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January 24, 2020

Ms. Tanowa Troupe, Secretary
Ohio Power Siting Board
Docketing Division
180 East Broad Street, 11th Floor
Columbus, Ohio 43215-3797

Re: Case No. 18-1607-EL-BGN - In the Matter of the Application of Firelands Wind, LLC for a Certificate of Environmental Compatibility and Public Need to Construct a Wind-Powered Electric Generation Facility in Huron and Erie Counties, Ohio.

Updated Part 8 of 17 of Application

Dear Ms. Troupe:

On January 31, 2019, as supplemented on March 18, 2019, April 11, 2019, July 10, 2019, and September 12, 2019, as revised on October 4, 2019, Firelands Wind, LLC ("Applicant") filed an application ("Application") with the Ohio Power Siting Board ("OPSB") proposing to construct a wind-powered electric generation facility in Huron and Erie Counties, Ohio.

The Application filed on January 31, 2019, was electronically filed ("e-filed") with the OPSB in 17 parts, totaling over 5,300 pages. Yesterday the Applicant discovered that, through a transmission error, Exhibits T through X were inadvertently cut off of Part 8 of 17 that was e-filed on January 31, 2019. In accordance with Ohio Administrative Code ("O.A.C") Rule 4906-2-02(D)(4), on January 31, 2019, 5 hard copies and 10 USB drives were delivered to the Docketing Division of the OPSB - the Applicant has confirmed that these hard copies and USB drives contained Exhibits T through X. At this time, the Applicant is filing an updated Part 8 of 17 of the Application filed on January 31, 2019. In addition, this same day, in accordance with O.A.C. Rules 4906-3-07(A) and 4906-3-09(A)(1), the Applicant sent an updated written notice to those individuals receiving notice of the Application.

We are available, at your convenience, to answer any questions you may have.

Respectfully submitted,

/s/ *Christine M.T. Pirik*____
Christine M.T. Pirik (0029759)
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Cc: Craig Butler
Jonathan Pawley

CERTIFICATE OF SERVICE

The Ohio Power Siting Board's e-filing system will electronically serve notice of the filing of this document on the parties referenced in the service list of the docket card who have electronically subscribed to these cases. In addition, the undersigned certifies that a copy of the foregoing document is also being served upon the persons below this 24th day of January, 2020.

/s/ Christine M.T. Pirik
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COLUMBUS 59714-18 131443v2

Firelands Wind, LLC
Case No. 18-1607-EL-BGN

Updated Application Part 8 of 17

<u>Part 8 includes</u>:

- **Exhibit S** **Raptor Migration/Use Surveys (see Part 8 of 17 e-filed on January 31, 2019)**
- **Exhibit T** **Passerine Migration Surveys (see attached)**
- **Exhibit U** **Eagle Use Surveys (see attached)**
- **Exhibit V** **Breeding Bird Surveys (see attached)**
- **Exhibit W** **Owl Surveys (see attached)**
- **Exhibit X** **Acoustic Bat Surveys (see attached)**

Note: Five hard copies and 10 USB drives for Exhibits S through X were filed with the Docketing Division of the Ohio Power Siting Board on January 31, 2019. Exhibit S was also transmitted and e-filed on January 31, 2019, as part of Part 8 of 17 of the Application. Attached hereto and being e-filed today are Exhibits T through X, which, through a transmission error, were inadvertently cut off of Part 8 of 17.

Date Filed: January 24, 2020

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Attorneys for Firelands Wind, LLC

Firelands Wind, LLC
Case No. 18-1607-EL-BGN

Exhibit T
Passerine Migration Surveys

1. **Passerine Migration Surveys for the Emerson Creek Wind Project Huron and Erie Counties, Ohio dated May 8, 2018**
2. **Passerine Migration Surveys for the Emerson Creek Wind Project Huron County, Ohio dated July 17, 2018**
3. **Summary of results of 2012 passerine migration surveys at the Emerson Creek Wind Resource Area dated January 7, 2013**

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Exhibit T
Passerine Migration Surveys

1. Passerine Migration Surveys for the Emerson Creek Wind Project Huron and Erie Counties, Ohio dated May 8, 2018

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Passerine Migration Surveys for the Emerson Creek Wind Project Huron and Erie Counties, Ohio

Final Report

September 16, 2016 – September 13, 2017

Prepared by:

Goniela Iskali and Chad LeBeau

Western EcoSystems Technology, Inc.
408 West Sixth Street
Bloomington, Indiana 47404

May 8, 2018

Privileged and Confidential - Not For Distribution

EXECUTIVE SUMMARY

This report presents the results of the 2016 – 2017 passerine migration surveys completed by Western EcoSystems Technology, Inc. for the Emerson Creek Wind Project (Project) located in Huron and Erie Counties, Ohio. Survey protocols were developed following the Ohio Department of Natural Resources (ODNR) *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio* (ODNR 2009). The objective of the surveys was to determine seasonal and spatial use of the Project by migrating passerines and other birds. In addition, assess potential risk associated with the construction and operation of the Project to migrating passerines, specifically federal- and state-listed bird species.

Surveys were generally completed weekly during the spring (April 1 to May 31) and fall (August 15 to November 15) passerine migration seasons at six points. Surveys consisted of 10-minute counts at each point and all surveys were completed between dawn and 10:00 a.m. near passerine habitat as defined by the ODNR (forest, shrub/scrub and wooded wetland). Survey points were located near forest habitat due to the scarcity of shrub or wooded wetland habitat near public roads. All birds seen or heard were recorded within 200 meters (656 feet) of the surveyor, as per ODNR protocol, but the emphasis was placed on passerines and federal- and state-listed species.

A total of 3,220 birds, within 993 groups and consisting of 76 identifiable species were observed during the surveys. Red-winged blackbird, European starling, and American robin were the most abundant birds observed during the study period. Mean small bird use was higher in the fall (21.8 birds/200-meters/10-minute survey) than spring (17.8 birds/200-meters/10-minute survey), but richness was higher in the spring (8.9 bird species/200-meters/10-minute survey) compared to fall (4.3 bird species/200-meters/10-minute survey).

No federal or state threatened or endangered species were observed during the surveys. Two species that are listed as Birds of Conservation Concern (red-headed woodpecker and wood thrush) were observed during the surveys. Overall, the Project presents seasonal and spatial use patterns for passerines that are similar to many Midwestern wind energy facilities in agricultural landscapes and likely presents a low risk of impact to most passerines. Siting turbines away from forest, shrub, and wooded wetland habitat would likely avoid or minimize potential risk to sensitive species and migrating passerines.

STUDY PARTICIPANTS

Western EcoSystems Technology, Inc.

Goniela Iskali	Project Manager
Chad LeBeau	Senior Reviewer
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Ray Tupling	Statistician
Carissa Goodman	Data Analyst
Jeff Fruhwirth	GIS Technician
Wendy Bruso	Technical Editing Manger
Katie Michaels	Technical Editing Coordinator
Dave Klein	Technical Editor
Dan Kramer	Field Technician
Karl DuBridge	Field Technician

REPORT REFERENCE

Iskali, G, A. and C.LeBeau. 2018. Passerine Migration Surveys for the Emerson Creek Wind Project, Huron and Erie Counties, Ohio. Draft Report: September 16, 2016 – September 13, 2017. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. May 8, 2018.

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INTRODUCTION

This report presents the results of the 2016-2017 passerine migration surveys completed by Western EcoSystems Technology, Inc. (WEST) for the Emerson Creek Wind Project (Project) located in Huron and Erie Counties, Ohio. Survey protocols were developed following the Ohio Department of Natural Resources (ODNR) *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio* (ODNR 2009). The objective of the surveys was to determine seasonal and spatial use of the Project by migrating passerines and other birds. In addition, the surveys were to assess potential risk associated with the construction and operation of the Project to migrating passerines, specifically federal- and state-listed bird species.

PROJECT AREA

The proposed 159.6-square kilometer (km^2; 39,442-acre [ac]) Project is located 1.9 km (less than 1.2 mile [mi]) east of Bellevue, Ohio. According to the US Geological Survey (USGS) National Land Cover Dataset (NLCD), the Project area is dominated by croplands (88.1%; Table 1, Figure 1; USGS NLCD 2011, Homer et al. 2015), including corn (*Zea mays*) and soybeans (*Glycine max*). Developed areas (6.5%) and deciduous forests (4.3%) are the next most common land cover types within the Project area (Table 1). All other land cover types comprise less than 1.0% of the Project, individually (Table 1, Figure 1).

Table 1. Land cover types and composition at the Emerson Creek Wind Project.

Habitat	Acres	% Composition
Cultivated Crops	34,722	88.0
Developed	2,572	6.5
Deciduous Forest	1,680	4.3
Hay/Pasture	286	0.7
Open Water	170	0.4
Barren Land	3	<0.1
Shrub/Scrub	3	<0.1
Evergreen Forest	2	<0.1
Woody Wetlands	2	<0.1
Emergent Herbaceous Wetlands	1	<0.1
Total	**39,442**	**100**

Data from USGS NLCD 2011, Homer et al. 2015

Values may not add up due to rounding.

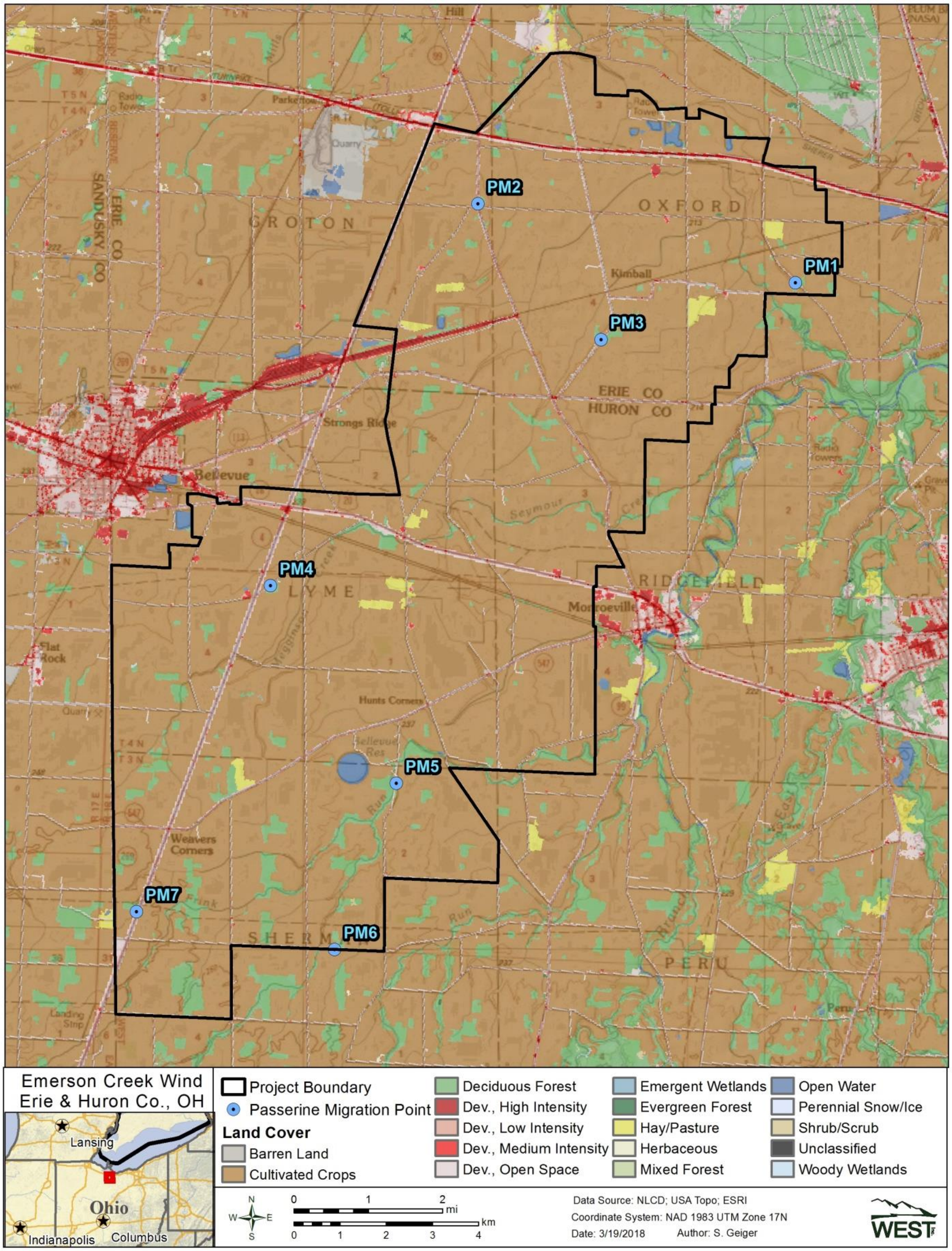

Figure 1. Land cover and locations of passerine migration survey points within the Emerson Creek Wind Project (USGS NLCD 2011, Homer et al. 2015).

