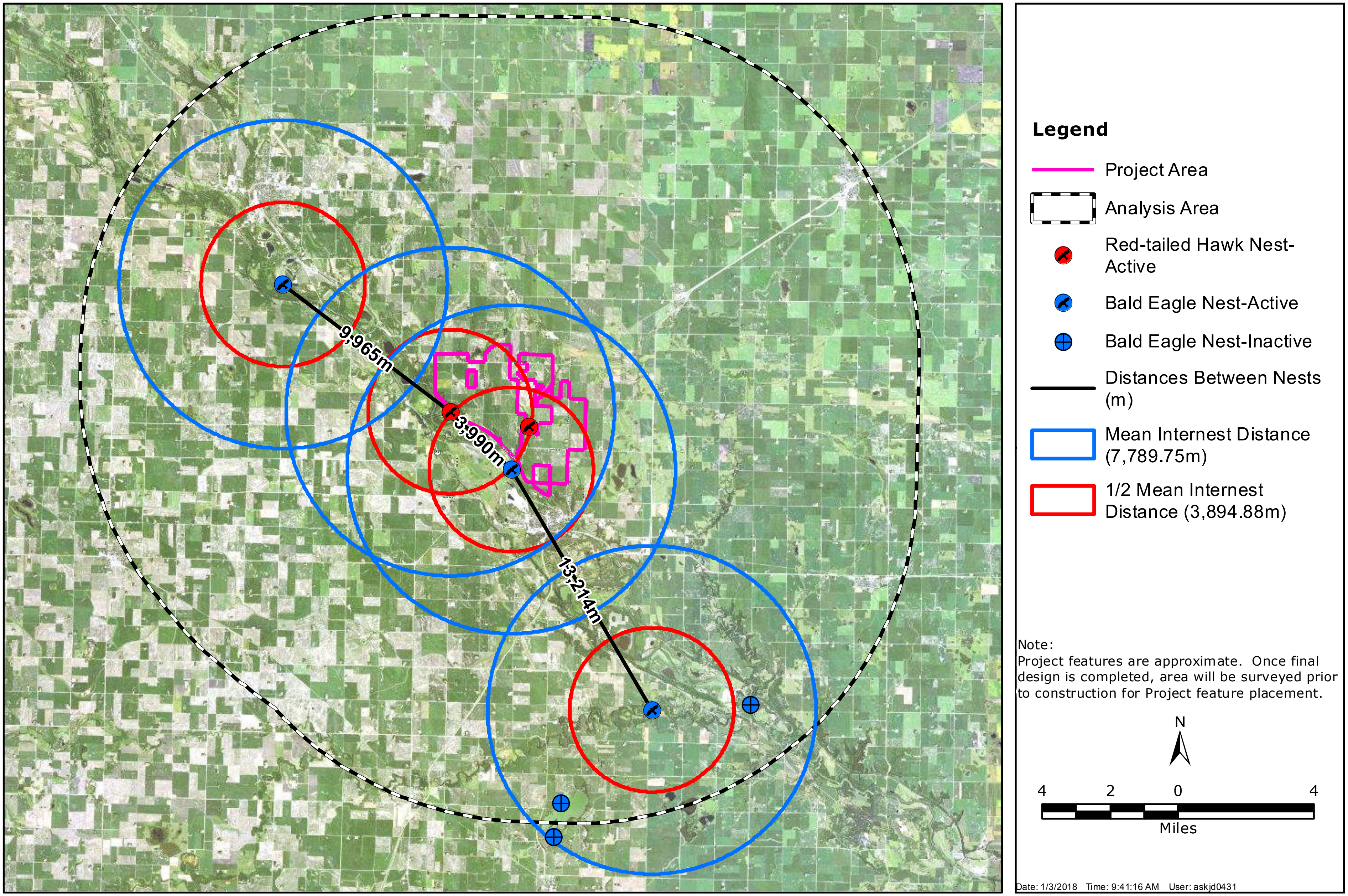


Note:
Project features are approximate. Once final design is completed, area will be surveyed prior to construction for Project feature placement.

Date: 1/3/2018 Time: 9:36:20 AM User: askjd0431

Path: J:\GIS\2759\05 Palmers Creek Wind Farm\01 Avian PC Surveys\MXD\F4_Nest Locations and Survey Area.mxd

PALMER'S CREEK WIND FARM, LLC	WENCK Responsive partner. Exceptional outcomes.	JAN 2018
Nest Locations and Survey Area		Figure 4



PALMER'S CREEK WIND FARM, LLC

Nest Locations and Mean Internest Distance within 10-Mile Analysis Area

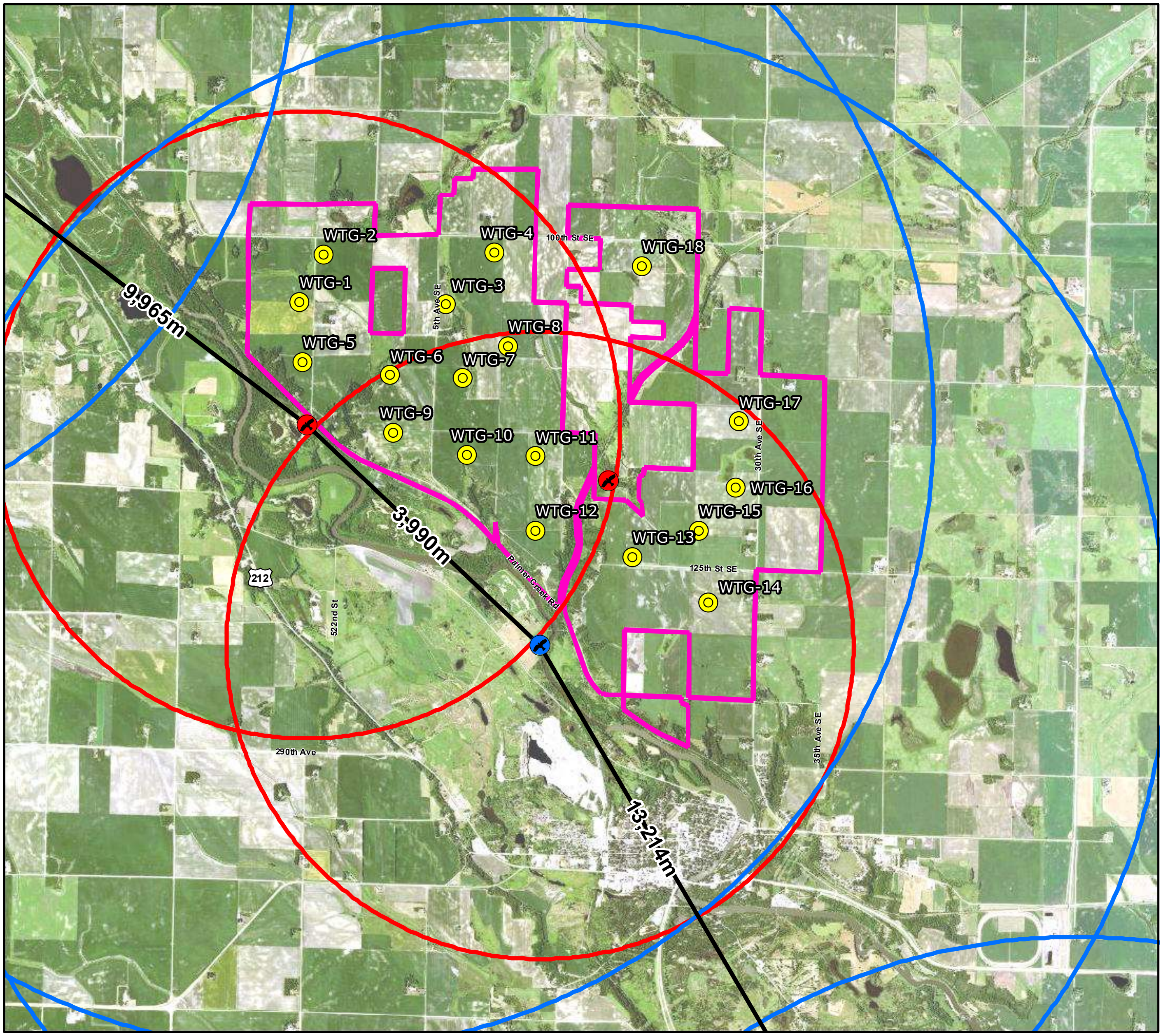
WENCK

Responsive partner. Exceptional outcomes.

JAN 2018

Figure 5

Path: J:\GIS\2759\05 Palmers Creek Wind Farm\01 Avian PC Surveys\MXD\F5_Nest Locations and Mean Internest Distance.mxd



Legend

- Turbine Locations
- Project Area
- Analysis Area
- Red-tailed Hawk Nest-Active
- Bald Eagle Nest-Active
- Bald Eagle Nest-Inactive
- Distances Between Nests (m)
- Mean Internest Distance (7,789.75m)
- 1/2 Mean Internest Distance (3,894.88m)

Note:
Project features are approximate. Once final design is completed, area will be surveyed prior to construction for Project feature placement.

N

1 0.5 0 1
Miles

Date: 1/3/2018 Time: 9:45:26 AM User: askjd0431

Path: J:\GIS\2759\05 Palmers Creek Wind Farm\01 Avian PC Surveys\MXD\F6_Project Area Mean Internest Distance.mxd

PALMER'S CREEK WIND FARM, LLC	JAN 2018
Project Area and Mean Internest Distance	Figure 6

WENCK
Responsive partner. Exceptional outcomes.

Appendix C

Aerial Eagle/Raptor Nest Survey Report; Palmer's Creek Wind Farm

Responsive partner.
Exceptional outcomes.

April 27, 2017

Michael Rutledge
Palmer's Creek Wind Farm, LLC
501 West Highway 212
Granite Falls, MN 56241

Aerial Eagle/Raptor Nest Survey Report
Palmer's Creek Wind Farm
Chippewa County, Minnesota
Wenck File No. B2759-0005-11

Introduction

Palmer's Creek Wind Farm, LLC contracted Wenck Associates, Inc. to complete an aerial bald eagle (*Haliaeetus leucocephalus*) nest survey on state and private lands surrounding the proposed Palmer's Creek Wind Farm project area (**Figure 1**). The survey was recommended to potentially identify active/inactive nests within a ten-mile buffer of the project area (USFWS 2016). In 2007, the bald eagle (State Special Concern Species) 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.

Methods

The objective of the aerial eagle nest surveys is to locate and record nests that may be in the proximity of the project area, to identify concentration and density of eagle nests, and to identify nests that may be vulnerable to disturbance and/or displacement effects by the proposed project. The intent of the nest survey is to gather information on species nesting in the area, including nest locations, nesting season (timing), and nest success.

The survey was conducted within a ten-mile buffer from the project area (defined as the analysis area). Eagle Aviation Inc. was contracted to fly an aerial survey of the project area on April 20, 2017. A Cessna Skyhawk with two observers were used during the survey, Ray Jilek (Eagle Aviation, Pilot) and Justin Askim (Wenck, Natural Resources Services Leader) (**Photo 1**). Complete coverage of the project area was obtained by systematically flying over the landscape and visually scanning all areas for potential roosting, nesting and foraging eagles. Aerial surveys were conducted using a fixed-wing aircraft, flying over relatively even terrain at approximately 250 – 500 feet above ground level and at speeds of 85 to 125 miles per hour.

Photo 1: Note low flight ceiling height and minor precipitation prior to the aerial survey.

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A total of approximately 415 miles were flown in the analysis area to investigate woody draws, riparian areas, farm yards and other appropriate habitats for eagle nests and eagle activity (**Figure 2**).

Existing data on bald eagle nest locations was received from the Minnesota Department of Natural Resources (MNDNR) on July 5, 2016. Based on historical records, one nest is located in Section 11, T116N R40W (MNDNR 2016), is nest was not observed during the aerial surveys. However, two eagles were observed perched in the areas. During the 2016 field surveys, another eagle nest (**Figure 3**, Nest 3) was located in the Minnesota River Valley, approximately one mile southeast of the nearest WTG (WTG 12) and 0.3 miles outside of the project area. This nest was not recorded in the MNDNR Natural Heritage Information System (NHIS) database. Both nests are located outside of the project area. These nests were further examined during the aerial survey, as summarized in **Table 1** below.

Results and Conclusion

Three active nests, three inactive nests and ten individuals (three on nest and seven in flight or perched) were observed during the April 20, 2017 aerial survey (**Figure 2**, **Figure 3** and **Table 1**). With the exception of Nest 3, all nests are approximately five miles or greater from the project area.

Table 1: Eagle Nests Within Palmer's Creek Wind Farm Analysis Area

Nest Number	Status	Distance from Project Area	Latitude	Longitude
1	Active	4.9 miles	44.90855599	-95.70717782
2	Inactive	8.5 miles	44.73293894	-95.42223611
3	Active	0.3 miles	44.83149047	-95.56799484
4	Active	7.0 miles	44.72996346	-95.48105437
5	Inactive	10.0 miles	44.67489358	-95.53845803
6	Inactive	9.0 miles	44.68952578	-95.53443812

Eagle nest density within the analysis area is approximately one active nest per 102,000 acres.

Please contact Justin Askim at 701-751-6125, jaskim@wenck.com if you have comments or require additional information.

Sincerely,

WENCK ASSOCIATES, INC.

Justin Askim
Principal/Natural Resources Services Leader

References

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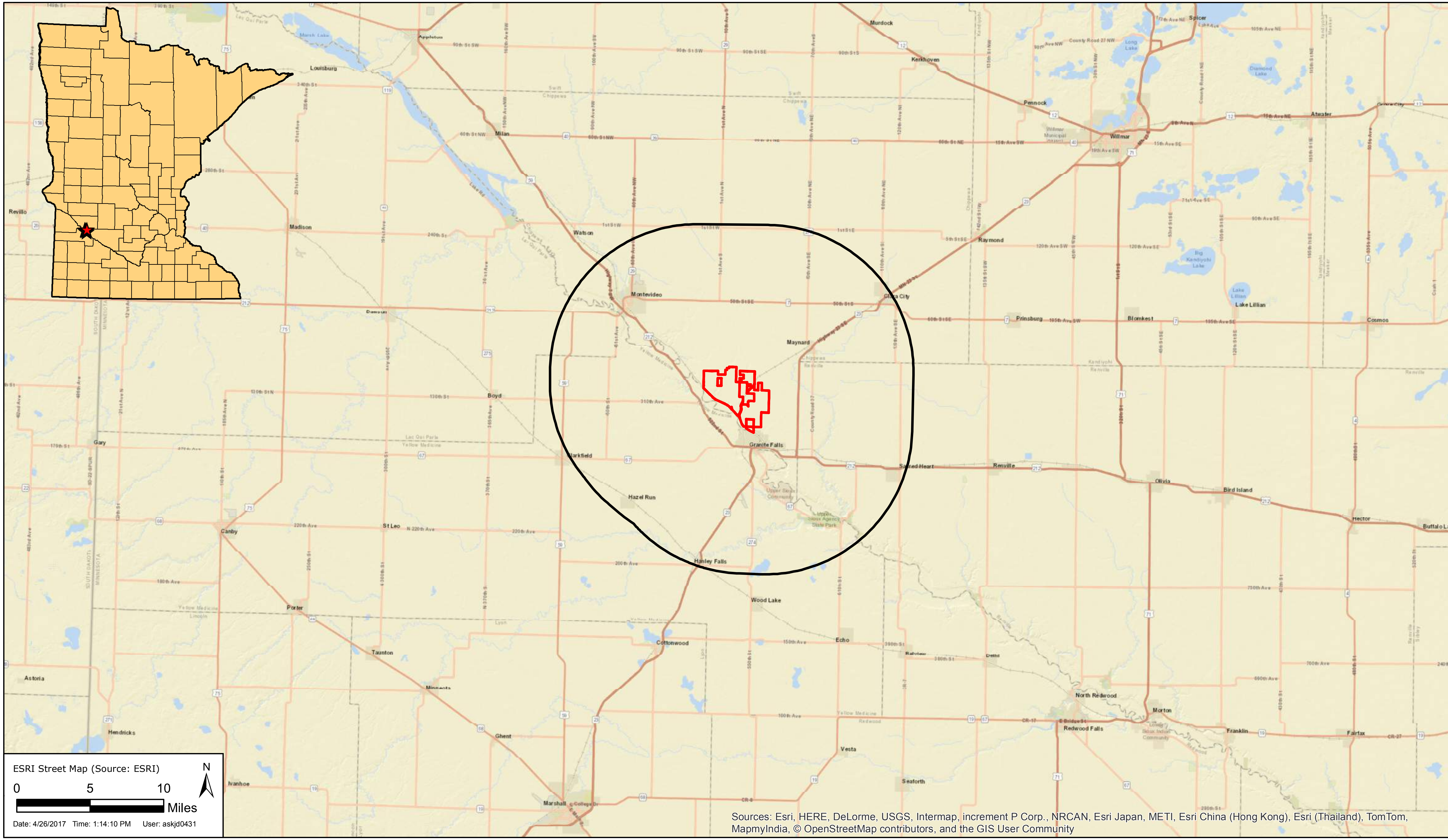

PALMER'S CREEK WIND FARM, LLC

Project Location and Analysis Area

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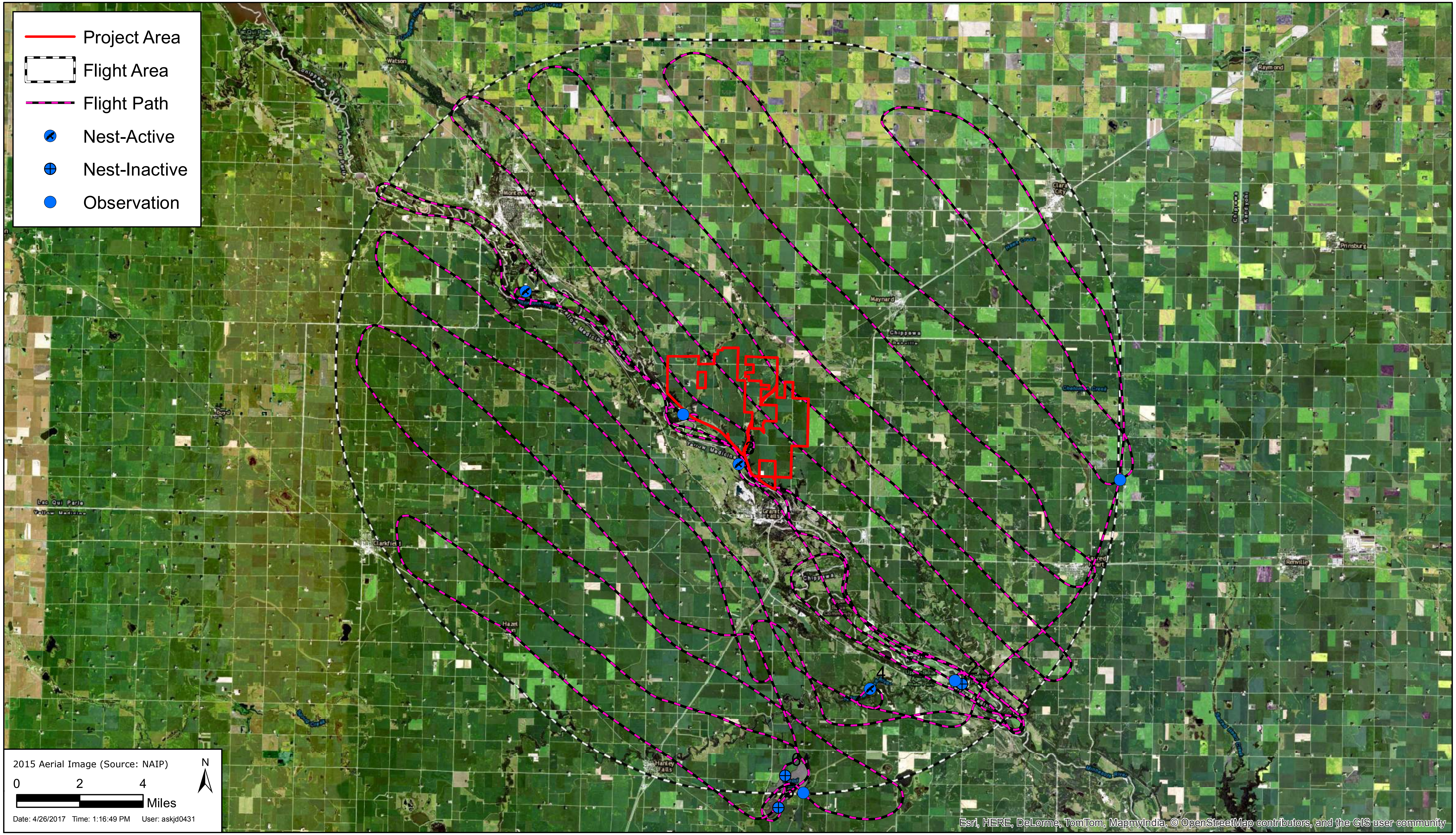
Figure 1

Path: J:\GIS\2759\05 Palmers Creek Wind Farm\11 Aerial Eagle Surveys\mxd\F1-Flight Area.mxd



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Flight Path and Results

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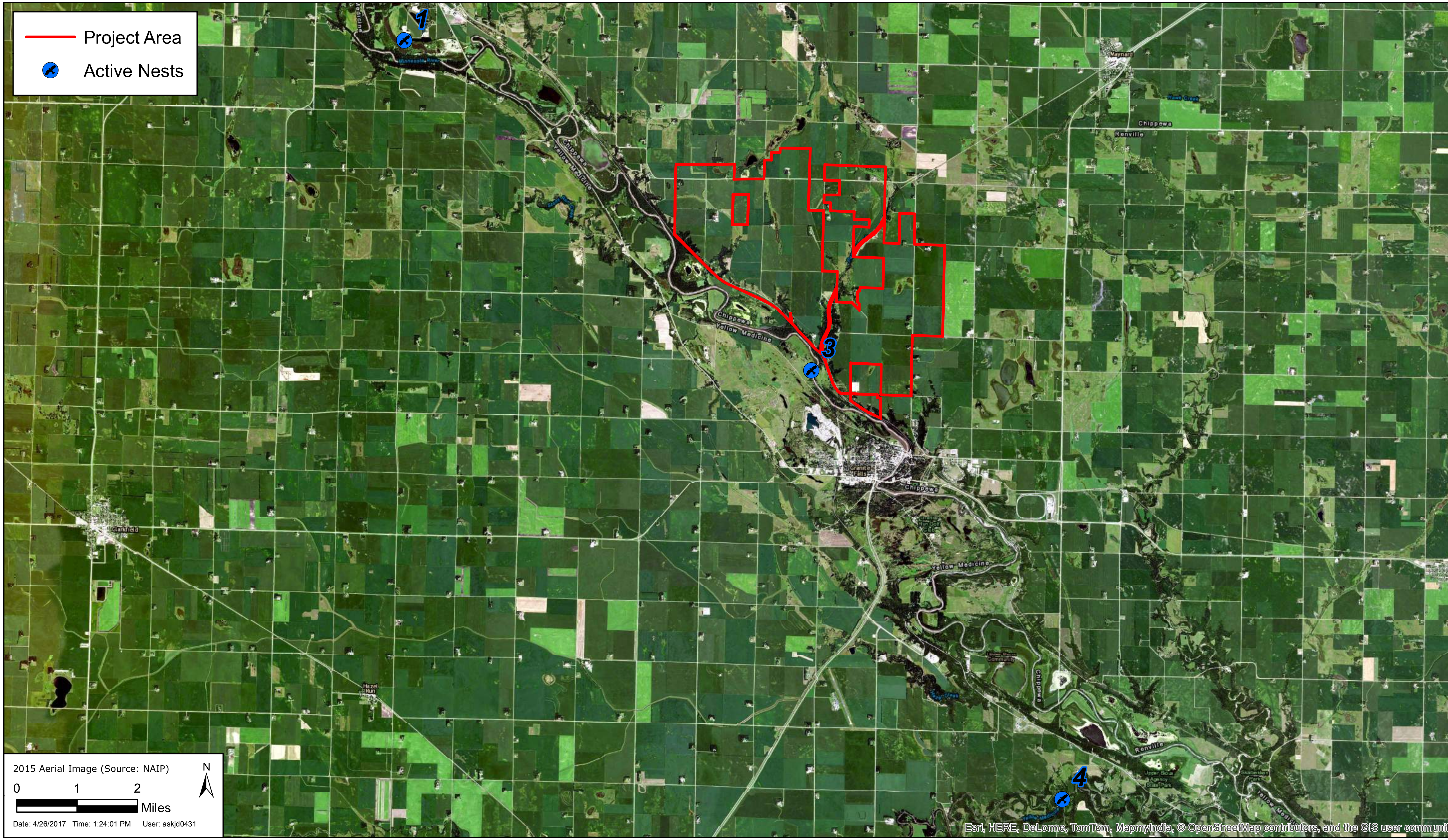
Figure 2



Path: J:\GIS\2759\05 Palmers Creek Wind Farm\11 Aerial Eagle Surveys\mxd\F3-Active Nest Locations.mxd

PALMER'S CREEK WIND FARM, LLC

Active Nest Locations

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Figure 3

Appendix D

Interim Acoustic Bat Summary Report (2015-2016); Palmer’s Creek Wind Farm

Final Acoustic Bat Report (November 2017); Palmer’s Creek Wind Farm

FAGEN, INC.

GRANITE FALLS, MINNESOTA

Palmer's Creek Wind Farm

Acoustic Bat Summary Report

2017

NEW CENTURY ENVIRONMENTAL

Environmental Compliance and Stewardship made Cost Effective

NEW CENTURY ENVIRONMENTAL LLC, COLUMBUS, NE

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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.

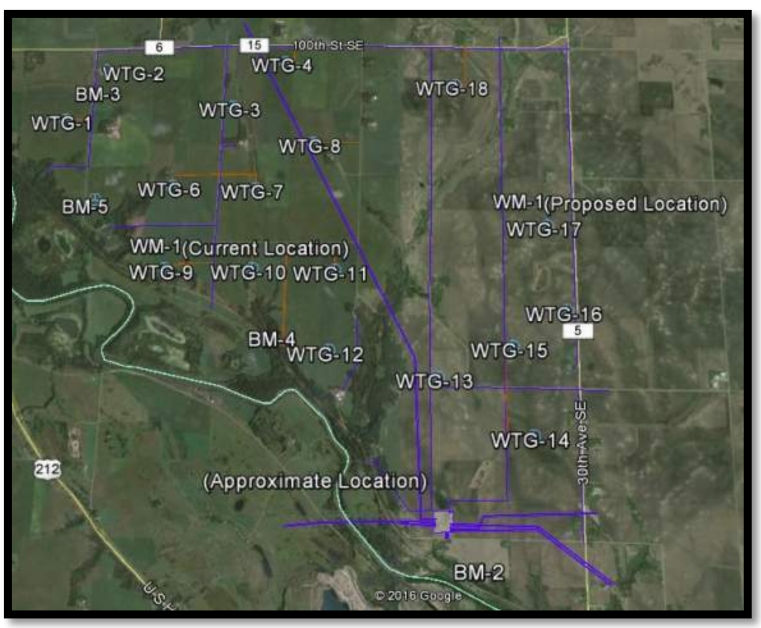

Figure 2: Project location along with bat monitor (BM) locations. BM-1 is not shown on the map but lies next to BM-2.

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*).

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Appendix

Summary Graphs

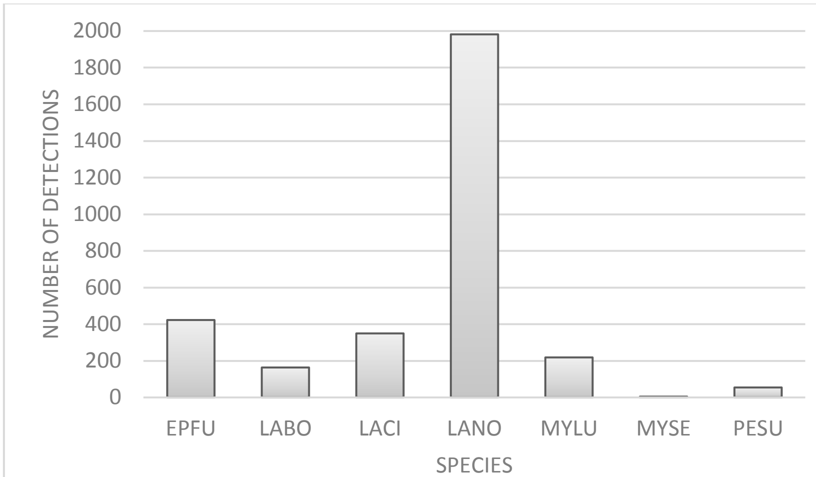

Figure 9.1: Total number of bat detections by species for monitor 1

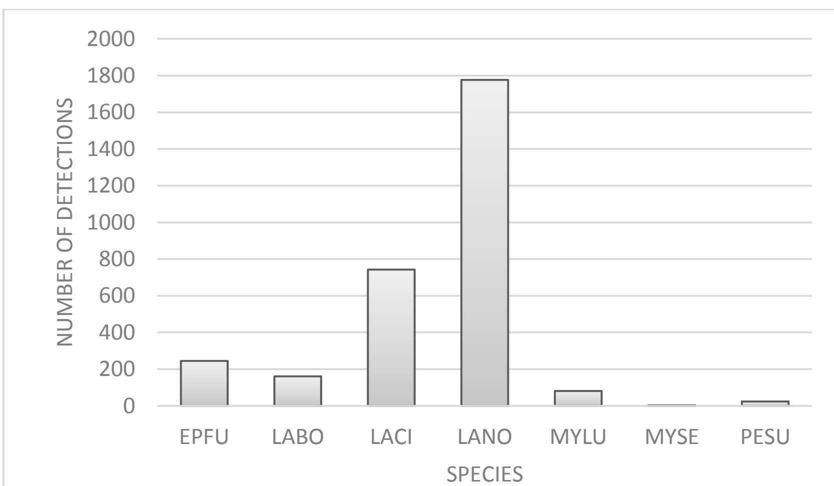

Figure 9.2: Total number of bat detections by species for monitor 2

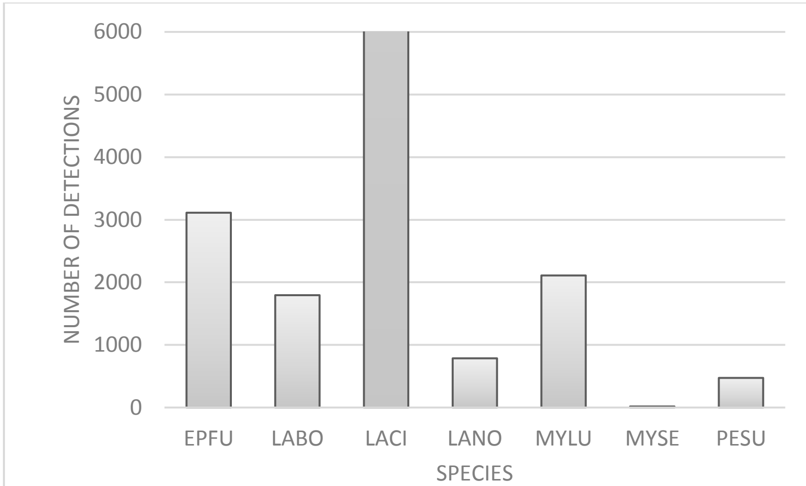

Figure 9.3: Total number of bat detections by species for monitor 3

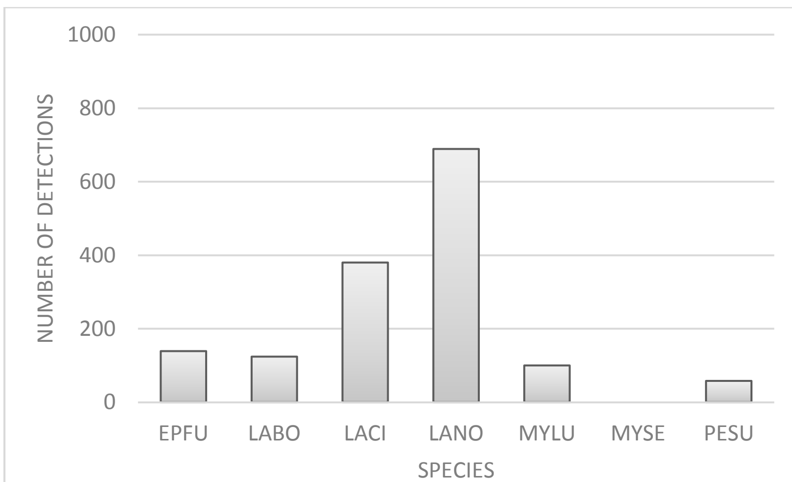

Figure 9.4: Total number of bat detections by species for monitor 4

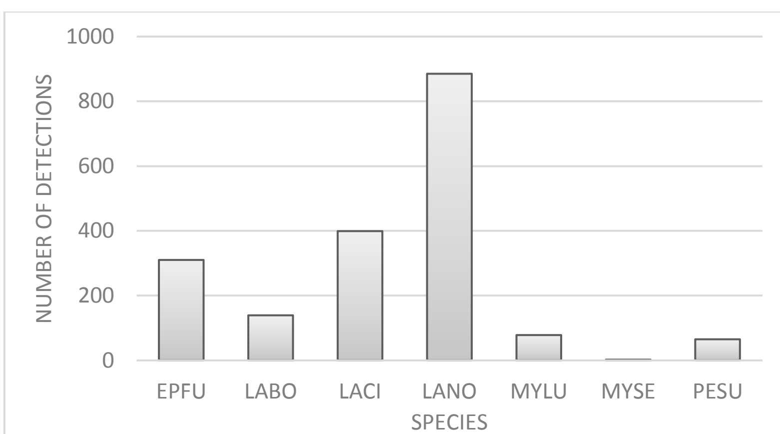

Figure 9.5: Total number of bat detections by species for monitor 5

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.

Fagen, Inc.

Palmer's Creek Wind Farm, LLC 2017 Acoustic Bat Report

Granite Falls, MN

New Century Environmental
11-14-2017

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Palmer's Creek Wind Farm, LLC Acoustic Bat Survey Report 2017
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 completing an acoustic bat survey to evaluate the diversity/abundance of bat species within the study area of the proposed Palmer's Creek Wind Farm, LLC. The client proposes to develop a wind farm within the study area of Chippewa County, Minnesota (just north across the Minnesota River from Granite Falls). Staff of Fagen Engineering deployed four separate zero-crossing systems and two Wildlife Acoustics SM3 full-spectrum systems to record bat activity throughout the study area from 27 March through 16 October 2017. The data collected by Fagen Engineering was sent to NCE, where it was analyzed, as appropriate, with either Kaleidoscope version 3.1.8 (in zero-crossing mode) or Sonobat 3 (full-spectrum only) to evaluate diversity and abundance of bat species at the Palmer's Creek site. 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. Each detector had a total of 203 functioning detector nights (for a total of 1218 detector nights), with a preliminary average bat pass per detector night at 143.93 detected. As discussed in detail below, this average is subject to some adjustment due to inter-related technological and ecological issues.

Introduction: 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.

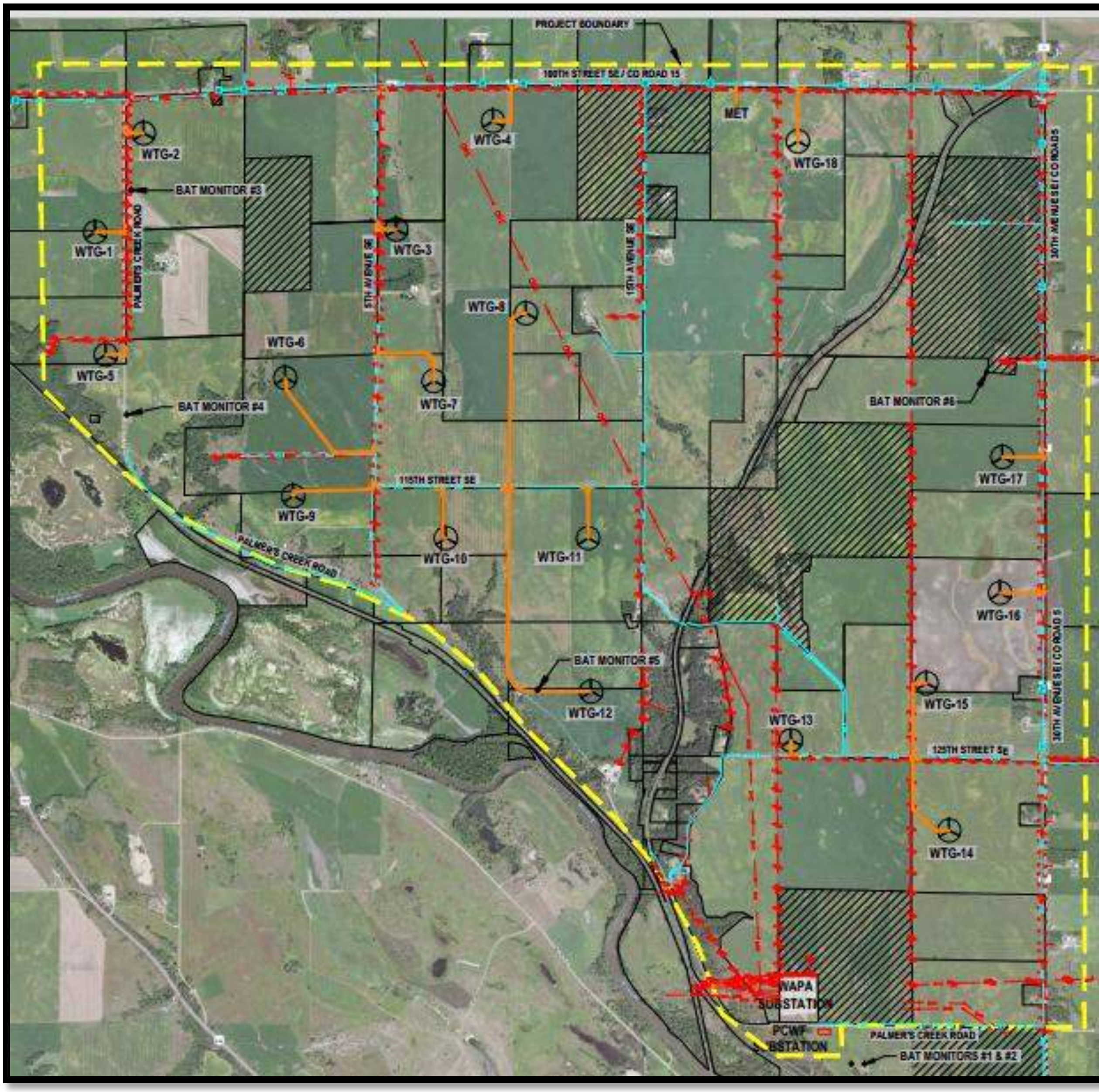

Figure 2. Map of study area showing bat detector locations.

Methods

Data was gathered in the field by Fagen Engineering, LLC within the study area from four different Anabat acoustic detectors (Figure 2: Monitors 1, 2, 4 and 5) and two Wildlife Acoustics SM3BAT full-spectrum bat detectors (Figure 2: Monitors 3 and 6). The detectors gathered data from 27 March through 16 October 2017. The data were sent to New Century Environmental staff via certified mail, and the data was then downloaded and processed with Sonobat 3 for full-spectrum data, and Kaleidoscope Pro version 3.1.8 for full-spectrum and zero-crossing data. Kaleidoscope Pro has been approved by the U.S. Fish & Wildlife Service for use for presence/absence analysis for Indiana bats (*Myotis sodalis*) and northern long-eared bats (*Myotis septentrionalis*).[1] Kaleidoscope Pro has also been approved by the U.S Geological Survey's standard validation process (USFWS 2016).

Preliminary Results

Detector 1

Detector 1 is located on the lower end of a met tower surrounded by row crops with mature, old-growth, high-quality roosting trees within 50m, with potential bat prey available in abundance. The quality of the bat habitat at this location is much better than average for the study area as a whole, and (arguably) much, much better than is typical for the rotor areas projected for the site. The detector had 203 functioning detector nights and recorded 10,447 files that Kaleidoscope Pro was able to classify as bat passes. The mean bat passes per detector night is 51.46.

Table 1: Results from Detector 1

Code	Common name	Scientific Name	P-Value	# of passes	Conservation Status		
					IUCN 3.1	Federal	MN
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	0-present	3425	Least Concern	Not listed	No special status
EPFU	Big-Brown Bat	*Eptesicus fuscus*	0-present	2240	Least Concern	Not listed	Species of Concern
LACI	Hoary Bat	*Lasiurus cinereus*	0-present	4222	Least Concern	Status undefined	No special status
LABO	Eastern Red Bat	*Lasiurus borealis*	0-present	231	Least Concern	Not listed	No special status
MYLU	Little Brown Bat	*Myotis lucificus*	0-present	195	Least Concern	Not listed	Species of Concern
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	1-absent	11	Threatened	Threatened 4(d)	Species of Concern
PESU	Tri-colored bat	*Perimyotis subflavus*	0-present	123	Least Concern	Not listed	Species of Concern

[1]https://www.fws.gov/midwest/Endangered/mammals/inba/surveys/inbaAcousticSoftware.html

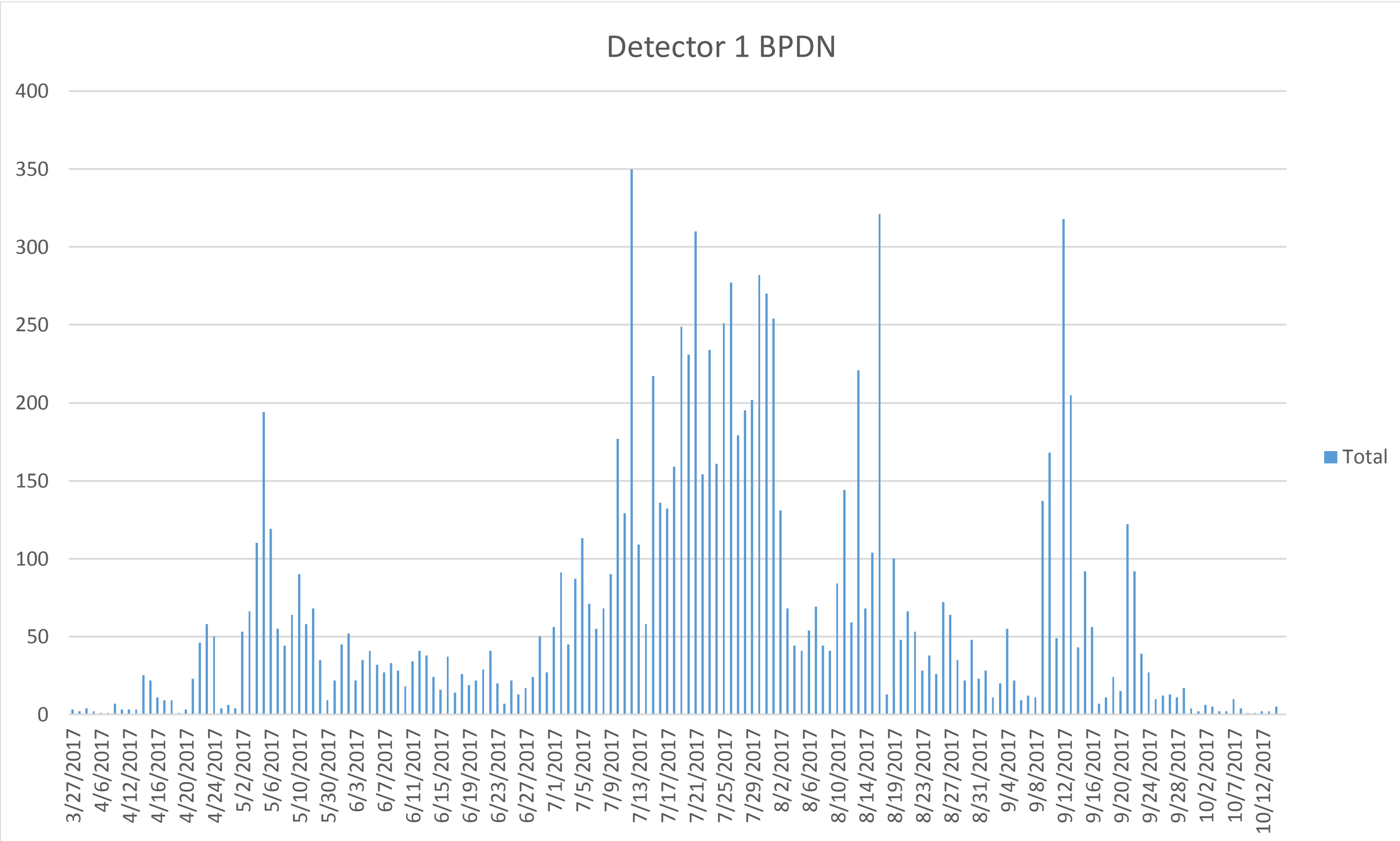

Figure 3. Bat activity for Detector 1 at the Palmer Creek Wind Farm LLC for the study period March 27th, 2017 through October 16th, 2017.

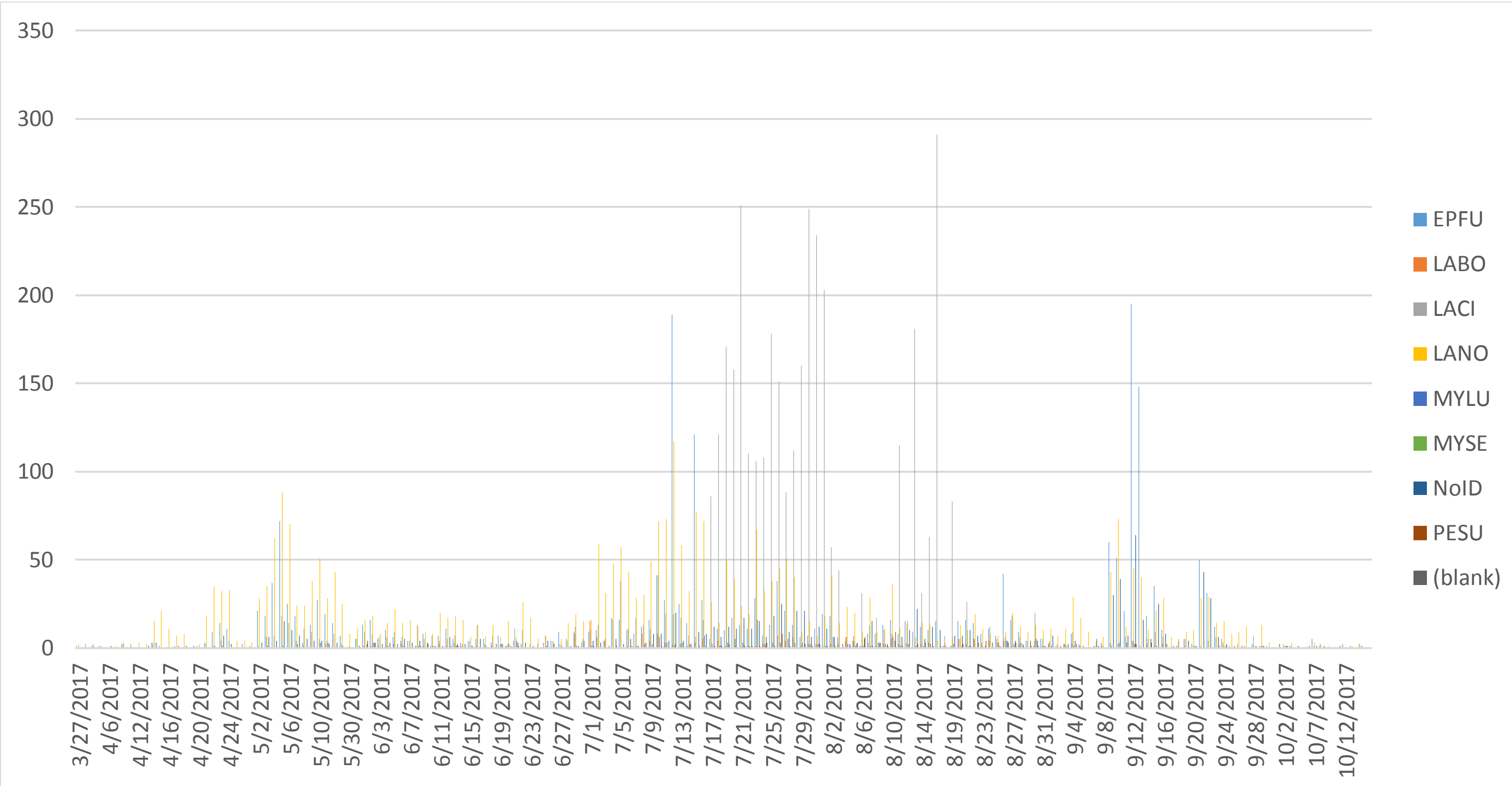

Figure 4. Detector 1 results by date and species.

Detector 2

Detector 2 is located on the upper end of the same MET tower as Detector 1, at an elevation of approximately 55m. The detector had 203 functioning detector nights and recorded 1,681 files that Kaleidoscope Pro classified as bat passes. The mean bat passes per detector night is 8.28.

Table 2: Results from Detector 2

Code	Common name	Scientific Name	P-Value	# of passes	Conservation Status		
					IUCN 3.1	Federal	MN
EPFU	Big-Brown Bat	*Eptesicus fuscus*	0-present	391	Least Concern	Not listed	Species of Concern
LACI	Hoary Bat	*Lasiurus cinereus*	0-present	1213	Least Concern	Status undefined	No special status
LABO	Eastern Red Bat	*Lasiurus borealis*	1-absent	3	Least Concern	Not listed	No special status
MYLU	Little Brown Bat	*Myotis lucificus*	0-present	72	Least Concern	Not listed	Species of Concern

PESU	Tri-colored bat	*Perimyotis subflavus*	1-absent	2	Least Concern	Not listed	Species of Concern

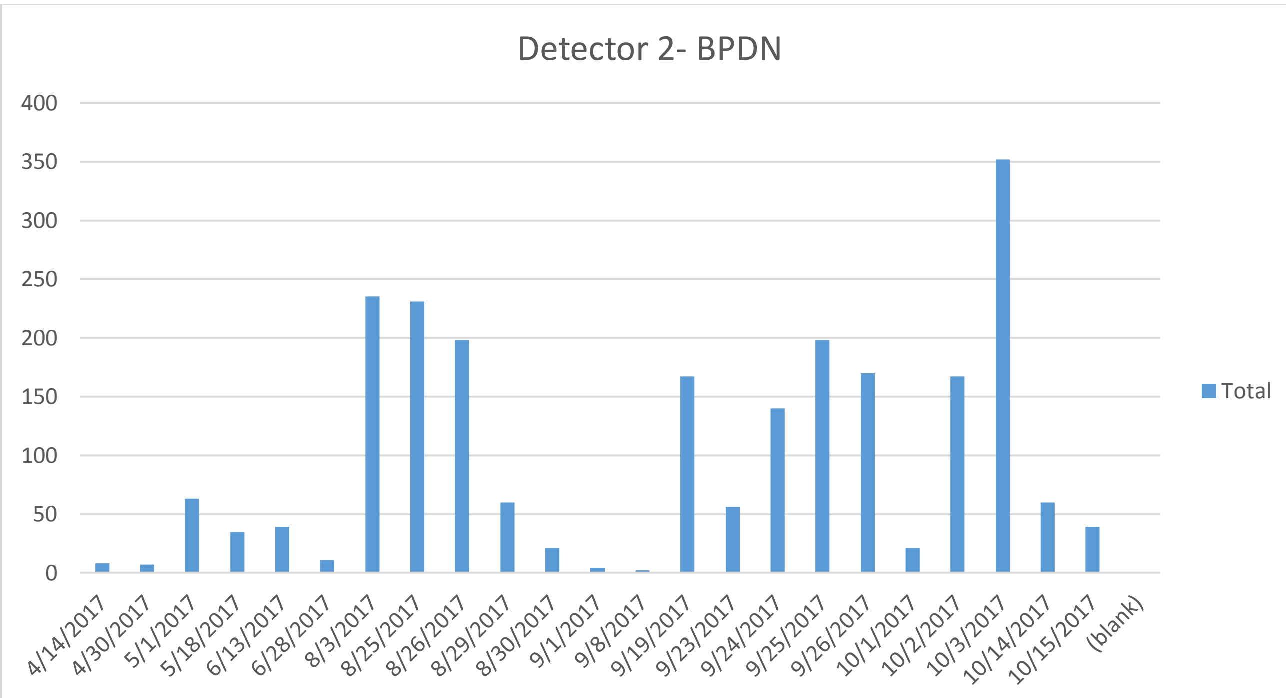

Figure 5. Bat activity for Detector 2 at the Palmer Creek Wind Farm LLC for the study period March 27th, 2017 through October 16th, 2017.

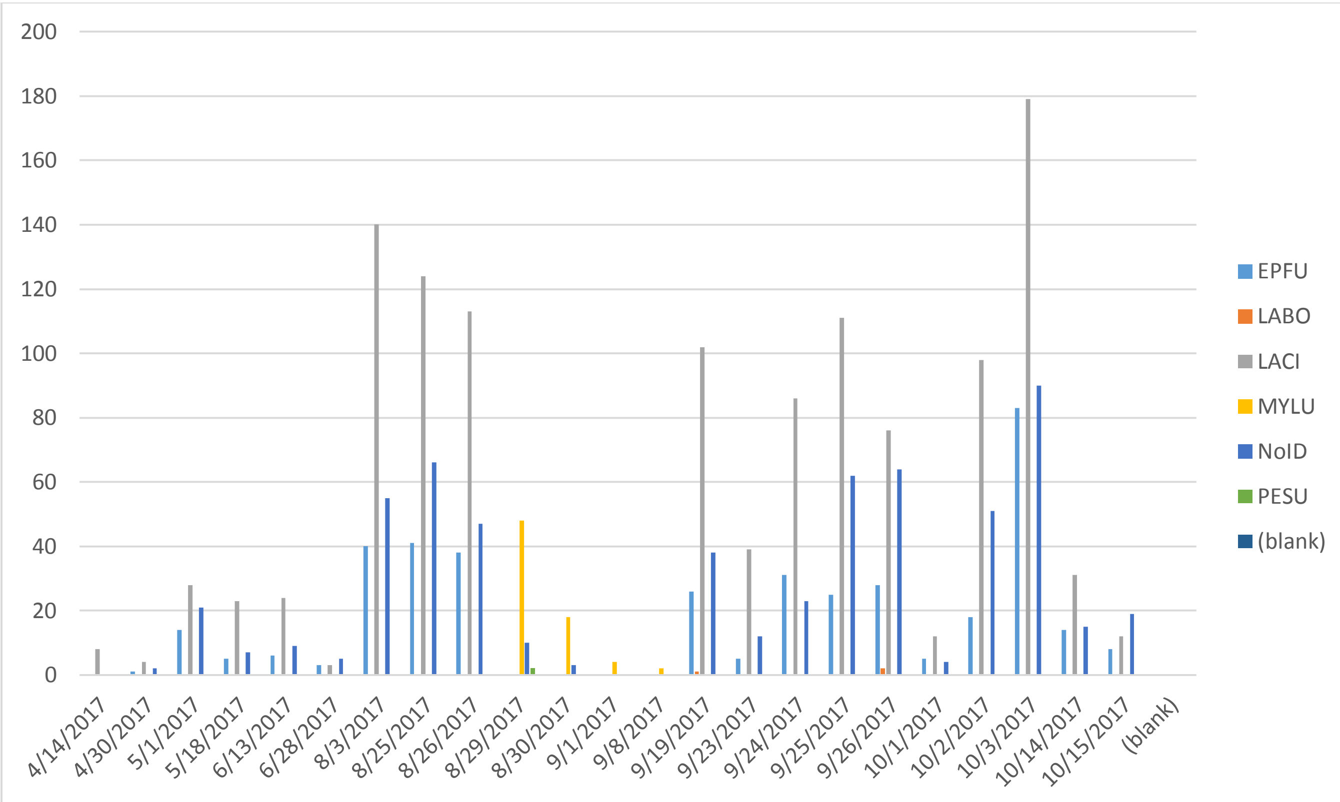

Figure 6. Results from Detector 2 by date and species.

Detector 3-Sonobat and Kaleidoscope

Detector 3, one of two full-spectrum SM3 ultrasonic detectors, was installed along a ditch bank surrounded by row crops and roosting tree habitat. The ditch in question is known to be a corridor used by bats traveling between the Sween Wildlife Management Area and the Minnesota River and is covered by a Re-invest in Minnesota (RIM) easement. The bat habitat in this area is excellent, and is much better than the typical bat habitat in the project area. The detector had 203 functioning detector nights and recorded 8,160 files that Kaleidoscope Pro classified as bat passes. The mean bat passes per detector night is 40.2.

Table 3: Results from Detector 3

			Kaleidoscope		Sonobat		Conservation Status		
Code	**Common name**	**Scientific Name**	**P-Value**	**# of passes**	**# of passes**	**Likelihood of presence**	**IUCN 3.1**	**Federal**	**MN**
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	0-present	3040	3853	1-present	Least concern	Not listed	No special status
EPFU	Big-Brown Bat	*Eptesicus fuscus*	0-present	2649	4731	1-present	Least concern	Not listed	Species of Concern
LACI	Hoary Bat	*Lasiurus cinereus*	0-present	1226	662	1-present	Least concern	Status undefined	No special status
LABO	Eastern Red Bat	*Lasiurus borealis*	0-present	415	122	1-present	Least concern	Not listed	No special status
MYLU	Little Brown Bat	*Myotis lucificus*	0-present	784	500	1-present	Least concern	Not listed	Species of Concern
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	1-absent	1	0	0-absent	Threatened	Threatened 4(d)	Species of Concern
PESU	Tri-colored bat	*Perimyotis subflavus*	1-absent	45	48	1-present	Least concern	Not listed	Species of Concern
MYSO	Indiana bat	*Myotis Sodalis*	1-absent	0	6	0.72384	Near threatened	Endangered	Endangered
NYHU	Evening bat	*Nycticeius humeralis*	1-absent	0	102	0.99945	Least concern	Not listed	No special status

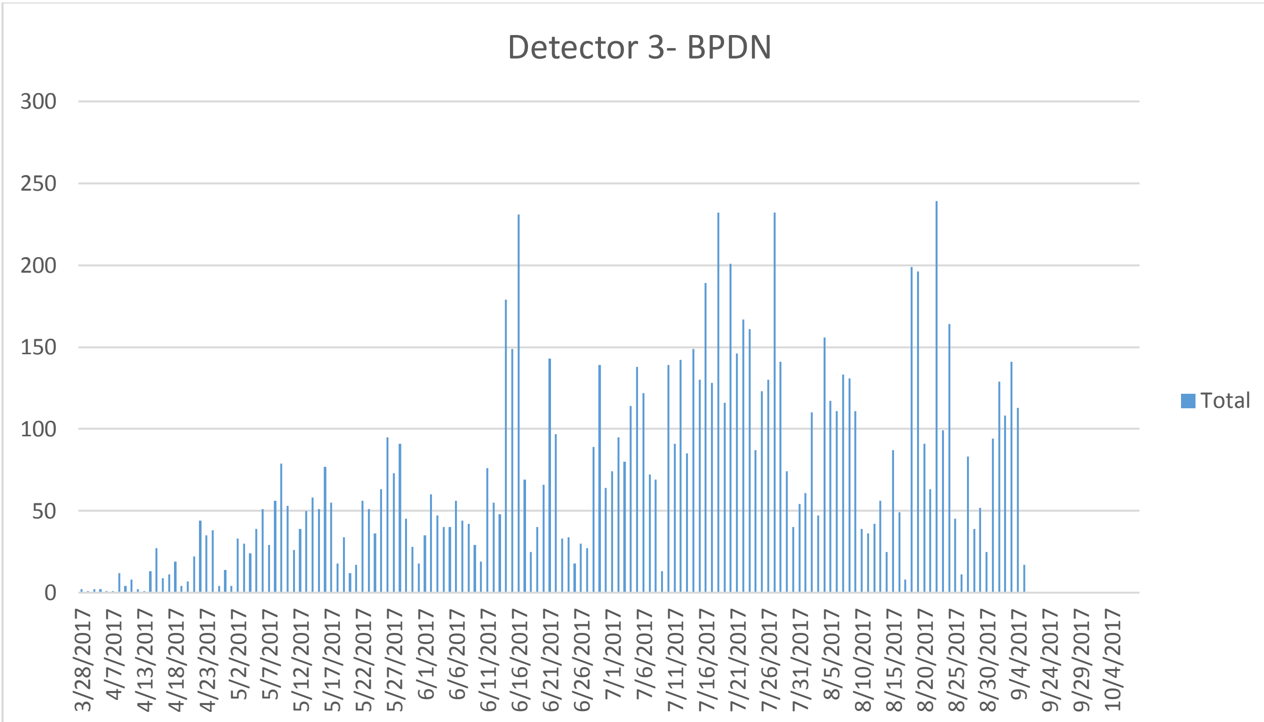

Figure 7. Bat activity for Detector 3 at the Palmer Creek Wind Farm LLC for the study period March 27th, 2017 through October 16th, 2017.

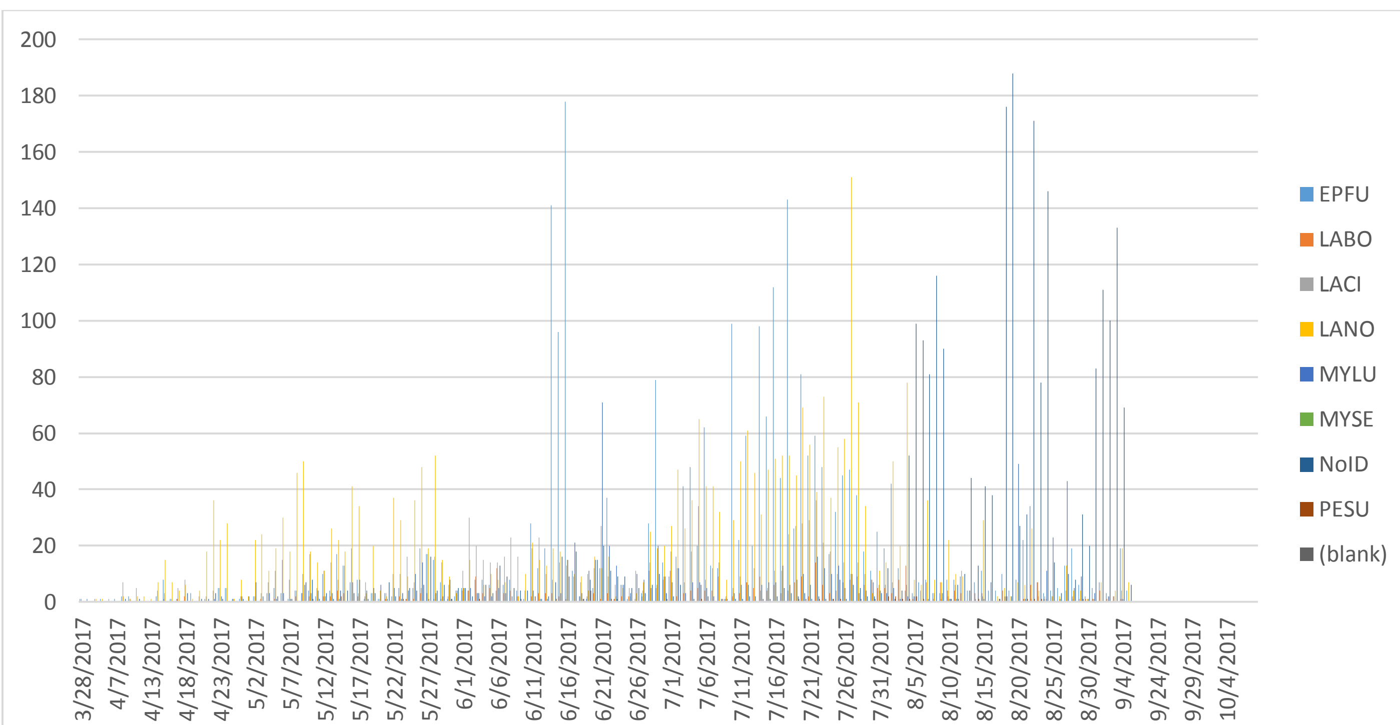

Figure 8. Results for Detector 3 by date and species.

Detector 4

Detector 4 is located in a cornfield; a creek with roosting habitat is located near the site. The bat habitat in this area is at least very good, with forage, water, and roosting potential in abundance in the immediate vicinity. With a location just north of the Minnesota River Valley, this site, like Sites 1,2, and 3, has bat habitat of greater quality than is typical for the Palmer's Creek study site as a whole. The detector had 203 functioning detector nights and recorded 70,225 files Kaleidoscope Pro classified as bat passes. The mean total bat passes per detector night is 345.93. The activity recorded at his site may be inflated by a large number of false positives, and will be discussed below in more detail.

Table 4: Results from Detector 4

Code	Common name	Scientific Name	P-Value	# of passes	Conservation Status		
					IUCN 3.1	Federal	MN
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	0-present	2062	Least Concern	Not listed	No special status
EPFU	Big-Brown Bat	*Eptesicus fuscus*	0-present	915	Least Concern	Not listed	Species of Concern
LACI	Hoary Bat	*Lasiurus cinereus*	0-present	66657	Least Concern	Status undefined	No special status
LABO	Eastern Red Bat	*Lasiurus borealis*	0-present	309	Least Concern	Not listed	No special status
MYLU	Little Brown Bat	*Myotis lucificus*	0-present	198	Least Concern	Not listed	Species of Concern
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	1-absent	0	Threatened	Threatened 4(d)	Species of Concern
PESU	Tri-colored bat	*Perimyotis subflavus*	0-present	82	Least Concern	Not listed	Species of Concern

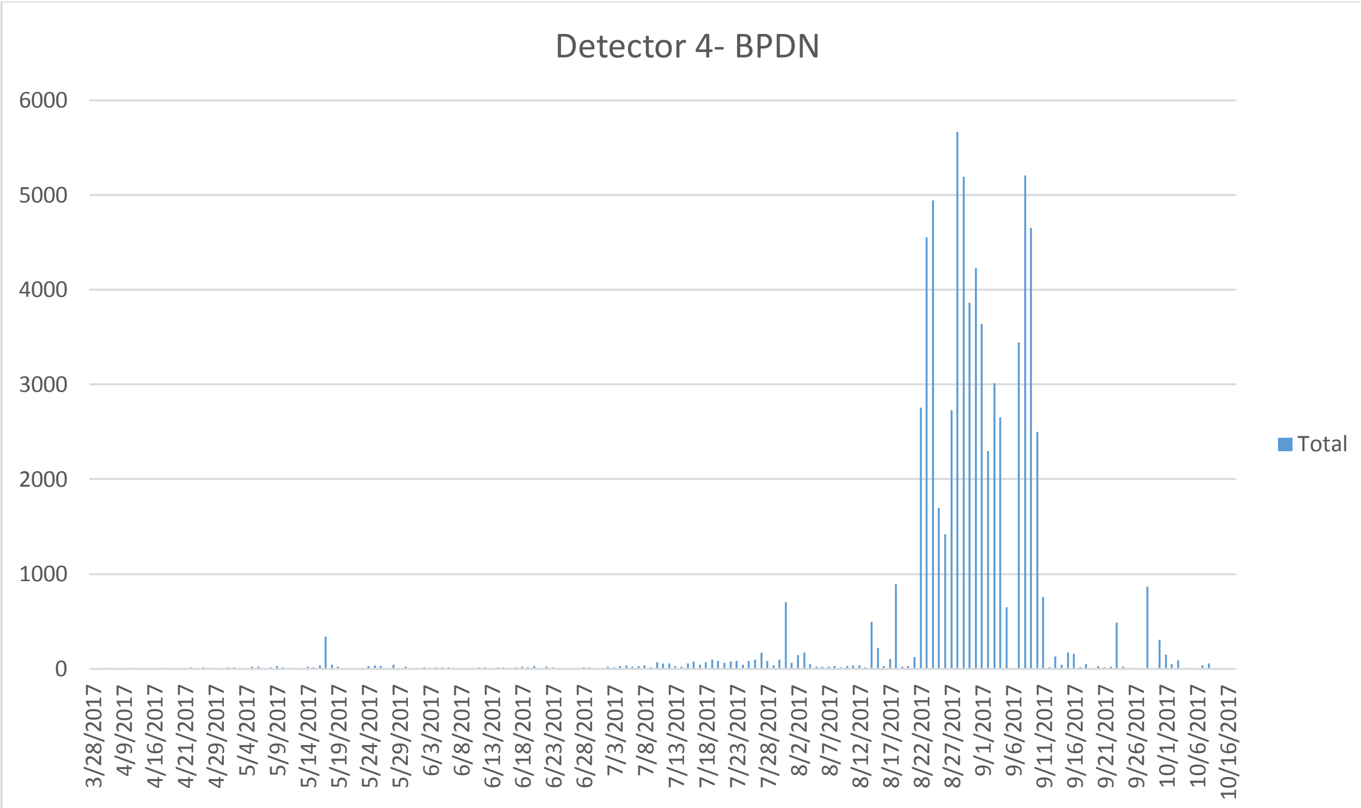

Figure 9. Bat activity at Detector 4 at the Palmer Creek Wind Farm LLC for the study period March 27th, 2017 through October 16th, 2017.

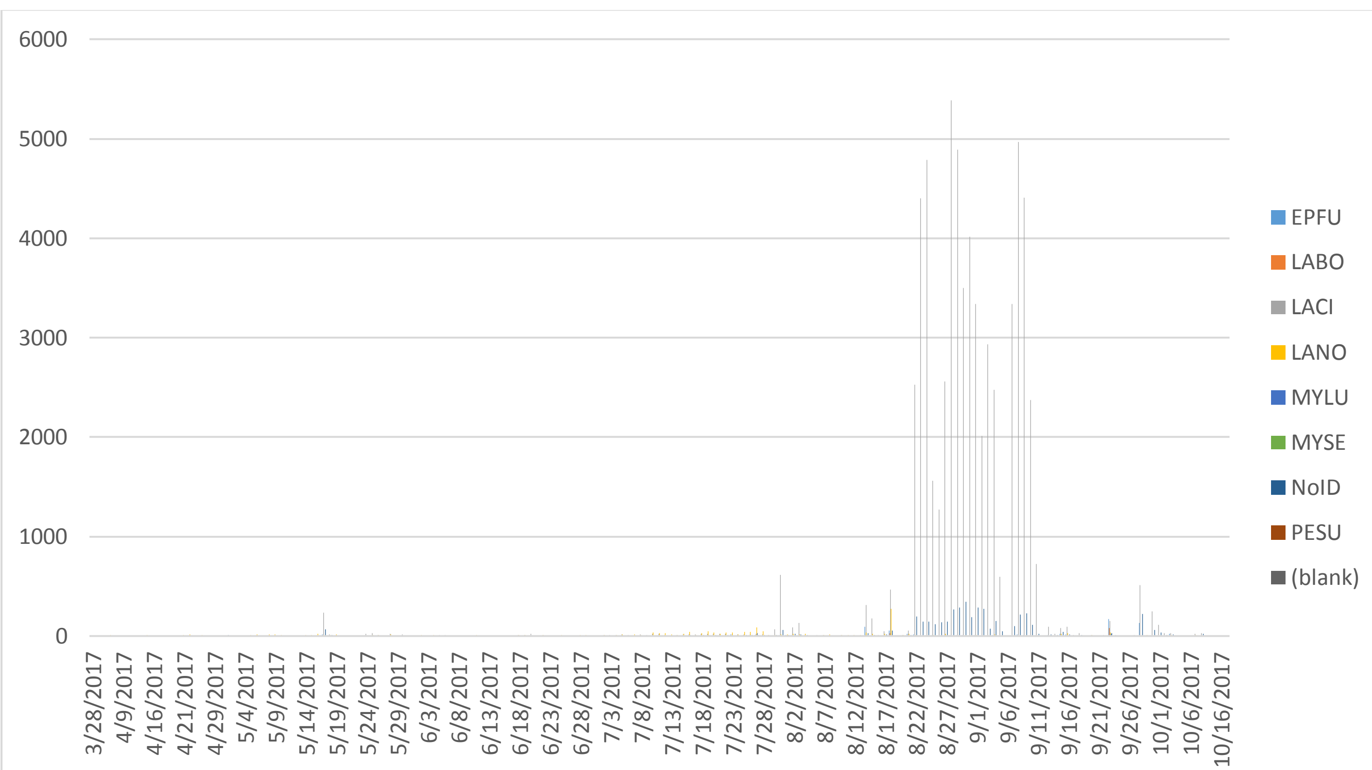

Figure 10. Results for Detector 4 by date and species.