METHODS

Survey Methods

ODNR protocol recommends one point-count location for every 247.1 ac (100 ha) of combined forest, shrub, and wooded wetland habitats, and that points be established in patches of these habitats and stratified across the site (ODNR 2009). There are 1,688 ac (683 ha) of forest, shrub, and wooded wetland in the Project and therefore seven points would need to be completed to satisfy the ODNR recommendations. Seven points were surveyed within the Project but only six were completed during both seasons because land access restrictions prevented surveys at “PM2” during the fall 2016 (Figure 1). Shrub and wooded wetlands are very rare in the Project (<0.1%), thus surveys were completed near forest habitat.

Surveys were generally completed weekly during the spring (April 1 to May 31) and fall (August 15 to November 15) passerine migration seasons. Passerine migration surveys consisted of 10-minute (min) counts at each point, in which all birds, regardless of size, seen or heard within 200 meters (m; 656 feet [ft]) of the surveyor were recorded (ODNR 2009). Birds flying overhead that do not land or originate within 200 m (656 ft) of the center of the point were listed as “fly over.” All surveys were completed between dawn and 10:00 a.m. At each survey point, the date, start and end time of the survey period, and weather information (e.g., temperature, wind speed and direction, and cloud cover) were recorded for each survey. Species or best possible identification, number of individuals, sex and age class (if possible), distance from observer, bearing, activity (behavior), and habitat(s) were recorded for each observation (ODNR 2009). Approximate flight height and distance from plot center at first observation were recorded to the nearest 1-m (3-ft) interval. Locations of sensitive species recorded during surveys were identified on field maps by unique observation number. Comments were recorded in the comments section of the datasheet.

Observations of sensitive species (defined as species afforded protection under the Endangered Species Act [1973], Bald and Golden Eagle Protection Act [BGEPA; 1940], listed as threatened or endangered by the state of Ohio [ODNR 2016], or Birds of Conservation Concern [BCC; USFWS 2018]) were recorded during the surveys, as well as incidentally or in-transit within the Project.

Statistical Analysis

For analysis purposes, a visit was defined as the required length of time, in days, to survey all of the plots within the Project once. Seasons were defined as per ODNR protocol as spring (April 1 to May 31) and fall (August 1 to November 15; ODNR 2009). Small birds were defined as passerines, hummingbirds and certain smaller species of woodpeckers. Large birds were defined as waterbirds, waterfowl, shorebirds, diurnal raptors, vultures, upland game birds, doves and pigeons, large corvids, large woodpeckers and goatsuckers.

Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following surveys, observers were responsible for inspecting data forms for completeness, accuracy, and legibility. Potentially erroneous data was identified using a series of database queries. Irregular codes or data suspected as being questionable were discussed with the observer and/or survey manager. Errors, omissions, or problems identified in later stages of analysis were traced back to the raw datasheets, and appropriate changes in all steps were made.

Data Compilation and Storage

A Microsoft® SQL database was developed to store, organize, and retrieve survey data. Data were keyed into the electronic database using a pre-defined protocol to facilitate subsequent QA/QC and data analysis. All datasheets, field notebooks (if provided), and electronic data files were retained for reference.

Bird Diversity and Species Richness

Bird diversity is illustrated by the total number of unique species observed. Species lists (with the number of observations and the number of groups) were generated by season and included all observations of birds detected within the 200-m (656-ft) buffer. In some cases, the tally may represent repeated sightings of the same individual. Species richness was calculated for each season by first averaging the total number of species observed within each plot during a visit, then averaging across plots within each visit, followed by averaging across visits within the season. Overall species richness was calculated as a weighted average of seasonal values by the number of days in each season for each survey type. Species diversity and richness were compared among seasons within respective survey types.

Mean Use and Frequency of Occurrence

For generating standardized avian use estimates, all small birds detected within the 200-m (656-ft) radius plot were used in the analysis. Standardized estimates of mean bird use (number of birds per plot per survey) were used to compare differences between bird types, seasons, and survey points. Mean use by season was calculated by summing the total number of birds seen within each plot during a visit, then averaging across plots within each visit, followed by averaging across visits within the season. Overall mean use was calculated as a weighted average of seasonal values by the number of days in each season. In addition, mean use was spatially compared among points across the Project.

RESULTS

Surveys were completed once weekly from September 16 to November 10, 2016 and August 17 to September 13, 2017 (fall) and from April 7 to May 30, 2017 (spring). A total of 23 passerine migration survey visits were completed throughout the survey period for a total of 137 surveys in approximately 23 survey hours. For all birds recorded during the surveys, details on the number of observations and groups recorded by species within 200-m (656-ft) radius plots are presented in Appendix A.

Bird Diversity and Species Richness

A total of 3,220 individuals, within 993 groups and consisting of 76 identifiable species were observed during the surveys (Appendix A). Passerines were commonly observed during the survey, consisting of 54 (71.1%) of the species observed (Appendix A). Small bird richness was greater during the spring season (8.9 species/200-m plot/10 min survey) compared to the fall season (4.3 species/200-m plot/10 min survey). Overall small bird species richness was approximately 6.6 species/200-m plot/10-min survey. Three species composed 54.8% of all observations: red-winged blackbird (*Agelaius phoeniceus*; 29.1%), European starling (*Sturnus vulgaris;* 17.5%), and American robin (*Turdus migratorius*; 8.2%). All other species accounted for 7.2% or fewer of the observations, individually (Appendix A).

Bird Use, Percent of Use, and Frequency of Occurrence

Overall mean use for small birds was greater in the fall (21.8 birds/200-m plot/10-min survey) compared to the spring (17.8 birds/200-m plot/10-min survey). Passerines represented the greatest percent use of all small birds observed, 96.9% during fall and 96.1% during spring. Frequency of individual species observed varied between the fall and spring seasons (Table 2).

Small bird use was highest at Point 4 (28.5 birds/200-m plot/10-min survey), with use at the remaining points ranging from 2.4 (Point 2) to 28.3 (Point 3). Passerines comprised the highest mean use for each point ranging from 2.4 (Point 2) to 27.8 (Points 3 and 4) compared to the other small bird species groups (Table 3).

Table 2. Mean bird use (number of birds/200-m plot/10-min survey), percent of total use (%), and frequency of occurrence (%) for each bird type and species by season during passerine migration surveys at the Emerson Creek Wind Project from Fall 2016, and Spring 2017, and Fall 2017.

	Mean Use		% of Use		% Frequency	
Type / Species	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**
Passerines	**21.1**	**17.1**	**96.9**	**96.1**	**97.6**	**100.0**
Acadian flycatcher	0.0	0.0	0.0	0.1	0.0	1.9
American goldfinch	0.5	0.7	2.4	3.6	30.6	37.0
American robin	1.0	2.7	4.5	15.3	30.3	88.9
Baltimore oriole	0.1	0.4	0.3	2.1	6.0	33.3
bank swallow	0.1	0.0	0.3	0.0	2.4	0.0
barn swallow	0.4	0.4	1.8	2.4	9.5	14.8
black-capped chickadee	0.1	0.0	0.6	0.2	6.3	3.7
black-throated green warbler	0.0	0.0	<0.1	0.0	1.0	0.0
blue-winged warbler	0.0	0.0	<0.1	0.0	1.0	0.0
blue jay	1.5	1.0	6.8	5.6	69.9	55.6
brown-headed cowbird	0.9	0.5	4.2	3.0	8.3	22.2
brown thrasher	0.0	0.1	0.0	0.5	0.0	9.3
Carolina wren	0.1	0.0	0.2	0.2	4.8	3.7

cedar waxwing	0.0	0.2	0.0	0.8	0.0	3.7
chipping sparrow	0.0	0.2	<0.1	1.2	1.2	22.2
common grackle	0.5	3.0	2.2	16.7	3.4	59.3
common yellowthroat	0.0	0.1	0.0	0.3	0.0	5.6
eastern bluebird	0.1	0.1	0.5	0.3	3.4	5.6
eastern kingbird	0.0	0.0	<0.1	0.1	1.2	1.9
eastern meadowlark	0.0	0.0	<0.1	0.2	1.0	3.7
eastern phoebe	0.0	0.0	<0.1	0.0	1.2	0.0
eastern wood-pewee	0.1	0.0	0.5	0.1	10.7	1.9
European starling	4.9	1.0	22.5	5.7	35.9	46.3
field sparrow	0.0	0.2	<0.1	0.8	1.0	13.0
gray catbird	0.1	0.1	0.6	0.7	11.2	13.0
great crested flycatcher	0.0	0.1	0.0	0.3	0.0	5.6
hermit thrush	0.0	0.0	0.0	0.1	0.0	1.9
horned lark	0.1	0.0	0.3	0.1	4.4	1.9
house finch	0.3	0.2	1.3	1.0	11.9	16.7
house sparrow	0.7	1.3	3.4	7.1	29.3	42.6
house wren	0.0	0.2	0.2	1.2	3.6	22.2
indigo bunting	0.0	0.1	0.1	0.5	2.4	9.3
northern cardinal	0.1	0.5	0.6	3.0	9.2	50.0
orchard oriole	0.0	0.1	0.0	0.4	0.0	7.4
purple martin	0.0	0.0	0.0	0.2	0.0	3.7
red-breasted nuthatch	0.0	0.0	<0.1	0.0	1.0	0.0
red-eyed vireo	0.0	0.2	0.0	1.0	0.0	16.7
red-winged blackbird	8.2	1.9	37.5	10.5	20.1	51.9
rose-breasted grosbeak	0.0	0.0	<0.1	0.2	1.2	3.7
ruby-crowned kinglet	0.0	0.0	0.0	0.1	0.0	1.9
scarlet tanager	0.0	0.0	0.0	0.1	0.0	1.9
song sparrow	0.1	0.6	0.2	3.4	4.6	50.0
tree swallow	0.7	0.1	3.2	0.3	7.0	3.7
tufted titmouse	0.1	0.5	0.4	2.6	6.8	42.6
unidentified sparrow	0.0	0.0	0.1	0.0	1.0	0.0
vesper sparrow	0.0	0.0	0.0	0.1	0.0	1.9
warbling vireo	0.0	0.0	0.0	0.2	0.0	3.7
white-breasted nuthatch	0.3	0.1	1.6	0.7	24.7	13.0
white-crowned sparrow	0.0	0.0	0.0	0.2	0.0	1.9
white-throated sparrow	0.0	0.2	0.0	0.9	0.0	7.4
wood thrush	0.0	0.2	<0.1	0.9	1.2	13.0
yellow-rumped warbler	0.0	0.0	<0.1	0.0	1.2	0.0
yellow-throated vireo	0.0	0.0	0.0	0.1	0.0	1.9
yellow warbler	0.0	0.1	<0.1	0.3	1.2	5.6
Cuckoos	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**1.9**
yellow-billed cuckoo	0.0	0.0	0.0	0.1	0.0	1.9
Swifts/Hummingbirds	**0.1**	**0.1**	**0.3**	**0.5**	**4.8**	**5.6**
chimney swift	0.1	0.1	0.3	0.5	4.8	5.6
Woodpeckers	**0.6**	**0.6**	**2.5**	**3.2**	**40.1**	**40.7**
downy woodpecker	0.1	0.0	0.5	0.2	10.4	3.7
hairy woodpecker	0.0	0.0	0.1	0.0	2.2	0.0
northern flicker	0.1	0.2	0.2	1.1	5.4	20.4

pileated woodpecker	0.1	0.0	0.2	0.2	3.4	3.7
red-bellied woodpecker	0.2	0.2	1.1	1.4	24.5	24.1
red-headed woodpecker	0.1	0.1	0.3	0.3	7.1	5.6
unidentified woodpecker	0.0	0.0	<0.1	0.0	1.0	0.0
Unidentified Birds	**0.1**	**0.0**	**0.3**	**0.0**	**1.2**	**0.0**
unidentified bird (small)	0.1	0.0	0.3	0.0	1.2	0.0
Overall Small Birds[1]	**21.8**	**17.8**	**100**	**100**		

[1]Sums of values may not add to total value shown due to rounding.