Detector 5

Detector 5 is located on a fence line between cornfields, near high-quality roosting and foraging habitat and water. The habitat is excellent for bats, but is not typical for the Palmer's Creek study site as a whole. The detector had 203 functioning detector nights and recorded 66,003 files Kaleidoscope Pro classified as bat passes. The mean bat passes per detector night is 325.14, and this total, like the total for Detector 4, may be inflated by false positives, as will be discussed in detail below.

Table 5: Results from Detector 5

Code	Common name	Scientific Name	P-Value	# of passes	Conservation Status		
					IUCN 3.1	Federal	MN
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	0-present	2352	Least Concern	Not listed	No special status
EPFU	Big-Brown Bat	*Eptesicus fuscus*	0-present	1464	Least Concern	Not listed	Species of Concern
LACI	Hoary Bat	*Lasiurus cinereus*	0-present	61681	Least Concern	Status undefined	No special status
LABO	Eastern Red Bat	*Lasiurus borealis*	0-present	248	Least Concern	Not listed	No special status
MYLU	Little Brown Bat	*Myotis lucificus*	0-present	159	Least Concern	Not listed	Species of Concern
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	1-absent	0	Threatened	Threatened 4(d)	Species of Concern
PESU	Tri-colored bat	*Perimyotis subflavus*	0-present	99	Least Concern	Not listed	Species of Concern

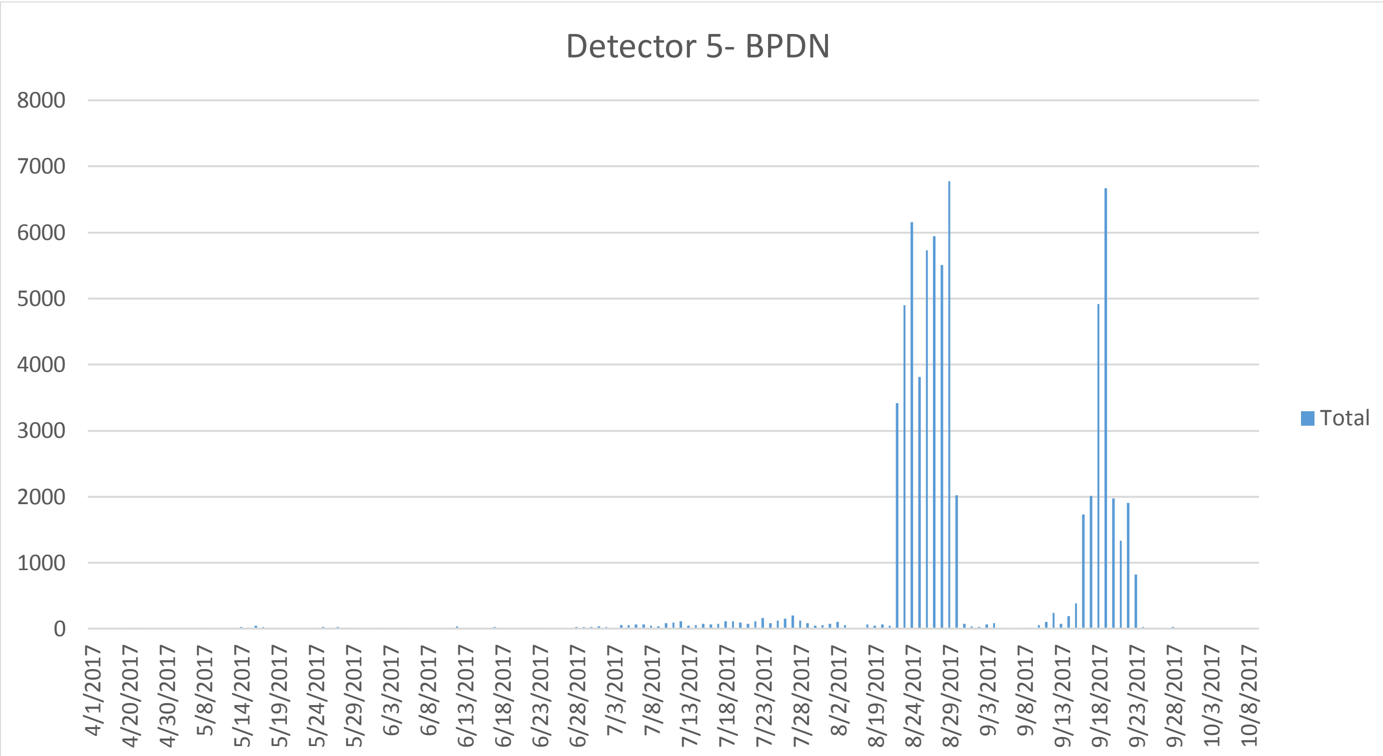

Figure 11. Bat activity at Detector 5 at the Palmer Creek Wind Farm LLC for the study period March 27th, 2017 through October 16th, 2017.

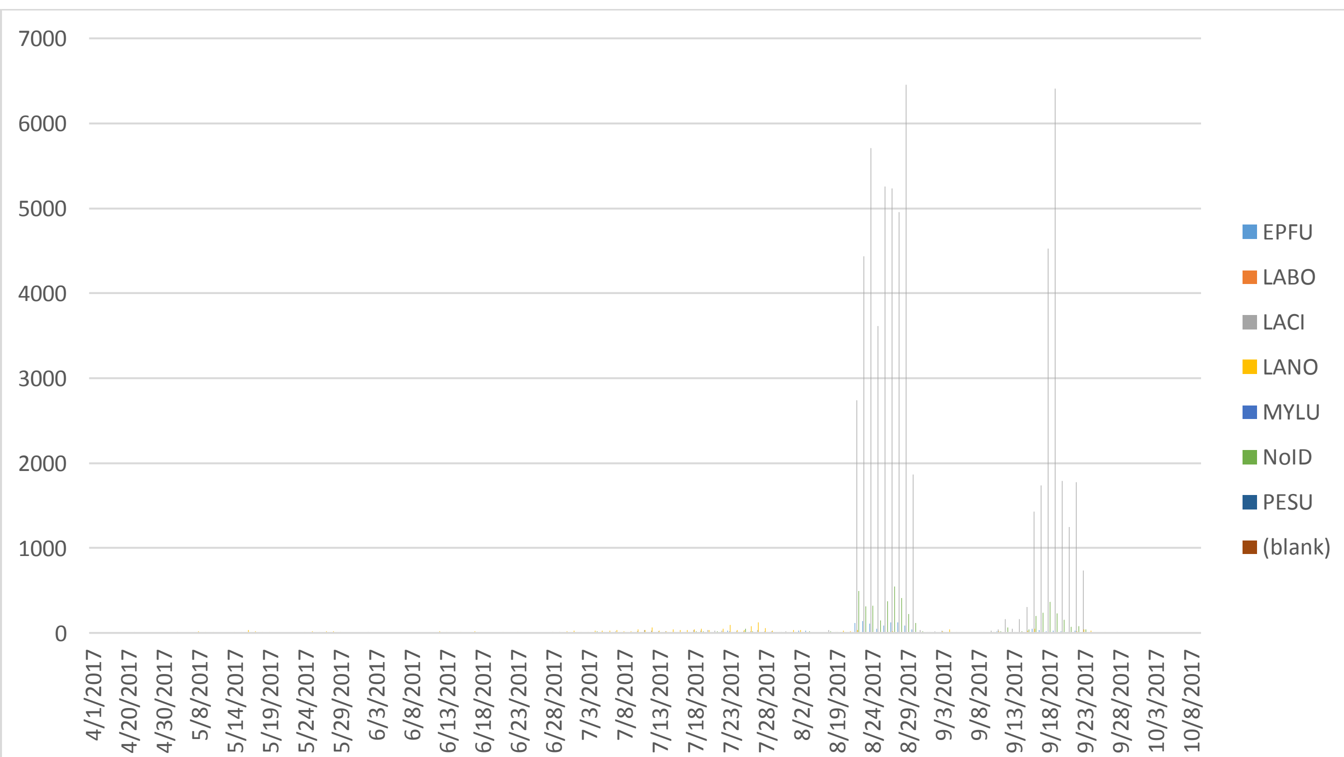

Figure 12. Results for Detector 5 by date and species.

Detector 6-Sonobat and Kaleidoscope

Detector 6, the second of the SM3BAT full spectrum devices, was located immediately adjacent to a shelterbelt near an abandoned farmhouse. The detector had 203 functioning detector nights and recorded a total of 18,455 files Kaleidoscope Pro classified as bat passes. The mean bat passes per detector night is 90.91. Although the results for this site are not subject to the same doubts as Sites 4 and 5, results from this site may reflect characteristics particular to this site that are not easily generalized to the site as a whole.

Table 6: Results for Detector 6

Code	Common name	Scientific Name	Kaleidoscope		Sonobat		Conservation Status		
			P-Value	# of passes	# of passes	Likelihood of presence	IUCN 3.1	Federal	MN
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	0-present	6418	4116	1-present	Least concern	Not listed	No special status
EPFU	Big-Brown Bat	*Eptesicus fuscus*	0-present	6673	5995	1-present	Least concern	Not listed	Species of Concern
LACI	Hoary Bat	*Lasiurus cinereus*	0-present	3297	1124	1-present	Least concern	Status undefined	No special status
LABO	Eastern Red Bat	*Lasiurus borealis*	0-present	1314	608	1-present	Least concern	Not listed	No special status
MYLU	Little Brown Bat	*Myotis lucificus*	0-present	611	154	1-present	Least concern	Not listed	Species of Concern
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	1-absent	1	0	0-absent	Threatened	Threatened 4(d)	Species of Concern
PESU	Tri-colored bat	*Perimyotis subflavus*	0-present	141	95	1-present	Least concern	Not listed	Species of Concern

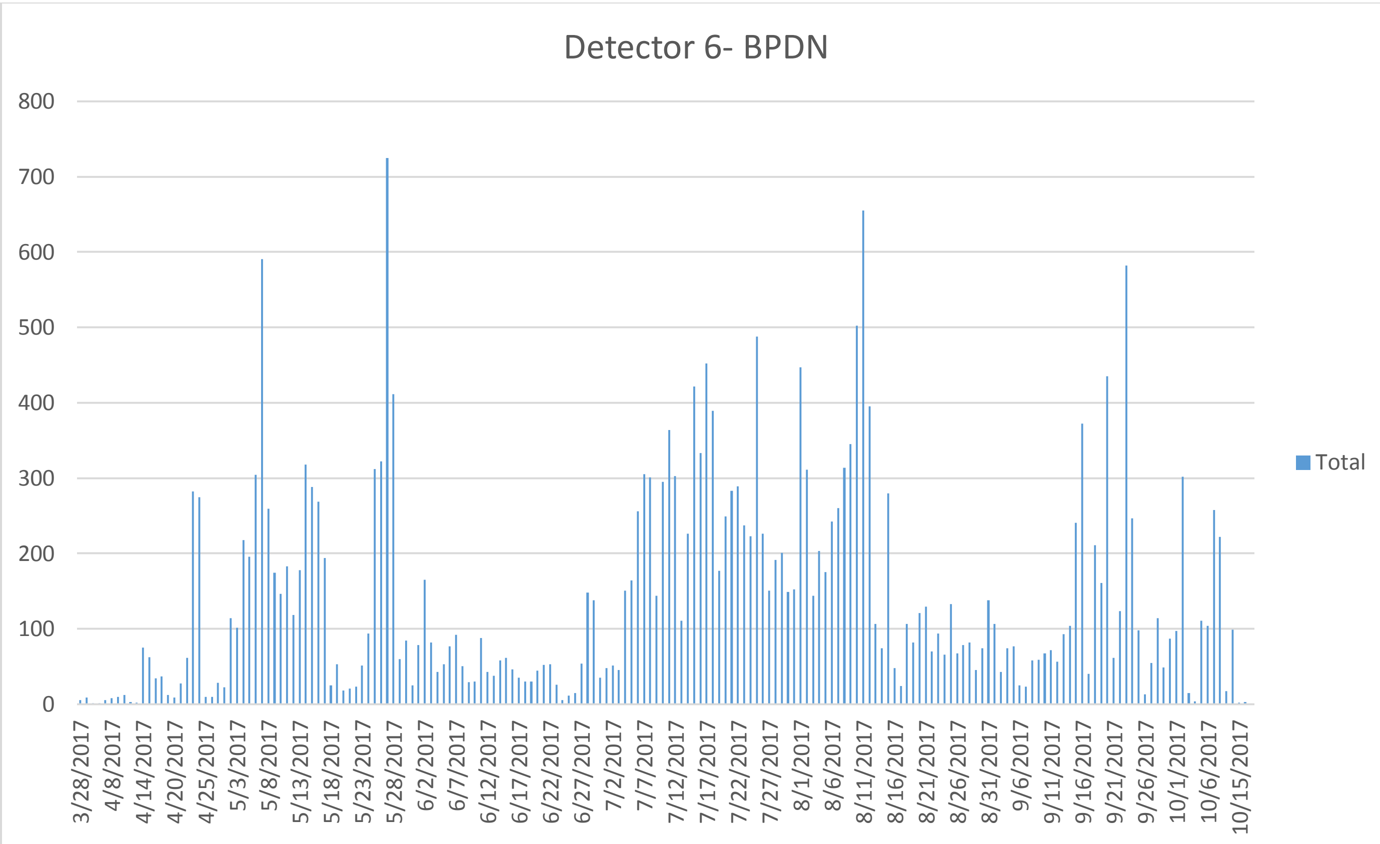

Figure 13. Bat activity at Detector 6 at the Palmer Creek Wind Farm LLC for the study period March 27th, 2017 through October 16th, 2017.

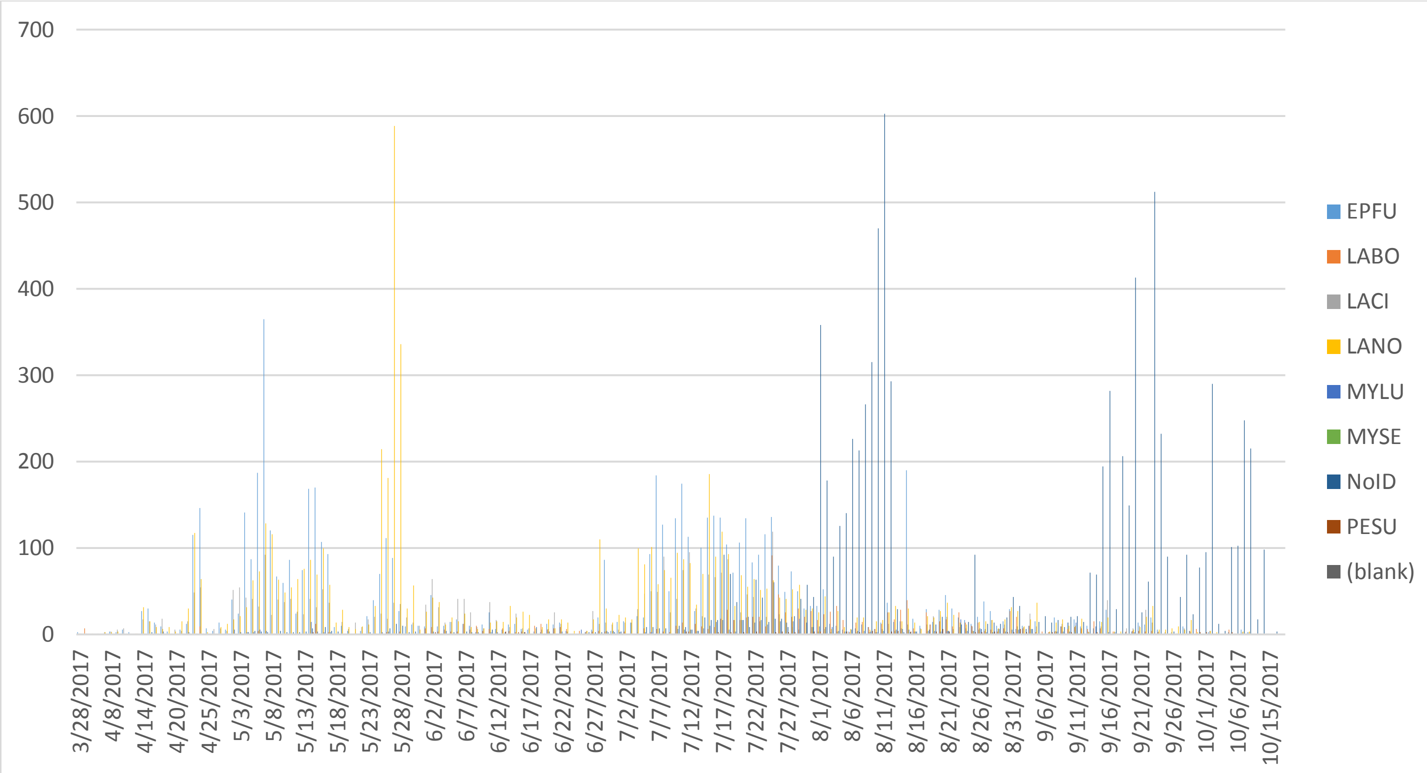

Figure 14. Results for Detector 6 by date and species.

Discussion: Preliminary Conclusions

As summarized in Table 7, the site has significant bat activity from species shown to be at high risk of mortality at wind energy facilities in carcass surveys: the Hoary, Silver-haired, and Eastern Red Bats, and the Big and Little Brown Bats (e.g., Gruver and Bishop-Boros 2015). Additionally, The Big Brown Bat and Little Brown Bat are also species of special conservation concern in Minnesota. The Northern Long-eared Myotis is absent from the site, and the Tricolored Bat (which is also a species of special conservation concern in Minnesota) appears to be rare in the Palmer's Creek area.

At this point, there is a total of 175,318 bat passes detected, in 1,218 functioning detector nights for an average of 143.93 bat passes per detector night. These preliminary conclusions should, however, be tempered by detailed caveats.

Discussion: SM3 Enhanced data capture and inflation of BPDN

Although some high quality bat habitat in the area (e.g., the river corridor of the Minnesota River, the RIM easement connecting the river to the Sween Wildlife Management Area) are very likely sites of significant bat activity, some of the unusual level of bat activity detected is probably due not simply to bat activity alone, but to improved technology for detecting bat activity. Specifically, it is probably not an accident that the new Wildlife Acoustics SM3BAT detectors detected significantly more bat activity than the other detectors, as is clearly shown in Table 7. Although the extent of the improvement in data acquisition efficiency is not yet known with precision, it is our experience that the new weather resistant, omni-directional ultrasonic microphone used with the SM3BAT (SMM-U1 microphone) does result in a significant improvement in data capture for long-term deployments, and that this alone will produce an increased BPDN relative to older detectors with the same level of bat activity. This difference in data capture can be unequivocally demonstrated with paired, side-by-side, simultaneous detector deployments: Joel Tigner, co-owner of Batworks and a participant in the South Dakota Bat Working Group, has found that up to four Pettersson D240X units had to be deployed to reliably capture the same data as one SM3BAT with the new omni-directional ultrasonic microphone. According to Dr. Tigner, the ability of the SM3BAT SMM-U1 microphone to capture bat vocalizations (in long-term deployments) is reliably matched only by four Pettersson D240Xs, with each dedicated to a different quadrant of the sky. If this is so, the BPDN calculated for data collected with an SM3BAT unit is from 1x to 4x greater than what would be calculated from the same site with the same bat activity if older detectors/microphones had been employed. Consequently, a BPDN of 10 with older technology is somewhere between 10 and 40 with an SM3BAT. This technological difference should be taken into account in site evaluation by BPDN standards developed with less sensitive and less efficient detectors. Of course, at this point, there is a lot of fudge in this, and much needs to be done to evaluate the extent to which improving technology may be producing a high bias in the data. Experiments are ongoing, but there is difficulty in resolving key issues, especially as the bats do not tend to cooperate very well with researchers, and seem to have their own agenda. To the extent that bats behave in the way that bat researchers imagine they will when setting up detectors and only go where microphones are pointed, older detectors will work almost as well as SM3BAT detectors. For example, if a microphone is oriented to capture activity where bats flow through a gap in a ridgeline, and bats reliably flow through the gap and don't flutter about feeding over trees and drinking from ponds and puddles outside the primary detection area, an older unit will work almost as well as a new SM3BAT. However, if the bats do not do only what's expected, or don't flow through the gap and instead feed over the trees, drink from puddles, and fly every which way other than in the gap at least some of the time, the SM3BAT with the new microphone will capture up to 4 times the bat passes as older units like the Pettersson D240X. Obviously, this is a subject that will require further work, but that's where it's at for now. An addendum that tentatively quantifies the effect of enhanced data capture may become available sometime this winter, but it all depends on the data, so we'll see and no promises.

Discussion: Detector 6 Caveats

Considerations specific to Site 6 suggest that the data from Detector 6 is peculiar to the site and not representative or generalizable. This is not to say that such data should be abandoned, or otherwise impugned. Instead, the data from Detector 6 should be contextualized appropriately, and understood ecologically:

1. First, the site is just outside of the shelterbelt of an abandoned farmstead and is likely heavily influenced by unusual roosting and foraging conditions: the site almost certainly samples unusually concentrated and persistent bat roosting and feeding activity due to the presence of mature trees within 5m of the detector, and abandoned and accessible buildings within 50m of

the detector, which are likely to produce and unusual and unrepresentative concentration of bats.

2. The nearby farmyard also has a functioning automatic yard light that may have concentrated bat prey and bat foraging activity: At one study area in Ontario, Canada, both hoary and eastern red bats spent most of their foraging time near street lights (Hickey and Fenton 1990, Hickey 1992), where moth abundance is much higher than areas away from the lights (Hickey and Fenton 1990). Other studies have also shown high foraging activity around lights by hoary, red and big brown bats (Wilson 1965, Hamilton and Whitaker 1979, Fenton et al. 1983, Belwood and Fullard 1984, Geggie and Fenton 1985, Barclay 1985, Furlonger et al. 1987, Fullard 1989) (as cited in Erickson et al. 2002)
3. Second, the unusually persistent high activity data (Figures 13 and 14) suggests that the peculiar conditions of the site are particular to the site and due to an unrepresentative peri-domestic enhancement particular to the conditions of a semi-abandoned farmstead.
4. On a visit to site 6 in September 2017, NCE personnel observed persistent and concentrated feeding activity at the site by at least 6 and possibly 8 nighthawks (*Chordeiles minor*), and any site that can produce unusually concentrated and persistent foraging activities by nighthawks could produce unusually concentrated and persistent feeding activity by bats, which are, like nighthawks, flying, nocturnal insectivores. Although concentrated and persistent foraging by bats as well as nighthawks was not observed at site 6 in the late season September 2017 site visit, Kurt Tooley of NCE has personally witnessed simultaneous concentrated and persistent foraging by nighthawks and bats at street and yard lights in south-central Missouri on more than 100 occasions (Kurt Tooley, personal observation).

Given these considerations, data from Detector 6 is best understood as an outlier captured by mischance, which is an unfortunately familiar experience to all experienced field researchers. As such, a similar detector installation 100m away in more representative habitat could very well produce a five to fifteen-fold reduction in detected bat activity (Erickson 2002).

Discussion: Indiana bats

The Palmer's Creek area is well outside the range of the Indiana bat (*Myotis sodalis*)[2], and surveys for Indiana bats were neither warranted ecologically, nor required by Minnesota DNR or USFWS. There were, however, a few passes in data collected at Detector 3 that Sonobat identified as Indiana bat passes (Table 3). These identifications are, however, almost certainly little brown bat calls that Sonobat has mistaken for Indiana bat calls. According to the classification notes that accompany Sonobat 3.1 NE[3], some false-positive identifications of Indiana bats are inevitable anytime there are enough of little brown bat calls in the data, simply because the closely related Indiana and little brown bats have very similar calls that are very hard to discriminate with even the highest quality data. According to a presentation by Szewczak and Harris[4], the false positive rate for Indiana bat identifications by Sonobat

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[2] https://www.fws.gov/midwest/Endangered/mammals/inba/RangeMapINBA.html
[3] http://www.sonobat.com/download/MysoMyluClassificationNote-NE-v3.1.pdf
see also: http://www.sonobat.com/download/SonoBatClassificationNote-NE-v3.1.pdf
[4] http://www.nebwg.org/AnnualMeetings/2013/2013presentations/SzewczakTestforIBATs.pdf

3.1 in the presence of little brown bats in field data is near 4%, which certainly puts the six false-positives from Detector 3 in the predictable range given that little brown bat passes identified by Sonobat in Detector 3 data number 500. So this should be no cause for concern. Moreover, it should also be noted that Kaleidoscope, which unlike Sonobat 3.1 is a program approved by the USFWS for presence/probable absence surveys for Indiana bats[5], identified no Indiana bats from Detector 3, or any other detector deployed on the Palmer's creek site in 2015-2017. So it is very unlikely that there are any Indiana bats in the Palmer's Creek area.

Discussion: Incredible numbers of hoary bats at Detectors 4 and 5? Or not?

In data that is reminiscent of 2014-2015 data from Detector 3 that was excluded by a consensus of regulators and NCE personnel, data from Detectors 4 and 5 included an incredible number of files that were identified as hoary bat passes by Kaleidoscope in 2017. These data are dominated by an incredible accumulation of files identified as hoary bats in narrow windows that could be either incredible migration pulses, or false positives. Although results cannot be definitely known, even a cursory examination of these data in context suggests that the great bulk of the identifications in question are false-positive identifications of ambient noise. For example, within the temporal window in question, the bulk of the questionable data was accumulated in only a few nights (e.g., Detector 4: 8/23-24, 8/28-29, 9/8-9; Detector 5: 8/24-26, 8/27, 8/29, 9/19) at a rate that was very near the maximum possible rate that the detectors could record, which is four or five thousand passes per night, from the time the detectors turned on until the time the detectors turned off. Although such activity by hoary bats is not impossible, it is very unlikely, especially with hoary bats, which is not known to migrate in concentrations sufficient to produce such data legitimately. The presence of the Minnesota River just south of the Palmer's Creek area may very well produce some local enhancement, but more than 120,000 hoary bat passes between Detectors 4 and 5 is too much to be believed, especially when no other detector on site—which includes detectors placed just as close to the Minnesota River as Detectors 4 and 5—recorded any event of similar magnitude. Bat data does often have a great deal of inter-annual variation, and large variation on geographic scales as small as 50m, but this is still too much activity, at too great a temporal density to be at all likely for hoary bats. In contrast, noise files are often accumulated at a maximum or near maximum rate when conditions are right, like when it is windy enough and the corn is dry enough. Although just speculation at this point, Detector 3 was adjacent to a cornfield when it recorded the data that was excluded by consensus in 2014-2015, and Detectors 4 and 5 are virtually in the late season, drying corn during the periods when they recorded data identified by Kaleidoscope as hoary bat passes.

Moreover, although acoustic bat surveys are invaluable, powerful, and essential tools for studying bats, the fact that all such techniques are still works in progress (with particular strengths and weaknesses) must be taken into account when interpreting results. For example, although results were highly variable and identifiers are always improving, Clement et al. (2014) found that some acoustic identification programs identified more than half of more than 13,000 noise files as bat calls, and the

[5] https://www.fws.gov/midwest/Endangered/mammals/inba/surveys/inbaAcousticSoftware.html

group batdetective.org has specifically identified false-positive identification of noise as an issue, and is working to overcome the problem with open-source methods.[6]

Although all detectors and automated classifiers have strengths and weaknesses, the automated classifier that identified the huge number of highly concentrated hoary bat passes in Detector 4 and 5 data, Kaleidoscope 3.1.8, does tend to produce hoary bat identifications at a rate much higher than other acoustic identification programs: In work by Chenger and Tyburec[7], false-positive identifications of hoary bats were far more common with Kaleidoscope than Sonobat (in tests involving only bat data), and surveys by WEST, Inc., that used several automated classifiers on the same data consistently show Kaleidoscope identifying up to 50 times as many files as hoary bats compared to other automated classifiers like BCID and Echoclass in some conditions (e.g., Gruver and Bishop-Boros 2016)[8]. So Kaleidoscope tends to identify things as hoary bats.

This kind of problem is made only more acute at noisy sites, and like most wind energy sites, Palmer's Creek is a windy, noisy site. In fact, in almost all full-spectrum files, which preserve and thereby permit a fuller appreciation of the total ultrasound environment, almost all recorded bat calls were embedded in a wall of noise, much of which could easily be mistaken for bat calls by an unlucky zero-crossing device and classifier. Significantly, the SM3 full-spectrum device that replaced a suspect zero-crossing detector at Site 3 reduced the estimate of total hoary bat activity at that site from 53,382 (2016) to 662 (2017), a factor of a bit more than 80 (some of which is almost certainly inter-annual variation).

Given these considerations, some revision in the BPDN at Sites 4 and 5, and in the Palmer's Creek totals as summarized in Table 7 is defensible. For example, if you exclude the very likely incorrect hoary bat detections from data from Detectors 4 and 5 and replace those numbers with ten times the average of hoary bat passes from Sites 3 and 6 (where the data cannot be confused in the same way), the BPDN for the Palmer's Creek site falls from 143.93 to 50.7 (Table 8). If all unreliable hoary bat identifications are excluded (Detector 1 data is also potentially confused with hoary bat false-positives) and replaced with the average of Detectors 3 and 6, the BPDN is 34.8 (Table 9).

Another Independent Look at Detector 4 and 5 Data: Chris Corben

As the suspect data from Detectors 4 and 5 (and possibly other detectors) is central to risk evaluation at the Palmer's Creek site, a second and independent interpretation of the data was sought from Chris

[6] some scrolling may be necessary: http://blog.batdetective.org/
Also see the pre-print:
https://www.biorxiv.org/content/biorxiv/early/2017/06/29/156869.full.pdf

[7] https://batmanagement.com/blogs/acoustic-monitoring/top-recommendation-for-bat-call-analysis
[8]http://www.maine.gov/dep/ftp/WindPowerProjectFiles/NumberNine/application/Exhibits%207-A%20to%207-E/7E_wildlife%20reports/7E5-NumberNine_2014_Acoustic_Report_012615.pdf

Corben, a bat researcher with incredible experience interpreting zero-crossing data like that obtained from Detectors 4 and 5.[9] As summarized by Dr. Corben,

> [I] got your files and the results are quite unambiguous.
>
> Monitor #4
> 4813 files generated over one night
> 24 of these include real bat calls
> Almost all of the files are dominated by regular, low frequency noise in pulses at about 10 per second, though fluctuating somewhat in rate. This noise started at 2041 and continued till 0427. Both before and after these times, there were files without this noise, yet the noise seems remarkably consistent over most of the night. I don't know what is the source of this noise, but it seems to be acoustic and coming from outside the detector. It could be insects, but seem too consistent. It might be some sort of mechanical noise. Whatever it is, the best clue will come from consideration of the overall, long-term, temporal pattern.
> The division ratio of this detector was set to 4, which doubles the amount of data stored. A division ratio of 8 would be a better choice.
> The noise was consistently identified by Kaleidoscope as Hoary Bats. While there are several bat species in the dataset, none of the files I saw seems consistent with Hoary Bat, so all the Hoary Bat identifications in this dataset are spurious. Many of the files with real bats were identified as LACI just because the noise dominated the dataset and was identified as LACI.
>
> Monitor #5
> 2864 files generated over one night
> 56 of these include real bat calls
> This dataset was dominated by two types of noise. From 1800 till 1929, there was noise at a pulse rate of about 15 per second and dominated by a 40 kHz component. From 2032 till 0507 there was noise similar to that at the Monitor #4, but at only about 6 pulses per second. At 2204, both types of noise can be seen at the same time and without any synchrony between the pulses. There is a reversion to the first type of noise right at the end of the night's recording. Both types of noise seem to go through various stages.
> The division ratio of this detector was set to 4, which doubles the amount of data stored. A division ratio of 8 would be a better choice.
> The lower pulse rate noise was consistently identified by Kaleidoscope

[9] http://users.lmi.net/corben/

> as Hoary Bats. While there are several bat species in the dataset, none of the files I saw seems consistent with Hoary Bat, so all the Hoary Bat identifications in this dataset are spurious. Many of the files with real bats were identified as LACI just because the noise dominated the dataset and was identified as LACI.
>
> In summary, I think the noise is most likely insects, because the variation seems most likely to come from a biological origin. However, the consistent nature seems unusual for insects, but I cannot envisage any likely alternative. I wouldn't expect this kind of variation in mechanical or electronic noise. A better understanding of the noise could come from a careful analysis of its temporal structure.
>
> There are bats in both datasets, but all the identifications of Hoary Bats are spurious and based on the noise.
>
> I should point out that I over-generalized in stating that ALL LACI IDs were spurious. This only applies to the two datasets I viewed, and even there it is possible I overlooked some real ones, though not very likely! But there is no doubt that by far the bulk of the LACI IDs are spurious in the sets I looked at.

Chris Corben's conclusions are thus in very good general agreement with NCE's conclusions regarding the huge number of spurious hoary bat identifications in the Palmer's Creek data.

Summary and Conclusion

As summarized in Tables 8 and 9, a corrected BPDN of between 50.7 and 34.8 is high for pre-construction surveys of potential wind energy sites in Minnesota, and is in the ballpark for what might be expected of the best bat habitat (Johnson et al. 2003). However, as the site's sampling is heavily biased toward the best bat habitat within or near the projected project footprint (due in part to regulator requests for sampling at specific sites), this is not too surprising, and it is reasonable to expect that the bat activity characteristic of the rotor area will be as much as 15 times less (Johnson et al. 2003). In total, if the net effect of accounting for the known high bias in habitat quality and the potential high bias due to improved data capture of new technology is taken into account, the Palmer's Creek site could have an adjusted BPDN <10 quite easily. Consequently, bat mortality from the construction and operation of the proposed facility is likely within the normal range of such facilities in Minnesota.

Table 7: Summary of Detectors 1-6

Common name	Scientific Name	# of bat passes							Conservation Status		
		Detector 1	Detector 2	Detector 3(SM3)	Detector 4	Detector 5	Detector 6(SM3)	total	IUCN 3.1	Federal	MN
Silver-Haired Bat	*Lasionycteris noctivagans*	*3425*	*0*	*3040*	*2062*	*2352*	*6418*	*17297*	Least Concern	Not listed	No special status
Big-Brown Bat	*Eptesicus fuscus*	*2240*	*391*	*2649*	*915*	*1464*	*6673*	*14332*	Least Concern	Not listed	Species of Concern
Hoary Bat	*Lasiurus cinereus*	*4222*	*1213*	*1226*	*66657*	*61681*	*3297*	*138296*	Least Concern	Status undefined	No special status
Eastern Red Bat	*Lasiurus borealis*	*231*	*3*	*415*	*309*	*248*	*1314*	*2748*	Least Concern	Not listed	No special status
Little Brown Bat	*Myotis lucificus*	*195*	*72*	*784*	*198*	*159*	*611*	*2019*	Least Concern	Not listed	Species of Concern
Northern long-eared myotis	*Myotis septentrionalis*	*11*	*0*	*1*	*0*	*0*	*1*	*13*	Threatened	Threatened 4(d)	Species of Concern
Tri-colored bat	*Perimyotis subflavus*	*123*	*2*	*45*	*82*	*99*	*141*	*613*	Least Concern	Not listed	Species of Concern
	total	*10447*	*1681*	*8160*	*70223*	*66003*	*18455*	*175318*			
	BPDN	*51.46*	*8.28*	*40.2*	*345.93*	*325.14*	*90.91*	*143.93*			

Table 8: Revised numbers—Maximum reasonable scenario (10x average hoary bat Sonobat data)

Common name	Scientific Name	# of bat passes						
		Detector 1	**Detector 2**	**Detector 3(SM3)**	**Detector 4**	**Detector 5**	**Detector 6(SM3)**	**total**
Silver-Haired Bat	*Lasionycteris noctivagans*	*3425*	*0*	*3040*	*2062*	*2352*	*6418*	*17297*
Big-Brown Bat	*Eptesicus fuscus*	*2240*	*391*	*2649*	*915*	*1464*	*6673*	*14332*
Hoary Bat	*Lasiurus cinereus*	*4222*	*1213*	*662 (Sonobat)*	*8930*	*8930*	*1124 (Sonobat)*	*25,081*
Eastern Red Bat	*Lasiurus borealis*	*231*	*3*	*415*	*309*	*248*	*1314*	*2520*
Little Brown Bat	*Myotis lucificus*	*195*	*72*	*784*	*198*	*159*	*611*	*2019*
Northern long-eared myotis	*Myotis septentrionalis*	*11*	*0*	*1*	*0*	*0*	*1*	*13*
Tri-colored bat	*Perimyotis subflavus*	*123*	*2*	*45*	*82*	*99*	*141*	*492*
	total	*10447*	*1681*	*7596*	*12,496*	*13,252*	*16,282*	*61754*
	BPDN	*51.46*	*8.28*	*37.4*	*61.56*	*65.3*	*80.2*	*50.7*

Table 9: Revised numbers (average hoary bat Sonobat data)

Common name	Scientific Name	# of bat passes						
		Detector 1	Detector 2	Detector 3(SM3)	Detector 4	Detector 5	Detector 6(SM3)	total
Silver-Haired Bat	*Lasionycteris noctivagans*	*3425*	*0*	*3040*	*2062*	*2352*	*6418*	*17297*
Big-Brown Bat	*Eptesicus fuscus*	*2240*	*391*	*2649*	*915*	*1464*	*6673*	*14332*
Hoary Bat	*Lasiurus cinereus*	*893*	*1213*	*662 (Sonobat)*	*893*	*893*	*1124 (Sonobat)*	*5678*
Eastern Red Bat	*Lasiurus borealis*	*231*	*3*	*415*	*309*	*248*	*1314*	*2520*
Little Brown Bat	*Myotis lucificus*	*195*	*72*	*784*	*198*	*159*	*611*	*2019*
Northern long-eared myotis	*Myotis septentrionalis*	*11*	*0*	*1*	*0*	*0*	*1*	*13*
Tri-colored bat	*Perimyotis subflavus*	*123*	*2*	*45*	*82*	*99*	*141*	*492*
	total	*7118*	*1681*	*7596*	*4459*	*5215*	*16,282*	*42351*
	BPDN	*35.1*	*8.28*	*37.4*	*22.0*	*25.7*	*80.2*	*34.8*

Table 10: 2015-2017 Data (uncorrected)

		# of bat passes										
Common name	**Scientific Name**	**Detector 1**		**Detector 2**		**Detector 3**		**Detector 4**		**Detector 5**		**Detector 6**
		2015/2016	**2017**	**2015/2016**	**2017**	**2016**	**2017 (SM3)**	**2016**	**2017**	**2016**	**2017**	**2017 (SM3)**
Silver-Haired Bat	*Lasionycteris noctivagans*	1971	3425	1717	0	779	3040	688	2062	871	2352	6418
Big-Brown Bat	*Eptesicus fuscus*	427	2240	167	391	3053	2649	143	915	316	1464	6673
Hoary Bat	*Lasiurus cinereus*	347	4222	887	1213	53382	1226	390	66657	403	61681	3297
Eastern Red Bat	*Lasiurus borealis*	158	231	165	3	1770	415	129	309	138	248	1314
Little Brown Bat	*Myotis lucificus*	219	195	52	72	2128	784	103	198	75	159	611
Northern long-eared myotis	*Myotis septentrionalis*	4	11	2	0	18	1	0	0	2	0	1
Tri-colored bat	*Perimyotis subflavus*	55	123	14	2	465	45	59	82	70	99	141
	BPDN	*18.18*	*51.46*	*12.41*	*8.28*	*843.77*	*40.2*	*20.71*	*345.9*	*25.68*	*325.1*	*90.91*

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Appendix

Raw data from Detector 1 (includes March 27th through October 16th, 2017)

KALEIDOSCOPE 3.1.8
Bats of North America 3.1.0

S/A:-1		EPFU	LABO	LACI	LANO	MYLU	MYSE	PESU	NOID	NOISE
*	*	2240	231	4222	3425	195	11	123	897	92862
Download	*	3		5	3				0	3
	20170327	1			2				0	0
	20170330								0	1
	20170331			2					0	0
	20170401	1		2	1				0	0
	20170404	1		1					0	2
Download_0001	*	7	1	7	72				8	52
	20170406								1	4
	20170407				1				0	2
	20170408	2		2	3				0	3
	20170411			2	3				0	1
	20170412				1				0	9
	20170413	1			9				2	3
	20170414	2	1	3	19				2	7
	20170415	1			12				0	8
	20170416				13				0	3
	20170417	1			9				2	12
	20170418				2				1	0
Download_0002	*	153		37	297	4			28	216
	20170420	1			3				0	0
	20170421	4		2	23	1			0	13
	20170422	9		2	40				1	16
	20170423	15		3	36	1			6	19
	20170424	9		4	22				2	9
	20170425								0	5
	20170429	3			7				0	3
	20170430								0	74
	20170501								0	7
	20170502	22		1	32				3	15
	20170503	17		6	37	1			6	20
	20170504	73		19	97	1			10	35
Download_0003	*	162	3	64	358	9			44	140
	20170505	43		14	90				16	25
	20170506	34		9	44	2			9	24
	20170507	4		3	25				5	17

	20170508	4	1	13	25				2	13
	20170509	34		10	54	2			5	14
	20170510	3	1	1	19	2			2	9
	20170511	27	1	9	60	2			5	18
	20170512	13		4	33	1			0	11
	20170530			1	8				0	9
Download_0004	*	152	28	176	368	23	1	16	61	854
	20170531	16		10	19			2	2	25
	20170601	18	2	6	22	3		4	3	14
	20170602	2	1	9	11			1	3	20
	20170603	10		7	12				3	4
	20170604	9	2	8	18	1			0	13
	20170605	2	3	4	18	1			5	25
	20170606	6		6	12				3	10
	20170607			13	16	1		1	6	22
	20170608	9	2	8	9			2	3	13
	20170609			5	6				0	19
	20170610	2	1	2	18	1			1	9
	20170611	9	2	9	17			1	4	14
	20170612	12	1	6	19	1	1	1	5	37
	20170613	4	3	3	18				2	146
	20170614	2		2	9				1	12
	20170615	6	1	4	10	1			2	27
	20170616	1		11	7	1			3	10
	20170617	7		4	6			2	0	13
	20170618	1	1	6	11	1			1	24
	20170619	7		3	18	3		1	1	13
	20170620	3	1	4	5	4		1	1	56
	20170621	4		13	28				4	33
	20170622			4	12				1	37
	20170623			2	7				1	19
	20170624			6	5				3	45
	20170625	4		3	7	1			1	14
	20170626	4		4	3	3			0	19
	20170627	10		3	11				1	94
	20170628	4	8	11	14	1			1	67
Download_0005	*	691	77	1640	1220	70	7	25	208	37751
	20170629	8		7	18	4			0	23
	20170630	4	14	2	14	1		1	3	35
	20170701	11	7	20	58				3	21
	20170702	9	4	6	27			1	1	30
	20170703	7		3	41			1	1	30
	20170704	18		25	58				4	37

	20170705	16	1	38	56			1	5	42
	20170706	6		11	22				2	78
	20170707	8	7	14	30	3			2	76
	20170708	14	5	12	36	2			5	79
	20170709	42	8	38	91	2		1	11	257
	20170710	26	2	11	55	5			5	86
	20170711	67	3	33	95	2	1		11	124
	20170712	150	1	14	92	4	1		14	56
	20170713	9	2	8	34	2			0	338
	20170714	32	3	9	37			1	4	509
	20170715	125	5	10	115	7	1		14	633
	20170716	9		22	28	2		1	7	1602
	20170717	9	3	174	18		1		11	3642
	20170718	9	2	19	48	1		3	7	2491
	20170719	18		269	42	6	1		13	3666
	20170720	16		104	22	4	1	1	15	4604
	20170721	7	1	294	19	2			12	4071
	20170722	29	1	113	68	11		2	14	3861
	20170723	7	1	17	33	6	1	3	8	3384
	20170724	5	1	226	14	2			13	3856
	20170725	30	6	141	49	4		9	23	4120
Download_0006	*	243	56	1999	417	46		42	195	39555
	20170726	31	3	70	67	5		1	15	2632
	20170727	19	8	137	44	4			10	3129
	20170728	7	1	143	12	3		1	28	3501
	20170729	7	1	190	10	1		1	12	3840
	20170730	10	3	306	9	1		1	9	4094
	20170731	13		116	13	2		3	13	3139
	20170801	20	2	187	45	2		1	9	1681
	20170802	9	1	64	10	5			1	1720
	20170803	5	2	4	28	2		3	1	160
	20170804	4	6	4	6			3	1	719
	20170805	4	8	12	26	1			3	1643
	20170806	5	3	24	19	1		7	6	412
	20170807	5	1	12	17	2		2	13	756
	20170808	7		24	5	2		2	3	1699
	20170809	13	7	3	32	8		9	4	935
	20170810	19	2	9	21	1		1	3	993
	20170811	9	1	115	12	2			6	1463
	20170812	18	2	88	8	1		1	17	1754
	20170813	1		110	4			3	15	1416
	20170814	15	3	37	22	2		2	7	956
	20170815	22	2	344	7	1		1	19	2148

	20170816								0	702
	20170817								0	63
Download_0007	*	715	58	267	547	41	3	30	269	13183
	20170818	1	1	7	3	3			0	1027
	20170819	12	6	84	12			1	10	1788
	20170820	9		11	13		1	2	9	1158
	20170821	25	6	23	21	1		2	11	1133
	20170822	2	4	1	10			4	2	668
	20170823	12	3	1	8			1	0	1680
	20170824	10	4	14	7	3			3	1124
	20170825	37	5	3	9	2		2	3	343
	20170826	21	2	10	15	4		3	3	614
	20170827	6	1	15	18	1		2	3	343
	20170828	7	1	3	6	2			4	18
	20170829	2	4	5	8	5		2	3	9
	20170830	5		20	14	1			3	82
	20170831	1	4	4	12				4	439
	20170901	3		5	8	1			4	87
	20170902		2	1	12				1	6
	20170903	9	1	11	24	2			5	1039
	20170904	3	2	1	20			2	1	78
	20170905				14			1	0	2
	20170906			1	2	5			0	0
	20170907	1			6			1	0	3
	20170908	3	1	1	5				0	3
	20170909	62		3	44	3			31	189
	20170910	50		3	69	1			38	217
	20170911	20	1	7	13	4		1	8	66
	20170912	201	3	2	45	1	2	1	65	246
	20170913	144	2	2	44			2	16	169
	20170914	21		9	15			1	4	41
	20170915	38	3	7	27	1		2	28	190
	20170916	2		3	16				4	4
	20170917				5				1	2
	20170918	1	2	5	2				0	69
	20170919	7		5	16				5	343
	20170920				4	1			0	3
Download_0008	*	114	8	27	143	2		10	84	1108
	20170921	58		2	29				45	432
	20170922	34		9	37				31	233
	20170923	1	1		6			2	2	57
	20170924	5	2	1	20			1	0	7
	20170925	1	2		2			1	0	1

20170926	1			15		1	0	3
20170927	1			5			1	5
20170928	1		7	11			0	5
20170929	1		1	6	1		1	1
20170930	1						0	12
20171001					1	2	0	102
20171002			2	1		1	1	234
20171003	1		1	3			0	1
20171004							0	6
20171005		1	1	1		1	0	3
20171007	5	2	1	3			2	4
20171008	1						0	0
20171009				1			0	1
20171011						1	0	0
20171012	2			1			0	1
20171013	1						0	0
20171016			2	2			1	0

<u>Raw data from Detector 2 (includes March 27th through October 16th, 2017)</u>

KALEIDOSCOPE 3.1.8			Bats of North America 3.1.0 S/A:-1							
		EPFU	LABO	LACI	LANO	MYLU	MYSE	PESU	NOID	NOISE
*	*	391	3	1213		72		2	603	16854
Download_0001	*			4					0	5
	20170414			4					0	4
	20170417								0	1
Download_0002	*	15		32					23	204
	20170430	15		32					23	204
Download_0003	*	5		27					7	65

	20170414			4					0	4
	20170417								0	1
	20170515								0	23
	20170517	5		23					7	37
Download_0004	*	9		27					14	421
	20170610								0	1
	20170613	6		24					9	296
	20170627	3		3					5	124
Download_0005	*								0	42
	20170704								0	8
	20170709								0	33
	20170724								0	1
Download_0006	*	40		140					55	1027
	20170802	40		140					55	1027
Download_0007	*	105	1	339		72		2	164	3036
	20170818								0	2
	20170825	79		237					113	1215
	20170829					66		2	13	1307
	20170901					4			0	168
	20170907					2			0	57
	20170918	26	1	102					38	137
	20170919								0	150
Download_0008	*	217	2	644					340	12054
	20170922								0	6
	20170923	36		125					35	335
	20170924	5		53					18	982
	20170925	48	2	134					108	8148
	20170930	5		12					4	21
	20171001	16		90					43	699
	20171002	85		187					98	1281
	20171005								0	1
	20171014	22		43					34	581

Raw data from Detector 3 (includes March 27th through October 16th, 2017)

KALEIDOSCOPE 3.1.8
Bats of North America

3.1.0 S/A:-1	EPFU	LABO	LACI	LANO	MYLU	MYSE	PESU	NOID	NOISE
*	2649	415	1226	3040	784	1	45	2499	1103
Data	21	4	37	49				5	19
Data04	161	36	248	617	98		4	91	261

Data05	650	94	379	292	261	1	12	212	309
Data06	1304	143	398	1180	190		8	57	55
Data07	324	106	109	605	64		17	752	193
Data08	169	30	18	112	151		4	1374	234
Data3	20	2	37	185	20			8	32

Raw data from Detector 4 (includes March 27th through October 16th, 2017)

KALEIDOSCOPE 3.1.8
Bats of North America 3.1.0

S/A:-1		EPFU	LABO	LACI	LANO	MYLU	MYSE	PESU	NOID	NOISE
*	*	915	309	66657	2062	198	2	82	4585	68968
Download_0001	*		1	7	34				2	238
	20170328			1					0	1
	20170329								0	1
	20170331			1					0	0
	20170401				1				1	7
	20170402								0	2
	20170403								0	1
	20170407				7				0	71
	20170408			1	2				0	6
	20170409								0	22
	20170411			3					0	1
	20170412				1				0	21
	20170413				2				1	3
	20170414			1	6				0	3
	20170415				6				0	1
	20170416				6				0	0
	20170417		1		2				0	97
	20170418				1				0	1
Download_0002	*	13	1	15	60	2			14	2726
	20170420				1				2	3
	20170421			1	14				0	4
	20170422				11				0	3
	20170423			1	4	1			2	41
	20170424	1		1	7				0	5
	20170425								0	107
	20170426								0	5
	20170428	1			1				0	0
	20170429			3	3				1	2
	20170430	6	1						8	2546

	20170501			1				0	2
	20170502	3		4	8	1		1	2
	20170503				2			0	3
	20170504	2		4	9			0	3
Download_0003	*	29	14	380	223	12	2	112	3528
	20170505	1	1	5	21	1		0	11
	20170506			4	6			2	13
	20170507				1			0	391
	20170508		1	1	25			0	417
	20170509	1	2	6	14	2		3	5
	20170510				4			1	5
	20170511			2	6			2	5
	20170512	1		1	10	1		0	6
	20170513		2	2	1			1	2
	20170514	1		6	8	5		0	5
	20170515			1	20			3	302
	20170516	2	1	2	18	1		4	10
	20170517	21	5	249	9			73	2154
	20170518			7	19	1		3	12
	20170519			1	5		1	1	6
	20170520			3				0	25
	20170521			3	2			6	4
	20170522		1	1	6			0	4
	20170523			3	3			1	3
	20170524			38	7			3	14
	20170525			9	8			4	11
	20170526			11	7	1		3	8
	20170527	1	1		13		1	1	11
	20170528			20	8			0	91
	20170529	1		5	2			1	13
Download_0004	*	6	9	149	152	17	5	32	875
	20170530		1	17	1			2	4
	20170531			2	2			1	4
	20170601			3	3			0	3
	20170602			5	7	3		2	16
	20170603			3	9	1	1	0	45
	20170604		1	7	5			0	1
	20170605			6	7			1	0
	20170606			3	2		1	1	2
	20170607		1	3	4			1	4
	20170608			4	3		1	0	1
	20170609		1	3				0	6
	20170610			7	7			0	11

	20170611			5	8	1	2	3	8
	20170612	1	1	2	5			2	6
	20170613			2	1	1		1	444
	20170614		1	8	5	1		3	119
	20170615				2	3		1	14
	20170616			3	5			1	5
	20170617			3	8			2	21
	20170618			14	6			2	5
	20170619	1	1	4	7			2	5
	20170620	1		19	4	1		1	11
	20170621	1		8	11			2	8
	20170622		1	5	9	1		1	7
	20170623		1	2	2	1		1	6
	20170624				4			0	2
	20170625			1	6			0	3
	20170626			1	3	2		1	1
	20170627	2		6	4			1	96
	20170628			3	12	2		0	17
Download_0005	*	82	62	375	561	51	8	95	1122
	20170629	1			5	1		1	2
	20170630		1	3	4	1		2	4
	20170701	1		12	5	1	1	1	7
	20170702			3	8			0	5
	20170703			7	9		1	2	9
	20170704	1		14	9		1	0	12
	20170705		1	15	14			1	15
	20170706	3	2	8	9	1		4	6
	20170707	2	1	11	16	1		2	9
	20170708	3	2	11	8	1		0	8
	20170709	1	1	17	29			2	534
	20170710	4	1	15	23	3		1	14
	20170711	2	3	21	27	2		4	22
	20170712	2		10	31	3		1	18
	20170713	2		1	8	1		1	13
	20170714	3	1	8	17	1		2	15
	20170715	6	2	24	45	5		6	31
	20170716	3	5	9	13	6	1	3	19
	20170717	3	6	31	22	1		9	24
	20170718	3	1	18	26	3		4	21
	20170719	4	5	28	60	8	2	8	30
	20170720	8	6	13	27	2	1	8	30
	20170721	6	3	24	32	1		6	141
	20170722	12	5	20	34	4	1	11	25

	20170723	3	3	13	14	1			3	12
	20170724	3	3	20	18				5	53
	20170725	6	10	19	48	4			8	43
Download_0006	*	228	100	1928	540	75	2	34	284	14231
	20170726	10	4	17	64	6			11	50
	20170727	8	11	19	91	29		1	12	56
	20170728	4	6	13	10	3		7	6	11
	20170729	1	1	5	8				1	10
	20170730	6	3	676	13	6			70	1402
	20170731	5	4	13	16	2		2	2	11
	20170801	15	5	15	21	1		1	12	3083
	20170802	4		200	11	2		1	35	1629
	20170803	3	5	8	24			1	5	14
	20170804	1	2	7	8	1		5	5	15
	20170805	1	5	6	10	2			4	9
	20170806			9	9			1	0	17
	20170807	3		6	12	1		1	1	18
	20170808	2		4	9	1			4	129
	20170809	2	4	2	13	3		2	5	285
	20170810	2	2	11	11	2			2	20
	20170811	4	1	6	13	2		4	4	11
	20170812	2	2	10	9			2	1	22
	20170813	3		59	14	1		1	9	642
	20170814	93	11	425	39	8	2	2	28	329
	20170815	3	3	14	13	2			7	25
	20170816	3	2	40	9	1			12	4946
	20170817	53	29	363	113	2		3	48	1497
Download_0007	*	217	30	62637	400	17		27	3632	34575
	20170818	5	2	119	175			1	21	355
	20170819	1	1	10	11	1		2	3	14
	20170820	3	2	18	11			2	4	117
	20170821	33	6	363	24	1			49	1774
	20170822	6	1	3216	1			1	211	491
	20170823	3	1	7685					142	119
	20170824	6	1	1705	3	2			181	1571
	20170825	5	2	1448	7	2		1	145	1144
	20170826	4	1	327	23			1	46	2755
	20170827	11		4381	2			1	277	1217
	20170828	12	1	6378		1			221	313
	20170829	6	1	3408	3	1			395	1658
	20170830	9	2	4487	8	1		3	253	507
	20170831	5	1	3483	12				176	929
	20170901	8	3	3099				2	363	1540

	20170902	2		505	1			98	2209
	20170903	7		5045	17			197	487
	20170904	2	1	193	4		1	16	173
	20170905	3		595	2			47	302
	20170906			1	3		1	0	1
	20170907	16		5861	2		1	214	447
	20170908	10		4745	1	1		223	476
	20170909	6		4484	4			221	1252
	20170910	2		724	2	1		19	858
	20170911		1	6	6	1	2	5	3863
	20170912	2		3	3	1	1	3	11
	20170913	6	1	115	6	1	2	25	3345
	20170914			10	9			4	1708
	20170915	31		124	24		3	44	2860
	20170916	6	1	43	22		1	12	550
	20170917	1		41	2			11	616
	20170918	2		2	1			2	10
	20170919	4	1	9	10	1	1	3	894
	20170920			4	1	2		1	9
Download_0008	*	340	92	1166	92	24	6	414	11673
	20170921	1	2	4	4		2	3	105
	20170922	1		9	11	1		3	73
	20170923	170	83	153	31	21	1	28	319
	20170924	1		2	7			1	27
	20170925							1	2
	20170926	1		1	3			2	8
	20170927			6		1		0	20
	20170928	130		510	9			225	1457
	20170929				1			0	11
	20170930	1	1	249			1	61	2044
	20171001			120	1			32	2090
	20171002	26	5	53	12	1	2	27	1918
	20171003		1	1	2			0	13
	20171004			4	1			1	517
	20171005			2	1			0	47
	20171006			2	1			4	869
	20171007	9		48	6			25	1841
	20171008				1			1	7
	20171009				1			0	0
	20171010							0	1
	20171011							0	162
	20171012							0	87
	20171013							0	3

20171014		0	27
20171015	1	0	22
20171016	1	0	3

Raw data from Detector 5 (includes March 27th through October 16th, 2017)

KALEIDOSCOPE 3.1.8
Bats of North America 3.1.0

S/A:-1		EPFU	LABO	LACI	LANO	MYLU	MYSE	PESU	NOID	NOISE
*	*	1464	248	61681	2352	159		99	5107	162657
Download	*			1					1	2
	20170401			1					1	1
	20170404								0	1
Download_0001	*			4	3				0	135
	20170407								0	113
	20170408			3	1				0	0
	20170409								0	19
	20170414			1	1				0	1
	20170416				1				0	1
	20170417								0	1
Download_0002	*	2	1	13	22				8	274
	20170420				2				0	0
	20170421			1	1				0	72
	20170422	2	1	11	5				1	104
	20170423			1	7				1	15
	20170429				5				0	2
	20170430								0	68
	20170501				2				6	13
	20170502				2				6	13
	20170503				2				6	12
	20170504				2				0	8
Download_0003	*	12	12	35	300	10		3	15	414
	20170505				7	1			0	8
	20170506				9				1	1
	20170507				12				2	39
	20170508		1	2	15	1			2	15
	20170509				7	1			0	9
	20170510			2	6				0	2
	20170512			3	3				0	2
	20170513	4	1	7	10	1			0	65
	20170514	2	1	2	8			2	2	30
	20170515		2	3	34			1	1	16
	20170516	2	1	5	34	2			0	31

	20170517								0	43
	20170518	1		1	19				0	3
	20170519				9	1			0	2
	20170520		1						1	8
	20170521				5				1	3
	20170522		1		9				0	6
	20170523		2		13				0	8
	20170524			4	22				1	9
	20170525	1	1	2	19	2			2	37
	20170526	2		3	18	1			1	12
	20170527			1	21				0	4
	20170528				11				0	15
	20170529		1		9				1	46
Download_0004	*	6	15	130	193	3		6	32	3516
	20170530		1	2	4				1	5
	20170531			1	2				1	4
	20170601				1				0	0
	20170602		2	19	2				4	18
	20170603			1					0	1
	20170604			6	5				1	32
	20170605	1		6	10				2	13
	20170606			7	2				0	2
	20170607		1	5	3				1	47
	20170608			3	3				0	52
	20170609			2					1	1460
	20170610				3				2	43
	20170611			11	21				2	34
	20170612	2		7	17			1	5	39
	20170613		2	1	3				1	874
	20170614			3	9				0	13
	20170615			3	17	1			0	15
	20170616		1	5	16				1	36
	20170617			3	2				1	40
	20170618			6					1	5
	20170619		1	6	4				1	50
	20170620		1	3	6				0	8
	20170621		1	3	9			2	1	13
	20170622	2	1	6	1				0	4
	20170623				14	1		1	2	47
	20170624	1		1	5			1	1	165
	20170625			1	3				0	9
	20170626		1	1	9				1	12
	20170627			2	6			1	0	335

	20170628		3	16	16	1		2	140
Download_0005	*	155	93	482	959	78	32	314	43721
	20170629			6	21	4	1	2	34
	20170630		1	3	27	2		2	119
	20170701		2	8	15	1	1	2	22
	20170702	1		5	11	2		3	12
	20170703		1	1	23			1	15
	20170704	1	5	19	24	2		22	186
	20170705	5	11	14	32	3	4	8	58
	20170706	4	3	9	32	3		2	215
	20170707	1		19	28	1		5	93
	20170708	3	7	8	20	2	1	14	39
	20170709	2	2	15	39	1		6	642
	20170710	3	4	26	28	5	3	11	36
	20170711	2	3	39	53	1	2	11	65
	20170712	3		19	51	5	1	7	55
	20170713	1	2	17	18		1	12	20
	20170714	2	2	19	36	1	1	9	23
	20170715	6	4	15	46	4	2	2	70
	20170716	9	2	12	28	4		5	48
	20170717	14	7	34	40	3		14	458
	20170718	9	5	15	30	3	3	19	56
	20170719	5	3	32	57	9	3	23	131
	20170720	1	8	33	17	4	2	12	46
	20170721	7	4	25	41	6	1	21	2868
	20170722	34	4	20	98	7		14	4449
	20170723	2	7	26	20	2	3	9	75
	20170724	16	3	19	34		3	29	8442
	20170725	24	3	24	90	3		49	25444
Download_0006	*	108	44	137	333	28	15	107	67680
	20170726	10	7	20	115			14	3538
	20170727	11	7	34	68	2	5	13	3382
	20170728	4	9	15	35	4	2	7	4725
	20170729	16	6	16	21	3	1	11	10745
	20170730	2	5	5	10	7	1	9	3767
	20170731	5	2	22	26	2	5	8	8587
	20170801	22	7	20	52	9	1	23	6197
	20170802	18	1	5	6	1		5	19154
	20170803	16						16	3468
	20170804	1						0	1752
	20170805							0	113
	20170806	3						1	1807
	20170807							0	286

	20170808								0	44
	20170809								0	97
	20170810								0	16
	20170812								0	1
	20170814								0	1
Download_0007	*	1130	74	57624	410	33		40	4458	41356
	20170818	9	1	36	3				27	1212
	20170819	7	6	20	32	6			16	4418
	20170820		5	7	16	2			4	1720
	20170821	59	9	725	39	3		9	130	2311
	20170822	103	1	3692	7	1		3	508	1504
	20170823	172	1	5691	2	2		2	313	905
	20170824	88		5495	5	2			297	470
	20170825	46	2	3219		2		2	146	716
	20170826	102	3	5444	27	1		1	436	321
	20170827	136	2	4459	10			3	546	610
	20170828	109	1	5749	4	1			352	1253
	20170829	78	1	5586	1			1	206	1558
	20170830	6		232	6	1		1	25	1069
	20170831	7	2	25	14	2			25	1681
	20170901	1	4	27	5				4	1016
	20170902			1	7			2	0	51
	20170903	10	4	40	44	1		1	26	1366
	20170904	3		3	18	1			0	278
	20170905	1		2		1			4	1
	20170906			1	2				0	1
	20170907		2	2	9	1		1	1	337
	20170908	1	3	3	1				0	191
	20170909	2	2	16	7				5	1917
	20170910	3	5	51	8	1		4	30	2381
	20170911	16	4	9	23	1		1	8	621
	20170912	4	2	203	8	1		1	69	2526
	20170913	5	3	90	5			1	4	1837
	20170914	12	4	197	25	2		2	50	2705
	20170915	22	1	993	38			2	51	2740
	20170916	26	2	622	28	1		1	159	1050
	20170917	42	2	2675	2				318	657
	20170918	19	2	5842	2			1	435	1046
	20170919	39		5845	9				232	821
	20170920	2		622	3			1	31	66
Download_0008	*	51	9	3255	132	7		3	172	5559
	20170921	14	2	1772	10	4			99	2061
	20170922	21	1	1466	43				63	883

20170923				16	1		1	1	1505
20170924	1		2	26			1	0	182
20170925		1						1	2
20170926	1	1	1	18				0	7
20170927			1	4	1		1	1	2
20170928	10		7	5				4	44
20170929				4				0	3
20170930	1	1			1			0	79
20171001								0	188
20171002		1	3	3				1	504
20171003		1						1	1
20171004				1				1	0
20171005	1		1	1				0	1
20171006		1	1					0	2
20171007	1		1	1				0	3
20171008	1							0	0
20171010								0	1
20171011								0	5
20171012								0	21
20171014								0	55
20171015								0	5
20171016								0	5

Raw data from Detector 6 (includes March 27th through October 16th, 2017)

KALEIDOSCOPE 3.1.8
Bats of North America 3.1.0

S/A:-1	EPFU	LABO	LACI	LANO	MYLU	MYSE	PESU	NOID	NOISE
*	6673	1314	3297	6418	611	1	141	8295	1713
Data	3	7	2	2	1			1	1
Data001	95	1	80	76	4			4	1
Data04	1967	28	707	2476	39	1	5	82	73
Data05	302	152	504	569	46		11	32	73
Data06	2453	357	1193	1820	238		22	489	134
Data07	741	441	117	559	150		44	3491	485
Data08	483	287	299	444	117		52	1858	482
Data09	77	28	79	121	1		7	2328	445
Data3	552	13	316	351	15			10	19

APPENDIX D – PALMER’S CREEK WIND FARM ACOUSTIC BAT SUMMARY REPORT

FAGEN, INC.

GRANITE FALLS, MINNESOTA

Palmer's Creek Wind Farm

Acoustic Bat Summary Report

2017

NEW CENTURY ENVIRONMENTAL LLC, COLUMBUS, NE

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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.

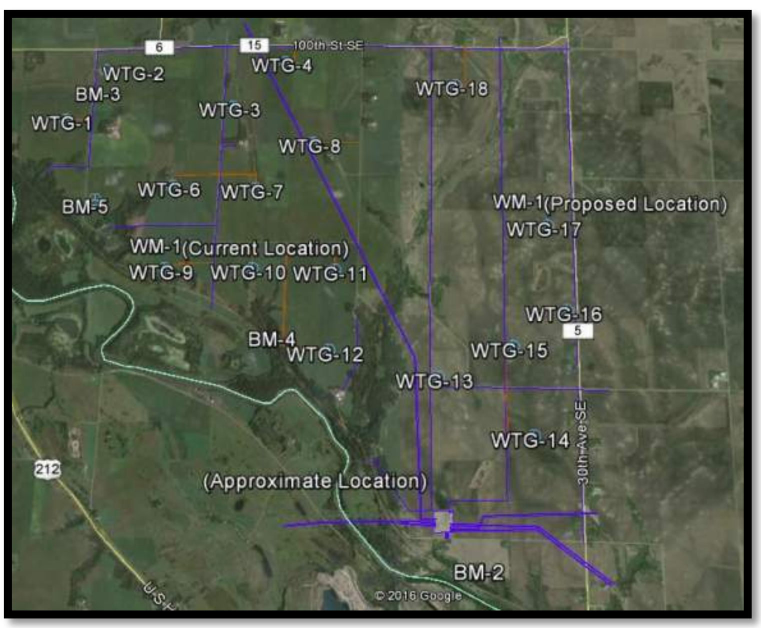

Figure 2: Project location along with bat monitor (BM) locations. BM-1 is not shown on the map but lies next to BM-2.

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*).

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Appendix

Summary Graphs

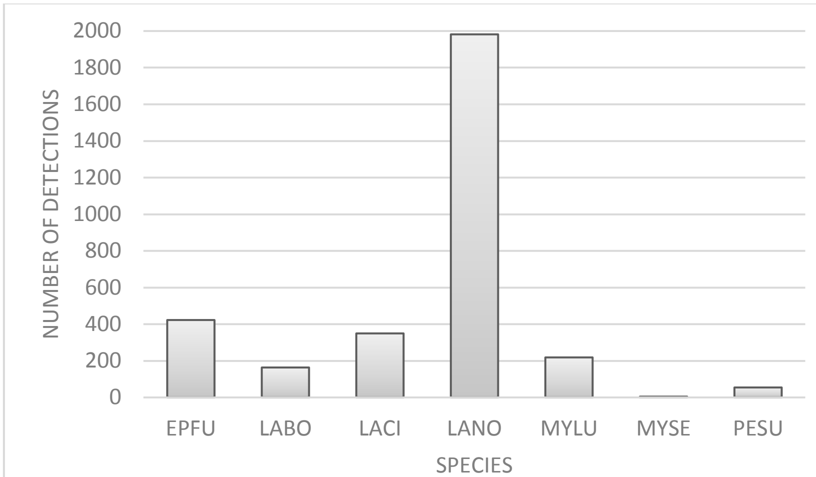

Figure 9.1: Total number of bat detections by species for monitor 1

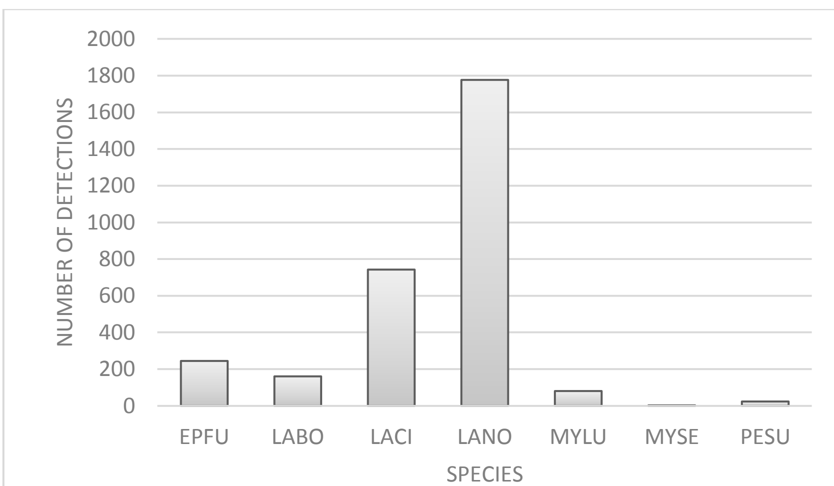

Figure 9.2: Total number of bat detections by species for monitor 2

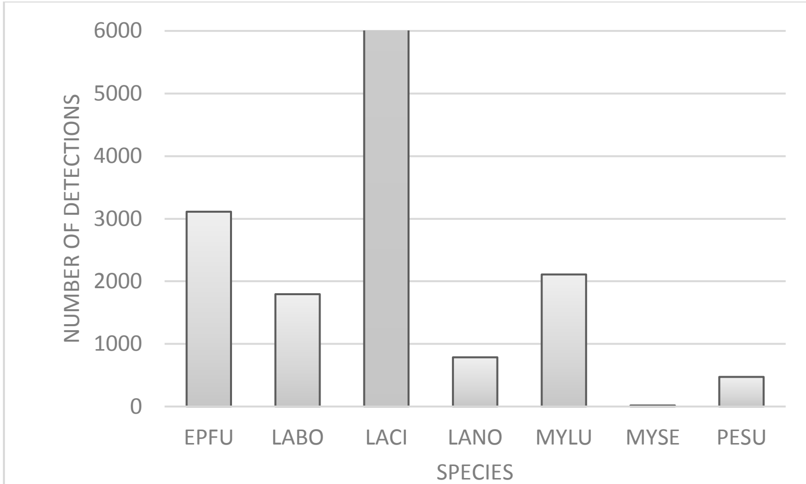

Figure 9.3: Total number of bat detections by species for monitor 3

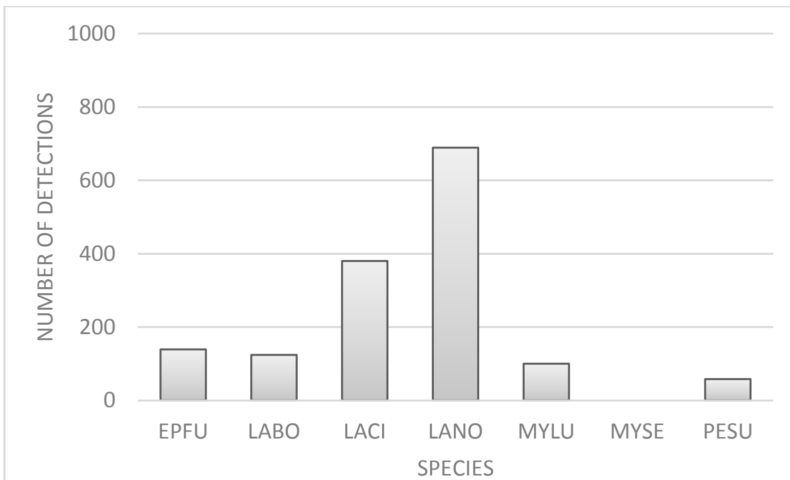

Figure 9.4: Total number of bat detections by species for monitor 4

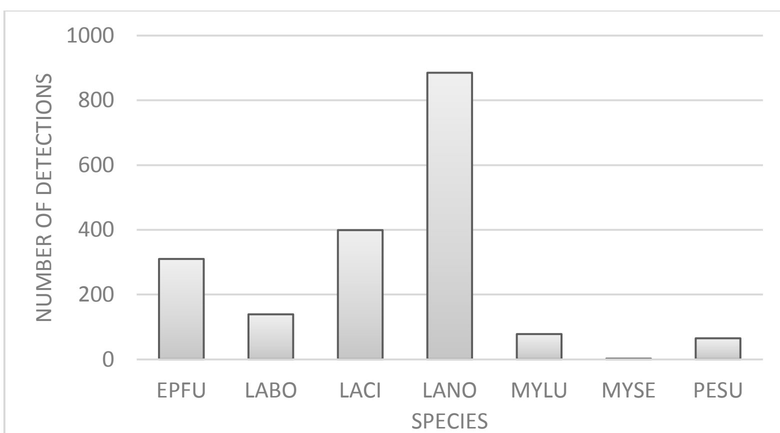

Figure 9.5: Total number of bat detections by species for monitor 5

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.

Fagen, Inc.

Palmer's Creek Wind Farm, LLC 2017 Acoustic Bat Report

Granite Falls, MN

New Century Environmental

11-14-2017

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Palmer's Creek Wind Farm, LLC Acoustic Bat Survey Report 2017
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 completing an acoustic bat survey to evaluate the diversity/abundance of bat species within the study area of the proposed Palmer's Creek Wind Farm, LLC. The client proposes to develop a wind farm within the study area of Chippewa County, Minnesota (just north across the Minnesota River from Granite Falls). Staff of Fagen Engineering deployed four separate zero-crossing systems and two Wildlife Acoustics SM3 full-spectrum systems to record bat activity throughout the study area from 27 March through 16 October 2017. The data collected by Fagen Engineering was sent to NCE, where it was analyzed, as appropriate, with either Kaleidoscope version 3.1.8 (in zero-crossing mode) or Sonobat 3 (full-spectrum only) to evaluate diversity and abundance of bat species at the Palmer's Creek site. 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. Each detector had a total of 203 functioning detector nights (for a total of 1218 detector nights), with a preliminary average bat pass per detector night at 143.93 detected. As discussed in detail below, this average is subject to some adjustment due to inter-related technological and ecological issues.

Introduction: 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.

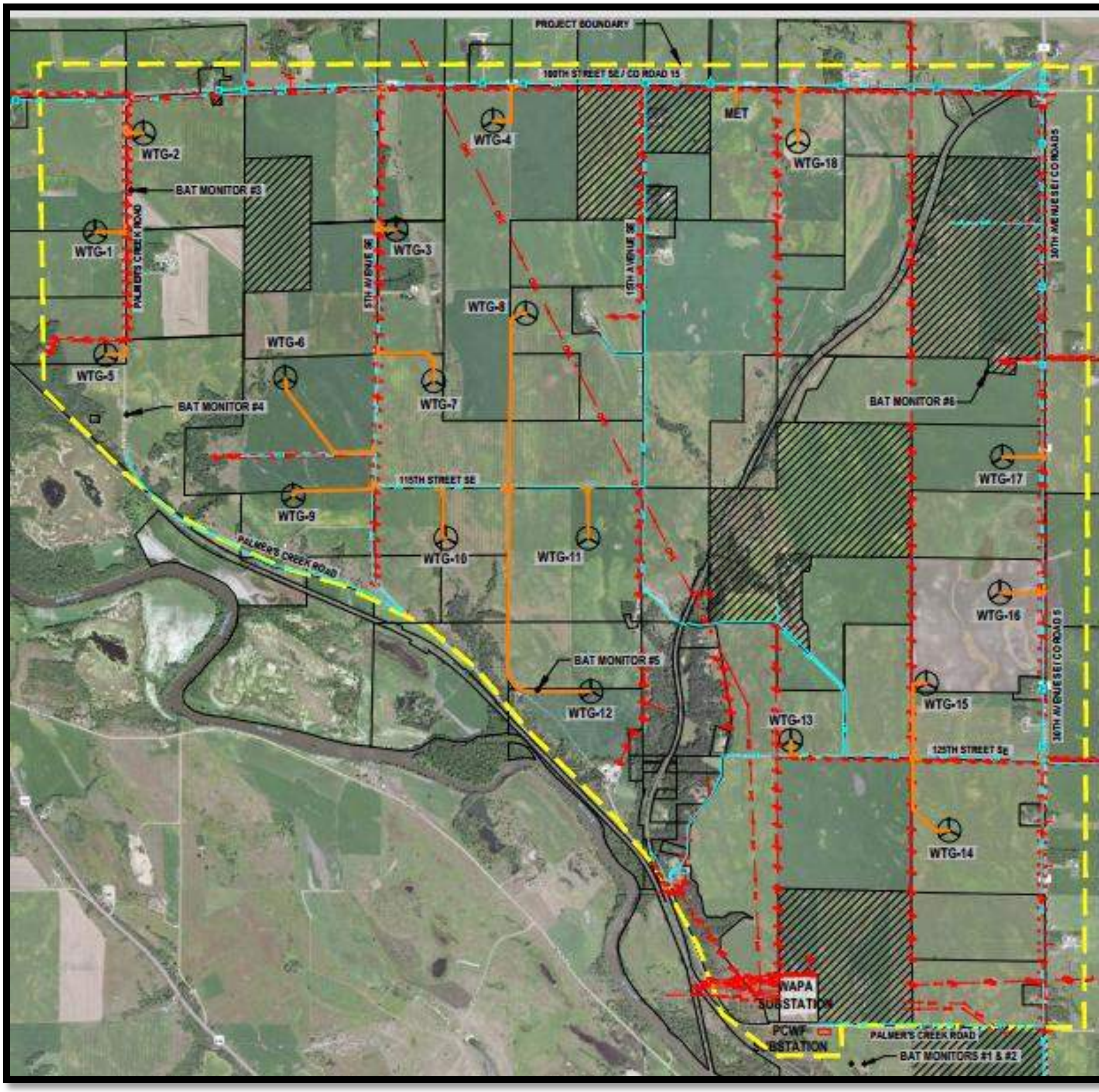

Figure 2. Map of study area showing bat detector locations.

Methods

Data was gathered in the field by Fagen Engineering, LLC within the study area from four different Anabat acoustic detectors (Figure 2: Monitors 1, 2, 4 and 5) and two Wildlife Acoustics SM3BAT full-spectrum bat detectors (Figure 2: Monitors 3 and 6). The detectors gathered data from 27 March through 16 October 2017. The data were sent to New Century Environmental staff via certified mail, and the data was then downloaded and processed with Sonobat 3 for full-spectrum data, and Kaleidoscope Pro version 3.1.8 for full-spectrum and zero-crossing data. Kaleidoscope Pro has been approved by the U.S. Fish & Wildlife Service for use for presence/absence analysis for Indiana bats (*Myotis sodalis*) and northern long-eared bats (*Myotis septentrionalis*).[1] Kaleidoscope Pro has also been approved by the U.S Geological Survey's standard validation process (USFWS 2016).

Preliminary Results

Detector 1

Detector 1 is located on the lower end of a met tower surrounded by row crops with mature, old-growth, high-quality roosting trees within 50m, with potential bat prey available in abundance. The quality of the bat habitat at this location is much better than average for the study area as a whole, and (arguably) much, much better than is typical for the rotor areas projected for the site. The detector had 203 functioning detector nights and recorded 10,447 files that Kaleidoscope Pro was able to classify as bat passes. The mean bat passes per detector night is 51.46.

Table 1: Results from Detector 1

Code	Common name	Scientific Name	P-Value	# of passes	Conservation Status		
					IUCN 3.1	Federal	MN
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	0-present	3425	Least Concern	Not listed	No special status
EPFU	Big-Brown Bat	*Eptesicus fuscus*	0-present	2240	Least Concern	Not listed	Species of Concern
LACI	Hoary Bat	*Lasiurus cinereus*	0-present	4222	Least Concern	Status undefined	No special status
LABO	Eastern Red Bat	*Lasiurus borealis*	0-present	231	Least Concern	Not listed	No special status
MYLU	Little Brown Bat	*Myotis lucificus*	0-present	195	Least Concern	Not listed	Species of Concern
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	1-absent	11	Threatened	Threatened 4(d)	Species of Concern
PESU	Tri-colored bat	*Perimyotis subflavus*	0-present	123	Least Concern	Not listed	Species of Concern

[1] https://www.fws.gov/midwest/Endangered/mammals/inba/surveys/inbaAcousticSoftware.html

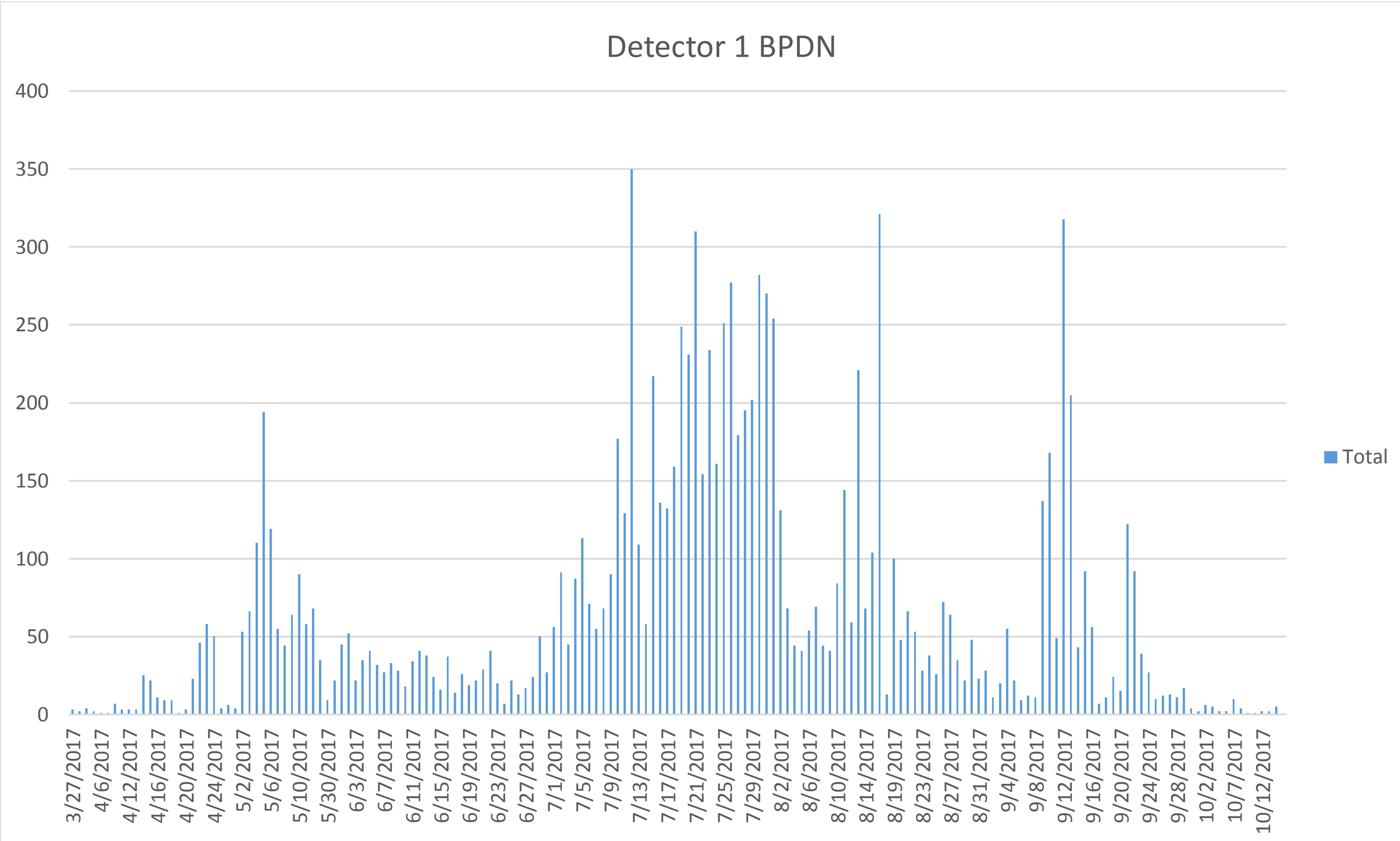

Figure 3. Bat activity for Detector 1 at the Palmer Creek Wind Farm LLC for the study period March 27th, 2017 through October 16th, 2017.

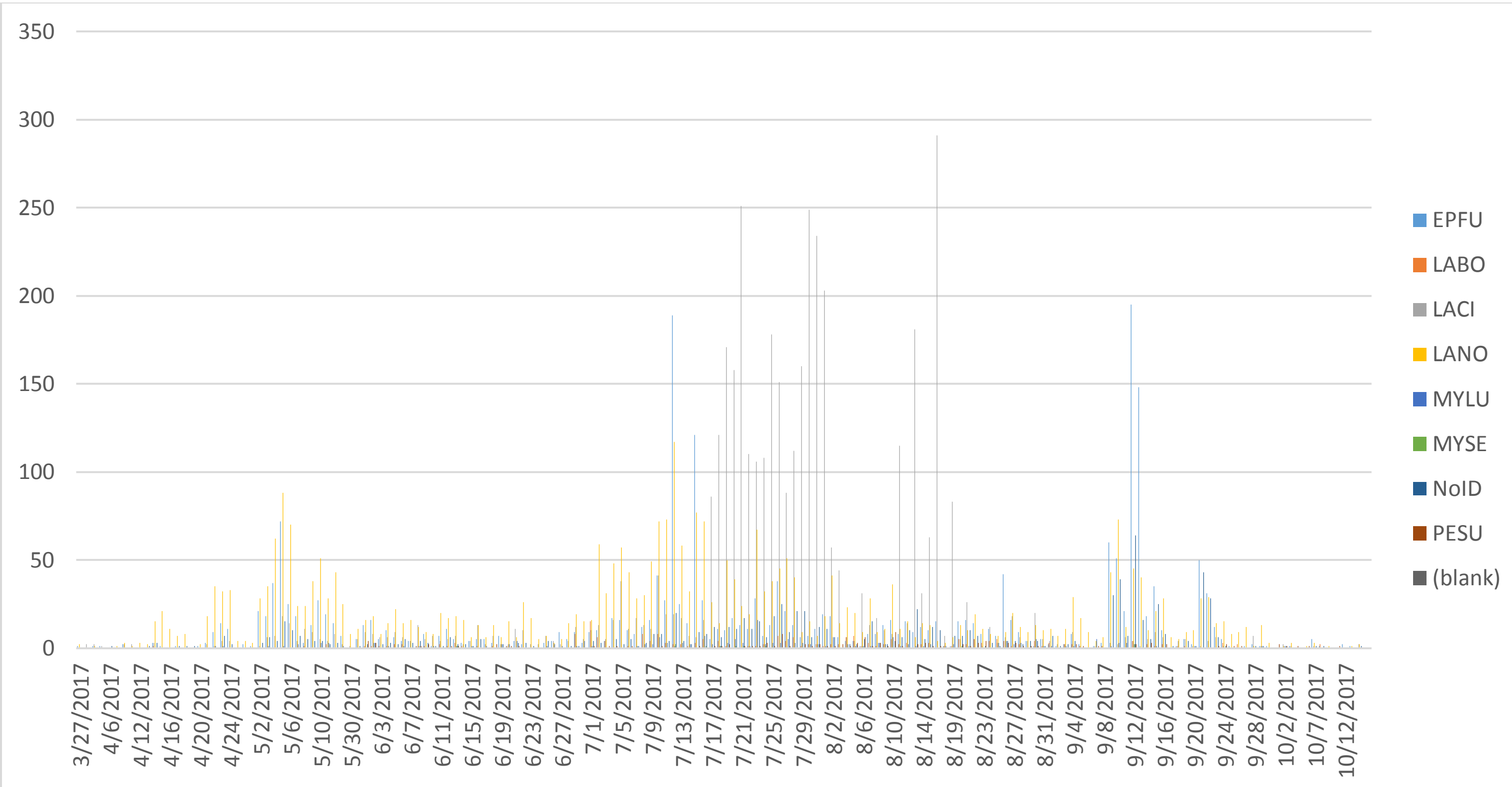

Figure 4. Detector 1 results by date and species.

Detector 2

Detector 2 is located on the upper end of the same MET tower as Detector 1, at an elevation of approximately 55m. The detector had 203 functioning detector nights and recorded 1,681 files that Kaleidoscope Pro classified as bat passes. The mean bat passes per detector night is 8.28.

Table 2: Results from Detector 2

Code	Common name	Scientific Name	P-Value	# of passes	Conservation Status		
					IUCN 3.1	Federal	MN
EPFU	Big-Brown Bat	*Eptesicus fuscus*	0-present	391	Least Concern	Not listed	Species of Concern
LACI	Hoary Bat	*Lasiurus cinereus*	0-present	1213	Least Concern	Status undefined	No special status
LABO	Eastern Red Bat	*Lasiurus borealis*	1-absent	3	Least Concern	Not listed	No special status
MYLU	Little Brown Bat	*Myotis lucificus*	0-present	72	Least Concern	Not listed	Species of Concern

PESU	Tri-colored bat	*Perimyotis subflavus*	1-absent	2	Least Concern	Not listed	Species of Concern

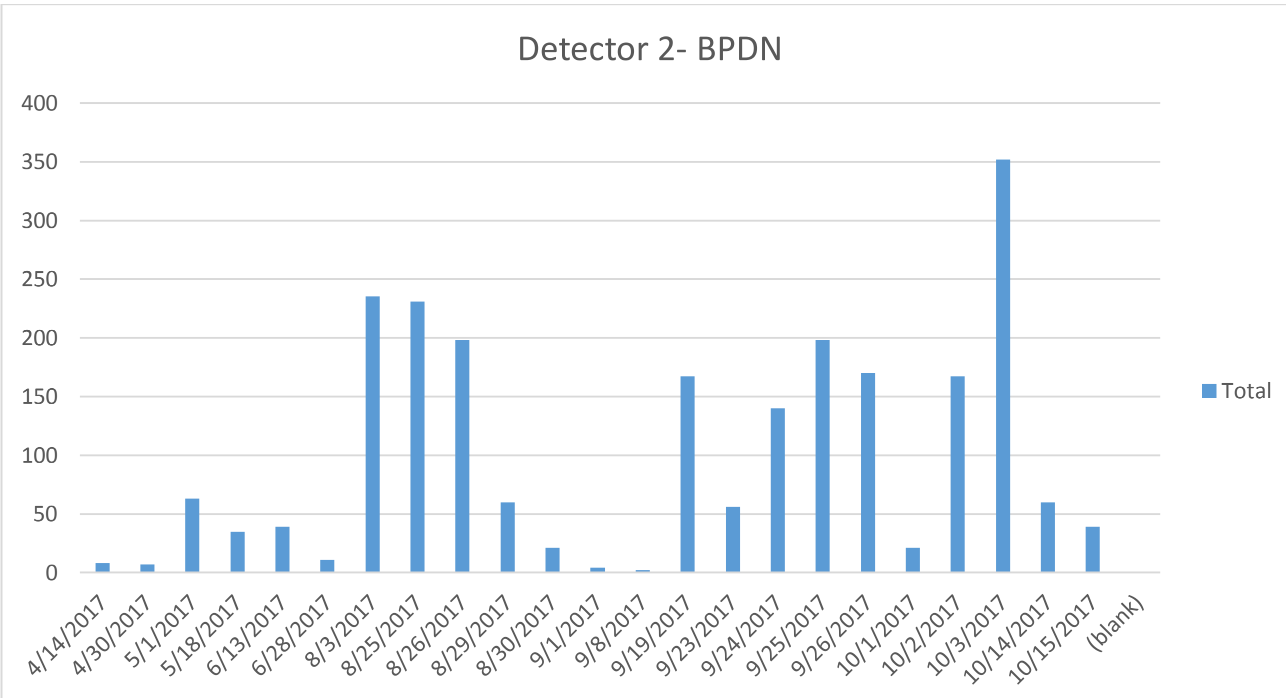

Figure 5. Bat activity for Detector 2 at the Palmer Creek Wind Farm LLC for the study period March 27th, 2017 through October 16th, 2017.

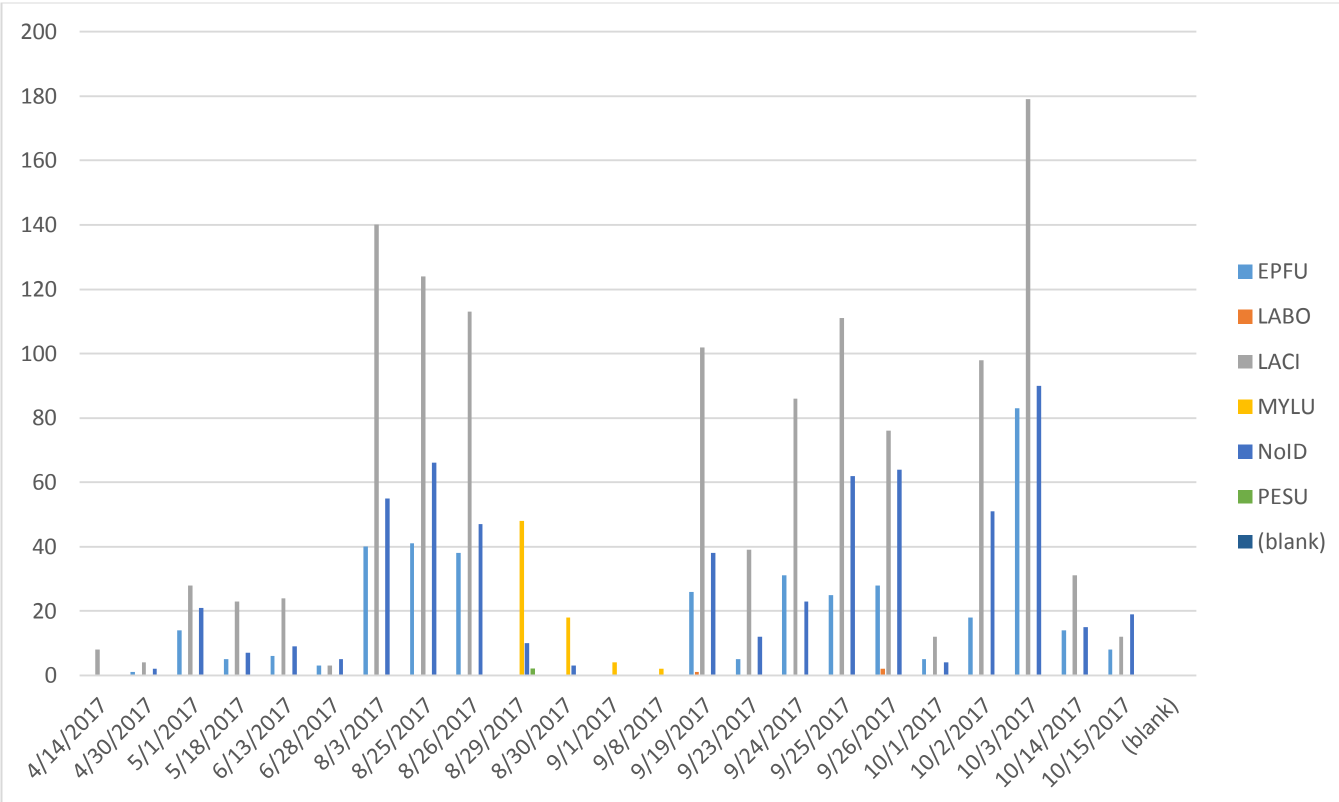

Figure 6. Results from Detector 2 by date and species.

Detector 3-Sonobat and Kaleidoscope

Detector 3, one of two full-spectrum SM3 ultrasonic detectors, was installed along a ditch bank surrounded by row crops and roosting tree habitat. The ditch in question is known to be a corridor used by bats traveling between the Sween Wildlife Management Area and the Minnesota River and is covered by a Re-invest in Minnesota (RIM) easement. The bat habitat in this area is excellent, and is much better than the typical bat habitat in the project area. The detector had 203 functioning detector nights and recorded 8,160 files that Kaleidoscope Pro classified as bat passes. The mean bat passes per detector night is 40.2.

Table 3: Results from Detector 3

			Kaleidoscope		Sonobat		Conservation Status		
Code	**Common name**	**Scientific Name**	**P-Value**	**# of passes**	**# of passes**	**Likelihood of presence**	**IUCN 3.1**	**Federal**	**MN**
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	0-present	3040	3853	1-present	Least concern	Not listed	No special status
EPFU	Big-Brown Bat	*Eptesicus fuscus*	0-present	2649	4731	1-present	Least concern	Not listed	Species of Concern
LACI	Hoary Bat	*Lasiurus cinereus*	0-present	1226	662	1-present	Least concern	Status undefined	No special status
LABO	Eastern Red Bat	*Lasiurus borealis*	0-present	415	122	1-present	Least concern	Not listed	No special status
MYLU	Little Brown Bat	*Myotis lucificus*	0-present	784	500	1-present	Least concern	Not listed	Species of Concern
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	1-absent	1	0	0-absent	Threatened	Threatened 4(d)	Species of Concern
PESU	Tri-colored bat	*Perimyotis subflavus*	1-absent	45	48	1-present	Least concern	Not listed	Species of Concern
MYSO	Indiana bat	*Myotis Sodalis*	1-absent	0	6	0.72384	Near threatened	Endangered	Endangered
NYHU	Evening bat	*Nycticeius humeralis*	1-absent	0	102	0.99945	Least concern	Not listed	No special status

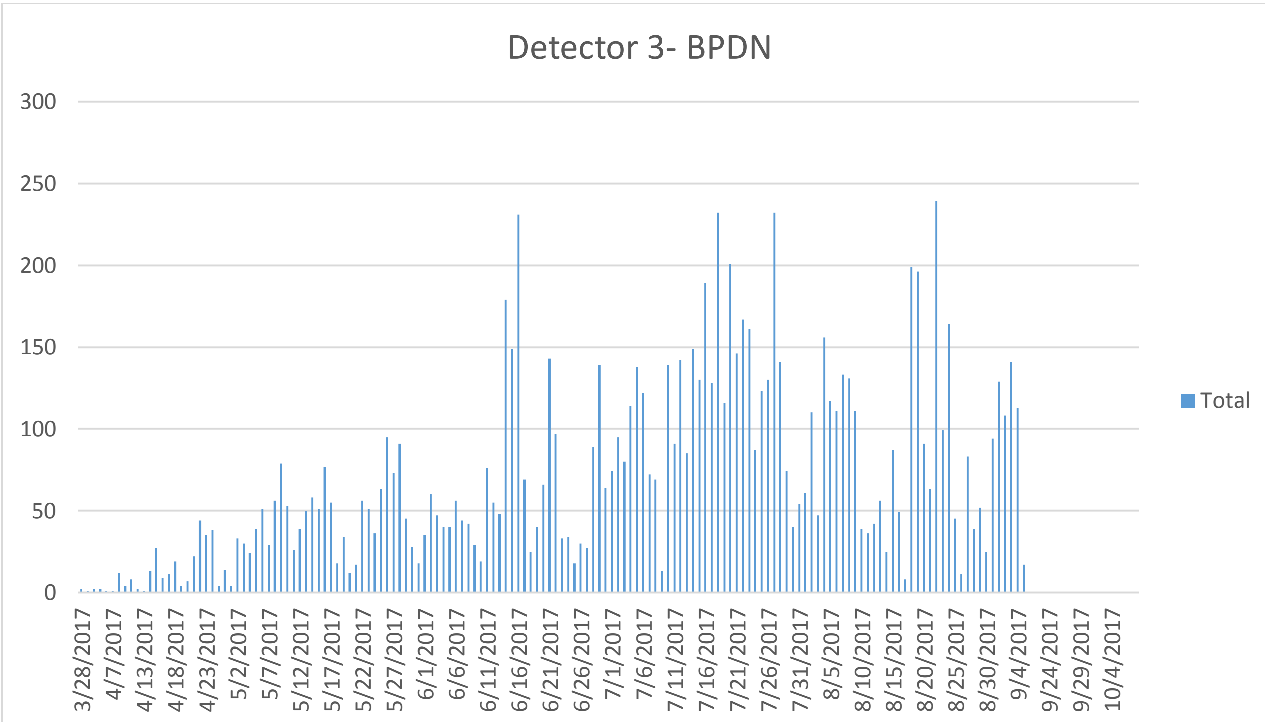

Figure 7. Bat activity for Detector 3 at the Palmer Creek Wind Farm LLC for the study period March 27th, 2017 through October 16th, 2017.

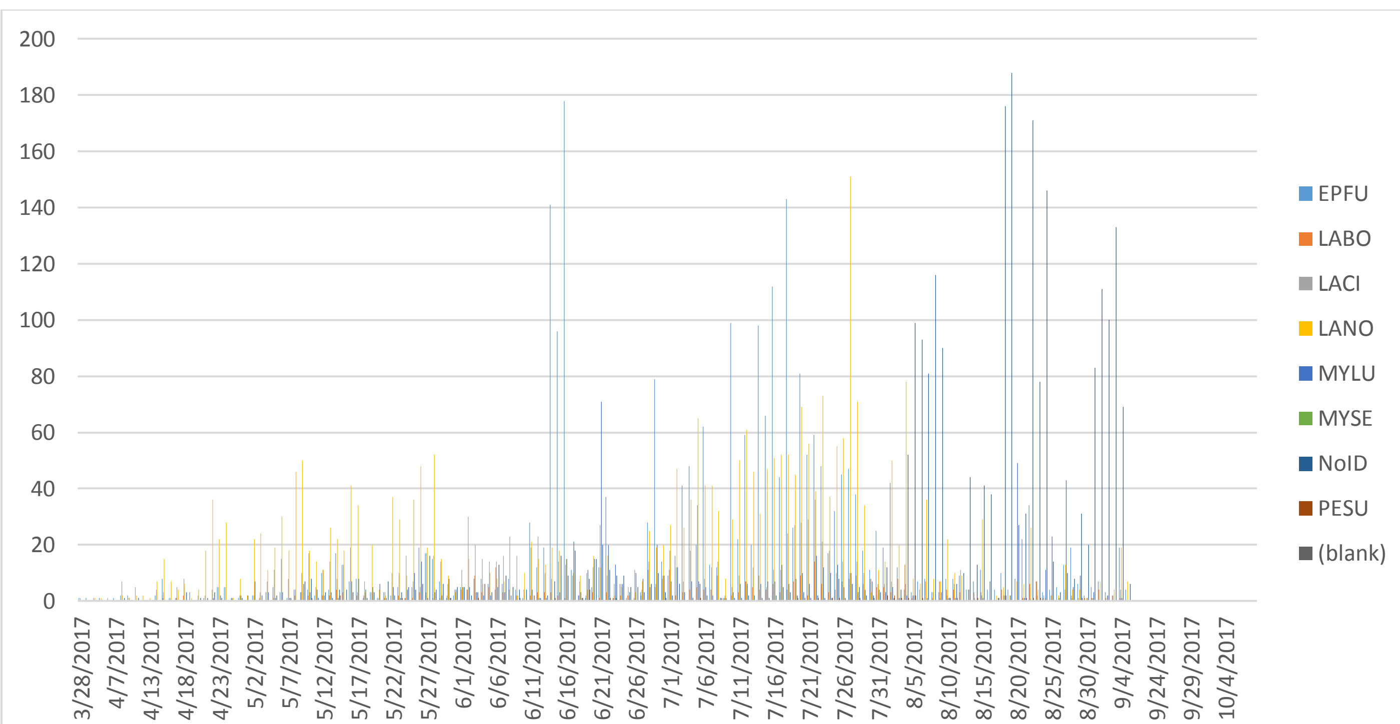

Figure 8. Results for Detector 3 by date and species.

Detector 4

Detector 4 is located in a cornfield; a creek with roosting habitat is located near the site. The bat habitat in this area is at least very good, with forage, water, and roosting potential in abundance in the immediate vicinity. With a location just north of the Minnesota River Valley, this site, like Sites 1,2, and 3, has bat habitat of greater quality than is typical for the Palmer's Creek study site as a whole. The detector had 203 functioning detector nights and recorded 70,225 files Kaleidoscope Pro classified as bat passes. The mean total bat passes per detector night is 345.93. The activity recorded at his site may be inflated by a large number of false positives, and will be discussed below in more detail.

Table 4: Results from Detector 4

Code	Common name	Scientific Name	P-Value	# of passes	Conservation Status		
					IUCN 3.1	Federal	MN
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	0-present	2062	Least Concern	Not listed	No special status
EPFU	Big-Brown Bat	*Eptesicus fuscus*	0-present	915	Least Concern	Not listed	Species of Concern
LACI	Hoary Bat	*Lasiurus cinereus*	0-present	66657	Least Concern	Status undefined	No special status
LABO	Eastern Red Bat	*Lasiurus borealis*	0-present	309	Least Concern	Not listed	No special status
MYLU	Little Brown Bat	*Myotis lucificus*	0-present	198	Least Concern	Not listed	Species of Concern
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	1-absent	0	Threatened	Threatened 4(d)	Species of Concern
PESU	Tri-colored bat	*Perimyotis subflavus*	0-present	82	Least Concern	Not listed	Species of Concern

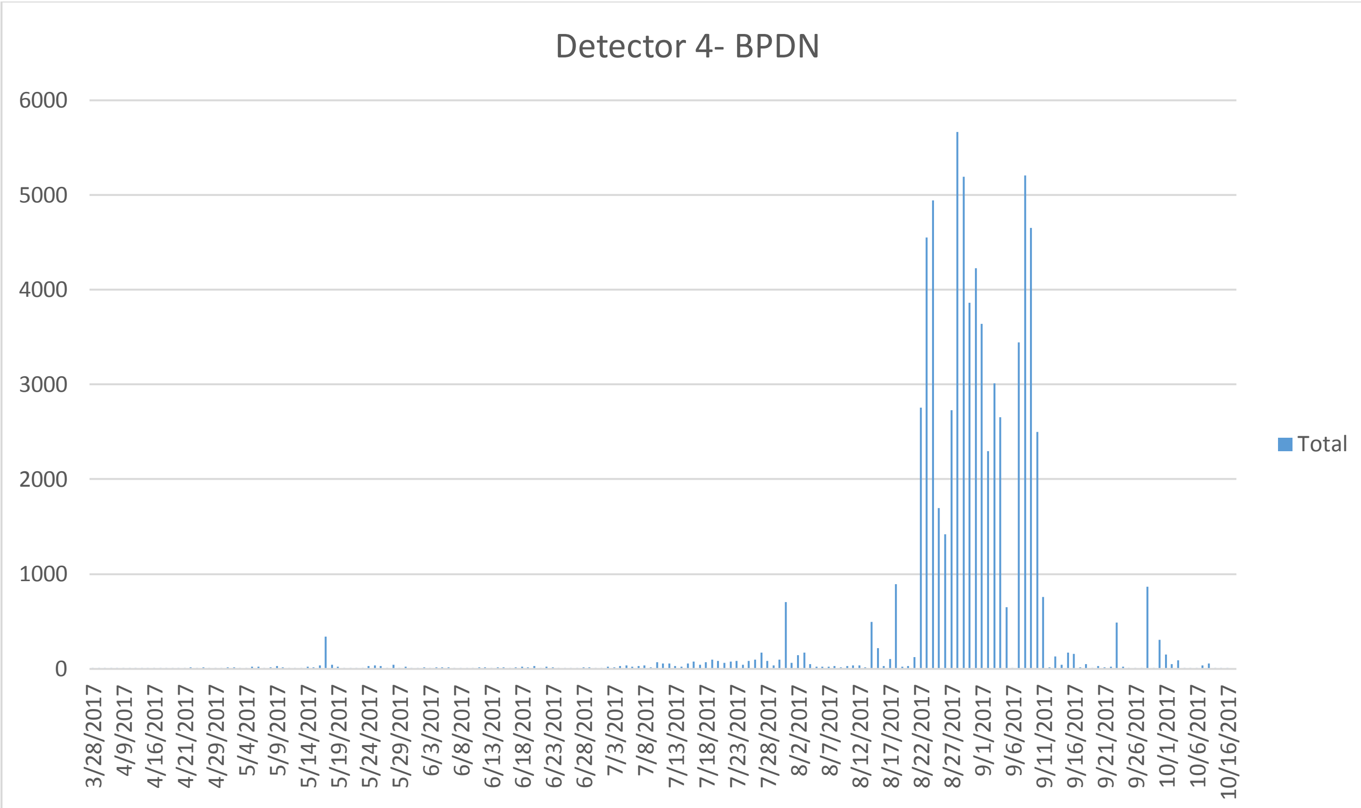

Figure 9. Bat activity at Detector 4 at the Palmer Creek Wind Farm LLC for the study period March 27th, 2017 through October 16th, 2017.

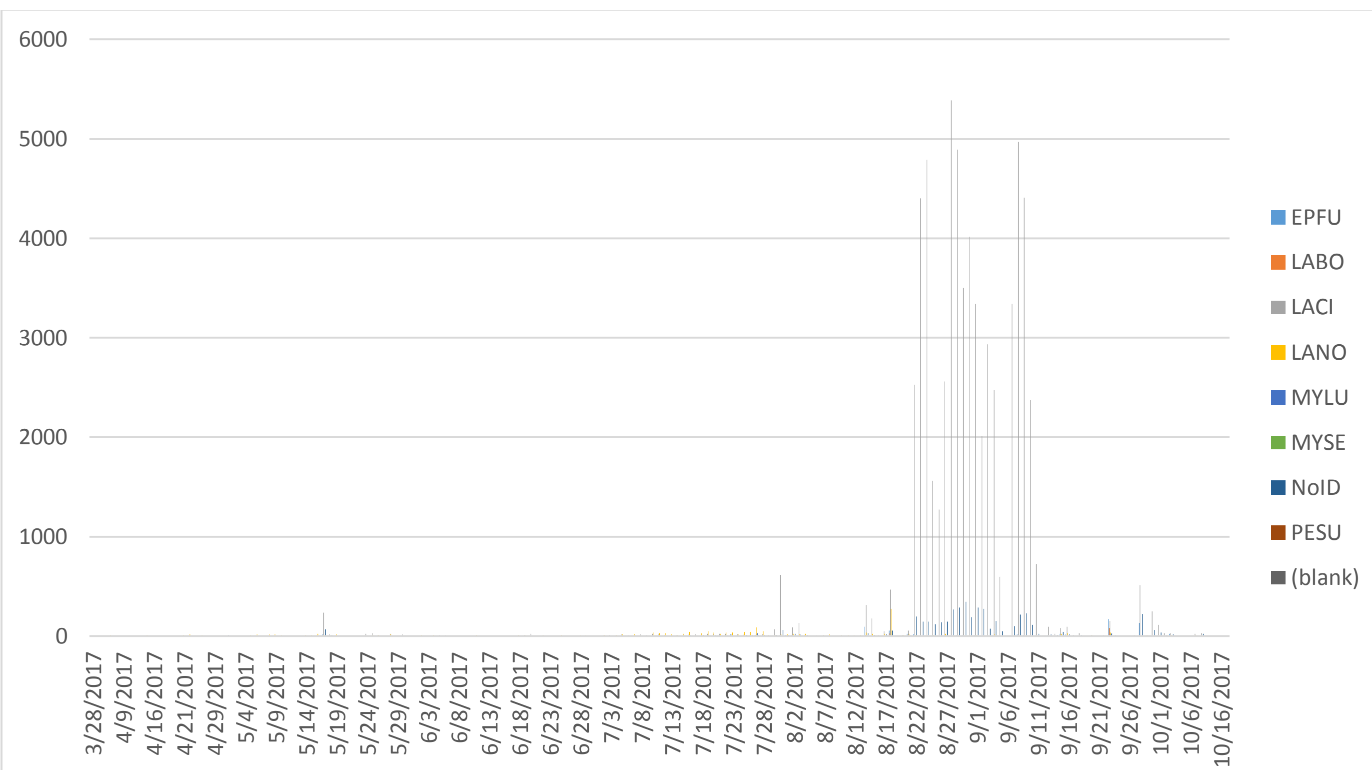

Figure 10. Results for Detector 4 by date and species.

Detector 5

Detector 5 is located on a fence line between cornfields, near high-quality roosting and foraging habitat and water. The habitat is excellent for bats, but is not typical for the Palmer's Creek study site as a whole. The detector had 203 functioning detector nights and recorded 66,003 files Kaleidoscope Pro classified as bat passes. The mean bat passes per detector night is 325.14, and this total, like the total for Detector 4, may be inflated by false positives, as will be discussed in detail below.

Table 5: Results from Detector 5

Code	Common name	Scientific Name	P-Value	# of passes	Conservation Status		
					IUCN 3.1	Federal	MN
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	0-present	2352	Least Concern	Not listed	No special status
EPFU	Big-Brown Bat	*Eptesicus fuscus*	0-present	1464	Least Concern	Not listed	Species of Concern
LACI	Hoary Bat	*Lasiurus cinereus*	0-present	61681	Least Concern	Status undefined	No special status
LABO	Eastern Red Bat	*Lasiurus borealis*	0-present	248	Least Concern	Not listed	No special status
MYLU	Little Brown Bat	*Myotis lucificus*	0-present	159	Least Concern	Not listed	Species of Concern
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	1-absent	0	Threatened	Threatened 4(d)	Species of Concern
PESU	Tri-colored bat	*Perimyotis subflavus*	0-present	99	Least Concern	Not listed	Species of Concern

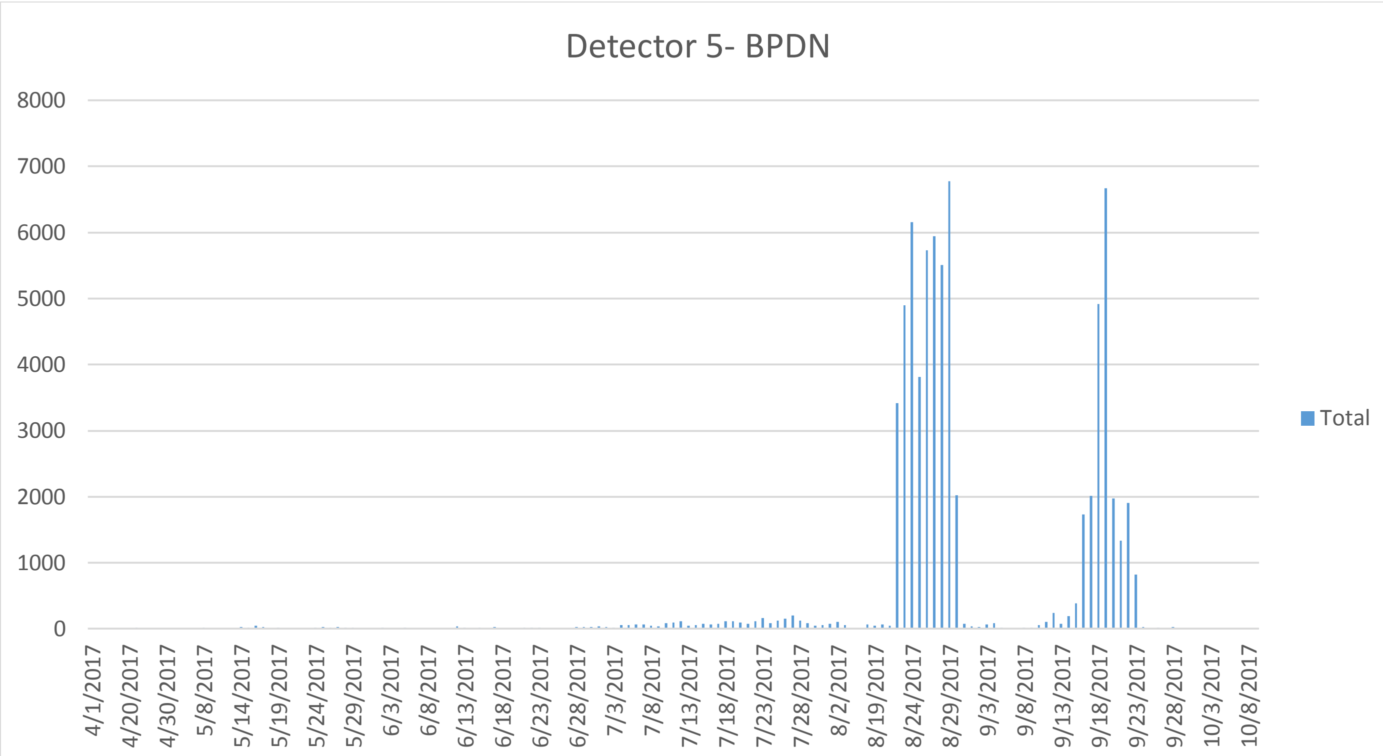

Figure 11. Bat activity at Detector 5 at the Palmer Creek Wind Farm LLC for the study period March 27th, 2017 through October 16th, 2017.

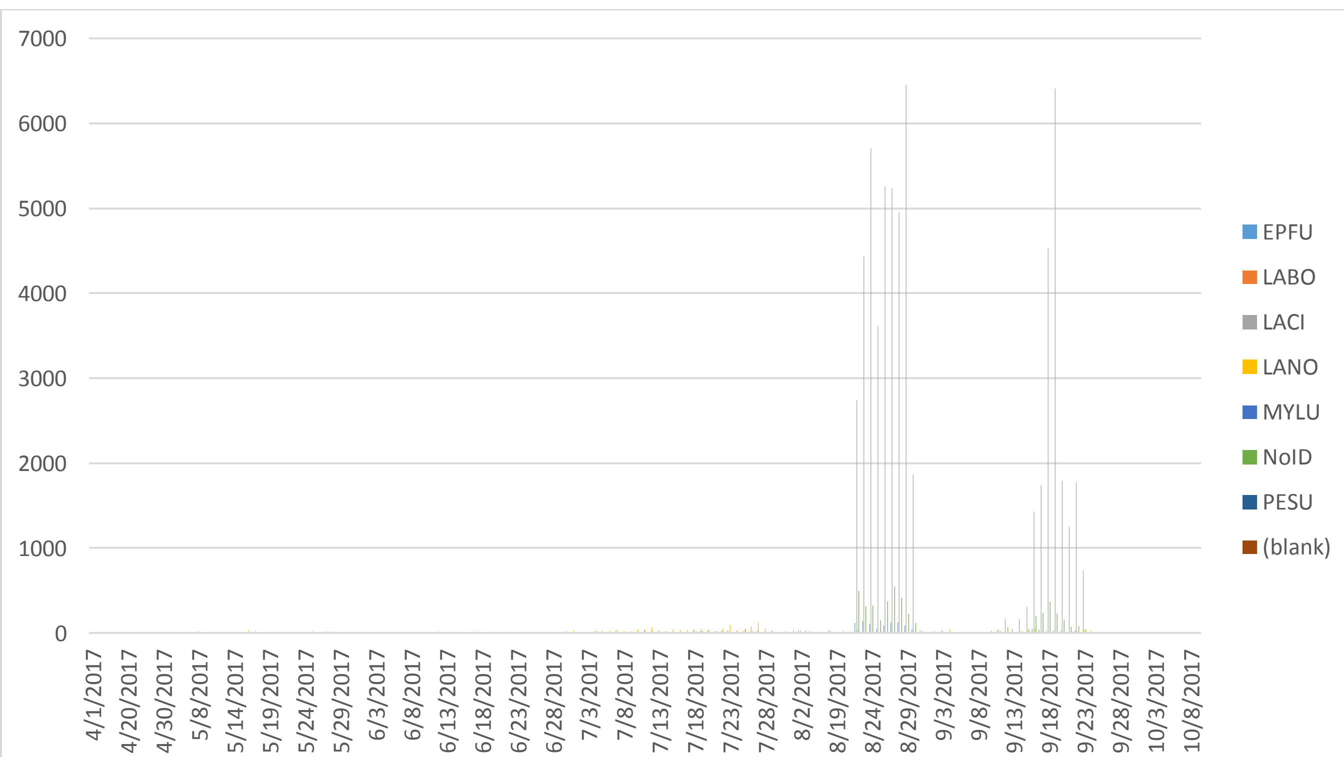

Figure 12. Results for Detector 5 by date and species.

Detector 6-Sonobat and Kaleidoscope

Detector 6, the second of the SM3BAT full spectrum devices, was located immediately adjacent to a shelterbelt near an abandoned farmhouse. The detector had 203 functioning detector nights and recorded a total of 18,455 files Kaleidoscope Pro classified as bat passes. The mean bat passes per detector night is 90.91. Although the results for this site are not subject to the same doubts as Sites 4 and 5, results from this site may reflect characteristics particular to this site that are not easily generalized to the site as a whole.

Table 6: Results for Detector 6

Code	Common name	Scientific Name	Kaleidoscope		Sonobat		Conservation Status		
			P-Value	# of passes	# of passes	Likelihood of presence	IUCN 3.1	Federal	MN
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	0-present	6418	4116	1-present	Least concern	Not listed	No special status
EPFU	Big-Brown Bat	*Eptesicus fuscus*	0-present	6673	5995	1-present	Least concern	Not listed	Species of Concern
LACI	Hoary Bat	*Lasiurus cinereus*	0-present	3297	1124	1-present	Least concern	Status undefined	No special status
LABO	Eastern Red Bat	*Lasiurus borealis*	0-present	1314	608	1-present	Least concern	Not listed	No special status
MYLU	Little Brown Bat	*Myotis lucificus*	0-present	611	154	1-present	Least concern	Not listed	Species of Concern
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	1-absent	1	0	0-absent	Threatened	Threatened 4(d)	Species of Concern
PESU	Tri-colored bat	*Perimyotis subflavus*	0-present	141	95	1-present	Least concern	Not listed	Species of Concern

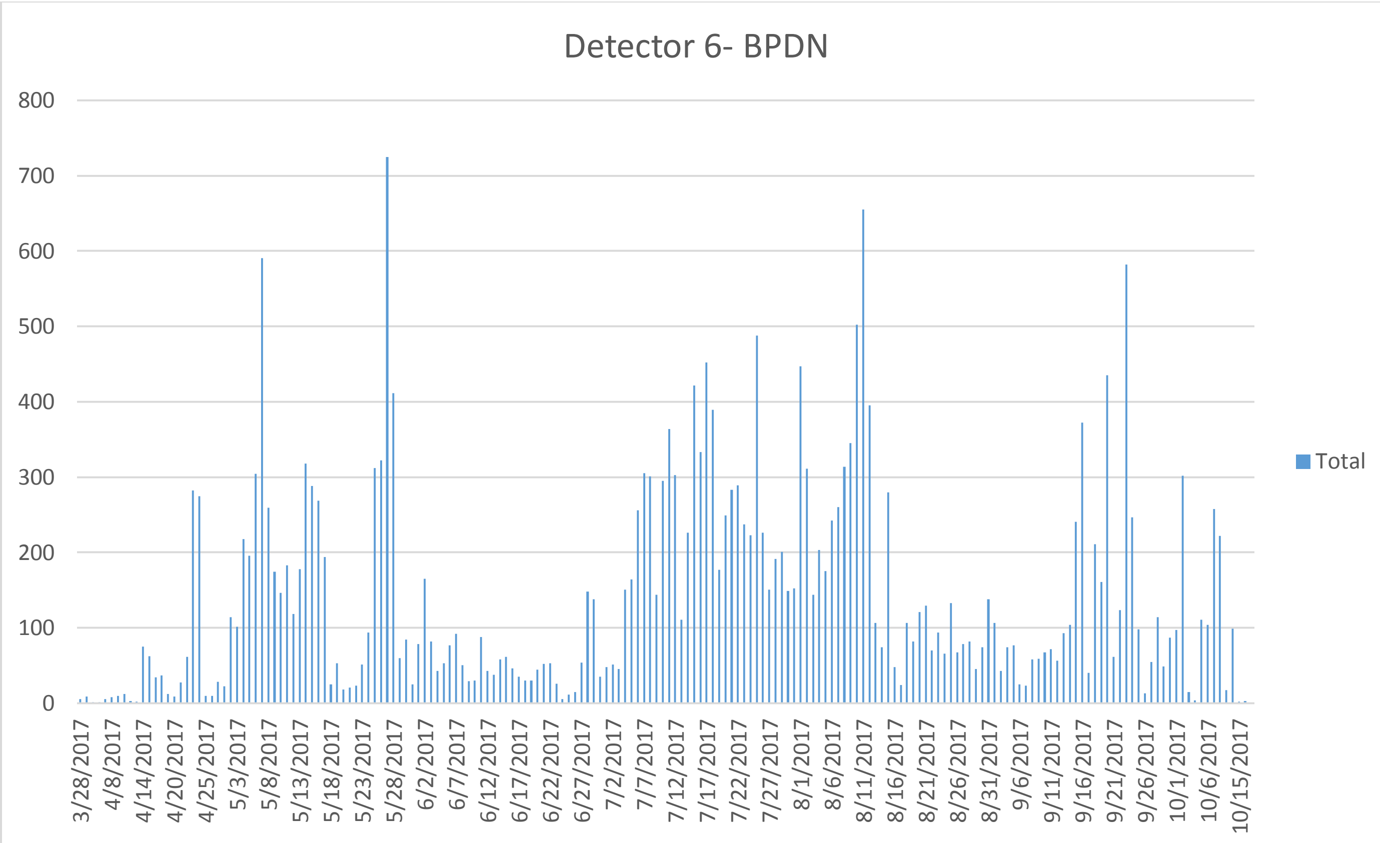

Figure 13. Bat activity at Detector 6 at the Palmer Creek Wind Farm LLC for the study period March 27th, 2017 through October 16th, 2017.

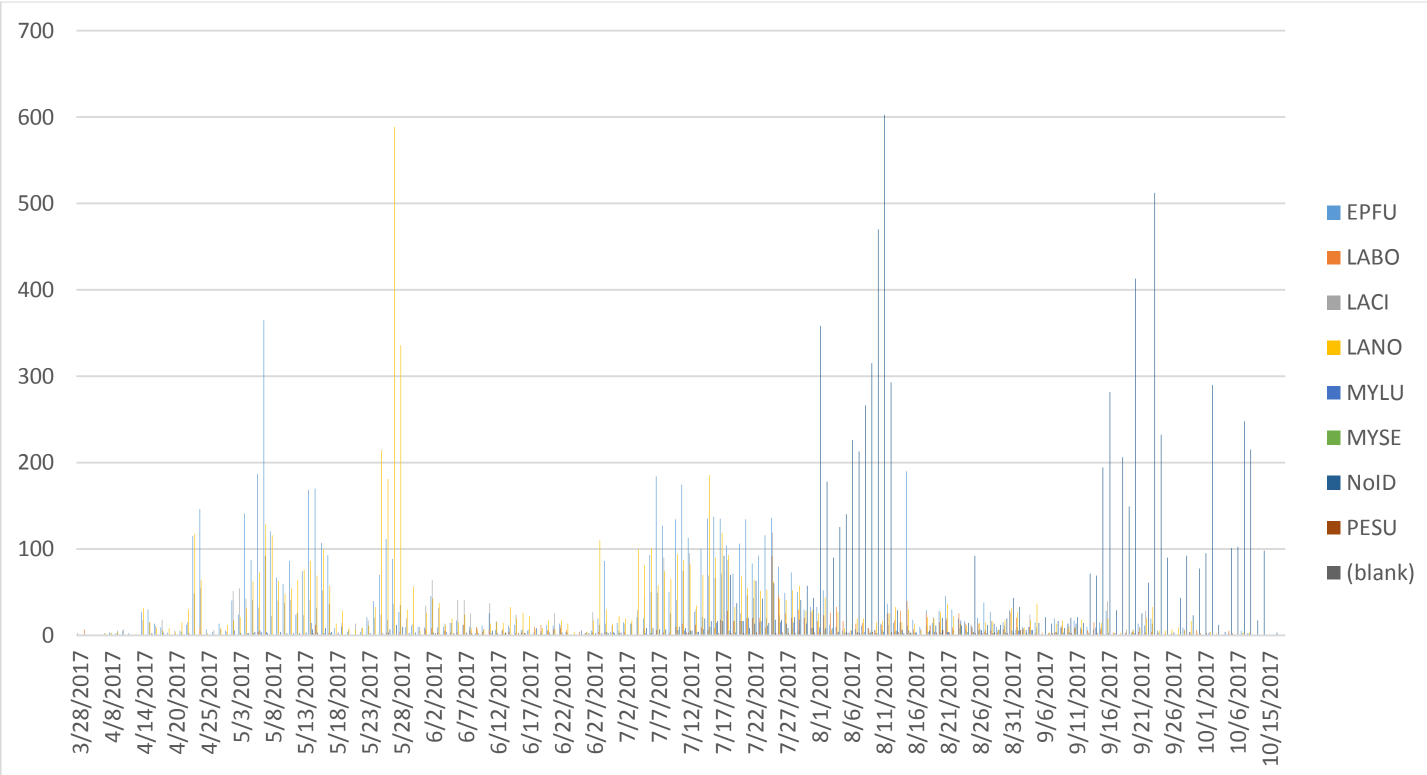

Figure 14. Results for Detector 6 by date and species.

Discussion: Preliminary Conclusions

As summarized in Table 7, the site has significant bat activity from species shown to be at high risk of mortality at wind energy facilities in carcass surveys: the Hoary, Silver-haired, and Eastern Red Bats, and the Big and Little Brown Bats (e.g., Gruver and Bishop-Boros 2015). Additionally, The Big Brown Bat and Little Brown Bat are also species of special conservation concern in Minnesota. The Northern Long-eared Myotis is absent from the site, and the Tricolored Bat (which is also a species of special conservation concern in Minnesota) appears to be rare in the Palmer's Creek area.

At this point, there is a total of 175,318 bat passes detected, in 1,218 functioning detector nights for an average of 143.93 bat passes per detector night. These preliminary conclusions should, however, be tempered by detailed caveats.

Discussion: SM3 Enhanced data capture and inflation of BPDN

Although some high quality bat habitat in the area (e.g., the river corridor of the Minnesota River, the RIM easement connecting the river to the Sween Wildlife Management Area) are very likely sites of significant bat activity, some of the unusual level of bat activity detected is probably due not simply to bat activity alone, but to improved technology for detecting bat activity. Specifically, it is probably not an accident that the new Wildlife Acoustics SM3BAT detectors detected significantly more bat activity than the other detectors, as is clearly shown in Table 7. Although the extent of the improvement in data acquisition efficiency is not yet known with precision, it is our experience that the new weather resistant, omni-directional ultrasonic microphone used with the SM3BAT (SMM-U1 microphone) does result in a significant improvement in data capture for long-term deployments, and that this alone will produce an increased BPDN relative to older detectors with the same level of bat activity. This difference in data capture can be unequivocally demonstrated with paired, side-by-side, simultaneous detector deployments: Joel Tigner, co-owner of Batworks and a participant in the South Dakota Bat Working Group, has found that up to four Pettersson D240X units had to be deployed to reliably capture the same data as one SM3BAT with the new omni-directional ultrasonic microphone. According to Dr. Tigner, the ability of the SM3BAT SMM-U1 microphone to capture bat vocalizations (in long-term deployments) is reliably matched only by four Pettersson D240Xs, with each dedicated to a different quadrant of the sky. If this is so, the BPDN calculated for data collected with an SM3BAT unit is from 1x to 4x greater than what would be calculated from the same site with the same bat activity if older detectors/microphones had been employed. Consequently, a BPDN of 10 with older technology is somewhere between 10 and 40 with an SM3BAT. This technological difference should be taken into account in site evaluation by BPDN standards developed with less sensitive and less efficient detectors. Of course, at this point, there is a lot of fudge in this, and much needs to be done to evaluate the extent to which improving technology may be producing a high bias in the data. Experiments are ongoing, but there is difficulty in resolving key issues, especially as the bats do not tend to cooperate very well with researchers, and seem to have their own agenda. To the extent that bats behave in the way that bat researchers imagine they will when setting up detectors and only go where microphones are pointed, older detectors will work almost as well as SM3BAT detectors. For example, if a microphone is oriented to capture activity where bats flow through a gap in a ridgeline, and bats reliably flow through the gap and don't flutter about feeding over trees and drinking from ponds and puddles outside the primary detection area, an older unit will work almost as well as a new SM3BAT. However, if the bats do not do only what's expected, or don't flow through the gap and instead feed over the trees, drink from puddles, and fly every which way other than in the gap at least some of the time, the SM3BAT with the new microphone will capture up to 4 times the bat passes as older units like the Pettersson D240X. Obviously, this is a subject that will require further work, but that's where it's at for now. An addendum that tentatively quantifies the effect of enhanced data capture may become available sometime this winter, but it all depends on the data, so we'll see and no promises.

Discussion: Detector 6 Caveats

Considerations specific to Site 6 suggest that the data from Detector 6 is peculiar to the site and not representative or generalizable. This is not to say that such data should be abandoned, or otherwise impugned. Instead, the data from Detector 6 should be contextualized appropriately, and understood ecologically:

1. First, the site is just outside of the shelterbelt of an abandoned farmstead and is likely heavily influenced by unusual roosting and foraging conditions: the site almost certainly samples unusually concentrated and persistent bat roosting and feeding activity due to the presence of mature trees within 5m of the detector, and abandoned and accessible buildings within 50m of

the detector, which are likely to produce and unusual and unrepresentative concentration of bats.

2. The nearby farmyard also has a functioning automatic yard light that may have concentrated bat prey and bat foraging activity: At one study area in Ontario, Canada, both hoary and eastern red bats spent most of their foraging time near street lights (Hickey and Fenton 1990, Hickey 1992), where moth abundance is much higher than areas away from the lights (Hickey and Fenton 1990). Other studies have also shown high foraging activity around lights by hoary, red and big brown bats (Wilson 1965, Hamilton and Whitaker 1979, Fenton et al. 1983, Belwood and Fullard 1984, Geggie and Fenton 1985, Barclay 1985, Furlonger et al. 1987, Fullard 1989) (as cited in Erickson et al. 2002)
3. Second, the unusually persistent high activity data (Figures 13 and 14) suggests that the peculiar conditions of the site are particular to the site and due to an unrepresentative peri-domestic enhancement particular to the conditions of a semi-abandoned farmstead.
4. On a visit to site 6 in September 2017, NCE personnel observed persistent and concentrated feeding activity at the site by at least 6 and possibly 8 nighthawks (*Chordeiles minor*), and any site that can produce unusually concentrated and persistent foraging activities by nighthawks could produce unusually concentrated and persistent feeding activity by bats, which are, like nighthawks, flying, nocturnal insectivores. Although concentrated and persistent foraging by bats as well as nighthawks was not observed at site 6 in the late season September 2017 site visit, Kurt Tooley of NCE has personally witnessed simultaneous concentrated and persistent foraging by nighthawks and bats at street and yard lights in south-central Missouri on more than 100 occasions (Kurt Tooley, personal observation).

Given these considerations, data from Detector 6 is best understood as an outlier captured by mischance, which is an unfortunately familiar experience to all experienced field researchers. As such, a similar detector installation 100m away in more representative habitat could very well produce a five to fifteen-fold reduction in detected bat activity (Erickson 2002).

Discussion: Indiana bats

The Palmer's Creek area is well outside the range of the Indiana bat (*Myotis sodalis*)[2], and surveys for Indiana bats were neither warranted ecologically, nor required by Minnesota DNR or USFWS. There were, however, a few passes in data collected at Detector 3 that Sonobat identified as Indiana bat passes (Table 3). These identifications are, however, almost certainly little brown bat calls that Sonobat has mistaken for Indiana bat calls. According to the classification notes that accompany Sonobat 3.1 NE[3], some false-positive identifications of Indiana bats are inevitable anytime there are enough of little brown bat calls in the data, simply because the closely related Indiana and little brown bats have very similar calls that are very hard to discriminate with even the highest quality data. According to a presentation by Szewczak and Harris[4], the false positive rate for Indiana bat identifications by Sonobat

[2] https://www.fws.gov/midwest/Endangered/mammals/inba/RangeMapINBA.html
[3] http://www.sonobat.com/download/MysoMyluClassificationNote-NE-v3.1.pdf
see also: http://www.sonobat.com/download/SonoBatClassificationNote-NE-v3.1.pdf
[4] http://www.nebwg.org/AnnualMeetings/2013/2013presentations/SzewczakTestforIBATs.pdf

3.1 in the presence of little brown bats in field data is near 4%, which certainly puts the six false-positives from Detector 3 in the predictable range given that little brown bat passes identified by Sonobat in Detector 3 data number 500. So this should be no cause for concern. Moreover, it should also be noted that Kaleidoscope, which unlike Sonobat 3.1 is a program approved by the USFWS for presence/probable absence surveys for Indiana bats[5], identified no Indiana bats from Detector 3, or any other detector deployed on the Palmer's creek site in 2015-2017. So it is very unlikely that there are any Indiana bats in the Palmer's Creek area.

Discussion: Incredible numbers of hoary bats at Detectors 4 and 5? Or not?

In data that is reminiscent of 2014-2015 data from Detector 3 that was excluded by a consensus of regulators and NCE personnel, data from Detectors 4 and 5 included an incredible number of files that were identified as hoary bat passes by Kaleidoscope in 2017. These data are dominated by an incredible accumulation of files identified as hoary bats in narrow windows that could be either incredible migration pulses, or false positives. Although results cannot be definitely known, even a cursory examination of these data in context suggests that the great bulk of the identifications in question are false-positive identifications of ambient noise. For example, within the temporal window in question, the bulk of the questionable data was accumulated in only a few nights (e.g., Detector 4: 8/23-24, 8/28-29, 9/8-9; Detector 5: 8/24-26, 8/27, 8/29, 9/19) at a rate that was very near the maximum possible rate that the detectors could record, which is four or five thousand passes per night, from the time the detectors turned on until the time the detectors turned off. Although such activity by hoary bats is not impossible, it is very unlikely, especially with hoary bats, which is not known to migrate in concentrations sufficient to produce such data legitimately. The presence of the Minnesota River just south of the Palmer's Creek area may very well produce some local enhancement, but more than 120,000 hoary bat passes between Detectors 4 and 5 is too much to be believed, especially when no other detector on site—which includes detectors placed just as close to the Minnesota River as Detectors 4 and 5—recorded any event of similar magnitude. Bat data does often have a great deal of inter-annual variation, and large variation on geographic scales as small as 50m, but this is still too much activity, at too great a temporal density to be at all likely for hoary bats. In contrast, noise files are often accumulated at a maximum or near maximum rate when conditions are right, like when it is windy enough and the corn is dry enough. Although just speculation at this point, Detector 3 was adjacent to a cornfield when it recorded the data that was excluded by consensus in 2014-2015, and Detectors 4 and 5 are virtually in the late season, drying corn during the periods when they recorded data identified by Kaleidoscope as hoary bat passes.

Moreover, although acoustic bat surveys are invaluable, powerful, and essential tools for studying bats, the fact that all such techniques are still works in progress (with particular strengths and weaknesses) must be taken into account when interpreting results. For example, although results were highly variable and identifiers are always improving, Clement et al. (2014) found that some acoustic identification programs identified more than half of more than 13,000 noise files as bat calls, and the

[5] https://www.fws.gov/midwest/Endangered/mammals/inba/surveys/inbaAcousticSoftware.html

group batdetective.org has specifically identified false-positive identification of noise as an issue, and is working to overcome the problem with open-source methods.[6]

Although all detectors and automated classifiers have strengths and weaknesses, the automated classifier that identified the huge number of highly concentrated hoary bat passes in Detector 4 and 5 data, Kaleidoscope 3.1.8, does tend to produce hoary bat identifications at a rate much higher than other acoustic identification programs: In work by Chenger and Tyburec[7], false-positive identifications of hoary bats were far more common with Kaleidoscope than Sonobat (in tests involving only bat data), and surveys by WEST, Inc., that used several automated classifiers on the same data consistently show Kaleidoscope identifying up to 50 times as many files as hoary bats compared to other automated classifiers like BCID and Echoclass in some conditions (e.g., Gruver and Bishop-Boros 2016)[8]. So Kaleidoscope tends to identify things as hoary bats.

This kind of problem is made only more acute at noisy sites, and like most wind energy sites, Palmer's Creek is a windy, noisy site. In fact, in almost all full-spectrum files, which preserve and thereby permit a fuller appreciation of the total ultrasound environment, almost all recorded bat calls were embedded in a wall of noise, much of which could easily be mistaken for bat calls by an unlucky zero-crossing device and classifier. Significantly, the SM3 full-spectrum device that replaced a suspect zero-crossing detector at Site 3 reduced the estimate of total hoary bat activity at that site from 53,382 (2016) to 662 (2017), a factor of a bit more than 80 (some of which is almost certainly inter-annual variation).