Table 3. Mean use for all birds (number of birds/200-m plot/10-min survey) by point for all small bird types observed during passerine migration surveys at the Emerson Creek Wind Project from Fall 2016, Spring 2017 and Fall 2017.

	Survey Point						
Bird Type	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Passerines	17.9	2.4	27.8	27.8	11.3	16.4	20.6
Cuckoos	0	0	<0.1	0	0	0	0
Swifts/Hummingbirds	0.1	0	0.1	0.1	0.1	<0.1	0
Woodpeckers	0.6	0	0.3	0.4	1.1	0.4	0.6
unidentified small birds	0	0	0	0.2	0	0	0
Overall Small Birds	**18.6**	**2.4**	**28.3**	**28.5**	**12.6**	**16.7**	**21.2**

[1]Sums of values may not add to total value shown due to rounding.

Sensitive Species

No federal or state endangered or threatened species were recorded during the passerine migration surveys. Two BCC species were observed during the surveys: red-headed woodpecker (*Melanerpes erythrocephalus*, n=9) and wood thrush (*Hylocichla mustelina*, n=10; USFWS 2018). Both species were observed during both survey seasons with the red-headed woodpecker observed at survey points “PM4”, “PM5”, “PM6” and “PM7”, and the wood thrush at survey points “PM3”, “PM4” and “PM5”.

CONCLUSIONS

Analysis of the data collected during the surveys generally indicates that development of the Project is not likely to cause significant impacts to migrating passerine populations. No federal or state threatened or endangered species were observed during the surveys, and only two BCC species were observed in low numbers. The majority of the migrating passerines species observed are widespread and abundant (ODNR 2014), suggesting low risk of adverse impacts to as a result of development and operation of the Project. Siting turbines away from forest, shrub/scrub, and wooded wetland habitat would likely avoid or minimize potential risk to sensitive species and migrating passerines. Erickson et al. (2014) completed an analysis of passerine mortality at 116 wind energy facilities in the US and Canada and estimated that about 134,000 to 230,000 small passerine fatalities from collision with wind turbines occur annually, or 2.10 to 3.35 small birds per MW of installed capacity. Other human-related sources of bird deaths, (e.g., communication towers, buildings, and domestic cats) have been estimated to kill millions to billions of birds each year.

REFERENCES

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Appendix A. Species Observed at the Emerson Creek Wind Project during Passerine Migration Surveys during the Fall (September 16 through November 10, 2016 and August 17 through September 13, 2017) and Spring (April 7 through May 30, 2017) seasons

Appendix A. Species Observed at the Emerson Creek Wind Project during Passerine Migration Surveys during the Fall (September 16 through November 10, 2016 and August 17 through September 13, 2017) and Spring (April 7 through May 30, 2017) seasons.

		Fall		Spring		Total	
Type / Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Waterbirds		0	0	4	6	4	6
great blue heron	*Ardea herodias*	0	0	3	5	3	5
great egret	*Ardea alba*	0	0	1	1	1	1
Waterfowl		4	122	4	14	8	136
Cada goose	*Branta cadensis*	3	121	4	14	7	135
mallard	*As platyrhynchos*	1	1	0	0	1	1
Shorebirds		25	101	7	7	32	108
black-bellied plover	*Pluvialis squatarola*	1	8	0	0	1	8
killdeer	*Charadrius vociferus*	24	93	6	6	30	99
spotted sandpiper	*Actitis macularius*	0	0	1	1	1	1
Gulls/Terns		3	77	0	0	3	77
Herring gull	*Larus argentatus*	1	1	0	0	1	1
ring-billed gull	*Larus delawarensis*	2	76	0	0	2	76
Diurl Raptors		6	6	1	1	7	7
Accipiters		2	2	0	0	2	2
Cooper's hawk	*Accipiter cooperii*	2	2	0	0	2	2
Buteos		4	4	1	1	5	5
red-tailed hawk	*Buteo jamaicensis*	4	4	1	1	5	5
Vultures		1	2	5	15	6	17
turkey vulture	*Cathartes aura*	1	2	5	15	6	17
Doves/Pigeons		23	36	20	27	43	63
mourning dove	*Zeida macroura*	22	35	20	27	42	62
rock pigeon	*Columba livia*	1	1	0	0	1	1
Large Corvids		16	37	7	9	23	46
American crow	*Corvus brachyrhynchos*	16	37	7	9	23	46
Cuckoos		0	0	1	1	1	1
yellow-billed cuckoo	*Coccyzus americanus*	0	0	1	1	1	1
Passerines		351	1807	433	861	784	2668
Acadian flycatcher	*Empidox virescens*	0	0	1	1	1	1
American goldfinch	*Spinus tristis*	30	44	20	35	50	79
American robin	*Turdus migratorius*	29	86	56	134	85	220
Baltimore oriole	*Icterus galbula*	5	6	18	20	23	26
bank swallow	*Riparia riparia*	2	6	0	0	2	6
barn swallow	*Hirundo rustica*	9	33	8	23	17	56
black-capped chickadee	*Poecile atricapillus*	6	12	2	2	8	14
black-throated green warbler	*Setophaga virens*	1	1	0	0	1	1
blue-winged warbler	*Vermivora cyanoptera*	1	2	0	0	1	2
blue jay	*Cyanocitta cristata*	68	134	26	48	94	182
brown-headed cowbird	*Molothrus ater*	8	81	12	29	20	110
brown thrasher	*Toxostoma rufum*	0	0	4	4	4	4
Caroli wren	*Thryothorus ludovicianus*	4	4	2	2	6	6
cedar waxwing	*Bombycilla cedrorum*	0	0	2	8	2	8

Appendix A. Species Observed at the Emerson Creek Wind Project during Passerine Migration Surveys during the Fall (September 16 through November 10, 2016 and August 17 through September 13, 2017) and Spring (April 7 through May 30, 2017) seasons.

		Fall		Spring		Total	
Type / Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
chipping sparrow	*Spizella passeri*	1	1	12	12	13	13
common grackle	*Quiscalus quiscula*	3	41	31	152	34	193
common yellowthroat	*Geothlypis trichas*	0	0	3	3	3	3
eastern bluebird	*Sialia sialis*	3	10	3	3	6	13
eastern kingbird	*Tyrannus tyrannus*	1	1	1	1	2	2
eastern meadowlark	*Sturnella mag*	1	2	2	2	3	4
eastern phoebe	*Sayornis phoebe*	1	1	0	0	1	1
eastern wood-pewee	*Contopus virens*	9	9	1	1	10	10
European starling	*Sturnus vulgaris*	40	419	24	48	64	467
field sparrow	*Spizella pusilla*	1	1	6	7	7	8
gray catbird	*Dumetella carolinensis*	10	11	7	7	17	18
great crested flycatcher	*Myiarchus crinitus*	0	0	3	3	3	3
hermit thrush	*Catharus guttatus*	0	0	1	1	1	1
horned lark	*Eremophila alpestris*	4	6	1	1	5	7
house finch	*Haemorhous mexicanus*	10	23	9	10	19	33
house sparrow	*Passer domesticus*	25	63	22	65	47	128
house wren	*Troglodytes aedon*	3	3	12	12	15	15
indigo bunting	*Passeri cyanea*	2	2	5	5	7	7
northern cardinal	*Cardilis cardilis*	8	11	24	25	32	36
orchard oriole	*Icterus spurius*	0	0	4	4	4	4
purple martin	*Progne subis*	0	0	2	2	2	2
red-breasted nuthatch	*Sitta cadensis*	1	1	0	0	1	1
red-eyed vireo	*Vireo olivaceus*	0	0	9	10	9	10
red-winged blackbird	*Agelaius phoeniceus*	23	687	24	89	47	776
rose-breasted grosbeak	*Pheucticus ludovicianus*	1	1	2	2	3	3
ruby-crowned kinglet	*Regulus calendula*	0	0	1	1	1	1
scarlet tager	*Piranga olivacea*	0	0	1	1	1	1
song sparrow	*Melospiza melodia*	4	4	26	31	30	35
tree swallow	*Tachycineta bicolor*	6	59	2	3	8	62
tufted titmouse	*Baeolophus bicolor*	6	7	19	21	25	28
unidentified sparrow		1	3	0	0	1	3
vesper sparrow	*Pooecetes gramineus*	0	0	1	1	1	1
warbling vireo	*Vireo gilvus*	0	0	2	2	2	2
white-breasted nuthatch	*Sitta carolinensis*	21	29	6	6	27	35
white-crowned sparrow	*Zonotrichia leucophrys*	0	0	1	2	1	2
white-throated sparrow	*Zonotrichia albicollis*	0	0	4	9	4	9
wood thrush	*Hylocichla musteli*	1	1	7	9	8	10
yellow-rumped warbler	*Setophaga corota*	1	1	0	0	1	1
yellow-throated vireo	*Vireo flavifrons*	0	0	1	1	1	1
yellow warbler	*Setophaga petechia*	1	1	3	3	4	4
Swifts/Hummingbirds		4	6	3	5	7	11
chimney swift	*Chaetura pelagica*	4	6	3	5	7	11

Appendix A. Species Observed at the Emerson Creek Wind Project during Passerine Migration Surveys during the Fall (September 16 through November 10, 2016 and August 17 through September 13, 2017) and Spring (April 7 through May 30, 2017) seasons.

		Fall		Spring		Total	
Type / Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Woodpeckers		47	48	27	27	74	75
downy woodpecker	*Picoides pubescens*	9	9	2	2	11	11
hairy woodpecker	*Picoides villosus*	2	2	0	0	2	2
northern flicker	*Colaptes auratus*	5	5	9	9	14	14
pileated woodpecker	*Dryocopus pileatus*	3	4	2	2	5	6
red-bellied woodpecker	*Melanerpes carolinus*	21	21	11	11	32	32
red-headed woodpecker	*Melanerpes erythrocephalus*	6	6	3	3	9	9
unidentified woodpecker		1	1	0	0	1	1
Unidentified Birds		1	5	0	0	1	5
unidentified bird (small)		1	5	0	0	1	5
Overall		**481**	**2,247**	**512**	**973**	**993**	**3,220**

Firelands Wind, LLC
Case No. 18-1607-EL-BGN

Exhibit T
Passerine Migration Surveys

2. Passerine Migration Surveys for the Emerson Creek Wind Project Huron County, Ohio dated July 17, 2018

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Passerine Migration Surveys for the Emerson Creek Wind Project Huron County, Ohio

September 16, 2016 – November 2, 2017

Prepared by:

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Western EcoSystems Technology, Inc.
408 West Sixth Street
Bloomington, Indiana 47404

July 17, 2018

EXECUTIVE SUMMARY

Western EcoSystems Technology, Inc. completed passerine migration surveys during fall 2016 and spring and fall 2017, for the Emerson Creek Wind Project (Project) located in Huron County, Ohio. Survey protocols were developed following the Ohio Department of Natural Resources (ODNR) *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio* (ODNR 2009). The objective of the surveys was to evaluate the use of the Project by migrating passerines and other birds during the spring and fall. In addition, results from these surveys were compared to early surveys completed with similar protocols in 2010, 2011 and 2012.