Given these considerations, some revision in the BPDN at Sites 4 and 5, and in the Palmer's Creek totals as summarized in Table 7 is defensible. For example, if you exclude the very likely incorrect hoary bat detections from data from Detectors 4 and 5 and replace those numbers with ten times the average of hoary bat passes from Sites 3 and 6 (where the data cannot be confused in the same way), the BPDN for the Palmer's Creek site falls from 143.93 to 50.7 (Table 8). If all unreliable hoary bat identifications are excluded (Detector 1 data is also potentially confused with hoary bat false-positives) and replaced with the average of Detectors 3 and 6, the BPDN is 34.8 (Table 9).

Another Independent Look at Detector 4 and 5 Data: Chris Corben

As the suspect data from Detectors 4 and 5 (and possibly other detectors) is central to risk evaluation at the Palmer's Creek site, a second and independent interpretation of the data was sought from Chris

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[6] some scrolling may be necessary: http://blog.batdetective.org/
Also see the pre-print:
https://www.biorxiv.org/content/biorxiv/early/2017/06/29/156869.full.pdf

[7] https://batmanagement.com/blogs/acoustic-monitoring/top-recommendation-for-bat-call-analysis

[8]http://www.maine.gov/dep/ftp/WindPowerProjectFiles/NumberNine/application/Exhibits%207-A%20to%207-E/7E_wildlife%20reports/7E5-NumberNine_2014_Acoustic_Report_012615.pdf

Corben, a bat researcher with incredible experience interpreting zero-crossing data like that obtained from Detectors 4 and 5.[9] As summarized by Dr. Corben,

> [I] got your files and the results are quite unambiguous.
>
> Monitor #4
> 4813 files generated over one night
> 24 of these include real bat calls
> Almost all of the files are dominated by regular, low frequency noise in pulses at about 10 per second, though fluctuating somewhat in rate. This noise started at 2041 and continued till 0427. Both before and after these times, there were files without this noise, yet the noise seems remarkably consistent over most of the night. I don't know what is the source of this noise, but it seems to be acoustic and coming from outside the detector. It could be insects, but seem too consistent. It might be some sort of mechanical noise. Whatever it is, the best clue will come from consideration of the overall, long-term, temporal pattern.
> The division ratio of this detector was set to 4, which doubles the amount of data stored. A division ratio of 8 would be a better choice.
> The noise was consistently identified by Kaleidoscope as Hoary Bats. While there are several bat species in the dataset, none of the files I saw seems consistent with Hoary Bat, so all the Hoary Bat identifications in this dataset are spurious. Many of the files with real bats were identified as LACI just because the noise dominated the dataset and was identified as LACI.
>
> Monitor #5
> 2864 files generated over one night
> 56 of these include real bat calls
> This dataset was dominated by two types of noise. From 1800 till 1929, there was noise at a pulse rate of about 15 per second and dominated by a 40 kHz component. From 2032 till 0507 there was noise similar to that at the Monitor #4, but at only about 6 pulses per second. At 2204, both types of noise can be seen at the same time and without any synchrony between the pulses. There is a reversion to the first type of noise right at the end of the night's recording. Both types of noise seem to go through various stages.
> The division ratio of this detector was set to 4, which doubles the amount of data stored. A division ratio of 8 would be a better choice.
> The lower pulse rate noise was consistently identified by Kaleidoscope

[9] http://users.lmi.net/corben/

> as Hoary Bats. While there are several bat species in the dataset, none of the files I saw seems consistent with Hoary Bat, so all the Hoary Bat identifications in this dataset are spurious. Many of the files with real bats were identified as LACI just because the noise dominated the dataset and was identified as LACI.
>
> In summary, I think the noise is most likely insects, because the variation seems most likely to come from a biological origin. However, the consistent nature seems unusual for insects, but I cannot envisage any likely alternative. I wouldn't expect this kind of variation in mechanical or electronic noise. A better understanding of the noise could come from a careful analysis of its temporal structure.
>
> There are bats in both datasets, but all the identifications of Hoary Bats are spurious and based on the noise.
>
> I should point out that I over-generalized in stating that ALL LACI IDs were spurious. This only applies to the two datasets I viewed, and even there it is possible I overlooked some real ones, though not very likely! But there is no doubt that by far the bulk of the LACI IDs are spurious in the sets I looked at.

Chris Corben's conclusions are thus in very good general agreement with NCE's conclusions regarding the huge number of spurious hoary bat identifications in the Palmer's Creek data.

Summary and Conclusion

As summarized in Tables 8 and 9, a corrected BPDN of between 50.7 and 34.8 is high for pre-construction surveys of potential wind energy sites in Minnesota, and is in the ballpark for what might be expected of the best bat habitat (Johnson et al. 2003). However, as the site's sampling is heavily biased toward the best bat habitat within or near the projected project footprint (due in part to regulator requests for sampling at specific sites), this is not too surprising, and it is reasonable to expect that the bat activity characteristic of the rotor area will be as much as 15 times less (Johnson et al. 2003). In total, if the net effect of accounting for the known high bias in habitat quality and the potential high bias due to improved data capture of new technology is taken into account, the Palmer's Creek site could have an adjusted BPDN <10 quite easily. Consequently, bat mortality from the construction and operation of the proposed facility is likely within the normal range of such facilities in Minnesota.

Table 7: Summary of Detectors 1-6

Common name	Scientific Name	# of bat passes							Conservation Status		
		Detector 1	Detector 2	Detector 3(SM3)	Detector 4	Detector 5	Detector 6(SM3)	total	IUCN 3.1	Federal	MN
Silver-Haired Bat	*Lasionycteris noctivagans*	*3425*	*0*	*3040*	*2062*	*2352*	*6418*	*17297*	Least Concern	Not listed	No special status
Big-Brown Bat	*Eptesicus fuscus*	*2240*	*391*	*2649*	*915*	*1464*	*6673*	*14332*	Least Concern	Not listed	Species of Concern
Hoary Bat	*Lasiurus cinereus*	*4222*	*1213*	*1226*	*66657*	*61681*	*3297*	*138296*	Least Concern	Status undefined	No special status
Eastern Red Bat	*Lasiurus borealis*	*231*	*3*	*415*	*309*	*248*	*1314*	*2748*	Least Concern	Not listed	No special status
Little Brown Bat	*Myotis lucificus*	*195*	*72*	*784*	*198*	*159*	*611*	*2019*	Least Concern	Not listed	Species of Concern
Northern long-eared myotis	*Myotis septentrionalis*	*11*	*0*	*1*	*0*	*0*	*1*	*13*	Threatened	Threatened 4(d)	Species of Concern
Tri-colored bat	*Perimyotis subflavus*	*123*	*2*	*45*	*82*	*99*	*141*	*613*	Least Concern	Not listed	Species of Concern
	total	*10447*	*1681*	*8160*	*70223*	*66003*	*18455*	*175318*			
	BPDN	*51.46*	*8.28*	*40.2*	*345.93*	*325.14*	*90.91*	*143.93*			

Table 8: Revised numbers—Maximum reasonable scenario (10x average hoary bat Sonobat data)

Common name	Scientific Name	# of bat passes						
		Detector 1	Detector 2	Detector 3(SM3)	Detector 4	Detector 5	Detector 6(SM3)	total
Silver-Haired Bat	*Lasionycteris noctivagans*	*3425*	*0*	*3040*	*2062*	*2352*	*6418*	*17297*
Big-Brown Bat	*Eptesicus fuscus*	*2240*	*391*	*2649*	*915*	*1464*	*6673*	*14332*
Hoary Bat	*Lasiurus cinereus*	*4222*	*1213*	*662 (Sonobat)*	*8930*	*8930*	*1124 (Sonobat)*	*25,081*
Eastern Red Bat	*Lasiurus borealis*	*231*	*3*	*415*	*309*	*248*	*1314*	*2520*
Little Brown Bat	*Myotis lucificus*	*195*	*72*	*784*	*198*	*159*	*611*	*2019*
Northern long-eared myotis	*Myotis septentrionalis*	*11*	*0*	*1*	*0*	*0*	*1*	*13*
Tri-colored bat	*Perimyotis subflavus*	*123*	*2*	*45*	*82*	*99*	*141*	*492*
	total	*10447*	*1681*	*7596*	*12,496*	*13,252*	*16,282*	*61754*
	BPDN	*51.46*	*8.28*	*37.4*	*61.56*	*65.3*	*80.2*	*50.7*

Table 9: Revised numbers (average hoary bat Sonobat data)

Common name	Scientific Name	# of bat passes						
		Detector 1	Detector 2	Detector 3(SM3)	Detector 4	Detector 5	Detector 6(SM3)	total
Silver-Haired Bat	*Lasionycteris noctivagans*	*3425*	*0*	*3040*	*2062*	*2352*	*6418*	*17297*
Big-Brown Bat	*Eptesicus fuscus*	*2240*	*391*	*2649*	*915*	*1464*	*6673*	*14332*
Hoary Bat	*Lasiurus cinereus*	*893*	*1213*	*662 (Sonobat)*	*893*	*893*	*1124 (Sonobat)*	*5678*
Eastern Red Bat	*Lasiurus borealis*	*231*	*3*	*415*	*309*	*248*	*1314*	*2520*
Little Brown Bat	*Myotis lucificus*	*195*	*72*	*784*	*198*	*159*	*611*	*2019*
Northern long-eared myotis	*Myotis septentrionalis*	*11*	*0*	*1*	*0*	*0*	*1*	*13*
Tri-colored bat	*Perimyotis subflavus*	*123*	*2*	*45*	*82*	*99*	*141*	*492*
	total	*7118*	*1681*	*7596*	*4459*	*5215*	*16,282*	*42351*
	BPDN	*35.1*	*8.28*	*37.4*	*22.0*	*25.7*	*80.2*	*34.8*

Table 10: 2015-2017 Data (uncorrected)

		# of bat passes										
Common name	**Scientific Name**	**Detector 1**		**Detector 2**		**Detector 3**		**Detector 4**		**Detector 5**		**Detector 6**
		2015/2016	**2017**	**2015/2016**	**2017**	**2016**	**2017 (SM3)**	**2016**	**2017**	**2016**	**2017**	**2017 (SM3)**
Silver-Haired Bat	*Lasionycteris noctivagans*	1971	3425	1717	0	779	3040	688	2062	871	2352	6418
Big-Brown Bat	*Eptesicus fuscus*	427	2240	167	391	3053	2649	143	915	316	1464	6673
Hoary Bat	*Lasiurus cinereus*	347	4222	887	1213	53382	1226	390	66657	403	61681	3297
Eastern Red Bat	*Lasiurus borealis*	158	231	165	3	1770	415	129	309	138	248	1314
Little Brown Bat	*Myotis lucificus*	219	195	52	72	2128	784	103	198	75	159	611
Northern long-eared myotis	*Myotis septentrionalis*	4	11	2	0	18	1	0	0	2	0	1
Tri-colored bat	*Perimyotis subflavus*	55	123	14	2	465	45	59	82	70	99	141
	BPDN	*18.18*	*51.46*	*12.41*	*8.28*	*843.77*	*40.2*	*20.71*	*345.9*	*25.68*	*325.1*	*90.91*

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Appendix

Raw data from Detector 1 (includes March 27th through October 16th, 2017)

KALEIDOSCOPE 3.1.8
Bats of North America 3.1.0

S/A:-1		EPFU	LABO	LACI	LANO	MYLU	MYSE	PESU	NOID	NOISE
*	*	2240	231	4222	3425	195	11	123	897	92862
Download	*	3		5	3				0	3
	20170327	1			2				0	0
	20170330								0	1
	20170331			2					0	0
	20170401	1		2	1				0	0
	20170404	1		1					0	2
Download_0001	*	7	1	7	72				8	52
	20170406								1	4
	20170407				1				0	2
	20170408	2		2	3				0	3
	20170411			2	3				0	1
	20170412				1				0	9
	20170413	1			9				2	3
	20170414	2	1	3	19				2	7
	20170415	1			12				0	8
	20170416				13				0	3
	20170417	1			9				2	12
	20170418				2				1	0
Download_0002	*	153		37	297	4			28	216
	20170420	1			3				0	0
	20170421	4		2	23	1			0	13
	20170422	9		2	40				1	16
	20170423	15		3	36	1			6	19
	20170424	9		4	22				2	9
	20170425								0	5
	20170429	3			7				0	3
	20170430								0	74
	20170501								0	7
	20170502	22		1	32				3	15
	20170503	17		6	37	1			6	20
	20170504	73		19	97	1			10	35
Download_0003	*	162	3	64	358	9			44	140
	20170505	43		14	90				16	25
	20170506	34		9	44	2			9	24
	20170507	4		3	25				5	17

	20170508	4	1	13	25				2	13
	20170509	34		10	54	2			5	14
	20170510	3	1	1	19	2			2	9
	20170511	27	1	9	60	2			5	18
	20170512	13		4	33	1			0	11
	20170530			1	8				0	9
Download_0004	*	152	28	176	368	23	1	16	61	854
	20170531	16		10	19			2	2	25
	20170601	18	2	6	22	3		4	3	14
	20170602	2	1	9	11			1	3	20
	20170603	10		7	12				3	4
	20170604	9	2	8	18	1			0	13
	20170605	2	3	4	18	1			5	25
	20170606	6		6	12				3	10
	20170607			13	16	1		1	6	22
	20170608	9	2	8	9			2	3	13
	20170609			5	6				0	19
	20170610	2	1	2	18	1			1	9
	20170611	9	2	9	17			1	4	14
	20170612	12	1	6	19	1	1	1	5	37
	20170613	4	3	3	18				2	146
	20170614	2		2	9				1	12
	20170615	6	1	4	10	1			2	27
	20170616	1		11	7	1			3	10
	20170617	7		4	6			2	0	13
	20170618	1	1	6	11	1			1	24
	20170619	7		3	18	3		1	1	13
	20170620	3	1	4	5	4		1	1	56
	20170621	4		13	28				4	33
	20170622			4	12				1	37
	20170623			2	7				1	19
	20170624			6	5				3	45
	20170625	4		3	7	1			1	14
	20170626	4		4	3	3			0	19
	20170627	10		3	11				1	94
	20170628	4	8	11	14	1			1	67
Download_0005	*	691	77	1640	1220	70	7	25	208	37751
	20170629	8		7	18	4			0	23
	20170630	4	14	2	14	1		1	3	35
	20170701	11	7	20	58				3	21
	20170702	9	4	6	27			1	1	30
	20170703	7		3	41			1	1	30
	20170704	18		25	58				4	37

	20170705	16	1	38	56			1	5	42
	20170706	6		11	22				2	78
	20170707	8	7	14	30	3			2	76
	20170708	14	5	12	36	2			5	79
	20170709	42	8	38	91	2		1	11	257
	20170710	26	2	11	55	5			5	86
	20170711	67	3	33	95	2	1		11	124
	20170712	150	1	14	92	4	1		14	56
	20170713	9	2	8	34	2			0	338
	20170714	32	3	9	37			1	4	509
	20170715	125	5	10	115	7	1		14	633
	20170716	9		22	28	2		1	7	1602
	20170717	9	3	174	18		1		11	3642
	20170718	9	2	19	48	1		3	7	2491
	20170719	18		269	42	6	1		13	3666
	20170720	16		104	22	4	1	1	15	4604
	20170721	7	1	294	19	2			12	4071
	20170722	29	1	113	68	11		2	14	3861
	20170723	7	1	17	33	6	1	3	8	3384
	20170724	5	1	226	14	2			13	3856
	20170725	30	6	141	49	4		9	23	4120
Download_0006	*	243	56	1999	417	46		42	195	39555
	20170726	31	3	70	67	5		1	15	2632
	20170727	19	8	137	44	4			10	3129
	20170728	7	1	143	12	3		1	28	3501
	20170729	7	1	190	10	1		1	12	3840
	20170730	10	3	306	9	1		1	9	4094
	20170731	13		116	13	2		3	13	3139
	20170801	20	2	187	45	2		1	9	1681
	20170802	9	1	64	10	5			1	1720
	20170803	5	2	4	28	2		3	1	160
	20170804	4	6	4	6			3	1	719
	20170805	4	8	12	26	1			3	1643
	20170806	5	3	24	19	1		7	6	412
	20170807	5	1	12	17	2		2	13	756
	20170808	7		24	5	2		2	3	1699
	20170809	13	7	3	32	8		9	4	935
	20170810	19	2	9	21	1		1	3	993
	20170811	9	1	115	12	2			6	1463
	20170812	18	2	88	8	1		1	17	1754
	20170813	1		110	4			3	15	1416
	20170814	15	3	37	22	2		2	7	956
	20170815	22	2	344	7	1		1	19	2148

	20170816								0	702
	20170817								0	63
Download_0007	*	715	58	267	547	41	3	30	269	13183
	20170818	1	1	7	3	3			0	1027
	20170819	12	6	84	12			1	10	1788
	20170820	9		11	13		1	2	9	1158
	20170821	25	6	23	21	1		2	11	1133
	20170822	2	4	1	10			4	2	668
	20170823	12	3	1	8			1	0	1680
	20170824	10	4	14	7	3			3	1124
	20170825	37	5	3	9	2		2	3	343
	20170826	21	2	10	15	4		3	3	614
	20170827	6	1	15	18	1		2	3	343
	20170828	7	1	3	6	2			4	18
	20170829	2	4	5	8	5		2	3	9
	20170830	5		20	14	1			3	82
	20170831	1	4	4	12				4	439
	20170901	3		5	8	1			4	87
	20170902		2	1	12				1	6
	20170903	9	1	11	24	2			5	1039
	20170904	3	2	1	20			2	1	78
	20170905				14			1	0	2
	20170906			1	2	5			0	0
	20170907	1			6			1	0	3
	20170908	3	1	1	5				0	3
	20170909	62		3	44	3			31	189
	20170910	50		3	69	1			38	217
	20170911	20	1	7	13	4		1	8	66
	20170912	201	3	2	45	1	2	1	65	246
	20170913	144	2	2	44			2	16	169
	20170914	21		9	15			1	4	41
	20170915	38	3	7	27	1		2	28	190
	20170916	2		3	16				4	4
	20170917				5				1	2
	20170918	1	2	5	2				0	69
	20170919	7		5	16				5	343
	20170920				4	1			0	3
Download_0008	*	114	8	27	143	2		10	84	1108
	20170921	58		2	29				45	432
	20170922	34		9	37				31	233
	20170923	1	1		6			2	2	57
	20170924	5	2	1	20			1	0	7
	20170925	1	2		2			1	0	1

20170926	1			15			1	0	3
20170927	1			5				1	5
20170928	1		7	11				0	5
20170929	1		1	6	1			1	1
20170930	1							0	12
20171001					1		2	0	102
20171002			2	1			1	1	234
20171003	1		1	3				0	1
20171004								0	6
20171005		1	1	1			1	0	3
20171007	5	2	1	3				2	4
20171008	1							0	0
20171009				1				0	1
20171011							1	0	0
20171012	2			1				0	1
20171013	1							0	0
20171016			2	2				1	0

Raw data from Detector 2 (includes March 27th through October 16th, 2017)

KALEIDOSCOPE 3.1.8			Bats of North America 3.1.0 S/A:-1							
		EPFU	LABO	LACI	LANO	MYLU	MYSE	PESU	NOID	NOISE
*	*	391	3	1213		72		2	603	16854
Download_0001	*			4					0	5
	20170414			4					0	4
	20170417								0	1
Download_0002	*	15		32					23	204
	20170430	15		32					23	204
Download_0003	*	5		27					7	65

	20170414			4					0	4
	20170417								0	1
	20170515								0	23
	20170517	5		23					7	37
Download_0004	*	9		27					14	421
	20170610								0	1
	20170613	6		24					9	296
	20170627	3		3					5	124
Download_0005	*								0	42
	20170704								0	8
	20170709								0	33
	20170724								0	1
Download_0006	*	40		140					55	1027
	20170802	40		140					55	1027
Download_0007	*	105	1	339		72		2	164	3036
	20170818								0	2
	20170825	79		237					113	1215
	20170829					66		2	13	1307
	20170901					4			0	168
	20170907					2			0	57
	20170918	26	1	102					38	137
	20170919								0	150
Download_0008	*	217	2	644					340	12054
	20170922								0	6
	20170923	36		125					35	335
	20170924	5		53					18	982
	20170925	48	2	134					108	8148
	20170930	5		12					4	21
	20171001	16		90					43	699
	20171002	85		187					98	1281
	20171005								0	1
	20171014	22		43					34	581

Raw data from Detector 3 (includes March 27th through October 16th, 2017)

KALEIDOSCOPE 3.1.8
Bats of North America

3.1.0 S/A:-1	EPFU	LABO	LACI	LANO	MYLU	MYSE	PESU	NOID	NOISE
*	2649	415	1226	3040	784	1	45	2499	1103
Data	21	4	37	49				5	19
Data04	161	36	248	617	98		4	91	261

Data05	650	94	379	292	261	1	12	212	309
Data06	1304	143	398	1180	190		8	57	55
Data07	324	106	109	605	64		17	752	193
Data08	169	30	18	112	151		4	1374	234
Data3	20	2	37	185	20			8	32

Raw data from Detector 4 (includes March 27th through October 16th, 2017)

KALEIDOSCOPE 3.1.8
Bats of North America 3.1.0

S/A:-1		EPFU	LABO	LACI	LANO	MYLU	MYSE	PESU	NOID	NOISE
*	*	915	309	66657	2062	198	2	82	4585	68968
Download_0001	*		1	7	34				2	238
	20170328			1					0	1
	20170329								0	1
	20170331			1					0	0
	20170401				1				1	7
	20170402								0	2
	20170403								0	1
	20170407				7				0	71
	20170408			1	2				0	6
	20170409								0	22
	20170411			3					0	1
	20170412				1				0	21
	20170413				2				1	3
	20170414			1	6				0	3
	20170415				6				0	1
	20170416				6				0	0
	20170417		1		2				0	97
	20170418				1				0	1
Download_0002	*	13	1	15	60	2			14	2726
	20170420				1				2	3
	20170421			1	14				0	4
	20170422				11				0	3
	20170423			1	4	1			2	41
	20170424	1		1	7				0	5
	20170425								0	107
	20170426								0	5
	20170428	1			1				0	0
	20170429			3	3				1	2
	20170430	6	1						8	2546

	20170501			1				0	2
	20170502	3		4	8	1		1	2
	20170503				2			0	3
	20170504	2		4	9			0	3
Download_0003	*	29	14	380	223	12	2	112	3528
	20170505	1	1	5	21	1		0	11
	20170506			4	6			2	13
	20170507				1			0	391
	20170508		1	1	25			0	417
	20170509	1	2	6	14	2		3	5
	20170510				4			1	5
	20170511			2	6			2	5
	20170512	1		1	10	1		0	6
	20170513		2	2	1			1	2
	20170514	1		6	8	5		0	5
	20170515			1	20			3	302
	20170516	2	1	2	18	1		4	10
	20170517	21	5	249	9			73	2154
	20170518			7	19	1		3	12
	20170519			1	5		1	1	6
	20170520			3				0	25
	20170521			3	2			6	4
	20170522		1	1	6			0	4
	20170523			3	3			1	3
	20170524			38	7			3	14
	20170525			9	8			4	11
	20170526			11	7	1		3	8
	20170527	1	1		13		1	1	11
	20170528			20	8			0	91
	20170529	1		5	2			1	13
Download_0004	*	6	9	149	152	17	5	32	875
	20170530		1	17	1			2	4
	20170531			2	2			1	4
	20170601			3	3			0	3
	20170602			5	7	3		2	16
	20170603			3	9	1	1	0	45
	20170604		1	7	5			0	1
	20170605			6	7			1	0
	20170606			3	2		1	1	2
	20170607		1	3	4			1	4
	20170608			4	3		1	0	1
	20170609		1	3				0	6
	20170610			7	7			0	11

	20170611			5	8	1	2	3	8
	20170612	1	1	2	5			2	6
	20170613			2	1	1		1	444
	20170614		1	8	5	1		3	119
	20170615				2	3		1	14
	20170616			3	5			1	5
	20170617			3	8			2	21
	20170618			14	6			2	5
	20170619	1	1	4	7			2	5
	20170620	1		19	4	1		1	11
	20170621	1		8	11			2	8
	20170622		1	5	9	1		1	7
	20170623		1	2	2	1		1	6
	20170624				4			0	2
	20170625			1	6			0	3
	20170626			1	3	2		1	1
	20170627	2		6	4			1	96
	20170628			3	12	2		0	17
Download_0005	*	82	62	375	561	51	8	95	1122
	20170629	1			5	1		1	2
	20170630		1	3	4	1		2	4
	20170701	1		12	5	1	1	1	7
	20170702			3	8			0	5
	20170703			7	9		1	2	9
	20170704	1		14	9		1	0	12
	20170705		1	15	14			1	15
	20170706	3	2	8	9	1		4	6
	20170707	2	1	11	16	1		2	9
	20170708	3	2	11	8	1		0	8
	20170709	1	1	17	29			2	534
	20170710	4	1	15	23	3		1	14
	20170711	2	3	21	27	2		4	22
	20170712	2		10	31	3		1	18
	20170713	2		1	8	1		1	13
	20170714	3	1	8	17	1		2	15
	20170715	6	2	24	45	5		6	31
	20170716	3	5	9	13	6	1	3	19
	20170717	3	6	31	22	1		9	24
	20170718	3	1	18	26	3		4	21
	20170719	4	5	28	60	8	2	8	30
	20170720	8	6	13	27	2	1	8	30
	20170721	6	3	24	32	1		6	141
	20170722	12	5	20	34	4	1	11	25

	20170723	3	3	13	14	1			3	12
	20170724	3	3	20	18				5	53
	20170725	6	10	19	48	4			8	43
Download_0006	*	228	100	1928	540	75	2	34	284	14231
	20170726	10	4	17	64	6			11	50
	20170727	8	11	19	91	29		1	12	56
	20170728	4	6	13	10	3		7	6	11
	20170729	1	1	5	8				1	10
	20170730	6	3	676	13	6			70	1402
	20170731	5	4	13	16	2		2	2	11
	20170801	15	5	15	21	1		1	12	3083
	20170802	4		200	11	2		1	35	1629
	20170803	3	5	8	24			1	5	14
	20170804	1	2	7	8	1		5	5	15
	20170805	1	5	6	10	2			4	9
	20170806			9	9			1	0	17
	20170807	3		6	12	1		1	1	18
	20170808	2		4	9	1			4	129
	20170809	2	4	2	13	3		2	5	285
	20170810	2	2	11	11	2			2	20
	20170811	4	1	6	13	2		4	4	11
	20170812	2	2	10	9			2	1	22
	20170813	3		59	14	1		1	9	642
	20170814	93	11	425	39	8	2	2	28	329
	20170815	3	3	14	13	2			7	25
	20170816	3	2	40	9	1			12	4946
	20170817	53	29	363	113	2		3	48	1497
Download_0007	*	217	30	62637	400	17		27	3632	34575
	20170818	5	2	119	175			1	21	355
	20170819	1	1	10	11	1		2	3	14
	20170820	3	2	18	11			2	4	117
	20170821	33	6	363	24	1			49	1774
	20170822	6	1	3216	1			1	211	491
	20170823	3	1	7685					142	119
	20170824	6	1	1705	3	2			181	1571
	20170825	5	2	1448	7	2		1	145	1144
	20170826	4	1	327	23			1	46	2755
	20170827	11		4381	2			1	277	1217
	20170828	12	1	6378		1			221	313
	20170829	6	1	3408	3	1			395	1658
	20170830	9	2	4487	8	1		3	253	507
	20170831	5	1	3483	12				176	929
	20170901	8	3	3099				2	363	1540

	20170902	2		505	1			98	2209
	20170903	7		5045	17			197	487
	20170904	2	1	193	4		1	16	173
	20170905	3		595	2			47	302
	20170906			1	3		1	0	1
	20170907	16		5861	2		1	214	447
	20170908	10		4745	1	1		223	476
	20170909	6		4484	4			221	1252
	20170910	2		724	2	1		19	858
	20170911		1	6	6	1	2	5	3863
	20170912	2		3	3	1	1	3	11
	20170913	6	1	115	6	1	2	25	3345
	20170914			10	9			4	1708
	20170915	31		124	24		3	44	2860
	20170916	6	1	43	22		1	12	550
	20170917	1		41	2			11	616
	20170918	2		2	1			2	10
	20170919	4	1	9	10	1	1	3	894
	20170920			4	1	2		1	9
Download_0008	*	340	92	1166	92	24	6	414	11673
	20170921	1	2	4	4		2	3	105
	20170922	1		9	11	1		3	73
	20170923	170	83	153	31	21	1	28	319
	20170924	1		2	7			1	27
	20170925							1	2
	20170926	1		1	3			2	8
	20170927			6		1		0	20
	20170928	130		510	9			225	1457
	20170929				1			0	11
	20170930	1	1	249			1	61	2044
	20171001			120	1			32	2090
	20171002	26	5	53	12	1	2	27	1918
	20171003		1	1	2			0	13
	20171004			4	1			1	517
	20171005			2	1			0	47
	20171006			2	1			4	869
	20171007	9		48	6			25	1841
	20171008				1			1	7
	20171009				1			0	0
	20171010							0	1
	20171011							0	162
	20171012							0	87
	20171013							0	3

20171014		0	27
20171015	1	0	22
20171016	1	0	3

<u>Raw data from Detector 5 (includes March 27th through October 16th, 2017)</u>

KALEIDOSCOPE 3.1.8
Bats of North America 3.1.0

S/A:-1		EPFU	LABO	LACI	LANO	MYLU	MYSE	PESU	NOID	NOISE
*	*	1464	248	61681	2352	159		99	5107	162657
Download	*			1					1	2
	20170401			1					1	1
	20170404								0	1
Download_0001	*			4	3				0	135
	20170407								0	113
	20170408			3	1				0	0
	20170409								0	19
	20170414			1	1				0	1
	20170416				1				0	1
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	20170509				7	1			0	9
	20170510			2	6				0	2
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	20170609			2				1	1460
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	20170910	3	5	51	8	1	4	30	2381
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	20170914	12	4	197	25	2	2	50	2705
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20171002		1	3	3				1	504
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20171004				1				1	0
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20171006		1	1					0	2
20171007	1		1	1				0	3
20171008	1							0	0
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20171012								0	21
20171014								0	55
20171015								0	5
20171016								0	5

Raw data from Detector 6 (includes March 27th through October 16th, 2017)

KALEIDOSCOPE 3.1.8
Bats of North America 3.1.0

S/A:-1	EPFU	LABO	LACI	LANO	MYLU	MYSE	PESU	NOID	NOISE
*	6673	1314	3297	6418	611	1	141	8295	1713
Data	3	7	2	2	1			1	1
Data001	95	1	80	76	4			4	1
Data04	1967	28	707	2476	39	1	5	82	73
Data05	302	152	504	569	46		11	32	73
Data06	2453	357	1193	1820	238		22	489	134
Data07	741	441	117	559	150		44	3491	485
Data08	483	287	299	444	117		52	1858	482
Data09	77	28	79	121	1		7	2328	445
Data3	552	13	316	351	15			10	19

APPENDIX E – BIRD AND BAT CONSERVATION STRATEGY

WENCK File #2759-0005-05
January 2018

Palmer's Creek Wind Farm Bird and Bat Conservation Strategy

Prepared for:

Palmer's Creek Wind Farm, LLC

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Granite Falls, MN 56241

Prepared by:

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Documents Appended by Reference and Available in Site Permit Application and Environmental Assessment

1.0 Palmer’s Creek Information

Palmer’s Creek Wind Farm, LLC (Palmer’s Creek, PCWF) 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 wind energy facility in Chippewa County, Minnesota (**Figures 1 and 2, Site Location Map and Site Detail Map, respectively**). The expected life of the Project is approximately 20 to 40 years. The Palmer’s Creek Wind Farm will consist of:

- Two 2.3-MW and sixteen (16) 2.5-MW wind turbines,
- Underground electric collector lines,
- New central collector substation (Palmer’s Creek Substation),
- Approximately 1000-foot long T-line interconnecting the Granite Falls Substation,
- O&M facility,
- Access roads connecting to each turbine,
- One permanent meteorological tower,
- Supervisory control and data acquisition (SCADA) system, and
- Temporary laydown yard.

An interconnection agreement with the Southwest Power Pool (SPP) to connect the Palmer’s Creek Project to WAPA’s Granite Falls Substation and associated transmission system will be executed. This interconnection is a federal action under the National Environmental Policy Act of 1969 (NEPA), and therefore an Environmental Assessment (EA), of which this Bird and Bat Conservation Strategy (BBCS) is part, was prepared.

Palmer’s Creek is committed to its responsibility to be a good steward of the environment and to adhere to federal, state and local laws. Palmer’s Creek wind project policy calls for wind projects to be designed, constructed, and operated in an environmentally sensitive manner and either avoid or minimize potential avian and bat impacts. Palmer’s Creek understands that even with diligent design, construction and operation activities, avian and bat fatalities may occur, including species that are protected under federal and state laws, and therefore, has developed a BBCS for the Project to ensure:

- All Project-related actions comply with federal and state regulations;
- All Project-related actions comply with permit conditions;
- Project-specific species concerns are included in the BBCS, including avoidance and minimization measures;
- Public and private organizations are included in programs and research that minimize detrimental effects of bird and bat interactions with wind projects.
- The procedures described in this BBCS are followed;
- Palmer’s Creek’ staff and all relevant subcontractors receive the appropriate training pursuant to wildlife monitoring and reporting protocols; and,
- The documentation of bird and bat injuries and fatalities may provide the basis for future modifications to the BBCS.

This BBCS continues Palmer’s Creek regulatory compliance through a proactive approach to reducing risk to birds and bats and their habitats.

2.0 Project Description and Overview

Palmer's Creek proposes to construct a LWECS with a 44.6-MW nameplate capacity wind energy facility in Chippewa County, Minnesota (Figures 1 and 2, Site Location Map and Site Detail Map, respectively). Palmer's Creek further proposes to interconnect the Project to the existing Granite Falls Substation within the project area boundary. The anticipated timeline for construction is January 15, 2018 to October 2018 with commercial operation date (COD) of September 15, 2018.

2.1 PROJECT LOCATION

The southern boundary of the project area is located approximately one mile north of the City of Granite Falls, Minnesota in Granite Falls Township, east of the Minnesota River (**Figure 1, Site Location Map**).

Table 2-1: Project Location.

County	Township Name	Township	Range	Sections
Chippewa	Granite Falls	116 North	39 West	3-10, 15-22, 27, 28, 29
Chippewa	Granite Falls	116 North	40 West	1, 12, 13

2.2 SIZE OF THE PROJECT AREA

The project area boundary is approximately 6,150 acres. The Project will place 18 turbines across the project area, connecting these turbines by access roads and transmission facilities. Project construction will result in land disturbance for:

- 18 turbines,
- approximately 14 miles of collection lines,
- an approximately 1,000-foot 115 kW transmission line,
- approximately 5.5 miles of new or upgraded roads,
- approximately 5.5 miles of temporary, construction access roads,
- approximately one acre for a new substation,
- approximately three acres of laydown area,
- one meteorological tower.

Project construction is anticipated to include temporary land disturbance of approximately 172 acres for Project construction. Permanent land disturbance will be approximately 12 acres for turbines and associated facilities. Refer to **Table 2-2, Temporary and Permanent Land Disturbance**.

Table 2-2: Temporary and Permanent Land Disturbance.

Cover Types	Temporary Disturbance	Permanent Disturbance
Barren Land (Rock/Sand/Clay)	0	0
Cultivated Crops	161	10
Deciduous Forest	1	0
Developed	7	0.6
Emergent Herbaceous Wetlands	1.1	0
Grassland/Herbaceous	0.5	0.1
Open Water	0	0
Pasture/Hay	1.2	0.6
Shrub/Scrub	0.1	0.1
Total	**171.9**	**11.4**

Source: NLCD, 2011.

3.0 Project Design

The Project was designed to optimize wind resources, while minimizing potential impacts to ecological and cultural resources (**Figure 2, Site Detail Map**).

3.1 DESCRIPTION OF LAYOUT AND SETBACK

The Project construction will occur primarily on agricultural land and will require regulatory setbacks. The current Project layout (**Figure 2, Site Detail Map**) may differ from the final construction layout, but Palmer's Creek anticipates the final layout will remain substantially similar to what is presented in the Site Permit Application and EA. Any project layout changes will be identified, evaluated, and discussed with the DOC-Energy, Environmental Review and Analysis (EERA) staff prior to beginning construction.

3.2 DESCRIPTION OF TURBINES AND TOWERS

Basic wind turbine components include a nacelle, hub, blades, tower and foundation. A wind turbine operates three propeller-like blades mounted to a hub, which forms the rotor.

3.2.1 Wind Turbine Design

Palmer's Creek plans to install two (2) 2.3-MW and sixteen (16) 2.5-MW horizontal axis wind turbines. **Table 3-1** provides a summary of the turbine characteristics. Each wind turbine will consist of three blades mounted to the rotor hub. The hub will be mounted to a turbine tower consisting of cylindrical monopoles. The towers will be constructed of high strength tubular steel, approximately 15 feet in diameter at the base, with internal joint flanges. Towers would be fabricated in three sections and assembled onsite. The tower color will be non-reflective light grey, and all surfaces will be multi-layer coated for protection against corrosion. Marking and lighting of the wind farm will be done in compliance with Federal Aviation Administration (FAA) regulations.

Table 3-1: Turbine Characteristics.

	GE 2.3	GE 2.5
Nameplate Capacity	2.3 MW	2.5 MW
Hub Height	262 feet (80 meters)	295 feet (90 meters)
Rotor Diameter	380 feet (116 meters)	380 feet (116 meters)
Total Height	452 feet (150 meters)	485 feet (146 meters)
Swept Area	113,411 feet (10,568 meters)	113,411 feet (10,568 meters)
Cut-in Wind Speed	6.7 mph (3 m/s)	6.7 mph (3 m/s)
Cut-out Wind Speed	56 mph (25 m/s)	56 mph (25 m/s)

	GE 2.3	GE 2.5
Rated Wind Speed	85 mph (38 m/s)	85 mph (38 m/s)
Rotor Speed	8 to 15.7 rpm	8 to 15.7 rpm

3.2.2 Foundations

The wind turbine foundations will typically be reinforced concrete spread foundations. The actual foundation for each turbine will be specifically designed based on geotechnical analysis of a 50-foot core sample at each turbine location combined with structural loading requirements for the turbine. The pedestal diameter for an approximate 262 feet tower is approximately 18 feet. In some cases, an area around a turbine may be covered in four inches of gravel, river rock, or crushed stone. The excavated area for the turbine foundations will typically be approximately 75 feet by 75 feet, approximately 0.1 acre. During construction, a larger area, approximately 300-foot diameter, will be used to lay down the rotors and maneuver cranes during turbine assembly.

3.2.3 Temporary Laydown and Crane Walks

An approximately three-acre temporary laydown area would be selected within the project area. Turbine components may be temporarily stored within this area before being moved to the final turbine sites (**Figure 2, Site Detail Map**). The location of the laydown area will be selected during final design; however, a preferred location will be an undeveloped or previously disturbed area that is flat (**Figure 4, Topographic Map**) and does not contain streams, wetlands (**Figure 8, Waterbodies and Wetlands**) or other environmentally sensitive resources.

In addition to the approximately 3-acre laydown area, temporary crane walk (**Figure 2, Site Detail Map**) disturbances will also be necessary for the Project. Crane walks are estimated to be 40 feet in width and will be located throughout the Project based on the shortest route to the next turbine in the construction sequence. However, cranes will utilize access roads if feasible. Where feasible, Palmer's Creek will make every effort to avoid streams, wetlands, and other environmentally sensitive resources. If avoidance is not possible, Palmer's Creek will acquire the necessary permits/approvals for Project construction and operation and will minimize impacts to the greatest extent possible.

3.2.4 Operation

Palmer's Creek Wind Farm, LLC will oversee all operations, maintenance, and management of the Project facilities through a service agreement with a qualified operations and maintenance (O&M) service. WTG and substation maintenance schedules and required outage durations are based on equipment manufacturer's recommendations and Palmer's Creek operating experience. O&M Service Provider will address both scheduled and unscheduled maintenance on the wind project, including repairs, replacement of parts and removal of failed parts. WTG maintenance will be performed as an on-going function during the life of the Project. Transformer and other substation maintenance will be completed on an annual basis and will be scheduled during times with minimal impact to production.

General maintenance includes maintaining Project structures, access roads, drainage systems and other facilities. General maintenance will be ongoing for the life of the project and scheduled as needed. Palmer's Creek will operate a SCADA system located at the base section of each WTG, substation control building, and O&M building.

3.3 DESCRIPTION OF ELECTRICAL SYSTEM

3.3.1 Generator Step-up Transformers

A generator step-up transformer will be installed at the base of each wind turbine to increase the output voltage of the wind turbine to the voltage of the power collection system (34.5-kV). The transformers will be mounted on concrete pads and will be placed next to each wind turbine.

3.3.2 34.5-kV Electrical Collector Systems

Each wind turbine within the Project Area would be interconnected by communication and electrical power collection circuit facilities. These facilities would include underground feeder lines (collector lines) that would collect wind-generated power from each wind turbine and deliver it to the Palmer's Creek Substation.

This system would be used to route the power from each turbine to the Palmer's Creek Substation (collector substation) where the electrical voltage would be stepped up from 34.5 kV to 115 kV. The underground collector system would be placed in one trench and connect each of the turbines to the Palmer's Creek Substation. The estimated trench length is 73,920 feet (approximately 14 miles).

The underground collector circuits would consist of three power cables contained in an insulated jacket and buried at a minimum depth of four feet that would not interfere with farming operations. Access to the underground lines would be located at each turbine site and where the cables enter Palmer's Creek Substation. Due to the power carrying limits of underground cabling, two underground collector lines or circuits would be used to collect power from the individual turbines.

The underground electrical collector and communication systems generally would be installed by plowing, trenching or directionally drilling the cables. Using this method, the disturbed soils and topsoil are typically replaced over the buried cable within one day, and the drainage patterns and surface topography are restored to pre-existing conditions. In grassland/rangeland areas, disturbed soils would be re-vegetated with a weed-free native plant seed mix.

The fiber optic communication cables for the Project will be installed in the same trenches as the underground electrical collector cables and will connect the communication channels from each turbine to the control room in the Palmer's Creek Substation.

3.3.3 Substation and Switching Station

A new collector substation, Palmer's Creek Substation (**Figure 2, Site Detail Map**), will be constructed at the south end of the project area, on private land, where the 34.5-kV electric collection grid and fiber optic communication network will terminate. Palmer's Creek Substation will include a transformer to step up the voltage of the collection grid from 34.5-kV to 115-kV, above-ground bus structures to interconnect the substation components, breakers, a control building, relays, switchgear, communications and controls, and other related facilities required for delivery of electric power to the adjacent 115-kV Granite Falls Substation.

The design of Palmer's Creek Substation is not finalized, but Palmer's Creek expects it will be enclosed by a chain link fence with dimensions roughly 110 feet by 170 feet. The substation components will be placed on concrete and steel foundations. Palmer's Creek Substation will be designed in compliance with Federal, State and local regulations, National Electrical Safety Code (NESC) standards, and other applicable industry standards and will be interconnected to the Granite Falls Substation, a WAPA-owned interconnection switchyard. The Palmer's Creek Substation will be located adjacent to the Granite Falls Substation, and the proposed transmission interconnection will consist of a 115-kV, 3-phase transmission line, approximately 1,000 feet in length between two facilities.

3.4 ASSOCIATED FACILITIES

There are several facilities associated with the Project that will be required for operation. These include project substation, collector lines, an approximate 1,000-foot 115 kV 3-phase transmission line, which have all been previously described. Other associated facilities include a permanent meteorological tower, SCADA building, O&M facility, and access roads.

3.4.1 Meteorological Tower

One temporary 200-foot meteorological tower and one temporary Sonic Detection and Ranging (SODAR) unit are currently installed within the project area. These temporary structures would be removed within approximately one year of Project construction. The Project will include installation of wind measurement equipment, such as a permanent 290-foot meteorological tower to house anemometers to measure the wind speed (**Figure 2, Site Detail Map**). The permanent tower will not have guy wires and will be lighted in compliance with FAA regulations.

3.4.2 O&M Facility

The precise location of the O&M facility has not been identified. It may be housed in offsite leased space or in a new structure in an undetermined location.

3.4.3 Access Roads

Approximately 5.5 miles of new or upgraded roads will be constructed to facilitate both construction and maintenance of the wind turbines (**Figure 2, Site Detail Map**). These roads have been designed to minimize length and construction impact. Initially, turbine access roads will be approximately 40 feet in width to accommodate the safe operation of construction equipment. Upon completion of construction, the turbine access roads will be reclaimed and narrowed to an extent allowing for the routine maintenance of the facility, or approximately 16 feet in width. The wind turbines will be accessible from gravel access roads, which will follow fence lines, field lines, and existing field access roads to the extent possible. Siting roads in areas with unstable soil will be avoided wherever possible. Roads will include appropriate drainage controls, including culverts and will be constructed in a manner to allow farm and/or land owner equipment to cross. The access road cross-sections will consist of graded soil, with soil stabilization, and surfaced with compacted base of course aggregate. Gates will be installed where access roads cross landowner fences.

4.0 Environmental Conditions

A Site Permit Application and EA were completed for the Project which provide greater detail of the environmental conditions and potential Project impacts. This BBCS is a part of those documents. The analysis was conducted following PUC procedures on siting LWECS and applicable portions of the Power Plant Siting Act, which was used to determine various exclusion and avoidance criteria considered in the selection of the project area.

Preliminary information used for evaluating environmental conditions and selecting the project area included agency queries to the Minnesota Department of Natural Resources (MNDNR), Minnesota State Historic Preservation Office (SHPO), Minnesota Department of Commerce (DOC), and Chippewa County.

The southern boundary of the project area is located approximately one mile north of the City of Granite Falls in Chippewa County, Minnesota in Granite Falls Township, east of the Minnesota River (**Figure 1, Site Location Map**). The project area is at approximately 1040 feet above mean sea level (amsl) above the Minnesota River valley at approximately 925 feet amsl (**Figure 4, Topographic Map**). The project area is comprised primarily of agricultural fields with dispersed rural homesteads (**Figure 2, Site Detail Map**).

4.1 VEGETATION

Cover types within the project area are summarized in **Table 4-1** and displayed on **Figure 3, Land Cover**. Cultivated crops comprise the vast majority of cover types in this area. Other cover types include pasture, grassland, and developed open space with some deciduous forest. The cover types other than cultivated crops are typically associated with rural residences including windbreaks, lawn, and pasture and grassland.

Table 4-1: Existing Cover Types of Palmer's Creek Wind Farm.

Cover Types	Total Acreage
Barren Land (Rock/Sand/Clay)	1
Cultivated Crops	5,157
Deciduous Forest	134
Developed	213
Emergent Herbaceous Wetlands	160
Grassland/Herbaceous	192
Open Water	5
Pasture/Hay	284
Shrub/Scrub	4
Total	**6,150**

Source: NLCD, 2011

4.2 WILDLIFE

Good habitat is found along the Minnesota River floodplain, nearby WMAs, and along some of the drainages in the project area. Agricultural production areas, such as cultivated crops, may be used on a temporary basis by birds and wildlife for foraging or short-term shelter.

The project area is primarily agricultural lands and does not contain significant wetland habitats (**Table 4-1, Existing Cover Types of Palmer's Creek Wind Farm and Figure 3, Land Cover**). The project area is adjacent to the Minnesota River, which provides large riverine and wetland habitats. The agricultural landscape and developments of the region have determined the type of wildlife present.

4.2.1 Birds

Migratory birds and waterfowl travel through Minnesota during the spring and fall of each year, as they alternate between summer breeding grounds in the northern portion of the continent and winter feeding ground in the southern half of the continent. The project area is located within the Mississippi River Flyway, which results in large spring and fall migrations of various bird species. During spring and fall migrations, flocks of migratory birds can number in the tens of thousands at traditional migratory staging areas and refuges. Migratory birds and waterfowl typically stage and rest in areas with significant amounts of wetland and open water habitats that provide sufficient food sources for the migration. The Minnesota River corridor is highly used by nesting, over-wintering, and migratory bald eagles.

The project area is adjacent to the Minnesota River and its floodplain. The Minnesota River valley provides a corridor of habitat for many birds and waterfowl. The project area is predominantly cropland, and the most common birds observed during the avian point count surveys are songbirds (66%, Wenck 2017). Canada goose (*Branta canadensis*) (0.40), American crow (*Corvus brachyrhynchos*) (0.25), unknown ducks (0.18) and unknown blackbirds (0.14) are most likely to be exposed (highest encounter rates) to collisions from wind turbines at PCWF. Cumulatively, surveys identified 5,368 avian individuals (64 different species) that were recorded during the eight fixed-PC surveys. The most frequently observed birds were European starling (*Sturnus vulgaris*) (19.63 percent of all birds observed/1,054 individuals), red-winged blackbird (*Agelaius phoeniceus*) (12.82 percent/688 individuals), American crow (10.54 percent/566 individuals), brown-headed cowbird (*Molothrus ater*) (6.99 percent/375 individuals), and Canada goose (6.48 percent/348 individuals). The remaining 59 species comprised approximately 43.54 percent of the total birds observed. Refer to Wenck (2017). **Appendix A, Avian Point Count Results, Final**. Cumulative overall mean bird use for all surveys was 18.64 birds/20 min. The overall mean use by non-raptors was 18.25 birds/20 min with the highest mean use with European starling (3.66 birds/20 min). The mean use for raptors/vultures/owls was 0.39 birds/20 min with the highest mean use with red-tailed hawk (0.16 birds/20 min). Cumulatively, the most common species present during the surveys was the field sparrow (13.54 percent of all surveys) (Wildlife Monitoring Report, Final, Wenck 2017).

Project siting will occur primarily on agricultural land that have been previously disturbed for cultivated crops and other agricultural practices. Minnesota Biological Survey (MBS) sites, native prairie, and wetland areas will be avoided.

The Project could affect birds due to collision mortality, displacement due to disturbance, habitat fragmentation, and habitat loss. Collision mortality rates are anticipated to be low.

The Project will not directly impact habitat in the project area. The Applicant has been coordinating with the MNDNR and USFWS. The results of the surveys will be used by permitting authorities to determine permit conditions based on the potential for impacts to wildlife.

Migratory birds and waterfowl will be most susceptible to impacts from the Project when taking off and landing at staging and resting areas, because these are the times they will be flying at heights that could cause collisions with WTGs. At other times during their migration, migratory birds and waterfowl will be flying at heights well above the maximum height of the WTGs.

WTGs closest to the Minnesota River are WTGs 1, 5, 9 and 12 (**Figure 2, Site Detail Map**). Avian collisions and subsequent mortality may be more likely with these WTGs than other WTGs in the project area. Lac qui Parle Dam is located about 16 miles north, and therefore, impacts to migration routes and patterns, resting and staging areas at the State Park or WMA are not anticipated.

4.2.2 Bats

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.

There was a total of seven bat species documented during the course of the study. The tri-colored bat (formerly known as eastern pipistrelle) (*Perimyotis subflavus*) 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. 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 13 passes 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 seven 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 eastern red bat (*Lasiurus borealis*) and the little brown bat (*Myotis lucifugus*). Refer to *Acoustic Bat Report, NCE 2017*, appended by reference.

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. For bats, the mean mortality rate at seventeen wind energy facilities in the Midwest is 9.6 bats per turbine per year (s.d. 24.1) (Stantec 2012). 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).

4.2.3 Important Bird Areas

Part of the western side of the project area, near the Minnesota River, overlaps with the Upper Minnesota River Valley Important Bird Area (IBA). Refer to **Figure 5, Ecologically Significant Areas**. IBAs, identified by Audubon Minnesota in partnership with the MNDNR, are part of an international conservation effort aimed at conserving critical bird habitats. The Upper Minnesota River Valley IBA incorporates the riparian corridor and adjacent river valley and upland communities along the Minnesota River and provides excellent habitat for a wide variety of bird species. This IBA contains significant bird habitat in an intensely agricultural area and is a natural corridor for migrating birds. Over 200 species, including state-listed species and Species in Greatest Conservation Need (SGCN) are known to use the IBA.

4.2.4 Rare and Unique Wildlife

4.2.4.1 Minnesota NHIS Data

A query of the MNDNR Natural Heritage Information System (NHIS) was completed (MNDNR 2016) to determine if there are rare species or other significant features in the project area. Ecologically Significant Areas (ESAs) were identified within the project area (**Figure 5**). The ESA results are detailed in the Site Permit Application.

The NHIS query also identified state-listed bird and wildlife species in the project vicinity. Although there are no NHIS records for bats near the Project, the MNDNR indicated that all seven of Minnesota's bats can be found throughout Minnesota. 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. There was a total of seven bat species documented throughout the course of the surveys (Fall 2015 to Fall 2017) (NCE 2017). Three species of concern in the State of Minnesota were observed during the acoustic bat monitoring. These species included the tricolored bat, big brown bat and little brown bat. The tricolored bat was detected in small numbers but was found at every monitor. 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 13 passes 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. Refer to *Acoustic Bat Report, NCE 2017*, appended by reference.

The NHIS query indicates a documented bald eagle (*Haliaeetus leucocephalus*) nest located just outside the project area (Section 11, T116N R40W) along the Minnesota River. This nest was active when checked in 2000, 2001, and 2005. Palmer's Creek completed point count surveys of bald eagles, and conducted aerial eagle nest surveys with 10 miles of the project area in April 2017. **Refer to Section 6.1.2 and 6.1.3 of this document.**

The NHIS indicated breeding season observations of two rare grassland birds: the lark sparrow (*Chondestes grammacus*), a state-listed species of concern, and the upland sandpiper (*Bartramia longicauda*), a SGCN. A minimum of 20 SGCN are known to use grassland habitat within the Minnesota River Prairie Ecological Subsection (where the Project is located). Potential impacts to grassland birds are a concern because many of these species are declining in number nationwide. There are small areas of grassland located within the project area, which may provide habitat for these species. The primary land disturbance for the Project will occur on cultivated, agricultural land, and will avoid grassland areas. The lark sparrow was not identified during the avian studies. However, upland sandpiper was observed incidentally within the project area but was not identified during the avian point count surveys. Refer to **Appendix A, Avian Point Count Results, Final** (Wenck 2017).

4.2.4.2 Federal Bird/Bat Species Known from County/Project Area Records

A list of federally threatened, endangered, candidate and proposed species was obtained for Chippewa County, Minnesota (MNDNR 2016) from the U.S. Fish and Wildlife Service (USFWS) Information for Planning and Conservation (IPaC) website (USFWS 2017). The Project Action and impact to Federal species are addressed by adherence to the Programmatic Biological Assessment Species Consistency Evaluation Form. The only Federally-listed bird and bat species with potential to occur is the northern long-eared bat. Refer to **Table 4-2, Federal/State Listed Bat Species**.

Table 4-2: Federal/State Listed Bat Species.

Scientific Names	Common Names	Status[1]	Documented in Project Area[2]
Eptesicus fuscus	Big Brown Bat	ST: Special Concern	Yes
Myotis lucifugus	Little Brown Myotis	ST: Special Concern	Yes
Myotis septentrionalis	Northern Myotis/ Northern Long-Eared Bat	ST: Special Concern F: Threatened	No
Perimyotis subflavus	Tri-colored Bat/Eastern Pipistrelle	ST: Special Concern	Yes

[1]Status = Federal Status (F), State Status (ST): E = endangered; T = threatened; P = proposed; C = candidate.
[2]Natural Heritage Information System (NHIS), or Eagle/Avian Point Count Surveys (**Appendix A**).

4.2.4.3 State Endangered, Threatened or Special Concern Species

A species is considered **endangered** if the species is threatened with extinction throughout all or a significant portion of its range within Minnesota. A species is considered **threatened** if the species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range within Minnesota. A species is considered a species of **special concern** if, although the species is not endangered or threatened, it is extremely uncommon in Minnesota, or has unique or highly specific habitat requirements and deserves careful monitoring of its status. Species on the periphery of their range that are not listed as threatened may be included in this category along with those species that were once threatened or endangered but now have increasing or protected, stable populations (MNDNR 2015).

Minnesota state-listed species and Species in Greatest Conservation Need are identified in Minnesota's State Wildlife Action Plan (MNDNR 2015).

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 (MNDNR 2016, refer to **Table 4-2**).

The Natural Heritage Information System (MNDNR 2016) identified breeding season observations of two rare grassland birds: the lark sparrow (*Chondestes grammacus*), a state-listed species of concern (**Table 4-3, Federal/State Listed Bird Species**), and the upland sandpiper (*Bartramia longicauda*), a Species in Greatest Conservation Need.

Table 4-3: Federal/State Listed Bird Species.

Scientific Names	Common Names	Status[1]	Documented in Project Area[2]
Accipiter gentilis	Northern Goshawk	ST: Special Concern	No
Aegolius funereus	Boreal Owl	ST: Special Concern	No
Ammodramus bairdii	Baird's Sparrow	ST: Endangered	No
Ammodramus henslowii	Henslow's Sparrow	ST: Endangered	No
Ammodramus nelsoni	Nelson’s Sparrow	ST: Special Concern	No
Anthus spragueii	Sprague's Pipit	ST: Endangered	No
Asio flammeus	Short-Eared Owl	ST: Special Concern	No
Athene cunicularia	Burrowing Owl	ST: Endangered	No
Buteo lineatus	Red-shouldered Hawk	ST: Special Concern	No
Calcarius ornatus	Chestnut-Collared Longspur	ST: Endangered	No
Calidris canutus	Rufa Red Knot	F: Threatened	No
Charadrius melodus	Piping Plover	ST: Endangered	No
Chondestes grammacus	Lark Sparrow	ST: Special Concern	Yes
Coturnicops noveboracensis	Yellow Rail	ST: Special Concern	No
Cygnus buccinator	Trumpeter Swan	ST: Special Concern	No
Empidonax virescens	Acadian Flycatcher	ST: Special Concern	No
Falco peregrinus	Peregrine Falcon	ST: Special Concern	No
Gallinula galeata	Common Gallinule	ST: Special Concern	No
Haliaeetus leucocephalus	Bald Eagle		Yes
Lanius ludovicianus	Loggerhead Shrike	ST: Endangered	No
Leucophaeus pipixcan	Franklin’s Gull	ST: Special Concern	No
Limosa fedoa	Marbled Godwit	ST: Special Concern	No
Parkesia motacilla	Louisiana Waterthrush	ST: Special Concern	No
Pelecanus erythrorhynchos	American White Pelican	ST: Special Concern	Yes
Phalaropus tricolor	Wilson's Phalarope	ST: Threatened	No

Scientific Names	Common Names	Status[1]	Documented in Project Area[2]
Podiceps auritus	Horned Grebe	ST: Endangered	No
Progne subis	Purple Martin	ST: Special Concern	No
Rallus elegans	King Rail	ST: Endangered	No
Setophaga cerulea	Cerulean Warbler	ST: Special Concern	No
Setophaga citrina	Hooded Warbler	ST: Special Concern	No
Sterna forsteri	Forster's Tern	ST: Special Concern	No
Sterna hirundo	Common Tern	ST: Threatened	No
Tympanuchus cupido	Greater Prairie Chicken	ST: Special Concern	No
Vireo bellii	Bell's Vireo	ST: Special Concern	No

[1] Status = Federal Status (F), State Status (ST): E = endangered; T = threatened; P=proposed; C = candidate.
[2] Natural Heritage Information System (NHIS), or Eagle/Avian Point Count Surveys (**Appendix A**).

The Minnesota State Wildlife Action Plan (SWAP) Species of Greatest Conservation Need List (SGNL) includes several bird species observed in the project area (MNDNR 2015). No federal or state listed species were present in the project area. The American white pelican, a Species of Special Concern (SPC), was observed (3 observations, 16 individuals) during the avian surveys. The pelicans were flying within the RSA. Refer to **Appendix A, Avian Point Count Results, Final**. Several studies have shown the American white pelican has increased in abundance across its range over the past 20-25 years (Wires et al. 2005; Evans and Knopf 1993). This species is a colonial nesting species that selects large, shallow bodies of water with flat bare islands isolated from human disturbance (Coffin and Pfannmueller 1988). Nonlisted species (NL) are included on the SWAP for reasons of population decline or significant breeding or winter populations in Minnesota. Species that are NL that were observed within the project area include bobolink (*Dolichonyx oryzivorus*), belted kingfisher (*Megaceryle alcyon*), field sparrow (*Spizella pusilla*), northern harrier (*Circus cyaneus*), sedge wren (*Cistothorus platensis*), Swainson's hawk (*Buteo swainsoni*), upland sandpiper (*Bartramia longicauda*), western meadowlark (*Sturnella neglecta*), and the yellow-headed blackbird (*Xanthocephalus xanthocephalus*) (**Appendix A, Avian Point Count Results, Final;** see **Section 6.1.1.3**).

Bald Eagle
In 2007, the bald eagle 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. Results of eagle surveys are presented below in **Section 6.0**.

Based on agency discussions, eagle nesting areas will be avoided, as feasible. Additionally, due to the Minnesota River Valley being a significant migration corridor, MNDNR has recommended post-construction avian fatality monitoring, which Palmer's Creek will implement as part of this Site Permit.

5.0 Regulatory Framework and Agency Consultation

This BBCS is required by the Minnesota Department of Commerce (DOC) and Western Area Power Administration (WAPA) as part of the permitting process for the Project. Avian and bat surveys were voluntarily implemented at the beginning of the permitting process. This BBCS document has utilized the wildlife survey results from the monitoring period which was completed in Fall 2017. All pre-construction avian and bat survey results will be submitted to the United States Department of Energy, WAPA, United States Fish and Wildlife Service (USFWS), Minnesota Department of Natural Resources (MNDNR), and DOC. Palmer's Creek committed to the best management practices and conservation measures outlined by WAPA in the Upper Great Plains Wind Energy Final Programmatic Environmental Impact Statement (EIS), which eliminated the need for a formal Biological Assessment. However, Programmatic Biological Assessment for Upper Great Plains Region Wind Energy Development Program Impact Information and Consistency Determination were used for biological evaluation, including submittal of the Consistency Evaluation Forms.

5.1 REGULATORY FRAMEWORK

5.1.1 Federal Laws

5.1.1.1 Federal Endangered Species Act

The federal Endangered Species Act (ESA 1973) defines and lists species as "endangered" and "threatened" and provides regulatory protection for the listed species. The federal ESA provides a program for conservation and recovery of threatened and endangered species; it also ensures the conservation of designated critical habitat that the USFWS has determined is required for the survival and recovery of these listed species. Section 9 of the federal ESA prohibits the take of species listed by USFWS as threatened or endangered. Take is defined as follows: "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in such conduct." In recognition that take cannot always be avoided, Section 10(a) of the federal ESA includes provisions for take that is incidental to, but not the purpose of, otherwise lawful activities. Section 10(a)(1)(B) permits (Incidental Take Permits) may be issued if take is incidental and does not jeopardize the survival and recovery of the species.

Section 7(a)(2) of the federal ESA requires that all federal agencies, including the USFWS, evaluate projects with respect to any species proposed for listing or already listed as endangered or threatened and any proposed or designated critical habitat for the species. Federal agencies are prohibited from authorizing, funding, or carrying out any action that will jeopardize the continued existence of a listed species or destroy or modify its critical habitat. As defined in the federal ESA, individuals, organizations, states, local governments, and other non- federal entities are affected by the designation of critical habitat only if their actions occur on federal lands; require a federal permit, license, or other authorization, or involve federal funding (ESA 1973).

5.1.1.2 Bald and Golden Eagle Protection Act

The federal Bald and Golden Eagle Protection Act of 1940 (BGEPA; 16 USC 668–668c, as amended) is administered by the USFWS and was enacted to protect bald and golden eagles, their nests, eggs, and parts (e.g., feathers or talons). The BGEPA states that no person shall take, possess, sell, purchase, barter, offer for sale, purchase or barter, transport, export, or import any bald or golden eagle alive or dead, or any part, nest or egg without a valid permit to do so (USFWS, n.d.). The BGEPA also prohibits the take of bald and golden eagles unless pursuant to regulations. Take is defined by the BGEPA as an action "to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb." Disturb is defined in the BGEPA as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: (1) injury to an eagle; (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior; or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior" (USFWS, n.d.). In addition to immediate impacts, this definition also covers impacts that result from human-caused alterations initiated around a previously used nest site during a time when eagles were not present. Permits are issued to Native Americans to possess eagle feathers for religious purposes, and salvaged eagle carcasses can be sent to the National Eagle Repository in Colorado where they are redistributed to Native Americans. This effort is coordinated by a local USFWS office. Although the bald eagle was removed from the Endangered Species List in June 2007, it is still federally protected under the BGEPA and Migratory Bird Treaty Act as described in the following section. In addition, the *National Bald Eagle Management Guidelines* were published in conjunction with delisting by the USFWS in May 2007 to provide provisions to continue to protect bald eagles from harmful actions and impacts.

Under the BGEPA, a final rule was published in May 2008, in the Federal Register (FR) that proposed authorization for take of bald eagles for those with existing authorization under the federal ESA where the bald eagle is covered in a Habitat Conservation Plan (HCP) or the golden eagle is covered as a non-listed species. The final rule also established a new permit category to provide expedited permits to entities authorized to take bald eagles through Section 7 incidental take permits. A proposed rule will later address authorization of take of (1) disturbance-type take of bald and golden eagles due to otherwise lawful activities and (2) eagle nests in rare cases where their location poses a risk to human safety or the eagles themselves.

In 2009, the USFWS issued a final rule on new permit regulations that would allow some disturbance of eagles "in the course of conducting lawful activities" (74 FR 46836–46879). Physical take of an eagle will only be authorized if every avoidance measure has been exhausted. Removal of nests will generally be permitted only in cases where the nest poses a threat to human health, or where the removal would protect eagles. Take permits may be issued when "necessary for the protection of…other interests in any particular locality" (USFWS 2009). Due to concerns about population declines, permits for take of golden eagles are likely to be restricted throughout the eagle's range (USFWS 2009). Considerations for issuing take permits include the health of the local and regional eagle populations, availability of suitable nesting and foraging habitat for any displaced eagles, and whether the take and associated mitigation provides a net benefit to eagles (74 FR 46836–46879, USFWS 2009). In April 2013, USFWS issued *Eagle Conservation Plan Guidance Module 1: Land-based Wind Energy (Version 2)* to address these new regulatory matters (USFWS 2013).

5.1.1.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA, 16 U.S.C. 703-712)) makes it unlawful to pursue, capture, kill, or possess any migratory bird or part, nest, or egg of any such bird listed in wildlife protection treaties between the United States, Great Britain, Mexico, Japan, and Russia (and other countries of the former Soviet Union). Most birds (outside of introduced species and non-migratory game birds) within the US and the Project area are protected under the MBTA. The birds, occupied nests and the contents of the nest (eggs or chicks) within the Project property are afforded protection pursuant to the MBTA. Unlike ESA and BGEPA, no permits are available to authorize incidental take of birds under the MBTA. Due to the potential for resident and migratory birds within the Project, development of this Bird and Bat Conservation Strategy was prepared to assist in complying with the MBTA.

5.1.2 State Laws

5.1.2.1 Wind Energy Site Permitting

The Wind Siting Act of Minnesota (Minnesota Statute Chapter 216F) requires that a site permit be issued from the PUC to build and operate a large wind energy conversion system (LWECS). According to the Statute, the siting of an LWECS must be compatible with environmental preservation, sustainable development, and the efficient use of resources (Minnesota Statute Section 216F.03). Further, the criteria considered by the PUC in designating LWECS sites must include the impact of the LWECS on humans and the environment (Minnesota Statute Section 216F.05). Palmer's Creek has designed the Project to comply with the PUC's wind turbine setback and siting guidelines, and other requirements set forth in Minnesota Rules Chapter 7854.

5.1.2.2 State Threatened and Endangered Species Laws

Per Minnesota Statute Section 84.0895, the MNDNR has adopted rules designating species meeting the statutory definitions of Endangered, Threatened, and Special Concern Species (ETSC). The resulting List of Endangered, Threatened, and Special Concern Species is codified as Minnesota Rules Chapter 6134. The Endangered Species Statute also authorizes the MNDNR to adopt rules regulating the treatment of species designated as endangered and threatened. These regulations are codified as Minnesota Rules, Parts 6212.1800 to 6212.2300. MNDNR defines endangered, threatened, and special concern species as follows:

- *Endangered (E)* – a plant or animal species that is threatened with extinction throughout all or a significant portion of its range in Minnesota.
- *Threatened (T)* – a plant or animal species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in Minnesota.
- *Special Concern (SC)* – species that are not endangered or threatened, but are extremely uncommon in Minnesota, or have unique or highly specific habitat requirements and deserve careful monitoring of their status. Species on the periphery of their range that are not listed as threatened may be included in this category along with those species that were once threatened or endangered but now have increasing or protected, stable populations.

5.2 AGENCY GUIDANCE AND CONSULTATION

As part of the planning and design of the Project, Palmer's Creek consulted public and private available guidance materials including:

- Avian and Bat Protection Plan white paper (USFWS 2010)
- Avian Protection Plan Guidelines (APLIC and USFWS 2005)
- Suggested Practices for Avian Protection on Power Lines (APLIC 2006)
- Reducing Avian Collisions with Power Lines (APLIC 2012)
- Odell Wind Farm: Wildlife Assessment and Field Studies Tier 3 Report (Dunlap et al. 2013)
- Wildlife Baseline Studies for the Highmore Wind Resource Area, Hughes, Hyde and Hand Counties, South Dakota (Derby et al. 2010)
- Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to other Sources of Avian Collision Mortality in the United States (Erickson et al. 2001)
- Synthesis and Comparison of Baseline Avian and Bat Use, Raptor Nesting and Mortality Information from Proposed and Existing Wind Developments (Erickson et al. 2002)
- An Assessment of Direct Mortality to Avifauna from Wind Energy Facilities in North Dakota and South Dakota (Graff 2015)
- A Review of Bat Mortality at Wind Energy Developments in the United States (Johnson 2005)
- U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines (USFWS 2012)
- Wind Turbine Interactions with Birds, Bats, and their Habitats: A Summary of Research Results and Priority Questions (NWCC)
- Acoustic Bat Summary Report: Palmer's Creek Wind Farm (*Final*) (NCE 2017)
- Wind Turbine Effects on Avian Activity, Habitat Use, and Mortality in Altamont Pass and Sollano County Resource Areas (Orloff and Flannery 1992)
- Towards Reliable Bird Surveys: Accounting for Individuals Present but not Detected (Thompson 2002)
- Upper Great Plains Wind Energy Final Programmatic Environmental Impact Statement (Western 2015)
- Bald Eagle Management Guidelines and Conservation Measures (USFWS, n.d.)
- National Bald Eagle Management Guidelines (USFWS 2007a)
- Eagle Permits; Take Necessary to Protect Interests in Particular Localities (USFWS 2009)
- Draft Eagle Conservation Plan Guidance (USFWS 2011)
- Eagle Conservation Plan Guidance: Land-based Wind Energy (Vers. 2) (USFWS 2013)
- Information for Planning and Conservation (IPaC) (USFWS 2017)
- Palmer's Creek Wind Farm, LLC.: Avian Point Count Survey Results (Wenck 2017)
- Wild Birds and Avian Influenza: An Introduction to Applied Field Research and Disease Sampling Techniques (Whitworth et al. 2007)
- Willow Creek Wind Project: Bird and Bat Conservation Strategy

A public scoping meeting was held on December 1, 2016, in Granite Falls, Minnesota. Federal, State, and local agencies were invited to the meeting and to provide comments regarding the Project. The public was invited through newspaper and radio announcements, and residents near the Project were invited to comment. The public scoping meeting documentation is included in Appendix I of the EA. Comments received regarding the proposed Project from agencies and the public are included in Appendix J of the EA.