Surveys were completed approximately once weekly from September 16 – November 9, 2016, April 7 – May 30, 2017, and August 17 – November 2, 2017 at a total of seven points. Surveys consisted of 10-minute counts at each point and all surveys were completed between dawn and 10:00 a.m. near passerine habitat as defined by the ODNR (forest, shrub/scrub, and wooded wetland). Survey points were located near forest habitat due to the scarcity of shrub or wooded wetland habitat near public roads. All birds seen or heard were recorded within 200 meters (m; 656 feet) of the surveyor, as per ODNR protocol (ODNR 2009).

A total of 83 species were documented during the 2016-2017 surveys. Red-winged blackbird, European starling, American robin, and common grackle were the most frequently recorded birds during the study period. Mean passerine use was higher in fall (21.0 birds/200-m plot/10-minute [min] survey) than spring (13.4 birds/200-m plot/10-min survey). Species richness was higher in spring (9.7 species/200-m plot/10 min survey) than fall (6.2 species/200-m plot/10 min survey).

Passerine species composition was similar between the 2016 – 2017 surveys and 2010 – 2011 and 2012 surveys, and the majority of the species documented are commonly found in cropland and/or forested habitat. No federal or state threatened or endangered species were observed during the surveys. Four species that are listed as Birds of Conservation Concern (BCC; bald eagle, bobolink, wood thrush, and red-headed woodpecker) were observed during the 2016 – 2017 surveys, compared to five BBC species observed during the 2010 – 2012 surveys (Canada warbler, prairie warbler, red-headed woodpecker, willow flycatcher, and wood thrush). Eight unique BCC species were observed during all survey years. Observations of each BCC species were infrequent with less than ten individuals observed for each species per survey year, and with no apparent spatial concentration at any particular location in the Project area. The Project presents species composition and seasonal and spatial use patterns for passerines that are similar to many Midwestern wind energy facilities in agricultural landscapes and therefore likely presents a low risk of impact to most passerines.

STUDY PARTICIPANTS

Western EcoSystems Technology, Inc.

Goniela Iskali	Project Manager
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Katie Wynne	Technical Editing Coordinator
Jean-Paul Willson	Technical Editor
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REPORT REFERENCE

Iskali, G, and C. LeBeau. 2018. Passerine Migration Surveys for the Emerson Creek Wind Project, Huron County, Ohio. Draft Report: September 16, 2016 – November 2, 2017. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. July 17, 2018.

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INTRODUCTION

Western EcoSystems Technology, Inc. (WEST) completed passerine migration surveys in fall 2016 and spring and fall 2017 for the Emerson Creek Wind Project (Project) located in Huron County, Ohio. Survey protocols were developed following the Ohio Department of Natural Resources (ODNR) *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio* (ODNR 2009). The objective of the surveys was to evaluate the use of the Project by migrating passerines and other birds during the spring and fall. In addition, results from these surveys were compared to early surveys completed with similar protocols in 2010, 2011 and 2012.

PROJECT AREA

The proposed 122.8-square kilometer (km^2; 30,352 acre) Project is located 2.24 km (1.4 mile [mi]) east of Willard, Ohio. According to the National Land Cover Dataset (NLCD), the Project area is dominated by croplands (80.1%; Table 1, Figure 1; US Geological Survey [USGS] NLCD 2011, Homer et al. 2015) with corn (*Zea mays*) and soybeans (*Glycine max*) being the main crops grown. Deciduous forests (13.5%), developed areas (4.9%) and hay/pasture (1.2%) are the next most common land cover types within the Project area (Table 1). All other land cover types compose 1.0% or less of the Project, combined (Table 1, Figure 1).

Table 1. Land cover types and composition at the Emerson Creek Wind Project.

Habitat	Acres	% Composition
Cultivated Crops	24,307	80.1
Deciduous Forest	4,091	13.5
Developed	1,496	4.9
Hay/Pasture	363	1.2
Herbaceous	66	0.2
Open Water	17	0.1
Evergreen Forest	8	<0.1
Mixed Forest	3	<0.1
Woody Wetlands	1	<0.1
Total	**30,352**	**100***

Data from USGS NLCD 2011, Homer et al. 2015.
*may not add up to 100 due to rounding

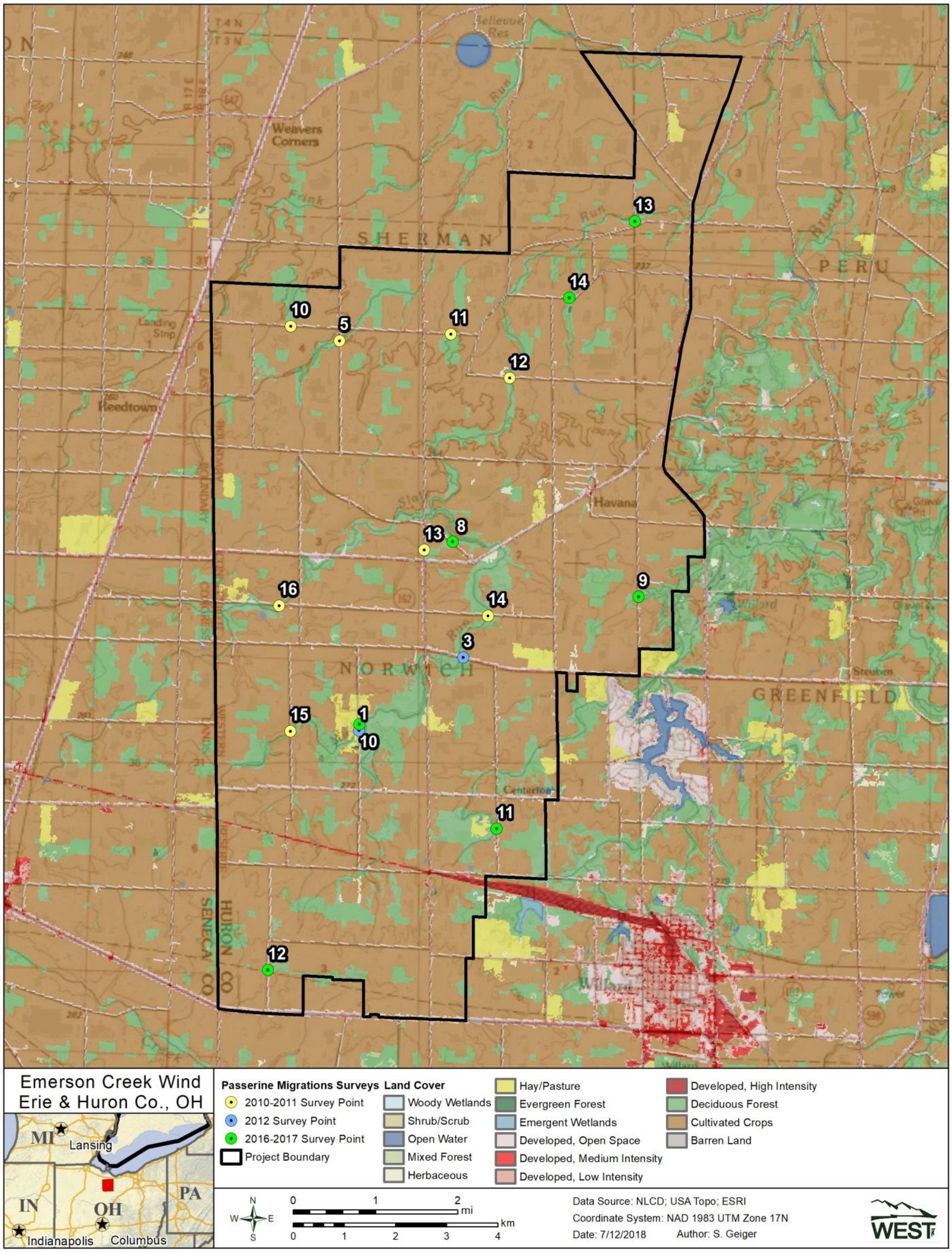

Figure 1. Land cover and locations of passerine migration survey points within the Emerson Creek Wind Project.

METHODS

Survey Methods

Survey points were established consistent with ODNR protocol recommendations: one point-count location for every 247.1 ac (100 ha) of combined forest, shrub, and wooded wetland habitats, with points stratified in patches of these habitats across the site (ODNR 2009). There are 4,103.4 ac (1,660.6 ha) of forest, shrub, and wooded wetland in the Project and therefore 17 points were surveyed. Shrub and wooded wetlands are very rare in the Project (<0.1%) thus, surveys were located near forest habitat in 2017, following the ODNR protocol within the Project (Figure 1).

Passerine migration surveys were completed approximately weekly during the 2016 – 2017 surveys following the ODNR protocol during the fall (August 15 – November 15) and spring (April 1 – May 31) passerine migration seasons (ODNR 2009). Surveys consisted of 10-minute (min) counts at each point, in which all birds seen or heard within 200 meters (m; 656 feet [ft]) of the surveyor were recorded, regardless of size (ODNR 2009). Birds flying overhead that did not land or originate within 200 m (656 ft) of the center of the point were listed as “fly over.” All surveys were completed between dawn and 10:00 a.m. At each survey point, the date, start and end time of the survey period, and weather information (e.g., temperature, wind speed and direction, and cloud cover) were recorded for each survey. Species or best possible identification, number of individuals, sex and age class (if identifiable), distance from observer, bearing, activity (behavior), and habitat(s) were recorded for each observation (ODNR 2009). Approximate flight height and distance from plot center at first observation were recorded to the nearest 1-m (3-ft) interval. Locations of sensitive species recorded during surveys were identified on field maps by unique observation number. Comments were recorded in the comments section of the datasheet.

Observations of sensitive species (defined as species afforded protection under the Endangered Species Act [1973], Bald and Golden Eagle Protection Act [BGEPA; 1940], listed as threatened or endangered by the state of Ohio [ODNR 2016], or Birds of Conservation Concern [BCC; USFWS 2018]) were recorded during the surveys, as well as incidentally or in-transit within the Project.

Statistical Analysis

For analysis purposes, a visit was defined as the required length of time, in days, to survey all of the plots within the Project once. Seasons were defined as per ODNR protocol as spring (April 1 – May 31) and fall (August 15 – November 15; ODNR 2009). Small birds were defined as passerines, swifts, hummingbirds, and certain smaller species of woodpeckers. Large birds were defined as waterbirds, waterfowl, shorebirds, diurnal raptors, vultures, upland game birds, doves and pigeons, large corvids, large woodpeckers and goatsuckers.

Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following surveys, observers were responsible for inspecting data forms for completeness, accuracy, and legibility. Potentially erroneous data was identified using a series of database queries. Irregular codes or data suspected as being questionable were discussed with the observer and/or survey manager. Errors, omissions, or problems identified in later stages of analysis were traced back to the raw datasheets, and appropriate changes in all steps were made.

Data Compilation and Storage

A Microsoft® SQL database was developed to store, organize, and retrieve survey data. Data were keyed into the electronic database using a pre-defined protocol to facilitate subsequent QA/QC and data analysis. All datasheets, field notebooks (if provided), and electronic data files were retained for reference.