The local, state and federal agencies were contacted during the evaluation of the Project to determine potential impacts, identify avoid, minimization, and mitigation measures, and for guidance on permitting and approvals needed for the Project. These agencies included:

- Federal Aviation Administration
- U.S. Fish and Wildlife Service
- Minnesota Department of Transportation
- Minnesota Department of Natural Resources
- Minnesota Public Utilities Commission
- Minnesota State Historic Preservation Office
- Upper Minnesota Regional Development Commission
- Chippewa County
- City of Granite Falls

Section 106 tribal consultation was initiated by WAPA on November 10, 2016 with 12 different tribes. A tribal consultation meeting was held on April 24, 2017 at the Upper Sioux Indian Community near Granite Falls, Minnesota. A second tribal consultation meeting was held on May 4, 2017 in the same location. Additionally, the tribal cultural specialist (TCS) was invited from each tribe to participate in the cultural resources survey.

Palmer's Creek has met with and exchanged correspondence a number of times throughout the course of designing and reviewing the Project. This included conference calls and meeting with the MNDNR, USFWS, DOC and WAPA to discuss concerns regarding turbine placement and other Project design features. Survey protocols, monitoring requirements, specific species, and biological assessment requirements were also discussed at several meetings and through correspondence.

Following these agency discussions, turbines were shifted to minimize potential impacts to the Sparta Wildlife Management Area, and survey protocols for bald eagles and other avian species were updated. The bat surveys were also discussed and modified to suit agency requests. A meeting on January 18, 2017 between WAPA, DOC, USFWS and Palmer's Creek resulted in agreement to use the Consistency Evaluation Forms in place of a biological assessment since a programmatic BA had already been completed as part of the Upper Great Plains Wind Energy Final Programmatic EIS.

A meeting with the MNDNR was held on September 14, 2017 to discuss the results and next steps for the bat surveys. A final report was to be prepared and submitted after analysis. Refer to NCE 2017. The MNDNR has determined the project is "high-risk" for bats. Because of the high-risk status, additional years (3) and intensity (4 times per week) of fatality monitoring will occur.

Additional consultation has been ongoing with state and federal agencies to continue to work through the environmental review and permitting processes. This includes addressing comments received on the Site Permit Application and EA, including comments directly related to avian and bat species.

6.0 Pre-Construction Site Specific Wildlife Surveys & Risk Assessments

6.1 AVIAN USE SURVEYS

Wenck Associates, Inc. was contracted by Palmer's Creek Wind Farm, LLC to conduct several avian studies. The data from these studies were used to identify species, species groups or species of concern that are present in the project area and that may be at a higher risk of mortality and/or displacement. 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% of the bird fatalities. Both migrant and resident passerine fatalities have been observed (Erickson et al. 2001 and Erickson et al. 2002). Data are presented in several categories, and highlight federally listed species, state listed species, and species of concern (Wenck 2017, and **Appendix A, Avian Point Count Results, Final**)

6.1.1 Diurnal Fixed-Point and Incidental Avian Use

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).

A total of 36 surveys were 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]).

Survey data was used to evaluate avian use, behavior, and species composition during Spring and Fall migration and to determine Summer resident species at the project area.

Point counts were selected to capture a diverse range of habitats and at locations with the best possible viewshed. Eight point-count locations were selected for the avian point count surveys (Refer to **Figure 6, Point Count Locations**).

All observations within an 800-meter radius at each point count were recorded; any observations outside the 800-meter radius were considered incidental. Each point count survey lasted for 20 minutes; all audio and visual observations were recorded. Surveys were conducted by an experienced ornithologist. Surveys were rotated to cover all daylight hours to ensure each point count was surveyed at various times of the day. Data recorded for each observation included species, number of individuals, time, 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.

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).

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.

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

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.

The encounter rate is the rate in which a species was observed flying through the RSA during the avian point count surveys at 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 PCWF:

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.

Please refer to **Appendix A, Avian Point Count Results, Final; and Wildlife Monitoring Report, Final (Wenck 2017)**. Also, refer to **Section 4.2.1** of this BBCS.

6.1.1.1 Eagle/Raptor Use and Encounter Rate

The raptor annual mean use rate in the project area of 0.39 raptors/20 min was compared with 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, mean raptor use in the project area is considered low.

Approximately 48.15 percent of all raptor observations were within the RSA. The highest raptor encounter rate was red-tailed hawk and turkey vulture, each with 0.07 individuals flying within the RSA/20 min. The raptor encounter rate calculated is relatively low, however the percentage of raptor observations within the RSA during the surveys and the low annual mean use rate (raptors/20 minutes) does not eliminate the potential for mortality in the project area.

Bald eagles are frequent in the area as reported during the avian point count surveys. Refer to **Wildlife Monitoring Report, Final (Wenck 2017)**. Twenty-one (21) observations of bald eagles included twenty-seven (27) individuals, with 30.77 percent of the them observed flying within the RSA. Most of these eagles have been observed within one mile of the Minnesota River. The bald eagle encounter rate is 0.03.

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 suggest that 3.2% 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 Flannery 1992). Golden eagles, red-tailed hawks and American kestrels were casualties more often than predicted based on abundance. Based on species occurrence/abundance within PCWF, red-tailed hawks, turkey vultures and bald eagles may be at highest collision risk for the Project. High raptor use (greater than 2.0 birds/20 min) has been associated with high raptor fatality at wind facilities (AWWI 2014). Conversely, raptor fatality appears to be low when raptor use is low (less than 1.0 birds/20 min; AWWI 2014), which is the case for raptor use in this project area. Currently the project area has a raptor use of 0.39 birds/20 minutes.

Turkey vultures and red-tailed hawks 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 facilities, 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. Project-related fatalities of red-tailed hawks, should they occur, are unlikely to have 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.

6.1.1.2 Non-raptor Use and Encounter Rate

Passerines make up a large proportion (66.26%), of the birds observed during the avian surveys in the project area and would be expected to make up the largest proportion of fatalities at the PCWF. Encounter rates indicate that unidentified blackbirds (0.14 birds/20 min) and red-winged blackbirds (0.11 birds/20 min) are most likely to be exposed to collisions from wind turbines in the project area. Other passerine and waterfowl species that flew through the RSA during the surveys include; Canada goose (0.40 birds/20 min) and American crow (0.25 birds/20 min). Refer to **Appendix A, Avian Point Count Results, Final**.

Passerine species have been the most abundant bird fatality at wind facilities outside California (Erickson et al. 2001, and 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 2002). Encounter rates indicate that the Canada goose, American crow, unknown duck, unknown blackbird and red-winged blackbird are likely to be exposed to collisions from wind turbines in the project area. 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 (refer to **Appendix A, Avian Point Count Results, Final**; and Table 10 of **Wildlife Monitoring Report, Final (Wenck 2017)**).

6.1.1.3 Sensitive Species

One (1) Species of Special Concern (MNDNR 2015), American white pelican, *Pelecanus erythrorhynchos*) has been observed during the field surveys. Three (3) observations consisted of 16 individuals. Nonlisted species (NL) are included on the (Minnesota State Wildlife Action Plan (SWAP) for reasons of population decline or significant breeding or winter populations in Minnesota. Species that are NL that were observed within the project area include bobolink (*Dolichonyx oryzivorus*), belted kingfisher (*Megaceryle alcyon*), field sparrow (*Spizella pusilla*), northern harrier (*Circus cyaneus*), sedge wren (*Cistothorus platensis*), Swainson's hawk (*Buteo swainsoni*), upland sandpiper (*Bartramia longicauda*), western meadowlark (*Sturnella neglecta*), and the yellow-headed blackbird (*Xanthocephalus xanthocephalus*). Refer to **Section 4.2.4 Rare and Unique Wildlife** of this BBCS, and **Appendix A, Avian Point Count Results, Final**.

IPaC (USFWS 2017) identified seventeen (17) Birds of Conversation Concern that have the probability of using the project area. During the avian point count surveys only one these species was observed within the project area. This species was the bobolink (1 observation, 1 individual).

6.1.2 Eagle Use Surveys

Following Stage 2 of the Eagle Conservation Plan Guidance (USFWS 2013), eagle point count surveys were conducted to collect quantitative data on eagle presence that allows estimation of eagle exposure rate, which forms the basis of a risk assessment model. Eagle use surveys focused exclusively on eagles and occur at the eight (8) point count locations (**Figure 6, Point Count Locations**) used for point count surveys in 2016-2017. The objective of the eagle use survey was 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 continued for one calendar year to capture temporal variation in eagle use of the study area.

Eagle use data is collected in 1-minute intervals so that the data can the 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 was 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 consisted of an 800-meter (0.5-mile) radius circle (0.77 square mile) that provided distant, unobstructed views and allowed visual observations of eagles and other large birds at a 2- to 3-mile distance. Numerical data was collected within 800-m-radius plots, but flight lines were documented across line-of-sight and were not limited to the 800-m-redius survey plot. A detailed protocol study-specific data sheets and data management plan is being adhered to and is utilized in the field.

Surveys were conducted once a month during the non-migration months (April-August). Surveys were conducted at a minimum of twice a month during the migration months (September-March), starting July 2016 and concluded in June 2017. Twenty (20) survey weeks were conducted. Individual surveys consisted 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 occurred in all weather conditions except when visibility is poor. These surveys were conducted outside of the twenty-minute avian point count surveys.

Eagle use surveys documented 19 bald eagles with 87 flight minutes, and 78.9 percent of the individuals were flying within the RSA. Most of these eagles have been observed within one mile of the Minnesota River. Eagles were observed less than 1 percent of the survey time (87 minutes observed/9,600 survey minutes). Of the 87 minutes in which eagles were observed, 78 minutes of observations were made with eagles flying within the RSA. The eagle point count surveys are reflective of the eagle data collected during the avian point count surveys, both with a relatively low encounter rate of 0.09 and 0.03, respectively (Wenck 2017). See also **Section 6.1.5, Eagle Collision Risk Analysis** within this BBCS.

Palmer's Creek has committed to continue eagle use surveys through 2018, during and through project construction.

6.1.3 Eagle/Raptor Nest Surveys

Raptors 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 are long-lived species with low reproduction rates, potential population 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. Adult raptors often fly near nest sites during the breeding season to attend to young and deliver prey. After young raptors 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.

Few raptor species that have been identified as nesting at wind energy facilities have been observed as fatalities at wind-energy facilities (Derby et al. 2010), therefore, the relationship is very low between the number of collision fatalities and raptor nests within or near project facilities. However, it is assumed that raptors nesting close to turbines would likely have a greater chance of being impacted from collision with turbines (Derby et al. 2010).

A raptor nest survey was conducted in the Spring of 2016 to locate raptor nests and determine nest activity status and the species using those nests. The initial surveys were conducted before tree leaf-out, to locate nests and to identify early breeding species. The project area and a 1-mile buffer area were surveyed from a vehicle using binoculars and spotting scopes. All raptor nest locations were documented with Global Positioning System (GPS) coordinates. Raptor species, height of nest, nest activity status, nest condition, substrate, and other relevant data were recorded for each nest. Additional visits were conducted when nests were 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 PCWF. A bald eagle (*Haliaeetus leucocephalus*) nest has been documented in T116N R40W Section 11 just outside of the project boundary. This nest was active when checked in 2000, 2001, and 2005. This nest was found to be currently used by red-tailed hawk during the Spring 2017 aerial raptor nest survey. Refer to *Aerial Eagle/Raptor Nest Survey Report, Wenck 2017 (Apr 27)*, appended by reference.

An additional nest was located in the Spring of 2016 by Fagen, this nest was active in 2016 and is in T116N R39W Section 20, immediately outside of the project boundary. Fagen staff monitored nest use data in 2016 and continued monitoring from April thru August 10, 2017. (Michael Rutledge, Fagen Engineering, Personal Communication, December 2017). Refer to **Section 6.1.4** of this BBCS for eagle monitoring results.

An aerial (fixed-wing) raptor/eagle nest survey was conducted on April 20, 2017 that encompassed a 10-mile buffer of the project area (**Figures 9, 10 and 11**). For any nests observed, the following was recorded: GPS location, approximate nest height, nest substrate, nest size, actively used or non-use, and species using nest. Three active nests, three inactive nests and ten individuals (three on nest and seven in flight or perched) were observed during the April 20, 2017 aerial survey (**Figures 10 and 11; Table 6-1**). Except for Nest 3, all nests are approximately five miles or greater from the project area. Refer to *Aerial Eagle/Raptor Nest Survey Report, Wenck 2017 (Apr 27)*, appended by reference.

Table 6-1: Eagle Nests Within Palmer's Creek Wind Farm Analysis Area.

Nest Number	Status	Distance from Project Area	Latitude	Longitude
1	Active	4.9 miles	44.90855599	-95.70717782
2	Inactive	8.5 miles	44.73293894	-95.42223611
3	Active	0.3 miles	44.83149047	-95.56799484
4	Active	7.0 miles	44.72996346	-95.48105437
5	Inactive	10.0 miles	44.67489358	-95.53845803
6	Inactive	9.0 miles	44.68952578	-95.53443812

Eagle nest density within the analysis area is approximately one active nest per 102,000 acres.

6.1.3.1 Eagle Mean Internest Distance

Eagle pairs that nest within one-half the mean project-area inter-nest distance are potentially susceptible to disturbance take and blade strike mortality, as these pairs and offspring may use the project footprint (USFWS 2013). The Eagle Conservation Plan Guidance (ECPG) recommends using the ½-MID to delineate territories and associated breeding eagles at risk of mortality or disturbance.

The 3 active bald eagle nests identified in the April 2017 aerial raptor survey (**Figure 11**) and the 1 active red-tailed hawk nest located in T116N R40W Section 11 (USFWS considers this an active eagle nest since it was historically documented as an eagle nest) were considered in this MID analysis following the ECPG.

The MID and 1/2-MID are presented in **Figures 12 and 13.** The analysis reveals the project area is situated within projected eagle territories. ½-MID boundaries covered all turbines, except WTG-18. These nesting eagles may be susceptible to mortality or disturbance. However, nearest eagle nest (red-tailed hawk nest in 2017) is situated 2,552 feet (0.48 miles) from the closest turbine (WTG-5). The nearest *active* eagle nest is located 4,662 feet (0.88 miles) from WTG-12. The project MID is 7,789.75 meters. The project ½-MID is 3,894.88 meters.

PCWF has shifted turbine placement from initial layout plans to minimize impacts to the Minnesota River and its associated ecosystem. See **Figure 2**.

PCWF has committed to implementing adaptive management strategies (i.e., apply new strategies as they evolve) for identifying and mitigating collision mortality at turbines and overhead lines.

6.1.4 Nesting Eagle Behaviors

A bald eagle nest was located Spring 2016 by Fagen. This nest was active in 2016 and 2017 and located in T116N R39W Section 20, immediately outside of the project area boundary. Fagen staff monitored this nest in 2016 and 2017 until all eaglets fledged (Michael Rutledge, Fagen Engineering, Personal Communication, December 2017). This nest was monitored for two 8-hour days/week during nesting season. "Local" flight data was recorded but not reported. "Local" flights were those where the birds merely changed perching locations within the immediate area. Flight vectors were reported for 8 compass points with the nest area at the center point (N, NE, E, SE, S, SW, W, NW). A “non-local” flight was reported as being in any given vector when the flight either originated in the nest area and terminated out of view, or originated out of view and terminated in the nest area. Two data points are reported for each vector: Total Flights and Food Bearing Flights.

The non-local flights occurred most often to the northwest of the nest in 2016 and southeast of the nest in 2017. See **Table 6-2** below.

Table 6-2: Eagle Nest Monitoring (T116N, R39W, Section 20)

Direction	2016 Nesting Season June 9 to August 25		2017 Nesting Season April 4 to August 10	
	Total Flights	Food Bearing Flights	Total Flights	Food Bearing Flights
North	17	1	8	1
Northeast	12	1	9	0
East	7	0	33	7
Southeast	15	1	96	14
South	24	0	75	11
Southwest	6	0	33	4
West	13	0	38	3
Northwest	90	4	25	1
Totals	**184**	**7**	**317**	**41**

6.1.5 Eagle Collision Risk Analysis

Based on 160 1-hour surveys from July 28, 2016, through June 16, 2017, Wenck observed 19 Bald Eagles. Project-specific and turbine-specific estimates of eagle fatality were calculated following the Eagle Conservation Plan Guidance Module 1- Land-based Wind Energy, Version 2 from the U.S. Fish and Wildlife Service (FWS) Division of Migratory Bird Management, April 2013. Using survey data, the hazardous area, Wenck estimated a potential eagle fatality amount of 0.1-0.5 fatalities per year. This constitutes a Stage 2 Assessment of potential project impacts to bald eagles. Note that these calculations do not account for the proportion of the project area that is hazardous. The 18 turbines represent a hazardous area of 0.14-0.76% of the 6,150-acre project footprint.

All the observed eagles were within or below the rotor sweep area (RSA) and are considered in the eagle fatality calculations. The turbine is assumed to be 80-90 meters tall with a rotor diameter of 116 meters. The radius is therefore approximately 58 meters. There were an additional eight incidental observations of bald eagles over the surveys. Most of the bald eagles were observed along the Minnesota River and all from point count locations 1, 2, 3, and 4.

The probability of avoidance is high for bald eagles (USFWS 2009 and 2013). The exposure rate for PCWF is 0.27 eagle-min/km^2-hr. Estimated eagle fatalities per year is 0.102. Over a 30-year project life, this equates to 3 eagle fatalities. Using a hazardous area equal to the rotor swept area instead of the default 25m radius yields a high-end annual fatality rate of 0.6 eagles or 16.5 over the life of the project.

This annual eagle fatality rate means that the project area qualifies as a Category 2 – High or Moderate Risk to Eagles (USFWS 2013). A project qualifies for Category 2 if it:

1. Has an important eagle-use area or migration concentration site within the project area but not in the project footprint; or
2. Has an annual eagle fatality rate estimate between 0.03 eagles per year and 5% of the estimated local-area population size; or
3. Causes cumulative annual take of the local area population of less than 5% of the estimated local population size.

The annual eagle fatality estimate is above 0.03 eagles per year. The project site is located within the Bald Eagle Management Unit 3: Great Lakes area with an approximate eagle density from the 2009 US Fish and Wildlife Service Final Environmental Assessment: Proposal to Permit Take as Provided Under the Bald and Golden Eagle Protection Act of 0.062 bald eagles per square mile. When a 53-mile buffer is used, the 5% benchmark level is 6.9 eagles per year. Therefore, even using the conservative estimate of a 58-m radius hazardous area, the project would cause a cumulative annual take of less than 5% of the local area population (Wenck 2017).

6.2 ACOUSTIC BAT SURVEYS

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

Staff of Fagen Engineering 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 15 October 2016. Three additional Anabat recorders were launched on 03 August 2016. **Refer to Figure 7, Bat Monitor Locations.** The data collected from Fagen was sent to NCE. NCE then took the data and processed 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.

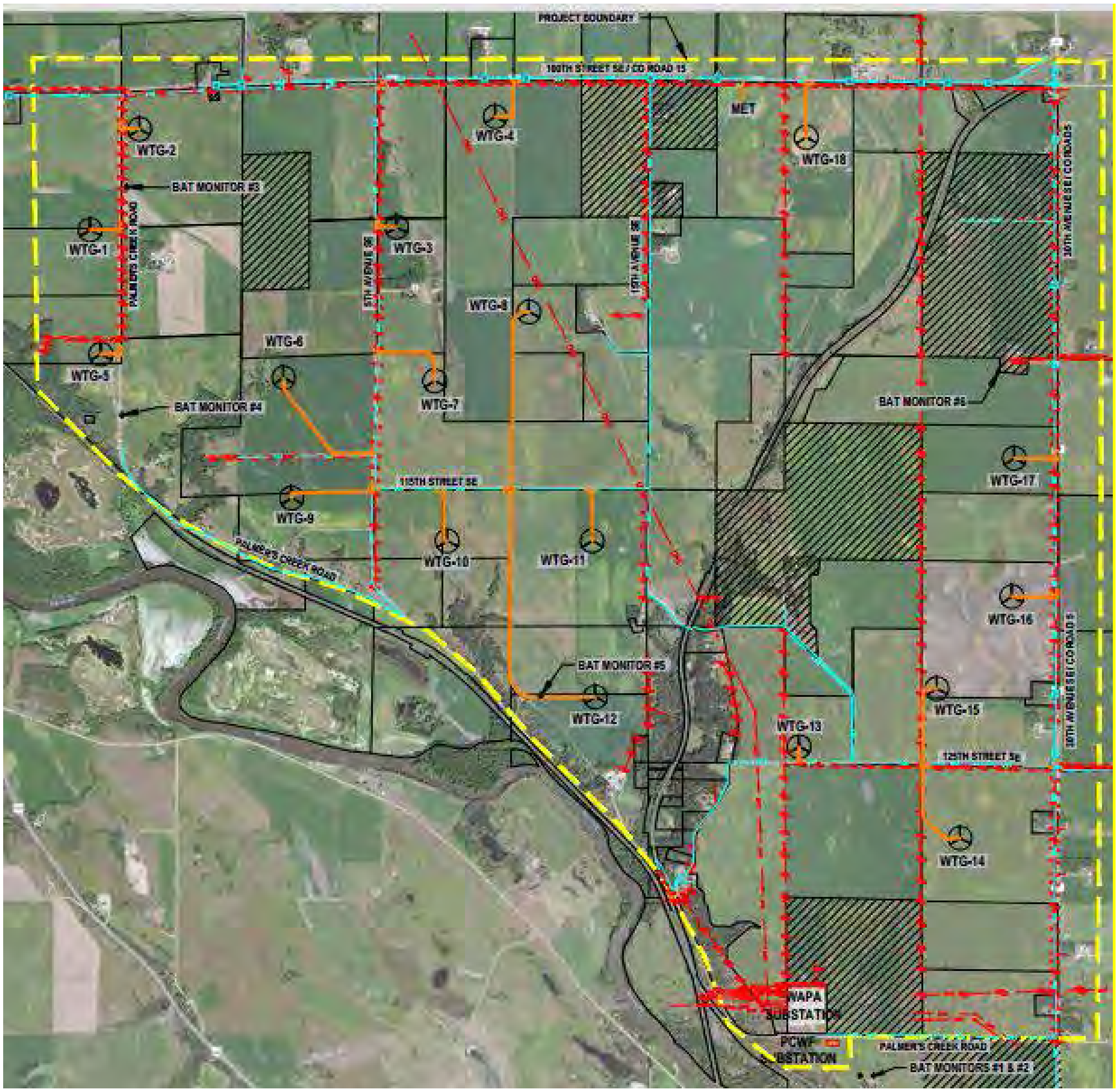

Figure 7. Bat Detector Locations at Palmer's Creek Wind Farm.

Bat Monitors (BM) 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 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.

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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 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*).

Staff of Fagen Engineering deployed four separate zero-crossing systems (**Figure 7**: Monitors 1, 2, 4 and 5) and two Wildlife Acoustics SM3 full-spectrum systems (**Figure 7**: Monitors 3 and 6) to record bat activity throughout the study area from 27 March through 16 October 2017. The data collected by Fagen Engineering was sent to NCE, where it was analyzed, as appropriate, with either Kaleidoscope version 3.1.8 (in zero-crossing mode) or Sonobat 3 (full-spectrum only) to evaluate diversity and abundance of bat species at the Palmer's Creek site. 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. Each detector had a total of 203 functioning detector nights (for a total of 1218 detector nights), with a preliminary average bat pass per detector night at 143.93 detected. This average is subject to some adjustment due to inter-related technological and ecological issues.

The site has significant bat activity from species shown to be at high risk of mortality at wind energy facilities in carcass surveys: the hoary, silver-haired, and eastern red bats, and the big and little brown bats (e.g., Gruver and Bishop-Boros 2015). Additionally, the big brown bat and little brown bat are also species of special conservation concern in Minnesota. The northern long-eared myotis is absent from the site, and the tricolored bat (which is also a species of special conservation concern in Minnesota) appears to be rare in the Palmer's Creek area (NCE 2017).

A corrected bat passes per detector night (BPDN) of between 50.7 and 34.8 is high for pre-construction surveys of potential wind energy sites in Minnesota, and is in the ballpark for what might be expected of the best bat habitat (Johnson et al. 2003). However, as the site's sampling is heavily biased toward the best bat habitat within or near the projected project footprint (due in part to regulator requests for sampling at specific sites), this is not too surprising, and it is reasonable to expect that the bat activity characteristic of the rotor area will be as much as 15 times less (Johnson et al. 2003). In total, if the net effect of accounting for the known high bias in habitat quality and the potential high bias due to improved data capture of new technology is taken into account, the Palmer's Creek site could have an adjusted BPDN <10. Consequently, bat mortality from the construction and operation of the proposed facility is likely within the normal range of such facilities in Minnesota (NCE 2017).

Palmer's Creek has committed to feathering the turbine blades. Feathering the blades when the wind is below the manufacturer's cut-in speed would reduce bat fatalities on the order of 70% at some sites without costing operators anything beyond operations time to implement the treatment, assuming the turbines are capable of being automated and do not require manual adjustments to curtail, which is logistically and financially challenging. Feathering blades below the manufacturer's cut-in speed should be implemented at all facilities where possible (NWCC 2012). Palmer’s Creek has committed that for all turbines and at all times, the hub would not be locked, but blades would be feathered to the wind such that revolution per minute would be minimal during periods when wind speed is less than the projects set cut-in speed [3.0 m/s].

7.0 Best Management Practices

7.1 WILDLIFE CONSERVATION MEASURES

Palmer's Creek has committed to implement several Best Management Practices (BMPs) and conservation measures for wildlife, derived from the Upper Great Plains Wind Energy Final Programmatic EIS (WAPA 2015). To implement these BMPs, several project plans and guidance documents will be developed for the Project prior to construction and operation. These plans will provide detailed information and implementation steps for BMPs that will benefit birds, bats, and their habitat. These plans are summarized in **Table 7-1, Summary of Project Plans and BMPs for Bird/Bat Protection**. Specific best management practices and conservation measures for birds and bat as they relate to the Project are identified in **Appendix B**. For the Project and Palmer's Creek to comply with the Site Permit Application and environmental assessment (EA), a detailed and complete list of BMPs were consulted on with DOC, MNDNR, USFWS and WAPA. This complete list is *appended by reference* and provided as an appendix in both the Site Permit Application and the EA for the Project.

Table 7-1: Summary of Project Plans and BMPs for Bird/Bat Protection.

Plan	Project BMPs Identified by Plan	Avian and Bat Protection Accomplished
Site Design Plans · Layout · Controlled Inspection/Cleaning Area · Excess Cut/Fill Placement · Profile · Erosion Control · Meteorological Towers · Re-fueling Areas · Engineered controls (e.g., fencing) · Drainage · Avoidance of important areas for wildlife · Utilize existing clearings in forests/shrublands · Consolidate facilities · Slope Stability Analysis · Co-location of t-lines, roads with existing/shared ROWs · Avoid aquifer conduits · Utilize dikes, swales, and lined ditches · Lighting guidelines	· Dust control · Erosion control · Site drainage · Ground disturbance · Use existing natural features (rocks, vegetation, drainage features) · Guy wires · Contamination · Safety · Fragmentation · Sediment transport · Lighting	· Dust control to minimize impacts to insects for forage. · Minimize impacts to habitat loss. · Guy wire marking to minimize avian/bat collision. · Engineered barriers prevent injury/death to unauthorized wildlife. · Avoidance of important wildlife areas minimizes direct/indirect impacts to birds/bats. · Fragmentation removes natural wildlife corridors/patterns. · Timed shut-off minimize light drawing insects, thus minimizes likelihood of birds/bats. · Downward-facing lights minimized horizontal and skyward illumination making unnatural light. Could confuse birds/bats.

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Plan	Project BMPs Identified by Plan	Avian and Bat Protection Accomplished
Construction Plan · Explosives · Maintenance Activities	· Litter control · Ground disturbance	· Minimize impacts to habitat loss.
Decommission Plan · Contour · Hazardous Materials and Waste · Well removal · Subsoil decompaction	· Ground disturbance · Structure removal · Contamination · Vegetation establishment	· Contouring creates natural landscape to minimize fragmentation. · Minimize impacts to habitat. · Soil decompaction allows easy vegetation establishment!
Noxious Weed & Invasive Plant Control Plan · Facility Monitoring · Certified weed-free mulch · Surface Disturbance · Fill Materials · Clean vehicles · Blading avoidance of native vegetation	· Invasive species · Spread of invasive species · Revegetation	· Minimize impacts to habitat. · Invasive species out-compete natural species, can change ecological function.
Hazardous Materials Plan · Vehicle Maintenance · Excess excavation materials · Waste storage facilities · Storage, Use & Transportation · Drip pans	· Contamination · Erosion control	· Minimize impacts to terrestrial and aquatic habitat of birds/bats.
Integrated Pest & Vegetation Management Plan · Pesticides/herbicides	· Contamination	· Minimize impacts to terrestrial and aquatic habitat of birds/bats.
Site Restoration Plan · Restoration Timing · Temporary Use Areas · Contours · Weed-free native grasses, forbs, and shrubs · Road-cuts · Preserve specimen trees · Preserve nonhazardous rock outcroppings · Topsoil segregation and spread · Planting pockets	· Erosion control · Invasive weed control · Contours · Revegetation	· Minimize impacts to terrestrial and aquatic habitat of birds/bats. · Invasive species out-compete natural species, can change ecological function. · Contouring creates natural landscape to minimize fragmentation. ·

8.0 Monitoring Studies

Palmer's Creek Wind Farm has committed to conduct one year of eagle nest monitoring (refer to **Appendix D**); and avian and bat fatality monitoring for three years, 4 times per week (March 15 to November 15) and two times per month from December through January after the wind farm is operational. The fatality monitoring protocol is outlined in **Appendix C, Protocol: Post-Construction Avian and Bat Studies.** These protocols adhere to the Land-based Wind Energy Guidelines (USFWS 2013). These monitoring studies will be used to inform operational minimization measures to reduce the direct impact to birds and bats.

9.0 References

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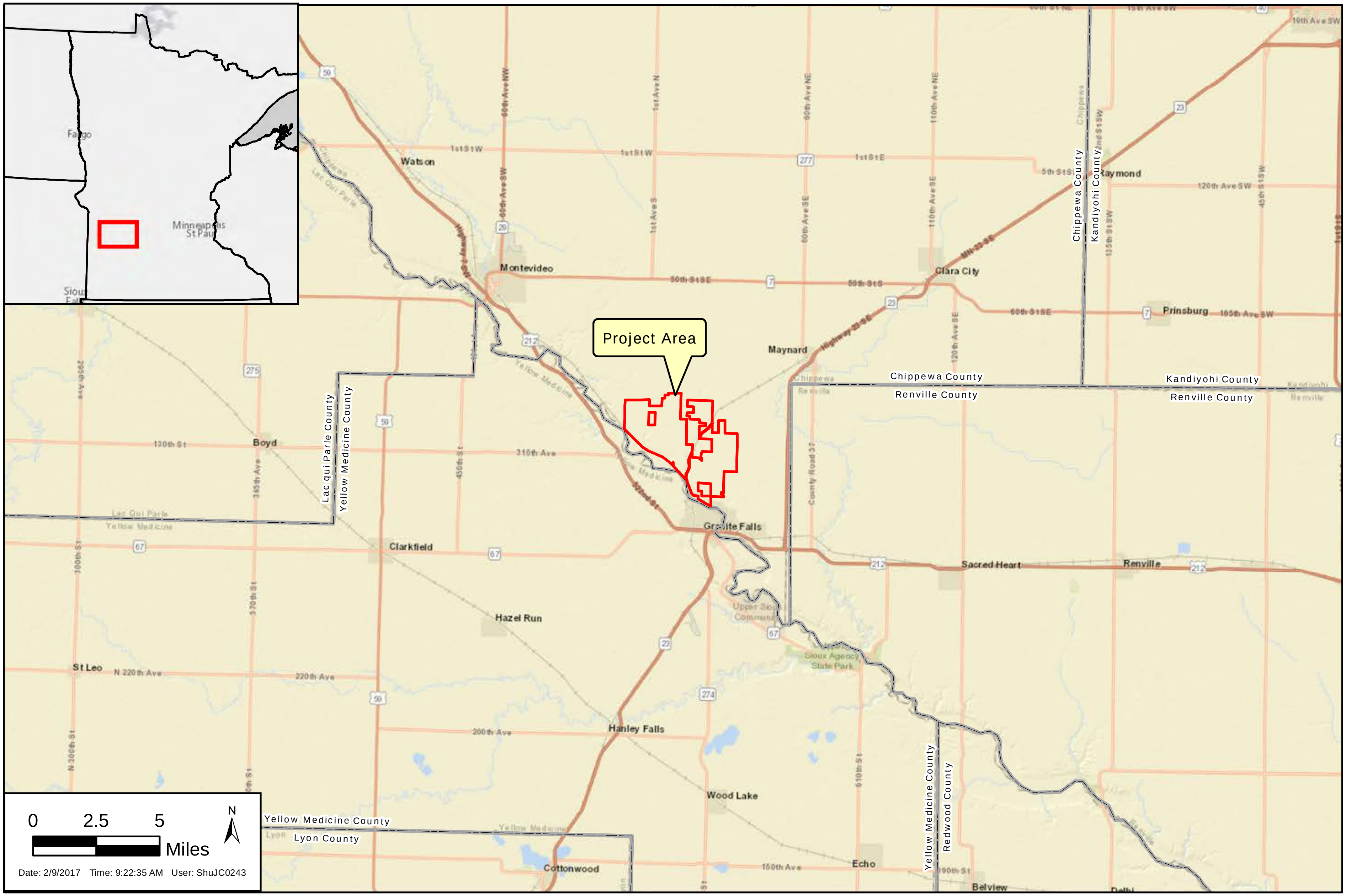
Figures



PALMER'S CREEK WIND FARM, LLC

Site Location Map

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Figure 1

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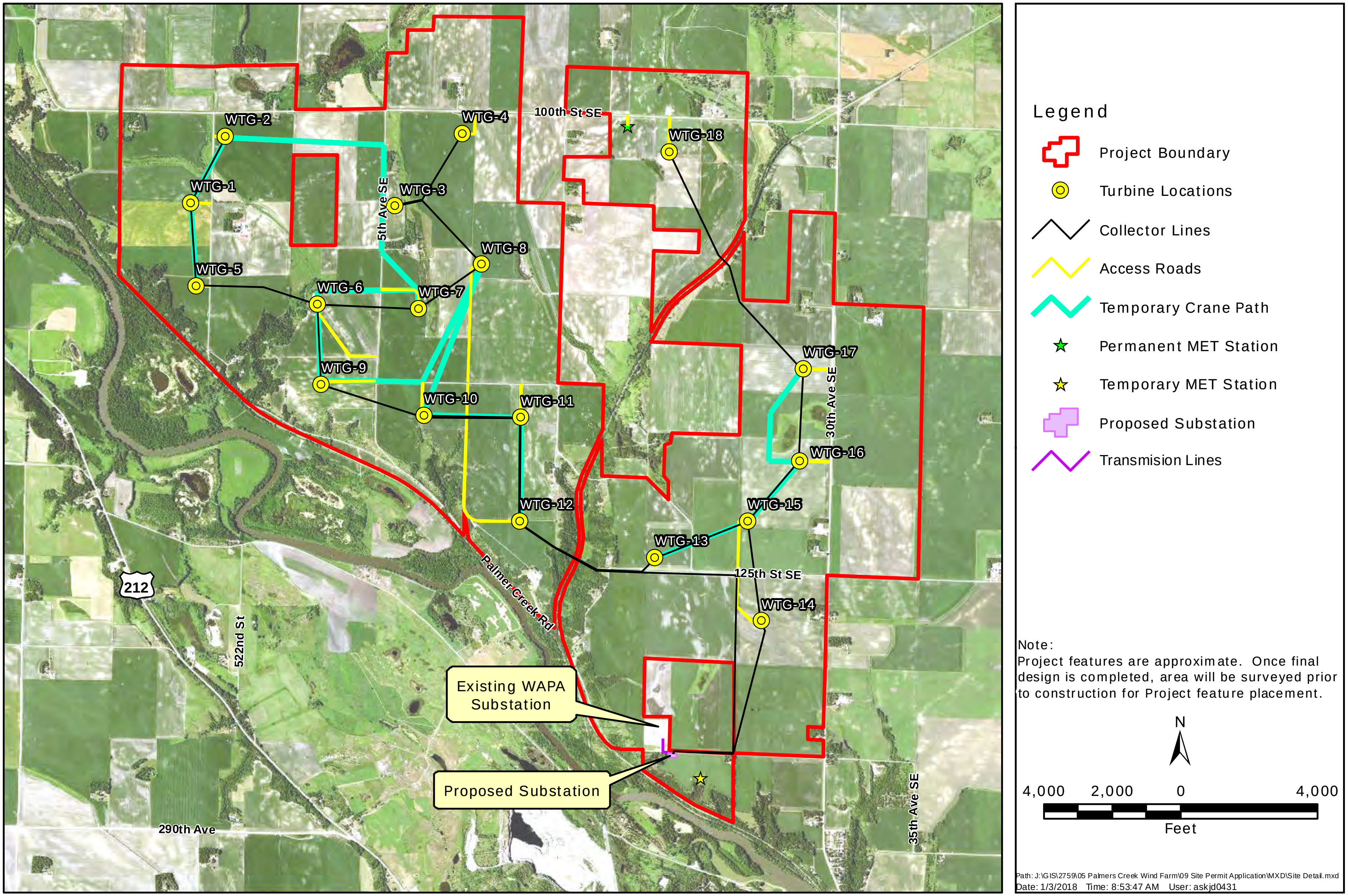

PALMER'S CREEK WIND FARM, LLC

Site Detail Map

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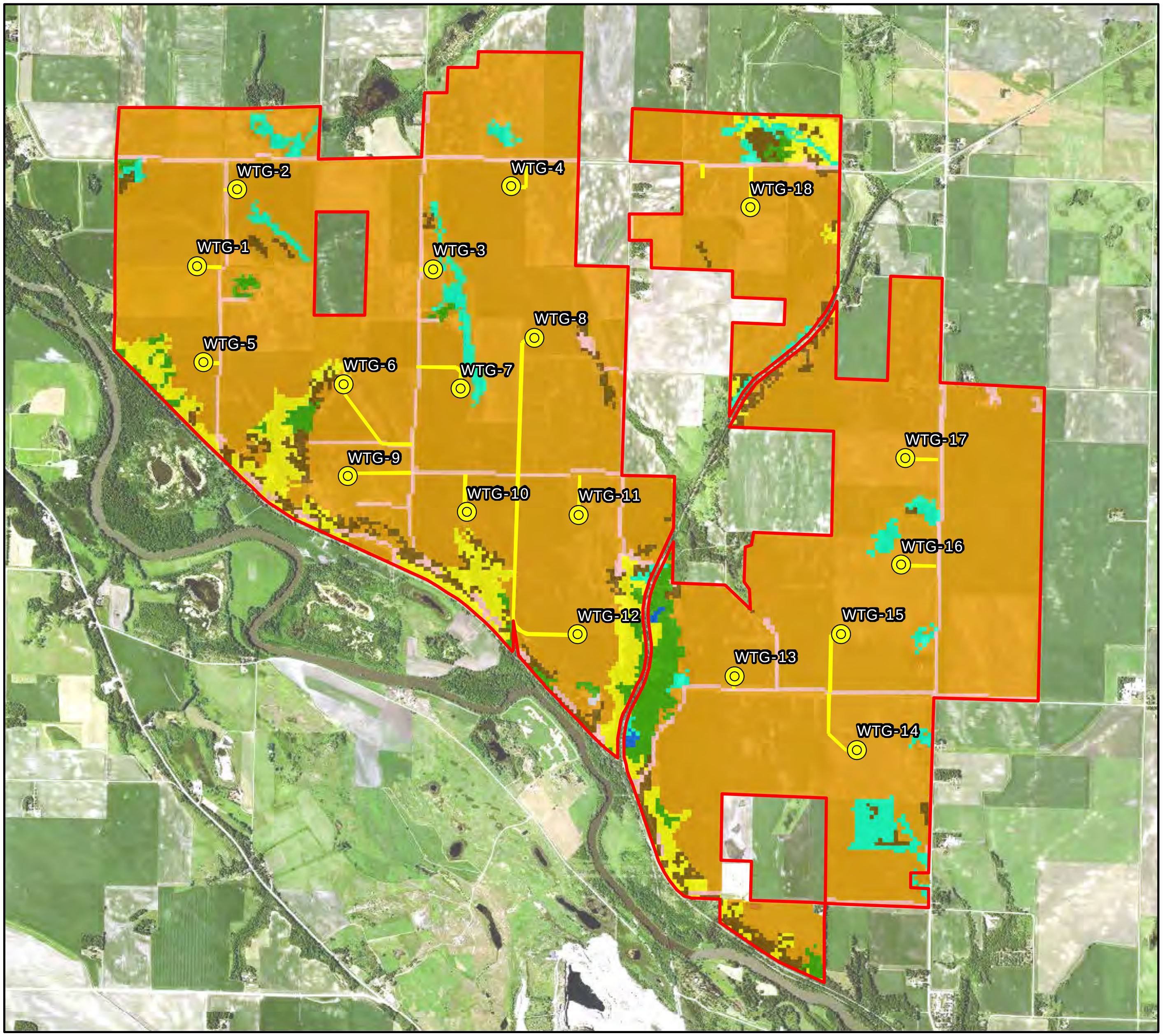
Figure 2



Legend

- Project Boundary
- Turbine Locations
- Access Roads

NLCD 2011

- Barren Land
- Cultivated Crops
- Wooded
- Developed
- Wetland
- Hay/Pasture
- Grassland
- Open Water
- Proposed Substation

Note:
Project features are approximate. Once final design is completed, area will be surveyed prior to construction for Project feature placement.

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PALMER'S CREEK WIND FARM, LLC

Land Cover

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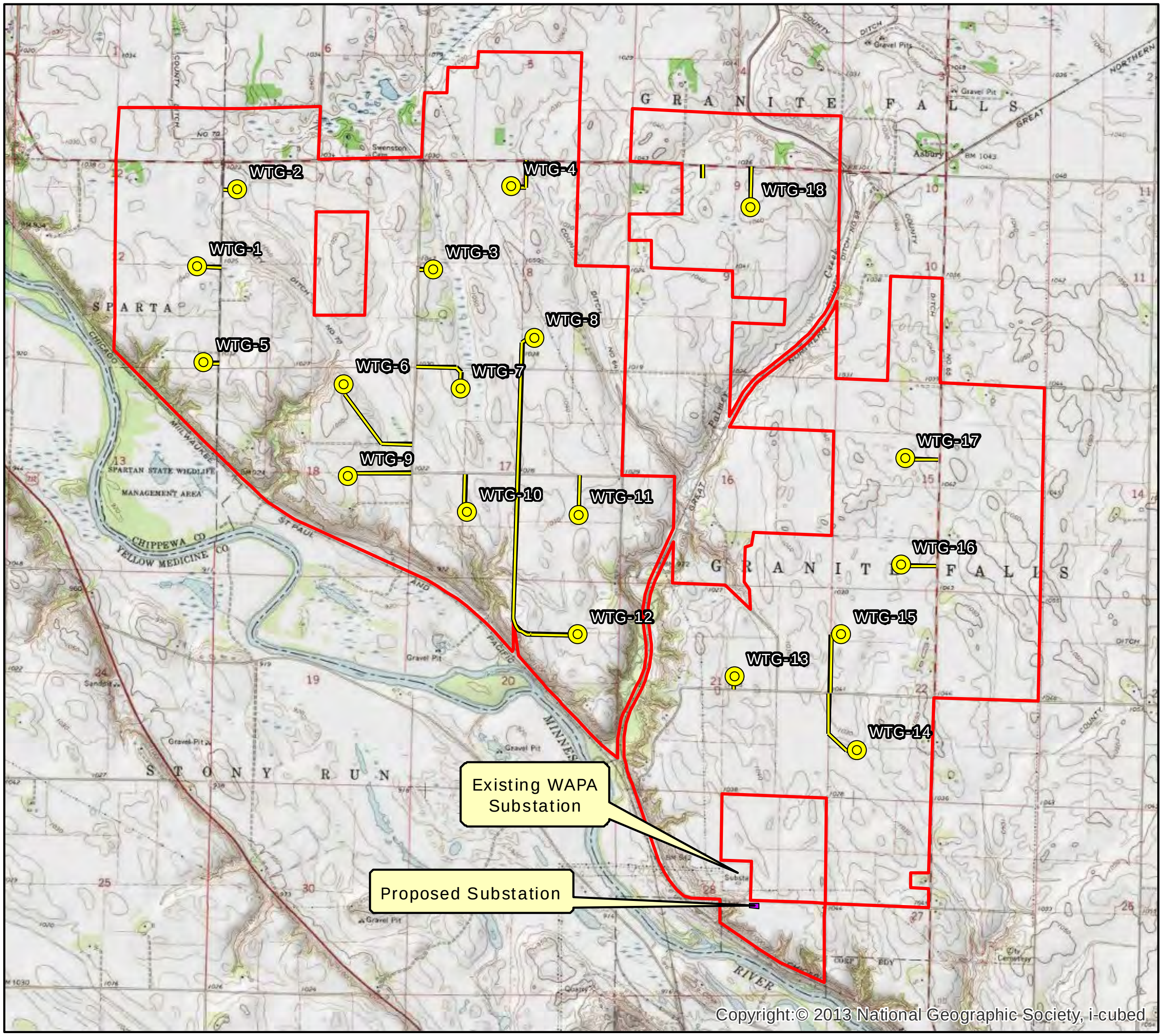
Figure 3



Legend

- Project Location
- Turbine Locations
- Access Roads
- Proposed Substation

Note:
Project features are approximate. Once final design is completed, area will be surveyed prior to construction for Project feature placement.

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PALMER'S CREEK WIND FARM, LLC

Topographic Map

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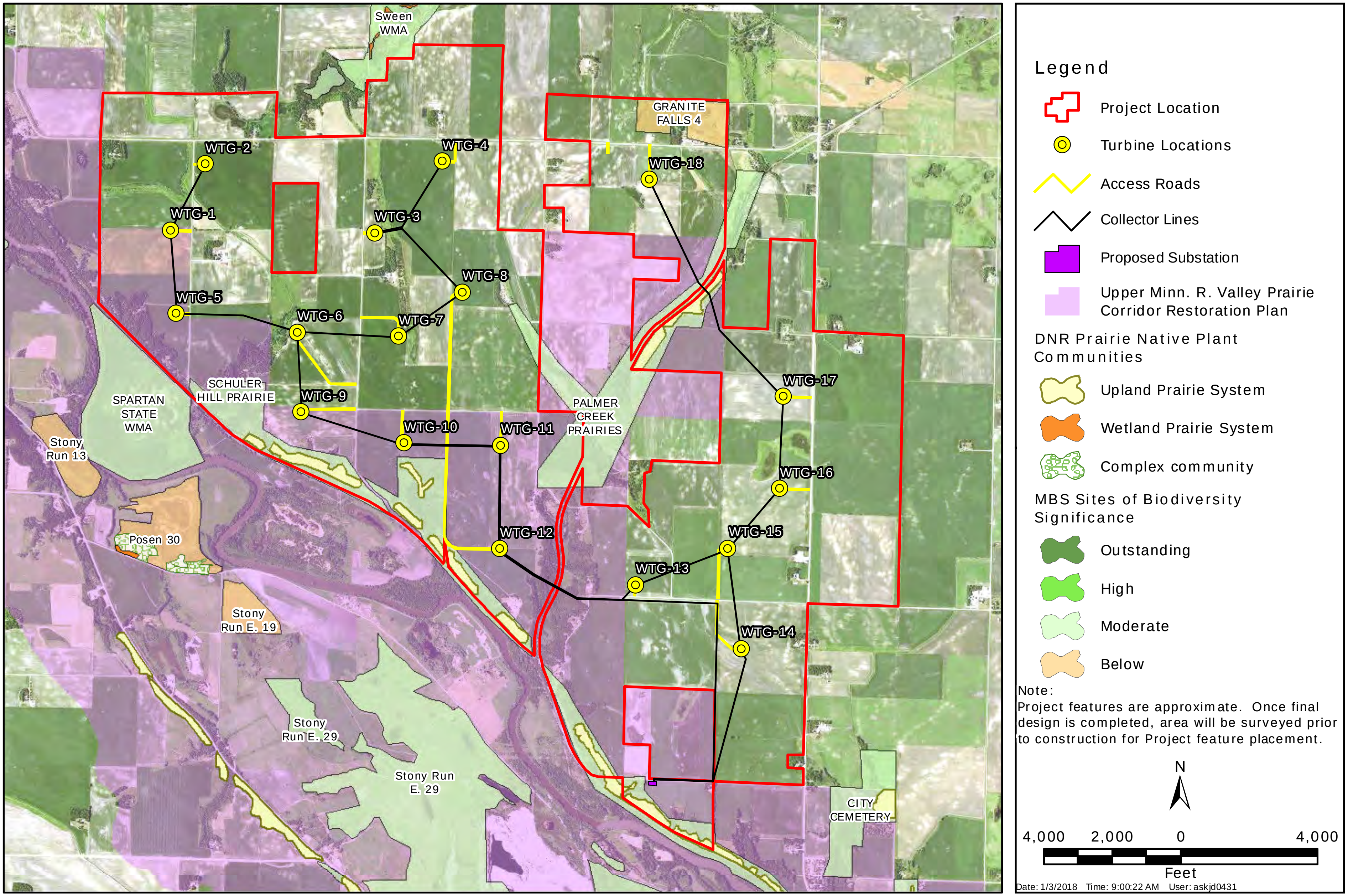
DEC 2017

Figure 4



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Ecologically Significant Areas

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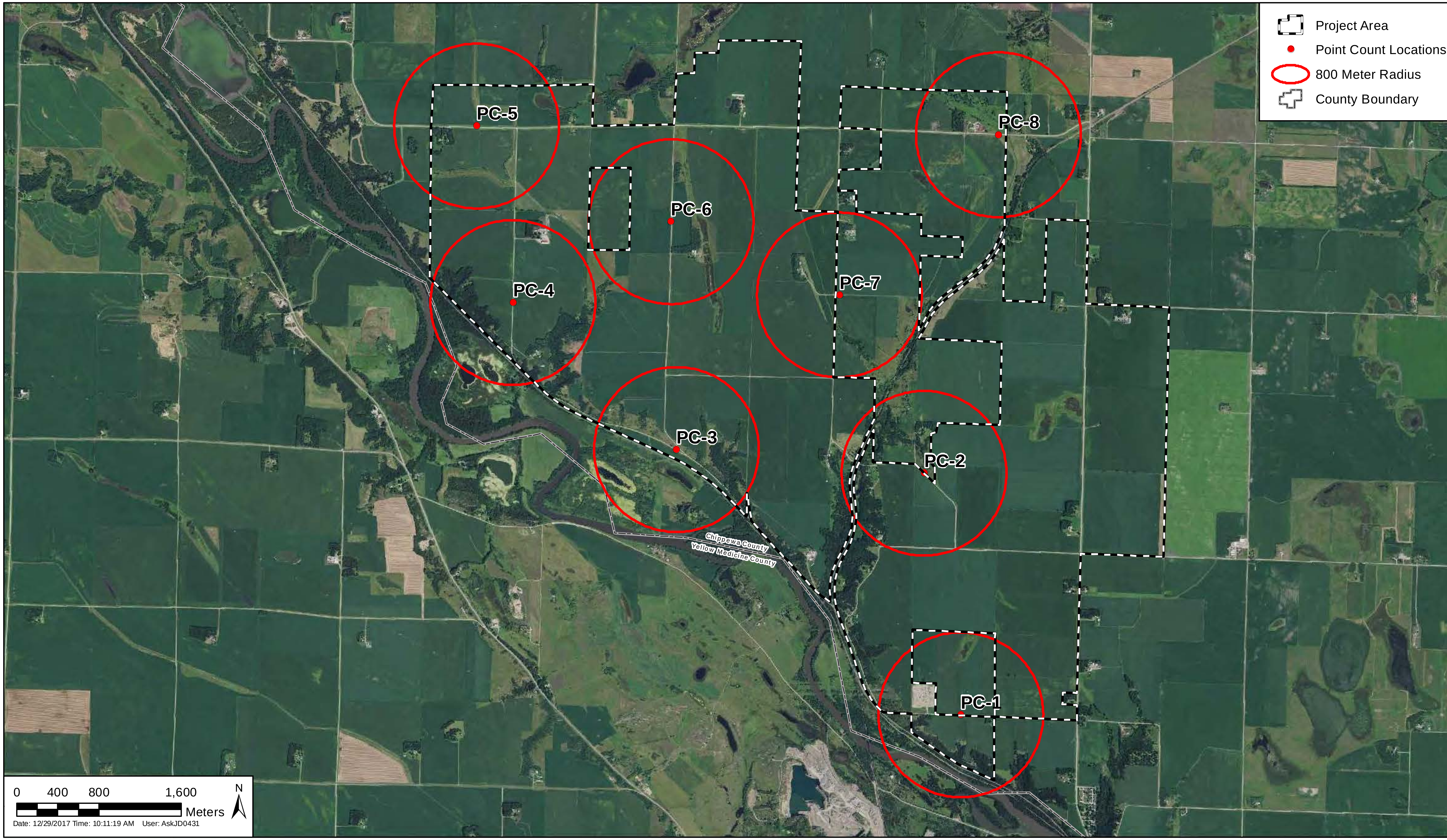
Figure 5



PALMER'S CREEK WIND FARM

Point Count Locations

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Figure 6

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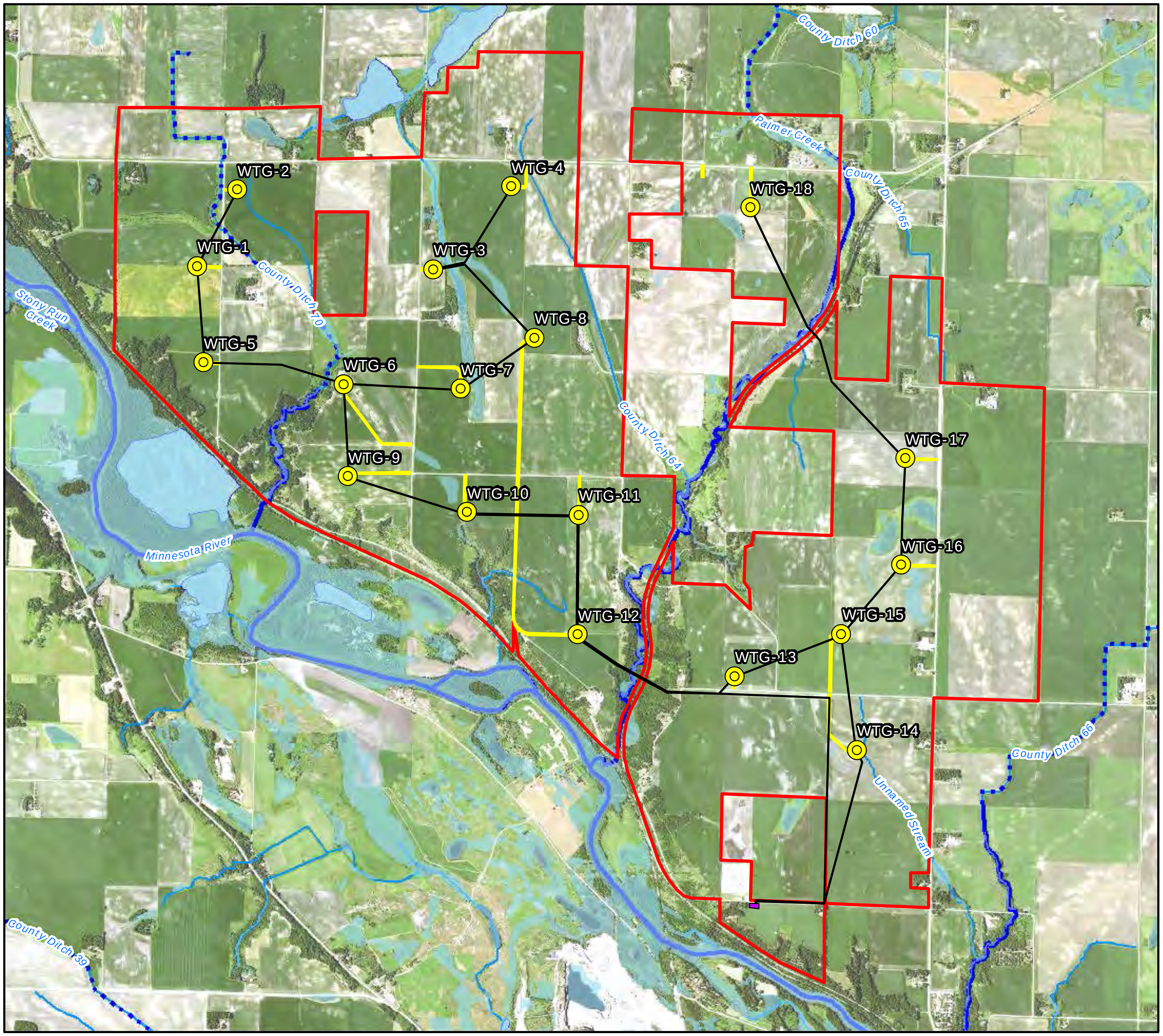

Project Boundary

Turbine Locations

Access Roads

Collector Lines

National Wetlands Inventory

Public

Public Ditch/Altered

Public Waters Basins

Rivers and Streams

Proposed Substation

Note:
Project features are approximate. Once final design is completed, area will be surveyed prior to construction for Project feature placement.

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PALMER'S CREEK WIND FARM, LLC

Waterbodies and Wetlands

WENCK ASSOCIATES

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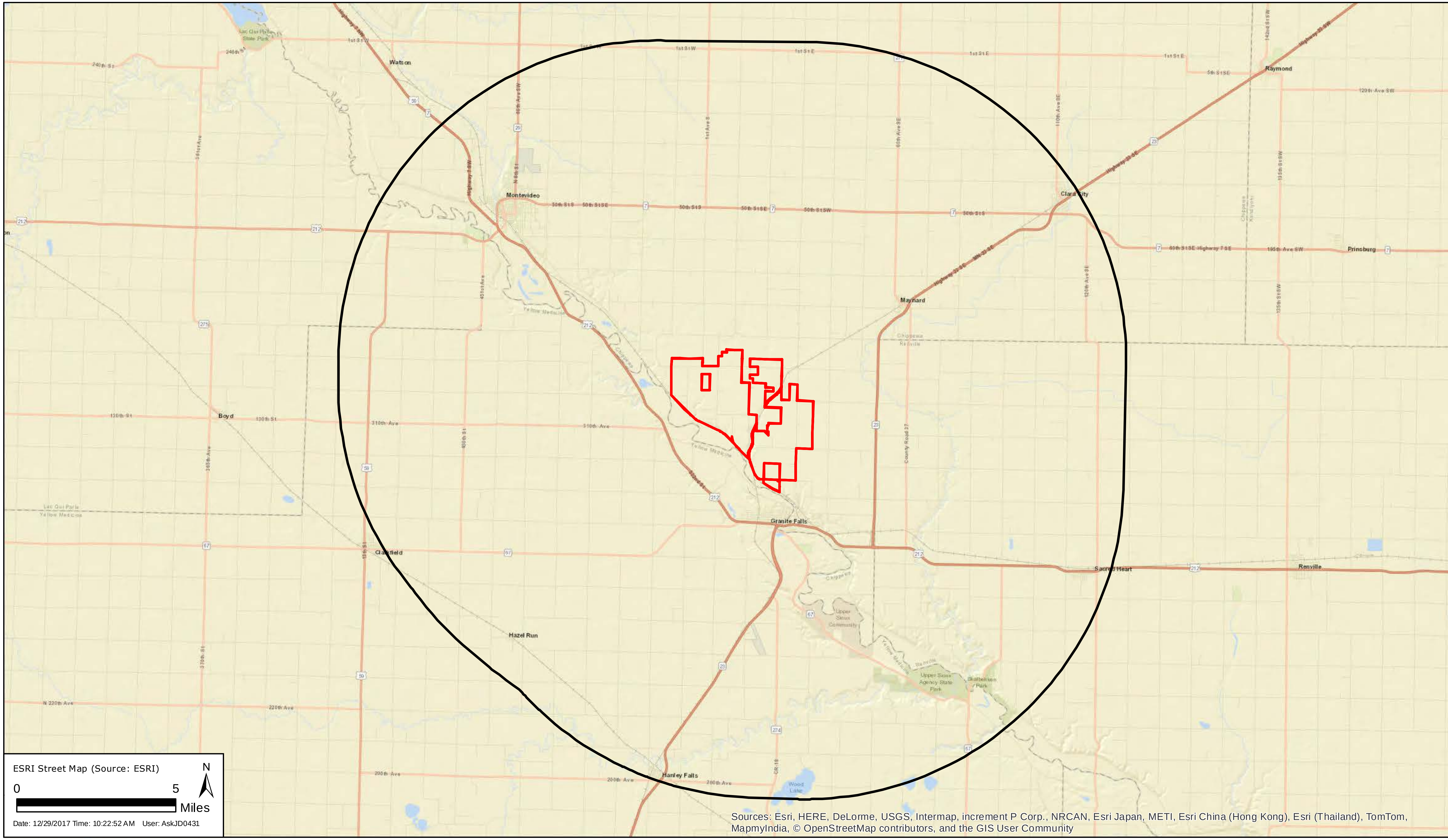
DEC 2017

Figure 8



PALMER'S CREEK WIND FARM, LLC	WENCK ASSOCIATES Responsive partner. Exceptional outcomes.	DEC 2017
Fixed-Wing Aerial Eagle/Raptor Nest Analysis Area		Figure 9

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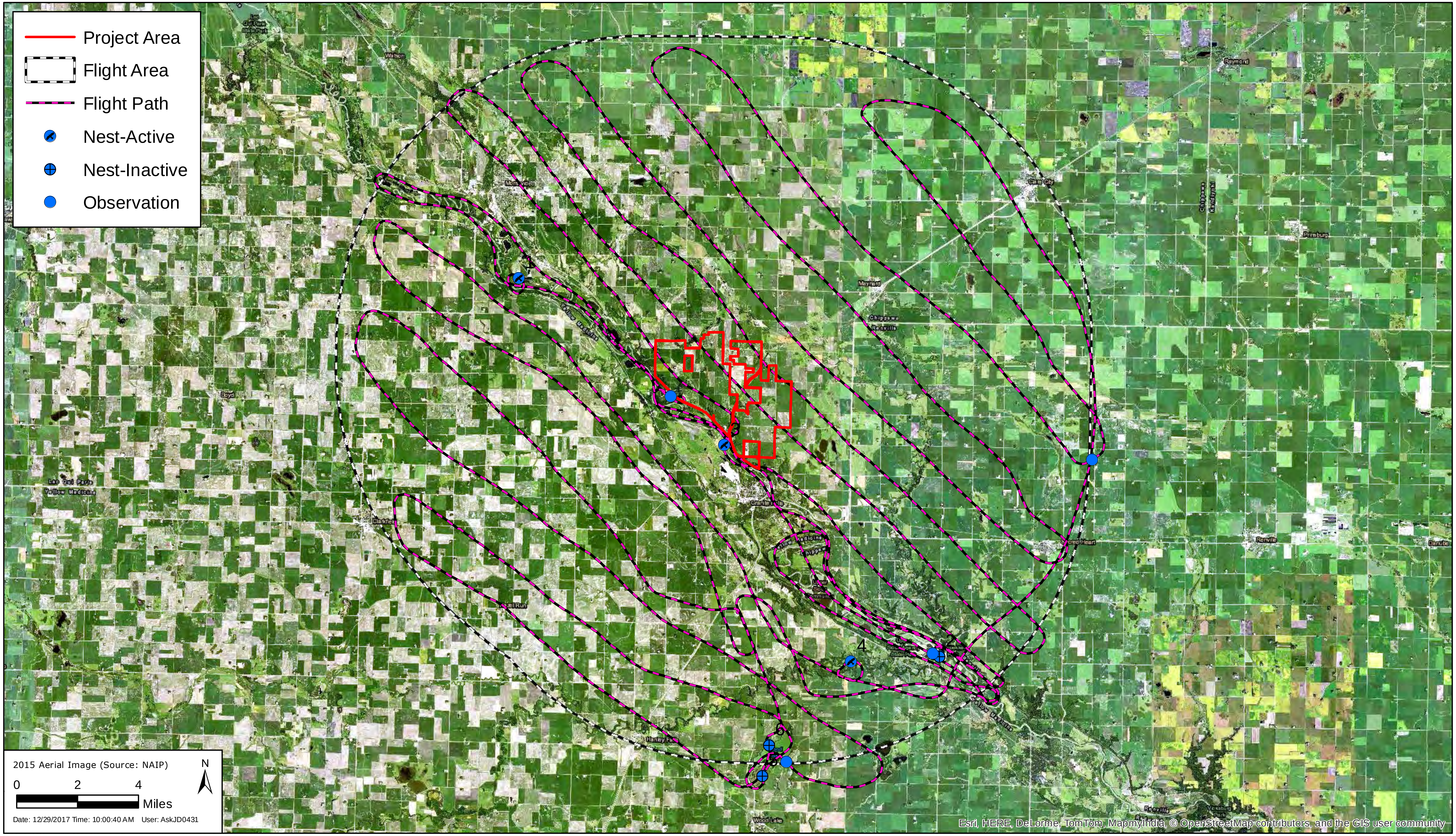

PALMER'S CREEK WIND FARM, LLC	WENCK ASSOCIATES Responsive partner. Exceptional outcomes.	DEC 2017
Fixed-Wing Aerial Eagle/Raptor Nest Flight Path and Results		Figure 10

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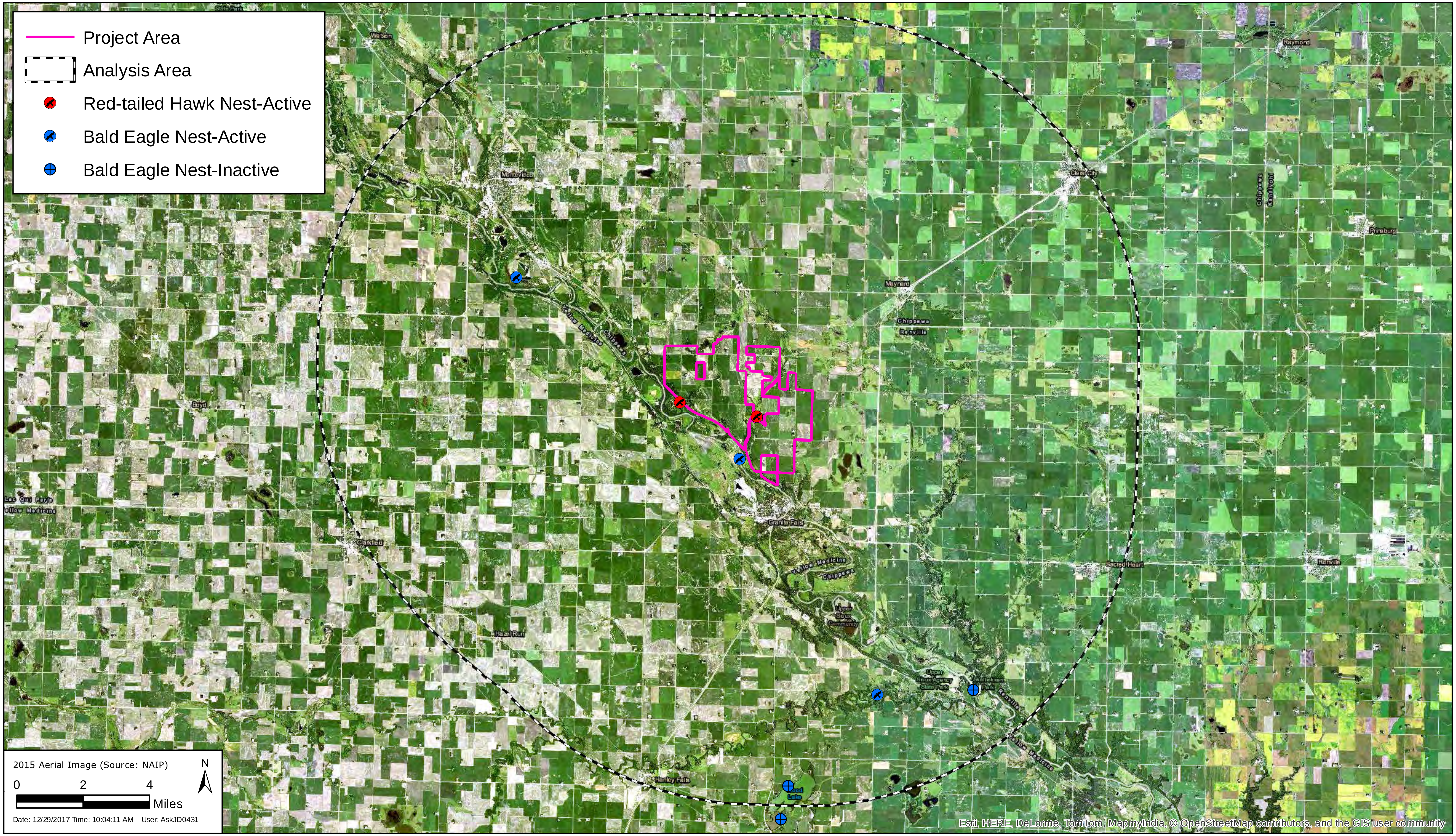

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PALMER'S CREEK WIND FARM, LLC	DEC 2017
Eagle/Raptor Nest Locations	Figure 11

WENCK ASSOCIATES
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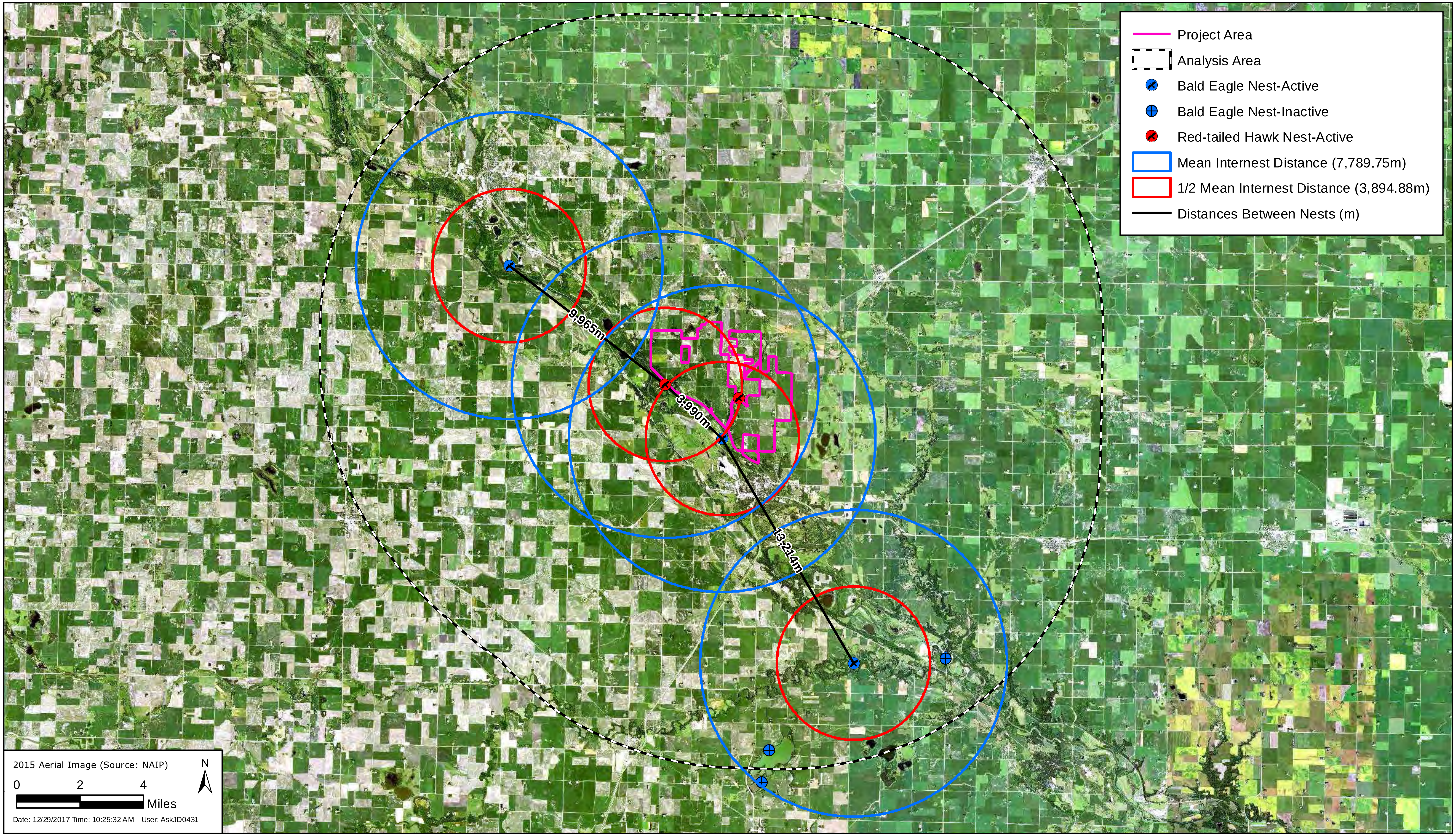