Bird Diversity and Species Richness

Bird diversity is illustrated by the total number of unique species observed. Species lists (with the number of observations and the number of groups) were generated by season and included all observations of birds detected within the 200-m (656-ft) buffer. In some cases, the tally may represent repeated sightings of the same individual. Species richness was calculated for each season by first averaging the total number of species observed within each plot during a visit, then averaging across plots within each visit, followed by averaging across visits within the season. Overall species richness was calculated as a weighted average of seasonal values by the number of days in each season for each survey type. Species diversity and richness were compared among seasons within respective survey types.

Mean Use and Frequency of Occurrence

For generating standardized avian use estimates, all small birds detected within the 200-m (656-ft) radius plot were used in the analysis. Standardized estimates of mean bird use (number of birds per plot per survey) were used to compare differences between bird types, seasons, and survey points. Mean use by season was calculated by summing the total number of birds seen within each plot during a visit, then averaging across plots within each visit, followed by averaging across visits within the season. Overall mean use was calculated as a weighted average of seasonal values by the number of days in each season. In addition, mean use was spatially compared among points across the Project.

Comparison of Results with Existing Data

Eight of the 17 points surveyed in this study were previously surveyed using similar methods in 2010 – 2011 (September 1 – November 10, 2010, and April 5 – May 28, 2011 and August 9 – August 30, 2011) and two points were surveyed in 2012 (April 4 - May 29 and August 15 – November 14, 2012) within the current Project boundary (Ritzert et al. 2012, Ritzert 2013; Figure 1). An additional seven points were surveyed in 2017. Species composition was compared across all years surveyed.

RESULTS

A total of 205 passerine migration surveys were completed throughout the 2016-17 survey periods for a total of 26.5 survey hours. Details on all birds recorded during the surveys and the number of observations and groups recorded by species within 200-m (656-ft) radius plots are presented in Appendix A.

Bird Diversity and Species Richness

A total of 83 species were recorded during the survey period (3,395 individuals within 1,261 groups). Passerines comprised 67 (80.7%) of the species recorded for a total of 2,741 birds in 999 groups (Appendix A). Overall Bird species richness was greater during the spring season (9.7species/200-m plot/10 min survey) compared to the fall season (6.2 species/200-m plot/10 min survey). Four species composed 45.5% of all observations: red-winged blackbird (*Agelaius phoeniceus*; 15.2%), European starling (*Sturnus vulgaris*; 12.4%), American robin (*Turdus migratorius*; 9.4%), and common grackle (*Quiscalus quiscula*; 8.5%). All other species accounted for 6.9% or fewer of the observations, individually (Appendix A).

Bird Use, Percent of Use, and Frequency of Occurrence

Overall mean small bird use was greater in the fall (22.0 birds/200-m plot/10-min survey) compared to the spring (14.1 birds/200-m plot/10-min survey). Passerines were the most frequently observed bird group and represented the greatest percent use of all birds observed, 95.2% during fall and 95.4% during spring. Frequency of individual species observed varied between the fall and spring seasons (Table 2).

Small bird use was highest at Point 11 (26.9 birds/200-m plot/10-min survey), with use at the remaining points ranging from 8.0 (point 12) to 22.1 (point 8). Passerines composed the highest mean use for each point ranging from 7.7 (point 12) to 26.4 (point 11), primarily because of higher use by the blackbird/oriole passerine group at all points (Table 3).

Table 2. Mean small bird use (number of birds/200-meter plot/10-minute survey), percent of total use (%), and frequency of occurrence (%) for each bird type and species by season during passerine migration surveys at the Emerson Creek Wind Project during September 16 – November 9, 2016, April 7 – May 30, 2017, and August 17 – November 2, 2017.

	Mean Use		% of Use		% Frequency	
Type/Species	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**
Passerines	20.98	13.4	95.2	95.4	98.2	98.4
Acadian flycatcher	0	0.02	0	0.1	0	1.6
American goldfinch	0.49	0.59	2.2	4.2	26.3	42.9
American robin	2.61	2.03	11.9	14.5	64.6	77.8
American tree sparrow	0.02	0	<0.1	0	0.9	0
Baltimore oriole	0.02	0.32	<0.1	2.3	1.3	28.6
bank swallow	0.03	0	0.1	0	0.6	0
barn swallow	0.26	0.22	1.2	1.6	6.5	15.9
black-capped chickadee	0.29	0.1	1.3	0.7	15.1	7.9
blue-gray gnatcatcher	0	0.02	0	0.1	0	1.6
blue jay	1.65	0.63	7.5	4.5	69.6	42.9
bobolink	0	0.05	0	0.3	0	3.2
brown-headed cowbird	0.9	0.48	4.1	3.4	5.6	22.2
brown creeper	0.02	0	0.1	0	2.3	0
brown thrasher	0	0.1	0	0.7	0	9.5
Carolina wren	0.12	0.13	0.5	0.9	9.4	12.7
cedar waxwing	0.1	0.06	0.4	0.5	1.3	3.2
chipping sparrow	0.04	0.37	0.2	2.6	1.6	23.8
common grackle	2.12	0.86	9.6	6.1	7	38.1
common yellowthroat	0.04	0.17	0.2	1.2	2.2	15.9
dark-eyed junco	0.05	0	0.2	0	3.6	0
eastern bluebird	0.48	0.14	2.2	1	17.1	14.3
eastern kingbird	0	0.02	0	0.1	0	1.6
eastern meadowlark	0	0.1	0	0.7	0	9.5
eastern phoebe	0.05	0.13	0.2	0.9	5.1	11.1
eastern towhee	0.01	0.06	<0.1	0.5	1.3	4.8
eastern wood-pewee	0.04	0.06	0.2	0.5	4.2	6.3
European starling	4.29	0.75	19.5	5.3	42.6	39.7
field sparrow	0	0.17	0	1.2	0	17.5
gray catbird	0.19	0.16	0.9	1.1	16.5	15.9
great crested flycatcher	0.02	0	<0.1	0	1.3	0
horned lark	0.04	0.05	0.2	0.3	1.8	3.2
house finch	0.11	0.02	0.5	0.1	8.4	1.6
house sparrow	0.57	0.62	2.6	4.4	11.9	25.4
house wren	0.03	0.46	0.1	3.3	2.6	39.7
indigo bunting	0.04	0.11	0.2	0.8	4.2	9.5
northern cardinal	0.08	0.56	0.3	4	7.6	49.2
orchard oriole	0	0.13	0	0.9	0	12.7
pine warbler	<0.01	0	<0.1	0	0.9	0
purple martin	0.01	0.03	<0.1	0.2	0.6	1.6
red-breasted nuthatch	<0.01	0	<0.1	0	0.9	0
red-eyed vireo	0	0.13	0	0.9	0	9.5
red-winged blackbird	4.36	1.52	19.8	10.8	24.5	39.7
rose-breasted grosbeak	0.01	0.16	<0.1	1.1	0.6	15.9
scarlet tanager	0	0.02	0	0.1	0	1.6
song sparrow	0.19	0.79	0.9	5.6	13.8	69.8
Swainson's thrush	<0.01	0	<0.1	0	0.6	0
tree swallow	0.08	0.1	0.4	0.7	6.5	4.8

tufted titmouse	0.19	0.3	0.8	2.1	12.1	27
unidentified empidonax	<0.01	0	<0.1	0	0.9	0
unidentified passerine	0	0.08	0	0.6	0	1.6
unidentified sparrow	0.06	0	0.3	0	1.8	0
unidentified wren	<0.01	0	<0.1	0	0.9	0
veery	<0.01	0	<0.1	0	0.9	0
vesper sparrow	0	0.02	0	0.1	0	1.6
warbling vireo	0.03	0.22	0.1	1.6	2.9	19
white-breasted nuthatch	0.52	0.1	2.4	0.7	36.9	9.5
white-throated sparrow	0	0.03	0	0.2	0	1.6
wood thrush	0	0.05	0	0.3	0	4.8
yellow-rumped warbler	0.78	0.02	3.5	0.1	14.5	1.6
yellow-throated vireo	0	0.05	0	0.3	0	4.8
yellow warbler	0	0.14	0	1	0	12.7
Swifts/Hummingbirds	0.01	0.11	<0.1	0.8	1.3	4.8
chimney swift	0	0.11	0	0.8	0	4.8
ruby-throated hummingbird	0.01	0	<0.1	0	1.3	0
Woodpeckers	1.02	0.54	4.6	3.8	58.4	41.3
downy woodpecker	0.3	0.08	1.4	0.6	28.1	7.9
hairy woodpecker	0.04	0.02	0.2	0.1	3.5	1.6
northern flicker	0.25	0.19	1.2	1.4	18.4	15.9
pileated woodpecker	0.06	0.05	0.3	0.3	6.1	4.8
red-bellied woodpecker	0.35	0.19	1.6	1.4	33.5	19
red-headed woodpecker	0.01	0.02	<0.1	0.1	1.3	1.6
unidentified woodpecker	<0.01	0	<0.1	0	0.9	0
Kingfishers	0.02	0	<0.1	0	1.3	0
belted kingfisher	0.02	0	<0.1	0	1.3	0
Overall Small Birds	**25.7**	**15.5**	**88.8**	**90.9**		

[1]Sums of values may not add to total value shown due to rounding.

Table 3. Mean use for small birds (number of birds/200-meter plot/10-minute survey) by point for all small bird types observed during passerine migration surveys at the Emerson Creek Wind Project during September 16 – November 9, 2016, April 7 – May 30, 2017, and August 17 – November 2, 2017.

	Survey Point						
Bird Type	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Passerines	21.09	14.91	16.26	26.39	7.7	17.09	17.14
Swifts/Hummingbirds	0.04	0.17	0.04	0	0.09	0	0.05
Woodpeckers	0.96	0.96	0.65	0.52	0.26	0.95	1.18
Kingfishers	0	0	0	0	0	0.14	0
Overall Small Birds	**22.09**	**16.04**	**16.96**	**26.91**	**8.04**	**18.18**	**18.36**

[1]Sums of values may not add to total value shown due to rounding.

Sensitive Species

No federal or state endangered or threatened species were recorded during the passerine migration surveys in 2016 – 2017. Four BCC were observed: bald eagle (*Haliaeetus leucocephalus,* n=1, point 10), bobolink (*Dolichonyx oryzivorus*, n=3, point 10), wood thrush (*Hylocichla mustelina*, n=3, points 8, 10, and 13), and red-headed woodpecker (*Melanerpes erythrocephalus,* n=3, points 8, 9, and 14; USFWS 2018).

Comparison to 2010 and 2012 Data

A total of 102 species were identified within the Project area during the 2010 – 2011 surveys, followed by 78 in 2012, and 83 in 2016 – 2017. However, fewer points were surveyed within the Project in 2012 (n=2) and 2016 – 2017 (n=7) compared to 2010 – 2011 (n=9; Ritzert et al 2012, Ritzert 2013). The most abundant species during the 2010 – 2011 survey were American robin, European starling, and blackbirds. The most abundant species during the 2012 survey were red-winged blackbird, American robin and blue jay (Appendix B) Overall, the species composition between the survey years was similar, and the majority of the species are those that area commonly found in cropland and/or forested habitat (ODNR 2017; Appendices A and B).

A total of seven BCC were observed over all survey periods: bald eagle, bobolink, wood thrush, red-headed woodpecker, Canada warbler (*Cardellina canadensis*), prairie warbler (*Setophaga discolor*), and willow flycatcher (*Empidonax traillii*). Red-headed woodpecker were observed during each survey period (n=10) and wood thrush (n=12) was observed during both the 2012 and 2016-2017 survey periods.