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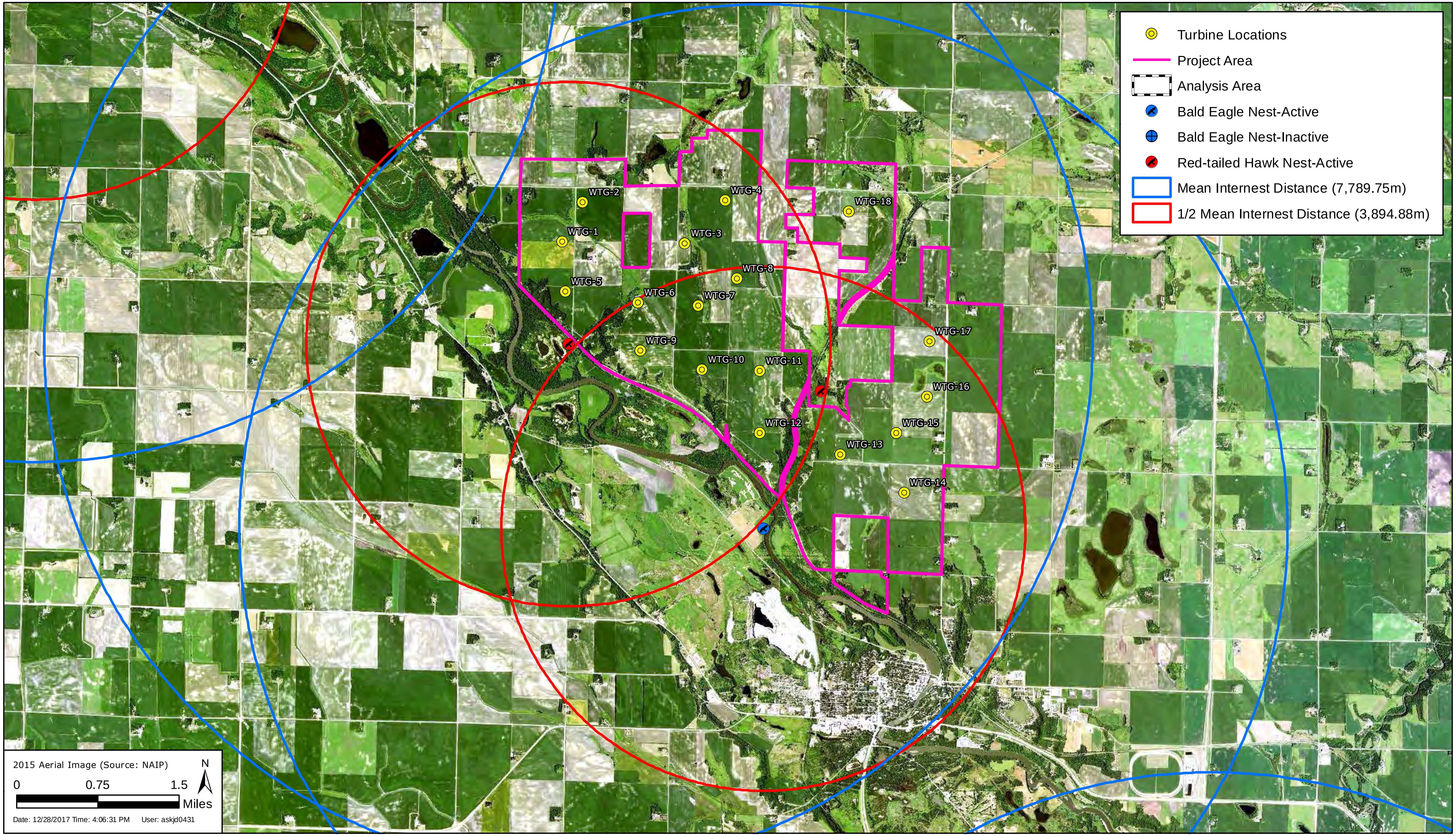
PALMER'S CREEK WIND FARM, LLC	WENCK Responsive partner. Exceptional outcomes.	DEC 2017
Nest Locations and Mean Internest Distance within 10-Mile Analysis Area		Figure 12



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PALMER'S CREEK WIND FARM, LLC

Project Area Mean Internest Distance

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Figure 13

Appendix A

Avian Point Count Results, Final (Wenck 2017)

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	34	1054	990	3.66	19.63%	8	2.78%	93.93%	98.69%	1.31%	0.00%	0.05	3.13%	0.00%	0.00%	0.00%	5.76%	0.00%	0.00%	0.61%	90.51%
Red-winged Blackbird	SB	52	688	676	2.39	12.82%	34	11.81%	98.26%	95.27%	4.73%	0.00%	0.11	0.15%	0.59%	0.00%	9.32%	7.69%	7.69%	23.37%	0.59%	50.59%
American Crow	C	73	566	360	1.97	10.54%	29	10.07%	63.60%	80.00%	20.00%	0.00%	0.25	23.06%	6.39%	10.28%	5.56%	20.28%	4.72%	13.61%	7.22%	8.89%
Brown-headed Cowbird	SB	33	375	325	1.30	6.99%	27	9.38%	86.67%	100.00%	0.00%	0.00%	0.00	4.62%	1.85%	2.46%	5.54%	12.92%	16.31%	14.77%	4.31%	37.23%
Canada Goose	WF	34	348	250	1.21	6.48%	12	4.17%	71.84%	12.00%	46.00%	42.00%	0.40	7.20%	0.00%	2.40%	24.80%	24.00%	7.20%	0.00%	34.40%	0.00%
Horned Lark	SB	53	199	171	0.69	3.71%	18	6.25%	85.93%	100.00%	0.00%	0.00%	0.00	2.92%	1.17%	1.75%	1.17%	11.11%	0.58%	16.37%	3.51%	61.40%
Barn Swallow	SB	26	188	188	0.65	3.50%	26	9.03%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	1.06%	0.00%	0.00%	0.00%	0.00%	0.00%	98.94%
Rock Pigeon	PD	49	172	166	0.60	3.20%	26	9.03%	96.51%	92.77%	7.23%	0.00%	0.04	24.10%	6.02%	7.23%	7.83%	4.22%	0.60%	7.23%	8.43%	34.34%
Blue Jay	C	58	148	81	0.51	2.76%	38	13.19%	54.73%	100.00%	0.00%	0.00%	0.00	11.11%	12.35%	13.58%	8.64%	13.58%	8.64%	13.58%	8.64%	9.88%
American Goldfinch	SB	38	146	146	0.51	2.72%	33	11.46%	100.00%	98.63%	1.37%	0.00%	0.01	14.38%	5.48%	31.51%	10.27%	17.12%	5.48%	2.05%	0.68%	13.01%
Wild Turkey	GB	10	139	0	0.48	2.59%	2	0.69%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Snow Bunting	SB	6	109	109	0.38	2.03%	0	0.00%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	15.60%	0.00%	0.00%	15.60%	0.00%	18.35%	0.00%	50.46%
Field Sparrow	SB	44	107	62	0.37	1.99%	39	13.54%	57.94%	100.00%	0.00%	0.00%	0.00	6.45%	0.00%	3.23%	3.23%	3.23%	3.23%	1.61%	0.00%	79.03%
Dark-eyed Junco	SB	13	100	100	0.35	1.86%	6	2.08%	100.00%	100.00%	0.00%	0.00%	0.00	7.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.00%	5.00%	68.00%
Common Grackle	SB	14	89	89	0.31	1.66%	8	2.78%	100.00%	84.27%	15.73%	0.00%	0.05	2.25%	4.49%	1.12%	25.84%	21.35%	5.62%	5.62%	33.71%	0.00%
Black-capped Chickadee	SB	16	80	76	0.28	1.49%	9	3.13%	95.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	2.63%	0.00%	0.00%	10.53%	6.58%	0.00%	80.26%
Unknown Duck	WF	12	74	52	0.26	1.38%	5	1.74%	70.27%	0.00%	100.00%	0.00%	0.18	26.92%	0.00%	0.00%	71.15%	0.00%	1.92%	0.00%	0.00%	0.00%
Mallard	WF	17	60	31	0.21	1.12%	4	1.39%	51.67%	45.16%	6.45%	48.39%	0.01	58.06%	19.35%	0.00%	3.23%	6.45%	0.00%	0.00%	9.68%	0.00%
Unidentified Sparrow	SB	5	60	59	0.21	1.12%	0	0.00%	98.33%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	44.07%	0.00%	55.93%
American Robin	SB	26	53	30	0.18	0.99%	16	5.56%	56.60%	100.00%	0.00%	0.00%	0.00	13.33%	0.00%	23.33%	13.33%	20.00%	6.67%	3.33%	10.00%	10.00%
Red-tailed Hawk	RVO	41	45	43	0.16	0.84%	18	6.25%	95.56%	39.53%	46.51%	13.95%	0.07	16.28%	9.30%	4.65%	23.26%	16.28%	6.98%	9.30%	9.30%	4.65%
Unknown Blackbird	SB	1	40	40	0.14	0.75%	1	0.35%	100.00%	0.00%	100.00%	0.00%	0.14	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
American Tree Sparrow	SB	5	38	37	0.13	0.71%	5	1.74%	97.37%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	35.14%	64.86%
Ring-necked Pheasant	GB	23	37	8	0.13	0.69%	10	3.47%	21.62%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	75.00%	0.00%	12.50%	12.50%	0.00%	0.00%
Mourning Dove	PD	23	34	24	0.12	0.63%	17	5.90%	70.59%	95.83%	4.17%	0.00%	0.00	45.83%	0.00%	12.50%	4.17%	4.17%	8.33%	25.00%	0.00%	0.00%
Tree Swallow	SB	13	30	30	0.10	0.56%	9	3.13%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.33%	10.00%	86.67%
Turkey Vulture	RVO	15	28	28	0.10	0.52%	9	3.13%	100.00%	14.29%	75.00%	10.71%	0.07	0.00%	0.00%	21.43%	14.29%	3.57%	0.00%	7.14%	46.43%	7.14%
Bald Eagle	RVO	21	27	26	0.09	0.50%	6	2.08%	96.30%	34.62%	30.77%	34.62%	0.03	19.23%	11.54%	0.00%	19.23%	23.08%	3.85%	0.00%	15.38%	7.69%
Cedar Waxwing	SB	8	27	22	0.09	0.50%	6	2.08%	81.48%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	36.36%	31.82%	31.82%	0.00%	0.00%	0.00%	0.00%
Ring-billed Gull	GT	6	25	25	0.09	0.47%	6	2.08%	100.00%	32.00%	68.00%	0.00%	0.06	0.00%	0.00%	0.00%	4.00%	8.00%	0.00%	8.00%	12.00%	68.00%
Killdeer	SH	16	23	11	0.08	0.43%	11	3.82%	47.83%	100.00%	0.00%	0.00%	0.00	36.36%	0.00%	18.18%	0.00%	0.00%	0.00%	0.00%	0.00%	45.45%
Common Yellowthroat	SB	12	22	0	0.08	0.41%	12	4.17%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow Warbler	SB	5	21	14	0.07	0.39%	3	1.04%	66.67%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	92.86%	0.00%	0.00%	7.14%	0.00%
Snow Goose	WF	2	20	20	0.07	0.37%	2	0.69%	100.00%	10.00%	0.00%	90.00%	0.00	0.00%	0.00%	0.00%	90.00%	10.00%	0.00%	0.00%	0.00%	0.00%
Clay-colored Sparrow	SB	13	17	0	0.06	0.32%	12	4.17%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Northern Flicker	WP	8	17	17	0.06	0.32%	6	2.08%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	29.41%	0.00%	17.65%	29.41%	17.65%	5.88%	0.00%	0.00%
American White Pelican	WB	3	16	16	0.06	0.30%	1	0.35%	100.00%	0.00%	100.00%	0.00%	0.06	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	18.75%	81.25%	0.00%
Western Meadowlark	SB	4	15	14	0.05	0.28%	3	1.04%	93.33%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	50.00%	35.71%	0.00%	14.29%	0.00%	0.00%
Savannah Sparrow	SB	2	15	7	0.05	0.28%	0	0.00%	46.67%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Downy Woodpecker	WP	14	14	9	0.05	0.26%	10	3.47%	64.29%	100.00%	0.00%	0.00%	0.00	11.11%	0.00%	11.11%	33.33%	11.11%	11.11%	22.22%	0.00%	0.00%
Bank Swallow	SB	1	12	12	0.04	0.22%	1	0.35%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Chipping Sparrow	SB	10	11	6	0.04	0.20%	8	2.78%	54.55%	100.00%	0.00%	0.00%	0.00	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	66.67%
Vesper Sparrow	SB	6	10	0	0.03	0.19%	6	2.08%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Song Sparrow	SB	7	9	0	0.03	0.17%	5	1.74%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellow-headed Blackbird	SB	4	8	7	0.03	0.15%	2	0.69%	87.50%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
Eastern Bluebird	SB	3	8	8	0.03	0.15%	2	0.69%	100.00%	100.00%	0.00%	0.00%	0.00	12.50%	25.00%	0.00%	0.00%	0.00%	0.00%	0.00%	62.50%	0.00%
Sedge Wren	SB	5	5	0	0.02	0.09%	5	1.74%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Least Flycatcher	SB	4	5	1	0.02	0.09%	4	1.39%	20.00%	100.00%	0.00%	0.00%	0.00	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Swainson's Hawk	RVO	4	5	3	0.02	0.09%	3	1.04%	60.00%	66.67%	33.33%	0.00%	0.00	0.00%	0.00%	0.00%	33.33%	33.33%	33.33%	0.00%	0.00%	0.00%
Belted Kingfisher	SB	4	4	3	0.01	0.07%	3	1.04%	75.00%	100.00%	0.00%	0.00%	0.00	66.67%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%	0.00%
Eastern Kingbird	SB	3	4	2	0.01	0.07%	3	1.04%	50.00%	100.00%	0.00%	0.00%	0.00	50.00%	0.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Rough-legged Hawk	RVO	3	4	4	0.01	0.07%	2	0.69%	100.00%	25.00%	25.00%	50.00%	0.00	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eastern Wood-Pewee	SB	3	3	0	0.01	0.06%	3	1.04%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Grasshopper Sparrow	SB	2	2	0	0.01	0.04%	2	0.69%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Great Blue Heron	WA	2	2	2	0.01	0.04%	2	0.69%	100.00%	50.00%	50.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	50.00%	0.00%
Northern Harrier	RVO	2	2	2	0.01	0.04%	0	0.00%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	50.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%
American Kestrel	RVO	1	1	1	0.00	0.02%	1	0.35%	100.00%	100.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Blue-winged teal	WF	1	1	0	0.00	0.02%	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bobolink	SB	1	1	0	0.00	0.02%	1	0.35%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cooper's Hawk	RVO	1	1	1	0.00	0.02%	0	0.00%	100.00%	0.00%	100.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Marsh Wren	SB	1	1	0	0.00	0.02%	1	0.35%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Upland Sandpiper	SH	1	1	0	0.00	0.02%	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Willow Flycatcher	SB	1	1	0	0.00	0.02%	1	0.35%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wilson's Snipe	SH	1	1	0	0.00	0.02%	1	0.35%	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		919	**5,368**	**4,404**	**18.64**	**100.00%**			**82.04%**				**1.53**	**7.86%**	**2.38%**	**3.63%**	**7.68%**	**10.13%**	**4.25%**	**9.33%**	**6.06%**	**48.67%**

Appendix B

Applicable Bird/Bat Best Management Practices and Conservation Measures

Best Management Practices (BMPs)	References	Project Application
Construction: Communication and other local utility cables shall be buried, where feasible.	VR-26, VRP 5-194	See Design Plans-Layout Plans.
Construction: Construction debris shall be removed from the site.	LU-3,LUP 5-14	X
Construction: Excess cut/fill materials shall be hauled in or out to minimize ground disturbance and impacts from fill piles. Material sources have been identified and will be obtained locally. Backfill will be utilized around turbines. Topsoil will be dispersed so farmers can farm again.	VR-22, VRP 5-193	See Construction Plans.
Construction: If needed during construction, only use explosives within specified times and at specified distances from sensitive wildlife or surface waters as established by the appropriate Federal and State agencies.	ER-7, ERP 5-130	X
Construction: Litter must be controlled and removed regularly during construction.	VR-30, VRP 5-194	X
Construction: Minimize the area disturbed during the installation of meteorological towers (i.e., the footprint needed for meteorological towers and associated laydown areas).	ER-2, ERP 5-129	See Design Plans-Layout Plans.
Construction: All construction activities will not occur during nesting season for ground nesting birds. If construction cannot be avoided during the nesting season, for grassland birds, nesting habitat will be made unsuitable (i.e., mowing) before nesting season begins. If that is not possible, a trained monitor will search for nests just before construction begins.	ER-3, ERP 5-129	See Design Plans-Layout Plans.
Decommissioning: All aboveground and near-ground structures, including turbines and ancillary structures, shall be removed from the site during decommissioning.	ER-23, ERP 5-132, VR-39, VRP 5-195	See Decommission Plan.
Decommissioning: Facilities constructed on Federal lands should follow the decommissioning recommendations provided in the USFWS's Land-Based Wind Energy Guidelines (USFWS 2012b).	ERP 5-132	See Decommission Plan.
Decommissioning: Salvage and reapply topsoil excavated during decommissioning activities to disturbed areas during final restoration activities.	ER-24, ERP 5-132	See Decommission Plan.
Decommissioning: When decommissioning sites, ensure that any wells are properly filled and capped.	WR-10, WRP 5-33	See Decommission Plan.
Design: Existing rocks, vegetation, and drainage patterns shall be preserved to the maximum extent possible.	VR-12, VRP 5-193	See Design Plans.
Design: No guy wires will be used. All permanent meterological towers will be free-standing. If guy wires are necessary for temporary structures, they shall be equipped with line marking devices.	ER-8, ERP 5-130	See Design and Layout Plans.
Design: Power collection cables or lines on the site should be buried in a manner that minimizes additional surface disturbance (e.g., collocating them with access roads).	VR-26, VRP 5-194, ERP 5-129	See Design, Layout and Construction Plans.
Design: Tower lighting will be in compliance with the 2016 Federal Aviation Administration guidance.		See Design Plans.
General: Conduct construction and maintenance activities when the ground is frozen or when soils are dry and native vegetation is dormant.	SR-5, SRP 5-25	See Construction Plan.
General: Facilities and off-site surrounding areas shall be kept clean of debris, "fugitive" trash or waste, and graffiti. Scrap heaps and materials dumps shall be prohibited and prevented. Materials storage yards, even if thought to be orderly, shall be kept to an absolute minimum. Surplus, broken, disused materials and equipment of any size shall not be allowed to accumulate.	VR-35, VRP 5-194	X
Haz. Materials: Dispose of excess excavation materials in approved areas to control erosion and minimize leaching of hazardous materials.	SR-8, SRP 5-26	See Hazardous Material Plan and Erosion Control Plan.
Haz. Materials: Hazardous materials and waste storage areas or facilities shall be formally designated and access to them restricted to authorized personnel. Construction debris, especially treated wood, shall not be disposed of or stored in areas where it could come in contact with aquatic habitats.	HM-16, HM 5-249	See Hazardous Material Plan and Design Plans.
Wildlife/Vegetation: If pesticides/herbicides are to be used on the site, develop an integrated pest and vegetation management plan to ensure that applications will be conducted within the framework of managing agencies and will entail the use of only EPA-registered pesticides/herbicides that are (1) nonpersistent and immobile and (2) applied by licensed applicators in accordance with label and application permit directions, following stipulations regarding suitability for terrestrial and aquatic applications.	HM-3, HMP 5-247	See Integrated Pest & Vegetation Management Plan.

Best Management Practices (BMPs)	References	Project Application
Haz. Materials: Limit herbicide and pesticide use to nonpersistent, immobile compounds and apply them using a properly licensed applicator in accordance with label requirements.	WR-6, WRP 5-33	See Integrated Pest & Vegetation Management Plan.
Haz. Materials: Prepare a hazardous materials and waste management plan that addresses the selection, transport, storage, and use of all hazardous materials needed for construction, operation, and decommissioning of the facility for local emergency response and public safety authorities and for the regulating agency, and that addresses the characterization, on-site storage, recycling, and disposal of all resulting wastes. The plan shall include a comprehensive hazardous materials inventory; Material Safety Data Sheets (MSDSs) for each type of hazardous material; emergency contacts and mutual aid agreements, if any; site map showing all hazardous materials and waste storage and use locations; copies of spill and emergency response plans (see below), and hazardous materials-related elements of a decommissioning/ closure plan. The waste management plan shall identify the waste streams that are expected to be generated at the site during construction and operation and address hazardous waste determination procedures, waste storage locations, waste-specific management and disposal requirements (e.g., selecting appropriate waste storage containers, appropriate off-site treatment, storage, and disposal facilities), inspection procedures, and waste minimization procedures. The plan shall address solid and liquid wastes that may be generated at the site in compliance with CWA requirements if a NPDES permit is needed.	HM-1, HMP 5-247	See Hazardous Materials Plan.
Maintenance: Promptly dispose of all garbage or human waste generated on site in order to avoid attracting nuisance wildlife.	ER-15, ERP 5-131	X
Maintenance: Clean and maintain catch basins, drainage ditches, and culverts regularly.	WR-5, WRP 5-33	X
Maintenance: Refueling areas shall be located away from surface water locations and drainages and on paved surfaces; features shall be added to direct spilled materials to sumps or safe storage areas where they can be subsequently recovered.	HM-12, HMP 5-248	See Design Plan-Refueling Areas.
Maintenance: Wind facilities and sites shall be actively and carefully maintained during operation. Wind energy projects shall evidence environmental care, which would also reinforce the expectation and impression of good management for benign or clean power.	VR-32, VRP 5-194	X
General: Minimize ground-disturbing activities, especially during the rainy season.	SR-1, SRP 5-25	X
Maintenance: Invasive species will be regularly monitored.	VR-32, VRP 5-194	See Invasive Species Prevention Plan.
Restoration: A site restoration plan shall be in place prior to construction. Restoration of the construction areas shall begin immediately after construction to reduce the likelihood of visual contrasts associated with erosion and invasive weed infestation and to reduce the visibility of affected areas as quickly as possible. Weed-free native grasses, forbs and shrubs will be used during re-seeding operations. No trees will be cleared/removed (all treed areas will be bored or avoided).	VR-9, VRP 5-192	See Site Restoration Plan and Invasive Species Prevention Plan.
Safety: Drip pans shall be used under the fuel pump and valve mechanisms of any bulk fueling vehicles and during on-site refueling to contain accidental releases.	HM-13, HMP 5-248	X
Safety: Use proper signage and/or engineered barriers (e.g., fencing) to limit access to electrically energized equipment and conductors in order to prevent access to electrical hazards by unauthorized individuals or wildlife.	HS-9, HSP 5-257	X
Siting: Avoid locating wind energy developments in areas of unique or important recreation, wildlife, or visual resources. When feasible, a wind energy development should be sited on already altered landscapes.	LUP 5-14	See Design-Layout Plan.
Siting: Consolidate infrastructure wherever possible to maximize efficient use of the land and minimize impacts. Existing transmission and market access should be evaluated and use of existing facilities should be maximized.	LUP 5-14	See Design-Layout Plan.
Siting: Consult with Federal, State, and county agencies; tribes; property owners; and other stakeholders as early as possible in the planning process to identify potentially significant land use conflicts and issues and State and local rules that govern wind energy development.	LUP 5-14	This Bird & Bat Conservation Strategy is part of the Site Permit Application (requirement for MN Dept. of Commerce and associated agencies).
Siting: Minimize the extent of land disturbance to the extent possible.	WRP 5-33	See Design-Layout Plan. Temporary land disturbance of approximately 172 acres for project construction. Permanent land disturbance will be approximately 12 acres for turbines and associated facilities.
Siting: Through site design, the number of structures required should be minimized. Activities should be combined and carried out in one structure, or structures should be collocated to share pads, fences, access roads, lighting, etc.	VRP 5-190	See Design-Layout Plan.
Vegetation: Reduce habitat disturbance by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas.	ER-4, ERP 5-130	X
Wetlands/Vegetation: For wetland and grassland easements, coordinate closely with the USFWS or USDA during initial project planning to ensure that wetland and grassland easements are avoided to the extent practicable.	LUP 5-15	Coordinated as part of the Site Permit Application.

Best Management Practices (BMPs)	References	Project Application
Wildlife/Vegetation: Contact appropriate Federal and State agencies (including State entities responsible for permitting energy development projects) early in the planning process to identify potentially sensitive ecological resources known to be present or likely to be present in the vicinity of the wind energy development.	WRP 5-128	Coordinated as part of the Site Permit Application.
Wildlife/Vegetation: Do not locate individual meteorological towers in or adjacent to sensitive habitats or in areas where ecological resources known to be sensitive to human activities are present.	WRP 5-129	See Design-Layout Plan.
Wildlife/Vegetation: Review existing information on species and habitats in the project area. Identify important, sensitive, or unique habitat (including large contiguous tracts of grassland habitat) and biota in the project site and vicinity, and design the project to avoid, minimize, or mitigate potential impacts on these resources. Avoidance is the typically the most effective, and therefore preferred, choice for minimizing impacts. The design and siting of the facility should follow appropriate guidance and requirements from Western and the USFWS (as specified for each species in the selected alternative in the Final PEIS) as well as those required by State permitting agencies, and other resource agencies, as available and applicable. For birds specifically, attention should be given to project placement that may be within or near Important Bird Areas (http://netapp.audubon.org/iba) or Hemispheric or Regional Western Hemisphere Shorebird Reserve Network sites (http://www.whsrn.org/whsrn-sites), or where bird species or habitats of conservation concern are known to occur. The IBA Program has identified the most essential areas for birds, and conservation of these areas will provide for long-term protection of biodiversity. Sources of information on these important habitats can be found at http://ecos.fws.gov/ipac, http://www.avianknowledge.net, and http://web4.audubon.org/bird/iba.	WRP 5-127	This Bird & Bat Conservation Strategy is part of the Site Permit Application (requirement for MN Dept. of Commerce and associated agencies).
Wildlife: Avoid constructing turbines in areas of concentrated prey base for raptors (e.g., prairie dog towns).	ERP 5-130	Aerial raptor nest surveys were conducted in Spring 2017. See Sections 6.1.2, 6.1.3, 6.1.4 and 6.1.5 of this Bird & Bat Conservation Strategy.
Wildlife: Consult with the appropriate natural resource agencies to avoid scheduling construction activities during important periods for wildlife courtship, breeding, nesting, lambing, or calving that are applicable to sensitive species within the project area.	ERP 5-130	This Bird & Bat Conservation Strategy is part of the Site Permit Application (requirement for MN Dept. of Commerce and associated agencies).
Wildlife: Establish buffer zones around known raptor nests, bat roosts, and biota and habitats of concern if site evaluations show that proposed construction activities would pose a significant risk to avian or bat species of concern.	ER-6, ERP 5-130	This Bird & Bat Conservation Strategy is part of the Site Permit Application (requirement for MN Dept. of Commerce and associated agencies).
Wildlife: Evaluate potential avian and bat use (including the locations of active nest sites, colonies, roosts, and migration corridors) of the project and use data to plan turbine (and other structure/infrastructure) locations to minimize impacts.	ERP 5-128	See Section 6.0 of this Bird & Bat Conservation Strategy.
Wildlife: Evaluate the potential for the wind energy project to adversely affect bald and golden eagles in a manner consistent with the Eagle Conservation Plan Guidance (USFWS 2013a). Early in the planning of transmission interconnection and wind farm location, coordination with USFWS Field Offices regarding the guidance is highly recommended. Documented occurrence of eagles can be acquired from the local USFWS Ecological Services office, State wildlife agencies, or State natural heritage databases in some cases, although on-site surveys may be needed. In accordance with the USFWS's Land-Based Wind Energy Guidelines (USFWS 2012b), surveys during early project development should identify all important eagle use areas (nesting, foraging, and winter roost areas) within the project's footprint. If recent data are available on the spacing of occupied eagle nests for the project-area nesting population, these data can be used to delineate an appropriate boundary for the project area. If appropriate survey data are unavailable, the USFWS suggests that the project area, for the purpose of evaluating potential effects on eagles, be defined as the project footprint together with areas within 10 mi (16 km) of the footprint boundary. As described in the USFWS's Land-Based Wind Energy Guidelines (USFWS 2012b), project developers should evaluate the need to develop an ECP.	ERP 5-128	See Sections 6.1.1.1, 6.1.2, 6.1.3, 6.1.3.1, 6.1.4, 6.1.5 of this Bird & Bat Conservation Strategy.
Wildlife: Follow the recommendations provided in the USFWS's Land-Based Wind Energy Guideline (USFWS 2012b) and, as appropriate, the Eagle Conservation Plan Guidance (USFWS 2013a). In addition, follow guidelines or recommendations developed by individual States (e.g., IDNR 2011; Kempema 2009; Nebraska Wind and Wildlife Working Group 2011) to address potential effects of wind energy development on ecological resources.	WRP 5-126	See Sections 6.1.1.1, 6.1.2, 6.1.3, 6.1.3.1, 6.1.4, 6.1.5 of this Bird & Bat Conservation Strategy.
Wildlife: If appropriate, conduct surveys for presence of Federal- and State-protected species and other species of concern and the habitats for such species that have a reasonable potential to occur within the project area based on habitat characteristics. Consult with the USFWS and/or appropriate State agency to identify species likely to be present and appropriate survey techniques, determine permit needs, and identify/apply species-specific avoidance and minimization measures.	WRP 5-128	Coordination with Federal and State agencies is occuring as this document is included in the Site Permit Application process.
Wildlife: If significant impacts on Important Bird Areas (IBAs) or similar ecologically important avian areas are not avoided, minimized, or mitigated, then this Final PEIS would not apply and a separate project specific NEPA evaluation must be developed and approved by the appropriate responsible federal agency prior to project construction.	WRP 5-128	This Project adheres to the Final PEIS.

Best Management Practices (BMPs)	References	Project Application
Wildlife: In the absence of long-term mortality studies, monitor regularly for potential wildlife problems including wildlife mortality. Report observations of potential wildlife problems, including wildlife mortality, to the appropriate State or Federal agency in a timely manner, and work with the agencies to utilize this information to avoid/minimize/offset impacts. The Ecological Services Division of the USFWS shall be contacted. Development of additional mitigation measures may be necessary.	ER-22, ERP 5-131	See this document, Bird & Bat Conservation Strategy.
Wildlife: If mortality monitoring indicates that it is necessary, increasing turbine cut-in speeds (i.e., prevent turbine rotation at lower wind velocity) in areas of bat conservation concern during times when active bats may be at particular risk from turbines. For all turbines and at all times, the hub would not be locked, but blades would be feathered to the wind such that revolution per minute would be minimal during periods when wind speed is less than the projects set cut-in speed [3.0 m/s].	ER-20, ERP 5-131	Cut-in speeds = 6.7 mph (3 m/s) for both GE 2.3 and GE 2.5 turbines.
Wildlife: Instruct employees, contractors, and site visitors to avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship and nesting) seasons. Pets shall not be allowed on the project area. If breeding wildlife is observed, the site supervisor will be notified and the wildlife will be avoided.	ER-21, ERP 5-131	X
Wildlife: Place marking devices on any newly constructed or upgraded transmission lines, where appropriate, within suitable habitats for sensitive bird species.	ER-14, ERP 5-131	X
Wildlife: Prepare a Bird and Bat Conservation Strategy (BBCS). The overall goal of such a plan is to reduce or eliminate avian and bat mortality; implementation of a BBCS builds support for a FONSI when projects tier from the PEIS. The wind energy facility developer should work closely with the USFWS and the appropriate State wildlife agencies to identify protective measures to include in the plan. These would include project design measures, construction phase measures, operational phase measures, and decommissioning phase measures. A minimum of 1 yr of post-construction monitoring is needed to validate the preconstruction risk assessment and allow the facility owner to adjust operations based on identified problems. Based on project location in proximity to occupancy, habitat, and other ttributes that may increase the risk to birds and bats, multiyear post-construction monitoring may be necessary at some project sites. It is of paramount importance that post-construction surveys are accurate estimates of fatality at wind power facilities. Simple carcass counts at wind energy facilities are inaccurate and underestimate the total number of fatalities because not all carcasses are found due to factors such as unsearchable terrain, carcass removal by scavengers, and less than perfect searcher efficiency. Post-construction surveys for mortality must be robust and standardized to provide reliable results upon which to base adaptive management decisions. For these reasons, using a fatality estimator model is critical. The USFWS recommends a model like the Evidence of Absence model developed by Huso et al. (2014). The user's guide and software developed to estimate bird and bat fatalities at wind-power facilities (Dalthorp et al. 2014) can be found at http://pubs.usgs.gov/ds/0881. The Evidence of Absence software provides for comparison of various combinations of search coverage, search interval, and searcher efficiency that all produce the same overall level of carcass detection probability. Results of monitoring activities shall be reported to the appropriate State or Federal agencies in a timely manner. If bat monitoring is appropriate for the site, installation of bat acoustic monitors should be considered at the time meteorological towers are installed to reduce costs and minimize delays by collecting data early during the site review process.	WRP 5-126	See this document, Bird & Bat Conservation Strategy.
Wildlife: The transmission lines shall be designed and constructed with regard to the recommendations in Avian Protection Plan Guidelines (APLIC and USFWS 2005), in conjunction with Suggested Practices for Avian Protection on Power Lines (APLIC 2006) and Reducing Avian Collisions with Power Lines (APLIC 2012), to reduce the operational and avian risks that result from avian interactions with electric utility facilities.	ER-1, ERP 5-128	See this document, Bird & Bat Conservation Strategy.
Wildlife: Tier to the Final Programmatic EIS. The responsible federal agency will use a tiered NEPA evaluation to document avoidance, minimization, or mitigation of impacts to important bird habitat (e.g., established private, State, or federal special management areas for birds, IBAs, Regional Western Hemisphere Shorebird Reserve Network, [http://www.whsrn.org/whsrn-sites], etc.) to achieve no significant impact to avian resources. On a project-by-project basis, developers should contact local USFWS offices early in the planning process to identify areas of conflict with specific avian species or important bird habitat. Developers shall work with USFWS and Western to develop avoidance, minimization, or mitigation measures to adequately demonstrate their project will have no significant impact on avian resources. In these cases, individual projects determined to be consistent with the selected alternative in the Final PEIS will require a FONSI to document consistency.	ER 5-127	X
Wildlife: Turn off unnecessary lighting at night to limit attraction of migratory birds. Follow lighting guidelines, where applicable, from the Wind Energy Guidelines Handbook. This includes using lights with timed shutoff, downward-directed lighting to minimize horizontal or skyward illumination, and avoidance of steady-burning, high-intensity lights.	ER-19, ERP 5-131	X

Appendix C

Protocol: Post-Construction Avian and Bat Studies

December 29, 2017

Protocol - Post Construction Avian and Bat Studies
Palmer's Creek Wind Farm

This document is prepared in conformance with the **U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines** and serves as the Post Construction Avian and Bat Study Protocol for the Palmer's Creek Wind Farm (PCWF), located north of Granite Falls, Chippewa County, Minnesota. The purpose of the proposed protocol is to satisfy the requirements of the PCWF Bird and Bat Conservation Strategy. The anticipated tasks include:

- Post-Construction Fatality Monitoring, including Searcher Efficiency Trials and Carcass Removal Trials

Post Construction Fatality Monitoring

Post Construction fatality monitoring will be conducted for the first three years of operation in accordance with Tier 4 of the U.S. Fish and Wildlife Service' Land-Based Wind Energy Guidelines and designed to answer the following questions:

- What are the fatality rates for the project?
- What are the fatality rates for species of concern?
- How do the estimated fatality rates compare to the predicted rates?
- Do fatalities vary within the project site in relation to site characteristics?
- How do the fatality rates compare to other projects in similar landscapes?
- What is the composition of fatalities in relation to migrating vs. resident birds/bats?
- Do the data suggest the need to employ measures to reduce impacts?
- All eighteen turbines will be monitored.

Carcass searches will be conducted for three full years, commencing within 60 days of COD, as allowed by weather conditions and safety considerations.

- Four times per week from March 15 until November 15
- Twice per month from December through February

The following information will be recorded at each turbine site:

- Weather conditions
- Ground cover conditions
- Start and finish times of survey
- Potential prey species, other than birds, observed within the survey area

Potential scavenge items, other than birds, will be either buried or removed.

Ten turbines will be included in the carcass searches, including Turbines #1,2,5,9,10 and 12. The survey area will be a 60-meter radius around each turbine.

Searches will take place at 10-meter transects out to 60 meters with a search area of 10 m centered on the transect centerline (5 m on each side). During periods of snow cover or other unsafe conditions, search patterns and methods may be modified to include different transect patterns and/or road and pad searches. Modified search methods will be documented in the permanent field notes.

All searches, with or without fatalities, shall be recorded on an Incident Report Form (Attached).

The USFWS, MNDOC, MNPUC and MNDNR (Interested Parties) shall be notified if:

- 5 or more dead or injured non-listed avian or bat species are discovered within a survey week, or;
- 1 or more dead or injured state threatened or endangered species or species of special concern, or;
- 1 or more dead or injured federally listed species, or;
- 1 or more dead or injured bald or gold eagle.

The specimen(s) shall be geo-located and the coordinates provided to Interested Parties.

Searcher Efficiency Trials

Searcher Efficiency Trials shall be conducted to estimate the proportion of carcasses found by searchers.

A minimum of 100 carcasses/year will be used for the trials.

Trials will be conducted during each season (spring, summer, fall, winter).

Carcasses representing small, medium and large birds/bats will be used.

Carcasses will be discreetly marked before placement.

The location of all placed carcasses will be marked with GPS.

All field personnel involved in Fatality Monitoring will be involved in Searcher Efficiency Trials.

A carcass missed by the searcher but found by the trial conductor shall be considered “Available-Not Detected”.

A carcass missed by the searcher and not found by the trial conductor shall be considered “Unavailable”. It will be assumed that this carcass was scavenged or otherwise removed.

At the end of each trial, the searcher efficiency will be calculated.

Unless being used for Carcass Removal Trials, all carcasses placed will be removed after Searcher Efficiency Trials have concluded.

Carcass Removal Trials

Carcass Removal Trials will be conducted to estimate the average length of time a carcass remains in the area and is potentially detectable.

Removal can be by scavenging or by other means, such as being buried or concealed during cultivation.

Carcasses will be placed in various locations under turbines and their location recorded by GPS.

The carcasses will be checked every day for the first four days, and then on day 7, 10, and 14, after which all remains will be removed and disposed of.

Reporting

An Annual Report shall be submitted to the Interested Parties by March 30 of the following year. The Annual Report shall:

1. Identify fatalities, including location and date of discovery;
2. List Total number of fatalities for each Quarter;
3. Include adjusted fatality estimates for each season and for small, medium and large birds, as well as bats
4. Include an analysis of spatial, seasonal and habitat relationships to the fatalities
5. Present standardized results using accepted statistical analyses

Personnel

Post Construction Avian and Bat Studies performed at Palmer’s Creek Wind Farm will be supervised by Michael Rutledge, a qualified biologist. All team members participating in the surveys will receive a minimum of 6 hours of classroom and field training.

Palmer's Creek Wind Farm Fatality Monitoring Survey Data Form
Site Summary

Observer Name: ______________________ Survey Start Time: ____________

Date: ______________________ Survey End Time: ____________

Turbine ID: ______________________

Weather:

- ☐ Clear
- ☐ Partly Cloudy
- ☐ Overcast
- ☐ Fog
- ☐ Rain

Temperature (Beginning of survey): ______________________

Ground Cover/Visibility Class: ☐ **A** ☐**B** ☐**C** ☐**D**

Prey Species On-Site: ☐ No ☐ Yes, Complete below

Species: ____

Distance from Turbine ____________

Direction from Turbine ____________

Fatalities Discovered: ☐ No ☐ Yes, Complete Incident Report Form for each fatality

Total Fatalities: ____________

Injuries Discovered: ☐ No ☐ Yes, Complete Incident Report Form for each injury

Total Injuries: ____________

Notes:

***Ground Cover Type/Visibility Class:**

A-More than 90% bare ground, sparse vegetation less than 6" tall

B-More than 25% bare ground, mostly sparse vegetation less than 6" tall

C-Less than 25% bare ground, less than 25% of vegetation is more than 12" tall or ground is rocky/scrubby

D-Less than 25% bare ground, more than 25% of vegetation is more than 12" tall

Incident Report Form

☐ **Bird** ☐ **Bat** **Identification Number**_______________________________

Species (If known)____

Carcass : ☐ **Complete** ☐ **Dismembered** ☐ **Partial**

Carcass Condition: ☐ **Fresh** ☐ **Decomposing** ☐ **Desiccated**

Time Since Death: ☐ **< 1 day** ☐ **< 1 week** ☐ **> 1 week** ☐ **Unknown**

Notes:____

☐ **Bird** ☐ **Bat** **Identification Number**_______________________________

Species (If known)____

Carcass : ☐ **Complete** ☐ **Dismembered** ☐ **Partial**

Carcass Condition: ☐ **Fresh** ☐ **Decomposing** ☐ **Desiccated**

Time Since Death: ☐ **< 1 day** ☐ **< 1 week** ☐ **> 1 week** ☐ **Unknown**

Notes:____

☐ **Bird** ☐ **Bat** **Identification Number**_______________________________

Species (If known)____

Carcass : ☐ **Complete** ☐ **Dismembered** ☐ **Partial**

Carcass Condition: ☐ **Fresh** ☐ **Decomposing** ☐ **Desiccated**

Time Since Death: ☐ **< 1 day** ☐ **< 1 week** ☐ **> 1 week** ☐ **Unknown**

Notes:____

☐ **Bird** ☐ **Bat** **Identification Number**_______________________________

Species (If known)____

Carcass : ☐ **Complete** ☐ **Dismembered** ☐ **Partial**

Carcass Condition: ☐ **Fresh** ☐ **Decomposing** ☐ **Desiccated**

Time Since Death: ☐ **< 1 day** ☐ **< 1 week** ☐ **> 1 week** ☐ **Unknown**

Notes:____

***Procedure for Carcass Marking**

Photograph carcass front and back with pen or other item in picture for size reference. Save Images.

From Main Screen, tap "Mark Waypoint". Tap on "Edit" on the next screen. Tap on numeric field at top of screen. Enter Carcass Identifier using the following format: Two digit Turbine # (ex. OT01, CC01), dash, six digit date, dash, four digit sample number. Tap the checkmark at the bottom of the screen to save your entries. Tap on the three lines icon at the bottom of the screen and select "Change Photo". Select the best photo of the carcass in question and then select "Use" from the bottom of the screen. Tap "Save" at the bottom of the screen and you are done.

Appendix D

Eagle Nest and Use Monitoring Protocol

Eagle Nest and Use Monitoring
Eagle Nest and Use Monitoring will be used to determine whether the eagles are using areas within the Project for foraging or other activities.

Monitoring will continue for one year of operation, at a minimum.

Any eagle nest located will be monitored a minimum of 2 days per week, 8 hours per day, from the time the nest is discovered and active until the chicks fledge.

Data recorded during monitoring will include the following:

- Date and time of observations
- Weather conditions
- Flight paths
- Flight heights
- Habitats used
- Number of chicks

After the one year of monitoring, operations personnel will continue to survey for new bald eagle nests within the project area for the life of the permit.

Results of the Post-Construction Eagle Nest Monitoring will be reported in an Annual Report to the PUC, the USFWS and MNDNR.

Personnel
Post-Construction Avian and Bat Studies performed at Palmer's Creek Wind Farm will be supervised and/or performed by Michael Rutledge, a qualified biologist.

Responsive partner.
Exceptional outcomes.

APPENDIX F – CONSISTENCY EVALUATION FORMS

Programmatic Biological Assessment Project Consistency Evaluation Form*
Upper Great Plains Region Wind Energy Development Program

(for USFWS Internal Use Only)	TAILS S7 Bundle #:	
	Individual TAILS Log #:	

Project Proponent

Project Name:	Palmer's Creek Wind Farm	Developer:	Palmer's Creek Wind Farm, LLC.
State:	Minnesota	City:	Granite Falls
County:	Chippewa	State:	Minnesota
Township, Range & Sections:	T116N-R39W-Secs. 3-10, 15-22,27,28 and 29 T116N-R40W-Secs. 1, 12 and 13	POC:	Kate Carlton
		Phone:	320-564-5392

Federal Agency/Point of Contact

Fish & Wildlife Service Ecological Services Field Office		Western Area Power Administration	
City:	Bloomington	City:	Billings
State:	Minnesota	State:	Montana
POC:	Pete Fasbender	POC:	Lou Hanebury
Phone:	952-252-0092 ext. 210	Phone:	406-255-2812

For actions involving USFWS Land interests:

USFWS Wetland Management District:

City: State:

POC:

Phone:

	Y	N
USFWS Property Interest	☐	☒
Grassland Easement Exchange	☐	☒

Project Description Overview with Best Estimates

Construction Initiation Date:	1/30/2018	Max. Turbine Ht:	148 meters	Project Area Size:	6,150 acres
Construction Completion Date:	10/31/2018	Turbine Pad Size:	0.65 acres	Wind Reserve Area Size:	
Number Turbines:	18	Miles (km) of New Road:	4.7 miles	Power Generating Initiation Date:	9/15/2018
Turbine Tower Height (ft/m):	80-90m	Miles (km) Improved Road:	0.8 miles	Project Termination Date:	3/31/2058
Turbine RSA:	10,568 sq. meters	Miles (km) Existing County Rd:	6.2 miles		

Turbine Size (MW), Make & Model: GE 2.3MW-116; GE 2.5MW-116

Collector Lines from Turbine to Substation: Miles Buried: 14 miles Miles Overhead: 0.19 miles (1,000 feet)

To help demonstrate compliance with the BMPs, Species Specific Avoidance and Minimization Measures, a complete application must include maps of the project area and associated species/habitat/buffer zones. Maps attached Yes ☒ No ☐

Land Cover Types Affected *NLCD, 2011.

	Yes	No	Private (Acres)	State (Acres)	Federal (Acres)	Subtotal (Acres)	% Total	Description/Comments
Native Grass	☒	☐	192				3.12	Small patches along streams and narrow drainages that can't be tilled.
Tame Grass	☒	☐	284				4.62	Mixed species assemblages of intermediate wheatgrass, alfalfa, quackgrass, smooth brome, and some native component. Hayed but not necessarily each year
Agricultural	☒	☐	5,157				83.85	Tillable, cropped farm land.
Wetland	☒	☐	165				2.68	Freshwater emergent wetland, freshwater forested/shrub wetland, freshwater pond, riverine (Palmer's Creek, Minnesota River, and County ditches.
Riparian	☐	☒	0				0	
Trees	☒	☐	138				2.24	Native trees in woody drainages, decadent shelterbelts around farmsteads, shrub/scrub.
Other	☒	☐	214				3.48	Barren land (rocks/sand/clay), developed (roads, houses).
Total			6,150				100%	See also the attached Table (Temporary and Permanent Land Disturbance)

ESA Listed (L), Proposed (P) and Candidate (C) Species Affected (Check Boxes)

Plants
- ☐ EP Fringed Orchid (L)
- ☐ Mead's Milkweed (L)
- ☐ Prairie Bush Clover (L)
- ☐ Ute Ladies'-Tresses (L)
- ☐ WP Fringed Orchid (L)
- ☐ Whitebark Pine (C)

Invertebrates
- ☐ American Burying Beetle (L)
- ☒ Dakota Skipper (L)
- ☐ Higgins Eye (L)
- ☒ Poweshiek Skipperling (L)
- ☐ Salt Creek Tiger Beetle (L)
- ☐ Scaleshell Mussel (L)

Fish
- ☐ Bull Trout (L)
- ☐ Pallid Sturgeon (L)
- ☐ Topeka Shiner (L)

Reptiles
- ☐ Eastern Massasauga (C)

Birds
- ☐ G. Sage Grouse (C)
- ☐ Int. Least Tern (L)
- ☐ Piping Plover (L)
- ☐ Rufa Red Knot (L)
- ☐ Sprague's Pipit (C)
- ☐ Whooping Crane (L)

Mammals
- ☐ Black-footed Ferret (L)
- ☐ Canada Lynx (L)
- ☐ Gray Wolf (L)
- ☐ Grizzly Bear (L)
- ☐ Indiana Bat (L)
- ☒ N. Long-Eared Bat (L)

*Programmatic Biological Assessment Project Consistency Evaluation Form**
Upper Great Plains Region Wind Energy Development Program

[X] **Project proponent has reviewed the Programmatic Wind Energy EIS and BA, Appendix B of the BA relating to Species Consistency Evaluation Forms, and the U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines.**

Commitment to incorporate applicable BMPs and Species-Specific Avoidance & Minimization Measures into the project plan:

Kate Carlton	K Carlton	12/15/17
Project Proponent (Point of Contact)	Signature	Date

Agency Verification of Compliance with the Programmatic Wind Energy Biological Assessment:

Matthew Marsh	Matthew T. Marsh	12/18/17
Western Area Power Administration (Point of Contact)	Signature	Date
Pete Fasbender	Peter Fasbender	5 Feb 2018
U.S. Fish & Wildlife Service (Point of Contact)	Signature	Date
NA	Marty [illegible]	12-Feb 2018
U.S. Fish & Wildlife Service (ES Field Office Lead Biologist)	Signature	Date

*Version 3: March 2015

Programmatic Biological Assessment Species Consistency Evaluation Form
Upper Great Plains Region Wind Energy Development Program
Impact Information and Consistency Determination

Dakota skipper (*Hesperia dacotae*)

Project Name: Palmer's Creek Wind Farm

Company: Palmer's Creek Wind Farm, LLC.

Best Management Practices

[X] All general BMPs, as stated in the final *Programmatic Environmental Impact Statement for the Upper Great Plains Region Wind Energy Program* and table 4.5-1 of the final *Programmatic Biological Assessment for the Upper Great Plains Region Wind Energy Program*, will be implemented where appropriate, during each phase of the project (i.e., site characterization, construction, operations, and decommissioning). Although not all-inclusive, several of the more important BMPs for the conservation of this species follow.

- [X] Projects shall be designed to utilize existing roads and utility corridors to the maximum extent feasible, and to minimize the number and length/size of new roads, laydown areas, and borrow areas.
- [X] Locate stationary construction equipment (e.g., compressors or generators) outside of and as far as practical from Dakota skipper occupied habitat and proposed critical habitat.
- [X] Minimize the size of areas in which soil would be disturbed or vegetation would be removed.
- [X] When disturbed areas are reclaimed, reseed with obligate plant species of suitable habitat.

Species-Specific Avoidance Measures

[X] Conduct preconstruction evaluations and/or surveys in areas of potential occurrence to identify suitable habitat and areas of occurrence within project boundaries.

[X] Do not site turbines, access roads, transmission line towers, or other project facilities in occupied habitat or suitable habitat within 0.6 mi (1 km) of occupied habitat.

[X] Do not site turbines, access roads, transmission line towers, or other project facilities in proposed critical habitat or within a 0.6 mi (1 km) buffer zone.

Species-Specific Minimization Measures

For projects that encompass suitable, but unoccupied, habitat farther than 0.6 mi (1 km) from occupied habitat:

[ ] Obtain a grassland easement of native prairie, equal to the amount disturbed that contains obligate plant species to minimize additional loss of suitable habitat, or improve existing nearby grassland easements to incorporate obligate plants to provide additional suitable habitat.

[X] Avoid broadcast applications of pesticides or herbicides that may be harmful to Dakota skippers or their nectar plants in Dakota skipper habitat. Ensure that field crews recognize target weeds to avoid adverse effects on important native species. Applications should be made by appropriately licensed applicators where required and applied only in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications. Limit pesticide use to non-persistent immobile pesticides.

Impact Information

Project within county with recorded Dakota skippers?	[X] Yes	[ ] No	
Preconstruction evaluations conducted with USFWS?	[ ] Yes	[X] No	Dates:
Parties involved:			
Suitable habitat in or near project footprint?	[ ] Yes	[X] No	
Distance from suitable habitat:	25.9	Miles	
Distance from proposed critical habitat?	25.9	Miles	
Has habitat been surveyed to protocol?	[ ] Yes	[X] No	Dates of survey:
Result of survey:	[ ] Occupied (species detected)		[ ] Not occupied (species not detected)
If occupied, 0.6 mi (1km) buffer zones delineated?	[ ] Yes	[ ] No	
Map of project footprint and species habitat attached?	[X] Yes	[ ] No	

Programmatic Biological Assessment Species Consistency Evaluation Form
Upper Great Plains Region Wind Energy Development Program
Impact Information and Consistency Determination

Dakota skipper (*Hesperia dacotae*)

Effects—Explanation of consistency determination with programmatic effects determination of "may affect, not likely to adversely affect" or "no effect": The Dakota skipper is a small butterfly found in the tallgrass and mixed-grass prairies of the Northern Great Plains. It is federally listed as a threatened species with designated critical habitat. Dakota skippers have a single flight per year occurring from the middle of June through the end of July (Dana 1991). Eggs hatch after incubating for 7–20 days; larvae shelter and forage at the bases of grass plants, overwintering at or below the ground surface (Dana 1991). Current data suggests that dispersal of Dakota skipper is very limited (USFWS 2014, 79 FR 63672), and individuals may be incapable of moving greater than one kilometer (0.6 miles) between patches of prairie habitat separated by structurally similar habitats (Cochrane and Delphey 2002). Roads and crop fields have been suspected to impede movements between patches, and movements are more likely along ridges than across valleys (Dana 1991). The Dakota skipper requires native prairie habitat for reproduction, foraging, and overwintering at or below ground, and do not typically move great distances between native prairie areas.

The project has been designed to avoid native prairie, where Dakota skippers complete their life cycle, by following established utility corridors along active roadways and previously disturbed areas, such as cultivated or managed agricultural areas. The project area has 192 acres (3.12% of project area) of herbaceous grassland, and 284 acres (4.62%) of pasutre/hay land (NLCD 2011). However, these habitats are mostly associated with dense woody drainages and have abundant shrubs and invasive vegetative species present. Refer to Figure 3, Land Cover. The disturbance to these habitats is minimal, 0.5 acres and 1.2 acres. Refer to Table 1, Temporary and Permanent Land Disturbance. Therefore, the project would not cause additional fragmentation of habitat, new barriers to dispersal, loss of connectivity, changes in distribution or isolation of known populations. The habitats are not anticipated to be that of suitable habitat for the species. The grassland patches are separated by roads, woody draws, and cropped fields. Further, the project area is located 25.9 miles from the nearest designated critical habitat. Refer to Figure 5, Dakota Skipper Map. There is no indication that the project would result in biologically meaningful or measurable changes to the existing habitat, individuals, or population of Dakota skipper.

Palmer's Creek has committed to implement the conservation measures identified in the Programmatic BA applicable to species in the project area and the conservation measures identified in the PBO for the Dakota skipper. With implementation of these measures, the Palmer's Creek Project and WAPA's transmission line **may affect, but is not likely to adversely effect**, the Dakota skipper.

REFERENCES

Cochrane, J. F., and P. Delphey. 2002. Status assessment and conservation guidelines: Dakota Skipper, Hesperia dacotae (Skinner) (Lepidoptera: Hesperiidae), Iowa, Minnesota, North Dakota, South Dakota, Manitoba, and Saskatchewan. Department of the Interior, U.S. Fish and Wildlife Service, Twin Cities Field Office, Minneapolis, Minnesota. 92 pp.

Dana, R. P. 1991. Conservation management of the prairie skippers Hesperia dacotae and Hesperia ottoe. Station Bulletin 594-1991 (AD-SB-5511-S), Minnesota Agricultural Experiment Station, University of Minnesota, St. Paul, Minnesota.

Federal Register 79:206 (24 October, 2014) pp. 63672-63748.

National Land Cover Database (NLCD). 2011. From Homer et al. 2015 Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. Photogrammetric Engineering and Remote Sensing, v. 81, no. 5, p. 345-354. Accessed online February 2015 at: http://www.mrlc.gov/nlcd2011.php.

U.S. Fish and Wildlife Service (USFWS). 2014. (79 FR 63672) Endangered and Threatened Wildlife and Plants; Threatened Species Status for Dakota Skipper and Endangered Species Status for Poweshiek Skipperling.

Programmatic Biological Assessment Species Consistency Evaluation Form
Upper Great Plains Region Wind Energy Development Program
Impact Information and Consistency Determination

Poweshiek skipperling (*Oarisma poweshiek*)

Project Name: Palmer's Creek Wind Farm

Company: Palmer's Creek Wind Farm, LLC.

Best Management Practices

[X] All general BMPs, as stated in the final *Programmatic Environmental Impact Statement for the Upper Great Plains Region Wind Energy Program* and table 4.5-1 of the final *Programmatic Biological Assessment for the Upper Great Plains Region Wind Energy Program*, will be implemented where appropriate, during each phase of the project (i.e., site characterization, construction, operations, and decommissioning). Although not all-inclusive, several of the more important BMPs for the conservation of this species follow.

- [X] Projects shall be designed to utilize existing roads and utility corridors to the maximum extent feasible, and to minimize the number and length/size of new roads, laydown areas, and borrow areas.
- [X] Locate stationary construction equipment (e.g., compressors or generators) outside of and as far as practical from Poweshiek skipperling occupied habitat and proposed critical habitat.
- [X] Minimize the size of areas in which soil would be disturbed or vegetation would be removed.
- [X] When disturbed areas are reclaimed, reseed with obligate plant species of suitable habitat.

Species-Specific Avoidance Measures

[X] Conduct preconstruction evaluations and/or surveys in areas of potential occurrence to identify suitable habitat and areas of occurrence within project boundaries.

[X] Do not site turbines, access roads, transmission line towers, or other project facilities in occupied habitat or suitable habitat within 0.6 mi (1 km) of occupied habitat.

[X] Do not site turbines, access roads, transmission line towers, or other project facilities in proposed critical habitat or within a 0.6 mi (1 km) buffer zone.

Species-Specific Minimization Measures

For projects that encompass suitable, but unoccupied habitat farther than 0.6 mi (1 km) from occupied habitat:

[ ] Obtain a grassland easement of native prairie, equal to the amount disturbed that contains obligate plant species to minimize additional loss of suitable habitat, or improve existing nearby grassland easements to incorporate obligate plants to provide additional suitable habitat.

[X] Avoid broadcast applications of pesticides or herbicides that may be harmful to the Poweshiek skipperling or their nectar plants in Poweshiek skipperling habitat. Ensure that field crews recognize target weeds to avoid adverse effects on important native species. Applications should be made by appropriately licensed applicators where required and applied only in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications. Limit pesticide use to non-persistent immobile pesticides.

Impact Information

Project within county with recorded Poweshiek skipperlings?	[X] Yes	[ ] No	
Preconstruction evaluations conducted with USFWS?	[ ] Yes	[X] No	Dates:
Parties involved:			
Suitable habitat in or near project footprint?	[ ] Yes	[X] No	
Distance from suitable habitat:	25.9	Miles	
Distance from proposed critical habitat:	25.9	Miles	
Has habitat been surveyed to protocol?	[ ] Yes	[X] No	Dates of survey:
Result of survey:	[ ] Occupied (species detected)		[ ] Not occupied (species not detected)
If occupied, 0.6 mi (1 km) buffer zones delineated?	[ ] Yes	[ ] No	
Map of project footprint and species habitat attached?	[X] Yes	[ ] No	

Poweshiek skipperling (*Oarisma poweshiek*)

Effects—Explanation of consistency determination with programmatic effects determination of "may affect, not likely to adversely affect" or "no effect":

The Poweshiek skipperling is a small butterfly that requires high quality tallgrass prairie in both upland, dry areas as well as low, moist areas. It is federally-listed as an endangered species with designated critical habitat. Similar to the Dakota skipper, the Poweshiek skipperling larvae (caterpillars) hibernate during winter on the ground; they resume activity in spring and continue developing until they pupate and emerge as adult butterflies, which have a short lifespan of only one to two weeks between mid-June and mid-July. Adult butterflies feed on nectar from prairie flowers such as purple coneflower (*Echinacea angustifolia*), blackeyed susan (*Rudbeckia hirta*) and palespike lobelia (*Lobelia spicata*) (USFWS 2016).

Historically, Poweshiek skipperlings were found in tallgrass prairie and prairie fens from Manitoba to Iowa, with populations also found in Michigan and Wisconsin. According to the USFWS, the Poweshiek skipperling may have been extirpated from the Dakotas, Minnesota and Iowa within the last 10 years. During surveys in 2014, the species could be found only at a few limited sites in Michigan, Wisconsin, and in Manitoba (USFWS 2016).

The project area contains relatively small areas of native prairie, which are outside of the construction limits of the project, and would therefore not be disturbed. The project has been designed to avoid native prairie, where Poweshiek skipperlings complete their life cycle, by following established utility corridors along active roadways and previously disturbed areas, such as cultivated or managed agricultural areas. The project area has 192 acres (3.12% of project area) of herbaceous grassland, and 284 acres (4.62%) of pasutre/hay land (NLCD 2011). However, these habitats are mostly associated with dense woody drainages and have abundant shrubs and invasive vegetative species present. Refer to Figure 3, Land Cover. The disturbance to these habitats is minimal, 0.5 acres and 1.2 acres. Refer to Table 1, Temporary and Permanent Land Disturbance. Therefore, the project would not cause additional fragmentation of habitat, new barriers to dispersal, loss of connectivity, changes in distribution or isolation of known populations. The habitats are not anticipated to be that of suitable habitat for the species. The grassland patches are separated by roads, woody draws, and cropped fields. Further, the project area is located 25.9 miles from the nearest designated critical habitat. Refer to Figure 5, Dakota Skipper Map. There is no indication that the project would result in biologically meaningful or measurable changes to the existing habitat, individuals, or population of Poweshiek skipperling.

Palmer's Creek has committed to implement the conservation measures identified in the Programmatic BA applicable to species in the project area and the conservation measures identified in the PBO for the Poweshiek skipperling. With implementation of these measures, the Palmer's Creek Project and WAPA's transmission line **may affect, but is not likely to adversely effect**, the Poweshiek skipperling.

REFERENCES

National Land Cover Database (NLCD). 2011. From Homer et al. 2015 Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. Photogrammetric Engineering and Remote Sensing, v. 81, no. 5, p. 345-354. Accessed online February 2015 at: http://www.mrlc.gov/nlcd2011.php.

U.S. Fish and Wildlife Service (USFWS). 2016. Poweshiek skipperling. Available online: https://www.fws.gov/midwest/endangered/insects/posk/index.html. Updated December 5, 2016. Accessed March 2017.

Programmatic Biological Assessment Species Consistency Evaluation Form
Upper Great Plains Region Wind Energy Development Program
Impact Information and Consistency Determination

Northern long-eared bat *(Myotis septentrionalis)*

Project Name: Palmer's Creek Wind Farm

Company: Palmer's Creek Wind Farm, LLC.

Best Management Practices

[X] All general BMPs, as stated in the final *Programmatic Environmental Impact Statement for the Upper Great Plains Region Wind Energy Program* and table 4.5-1 of the final *Programmatic Biological Assessment for the Upper Great Plains Region Wind Energy Program*, will be implemented where appropriate, during each phase of the project (i.e., site characterization, construction, operations, and decommissioning). Although not all-inclusive, several of the more important BMPs for the conservation of this species follow.

- [X] Activities with continuous periods (i.e., longer than 24 hours) of noise disturbances greater than 75 db measured on the A scale (e.g., loud machinery) should be avoided within a 1-mi (1.6-km) radius of known or assumed northern long-eared bat hibernacula.
- [X] Restrict use of herbicides for vegetation management near known or assumed northern long-eared bat hibernacula to those specifically approved for use in karst (e.g., sinkholes) and water (e.g., streams, ponds, lakes, wetlands).
- [X] Avoid clearing of suitable habitat (spring staging, fall swarming, summer roosting) within a 5-mile (8.0 km) radius of known or assumed northern long-eared bat hibernacula. Retain snags, dead/dying trees, and trees with exfoliating (loose) bark ≥3-in. (7.6-cm) diameter at breast height (dbh) in areas ≤1 mi (1.6 km) from water.
- [X] Develop and implement a Bird and Bat Conservation Strategy (BBCS) as described in the *Land-Based Wind Energy Guidelines* that includes survey protocols acceptable to the USFWS in the project area during the spring and fall bird and bat migration seasons. Mortality monitoring will help to identify individual turbines that contribute to avian and bat mortality. This information could be used to provide design layout information for future wind development projects and to reduce the potential for future avian and bat mortality.

Species-Specific Avoidance Measures

[X] Throughout the range of the northern long-eared bat within the UGP Region, conduct preconstruction evaluations and/or surveys to identify suitable foraging, roosting, and commuting habitat within project boundaries and to identify the distance from project boundaries to hibernacula known/presumed used by northern long-eared bats. Disturbance of hibernacula is prohibited throughout the year.

[X] Avoid all suitable habitat (do not site turbines) in areas within 5 mi (8 km) of hibernacula used by northern long-eared bats or within 0.5 mi (0.8 km) of known or presumed occupied foraging, roosting, and commuting habitat. Habitat evaluations should be coordinated with the local USFWS Ecological Services Office prior to or during turbine site planning.

Species-Specific Minimization Measures

[X] A robust survey developed and implemented as part of the BBCS program, consistent with the Wind Energy Guidelines and approved by the USFWS during the preconstruction evaluation and survey stage, will be implemented for a minimum of 1 yr preconstruction.

[X] The need for implementation of cut-in speeds higher than manufacturers' recommendations during the fall bat migration period will be based on the following site-specific, project-by-project risk assessments by the State Ecological Services Field Office of the USFWS:

- During the preconstruction evaluation and survey stage, and based on a collision risk assessment of location of the project, proximity to potential summer habitat, distance to known occurrences, distance to known hibernacula, and suspected migration patterns, the applicant will coordinate with Western, Refuges, and the local Ecological Services Field Offices of the USFWS to determine if the risk of injury or mortality is sufficiently high to warrant higher cut-in speeds.
- In the event that preconstruction surveys indicate species occurrence or occupancy of habitat adjacent to the project area, higher turbine cut-in speeds will be required to offset the increased risk for injury or mortality. The monitoring must be rigorous enough to meet standards acceptable to the local USFWS State office.
- When warranted by either of the two aforementioned conditions for specific projects, turbine cut-in speeds will be increased to 16.4 ft/sec (5.0 m/sec) or greater from 0.5 hour before sunset to 0.5 hour after sunrise during the fall migration period (generally August 15–October 15, but consult with the USFWS for the established migration dates in each State) for northern long-eared bats in the western and central areas of the UGP Region. In the eastern fringe of the UGP Region, a minimum cut-in speed of 22.6 ft/sec (6.9 m/sec) from 0.5 hour before sunset to 0.5 hour after sunrise during the fall migration period (generally August 15–October 15, but consult with the USFWS for established migration dates in each State) for northern long-eared bats is required. Areas within the UGP Region that occur east of the western borders of Minnesota and Iowa will be used as the line of demarcation where the minimum cut-in speed of 22.6 ft/sec (6.9 m/sec) will be used. Use of feathering below the respective cut-in speed of 16.4 ft/sec (5.0 m/sec) or 22.6 ft/sec (6.9 m/sec) will also be implemented at night during the fall migration season to eliminate turbine rotation and avoid mortality of migrating northern long-eared bats. Increased cut-in speed and feathering can be suspended from 0.5 hour after sunrise to 0.5 hour before sunset.

[X] Immediately report observations of northern long-eared bat mortality to the appropriate USFWS office.

Programmatic Biological Assessment Species Consistency Evaluation Form
Upper Great Plains Region Wind Energy Development Program
Impact Information and Consistency Determination

Northern long-eared bat *(Myotis septentrionalis)*

Impact Information				
Project within county with recorded northern long-eared bat?	☐ Yes	☒ No		
Preconstruction evaluations conducted with USFWS?	☒ Yes	☐ No	Dates:	1/18/2017
Parties involved:	WAPA, USFWS, MNDNR, MNDOC, Fagen, Wenck, New Century Env., Palmer's Creek Wind Farm, LLC			
Suitable foraging or roosting habitat in or near project footprint?	☒ Yes	☐ No		
Distance from suitable habitat:	0.0	Miles		
Distance from hibernacula:	80.4	Miles		
Has habitat been surveyed to protocol?	☒ Yes	☐ No	Dates of survey:	
Result of survey:	☐ Occupied (species detected)		☒ Not occupied (species not detected)	
Turbine cut-in speed:	3.0	m/sec		
Map of project footprint and species habitat attached?	☒ Yes		☐ No	

Effects—Explanation of consistency determination with programmatic effects determination of "may affect, not likely to adversely affect" or "no effect":

The northern long-eared bat (NLEB), also known as the Northern *Myotis*, is widely distributed in Canada and throughout the eastern half of the United States. It was designated a species of special concern in Minnesota in 1984, at which time it was known from only a few widely-distributed localities in the state. Subsequent survey work has documented additional locations in Minnesota and confirmed that the species can be found in the state in both summer and winter. A large hibernaculum was discovered in St. Louis County, and NLEBs have been found in most other caves and mines surveyed in Minnesota, though typically in low numbers (Bowman 2016). The project area is located in an area of Minnesota with no documented NLEB hibernacula. Refer to Figure 4, Townships Containing Documented Northern Long-Eared Bat Maternity Roost Trees and/or Hibernacula Entrances.

Bat surveys during summer involve documenting foraging bats and locating maternity colonies. Bats within the WRA (wind resource area) were surveyed using a bat detector and laptop computer. The ultrasonic calls of foraging bats are displayed on the computer screen and permanently stored in electronic files. The NLEB myotis was not documented at the Palmer's Creek Wind Farm study site. Even though a total of eight clicks were identified by Kaleidoscope Pro as MYSE (NLEB myotis), its p-value was 1 for every bat detector on site, indicating absence of the NLEB myotis from the site and any matching calls being in error. As discussed in the wildlife report and above, no northern long-eared bats were observed during acoustical surveys for the Project (NCE 2017). However, suitable habitat can be found in the project area. Refer to Figure 3, Land Cover.