CONCLUSIONS

No federal or state threatened or endangered species were observed during the surveys, and only four BCC species were observed in low numbers during the 2016 – 2017 surveys. The majority of the migrating passerines species observed are widespread and abundant (ODNR 2014). Passerine species composition was similar between the 2016 – 2017 surveys and 2010 – 2011 and 2012 surveys, and the majority of the species documented are commonly found in cropland and/or forested habitat. Eight unique BCC species were observed during all survey years, all in very low numbers.and with no apparent spatial concentration at any particular location in the Project area. The Project presents species composition and seasonal and spatial use patterns for passerines that are similar to many Midwestern wind energy facilities in agricultural landscapes and therefore likely presents a low risk of impact to most passerines.

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Appendix A. Bird Species Observed at the Emerson Creek Wind Project during Passerine Migration Surveys during the Fall (September 16 through November 9, 2016 and August 17 through November 2, 2017), and Spring (April 7 through May 30, 2017) seasons

Appendix A. Bird Species Observed at the Emerson Creek Wind Project during Passerine Migration Surveys during the Fall (September 16 through November 9, 2016 and August 17 through November 2, 2017) and Spring (April 7 through May 30, 2017) seasons.

		Fall		Spring		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Loons/Grebes		1	1	0	0	1	1
common loon	*Gavia immer*	1	1	0	0	1	1
Waterbirds		6	229	2	4	8	233
double-crested cormorant	*Phalacrocorax auritus*	3	225	0	0	3	225
great blue heron	*Ardea herodias*	2	2	0	0	2	2
green heron	*Butorides virescens*	1	2	2	4	3	6
Waterfowl		**3**	**22**	**8**	**34**	**11**	**56**
Canada goose	*Branta cadensis*	3	22	5	25	8	47
common goldeneye	*Bucephala clangula*	0	0	1	5	1	5
mallard	*As platyrhynchos*	0	0	2	4	2	4
Shorebirds		**9**	**12**	**6**	**7**	**15**	**19**
killdeer	*Charadrius vociferus*	9	12	6	7	15	19
Diurnal Raptors		**5**	**5**	**1**	**1**	**6**	**6**
American kestrel	*Falco sparverius*	1	1	0	0	1	1
bald eagle	*Haliaeetus leucocephalus*	1	1	0	0	1	1
red-tailed hawk	*Buteo jamaicensis*	2	2	1	1	3	3
sharp-shinned hawk	*Accipiter striatus*	1	1	0	0	1	1
Vultures		**5**	**21**	**7**	**8**	**12**	**29**
turkey vulture	*Cathartes aura*	5	21	7	8	12	29
Upland Game Birds		**1**	**1**	**1**	**1**	**2**	**2**
wild turkey	*Meleagris gallopavo*	1	1	1	1	2	2
Doves/Pigeons		**28**	**56**	**24**	**30**	**52**	**86**
mourning dove	*Zeida macroura*	28	56	24	30	52	86
Large Corvids		**27**	**77**	**6**	**8**	**33**	**85**
American crow	*Corvus brachyrhynchos*	27	77	6	8	33	85
Passerines		**447**	**1,897**	**552**	**844**	**999**	**2,741**
Acadian flycatcher	*Empidonax virescens*	0	0	1	1	1	1
American goldfinch	*Spinus tristis*	33	55	27	37	60	92
American robin	*Turdus migratorius*	57	192	63	128	120	320
American tree sparrow	*Spizelloides arborea*	1	2	0	0	1	2
Baltimore oriole	*Icterus galbula*	2	3	18	20	20	23
bank swallow	*Riparia riparia*	1	4	0	0	1	4
barn swallow	*Hirundo rustica*	11	40	10	14	21	54
black-capped chickadee	*Poecile atricapillus*	13	27	5	6	18	33
blue-gray gnatcatcher	*Polioptila caerulea*	0	0	1	1	1	1
blue jay	*Cyanocitta cristata*	66	148	27	40	93	188
bobolink	*Dolichonyx oryzivorus*	0	0	2	3	2	3
brown-headed cowbird	*Molothrus ater*	5	54	14	30	19	84
brown creeper	*Certhia americana*	1	1	0	0	1	1
brown thrasher	*Toxostoma rufum*	0	0	6	6	6	6
Carolina wren	*Thryothorus ludovicianus*	7	8	8	8	15	16
cedar waxwing	*Bombycilla cedrorum*	2	15	2	4	4	19
chipping sparrow	*Spizella passerina*	2	5	15	23	17	28
common grackle	*Quiscalus quiscula*	9	233	24	54	33	287
common yellowthroat	*Geothlypis trichas*	3	5	10	11	13	16
dark-eyed junco	*Junco hyemalis*	4	5	0	0	4	5
eastern bluebird	*Sialia sialis*	16	40	9	9	25	49
eastern kingbird	*Tyrannus tyrannus*	0	0	1	1	1	1
eastern meadowlark	*Sturnella magna*	0	0	6	6	6	6

Appendix A. Bird Species Observed at the Emerson Creek Wind Project during Passerine Migration Surveys during the Fall (September 16 through November 9, 2016 and August 17 through November 2, 2017) and Spring (April 7 through May 30, 2017) seasons.

		Fall		Spring		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
eastern phoebe	*Sayornis phoebe*	5	5	7	8	12	13
eastern towhee	*Pipilo erythrophthalmus*	2	2	3	4	5	6
eastern wood-pewee	*Contopus virens*	4	4	4	4	8	8
European starling	*Sturnus vulgaris*	39	375	25	47	64	422
field sparrow	*Spizella pusilla*	0	0	11	11	11	11
gray catbird	*Dumetella carolinensis*	25	27	10	10	35	37
great crested flycatcher	*Myiarchus crinitus*	2	3	0	0	2	3
horned lark	*Eremophila alpestris*	2	4	2	3	4	7
house finch	*Haemorhous mexicanus*	5	7	1	1	6	8
house sparrow	*Passer domesticus*	14	64	17	39	31	103
house wren	*Troglodytes aedon*	4	4	28	29	32	33
indigo bunting	*Passerina cyanea*	4	4	6	7	10	11
northern cardinal	*Cardinalis cardinalis*	8	8	34	35	42	43
orchard oriole	*Icterus spurius*	0	0	8	8	8	8
pine warbler	*Setophaga pinus*	1	1	0	0	1	1
purple martin	*Progne subis*	1	2	1	2	2	4
red-breasted nuthatch	*Sitta canadensis*	1	1	0	0	1	1
red-eyed vireo	*Vireo olivaceus*	0	0	7	8	7	8
red-winged blackbird	*Agelaius phoeniceus*	22	421	26	96	48	517
rose-breasted grosbeak	*Pheucticus ludovicianus*	1	2	10	10	11	12
scarlet tanager	*Piranga olivacea*	0	0	1	1	1	1
song sparrow	*Melospiza melodia*	17	19	46	50	63	69
Swainson's thrush	*Catharus ustulatus*	1	1	0	0	1	1
tree swallow	*Tachycineta bicolor*	5	7	3	6	8	13
tufted titmouse	*Baeolophus bicolor*	10	14	17	19	27	33
unidentified empidonax	*Empidonax spp*	1	1	0	0	1	1
unidentified passerine		0	0	1	5	1	5
unidentified sparrow		2	7	0	0	2	7
unidentified wren		1	1	0	0	1	1
veery	*Catharus fuscescens*	1	1	0	0	1	1
vesper sparrow	*Pooecetes gramineus*	0	0	1	1	1	1
warbling vireo	*Vireo gilvus*	2	2	12	14	14	16
white-breasted nuthatch	*Sitta carolinensis*	27	37	6	6	33	43
white-throated sparrow	*Zonotrichia albicollis*	0	0	1	2	1	2
wood thrush	*Hylocichla mustelina*	0	0	3	3	3	3
yellow-rumped warbler	*Setophaga coronata*	7	36	1	1	8	37
yellow-throated vireo	*Vireo flavifrons*	0	0	3	3	3	3
yellow warbler	*Setophaga petechia*	0	0	8	9	8	9
Swifts/Hummingbirds		2	2	3	7	5	9
chimney swift	*Chaetura pelagica*	0	0	3	7	3	7
ruby-throated hummingbird	*Archilochus colubris*	2	2	0	0	2	2
Woodpeckers		83	91	32	34	115	125
downy woodpecker	*Picoides pubescens*	26	28	5	5	31	33
hairy woodpecker	*Picoides villosus*	5	5	1	1	6	6
northern flicker	*Colaptes auratus*	19	23	10	12	29	35
pileated woodpecker	*Dryocopus pileatus*	5	5	3	3	8	8
red-bellied woodpecker	*Melanerpes carolinus*	25	27	12	12	37	39
red-headed woodpecker	*Melanerpes erythrocephalus*	2	2	1	1	3	3
unidentified woodpecker		1	1	0	0	1	1

Appendix A. Bird Species Observed at the Emerson Creek Wind Project during Passerine Migration Surveys during the Fall (September 16 through November 9, 2016 and August 17 through November 2, 2017) and Spring (April 7 through May 30, 2017) seasons.

		Fall		Spring		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Kingfishers		2	3	0	0	2	3
belted kingfisher	*Megaceryle alcyon*	2	3	0	0	2	3
Overall		**619**	**2,417**	**642**	**978**	**1,261**	**3,395**

Appendix B. Bird Species Observed at the Emerson Creek Wind Project during Passerine Migration Surveys during the 2010 – 2011 and 2012 Surveys

Appendix B1. Bird Species Observed at the Emerson Creek Wind Project during Passerine Migration Surveys during the 2010 and 2011 surveys.

		Fall		Spring		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Waterbirds		**1**	**2**	**4**	**4**	**5**	**6**
great blue heron	*Ardea herodias*	1	2	3	3	4	5
great egret	*Ardea alba*	0	0	1	1	1	1
Waterfowl		**4**	**28**	**7**	**12**	**11**	**40**
Canada goose	*Branta canadensis*	3	25	3	3	6	28
unknown duck		1	3	0	0	1	3
wood duck	*Aix sponsa*	0	0	4	9	4	9
Shorebirds		3	6	6	10	9	16
killdeer	*Charadrius vociferus*	3	6	6	10	9	16
Rails/Coots		**1**	**1**	**0**	**0**	**1**	**1**
American Coot	*Fulica americana*	1	1	0	0	1	1
Diurnal Raptors		**8**	**8**	**4**	**4**	**12**	**12**
American kestrel	*Falco sparverius*	2	2	1	1	3	3
red-tailed hawk	*Buteo jamaicensis*	5	5	3	3	8	8
sharp-shinned hawk	*Accipiter striatus*	1	1			1	1
Vultures		**5**	**5**	**7**	**15**	**12**	**20**
turkey vulture	*Cathartes aura*	5	5	7	15	12	20
Upland Game Birds		**2**	**2**	**0**	**0**	**2**	**2**
ring-necked pheasant	*Phasianus colchicus*	1	1	0	0	1	1
wild turkey	*Meleagris gallopavo*	1	1	0	0	1	1
Doves/Pigeons		**15**	**27**	**11**	**13**	**31**	**53**
mourning dove	*Zenaida macroura*	15	27	11	13	26	40
rock pigeon	*Columba livia*	5	13	0	0	5	13
Large Corvids		**18**	**31**	**25**	**34**	**43**	**65**
American crow	*Corvus brachyrhynchos*	18	31	25	34	43	65
Passerines		**575**	**15,83**	**505**	**706**	**1,080**	**2,289**
American goldfinch	*Spinus tristis*	54	157	21	39	75	196
American redstart	*Setophaga ruticilla*	4	7	4	5	8	12
American robin	*Turdus migratorius*	62	295	57	74	119	369
American tree sparrow	*Spizella arborea*	4	13			4	13
Baltimore oriole	*Icterus galbula*	4	5	12	15	16	20
Barn swallow	*Hirundo rustica*	6	10	4	6	10	16
black and white warbler	*Mniotilta varia*	1	2	2	4	3	6
black-capped chickadee	*Poecile atricapillus*	19	44	8	10	27	54
blue-gray gnatcatcher	*Polioptila caerulea*	0	0	4	5	4	5
brown-headed cowbird	*Molothrus ater*	0	0	17	37	17	37
blue-headed vireo	*Vireo solitarius*	0	0	1	1	1	1
bluejay	*Cyanocitta cristata*	43	93	27	37	70	130
blackpoll warbler	*Setophaga striata*	1	1	0	0	1	1
brown creeper	*Certhia americana*	3	4	0	0	3	4
brown thrasher	*Toxostoma rufum*	0	0	1	1	1	1
black-throated blue warbler	*Setophaga caerulescens*	1	1	0	0	1	1
black-throated green warbler	*Setophaga virens*	2	2	0	0	2	2
blue-winged warbler	*Vermivora cyanoptera*	0	0	1	1	1	1
Carolina chickadee	*Poecile carolinensis*	4	10	0	0	4	10
Carolina wren	*Thryothorus ludovicianus*	1	1	4	5	5	6
Cassin's sparrow	*Peucaea cassinii*	0	0	1	3	1	3
Canada warbler	*Cardellina canadensis*	1	1	0	0	1	1
cedar waxwing	*Bombycilla cedrorum*	8	39	0	0	8	39

Appendix B1. Bird Species Observed at the Emerson Creek Wind Project during Passerine Migration Surveys during the 2010 and 2011 surveys.

		Fall		Spring		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
chipping sparrow	*Spizella passerina*	2	3	10	12	12	15
cape may warbler	*Setophaga tigrina*	1	1	0	0	1	1
common grackle	*Quiscalus quiscula*	2	8	15	31	17	39
common yellowthroat	*Geothlypis trichas*	2	2	4	7	6	9
chestnut-sided warbler	*Setophaga pensylvanica*	2	2	0	0	2	2
dark-eyed junco	*Junco hyemalis*	8	58	1	1	9	59
eastern bluebird	*Sialia sialis*	6	10	0	0	6	10
eastern kingbird	*Tyrannus tyrannus*	2	2	1	1	3	3
eastern meadowlark	*Sturnella magna*	0	0	2	2	2	2
eastern phoebe	*Sayornis phoebe*	12	12	21	29	33	41
eastern towhee	*Pipilo erythrophthalmus*	0	0	3	3	3	3
eastern wood pewee	*Contopus virens*	25	29	7	7	32	36
European starling	*Sturnus vulgaris*	18	184	19	48	37	232
field sparrow	*Spizella pusilla*	15	27	14	14	29	41
fox sparrow	*Passerella iliaca*	0	0	1	1	1	1
great-crested flycatcher	*Myiarchus crinitus*	1	1	1	1	2	2
golden-crown kinglet	*Regulus satrapa*	4	4	1	5	5	9
gray catbird	*Dumetella carolinensis*	19	25	17	18	36	43
hermit thrush	*Catharus guttatus*	1	5	2	2	3	7
house finch	*Haemorhous mexicanus*	3	7	3	3	6	10
horned lark	*Eremophila alpestris*	6	20	2	3	8	23
house sparrow	*Passer domesticus*	4	14	0	0	4	14
house wren	*Troglodytes aedon*	7	7	13	13	20	20
indigo bunting	*Passerina cyanea*	12	17	8	9	20	26
Kentucky warbler	*Geothlypis formosa*	0	0	1	1	1	1
least flycatcher	*Empidonax minimus*	1	1	0	0	1	1
Lincoln's sparrow	*Melospiza lincolnii*	2	4	0	0	2	4
magnolia warbler	*Setophaga magnolia*	5	8	1	1	6	9
Nashville warbler	*Leiothlypis ruficapilla*	3	3	0	0	3	3
northern cardinal	*Cardinalis cardinalis*	26	34	27	31	53	65
northern rough-winged swallow	*Stelgidopteryx serripennis*	1	1	2	3	3	4
orchard oriole	*Icterus spurius*	0	0	2	3	2	3
palm warbler	*Setophaga palmarum*	0	0	1	1	1	1
pine warbler	*Setophaga pinus*	5	8	1	1	6	9
prairie warbler	*Setophaga discolor*	0	0	2	2	2	2
purple martin	*Progne subis*	1	1	1	1	2	2
rose-breasted grosbeak	*Pheucticus ludovicianus*	7	8	4	4	11	12
red-breasted nuthatch	*Sitta canadensis*	1	1	0	0	1	1
ruby-crowned kinglet	*Regulus calendula*	1	1	2	2	3	3
red-eyed vireo	*Vireo olivaceus*	4	6	1	1	5	7
red-winged blackbird	*Agelaius phoeniceus*	4	7	61	103	65	110
savannah sparrow	*Passerculus sandwichensis*	3	3	2	2	5	5
scarlet tanager	*Piranga olivacea*	2	3	0	0	2	3
song sparrow	*Melospiza melodia*	28	38	28	28	56	66
Swainson's thrush	*Catharus ustulatus*	2	5	0	0	2	5
Tennessee warbler	*Leiothlypis peregrina*	1	1	1	1	2	2
tree swallow	*Tachycineta bicolor*	6	13	3	5	9	18
tufted titmouse	*Baeolophus bicolor*	17	34	6	7	23	41
unknown blackbird		5	109	0	0	5	109

Appendix B1. Bird Species Observed at the Emerson Creek Wind Project during Passerine Migration Surveys during the 2010 and 2011 surveys.

		Fall		Spring		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
unknown passerine		2	3	7	8	9	11
unknown sparrow		6	19	2	2	8	21
unknown thrush		2	2	0	0	2	2
unknown warbler		3	6	0	0	3	6
vesper sparrow	*Pooecetes gramineus*	2	5	1	1	3	6
warbling vireo	*Vireo gilvus*	4	4	2	2	6	6
white-breasted nuthatch	*Sitta carolinensis*	44	63	12	16	56	79
white-crowned sparrow	*Zonotrichia leucophrys*	2	18	6	6	8	24
white-eyed vireo	*Vireo griseus*	0	0	1	1	1	1
willow flycatcher	*Empidonax traillii*	1	1	0	0	1	1
Wilson's warbler	*Cardellina pusilla*	2	3	0	0	2	3
wood thrush	*Hylocichla mustelina*	0	0	9	9	9	9
white-throated sparrow	*Zonotrichia albicollis*	4	8	0	0	4	8
yellow-rumped warbler	*Setophaga coronata*	8	39	5	5	13	44
yellow-throated vireo	*Vireo flavifrons*	0	0	1	1	1	1
yellow warbler	*Setophaga petechia*	0	0	4	5	4	5
Swifts/Hummingbirds		**2**	**2**	**0**	**0**	**2**	**2**
chimney swift	*Chaetura pelagica*	2	2	0	0	2	2
Woodpeckers		**91**	**109**	**47**	**57**	**138**	**166**
downy woodpecker	*Picoides pubescens*	21	28	8	11	29	39
hairy woodpecker	*Leuconotopicus villosus*	22	23	6	8	28	31
northern flicker	*Colaptes auratus*	19	22	17	19	36	41
red-bellied woodpecker	*Melanerpes carolinus*	20	26	6	8	26	34
red-headed woodpecker	*Melanerpes erythrocephalus*	2	3	1	1	3	4
unknown woodpecker		6	6	6	7	12	13
yellow-bellied sapsucker	*Sphyrapicus varius*	1	1	3	3	4	4
Overall		**732**	**1819**	**617**	**856**	**1,349**	**2,675**

Appendix B2. Bird Species Observed at the Emerson Creek Wind Project during Passerine Migration Surveys during the 2012 surveys.

		Fall		Spring		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Waterbirds		**2**	**2**	**0**	**0**	**2**	**2**
great blue heron	*Ardea herodias*	2	2	0	0	2	2
Waterfowl		**0**	**0**	**1**	**1**	**1**	**1**
Canada goose	*Branta canadensis*	0	0	1	1	1	1
Diurnal Raptors		**1**	**1**	**0**	**0**	**1**	**1**
American kestrel	*Falco sparverius*	1	1	0	0	1	1
Vultures		**1**	**1**	**5**	**16**	**6**	**17**
turkey vulture	*Cathartes aura*	1	1	5	16	6	17
Upland Game Birds		**0**	**0**	**1**	**1**	**1**	**1**
wild turkey	*Meleagris gallopavo*	0	0	1	1	1	1
Doves/Pigeons		**2**	**3**	**0**	**0**	**2**	**3**
mourning dove	*Zenaida macroura*	2	3	0	0	2	3
Large Corvids		**9**	**18**	**8**	**13**	**17**	**31**
American crow	*Corvus brachyrhynchos*	9	18	8	13	17	31
Passerines		**250**	**569**	**344**	**373**	**594**	**942**
American goldfinch	*Spinus tristis*	20	36	19	29	39	65
American redstart	*Setophaga ruticilla*	1	1	2	2	3	3
American robin	*Turdus migratorius*	30	56	18	20	48	76
American tree sparrow	*Spizella arborea*	1	1	0	0	1	1
Baltimore oriole	*Icterus galbula*	3	3	9	9	12	12
Barn swallow	*Hirundo rustica*	1	1	0	0	1	1
black and white warbler	*Mniotilta varia*	0	0	2	2	2	2
bay-breasted warbler	*Setophaga castanea*	0	0	1	1	1	1
black-capped chickadee	*Poecile atricapillus*	9	13	14	14	23	27
blue-gray gnatcatcher	*Polioptila caerulea*	0	0	10	10	10	10
brown-headed cowbird	*Molothrus ater*	0	0	16	24	16	24
bluejay	*Cyanocitta cristata*	34	35	12	16	46	51
blackpoll warbler	*Setophaga striata*	0	0	1	1	1	1
black-throated green warbler	*Setophaga virens*	0	0	1	1	1	1
blue-winged warbler	*Vermivora cyanoptera*	0	0	1	1	1	1
Carolina wren	*Thryothorus ludovicianus*	9	9	1	1	10	10
cedar waxwing	*Bombycilla cedrorum*	3	4	1	1	4	5
chipping sparrow	*Spizella passerina*	1	1	3	3	4	4
common grackle	*Quiscalus quiscula*	0	0	1	1	1	1
common yellowthroat	*Geothlypis trichas*	1	1	16	16	17	17
chestnut-sided warbler	*Setophaga pensylvanica*	0	0	1	1	1	1
dark-eyed junco	*Junco hyemalis*	2	8	0	0	2	8
eastern bluebird	*Sialia sialis*	6	23	1	1	7	24
eastern kingbird	*Tyrannus tyrannus*	2	2	1	1	3	3
eastern meadowlark	*Sturnella magna*	5	5	2	2	7	7
eastern phoebe	*Sayornis phoebe*	0	0	5	5	5	5
eastern towhee	*Pipilo erythrophthalmus*	0	0	2	2	2	2
eastern wood pewee	*Contopus virens*	12	12	4	4	16	16
European starling	*Sturnus vulgaris*	2	13	0	0	2	13
field sparrow	*Spizella pusilla*	1	1	12	12	13	13
great-crested flycatcher	*Myiarchus crinitus*	1	1	1	1	2	2
golden-crown kinglet	*Regulus satrapa*	6	35	0	0	6	35
gray catbird	*Dumetella carolinensis*	3	3	9	9	12	12
horned lark	*Eremophila alpestris*	2	4	0	0	2	4

Appendix B2. Bird Species Observed at the Emerson Creek Wind Project during Passerine Migration Surveys during the 2012 surveys.