Old buildings and hollow trees are potential hibernacula sites during the winter, but caves and mines are the favored choice for hibernating bats, especially for the NLEB. NLEBs have been found in the winter in Minnesota in natural caves, sand mines, and deep iron mines. Hibernacula are shared between both sexes and often multiple species of bat. Preferred sites typically have high humidity levels, minimal airflow, and a constant temperature (Fitch and Shump 1979). Based on the preferred sites criteria, hibernacula sites within the study area are unlikely. The study area contains none to very little hibernacula sites specific to NLEB. After spring emergence, bats migrate to summer roosting and foraging grounds.

In summer, the NLEB is often associated with forested habitats (Fire-Dependent Forests, Mesic Hardwood Forests, and Floodplain Forests) where they make use of tree roosts, especially near water sources. Loose bark, broken tree limbs, cavities, and cracks in a tree can all be utilized by bats as roosting sites. The sexes tend to roost separately, with females forming small (~30 individuals) maternity colonies to bear and rear their offspring. Males often roost alone, as they do not have the same high temperature needs as maternity colonies.

Summer roosting and foraging grounds are more of a possibility to house NLEB within the study area (Bowman 2016). According to the surveys conducted in 2015/2016, the NLEB is extremely unlikely to be present even during the spring/summer/autumn times. Acoustic bat monitoring was conducted from the fall of 2015 through mid-October of 2016. Acoustic bat monitoring will continue in 2017 starting in April.

The project has been designed to avoid impacting forested habitats (Figure 3, Land Cover) with only 1 acre of temporary disturbance expected. Refer to Table 1, Temporary and Permanent Land Disturbance.

Palmer's Creek has committed to implement the conservation measures identified in the Programmatic BA applicable to species in the project area. With zero NLEB documented onsite, implementation of applicable conservation measures, and continuance of monitoring for the species, the Palmer's Creek Project and WAPA's transmission line **may affect, but is not likely to adversely effect**, the northern long-eared bat.

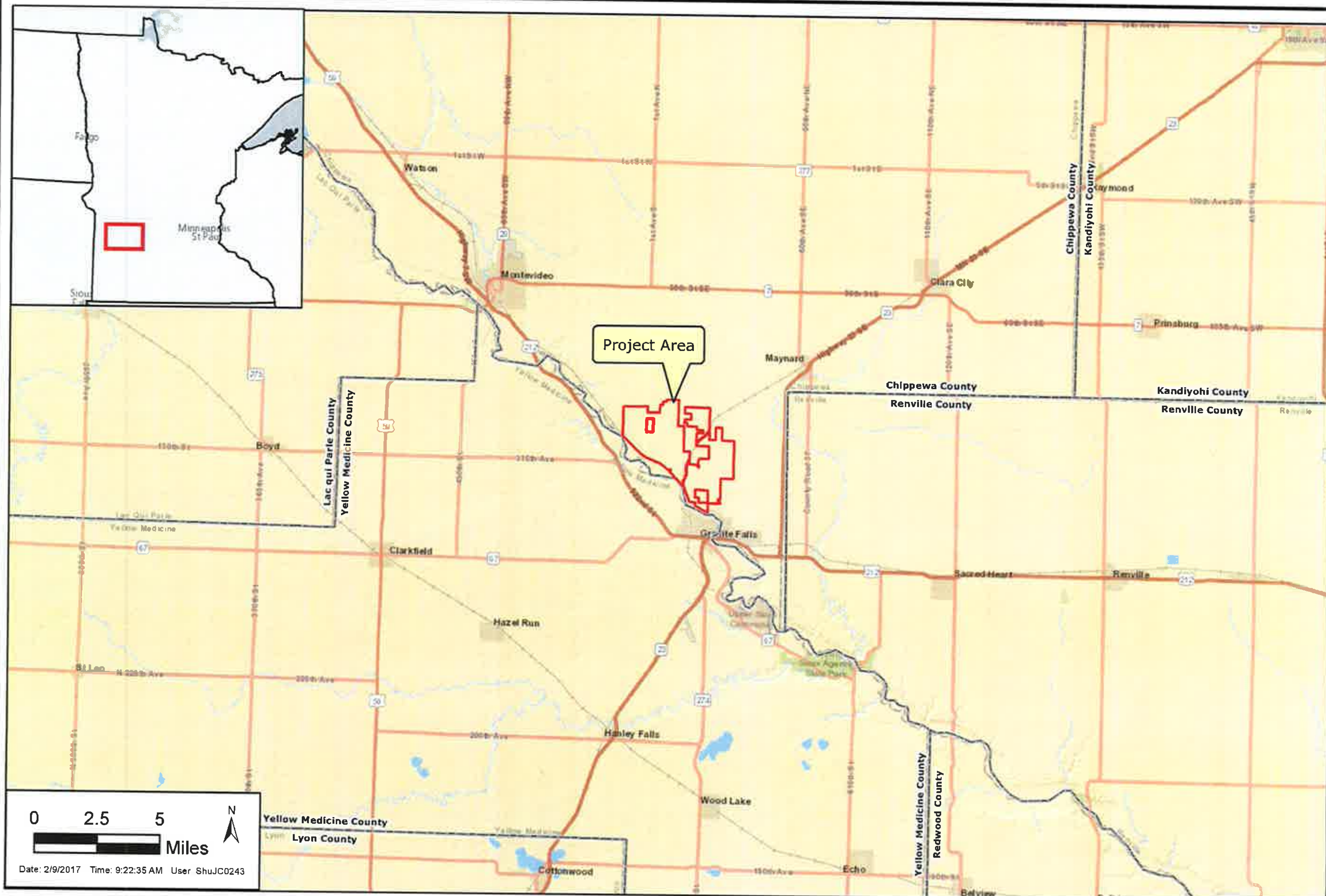
REFERENCES

Bowman, Melissa. 2016. Rare Species Guide. Minnesota Department of Natural Resources. Available online: <http://www.dnr.state.mn.us/>.

Fitch, J. H. and K. A. Shump, Jr. 1979. Myotis keenii. Mammalian Species 121:1-3.

New Century Environmental. 2017. Palmer's Creek Wind Farm Northern long-eared bat overview/background, draft report. April 5 2017.

Figures



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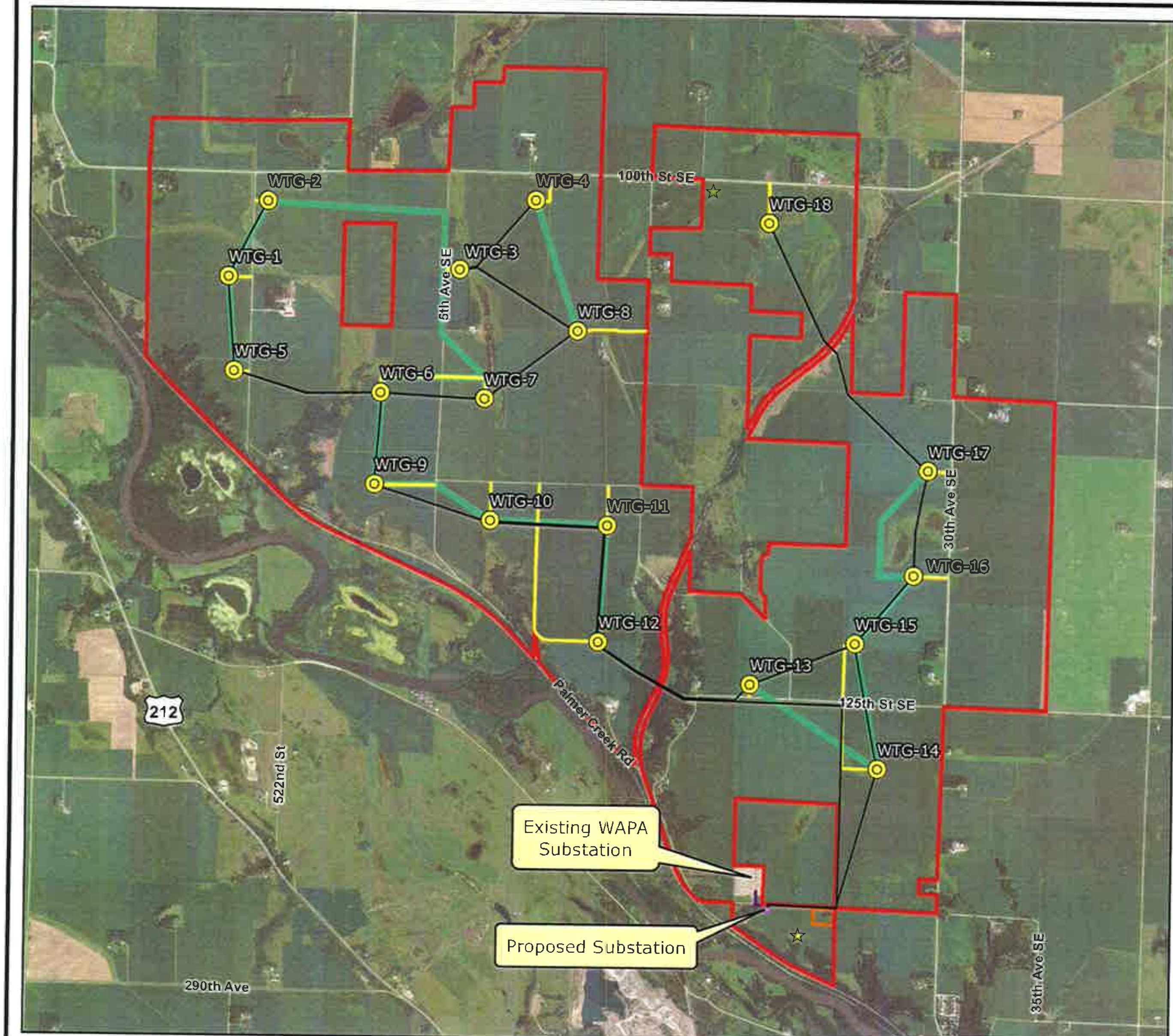
PALMER'S CREEK WIND FARM, LLC	WENCK ASSOCIATES Responsive partner. Exceptional outcomes.	FEB 2017
Site Location Map		Figure 1



Legend

- Project Boundary
- Turbine Locations
- Collector Lines
- Access Roads
- Temporary Crane Path
- Permanent MET Station
- Temporary MET Station
- Proposed Substation
- Transmision Lines
- O&M Building and Laydown Area

Note:
Project features are approximate. Once final design is completed, area will be surveyed prior to construction for Project feature placement.

N

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Feet

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PALMER'S CREEK WIND FARM, LLC

Site Detail Map

WENCK ASSOCIATES
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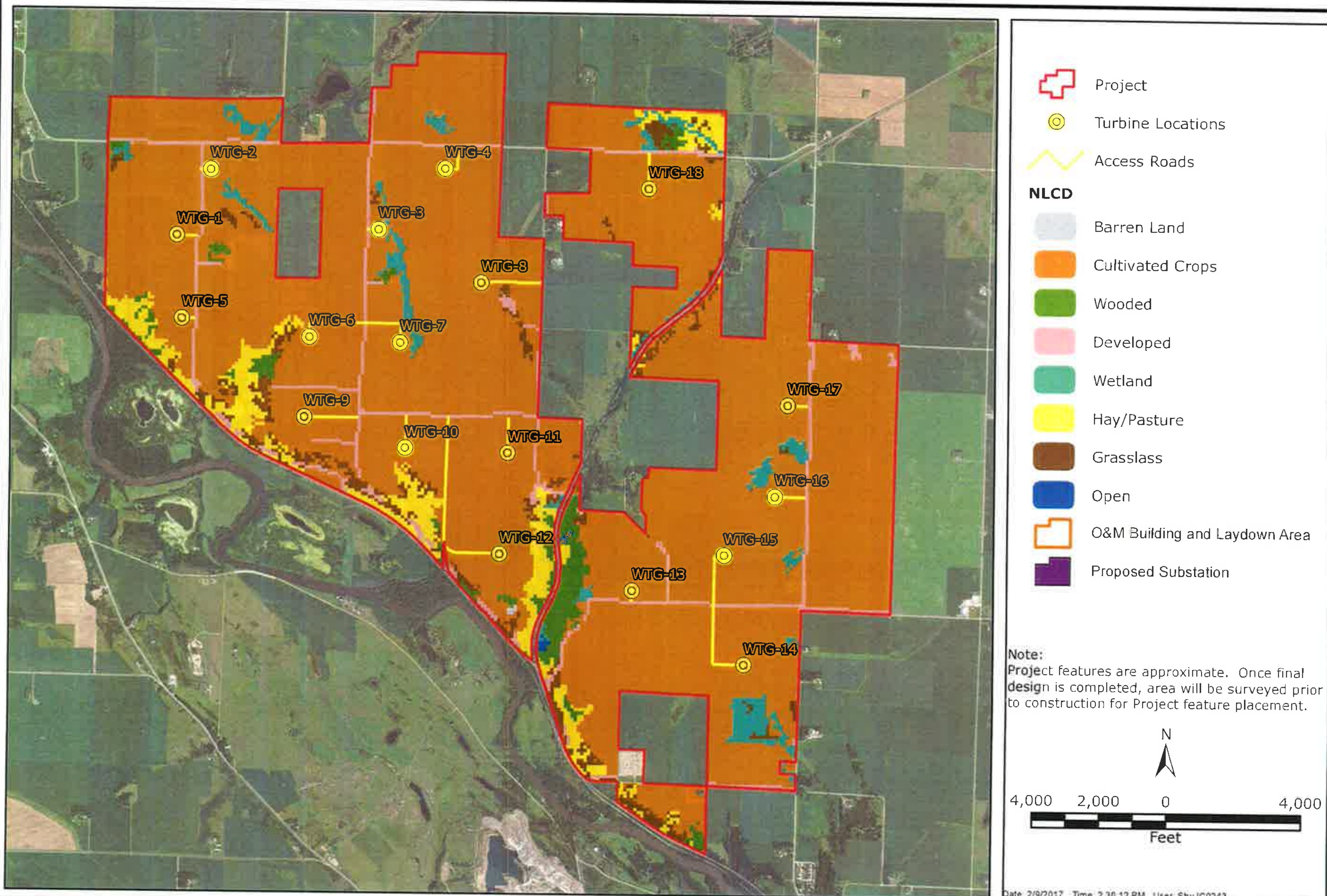
FEB 2017

Figure 2



PALMER'S CREEK WIND FARM, LLC

Land Cover

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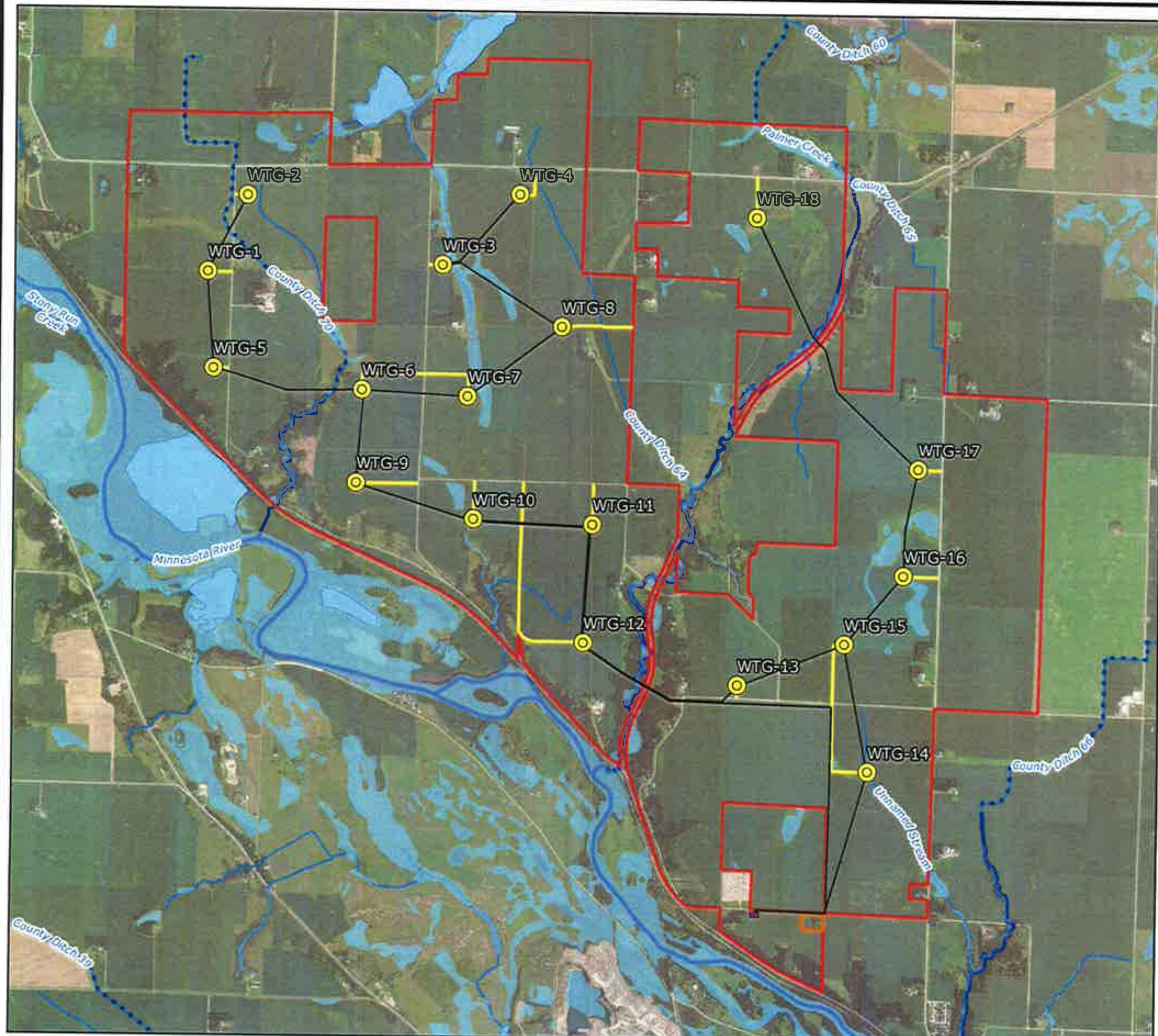
Figure 3



Project
Turbine Locations
Access Roads
Collector Lines
National Wetlands
Public Stream
Public Ditch/Altered Stream
Public Waters Basins
Rivers and Streams
O&M Building and Laydown Area
Proposed Substation

Note:
Project features are approximate. Once final design is completed, area will be surveyed prior to construction for Project feature placement.

N

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PALMER'S CREEK WIND FARM, LLC

Waterbodies and Wetlands

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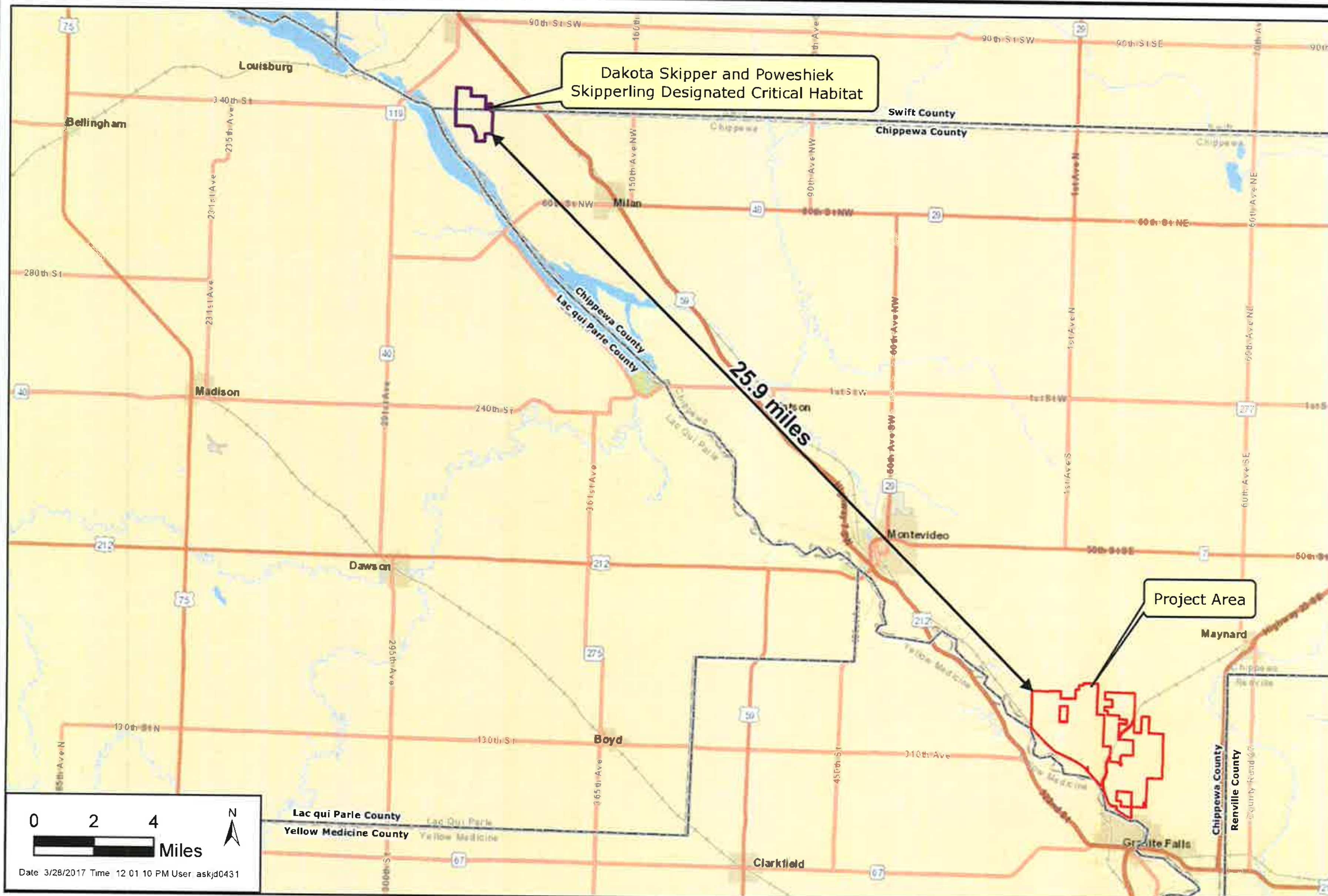
Figure 4



PALMER'S CREEK WIND FARM, LLC

Dakota Skipper

WENCK ASSOCIATES

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MAR 2017

Figure 5

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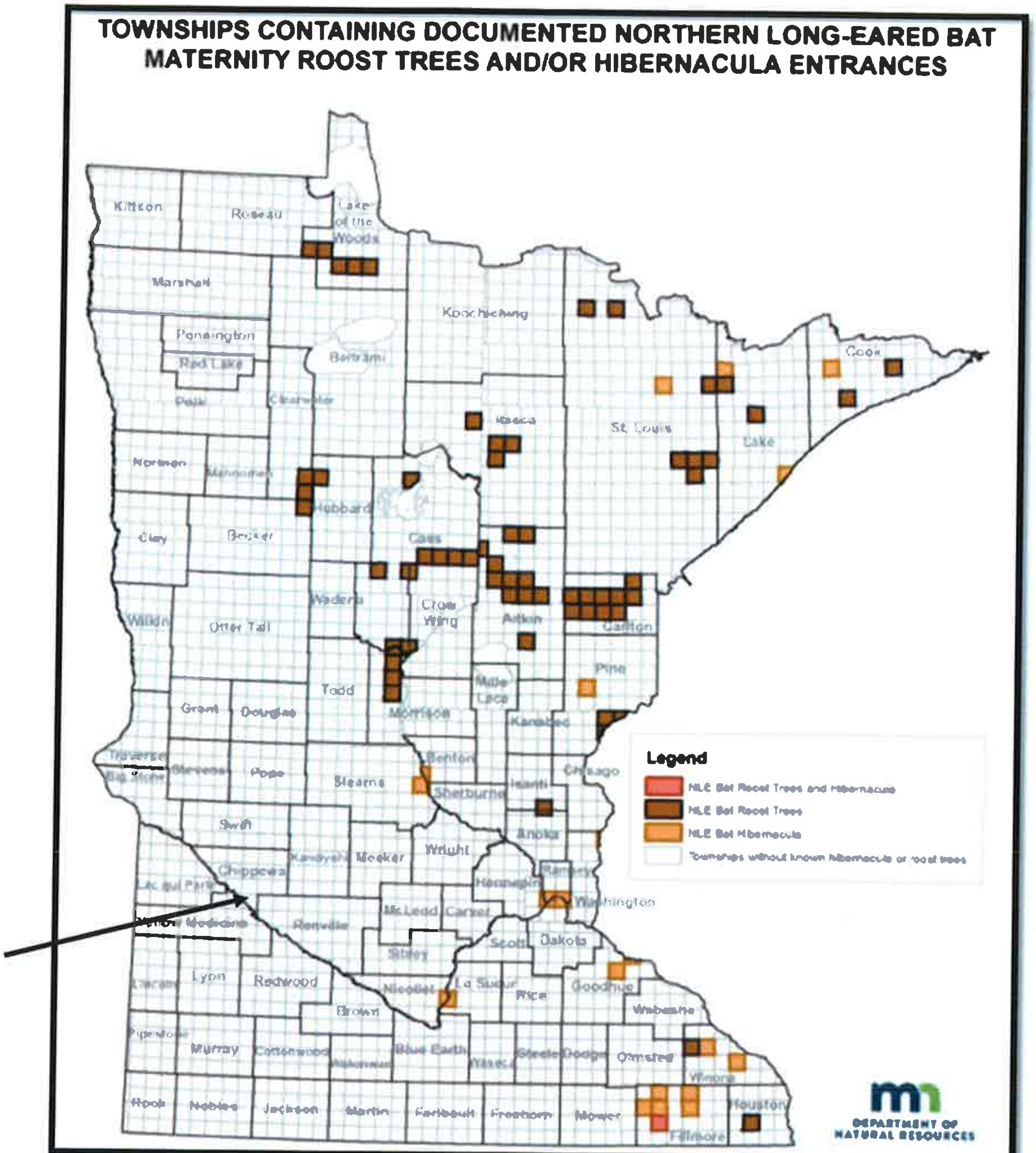
Figure 6. Documented Northern Long-Eared Bat Maternity Roost Trees and/or Hibernacula Entrances.



Tables

Table 1: Temporary and Permanent Land Disturbance

Cover Types	Temporary Disturbance	Permanent Disturbance
Barren Land (Rock/Sand/Clay)	0	0
Cultivated Crops	161	10
Deciduous Forest	1	0
Developed	7	0.6
Emergent Herbaceous Wetlands	1.1	0
Grassland/Herbaceous	0.5	0.1
Open Water	0	0
Pasture/Hay	1.2	0.6
Shrub/Scrub	0.1	0.1
Total	**171.9**	**11.4**

Source: NLCD, 2011.

APPENDIX G – BEST MANAGEMENT PRACTICES AND CONSERVATION MEASURES

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Air: Dust abatement measures shall be implemented in arid environments to minimize the impacts of vehicular and pedestrian traffic, construction, and wind on exposed surface soils.	VR-31, VRP 5-194						X	X			X							
Air: Install wind fences around disturbed areas if windborne dust is likely to impact sensitive areas beyond the site boundaries (e.g., nearby residences).	AQ-9, AQP 5-44				X		X	X			X			X				
Air: Limit idling of diesel equipment to no more than 10 minutes unless necessary for proper operation.	AQ-6, AQP 5-43								X									
Air: Minimize potential environmental impacts from the use of dust palliatives by taking the necessary measures to keep the chemicals out of sensitive terrestrial habitats and streams. The application of dust palliatives must comply with Federal, State, and local laws and regulations.	AQ-3, AQP 5-43						X			X		X	X	X				
Air: Post and enforce lower speed limits on dirt and gravel access roads to minimize airborne fugitive dust.	AQ-2, AQP 5-43							X	X		X							
Air: Use surface access roads, on-site roads, and parking lots with aggregates or that maintain compacted soil conditions to reduce dust generation.	AQ-1,AQP 5-43							X	X		X							
Air: Water unpaved roads, disturbed areas (e.g., scraping, excavation, backfilling, grading, and compacting), and loose materials generated during project activities as necessary to minimize fugitive dust generation.	AQ-8, AQP 5-44																	
Construction: Clean (e.g., through street vacuum sweeping) visible trackout or runoff dirt from the construction site off public roadways.	AQ-14, AQP 5-44							X	X									
Construction: Communication and other local utility cables shall be buried, where feasible.	VR-26, VRP 5-194						X		X									
Construction: Construct drainage ditches only where necessary; use appropriate structures at culvert outlets to prevent erosion.	WR-3, WR 5-33							X			X							
Construction: Construction activities shall be coordinated with landowners to minimize interference with farming or livestock operations. Issues that would need to be addressed could include installation of gates and cattle guards where access roads cross existing fencelines, access control, signing of open range areas, traffic management (e.g., vehicle speed management), and location of livestock water sources.	LU-2, LUP 5-14				X			X	X									
Construction: Construction debris shall be removed from the site.	LU-3,LUP 5-14				X				X									
Construction: Cultural resources discovered during construction shall immediately be brought to the attention of the responsible Federal agency. Work shall be immediately halted in the vicinity of the find to avoid further disturbance to the resources while they are being evaluated and appropriate mitigation plans are being developed.	CR-1, CRP 5-224				X													X
Construction: Drainage problems caused by construction shall be corrected to prevent damage to agricultural fields.	LU-7, LUP 5-14				X								X					
Construction: During construction, operations and maintenance, and decommissioning phases, traffic shall be restricted to designated project roads. Use of other unimproved roads shall be restricted to emergency situations.	LU-14, LUP 5-16							X										

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Construction: Employ fuel diesel engines in facility construction and maintenance that use ultra-low sulfur diesel, with a maximum 15 ppm sulfur content.	AQ-5, AQ 5-43								X									
Construction: Establish a controlled inspection and cleaning area for trucks and construction equipment are arriving from locations with known invasive vegetation problems. Visually inspect construction equipment arriving at the project area and remove and contain seeds that may be adhering to tires and other equipment surfaces.	ER-12, ERP 5-130														X	X		
Construction: Excess cut/fill materials shall be hauled in or out to minimize ground disturbance and impacts from fill piles.	VR-22, VRP 5-193						X				X				X			
Construction: Excess fill material shall not be disposed of downslope in order to avoid creating color contrast with existing vegetation/soils.	VR-21, VRP 5-193				X			X	X									
Construction: For road construction, excess fill shall be used to fill uphill-side swales to reduce slope interruption that would appear unnatural and to reduce fill piles.	VR-15, VRP 5-193				X		X				X							
Construction: If needed during construction, only use explosives within specified times and at specified distances from sensitive wildlife or surface waters as established by the appropriate Federal and State agencies.	ER-7, ERP 5-130					X			X				X			X		
Construction: In the unlikely event that blasting or pile driving would be needed during the construction period, notify nearby residents in advance.	NI-8, NIP 5-57				X			X	X									
Construction: Inspect and clean tires of construction-related vehicles, as necessary, so they are free of dirt prior to entering paved public roadways.	AQ-13, AQP 5-44						X	X										
Construction: Litter must be controlled and removed regularly during construction.	VR-30, VRP 5-194			X			X	X										
Construction: Locate stationary construction equipment (e.g., compressors or generators) as far as practical from nearby sensitive receptors.	NI-7, NIP 5-57						X									X		
Construction: Minimize the area disturbed during the installation of meteorological towers (i.e., the footprint needed for meteorological towers and associated laydown areas).	ER-2, ERP 5-129				X		X											
Construction: Schedule noisy activities to occur at the same time whenever feasible, since additional sources of noise generally do not greatly increase noise levels at the site boundary. Less frequent but noisy activities would generally be less annoying than lower-level noises occurring more frequently.	NI-3, NIP 5-57					X		X	X									
Construction: Schedule the installation of meteorological towers and other characterization activities to avoid disruption of wildlife reproductive activities or other important behaviors (e.g., do not install towers during periods of sage-grouse nesting).	ER-3, ERP 5-129															X		
Construction: Slash from vegetation removal shall be mulched and spread to cover fresh soil disturbances (preferred) or shall be buried. Slash piles shall not be left in sensitive viewing areas.	VR-13, VRP 5-193						X								X			
Construction: Soil borrow areas, cut-and-fill slopes, berms, waterbars, and other disturbed areas shall be contoured to approximate naturally occurring slopes, thereby avoiding form and line contrasts with the existing landscapes. Contouring to rough texture would trap seed and discourage offroad travel, thereby reducing associated visual impacts.	VR-40, VRP 5-195						X				X				X			

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Construction: Spray stockpiles of soils with water, cover with tarpaulins, and/or treat with appropriate dust suppressants, especially when high wind or storm conditions are likely. Vegetative plantings may also be used to limit dust generation for stockpiles that will be inactive for relatively long periods.	AQ-10, AQP 5-44														X			
Construction: Stabilize disturbed areas that are not actively under construction using methods such as erosion matting or soil aggregation, as site conditions warrant.	SR-6, SRP 5-26										X			X				
Construction: Stage construction activities to limit the area of disturbed soils exposed at any particular time.	AQ-7, AQP 5-44				X						X							
Construction: The burning of trash shall be prohibited during construction; trash shall be stored in containers and/or hauled off-site.	VR-29, VRP 5-194						X											
Construction: When possible, limit noisy construction activities to times when nearby sensitive receptors are least likely to be disturbed.	NI-5, NIP 5-57					X		X	X									
Cultural Resources: A paleontological resources management plan should be developed for areas where there is a high potential for paleontological material to be present. Management options may include avoidance, removal of the fossils, or monitoring. If the fossils are to be removed, a mitigation plan should be drafted identifying the strategy for collection of the fossils in the project area. Often it is unrealistic to remove all of the fossils, in which case a sampling strategy can be developed. If an area exhibits a high potential, but no fossils were observed during surveying, monitoring could be required. A qualified paleontologist should monitor all excavation and earthmoving in the sensitive area. Whether the strategy chosen is excavation or monitoring, a report detailing the results of the efforts should be produced.	CRP 5-217																	X
Cultural Resources: If a development is within the viewshed of a national historic trail eligible for listing on the NRHP, the developer should evaluate the potential visual impacts on the trail associated with the proposed project. If impacts were to occur, mitigation measures such as vegetation or landscape screening could be employed.	CRP 5-224						X											X
Cultural resources: If an area has a strong potential for containing fossil remains and those remains are exposed on the surface for potential collection, steps should be taken to educate workers and the public on the consequences of unauthorized collection.	CRP 5-217																	X

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Cultural resources: If cultural resources are known to be present at the site, or if areas with a high potential to contain cultural material have been identified, consultation with the SHPO should be undertaken by the appropriate Federal agency (e.g., Western, USFWS, USFS, or BLM). In instances where Federal oversight is not appropriate, developers can interact directly with the SHPO. Avoidance of these resources is always the preferred mitigation option. Other mitigation options include archaeological survey, excavation, data recovery, and monitoring (as warranted). If an area exhibits a high potential but no artifacts are observed during an archaeological survey, monitoring by a qualified archaeologist could be required during all excavation and earthmoving in the high-potential area. A report should be prepared documenting these activities. Other steps include the identification and implementation of measures to prevent potential looting/vandalism or erosion impacts, as well as educating workers and the public to make them aware of the consequences of unauthorized collection of artifacts.	CRP 5-224																	X
Cultural Resources: If human remains are found on a development site, work shall cease immediately in the vicinity of the find. The appropriate law enforcement officials and the appropriate Federal agency shall be contacted. No material shall be removed from the find location. Once it is determined that the remains belong to an archaeological site, the appropriate SHPO shall be contacted to determine how the remains shall be addressed.	CR-2, CRP 5-224								X									X
Cultural Resources: Palmer’s Creek Wind, in cooperating with the Upper Sioux THPO, will have THPO monitors on-site during construction of one wind turbine in a tribal area of concern. To protect the integrity of this area of concern, the facility to be monitored is not for public release. Information on this location can be requested from WAPA.																		X
Cultural Resources: Palmer’s Creek Wind, in cooperation with the Upper Sioux THPO, will shift the location of two project facilities to avoid tribal areas of concern. To protect the integrity of these areas of concern, the facilities to be moved are not for public release. Information on these locations can be requested from WAPA.																		X
Cultural Resources: Placement of wind energy structures in fossil-rich areas, such as outcrops, should be avoided.	CRP 5-217																	X
Cultural resources: Significant cultural resources can be affected by soil erosion. Minimization of soil erosion would protect important resources from damage.	CRP 5-224																	X
Cultural Resources: The appropriate Federal agency should consult with federally recognized Native American governments early in the planning process for a wind energy development to identify issues and areas of concern. Consultation is required under the NHPA. Consultation is necessary to establish whether the project is likely to disturb traditional cultural properties, affect access rights to particular locations, disrupt traditional cultural practices, affect trust resources such as eagles, and/or visually impact areas important to the tribe(s).	CRP 5-223																	X

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Cultural Resources: The presence of archaeological sites and historic properties in the area of potential effect should be determined on the basis of a records search of recorded sites and properties in the area and/or an archaeological survey. The SHPO is the primary repository for cultural resource information. The National Register of Historic Places could also be consulted at http://www.nps.gov/nr/research/index.htm.	CRP 5-223																	X
Cultural Resources: Whether paleontological resources exist in a project area should be determined on the basis of the sedimentary context and soil surveys of the area, a records search of Federal, State, and local inventories for past paleontological finds in the area, review of past paleontological surveys, and/or a paleontological survey.	CRP 5-217																	X
Decommissioning: Soil borrow areas, cut-and-fill slopes, berms, waterbars, and other disturbed areas should be contoured to approximate naturally occurring slopes, thereby avoiding form and line contrasts with the existing landscapes. Contouring to rough texture would trap seed and discourage off-road travel, thereby reducing associated visual impacts.	VR-40, VRP 5-195		X	X	X		X		X		X				X			
Decommissioning: All aboveground and near-ground structures, including turbines and ancillary structures, shall be removed from the site during decommissioning.	ER-23, ERP 5-132, VR-39, VRP 5-195				X				X									
Decommissioning: During facility decommissioning, the following shall occur: emergency response capabilities shall be maintained throughout the decommissioning period as long as hazardous materials and wastes remain on-site, and emergency response planning shall be extended to any temporary material and equipment storage areas that may have been established; temporary waste storage areas shall be properly designated, designed, and equipped; hazardous materials removed from systems shall be properly containerized and characterized, and recycling options shall be identified and pursued; off-site transportation of recovered hazardous materials and wastes resulting from decommissioning activities shall be conducted by authorized carriers; hazardous materials and waste shall be removed from on-site storage and management areas, and the areas shall be surveyed for contamination and remediated as necessary.	HM-20, HMP 5-249				X					X								
Decommissioning: Facilities constructed on Federal lands should follow the decommissioning recommendations provided in the USFWS's Land-Based Wind Energy Guidelines (USFWS 2012b).	ERP 5-132						X				X					X		
Decommissioning: Salvage and reapply topsoil excavated during decommissioning activities to disturbed areas during final restoration activities.	ER-24, ERP 5-132										X							
Decommissioning: When decommissioning sites, ensure that any wells are properly filled and capped.	WR-10, WRP 5-33				X			X	X									
Decommissioning; Excess concrete (excluding below ground portions of decommissioned turbine foundations intentionally left in place) shall not be buried or left in active agricultural areas.	LU-4, LUP 5-14				X				X	X								
Design: Color selections for turbines shall be made to reduce visual impact and shall be applied uniformly to tower, nacelle, and rotor, unless gradient or other patterned color schemes are used.	VR-2, VRP 5-191						X											

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Design: Commercial messages and symbols (such as logos, trademarks) on wind turbines shall be avoided and shall not appear on sites or ancillary structures of wind energy projects. Similarly, billboards and advertising messages shall also be discouraged.	VR-8, VRP 5-192						X											
Design: Culvert ends shall be painted or coated to reduce color contrasts with existing landscape.	VR-27, VRP 5-194						X											
Design: Electricity transmission projects associated with wind energy facilities should utilize nonspecular conductors and nonreflective coatings on insulators.	VRP 5-192						X	X										
Design: Existing rocks, vegetation, and drainage patterns shall be preserved to the maximum extent possible.	VR-12, VRP 5-193						X				X				X			
Design: For ancillary buildings and other structures, low-profile structures shall be chosen whenever possible to reduce their visibility	VR-1, VRP 5-190						X											
Design: For ancillary facilities, multiple-color camouflage technology applications should be considered for projects within sensitive viewsheds and with a visibility distance between 0.25 to 2 mi (0.4 to 3.2 km).	VRP 5-191						X											
Design: For ancillary structures, materials and surface treatments shall repeat and/or blend with the existing form, line, color, and texture of the landscape. If the project will be viewed against an earthen or other non-sky background, appropriately colored materials shall be selected for structures, or appropriate stains/coatings shall be applied to blend with the project's backdrop.	VR-4, VRP 5-191						X	X			X							
Design: Grouped structures shall all be painted the same color to reduce visual complexity and color contrast.	VR-3, VRP 5-191						X											
Design: Minimize the use of guy wires on permanent meteorological towers or use designs for towers that do not require guy wires. If guy wires are necessary, they shall be equipped with line marking devices.	ER-8, ERP 5-130						X	X	X							X		
Design: Power collection cables or lines on the site should be buried in a manner that minimizes additional surface disturbance (e.g., collocating them with access roads).	VR-26, VRP 5-194, ERP 5-129						X	X										
Design: Surface new roads with aggregate materials, wherever appropriate.	SR-2, SRP 5-25							X			X							
Design: The geometry of road ditch design shall consider visual objectives; rounded slopes are preferred to V-shaped and U-shaped ditches.	VR-16, VRP 5-193						X											
Design: The use of monopole structures is recommended. Truss or lattice-style wind turbine structures with lacework or pyramidal or prismatic shapes should be avoided. Monopole structures present a simpler profile, and less complex surface characteristics and reflective/shading properties.	VIP 5-191						X											
Erosion: Apply erosion controls relative to possible soil erosion from vehicular traffic.	WR-2, WRP 5-33							X				X	X					
Erosion: Apply standard erosion control BMPs to all construction activities and disturbed areas (e.g., sediment traps, water barriers, erosion control matting) as applicable to minimize erosion and protect water quality.	WR-1, WRP 5-33						X					X	X	X				
Erosion: Dispose of excess excavation materials in approved areas to control erosion.	WR-7, WRP 5-33						X				X		X	X	X			

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Erosion: Facilities, structures, and roads should be located in stable fertile soils to reduce visual contrasts from erosion and to better support rapid and complete regrowth of affected vegetation. Site hydrology should also be carefully considered in siting operations to avoid visual contrasts from erosion. Strip, stockpile, and stabilize topsoil from the site before excavating earth for facility construction.	VRP 5-190										X		X	X	X			
Erosion: Where feasible, construction on wet soils shall be avoided to reduce erosion.	VR-25, VRP 5-194						X				X			X				
General: Conduct construction and maintenance activities when the ground is frozen or when soils are dry and native vegetation is dormant.	SR-5, SRP 5-25				X										X			
General: Ensure that all pieces of heavy equipment meet emission standards specified in the State Code of Regulations, and conduct routine preventive maintenance, including tune-ups to manufacturer specification to ensure efficient combustion and minimum emissions. If possible, equipment with more stringent emission controls should be leased or purchased.	AQ-4, AQP 5-43					X												
General: Facilities and off-site surrounding areas shall be kept clean of debris, “fugitive” trash or waste, and graffiti. Scrap heaps and materials dumps shall be prohibited and prevented. Materials storage yards, even if thought to be orderly, shall be kept to an absolute minimum. Surplus, broken, disused materials and equipment of any size shall not be allowed to accumulate.	VR-35, VRP 5-194						X											
General: Gravel and other surface treatments shall be removed or buried.	VR-43, VRP 5-195						X											
General: Pollution prevention opportunities shall be identified and implemented, including material substitution of less hazardous alternatives, recycling, and waste minimization.	HM-5, HMP 5-248								X	X								
General: Procedures shall be established for fuel storage and dispensing, including shutting off vehicle (equipment) engines; using only authorized hoses, pumps, and other equipment in good working order; maintaining appropriate fire and spill response materials at equipment-fueling stations; providing emergency shutoffs for fuel pumps; ensuring that fueling stations are paved; ensuring that both aboveground fuel tanks and fueling areas have adequate secondary containment; prohibiting smoking, welding, or open flames in fuel storage and dispensing areas; equipping the area with fire suppression devices, as appropriate; conducting routine inspections of fuel storage and dispensing areas; requiring prompt recovery and remediation of all spills, and providing for the prompt removal of all fuel and fuel tanks used to support construction vehicles and equipment at the completion of facility construction and decommissioning phases.	HM-11, HMP 5-248								X	X								

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Haz. Materials: All site characterization, construction, operation, and decommissioning activities shall be conducted in compliance with applicable Federal and State laws and regulations, including the Toxic Substances Control Act of 1976, as amended (15 USC 2601, et seq.). In addition, any release of toxic substances (leaks, spills, and the like) in excess of the reportable quantity established by 40 CFR Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, Section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.	HM-4, HMP 5-247								X	X								
Haz. Materials: All vehicles and equipment shall be in proper working condition to ensure that there is no potential for leaks of motor oil, antifreeze, hydraulic fluid, grease, or other hazardous materials.	HM-15, HMP 5-249								X	X								
Haz. Materials: Authorized users for each type of hazardous material shall be identified.	HM-10, HMP 5-248									X								
Haz. Materials: Dedicated areas with secondary containment shall be established for off-loading hazardous materials transport vehicles.	HM-7, HMP-5-248								X	X								
Haz. Materials: Design requirements shall be established for hazardous materials and waste storage areas that are consistent with accepted industry practices as well as applicable Federal, State, and local regulations and that include, at a minimum, containers constructed of compatible materials, properly labeled, and in good condition; secondary containment features for liquid hazardous materials and wastes; physical separation of incompatible chemicals; and fire-fighting capabilities when warranted.	HM-17, HMP 5-249								X	X								
Haz. Materials: Dispose of excess excavation materials in approved areas to control erosion and minimize leaching of hazardous materials.	SR-8, SRP 5-26									X	X		X	X				
Haz. Materials: Hazardous materials and waste storage areas or facilities shall be formally designated and access to them restricted to authorized personnel. Construction debris, especially treated wood, shall not be disposed of or stored in areas where it could come in contact with aquatic habitats.	HM-16, HM 5-249									X		X	X	X				
Haz. Materials: In the event of an accidental release of hazardous substances to the environment, document the event, including a root cause analysis, a description of appropriate corrective actions taken, and a characterization of the resulting environmental or health and safety impacts. Documentation of the event shall be provided to permitting agencies and other appropriate Federal and State agencies within 30 days, as required.	HS-6, HSP 5-256								X	X								
Haz. Materials: Limit herbicide and pesticide use to nonpersistent, immobile compounds and apply them using a properly licensed applicator in accordance with label requirements.	WR-6, WRP 5-33								X					X	X			

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Haz. Materials: Prepare a hazardous materials and waste management plan that addresses the selection, transport, storage, and use of all hazardous materials needed for construction, operation, and decommissioning of the facility for local emergency response and public safety authorities and for the regulating agency, and that addresses the characterization, on-site storage, recycling, and disposal of all resulting wastes. The plan shall include a comprehensive hazardous materials inventory; Material Safety Data Sheets (MSDSs) for each type of hazardous material; emergency contacts and mutual aid agreements, if any; site map showing all hazardous materials and waste storage and use locations; copies of spill and emergency response plans (see below), and hazardous materials-related elements of a decommissioning/ closure plan. The waste management plan shall identify the waste streams that are expected to be generated at the site during construction and operation and address hazardous waste determination procedures, waste storage locations, waste-specific management and disposal requirements (e.g., selecting appropriate waste storage containers, appropriate off-site treatment, storage, and disposal facilities), inspection procedures, and waste minimization procedures. The plan shall address solid and liquid wastes that may be generated at the site in compliance with CWA requirements if a NPDES permit is needed.	HM-1, HMP 5-247								X	X								
Haz. Materials: Systems containing hazardous materials shall be designed and operated in a manner that limits the potential for their release, and constructed of compatible materials in good condition (as verified by periodic inspections), including provision of secondary containment features (to the extent practical); installation of sensors or other devices to monitor system integrity; installation of strategically placed valves to isolate damaged portions and limit the amount of hazardous materials in jeopardy of release; and robust inspection and use of repair procedures.	HM-6, HMP 5-248								X	X								
Haz. Materials: To the greatest extent practicable, "just-in-time" ordering procedures shall be employed that would limit the amounts of hazardous materials present on the site to quantities minimally necessary to support continued operations. Excess hazardous materials shall receive prompt disposition.	HM-8, HMP 5-248								X	X								
Haz. Materials: Written procedures for the storage, use, and transportation of each type of hazardous material present shall be provided, including all vehicle and equipment fuels.	HM-9, HMP 5-248								X	X								
Haz. Materials: Written procedures shall be established for inspecting hazardous materials and waste storage areas and for plant systems containing hazardous materials; identified deficiencies and their resolution shall be documented.	HM-18, HMP 5-249								X	X								
Invasive Species: Access roads, utility and transmission line corridors, and tower site areas shall be monitored regularly for the establishment of invasive species, and weed control measures should be initiated immediately upon evidence of the introduction of invasive species.	ER-17, ERP 5-131							X							X			

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Invasive Species: Develop a plan for control of noxious weeds and invasive plants that could occur as a result of new surface disturbance activities at the site. The plan shall address monitoring, weed identification, the manner in which weeds spread, and methods for treating infestations. Require the use of certified weed-free mulching.	ER-11, ERP 5-130								X						X			
Invasive species: Do not use fill materials that originate from areas with known invasive vegetation problems.	E-16, ERP 5-131														X			
Invasive Species: Invasive species monitoring at access roads, utility and transmission line corridors, and tower site areas will be conducted and documented on a monthly basis during construction and continue until final stabilization and revegetation is completed, per the Minnesota Construction Storm Water General Permit MN R 100001 and the associated Palmers Creek Wind Farm Construction SWPPP.											X		X		X			
Invasive species: Regularly monitor access roads and newly established utility and transmission line corridors for the establishment of invasive species. Initiate weed control measures immediately upon evidence of the introduction or establishment of invasive species.	ER-13, ERP 5-131														X			
Invasive species: Vehicles shall be washed outside of active agricultural areas to minimize the possibility of the spread of noxious weeds.	LU-5, LUP 5-14														X			
Maintenance: Clean and maintain catch basins, drainage ditches, and culverts regularly.	WR-5, WRP 5-33							X					X	X				
Maintenance: Inoperative or incomplete turbines cause the misperception in viewers that "wind power does not work" or that it is unreliable. Inoperative turbines shall be repaired, replaced, or removed quickly. Nacelle covers and rotor nose cones shall always be in place and undamaged.	VR-33, VRP 5-194						X											
Maintenance: Maintain all equipment in good working order in accordance with manufacturer specifications. Suitable mufflers and/or air-inlet silencers should be installed on all internal combustion engines and certain compressor components.	NIP 5-56					X	X											
Maintenance: Maintenance activities shall include dust abatement (in arid environments), litter cleanup, and noxious weed control.	VR-36, VRP 5-195								X		X				X			
Maintenance: Nacelles and towers shall be cleaned regularly (yearly, at minimum) to remove spilled or leaking fluids and the dirt and dust that accumulates, especially in seeping lubricants.	VR-34, VRP 5-194						X		X	X								
Maintenance: Promptly dispose of all garbage or human waste generated on site in order to avoid attracting nuisance wildlife.	ER-15, ERP 5-131								X							X		
Maintenance: Refueling areas shall be located away from surface water locations and drainages and on paved surfaces; features shall be added to direct spilled materials to sumps or safe storage areas where they can be subsequently recovered.	HM-12, HMP 5-248									X	X	X	X	X				
Maintenance: Regularly inspect access roads, utility and transmission line corridors, and tower site areas for damage from erosion, washouts, and rutting. Initiate corrective measures immediately upon evidence of damage.	ER-18, ERP 5-131							X	X		X		X	X				

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Maintenance: Restrict heavy vehicles and equipment to improved roads to the extent practicable.	SR-3, SRP 5-25							X			X							
Maintenance: Roads serving the site would need to be properly maintained to avoid erosion impacts.	LUP 5-13				X			X			X		X		X			
Maintenance: Schedules shall be established for the regular removal of wastes (including sanitary wastewater generated in temporary, portable sanitary facilities) for delivery by licensed haulers to appropriate off-site treatment or disposal facilities.	HM-19, HMP 5-249								X	X								
Maintenance: Spills shall be immediately addressed per the appropriate spill management plan, and cleanup and removal initiated, if needed. Operations and maintenance personnel shall be trained in spill prevention and containment, and spill containment supplies shall be located on site and be readily available.	HM-14, HMP 5-249								X	X								
Maintenance: Wind facilities and sites shall be actively and carefully maintained during operation. Wind energy projects shall evidence environmental care, which would also reinforce the expectation and impression of good management for benign or clean power.	VR-32, VRP 5-194						X		X									
Noise: Establish a process for documenting, investigating, evaluating, and resolving project-related noise complaints.	NI-4, NIP 5-57					X												
Noise: If a transformer becomes a noise issue, a new transformer with reduced flux density generating noise levels as much as 10–20 dB lower than National Electrical Manufacturers Association (NEMA) standard values could be installed. Alternatively, barrier walls, partial enclosures, or full enclosures could be adopted to shield or contain the transformer noise, depending on the degree of noise control needed.	NIP 5-57					X												
Noise: Select equipment with the lowest noise levels available and no prominent discrete tones, when possible.	NI-1, NP 5-56					X												
Recreation: Adequate safety measures (e.g., access control and traffic management) shall be established for recreational visitors to adjacent properties.	LU-9, LUP 5-14			X	X				X									
Restoration: A site restoration plan shall be in place prior to construction. Restoration of the construction areas shall begin immediately after construction to reduce the likelihood of visual contrasts associated with erosion and invasive weed infestation and to reduce the visibility of affected areas as quickly as possible.	VR-9, VRP 5-192						X				X				X			
Restoration: Develop restoration plans to ensure that all temporary use areas are restored.	LU-1, LUP 5-14				X								X	X				
Restoration: Disturbed surfaces shall be restored to their original contours as closely as possible and revegetated immediately after, or contemporaneously with, construction. Prompt action shall be taken to limit erosion and to accelerate restoring the preconstruction color and texture of the landscape.	VR-10, VRP 5-192						X				X				X			

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Restoration: Initiate habitat restoration of disturbed soils and vegetation as soon as possible after construction activities are completed. Restore areas of disturbed soil using weed-free native grasses, forbs, and shrubs, in consultation with land managers and appropriate agencies such as State or County extension offices or weed boards.	ER-9, ERP 5-130						X				X				X			
Restoration: Interim restoration shall be undertaken during the operating life of the project as soon as possible after disturbances.	VR-38, VRP 5-195										X				X			
Restoration: Reclaim areas of disturbed soil using weed-free native shrubs, grasses, and forbs. Restore the vegetation cover, composition, and diversity to values commensurate with the ecological setting.	ER-25, ERP 5-132														X			
Restoration: Reseed (non-cropland) disturbed areas with a native seed mix and revegetate disturbed areas immediately following construction.	WR-9, WRP 5-33														X			
Restoration: Reseed disturbed areas with a native seed mix and revegetate disturbed areas immediately following construction.	SR-12, SRP 5-26														X			
Restoration: Road-cut slopes shall be rounded, and the cut/fill pitch shall be varied to reduce contrasts in form and line; the slope shall be varied to preserve specimen trees and nonhazardous rock outcroppings.	VR-17, VRP 5-193						X				X				X			
Restoration: Rocks, brush, and forest debris shall be restored, whenever possible, to approximate preexisting visual conditions.	VR-44, VRP 5-195										X							
Restoration: Salvage topsoil from all excavation and construction activities to reapply to disturbed areas once construction is completed.	SR-7, SRP 5-26										X							
Restoration; Reestablish the original grade and drainage pattern to the extent practicable.	SR-11, SRP 5-26, WR-8, WRP 5-33										X							
Revegetation: Combining seeding, planting of nursery stock, transplanting of local vegetation within the proposed disturbance areas, and staging of construction shall be considered, enabling direct transplanting. Generally, native vegetation shall be used for revegetation, establishing a composition consistent with the form, line, color, and texture of the surrounding undisturbed landscape. Seed mixes shall be coordinated with local authorities, such as country extension services, weed boards, or land management agencies.	VR-42, VRP 5-195						X				X				X			
Safety: All site characterization, construction, operation, and decommissioning activities must be conducted in compliance with applicable Federal and State occupational safety and health standards (e.g., the Occupational Safety and Health Administration's [OSHA's] Occupational Safety and Health Standards, 29 CFR Parts 1910 and 1926, respectively).	HM-4, HMP 5-247								X	X								
Safety: All vehicles traveling within and around the project area should operate in accordance with posted speed limits.	NI-3, NP 5-57					X		X	X									

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Safety: As needed, the health and safety program must address OSHA standard practices for the safe use of explosives and blasting agents (if needed for site development); measures for reducing occupational EMF exposures; the establishment of fire safety evacuation procedures; and required safety performance standards (e.g., electrical system standards and lighting protection standards). The program shall include training requirements for applicable tasks for workers and establish procedures for providing required training to all workers. Documentation of training and a mechanism for reporting serious accidents to appropriate agencies shall be established.	HS-4, HSP 5-256								X	X								
Safety: Conduct a safety assessment to describe potential safety issues and the means that would be taken to mitigate them, covering issues such as site access, construction, safe work practices, security, heavy equipment transportation, traffic management, emergency procedures, and fire control.	HS-2, HSP 5-255							X										
Safety: Control vehicle and equipment speed on unpaved surfaces.	SR-4, SRP 5-25								X									
Safety: Cover vehicles transporting loose materials when traveling on public roads, and keep loads sufficiently wet and below the freeboard of the truck in order to minimize wind dispersal.	AQ-12, AQP 5-44						X											
Safety: Design all electrical systems to meet all applicable safety standards (e.g., the National Electrical Safety Code) and comply with the interconnection requirements of the transmission system operator.	HS-5, HSP 5-256								X									
Safety: Develop a fire management and protection plan to implement measures to minimize the potential for fires associated with substances used and stored at the site. The flammability of the specific chemicals used at the facility shall be considered.	HS-11, HSP 5-257								X									
Safety: Develop a health and safety program to protect workers during site characterization, construction, operation, and decommissioning of a wind energy project. The program shall identify all applicable Federal and State occupational safety standards and establish safe work practices addressing all hazards, including requirements for developing the following plans: general injury prevention; PPE requirements and training; respiratory protection; hearing conservation; electrical safety; hazardous materials safety and communication; housekeeping and material handling; confined space entry; hand and portable power tool use; gas-filled equipment use; and rescue response and emergency medical support, including on-site first-aid capability.	HS-3, HSP 5-255								X									

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Safety: Develop a project health and safety program that addresses protection of public health and safety during site characterization, construction, operation, maintenance, and decommissioning activities for a wind energy project. The program shall establish a safety zone or setback for wind energy facilities and associated transmission lines from residences and occupied buildings, roads, ROWs, and other public access areas that is sufficient to prevent accidents resulting from various hazards during all phases of development. It shall identify requirements for temporary fencing around staging areas, storage yards, and excavations during construction or decommissioning activities. It shall also identify measures to be taken during the operations phase to limit public access to facilities (e.g., equipment with access doors shall be locked to limit public access, and permanent fencing with slats shall be installed around electrical substations).	HS-7, HSP 5-256				X		X		X									
Safety: Drip pans shall be used under the fuel pump and valve mechanisms of any bulk fueling vehicles and during on-site refueling to contain accidental releases.	HM-13, HMP 5-248								X		X							
Safety: Project personnel and contractors shall be instructed and required to adhere to speed limits commensurate with road types, traffic volumes, vehicle types, and site-specific conditions to ensure safe and efficient traffic flow.	LU-13, LUP 5-16							X	X									
Safety: Train workers to comply with speed limits, use good engineering practices, minimize the drop height of excavated materials, and minimize disturbed areas.	AQ-11, AQP 5-44								X									
Safety: Use proper signage and/or engineered barriers (e.g., fencing) to limit access to electrically energized equipment and conductors in order to prevent access to electrical hazards by unauthorized individuals or wildlife.	HS-9, HSP 5-257								X							X		
Siting: Although wind turbines may sometimes be located on ridgelines, skylining of substations, transmission structures, communication towers, and other structures associated with wind energy developments should be avoided; that is, they should not be placed on ridgelines, summits, or other locations where they will be silhouetted against the sky from important viewing locations. Siting should avoid skylining by taking advantage of opportunities to use topography as a backdrop for views of facilities and structures. The presence of these structures should be concealed or made less conspicuous by siting and designing them to harmonize with desirable or acceptable characteristics of the surrounding environment.	VRP 5-188						X	X										
Siting: As feasible, siting of linear features (ROWs and roads) associated with wind energy developments should follow natural land contours rather than straight lines, particularly up slopes. Fall-line cuts should be avoided. Where it can be accomplished without introducing unacceptable impacts on other resources, following natural contours echoes the lines found in the landscape and often reduces cut-and-fill requirements; straight lines can introduce conspicuous linear contrasts that appear unnatural.	VRP 5-188						X	X			X							

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Siting: Avoid altering existing drainage systems, especially in sensitive areas such as erodible soils or steep slopes.	WR-4, WRP 5-33										X	X	X	X				
Siting: Avoid locating wind energy developments in areas of unique or important recreation, wildlife, or visual resources. When feasible, a wind energy development should be sited on already altered landscapes.	LUP 5-14			X	X		X									X	X	
Siting: Avoid placement of wind energy facilities in areas with unsuitable seismic, liquefaction, slope, subsidence, settling, and flooding conditions.	SRP 5-25										X							
Siting: Because the landscape setting observed from national historic sites, national trails, and tribal cultural resources may be a part of the historic context contributing to the historic significance of the site or trail, project siting should avoid locating facilities that would alter the visual setting such as would reduce the historic significance or function.	VRP 5-187																	X
Siting: Because visual impacts are usually lessened when vegetation and ground disturbances are minimized, where possible, in forested areas or shrublands, siting should take advantage of existing clearings to reduce vegetation clearing and ground disturbance.	VRP 5-189						X				X				X			
Siting: Consolidate infrastructure wherever possible to maximize efficient use of the land and minimize impacts. Existing transmission and market access should be evaluated and use of existing facilities should be maximized.	LUP 5-14							X			X		X	X				
Siting: Consult with Federal, State, and county agencies; tribes; property owners; and other stakeholders as early as possible in the planning process to identify potentially significant land use conflicts and issues and State and local rules that govern wind energy development.	LUP 5-14				X													
Siting: Consult with the DOD during initial project planning to evaluate the potential impact of a proposed development on military airspace in order to identify and address any DOD concerns.	LUP 5-15				X				X									
Siting: Establish sufficient setback distances from sensitive receptors wherever feasible. Based on previous experience, noise complaints seldom exist for people living more than 1–1.5 mi (1.6–2.4 km) from a wind farm (Stewart 2006).	NIP 5-56					X												
Siting: Existing roads should be used to the extent possible, but only in safe and environmentally sound locations. If new access roads are necessary, they should be designed and constructed to the appropriate standard necessary to accommodate their intended function (e.g., traffic volume and weight of vehicles) and minimize erosion. Access roads that are no longer needed should be recontoured and revegetated.	LUP 5-15						X	X			X			X	X			
Siting: Identify and avoid unstable slopes and local factors that can cause slope instability (groundwater conditions, precipitation, seismic activity, high slope angles, and certain geologic landforms).	WRP 5-33										X	X	X	X				
Siting: If operation of the wind energy facility and associated transmission lines and substations could cause potential adverse impacts on nearby residences and occupied buildings as a result of noise, sun reflection, or EMF, incorporate recommendations for addressing these concerns into the project design (e.g., establishing a sufficient setback from transmission lines).	HSP 5-257							X	X	X								

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Siting: Locations for transmission line and ROW road crossings of other roads, streams, and other linear features within a corridor should be chosen to avoid KOP viewsheds and other visually sensitive areas and to minimize disturbance to vegetation and landforms. The ROWs should cross linear features (e.g., trails, roads, and rivers) at right angles whenever possible to minimize the viewing area and duration.	VIP 5-189						X	X										
Siting: Minimize the extent of land disturbance to the extent possible.	WRP 5-33				X			X			X							
Siting: Minimize the extent of the project footprint, including improved roads and construction staging areas.	SRP 5-25			X	X		X	X			X		X	X	X	X		
Siting: Minimize the number of road miles of new road construction needed for the project.	ERP 5-129							X			X				X			
Siting: Minimize the size of areas in which soil would be disturbed or vegetation would be removed.	ERP 5-129										X				X			
Siting: Plan and site the wind energy development to minimize impacts on other land uses.	LUP 5-14				X													
Siting: Prepare the FAA-required notice of proposed construction during initial project planning in order to identify any air safety issues and required mitigation measures.	LUP 5-15				X				X									
Siting: Project design should provide visual order and unity among clusters of turbines (visual units) to avoid visual disruptions and perceived “disorder, disarray, or clutter.”	VRP 5-189						X											
Siting: Project developers shall work with appropriate agencies (e.g., DOE and TSA) to address critical infrastructure and key resource vulnerabilities at wind energy facilities, and to minimize and plan for potential risks from natural events, sabotage, and terrorism.	HS-12, HSP 5-257							X	X									
Siting: Site and design the project to comply with FAA regulations, including lighting requirements, and to avoid potential safety issues associated with proximity to airports, military bases or training areas, or landing strips.	HS-10, HSP 5-257						X		X									
Siting: Site and design wind energy facilities to eliminate glint and glare effects on roadway users, nearby residences, commercial areas, or other highly sensitive viewing locations, or reduce it to the lowest achievable levels.	HSP 5-257						X		X									
Siting: Site new roads to avoid crossing streams and wetlands and minimize the number of drainage bottom crossings.	SRP 5-25							X					X	X				
Siting: Site new roads to follow natural land contours; excessive slopes should be avoided.	SRP 5-25										X							
Siting: Siting of facilities, especially linear facilities, should take advantage of natural topographic breaks (i.e., pronounced changes in slope), and siting of facilities on steep side slopes should be avoided. Facilities sited on steep slopes are often more visible (particularly if either the project or viewer is elevated); in addition, they may be more susceptible to soil erosion, which could contribute to negative visual impacts.	VRP 5-188						X				X			X				
Siting: Siting should take advantage of both topography and vegetation (where possible) as screening devices to restrict views of projects from visually sensitive areas.	VRP 5-189						X				X				X			

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Siting: Spatially accurate and realistic photo simulations of wind turbines in the proposed location should be prepared as part of the siting process. Simulations should show views from sensitive visual resource areas; highly sensitive viewing locations, such as residences; and more representative typical viewing locations. Stakeholders should be involved in selecting KOPs for simulations. Where feasible, simulations should portray a range of lighting conditions and sun angles. Simulations should be based on accurate spatial information, particularly elevation data, and must account for screening vegetation and structures. Simulations should show enough of the surrounding landscape to show the project in the appropriate spatial context and should be reproduced at a large enough size to be comfortably viewed from the appropriate specified distance to accurately depict the apparent size of the facility in a real setting.	VRP 5-188			X			X											
Siting: Structures and roads should be designed and located to minimize and balance cuts and fills. Reducing cut and fill has numerous visual benefits, including fewer fill piles, landforms and vegetation that appear more natural, fewer or reduced color contrasts with disturbed soils, and reduced visual disturbance from erosion and the establishment of invasive species.	VRP 5-190						X	X			X							
Siting: Structures, roads, and other project elements should be set as far back from road, trail, and river crossings as possible, and vegetation should be used to screen views from crossings, where feasible.	VRP 5-191			X			X	X					X	X				
Siting: Take advantage of topography and the distance to nearby sensitive receptors when positioning potential sources of noise.	NIP 5-56					X												
Siting: The eye is naturally drawn to prominent landscape features (e.g., knobs and waterfalls); thus, projects and their elements should not be sited next to such features, where possible.	VRP 5-187						X				X							
Siting: The eye naturally follows strong natural lines in the landscape, and these lines and associated landforms can "focus" views on particular landscape features. For this reason, linear facilities associated with a wind energy project, such as transmission lines and roads, generally should not be sited so that they bisect ridge tops or run down the center of valley bottoms.	VRP 5-187						X				X							
Siting: The only way to completely avoid any adverse impacts on radar involves methods that avoid locating turbines in the radar line of sight (e.g., achieved by distance, terrain masking, or terrain relief; DOD 2006). An additional solution could be to replace aging radar equipment with modern and flexible equipment that can better distinguish wind farm clutter from aircraft or weather (Brenner et al. 2008). Turbine operations could also be curtailed during significant weather events. Western generally advises developers submitting nterconnection requests to avoid areas that would potentially conflict with radar facilities.	LUP 5-15				X				X									
Siting: The siting and design of facilities, structures, roads, and other project elements should match and repeat the form, line, color, and texture of the existing landscape.	VRP 5-190						X				X							

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Siting: Through site design, the number of structures required should be minimized. Activities should be combined and carried out in one structure, or structures should be collocated to share pads, fences, access roads, lighting, etc.	VRP 5-190				X		X											
Siting: To the extent possible, given the terrain of a site, wind turbines should be clustered or grouped when placed in large numbers, but a cluttering effect should be avoided by separating otherwise overly long lines of turbines or large arrays, and breaks or open zones should be inserted to create distinct visual units or groups of turbines.	VRP 5-189						X				X							
Siting: To the extent possible, transmission lines and roads associated with wind energy facilities should be collocated within a corridor to use existing/shared ROWs, existing/shared access and maintenance roads, and other infrastructure in order to reduce visual impacts associated with new construction.	VRP 5-189						X	X										
Siting: Use existing roads and disturbed areas to the extent possible.	SRP 5-25, WRP 5-33				X		X				X		X	X	X	X		X
Siting: Use existing roads to the maximum extent feasible to access a proposed project area. Install meteorological towers and conduct other characterization activities (e.g., geotechnical testing) as close as practicable to existing access roads.	VR-12, VRP 5-193			X	X		X	X			X				X	X		
Siting: Where possible, developments should be sited in already industrialized and developed landscapes, with due consideration for visual absorption capacity and possible cumulative effects.	VRP 5-187				X		X											
Siting: Wind turbine siting should be sensitive to and respond to the surrounding landscape in a visually pleasing way. For example, in rolling landscapes, a less rectilinear and rigid configuration of turbines that follows local topography may be appropriate. In flatter agricultural landscapes with rectilinear patterns of road and fields, a more geometric or linear wind turbine configuration may be preferred.	VRP 5-189			X			X	X										
Siting: Wind turbines should be sited properly to eliminate shadow flicker effects on nearby residences or other highly sensitive viewing locations, or reduce them to the lowest achievable levels, as calculated using appropriate siting software and procedures. Accurately determined shadow flicker estimates should be made available to stakeholders in advance of project approval. If turbine locations are changed during the siting process, shadow flicker effects should be recalculated and made available to potentially affected stakeholders.	VRP 5-188						X											
Soils: Following completion of construction and during decommissioning, subsoil shall be decompacted.	LU-8, LUP 5-14										X							
Soils: Minimize ground-disturbing activities, especially during the rainy season.	SR-1, SRP 5-25										X		X	X				
Soils: Topsoil from cut/fill activities shall be segregated and spread on freshly disturbed areas to reduce color contrast and aid rapid revegetation. Topsoil piles shall not be left in sensitive viewing areas.	VR-20, VRP 5-193						X				X				X			

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Soils: Topsoil shall be stripped from any agricultural area used for traffic or vehicle parking— segregating topsoil from excavated rock and subsoil—and replaced during restoration activities.	LU-6, LUP 5-14				X			X			X				X			
Topography: Benches shall be provided in rock cuts to accent natural strata.	VR-19, VRP 5-193						X				X							
Topography: Cut slopes shall be randomly scarified and roughened to reduce texture contrasts with existing landscapes and to aid in revegetation.	VR-41, VRP 5-195						X				X							
Topography: Natural or previously excavated bedrock landforms shall be sculpted and shaped when excavation of these landforms is required. A percentage of backslope, benches, and vertical variations shall be integrated into a final landform that repeats the natural shapes, forms, textures, and lines of the surrounding landscape. The earthen landform shall be integrated and transitioned into the excavated bedrock landform. Sculpted rock face angles, bench formations, and backslope need to adhere to the natural bedding planes of the natural bedrock geology. Half-case drill traces from pre-split blasting shall not remain evident in the final rock face. Where feasible, the color contrast shall be removed from the excavated rock faces by color-treating with a rock stain.	VR-24, VRP 5-193						X				X							
Transportation: A traffic management plan shall be prepared for the site access roads to ensure that no hazards would result from increased truck traffic and that traffic flow would not be adversely impacted. This plan shall identify measures that will be implemented to comply with any State or Federal DOT requirements, such as informational signs, flaggers when equipment may result in blocked throughways, and traffic cones to identify any necessary changes in temporary lane configurations. Signs shall be placed along roads to identify speed limits, travel restrictions, and other standard traffic control information. To minimize impacts on local communities, consideration shall be given to limiting construction vehicles on public roadways during the morning and late afternoon commute times.	HS-8, HSP 5-256							X	X									
Transportation: A transportation plan shall be prepared that identifies measures the developer will implement to comply with State or Federal requirements and to obtain the necessary permits. This will address the transport of turbine components, main assembly crane, and other large pieces of equipment. The plan shall consider specific object size, weight, origin, destination, and unique handling requirements and shall evaluate alternative means of transportation (e.g., rail or barge).	LU-11, LUP 5-15				X			X	X									
Transportation: Access roads shall be designed and constructed to the appropriate standard necessary to accommodate their intended function (e.g., traffic volume and weight of vehicles) and minimize erosion. Access roads that are no longer needed should be recontoured and revegetated.	LU-10, LUP 5-15				X			X			X				X			

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Transportation: Develop a traffic management plan for the site access roads to control hazards that could result from increased truck traffic (most likely during construction or decommissioning), ensuring that traffic flow would not be adversely affected and that specific issues of concern (e.g., the locations of school bus routes and stops) are identified and addressed. This plan shall incorporate measures such as informational signs, flaggers (when equipment may result in blocked throughways), and traffic cones to identify any necessary changes in temporary lane configurations. The plan shall be developed in coordination with local planning authorities.	HS-8, HSP 5-256						X	X	X									
Vegetation: Planting pockets shall be left on slopes, where feasible.	VR-18, VRP 5-193						X								X			
Vegetation: Reduce habitat disturbance by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas.	ER-4, ERP 5-130															X		
Vegetation: Road maintenance activities shall avoid blading of existing forbs and grasses in ditches and adjacent to roads; however, any invasive or noxious weeds shall be controlled as needed.	VR-37, VRP 5-195						X	X							X			
Vegetation: The vegetation-clearing design in forested areas should include the feathering of cleared area edges (i.e., the progressive and selective thinning of trees from the edge of the clearing inward) combined with the mixing of tree heights from the edge to create an irregular vegetation outline. These actions would result in a more natural-appearing edge, thereby avoiding the very high linear contrasts associated with straight-edged, clear-cut areas.	VRP 5-190						X								X			
Visual: In addition to mitigation measures that directly reduce the visual resource impacts of wind energy and associated facilities, aesthetic offsets present a mitigation option in some situations. Aesthetic offsets should be considered in situations where visual impacts are unavoidable or where alternative mitigation options are only partially effective or uneconomical. An aesthetic offset is a correction or remediation of an existing condition located in the same viewshed of the proposed development that has been determined to have a negative visual or aesthetic impact. For example, aesthetic offsets could include reclamation of unnecessary roads in the area, removal of abandoned buildings, cleanup of illegal dumps or trash, or the rehabilitation of existing erosion or disturbed areas.	VRP 5-196						X	X										
Visual: In forested areas and shrublands, openings in vegetation for facilities, structures, roads, etc., should mimic the size, shape, and characteristics of naturally occurring openings to the extent possible.	VRP 5-190						X	X							X			
Visual: In forested areas or shrublands, where possible, linear facilities should follow the edges of clearings (where they would be less conspicuous) rather than pass through their center.	VRP 5-189						X				X				X			
Visual: Installation of gravel and pavement shall be avoided where possible to reduce color and texture contrasts with the existing landscape.	VR-14, VRP 5-193						X	X										

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Visual: Lighting for facilities shall not exceed the minimum required for safety and security, and full cutoff designs that minimize upward light scattering (light pollution) shall be selected. If possible, site design shall be accomplished to make security lights nonessential. Where they are necessary, security lights shall be extinguished except when activated by motion detectors (e.g., only around the substation).	VR-7, VRP 5-192						X									X		
Visual: Minimize the amount of lighting installed on project turbines; all outdoor lighting on project buildings shall be downshielded.	ER-10, ERP 5-130						X											
Visual: Penalty clauses should be used to protect trees and other sensitive visual resources.	VRP 5-192						X								X			
Visual: Signage shall be minimized; reverse sides of signs and mounts shall be painted or coated to reduce color contrasts with the existing landscape.	VR-28, VRP 5-194						X											
Visual: Soil disturbance shall be minimized in areas with highly contrasting subsoil color.	VR-23, VRP 5-193						X				X							
Visual: The operator shall use nonreflective paints and coatings on wind turbines, visible ancillary structures, and other equipment to reduce reflection and glare.	VR-5, VRP 5-191						X											
Visual: Turbines, visible ancillary structures, and other equipment shall be painted before or immediately after installation.	VR-6, VRP 5-191						X											
Visual: Valuable trees and other scenic elements can be protected by clearing only to the edge of the designed grade manipulation and not beyond through the use of retaining walls, and by protecting tree roots and stems from construction activities. Brush-beating or mowing rather than vegetation removal should be done, where feasible.	VRP 5-193						X								X			
Visual: Visual impact mitigation objectives and activities shall be discussed with equipment operators before construction activities begin.	VR-11, VRP 5-192						X											
Visual: Where possible, projects should be sited outside the viewsheds of key observation points (KOPs), highly sensitive viewing locations, and/or areas with limited visual absorption capability and/or high scenic integrity. When wind energy developments and associated facilities must be sited within view of KOPs, they should be sited as far away as possible, since visual impacts generally diminish as viewing distance increases.	VRP 5-187			X			X											
Visual: Where possible, staging and laydown areas should be sited outside the viewsheds of KOPs and not in visually sensitive areas; they should be sited in swales, around bends, and behind ridges and vegetative screens, where these screening opportunities exist.	VRP 5-192			X			X				X							
Visual: Where screening topography and vegetation are absent, natural-looking earthwork berms and vegetative or architectural screening should be used to minimize visual impacts associated with ancillary facilities. Vegetative screening can be particularly effective along roadways.	VRP 5-190						X				X				X			
Visual: Wind turbines should exhibit visual uniformity in the shape, color, and size of rotor blades, nacelles, and towers.	VRP 5-190						X											
Water Resources: Avoid creating hydrologic conduits between two aquifers (e.g., upper and lower).	WRP 5-33											X	X	X				

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Water Resources: Identify areas of groundwater recharge and discharge and evaluate their potential relationship with surface water bodies and groundwater quality.	WRP 5-33											X	X	X				
Water resources: Isolate excavation areas (and soil piles) from surface water bodies using silt fencing, bales, or other accepted appropriate methods to prevent sediment transport by surface runoff.	SR-9, SRP 5-26						X				X							
Water resources: Use earth dikes, swales, and lined ditches to divert local runoff around the work site.	SR-10, SRP 5-26										X		X	X				
Wetlands/Vegetation: For wetland and grassland easements, coordinate closely with the USFWS or USDA during initial project planning to ensure that wetland and grassland easements are avoided to the extent practicable.	LUP 5-15						X							X	X			
Wildlife/Vegetation: Contact appropriate Federal and State agencies (including State entities responsible for permitting energy development projects) early in the planning process to identify potentially sensitive ecological resources known to be present or likely to be present in the vicinity of the wind energy development.	WRP 5-128							X			X							
Wildlife/Vegetation: Do not locate individual meteorological towers in or adjacent to sensitive habitats or in areas where ecological resources known to be sensitive to human activities are present.	WRP 5-129			X	X										X	X		
Wildlife/Vegetation: If pesticides/herbicides are to be used on the site, develop an integrated pest and vegetation management plan to ensure that applications will be conducted within the framework of managing agencies and will entail the use of only EPA-registered pesticides/herbicides that are (1) nonpersistent and immobile and (2) applied by licensed applicators in accordance with label and application permit directions, following stipulations regarding suitability for terrestrial and aquatic applications.	HM-3, HMP 5-247								X						X	X		

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Wildlife/Vegetation: Review existing information on species and habitats in the project area. Identify important, sensitive, or unique habitat (including large contiguous tracts of grassland habitat) and biota in the project site and vicinity, and design the project to avoid, minimize, or mitigate potential impacts on these resources. Avoidance is the typically the most effective, and therefore preferred, choice for minimizing impacts. The design and siting of the facility should follow appropriate guidance and requirements from Western and the USFWS (as specified for each species in the selected alternative in the Final PEIS) as well as those required by State permitting agencies, and other resource agencies, as available and applicable. For birds specifically, attention should be given to project placement that may be within or near Important Bird Areas (http://netapp.audubon.org/iba) or Hemispheric or Regional Western Hemisphere Shorebird Reserve Network sites (http://www.whsrn.org/whsrn-sites), or where bird species or habitats of conservation concern are known to occur. The IBA Program has identified the most essential areas for birds, and conservation of these areas will provide for long-term protection of biodiversity. Sources of information on these important habitats can be found at http://ecos.fws.gov/ipac, http://www.avianknowledge.net, and http://web4.audubon.org/bird/iba.	WRP 5-127															X		
Wildlife: A minimum of 1 yr of post-construction monitoring is needed to validate the preconstruction risk assessment and allow the facility owner to adjust operations based on identified problems. Based on project location in proximity to occupancy, habitat, and other attributes that may increase the risk to birds and bats, multiyear post-construction monitoring may be necessary at some project sites. It is of paramount importance that post-construction surveys are accurate estimates of fatality at wind power facilities. Simple carcass counts at wind energy facilities are inaccurate and underestimate the total number of fatalities because not all carcasses are found due to factors such as unsearchable terrain, carcass removal by scavengers, and less than perfect searcher efficiency. Post-construction surveys for mortality must be robust and standardized to provide reliable results upon which to base adaptive management decisions. For these reasons, using a fatality estimator model is critical. The USFWS recommends a model like the Evidence of Absence model developed by Huso et al. (2014). The user's guide and software developed to estimate bird and bat fatalities at wind-power facilities (Dalthorp et al. 2014) can be found at http://pubs.usgs.gov/ds/0881. The Evidence of Absence software provides for comparison of various combinations of search coverage, search interval, and searcher efficiency that all produce the same overall level of carcass detection probability. Results of monitoring activities shall be reported to the appropriate State or Federal agencies in a timely manner.	WRP 5-126															X		
Wildlife: Avoid constructing turbines in areas of concentrated prey base for raptors (e.g., prairie dog towns).	ERP 5-130															X		

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Wildlife: Consult with the appropriate natural resource agencies to avoid scheduling construction activities during important periods for wildlife courtship, breeding, nesting, lambing, or calving that are applicable to sensitive species within the project area.	ERP 5-130				X											X		
Wildlife: Establish buffer zones around known raptor nests, bat roosts, and biota and habitats of concern if site evaluations show that proposed construction activities would pose a significant risk to avian or bat species of concern.	ER-6, ERP 5-130															X		
Wildlife: Evaluate potential avian and bat use (including the locations of active nest sites, colonies, roosts, and migration corridors) of the project and use data to plan turbine (and other structure/infrastructure) locations to minimize impacts.	ERP 5-128															X		
Wildlife: Evaluate the potential for the wind energy project to adversely affect bald and golden eagles in a manner consistent with the Eagle Conservation Plan Guidance (USFWS 2013a). Early in the planning of transmission interconnection and wind farm location, coordination with USFWS Field Offices regarding the guidance is highly recommended. Documented occurrence of eagles can be acquired from the local USFWS Ecological Services office, State wildlife agencies, or State natural heritage databases in some cases, although on-site surveys may be needed. In accordance with the USFWS's Land-Based Wind Energy Guidelines (USFWS 2012b), surveys during early project development should identify all important eagle use areas (nesting, foraging, and winter roost areas) within the project's footprint. If recent data are available on the spacing of occupied eagle nests for the project-area nesting population, these data can be used to delineate an appropriate boundary for the project area. If appropriate survey data are unavailable, the USFWS suggests that the project area, for the purpose of evaluating potential effects on eagles, be defined as the project footprint together with areas within 10 mi (16 km) of the footprint boundary. As described in the USFWS's Land-Based Wind Energy Guidelines (USFWS 2012b), project developers should evaluate the need to develop an ECP.	ERP 5-128															X		
Wildlife: Follow the recommendations provided in the USFWS's Land-Based Wind Energy Guideline (USFWS 2012b) and, as appropriate, the Eagle Conservation Plan Guidance (USFWS 2013a). In addition, follow guidelines or recommendations developed by individual States (e.g., IDNR 2011; Kempema 2009; Nebraska Wind and Wildlife Working Group 2011) to address potential effects of wind energy development on ecological resources.	WRP 5-126				X											X		
Wildlife: If appropriate, conduct surveys for presence of Federal- and State-protected species and other species of concern and the habitats for such species that have a reasonable potential to occur within the project area based on habitat characteristics. Consult with the USFWS and/or appropriate State agency to identify species likely to be present and appropriate survey techniques, determine permit needs, and identify/apply species-specific avoidance and minimization measures.	WRP 5-128															X	X	

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Wildlife: If bat monitoring is appropriate for the site, installation of bat acoustic monitors should be considered at the time meteorological towers are installed to reduce costs and minimize delays by collecting data early during the site review process.	WRP 5-126															X		
Wildlife: If significant impacts on Important Bird Areas (IBAs) or similar ecologically important avian areas are not avoided, minimized, or mitigated, then this Final PEIS would not apply and a separate project specific NEPA evaluation must be developed and approved by the appropriate responsible federal agency prior to project construction.	WRP 5-128															X		
Wildlife: In the absence of long-term mortality studies, monitor regularly for potential wildlife problems including wildlife mortality. Report observations of potential wildlife problems, including wildlife mortality, to the appropriate State or Federal agency in a timely manner, and work with the agencies to utilize this information to avoid/minimize/offset impacts. The Ecological Services Division of the USFWS shall be contacted. Development of additional mitigation measures may be necessary.	ER-22, ERP 5-131															X		
Wildlife: Increasing turbine cut-in speeds (i.e., prevent turbine rotation at lower wind velocity) in areas of bat conservation concern during times when active bats may be at particular risk from turbines.	ER-20, ERP 5-131															X		
Wildlife: Instruct employees, contractors, and site visitors to avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship and nesting) seasons. Pets shall not be allowed on the project area.	ER-21, ERP 5-131															X		
Wildlife: Palmer's Creek Wind will implement adaptive management strategies (i.e., apply new strategies as they evolve) for identifying and mitigating collision mortality at turbines and overhead lines.																X		
Wildlife: Palmer's Creek Wind, via coordination with MNDNR, has committed to implementing advanced project monitoring at select wind turbines. This monitoring entails 3 years of 4-days per week fatality monitoring at wind turbines identified as high risk (see BBCS for complete monitoring details).																X		
Wildlife: Place marking devices on any newly constructed or upgraded transmission lines, where appropriate, within suitable habitats for sensitive bird species.	ER-14, ERP 5-131															X		
Wildlife: Prepare a Bird and Bat Conservation Strategy (BBCS). The overall goal of such a plan is to reduce or eliminate avian and bat mortality; implementation of a BBCS builds support for a FONSI when projects tier from the PEIS. The wind energy facility developer should work closely with the USFWS and the appropriate State wildlife agencies to identify protective measures to include in the plan. These would include project design measures, construction phase measures, operational phase measures, and decommissioning phase measures.	WRP 5-126															X		

BMP	References	Socio (7.1)	Land-Based Econ (7.2)	Rec & Tourism (7.3)	Land Use (7.4)	Noise (7.5)	Visual Impacts (7.6)	Public Service & Infra. (7.7)	Public Health & Safety (7.8)	Haz. Mat. (7.9)	Soils & Topo (7.10)	Ground-water Resources (7.11)	Surface Water & Flood-plains (7.12)	Wetlands (7.13)	Veg. (7.14)	Wildlife (7.15)	Rare & Unique Natural Resources (7.16)	Cultural & Archae (7.17)
Wildlife: The transmission lines shall be designed and constructed with regard to the recommendations in Avian Protection Plan Guidelines (APLIC and USFWS 2005), in conjunction with Suggested Practices for Avian Protection on Power Lines (APLIC 2006) and Reducing Avian Collisions with Power Lines (APLIC 2012), to reduce the operational and avian risks that result from avian interactions with electric utility facilities.	ER-1, ERP 5-128															X		
Wildlife: Tier to the Final Programmatic EIS. The responsible federal agency will use a tiered NEPA evaluation to document avoidance, minimization, or mitigation of impacts to important bird habitat (e.g., established private, State, or federal special management areas for birds, IBAs, Regional Western Hemisphere Shorebird Reserve Network, [http://www.whsrn.org/whsrn-sites], etc.) to achieve no significant impact to avian resources. On a project-by-project basis, developers should contact local USFWS offices early in the planning process to identify areas of conflict with specific avian species or important bird habitat. Developers shall work with USFWS and Western to develop avoidance, minimization, or mitigation measures to adequately demonstrate their project will have no significant impact on avian resources. In these cases, individual projects determined to be consistent with the selected alternative in the Final PEIS will require a FONSI to document consistency.	ER 5-127															X		
Wildlife: Turn off unnecessary lighting at night to limit attraction of migratory birds. Follow lighting guidelines, where applicable, from the Wind Energy Guidelines Handbook. This includes using lights with timed shutoff, downward-directed lighting to minimize horizontal or skyward illumination, and avoidance of steady-burning, high-intensity lights.	ER-19, ERP 5-131															X		

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APPENDIX H – PHASE I RECONNAISSANCE SURVEY OF THE PALMER’S CREEK WIND PROJECT

APPENDIX I – PUBLIC INVOLVEMENT INFORMATION

AFFIDAVIT OF PUBLICATION
Granite Falls – Clarkfield Advocate Tribune
713 Prentice St.
Granite Falls, MN 56241
State of Minnesota, County of Yellow Medicine

Lee Ann Smith, being duly sworn, on oath, says that he/she is the publisher or authorized agent of the newspaper known as the Granite Falls – Clarkfield Advocate Tribune, and has full knowledge of the facts which are stated below:

(A) The newspaper has complied with all of the requirements constituting qualification as a qualified newspaper, as provided by Minnesota Statute 331A.02, 331A.07, and other applicable laws, as amended.

(B) The printed Palmer's Creek Wind farm - Public Notice

which is attached was cut from the columns of said newspaper, and was printed and published once each week, for 1 successive weeks; it was first published on Thurs, the 10 day of Nov, 20 16, and was thereafter printed and published on every ____ to and including ____, the ____ day of ____, 20 ____; and printed below is a copy of the lower case alphabet from A to Z, both inclusive, which is hereby acknowledged as being the size and kind of type used in the composition and publication of the notice.

abcdefghijklmnopqrstuvwxyz

(C) Pursuant to Minnesota Statutes §580.033 relating to the publication of mortgage foreclosure notices: The newspaper's known office of issue is located in Yellow Medicine County. The newspaper complies with the conditions described in §580.33, subd.1, clause (1) or (2). If the newspaper's known office of issue is located in a county adjoining the county where the mortgaged premises or some part of the mortgaged premises described ion the notice are located, a substantial portion of the newspaper's circulation is in the latter county.

By Lee Ann Smith

Title Authorized Agent

Subscribed and sworn to before me on:

this 21 day of Nov, 20 16.

Ashley Finnes

Notary Public

RATE INFORMATION

(1) Lowest classified rate by commercial user for comparable space	$ ____ (Line, word or inch rate)
(2) Maximum rate allowed by law for the above matter	$ ____ (Line, word or inch rate)
(3) Rate actually charged for the above matter	$ ____ (Line, word or inch rate)

PUBLIC NOTICE

Public Input Encouraged!

Public comments are sought to define the scope and alternatives for an Environmental Assessment of a proposed wind facility in Chippewa County, north of Granite Falls, Minnesota. The proposed project, called Palmer's Creek Wind Farm, will include up to 18 wind turbine generators and the associated access roads and underground power collection system. An operations and maintenance facility will also be part of this project. Construction of the Palmer's Creek wind energy project is proposed to begin September 2017.

Western Area Power Administration will hold a public scoping meeting to define the scope of the Palmer's Creek Wind Environmental Assessment. The meeting location is handicapped accessible.

To learn more about this project and to share your ideas, join us at: 5 to 8 p.m. Thursday, December 1, 2016, Kilowatt Comunity Center, 600 Kilowatt Drive, Granite Falls, MN 56241.

For more information about the proposed project or to be added to the project mailing list, please contact:

Tom Atkinson, Environmental Protection Specialist, Western Power Administration, P.O. Box 1173, Bismarck, ND 58102-1173. Phone: (800) 422-0828. Email: tatkinson@wapa.gov

November 10, 2016

ASHLEY C. FINNES
Notary Public-Minnesota
My Commission Expires Jan 31, 2018

Western
AREA POWER
ADMINISTRATION

Scoping Meeting
Palmer Creek Wind Farm
Environmental Assessment (EA)

Thank you for your interest in the proposed Palmer Creek Wind Farm EA. Please complete the appropriate sections of this form to be included on the EA mailing list and/or to provide comments. Written comments can be submitted at the Scoping Meeting, faxed to (701) 221-4526, mailed to Mr. Tom Atkinson, Western Area Power Administration, North Dakota Maintenance Office, P.O. Box 1173, Bismarck, ND 58502-1173 or sent to **tatkinson@wapa.gov.**

☐ I would like to be kept informed of the ongoing progress of this Project. Please include my name on the mailing list.
☐ I prefer electronic/email communication.
☐ I prefer paper mailings.

Please Print Contact Info Below

Name:	Organization:
E-mail address:	Daytime Phone No. (*optional*):
Street Address:	City / State / Zip Code:

Please indicate any questions, comments or concerns you have about the proposed agreement modification in the comment section below (continue on separate sheet if necessary).

Thank you for your time and interest.

Department of Energy
Western Area Power Administration
Upper Great Plains Customer Service Region
P.O. Box 35800
Billings, MT 59107-5800

B0401.BL

OCT 1 2 2017

Dear Customers and Interested Parties:

This letter is to update you on the proposed Palmer's Creek Wind Project (Project) and to request your input on the Project. Palmer's Creek Wind, LLC proposes to construct a 45-megawatt (MW) wind farm with approximately 18 turbines and associated pads. Other Project components would include access roads, a new collector substation, an operations and maintenance facility, and other associated facilities. The Project would interconnect with Western Area Power Administration's (WAPA) Granite Falls Substation. The Project would be located on roughly 6,150 acres of privately owned land in Township 116N, Ranges 39W and 40W, Chippewa County, Minnesota.

The proposed interconnection is a Federal action under the National Environmental Policy Act of 1969. As a result, a draft Environmental Assessment (EA) has been prepared to analyze the environmental effects of the proposed Project on resources such as wetlands, vegetation and wildlife, cultural and recreation resources, as well as other social, economic, and environmental effects.

WAPA is requesting your review and comment on the draft EA, which is available for download at the following website:
https://www.wapa.gov/regions/UGP/Environment/Pages/Palmer'sCreekWind.aspx. Comments may be submitted in the following ways:

- By mail to:
  Western Area Power Administration
  6th Floor, Attn: Ms. Christina Gomer
  2900 4th Avenue North
  Billings, MT 59101
- By email to gomer@wapa.gov

For your input to be considered, comments must be received no later than Wednesday, November 15th, 2017. If you have any questions or need more information about the Project, please contact WAPA using the methods listed above or visit the Project website, also listed above. Thank you for your time and interest in the project.

Sincerely,

Christina M. Gomer

Christina M. Gomer
NEPA Coordinator

«First Name»	«Last Name»	«Job Title»	«Company/agency»	«Address 1»	«Address 2»	«City»	«State»	«Zip»
John	Fowler	Executive Director	Advisory Council on Historic Preservation	401 F Street NW	Suite 308	Washington	DC	20001-2637
Liz	Ludwig	Chippewa County Farm Service Agency	U.S. Department of Agriculture	629 North 11th Street	Suite 8	Montevideo	MN	56265
		Minnesota Flight Standards District Office	U.S. Department of Transportation, Federal Aviation Administration	6020 28th Avenue South		Minneapolis	MN	55450
Janet	Odeshoo	Acting Regional Administrator, Region V	U.S. Department of Homeland Security, Federal Emergency Management Agency	536 South Clark Street	6th Floor	Chicago	IL	60605
Michael	Bardee	Director, Office of Electric Reliability	Department of Energy, Federal Energy Regulatory Commission	888 First Street NE		Washington	DC	20426
Arlene	Kocher	Division Administrator, Minnesota Division	U.S. Department of Transportation, Federal Highway Administration	380 Jackson Street	Suite 500	Saint Paul	MN	55101
		St. Paul District	U.S. Army Corps of Engineers	180 5th Street East	Suite 700	Saint Paul	MN	55101
Alan	Walts	Director, Office of Enforcement and Compliance Assurance	U.S. Enviornmental Protection Agency, Region 5	77 West Jackson Boulevard		Chicago	IL	60604-3507
Cathee	Pullman	Minnesota State Office	U.S. Department of Agriculture, Natural Resources Conservation Service	375 Jackson Street	Suite 600	Saint Paul	MN	55101
Shantel	Lozinski	District Conservationist, Montevideo Field Office	U.S. Department of Agriculture, Natural Resources Conservation Service	619 North 11th Street	Suite 700	Montevideo	MN	56265
Ron	Omann	Enviornmental & Energy Coordinator	U.S. Department of Agriculture, Rural Utilities Service	375 Jackson Street	Suite 410	Saint Paul	MN	55101
Dean	Gettinger	District Manager, Northeastern States Office	U.S. Department of Interior, Bureau of Land Management	626 East Wisconsin Avenue	Suite 3200	Milwaukee	WI	53202-4617
		Minnesota Field Office	U.S. Department of Interior, Fish and Wildlife Service	4101 American Boulevard East		Bloomington	MN	55425-1665
Lori	Nordstrom	Assistant Regional Director, Midwest Region Ecological Services	U.S. Department of Interior, Fish and Wildlife Service	5600 American Blvd W	Suite 990	Bloomington	MN	55437-1458
		Litchfield Wetland Management District	U.S. Department of Interior, Fish and Wildlife Service	22274 615th Avenue		Litchfield	MN	55355
Patricia	Olby	Superintendent	U.S. Department of Interior, Bureau of Indian Affairs	Federal Building, Room 418	522 Minnesota Avenue NW	Bemidji	MN	56601
Tammie	Poitra	Acting Regional Director, Midwest Region	U.S. Department of Interior, Bureau of Indian Affairs	5600 American Blvd W	Suite 500	Bloomington	MN	55437
Collin	Peterson	Congressman, Montevideo District Office	U.S. House of Representatives, Minnesota District 7	100 North First Street		Montevideo	MN	56265
Al	Franken	Senator, Saint Paul Office	U.S. Senate	60 Plato Blvd. East	Suite 220	Saint Paul	MN	55107
Amy	Klobuchar	Senator, Northwestern & Central Office	U.S. Senate	121 4th Street South		Moorehead	MN	56560
Kevin	Mixon	Ecological and Water Resources	Minnesota Department of Natural Resources	261 Hwy 15 South		New Ulm	MN	56073
Jon	Huseby	District Engineer, Southwest Region	Minnesota Department of Transportation	2505 Transportation Road		Willmar	MN	56201
Nancy	Lange	Chair	Minnesota Public Utilities Commission	121 7th Place East	Suite 350	Saint Paul	MN	55101
Sarah	Beimers	Manager of Government Programs & Compliance	Minesota Historical Society	345 Kellogg Blvd. W.		Saint Paul	MN	55102-1903
Kate	Perushek	Governor's Office Liaison	State of Minnesota, Indian Affairs Council	161 Saint Anthony Avenue	Suite 919	Saint Paul	MN	55103
Mark	Dayton	Governor	Minnesota Office of the Governor	130 State Capitol	75 Rev. Dr. Martin Luther King Jr. Blvd	Saint Paul	MN	55155
Gary	Dahms	State Senator	Minnesota State Senate	95 University Avenue W.	Minnesota Senate Bldg., Room 2111	Saint Paul	MN	55155
Chris	Swedzinski	State Congressman	Minnesota State House of Representative	409 State Office Building		Saint Paul	MN	55155
Collin	Peterson	State Congressman	Minnesota State House of Representative	415 State Office Building		Saint Paul	MN	55155
		Energy Environmental Review & Analysis	Minnesota Department of Commerce	85 7th Place East	#280	Saint Paul	MN	55101
Mark	Schnobrich	McLead SWCD Supervisor	Minnesota Association of Soil and Water Conservation Districts	24209 Unit Avenue		Hutchinson	MN	55350
Thomas	Warner		Chippewa Soil and Water Conservation District	629 North 11th Street	Suite 7	Montevideo	MN	56265
David	Nordaune	District 3	Chippewa County Commissioner	89 Pleasant Street		Granite Falls	MN	56241
Bonnie	Crosby	Assessor	Chippewa County Assessor's Office	629 North 11th Street		Montevideo	MN	56265
Steve	Kubista	Highway Engineer	Chippewa County Highway Department	902 North 17th Street		Montevideo	MN	56265
Scott	Williams	Director	Chippewa County Land and Resource Management	629 North 11th Street		Montevideo	MN	56265
Tim	Bergeland		Chippewa County Emergency Management Department	629 North 11th Street		Montevideo	MN	56265
		North Star Chapter	Sierra Club	2327 East Franklin Avenue	#1	Minneapolis	MN	55406
		Minnesota Chapter	The Nature Conservancy	1101 West River Parkway	#200	Minneapolis	MN	55415
Ruth	Hoefs	State Chair, Minnesota Chapter	Ducks Unlimited	20676 340th Street		LeCenter	MN	56057
		Minnesota Divison	Izaak Walton League of America	2233 University Avenue West		Saint Paul	MN	55114
Molly	Pederson	Minnesota Team	Audubon Society	1 West Water Street	#200	Saint Paul	MN	55107
			Pheasants Forever, Inc.	679 West River Drive		New London	MN	56273
Dave and Cindy	Smiglewski				628 East Granite Street	Granite Falls	MN	56241
		Mr. Nineeman, Mr. Hatlestad, and Ms. Furshong	CURE		117 South 1st Street	Montevideo	MN	56265
Donna and Terry	Alstad			1065 125th Street SE		Granite Falls	MN	56241
Harold P. & Nancy J.	Anderson		Revocable Trust	308 Austin Street		Rockwell City	IA	50579
Joseph W & Savanna R	Anderson			190 Cty Rd 15 SW		Granite Falls	MN	56241
Jack E. and Karen	Baker			2763 540th Street		Granite Falls	MN	56241
Jonathan D & Lisa M	Baker			12075 30th Avenue SE		Granite Falls	MN	56241
Thomas and Karen	Baker			15025 Pete's Point Road		Granite Falls	MN	56241
Jeffrey R. and Cindy R.	Baker			12010 15th Avenue SE		Granite Falls	MN	56241
Keith D. and Robin R.	Beito			3030 110th Street SE		Granite Falls	MN	56241
Jeanne	Berends			1075 125th Street SE		Granite Falls	MN	56241
Bruce & Jennifer	Bestland			10070 30th Ave SE		Granite Falls	MN	56241
Rosella	Christiansen			601 Village Drive	Apt 315	Marshall	MN	56258
Grady	Dahl			212 E Skyline Dr		Granite Falls	MN	56241
Dean M	Dambroten			12410 850th Ave		Sacred Heart	MN	56285
Wayne and Lori	Formo			7035 40th Avenue SE				
Robert K. and Maxine M.	Fromm			16815 Red Fern Trail		Brainerd	MN	56401
Howard Jr & Sherill J	Gatchell			5282 306th Ave		Granite Falls	MN	56241
Kenneth D & Lois	Gustafson			733 NO Crescent Lane		Litchfield	MN	55355
Kenneth	Gustafson		Violet V Gustafson Life Estate	733 NO Crescent Lane		Litchfield	MN	55355
Juan G & Jodie Jolene	Gutie Cortez			13040 30th Ave SE		Granite Falls	MN	56241
Janice & Edward	Hagen		Jamice M Hagen Living Trust	9113 15th Ave S		Bloomington	MN	55425
Gary C & Donna	Halvorson			1040 Cty Rd 15 SW		Granite Falls	MN	56241
Coryanne L.	Hartmann			5908 West 53rd Street		Sioux Falls	SD	57103
Jennifer Ann	Henslin			15025 1st St E		Raymond	MN	56282
Paul W & Amy R	Hoernemann			12090 30th Ave SE		Granite Falls	MN	56241
Raymond J & Ruth M	Hoffman		Ruth Hoffman Revocable Trust	1000 Tonkawa Rd		Orono	MN	55356
Michael D and Janice E	Holien			86363 County Road 10		Sacred Heart	MN	56285
Steven B. & Karen Ann	Jacobson			1067 90th Street SE		Maynard	MN	56260
Stanley R.	Jacobson			801 North 13th Street	Apt. 123			
Lyle G & Mollie	Jaenisch			3095 125th St SE		Granite Falls	MN	56241
Richard	Jepson		David J & Donna O Jepson Revocable Trust	10253 850th Ave		Granite Falls	MN	56241
W. Mitchell and Carlee E.	Kling			4923 290th Avenue		Granite Falls	MN	56241
Julia Ann	Knudson			4946 Hwy 67		Granite Falls	MN	56241
Deland L & Paula	Kortgard			9075 1st Ave S		Granite Falls	MN	56241
John G. and Sharon A	Krogstad		(fka Sharon A. Balster)	12000 15th Avenue SW		Granite Falls	MN	56241
Doria A & Gene L	Larson		Doris Ann Larson Life Estate	1708 E Lincoln Ave #5		Montevideo	MN	56265
Darrol R. and LaVonne	Olsen			13065 30th Avenue SE		Granite Falls	MN	56241
James J	Olson		Upper Midwest Management Corp	2510 W Lincoln Ave	Suite 4	Olivia	MN	56277
Dorothy	Olson			2055 105th St SE		Granite Falls	MN	56241
Duane R & Carolyn	Olson			2065 Cty Rd 15 SE		Granite Falls	MN	56241
Eric and Amy	Peterson			237 East Skyline Drive		Granite Falls	MN	56241
Gale F. and Diane R.	Peterson			10095 15th Avenue SW		Granite Falls	MN	56241
Doug & Connie	Peterson		Robert & Carol/LTS Peterson	1122 9th St		Granite Falls	MN	56241
Robert C & Denise	Peterson			10070 15th Ave SE		Granite Falls	MN	56241
Randy L. and Pamela	Peyton			2025 County Road 15 SE		Granite Falls	MN	56241
Peter A. and Linda	Pfenning			10060 15th Avenue SE		Granite Falls	MN	56241
Blair	Reuther			110 Emily St		Nevis	MN	56467
Timothy R	Rhode			115 Cty Rd 15 SW		Granite Falls	MN	56241
Elroy W & Jill D	Ross			3015 110th St SE		Granite Falls	MN	56241
John E	Rottunda		John E Rottunda Trust Agreement et al	141 Apple Nook Court		Mankato	MN	56001
Robert A. and Alice	Rust			12025 30th Avenue SE		Granite Falls	MN	56241
Anthony W. and Stacie	Schuler			10080 5th Avenue SE		Granite Falls	MN	56241
Chad H.	Schuler			990 West Park Street		Granite Falls	MN	56241
Randy T. and Lori	Schuler			11095 15th Avenue SE		Granite Falls	MN	56241
Odell A.	Sletten			412 West Eagle Lake Drive		Maple Grove	MN	55369
Gary and Claire	Swanson			1055 125th Street SE		Granite Falls	MN	56241
Jon and Jennifer	Tjosvold			1050 125th Street SW		Granite Falls	MN	56241
Lorna L	Ulven			13060 30th Ave SE		Granite Falls	MN	56241
Scott & Waziyatawin	Wilson			9085 5th Ave SE		Granite Falls	MN	56241
			Darlene Peterson-Hauschild and Ardean Hauschild	6147 720th Avenue		Wheaton	MN	56296
			State of MN Dept of Natural Resources	P.O. Box 30	500 Lafayette Rd	Saint Paul	MN	55155
			Anna's LLC	5005 S Bur Oak Place		Sioux Falls	SD	57108
			Chloe A Schaplow et al	1948 Wiessner Dr NE		Salem	OR	97303
			Chippewa County	629 North 11th Street		Montevideo	MN	56265
			Lowell R. Knutson Trust/Beverly J. Knutson Trust	1090 County Road 15 SW		Montevideo	MN	56265
			Gerald A. Munsen Trust	2045 40th Street SE		Montevideo	MN	56265
			Schuler Enterprises, LLP	3060 70th Street SW		Montevideo	MN	56265
			Chippewa Historical Society	PO Box 303		Montevideo	MN	56265
			Lowry Farms Limited Partners - Northwestern Farm Management	301 South O'Connell St		Marshall	MN	56258
			Rottunda 1991 Trust	305 Horn Street		Las Vegas	NV	89107
			Fagen Farms, LLP	PO Box D		Granite Falls	MN	56241
			Victoria Sandberg Revocable Trust/Keith Sandberg Revocable Trust	9080 30th Avenue SE		Granite Falls	MN	56241
			Sparta Cemetery Association	9080 30th Avenue SE		Granite Falls	MN	56241
			JSP Tjosvold, LLP	1050 125th Street SW		Granite Falls	MN	56241
			Harold J Dahl Trust	10020 15th Ave SE		Granite Falls	MN	56241
			Mohammed Al-Otaibi et al	13035 30th Ave SE		Granite Falls	MN	56241
			Steven B Jacobson et al	1075 Cty Rd 15 SE		Granite Falls	MN	56241
			Marlin J. Legler Revoceable Trust/Constance L. Legler Credit Trust	1521 Mansfield Road		Grand Island	NE	68803
			Donald D. and Vera Finnes Trust	23681 Dero Drive		Glenwood	MN	56334
			Constance Sederstrom Life Estate	617 12th Ave E		Clarkfield	MN	56223

APPENDIX G – AGENCY CORRESPONDENCE AND PUBLIC COMMENTS

Letter Number	Comment Number	Entity	Date of Comment	Comment	Response	Section in Draft EA	Comment Topic
A	1	Cheyenne & Arapaho THPO	10/20/2017	At this time, it is determined to be categorized as No Properties; however, if at any time during the project implementation inadvertent discoveries are made that reflect evidence of human remains, ceremonial or cultural objects, historic sites such as stone rings, burial mounds, village or battlefield artifacts, please cease work in area of discovery and notify the THPO Office within 72 hours.	Comment noted. If any inadvertent discoveries are made during project implementation, work will cease in the area of discovery and the THPO will be contacted within 72 hours.	4.9	Cultural Resources
A	2	Cheyenne & Arapaho THPO	10/20/2017	In addition, if inadvertent discoveries are made; pursuant to Title 36 Code of Federal Regulation Part 800.13, as amended; you will also be required to make arrangements for a professional archaeologist to visit the site of discovery and assess the potential significance of any artifacts or features that were unearthed. If needed, we will contact the Tribes NAGPRA representatives.	Comment noted. If any inadvertent discoveries are made, the project will retain a professional archaeologist to assess the potential significance of any findings.	4.9	Cultural Resources
B	1a	COE	11/1/2017	The placement of aerial lines that cross navigable waters of the U.S. requires authorization under Section 10 of the Rivers and Harbors Act.	Section 10 authorization will be applied for as necessary for any proposed crossing of navigable waters of the U.S.		Waterbodies
B	1b	COE	11/1/2017	Underground utility lines through waters of the U.S., including wetlands, as well as navigable waters of the U.S. are regulated under Section 404 of the Clean Water Act if there is a discharge of dredged or fill material.	Section 404 authorization will be applied for as necessary for any discharge of dredged or fill material.		Wetlands
B	1c	COE	11/1/2017	Underground lines installed by directional bore method through waters of the U.S., including wetlands, do not involve a discharge and a permit is not required. However, if installation of connecting points requires excavation and backfill in waters of the U.S., including wetlands, a permit would be required.	Section 404 authorization will be applied for as necessary for any excavation and backfill in waters of the U.S.		Wetlands
B	1d	COE	11/1/2017	The placement of poles, overhead wiring, and/or buried wiring at upland locations is not within the jurisdiction of the Corps of Engineers, provided the work does not involve the placement of dredged or fill material into any waterbody or wetland.	Comment noted.		Waterbodies
B	1e	COE	11/1/2017	Temporary placement of fill material into any waterbody or wetland for purposes such as bypass roads, temporary stream crossings, cofferdam construction, or storage sites may require a permit.	Section 404 authorization will be applied for as necessary for any temporary placement of fill material into any waterbody or wetland for construction purposes.		Waterbodies
B	2	COE	11/1/2017	Without detailed construction plans, we cannot provide specific comments regarding the effects that the proposed activity would have on watercourse floodstages. It has been our experience that underground and overhead utility construction has negligible effects on flood stages, provided excess construction material is removed from the floodplain and additional care is taken not to disturb its hydraulic characteristics.	Comment noted.	3.3	Floodplain
B	3	COE	11/1/2017	You may also need city, county, or State permits for the project. You should contact the appropriate agencies for their permit requirements. If the project includes the placement of dredged or fill material in a Federal regulated waterbody, we will notify the responsible State agency for water quality (401) certification.	All required state or local permits will be applied for as needed.		Required Permits
B	4	COE	11/1/2017	You should also contact the State Historic Preservation Officer (SHPO) to determine if there are any known historic or archaeological sites in the area or if any cultural resource survey would be required.	A SHPO query was performed in 2016. A cultural resources survey was also completed for the project area. Results of the query and cultural resources survey are included as Appendix H in the EA document.	3.9	Historic Resources
C	1	EPA	11/15/2017	MINNESOTA RIVER VALLEY: The Minnesota River Valley is a habitat corridor for several bird species. Part of the western side of the project area, near the Minnesota River, overlaps with the Upper Minnesota River Valley Important Bird Area (IBA). The IBA, which incorporates the river valley, riparian corridor, and upland communities along the Minnesota River, provides habitat for a wide variety of bird species and serves as a natural corridor for migrating birds. As noted in the Drat EA, over 200 species, including state-listed species and Species in Greatest Conservation Need are known to use the IBA. Although project construction would occur outside the IBA, avian species following the river valley to migrate would migrate through the project area and have the potential to collide with proposed wind turbines 1, 5, 9, and 12.	Wind turbine siting is addressed in the Response to Comment C2 EPA below.	3.6.3	Migratory Birds, Sensitive Areas
C	2	EPA	11/15/2017	The Draft EA indicates that post-construction monitoring is required to determine bird mortality. In light of the fact that monitoring for bird mortality is not easily accomplished, an accurate assessment of post-construction impact may be difficult, if not impossible to achieve. In light of the facts that a) the Draft EA states "...the Minnesota River Valley being a significant migration corridor,..." and b) post-construction avian fatality monitoring would be required, including bat mortality monitoring, we question whether wind turbines 1, 5, 9, and 12 should be relocated. Recommendations: EPA recommends coordination with the U.S. Fish and Wildlife Service (FWS) and the Minnesota Department of Natural Resources (MnDNR) to determine if concern regarding bird/bat strikes and turbines 1, 5, 9, and 12 could be reduced if these four turbines were to be relocated. If this is the case, what buffer distance should be employed to inform the possible relocation of these four wind turbines?	Turbine siting locations were discussed with the MN DNR. The DNR has accepted these locations as high risk and additional fatality monitoring will be performed as part of this agreement. The turbines are currently sited as far north as possible. Palmer's Creek Wind Farm has committed to project monitoring, including 3 years of 4 days per week for fatality monitoring at WTGs identified as high risk. The Bird and Bat Conservation Strategy for the project includes these requirements.	4.6.3	Migratory birds, Turbine locations
C	3	EPA	11/15/2017	ECOLOGICALLY SIGNIFICANT AREAS: As stated in the Draft EA, a query of the MnDNR Natural Heritage Information System (NHIS) indicated the presence of Ecologically Significant Areas: Prairie Core Area (Upper Minnesota River Valley); Minnesota Biological Survey (MBS) sites of moderate biodiversity including Dry Hill Prairie remnants (native prairie), and Silver Maple - (Virginia Creeper) Floodplain Forest (rare wetland), which may contain state-listed plants. The Draft EA indicates MBS sites, native prairie, and wetland areas would be avoided if possible. Recommendations: The Draft EA is not clear as to whether avoidance of MBS, native prairie, and wetland areas was attempted. Because these habitat types are difficult, if not impossible, to successful recreate, and such attempted mitigation would increase the overall project cost, EPA recommends the analysis include information concerning attempts to avoid and/or minimize direct impacts (e.g., from construction, temporary lay down areas, or access routes) to MBS, native prairie, and wetland areas. EPA recommends a commitment to avoid impacting these areas to be included in the Finding of No Significant Impact (FONSI).	If WAPA deems a Finding of No Significant Impact (FONSI) is appropriate, all BMPs described in the draft EA will be incorporated as a required component of the Proposed Action.	3.6	Sensitive Areas
C	4	EPA	11/15/2017	WATER WITHDRAWALS: During construction of wind-energy sites and infrastructure, water withdrawals may be needed for construction activities, including dust suppression, concrete mixing, and vehicle and machinery washing. If water is not brought in from other sources outside the project area, available water from nearby surface waters may be used. Such withdrawals could reduce stream discharge and alter the natural hydrologic regime of the stream system. Recommendations: Acknowledging that all surface water withdrawals for construction activities would be required to meet all state and/or local regulations for water withdrawals, EPA recommends the analysis address the issue of water withdrawals in connection with the proposed project as well as efforts to avoid or minimize any adverse effects.	No water withdrawals are planned or required for the construction of this project.		Surface Water

Letter Number	Comment Number	Entity	Date of Comment	Comment	Response	Section in Draft EA	Comment Topic
C	5	EPA	11/15/2017	AIR QUALITY: Construction activities will result in temporary impacts to air quality. Recommendations: In addition to those measures found in Appendix G of the Draft EA, Best Management Practices (BMPs) and Conservation Measures, EPA recommends the FONSI include a commitment to implement relevant construction-related emission reduction measures listed on the enclosed document, EPA's Construction Emission Control Checklist.	The Construction Emission Control Checklist appears to be project-specific to Lake Erie Energy Development Corporation. Palmer's Creek will implement dust control measures, as described in the EA.	Appendix G	Air Quality
C	6	EPA	11/15/2017	MATERIALS MANAGEMENT: The Draft EA indicates wind turbine foundations would consist of pedestal diameters of approximately 18 feet. In some cases, an area around a turbine may be covered in four inches of gravel, river rock, or crushed stone. The excavated area for the turbine foundations would typically be approximately 75 feet by 75 feet. Recommendations: EPA recommends the analysis address the impact of obtaining the requisite gravel, river rock, or crushed stone and transporting these materials to the project site (e.g., anticipated number of transport vehicles traveling to the construction site each day, etc.). EPA also recommends the analysis address the proposed disposal of excavated materials. We suggest excavated material be made available to the community. For example, advertising within the community that clean backfill is available prior to disposing of any unused materials will reduce quantities that would otherwise be disposed of in landfills and reduce overall project cost.	Palmer's Creek intends to source construction materials locally. Palmer's Creek also intends to utilize backfill at each turbine, while topsoil will be distributed around agricultural fields for reuse. Excavated materials will be reused within the project area wherever possible.		Materials
C	7	EPA	11/15/2017	IMPACTS TO PLANT COMMUNITIES: Section 4.6.1, Plant Communities, indicated that approximately 10 acres of non-agricultural land would be temporarily disturbed for laydown areas and other construction activities, including one acre of forest. Following construction, disturbed areas would be restored to their condition prior to construction, including reseeding and planting trees, as determined during permitting. Recommendations: Acknowledging the BMPs listed in Appendix G, which indicates that restoration of disturbed soils and vegetation should be initiated as soon as possible after construction activities are completed using weed-free native grasses, forbs, and shrubs, EPA recommends a commitment be included in the FONSI to also replant trees impacted by the proposed project using native tree species appropriate to this ecoregion (e.g., along the southern edge of the Swenson Farmstead site). MnDNR could recommend a list of native tree species and, if replanting cannot take place at the impact location(s), recommend a suitable location(s) for tree planting.	Horizontal directional drilling will be used to avoid trees and/or forested communities and wetland areas to prevent impacts. Regular monitoring would occur as per the project construction stormwater (NPDES) permit. WAPA will refer to the BMPs, as described in the EA, in the FONSI.	4.6.1	Plant Communities
C	8	EPA	11/15/2017	One of the BMPs listed in Appendix G concerning invasive species indicates that access roads, utility and transmission line corridors, and tower site areas shall be monitored regularly for the establishment of invasive species, and weed control measures should be initiated immediately upon evidence of the introduction of invasive species. Recommendation: EPA commends the willingness to control invasive species in the project footprint. Nonetheless, EPA requests clarification concerning "regular monitoring" in the BMP list. For example, does "regularly mean that monitoring will take place once per month, per growing season, or after several growing seasons following initial restoration activities? How long will "regular monitoring" take place (e.g., during first 3-5 years or during entire life of the project)? Will "regular monitoring also apply to restoration activities for grasses, forbs, shrubs, and trees that are slated to be planted? MnDNR could recommend monitoring protocols for invasive species and newly-restored areas.	Monitoring will be conducted and documented on a monthly basis during construction and continue until final stabilization and revegetation is completed, per the Minnesota Construction Storm Water General Permit MN R 100001 and the associated Palmers Creek Wind Farm Construction SWPPP.	Appendix G	Invasive Species
C	9	EPA	11/15/2017	COORDINATION: The Draft EA indicates that Palmer's Creek has been in regular contact with the Upper Sioux Indian Community. Recommendations: The EPA recommends the analysis indicate the results of coordination with the Upper Sioux Indian Community. Since up to 15 wind turbines may be visible from the east observation point on the Upper Sioux Reservation, coordination is pertinent before a decision regarding the project's implementation can be reached.	Draft EA Sections 3.9 and 6.3 were revised to more accurately reflect the consultation and cultural surveys that were completed for the project.	3.9, 6.3	Section 106
D	1	FAA	11/6/2017	Thank you for soliciting input from the Federal Aviation Administration (FAA) Dakota-Minnesota Airports District office (DMA-ADO) on the proposed Palmer's Creek Wind Project draft Environmental Assessment (EA). The FAA DMA-ADO has only one substantive comment on the merits of the draft EA that may warrant attention. Please make it more clear to the reader that the Upper Sioux Community was ok that Tribal Cultural Specialists (TCSs) from the Ft. Peck and MHA Nation to be present during the cultural survey on behalf of all the other Tribes. We have run into similar scenarios where some Tribes with more local input and stake were not coordinated with on the local survey, but TCSs were brought in from other regions where they did not have as much local knowledge of the cultural resource concerns for the area.	Draft EA Sections 3.9 and 6.3 were revised to more accurately reflect the consultation and cultural surveys that were completed for the project.	3.9, 6.3	Section 106
D	2	FAA	11/6/2017	Additionally, we do emphasize the need to conduct an airspace study as it relates to the heights of the proposed wind turbines, meteorological tower, substation, temporary construction items including cranes, and other miscellaneous proposed action elements and their relatively close geographic proximity to the Granite Falls Municipal Airport and Montevideo-Chippewa County Airport. I pulled the following excerpt from the draft EA, section 4.12.2.1 on page 4-19. "Due to the height of the WTGs, FAA Form 7460-1 must be completed and submitted when a construction permit is filed or at least 45 days before the start date of Project construction, whichever is earliest. Based on distance and FAA compliance measures, the Project is not anticipated to cause impacts to the Granite Falls Municipal Airport/Lenzen-Roe-Fagen Memorial Field or the Montevideo-Chippewa County Airport." Based on the text above, we appreciate your acknowledgement of the wind turbine heights and submission of the FAA Form 7460-1 when a construction permit is filed or at least 45 days prior to construction, whichever comes sooner. The Form 7460-1 should be submitted to the FAA's Obstruction Evaluation/Airport Airspace Analysis (OE/AAA) website at https://oeaaa.faa.gov/oeaaa/external/portal.jsp For assistance on submitting this form please contact FAA DMA-ADO Program Manager, Simon Schmitz at (612) 253-4640 or email at Simon.Schmitz@faa.gov	Palmer's Creek will submit FAA Form 7460-1 at least 45 days before the start date of the Project or when a construction permit is filed, whichever is earliest.	4.1.1, 4.12	FAA Form 7460-1
E	1	Private Citizen	11/9/2017	I would like to share a few positive comments on the proposed wind farm for our area. First would be the economic aspect that would help my farm make ends meet financially. I am the fifth generation family farm and for the last two years the commodity price of corn and soybeans are below the cost of production and have made farming a challenge for our family. The extra wind tower payments would ensure my farm's stability. Second benefit is our haul roads and approaches to our fields would be improved in Granite Falls Township, and as a farmer moving my crops from field to farm site is very critical in the fall. Last our county and local schools would benefit with increased tax revenues that would be available after Palmer Creek Wind Farm is operating.	Comment noted.		
F-Verbal	1	Private Citizen	11/9/2017	Access to EA. Mr. Olson was having difficulty accessing the project website and downloading the Draft EA.	Ms. Gomer sent Mr. Olson a direct link to the Draft EA document. Mr. Olson was then able to download the Draft EA.		
F-Verbal	2	Private Citizen	11/9/2017	Eminent domain. Mr. Olson was concerned that, if he did not agree to leases/easements offered by Mr. Fagen, his property could potentially be taken by eminent domain and powerlines/associated infrastructure would cross his land without his agreement.	WAPA is not prepared to enforce eminent domain and landowners may decline signing documents where they do not agree to the terms.		Leases, Easements
F-Verbal	3	Private Citizen	11/9/2017	Setback distances. Mr. Olson was curious about setback distances from residences and property boundaries.	Ms. Gomer explained minimum setback distances, the Public Utilities Commission permitting process, and pointed Mr. Olson to several sections of the EA that would be of particular interest regarding this topic.	3.7, 4.5, 4.7	Setbacks

Letter Number	Comment Number	Entity	Date of Comment	Comment	Response	Section in Draft EA	Comment Topic
F-Verbal	4	Private Citizen	11/9/2017	Property values. Mr. Olson has concerns about the impact of the project on property values and resale values.	Comment noted.		Property Values
F-Verbal	5	Private Citizen	11/9/2017	Lease payments. Mr. Olson objected to some payment terms offered by Mr. Fagen. Particularly, Mr. Olson would like to see monthly/annual payments adjusted for inflation.	Ms. Gomer explained that these negotiations are between landowners and the project developer, and WAPA does not participate in lease negotiations. Ms. Gomer again stressed that, as a private development, WAPA is not prepared to enforce eminent domain and landowners are free to decline signing any documents where they do not agree to the terms.		Leases, Easements
G	1	Private Citizen	11/9/2017	I wish to again raise my concern about the visual impact of these large towers despoiling the area, forever altering the prospects of nearby property owners marketing the land for residential development.	Based on the viewshed analysis (BCA 2017), substantial visual impacts to the Byway are not anticipated relative to the existing transmission lines, substations, and other visible infrastructure in the area. Please refer to EA Section 4.7.1.	4.7.1	Visual impacts
G	2	Private Citizen	11/9/2017	The placement of towers along the ridge overlooking the Minnesota River poses a serious threat to migrating birds as well.	WAPA is coordinating with multiple agencies to assess the project impact on migratory bird species to lessen potential impacts. Palmer's Creek Wind Farm has committed to project monitoring, including 3 years of 4 days per week for fatality monitoring as WTGs identified as high risk. The Bird and Bat Conservation Strategy for the project includes these requirements.	Appendix E	Migratory birds
G	2	Private Citizen	11/9/2017	How the operator plans to connect up with the existing substation which sits on land that used to belong to my family. This 20 acre parcel was "taken" by the Federal Government in the 1950s despite the opposition of my father, and the legal representatives for my trust accounts as I was under age at the time of the action. Will this wind farm project generate any additional public domain actions surrounding the site? I would be greatly opposed to such developments, should that be the case.	The PCWF substation will tie into the WAPA substation via underground lines crossing participating landowner properties and existing public rights of way.	1.0, 2.1	Subsequent development
G	3	Private Citizen	11/9/2017	How great a "stand-off" distance must the operator observe when placing towers and other structures which are proposed to be placed close to the property boundaries of landowners who did not join in the project? I, for one, wish to ensure that this requirement is strictly observed.	The draft site permit application for the project indicates: Wind turbine towers shall not be located closer than 1,000 feet from all residences or the distance required to comply with the noise standards pursuant to Minn. R. 7030.0040, established by the Minnesota Pollution Control Agency, whichever is greater.	3.7, 4.7	Setbacks
H	1	Private Citizen	11/14/2017	Thank you for the information and the opportunity to provide comments on this project. It certainly appears this wind power generation project is being thoroughly vetted after reading the environmental assessment report. As a landowner affected by this project, there is a minimal impact to the land resources. Although this project could impact a common species of bats, this impact seems minimal and is definitely not devastating to them. On the other hand, this project supports “green energy” and will ultimately have a positive overall impact on our environment, especially global warming. In addition, there are economic benefits to this area of Minnesota including construction work / jobs during the building and installation of the wind generating equipment as well as permanent jobs to maintain this equipment. This project will also provide a new source of revenue / property taxes for Chippewa County. And finally, landowners who participate in this project will receive an economic benefit from lease payments for the wind turbines. Overall, this project certainly provides multiple economic benefits as well as providing electrical power in a sustainable manner without creating adverse harm to the environment.	Comment noted.		
I	1	Private Citizen	11/13/2017	I am unable to download the draft EA, but as a land owner and secretary of Sparta cemetery we support the Palmer Creek wind project.	Comment noted.		
J	1	USFWS	11/15/2107	The Service recommends Palmer Creek Wind follow both the Final Land-Based Wind Energy Guidelines https://www.fws.eov/ecological-services/es-librarv pdfs/WEG final.pdf as well as the Eagle Conservation Plan Guidance (ECP) (https://www.fws,eov/mieratorvbirds/pdf/manauemenDeaxleconservationn1anguidance.pdf) to minimize impacts to migratory birds, eagles, threatened and endangered species, and Fish and Wildlife Service Interest Lands. The project proponent is in the process of following these guidelines for preconstruction analysis. The Service recommends these guidelines are also followed for post-construction mortality monitoring and any necessary adaptive management. The Service makes the following recommendations for this proposed project:	Comment noted; Palmer's Creek Wind has commited to following the Land-Based Wind Energy Guidelines and Eagle Conservation Plan Guidance.	4.6, Appendix E	Eagles
J	2	USFWS	11/15/2107	Impacts to Service Interest Lands: There are three Service Interests Lands within two miles of the project boundary: Hawk Creek and Wang WPA, and Hinz FSA. These are managed by Morris and Litchfield Wetland Management District. We recommend considering the waterfowl and migratory bird corridors that may exist between the proposed project and these units, and avoid placing turbines directly in these corridors. Should turbines potentially impact migratory birds from these areas, we recommend operational minimization measures to reduce mortalities. The refuge managers for these properties are copied on this letter; we would like to include these managers in future discussions of minimization of migratory bird impacts.	Turbines will follow operational BMPs as per the Site Permit and adaptive management strategies. Palmer's Creek Wind Farm has committed to project monitoring, including 3 years of 4 days per week for fatality monitoring as WTGs identified as high risk. The Bird and Bat Conservation Strategy for the project includes these requirements.	Appendix E, Appendix G	Migratory birds, Service Interest Lands
J	3	USFWS	11/15/2107	Impacts to Migratory Birds: The Migratory Bird Treaty Act (16 U.S.C. 703-712; MBTA) implements four treaties that provide for international protection of migratory birds. The MBTA prohibits taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. Bald and golden eagles are afforded additional legal protection under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d). Unlike the Endangered Species Act, neither the MBTA nor its implementing regulations at 50 CFR Part 21, provide for permitting of “incidental take” of migratory birds.	Comment noted.	3.6.3, 4.6.3	Migratory Birds
J	4	USFWS	11/15/2107	Proximity to Minnesota River: The proposed project overlaps with the Upper Minnesota River Valley Important Bird Area (IBA), and there are multiple turbines within 0.5 miles from the Minnesota River. The Bird and Bat Conservation Strategy (BBCS) attached to the DEA states that important wildlife areas will be avoided to minimize direct impact to birds and bats. Because this river serves as an important migratory bird corridor, the Service recommends increasing turbine setback from the river as much as possible (<0.5 miles). We also recommend robust post-construction mortality monitoring, and using this data to inform operational minimization measures to reduce the direct impact to migratory birds (collision), especially during spring and fall migration periods.	Efforts were made to site turbine locations as far as possible from the river. Palmer's Creek Wind Farm, LLC consulted with the MN DNR regarding turbine locations within the migratory bird corridor. DNR accepted the turbine locations as high risk, which requires additional fatality monitoring and operation requirements. Palmer's Creek Wind Farm has committed to project monitoring, including 3 years of 4 days per week for fatality monitoring as WTGs identified as high risk. The Bird and Bat Conservation Strategy for the project includes these requirements.	3.6.3, 4.6.3	Sensitive Areas

Letter Number	Comment Number	Entity	Date of Comment	Comment	Response	Section in Draft EA	Comment Topic
J	5	USFWS	11/15/2107	Birds of Conservation Concern: The Service's Information for Planning and Consultation (IPaC, https://ecos.fws.gov/ipac/) has identified the following migratory birds of conservation concern within the proposed project boundary: American Bittern American Golden-plover Black Tern Black-billed Cuckoo Bobolink Buff-breasted Sandpiper Dunlin Franklin's Gull Hudsonian Godwit Lesser Yellowlegs Marbled Godwit Nelson's Sparrow Red-headed Woodpecker Ruddy Turnstone Semipalmated Sandpiper Short-billed Dowitcher Willet The Service recommends the DEA addresses measures to avoid and minimize impacts to these species. Information on the Service's identified list of Birds of Conservation Concern (and ways to minimize impacts) can be found: httns:/?www.fws.gov/birds/management/manaued- species/birds-of-conservation-concern.php.	Palmer's Creek Wind Farm LLC proposes to minimize impacts to Birds of Conservation Concern by following BMPs as detailed in Appendix G of the Draft EA. Additionally, fatality monitoring will occur during operation of the project. The Bird and Bat Conservation Strategy for the project includes monitoring requirements as it relates to migratory birds, including those listed on the USFWS IPaC (EA Appendix E).	Appendix E	Migratory birds, Birds of Conservation Concern
J	6	USFWS	11/15/2107	Lighting and Tender Design: The Service recommends any necessary lights on buildings, turbines or meteorological (met) towers be compliant with the 2016 Federal Aviation Administration (FAA) guidance on tower lighting, including the use of flashing and white lights, and to restrict the use of guy wires on met towers. These measures have been shown to reduce migratory bird collision by as much as 70%. More information about this guidance can be found: https://www.faa.gov/news/updates/?newsId=85204 https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds/collisions/communication-towers.php https:fJwww.faa.eovJdocumentLibrary/media/Advisory_ Circular/AC 70 7460-1L_.ndf httns://www.fwS.ROVJmigratorybirds/pdf/management/fccopportunitiestoreducebirdcollisions.pdf (enclosed)	Palmer's Creek Wind Farm LLC is coordinating with the FAA. The WTGs would be lit to meet the minimum FAA regulations, which require red flashing, strobe, or pulsed obstruction lights at night. No daytime lighting is required. All towers are freestanding with no guy wires. Please refer to EA Section 4.1.1 about lighting.	4.1.1	Lighting
J	7	USFWS	11/15/2107	Impacts to Eagles: Although bald and golden eagles were delisted from the Endangered Species Act on August 8, 2007, they are protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act (Eagle Act). The Service has been coordinating with the project proponent on assessing the proposed project's potential risks to bald and golden eagles. This assessment includes implementation of pre-construction eagle use monitoring and nest surveys. This coordination is on-going; the Service has recommended developing an Eagle Conservation Plan (ECP) to assess the proposed project's impact to eagles, and to determine if an eagle take permit is recommended.	Comment noted.	3.6.3, 4.6.3	Bald and Golden Eagles
J	7a	USFWS	11/15/2107	The project proponent has identified several eagle nests near the project boundary; the Service recommends placing turbines outside of projected eagle territories (estimated by the 1/2 Mean Internest Distance (MID) of known nests within a 10-mile radius). The Service has not generated estimated territories and cannot state if any proposed turbines locations are within the 1/2 MID.	The Bird and Bat Conservation Strategy calculated the 1/2-MID. Please refer to BBCS Section 6.1.3.1 for details on the MID as it relates to eagle territories. Turbines have been placed outside of eagle territories.	3.6.3, 4.6.3	Bald and Golden Eagles
J	7b	USFWS	11/15/2107	Figure 4 of Appendix B of the DEA lists a raptor nest on the western boundary of the project as a red-tailed hawk nest; however this nest was identified by the MN DNR Heritage Database and the Project's BBCS as an active bald eagle nest (located T116N R40W Section 11). We recommend the DEA be updated.	The active nest referred to by the DNR as a bald eagle's nest was field verified in 2017 as an active red-tailed hawk nest. However, the USFWS still considers it an active eagle's nest, and therefore was considered an active bald eagle nest for the purposes of MID analysis. The EA has been updated to reflect this.	3.6.3, 4.6.3	Raptor Species
J	7c	USFWS	11/15/2107	The Service recommends two years of pre-construction eagle use data to adequately determine eagle risk; this project has collected one year of eagle use data.	Preconstruction point count surveys have been performed for approximately one year. Additional pre-construction surveys are currently underway for 2018.	3.6.3, 4.6.3	Bald and Golden Eagles
J	7d	USFWS	11/15/2107	If the project wishes to apply for an eagle take permit, pre-construction surveys will need to comply with the data collection requirements under the 2016 Eagle Incidental Take Permit Regulations Regulations (found https://www.gpo.yov/fdsys/pkg/FR-2016-12-16/pdf/2016-29908.pdf)	Comment noted.	3.6.3, 4.6.3	Bald and Golden Eagles
J	7e	USFWS	11/15/2107	The DEA states the project proponent has estimated the projected eagle fatalities for this project; the project proponent has not discussed this risk assessment with the Service, and we have not had an opportunity to analyze the raw data.	WAPA and Palmer's Creek will continue coordinating with the USFWS regarding the voluntary eagle fatality calculations.	3.6.3, 4.6.3	Bald and Golden Eagles

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J	7f	USFWS	11/15/2107	Section 4.6.3.1. estimates bald eagle fatalities to be 0.0002/year, or 0.006 eagle fatalities over the life of the 30-year project. The Service ran our Collision Risk Model (CRM) with the following inputs (taken from the DEA): Number of Turbines: 18 Survey Hours: 160 Hazardous Area: 58 in radius Eagle Minutes: 87 The preliminary outputs from this modeling run was a projected take of 1.954 eagles/year (80" quantile, 1.327 mean). (Mean exposure = 0.271, SD = 0.0289) This is 10 eagles every 5 years, or 60 eagles over the life of the project. Due to the discrepancies between the DEA projected take and the Service's initial model runs, we recommend further coordination and data analysis.	WAPA and Palmer's Creek will continue coordinating with the USFWS regarding projected eagle fatalities. The EA was revised with updated estimates in Section 4.6.3.	4.6.3	Bald and Golden Eagles
J	8	USFWS	11/15/2107	Northern Long-eared Bat: The Northern Long-Eared bat (NLEB) (Myotis septentrionalis) has potential to occur in Chippewa County, and may occur within the project boundary. The Service currently does not have records of Northern Long-eared bats within the vicinity of the project, and the closest hibernaculum over 450 miles away. Suitable habitat exists for NELB within the project area (specifically along riparian areas); the Service recommends a 1,000 foot setback from wooded areas where NLEB may be foraging. This minimization measure will also benefit other bat species. Currently the NLEB is covered under the Final 4(d) rule, which states that take of NLEB by wind facilities is not prohibited. If the status of the NLEB is upgraded to endangered, or the 4(d) rule is removed, any take of NLEB by the operational project would be prohibited. Should prohibitions around NLEB take change, the Project Proponent should coordinate with the Service to determine project risk and if any additional measures are recommended.	Palmer's Creek Wind Farm project has committed to implementing the USFWS-approved BMPs to avoid, minimize and mitigate potential impacts to bats. Additionally, Palmer's Creek Wind Farm LLC has committed to feathering blades below cut-in speeds to avoid and minimize impacts to bats. These commitments are outlined in the Bird and Bat Conservation Strategy. If the status of the NLEB is upgraded to endangered, or the 4(d) rule is removed, Palmer's Creek Wind Farm LLC will coordinate with the USFWS on additional BMPs.	3.6	Listed Species
J	9	USFWS	11/15/2107	Other Bat Species: Should any other bat species become federally protected during the life of this project (and occurs within the project area), we recommend Palmer Creek Wind coordinate with the Service to determine relative risk and potential minimization measures.	Comment noted.	3.6	Listed Species
J	10	USFWS	11/15/2107	Prairie Butterfly Species: Both Dakota Skipper (Hesperia dacotae, Threatened) and Poweshiek skipperling (Oarisma poweshiek, Endangered) have the potential to occur within Chippewa County. However, there are no known records of either species and no designated Critical Habitat within the proposed project boundary. The Service recommends any revegetation work post-construction include the use of native and pollinator-friendly plants.	Areas that are not cropland will be reseeded with a weed-free native plant seed mixture appropriate to Minnesota prairie. Pollinator-friendly native plant species will be emphasized. Please refer to EA Section 2.1.1.8.	2.1.1.8	Listed Species
K	1	Upper Sioux THPO	12/1/2017	Do you need to include the general results of our TCS surveys? We had identified some potential areas, worked it out to move the substation to the east and wanted monitoring during construction. Unless I missed that I didn't see it in the EA but am not sure if that is needed.	EA Sections 3.9 and 6.3 were revised to more accurately reflect the consultation and cultural surveys that were completed for the project.	3.9, 6.3	Cultural Resources
K	2	Upper Sioux THPO	12/1/2017	Just an FYI in regards to 1862 the conflict is a term that is slowly being replaced with War. This is because it being called a conflict down plays the events and overlooks the fact that War was actually declared.	The term "Conflict" was changed to "War" in the revised EA.	3.9	Cultural Resources
		SHPO		WAPA requested comments from SHPO on the Draft EA. SHPO did not provide any official comments on the Draft EA, but did provide comments on cultural reports for the project.	WAPA will continue coordination with SHPO.	3.9	Cultural Resources