		Fall		Spring		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
house wren	*Troglodytes aedon*	0	0	7	7	7	7
indigo bunting	*Passerina cyanea*	3	3	12	12	15	15
magnolia warbler	*Setophaga magnolia*	0	0	1	1	1	1
Nashville warbler	*Leiothlypis ruficapilla*	0	0	1	1	1	1
northern cardinal	*Cardinalis cardinalis*	6	6	15	16	21	22
northern mockingbird	*Mimus polyglottos*	0	0	2	2	2	2
northern parula	*Setophaga americana*	0	0	4	4	4	4
rose-breasted grosbeak	*Pheucticus ludovicianus*	0	0	1	1	1	1
ruby-crowned kinglet	*Regulus calendula*	0	0	1	1	1	1
red-eyed vireo	*Vireo olivaceus*	2	2	4	4	6	6
red-winged blackbird	*Agelaius phoeniceus*	13	189	29	30	42	219
savannah sparrow	*Passerculus sandwichensis*	3	3	1	1	4	4
scarlet tanager	*Piranga olivacea*	2	2	9	9	11	11
song sparrow	*Melospiza melodia*	15	15	26	26	41	41
Swainson's thrush	*Catharus ustulatus*	0	0	1	1	1	1
Tennessee warbler	*Leiothlypis peregrina*	1	1	0	0	1	1
tree swallow	*Tachycineta bicolor*	1	3	0	0	1	3
tufted titmouse	*Baeolophus bicolor*	4	4	12	12	16	16
unknown passerine		2	8	0	0	2	8
unknown sparrow		3	5	0	0	3	5
vesper sparrow	*Pooecetes gramineus*	0	0	1	1	1	1
warbling vireo	*Vireo gilvus*	0	0	3	4	3	4
white-breasted nuthatch	*Sitta carolinensis*	19	25	5	5	24	30
white-crowned sparrow	*Zonotrichia leucophrys*	6	8	0	0	6	8
white-eyed vireo	*Vireo griseus*	0	0	1	1	1	1
willow flycatcher	*Empidonax traillii*	0	0	5	5	5	5
winter wren	*Troglodytes hiemalis*	1	1	0	0	1	1
wood thrush	*Hylocichla mustelina*	0	0	8	8	8	8
white-throated sparrow	*Zonotrichia albicollis*	5	10	0	0	5	10
yellow-rumped warbler	*Setophaga coronata*	8	15	2	4	10	19
yellow-throated vireo	*Vireo flavifrons*	1	1	4	4	5	5
yellow warbler	*Setophaga petechia*	0	0	23	23	23	23
Swifts/Hummingbirds		**1**	**1**	**0**	**0**	**1**	**1**
ruby-throated hummingbird	*Archilochus colubris*	1	1	0	0	1	1
Woodpeckers		**31**	**32**	**30**	**33**	**61**	**65**
downy woodpecker	*Picoides pubescens*	13	13	12	15	25	28
hairy woodpecker	*Leuconotopicus villosus*	6	6	1	1	7	7
northern flicker	*Colaptes auratus*	4	4	4	4	8	8
pileated woodpecker	*Dryocopus pileatus*	0	0	1	1	1	1
red-bellied woodpecker	*Melanerpes carolinus*	5	6	12	12	17	18
red-headed woodpecker	*Melanerpes erythrocephalus*	3	3	0	0	3	3
Overall		**297**	**627**	**389**	**437**	**686**	**1,064**

Firelands Wind, LLC
Case No. 18-1607-EL-BGN

Exhibit T
Passerine Migration Surveys

3. Summary of results of 2012 passerine migration surveys at the Emerson Creek Wind Resource Area dated January 7, 2013

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TECHNICAL MEMORANDUM

Date: January 7, 2013

To: Apex Wind Energy

From: Michelle L. Ritzert, WEST, Inc.

Subject: Summary of results of 2012 passerine migration surveys at the Emerson Creek Wind Resource Area.

Apex Wind Energy (Apex) is proposing to develop a wind energy facility known as the Emerson Creek Wind Resource Area (ECWRA), in Seneca and Huron Counties, Ohio. Apex contracted Western EcoSystems Technology, Inc. (WEST) to conduct baseline surveys in the ECWRA. Survey design followed methods described in the final draft of wildlife study guidelines from the Ohio Department of Natural Resources (ODNR 2009). This memo includes results from the 2012 passerine migration surveys conducted in the revised ECWRA between April 4 and November 14, 2012. The 2012 passerine migration surveys along with the surveys completed in 2010/2011 are intended to fulfill the ODNR recommendations outlined in the June 19, 2012 letter. Results from the 2010/2011 passerine migration surveys can be found in a separate report (Ritzert et al. 2012).

The objective of the passerine migration survey was to estimate the rate of use of the combined forest, shrub and wooded wetland habitats in the general project area by migrating birds. Passerine migration survey data consisted of counts of birds observed within circular plots around fixed observation points following similar methods as Reynolds et al. (1980). Eleven points were placed on leased lands within forested and shrub habitats in the proposed ECWRA (Figure 1). The radius of the survey plot included areas up to 200 meters (m; 656 feet [ft]), depending on terrain limitations.

All species of birds observed during each 10-minute (min) survey were recorded. Each bird's estimated distance from the observer was recorded to the nearest meter (3.3 ft). Any bird flying over the plot that did not originate from or land within 200 m (656 ft) of the center of the plot was recorded as a “fly over”. The flight direction of observed birds was also recorded. Approximate flight height above ground level (AGL) at first observation was also recorded to the nearest meter (3.3 ft) and the approximate lowest and highest flight heights observed was also recorded.

The behavior of each bird observed during the surveys was recorded. Behavior categories recognized include perched, soaring, flapping, flushed, circle soaring, hunting, gliding, and other (noted in comments). Any comments or unusual observations were noted in the comments section. Weather information, including temperature (degrees Fahrenheit [°F]), wind speed (miles per hour [mph]), wind direction and cloud cover (percentage [%]), was recorded for each survey point. The date, start, and end time of observation period, plot number, species or best possible identification, number of individuals, sex and age class if possible, distance from plot center when first observed (m), closest distance (m), height (m), and activity were recorded.

Passerine migration surveys were conducted during the spring (April 4 to May 31) and fall (August 14 to November 14) migration periods. Surveys were conducted weekly during daylight hours between 0600 and 1000 hours.

A total of 241 10-min surveys were conducted over 22 visits in the spring and fall and 6,783 individual bird observations within 3,619 separate groups were recorded (Table 1). Cumulatively, four species (3.4% of all species) comprised 39.5% of the individual observations: red-winged blackbird (*Agelaius phoeniceus*; 1,655 observations), American goldfinch (*Carduelis tristis*: 349 observations), American robin (*Turdus migratorius*; 347 observations), and European starling (*Sturnus vulgaris*; 327 observations). All other bird species composed 3.9% or less of the observations individually.

Mean bird use, percent composition, and frequency of occurrence by season were calculated. Overall bird use was higher in the fall (26.94 birds/plot/10-minute survey) than in the spring (22.22; Table 2). Passerines use was also higher in the fall than in the spring (25.16 and 19.9 birds/plot/10-min survey, respectively; Table 2). Passerines were observed during 100% of spring surveys and 97.2% of fall surveys and comprised over 89% of overall bird use during each season (Table 2).

No federally-listed threatened or endangered species were observed during the 2012 passerine migration surveys within the ECWRA. One state-listed endangered species, northern harrier (six observations), was observed during surveys (Table 3). Additionally, one state-listed threatened species (bald eagle [*Haliaeetus leucocephalus*; one observation], four species of special concern (boblink [*Dolichonyx oryzivorus*; 5 observations], cerulean warbler [*Dendroica cerulean*; one observation], Henslow's sparrow [*Ammodramus henslowii*; one observation], and sharp-shinned hawk [*Accipiter striatus*; one observation]), and 12 species of special interest (Blackburnian warbler [*Dendroica fusca*; one observation], brown creeper [*Certhia americana*; 17 observations], black-throated blue warbler [*Dendrocia caerulescens*; three observations], Canada warbler [*Wilsonia canadensis*; two observations], dark-eyed junco [*Junco hyemalis*; 32 observations], golden-crowned kinglet [*Regulus satrapa*; 154 observations], hermit thrush [*Catharus guttatus*; three observations], least flycatcher [*Empidonax minimus*; four observations], magnolia warbler [*Dendrocia magnolia*; four observations], pine siskin [*Carduelis pinus*; one observation], red-breasted nuthatch [*Sitta canadensis*; three observations], and winter wren [*Troglodytes troglodytes*; six observations]) were observed. The bald eagle is also protected under the Bald and Golden Eagle Protection Act (BGEPA 1940; Table 3).

Data collected to date at the ECWRA show that some passerines utilize the proposed wind energy facility as stopover habitat. The lack of post-construction studies of wind energy facilities in Ohio makes it difficult to utilize the data collected at the ECWRA to predict potential impacts to migrating passerines. The proposed facility is located within a landscape largely dominated by tilled agriculture, which is generally recommended by the United States Fish and Wildlife Service (USFWS) as more suitable for wind development versus areas containing native habitats (USFWS 2012). The efficacy of passerine migration and breeding bird counts as predictors of potential bird fatality rates will be better understood after more research is conducted at wind energy facilities in Ohio.

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Table 1. Summary of individuals (obs) and groups (grps) by bird type and species for passerine migration surveys at the Emerson Creek Wind Resource Area from April 4, to November 14, 2012.

		Fall		Spring		Overall	
Bird Type / Species	**Scientific Name**	**# of Grps.**	**# of Obs.**	**# of Grps.**	**# of Obs.**	**# of Grps.**	**# of Obs.**
Loons/Grebes		**0**	**0**	**2**	**2**	**2**	**2**
pied-billed grebe	*Podilymbus podiceps*	0	0	2	2	2	2
Waterbirds		**8**	**8**	**2**	**2**	**10**	**10**
great blue heron	*Ardea herodias*	8	8	1	1	9	9
little blue heron	*Egretta caerulea*	0	0	1	1	1	1
Waterfowl		**9**	**36**	**16**	**38**	**25**	**74**
Canada goose	*Branta canadensis*	2	23	12	30	14	53
canvasback	*Aythya valisineria*	3	6	0	0	3	6
lesser scaup	*Aythya affinis*	3	4	0	0	3	4
mallard	*Anas platyrhynchos*	0	0	3	5	3	5
wood duck	*Aix sponsa*	1	3	1	3	2	6
Shorebirds		**26**	**61**	**14**	**18**	**40**	**79**
dunlin	*Calidris alpina*	1	1	0	0	1	1
killdeer	*Charadrius vociferus*	23	58	14	18	37	76
unidentified shorebird		2	2	0	0	2	2
Gulls/Terns		**0**	**0**	**1**	**30**	**1**	**30**
unidentified tern		0	0	1	30	1	30
Diurnal Raptors		**17**	**17**	**16**	**16**	**33**	**33**
American kestrel	*Falco sparverius*	8	8	1	1	9	9
bald eagle	*Haliaeetus leucocephalus*	0	0	1	1	1	1
broad-winged hawk	*Buteo platypterus*	0	0	1	1	1	1
Cooper's hawk	*Accipiter cooperii*	1	1	1	1	2	2
northern harrier	*Circus cyaneus*	3	3	3	3	6	6
red-tailed hawk	*Buteo jamaicensis*	5	5	8	8	13	13
sharp-shinned hawk	*Accipiter striatus*	0	0	1	1	1	1
Vultures		**3**	**4**	**12**	**48**	**15**	**52**
turkey vulture	*Cathartes aura*	3	4	12	48	15	52
Upland Game Birds		**0**	**0**	**5**	**5**	**5**	**5**
wild turkey	*Meleagris gallopavo*	0	0	5	5	5	5
Doves/Pigeons		**25**	**33**	**3**	**5**	**28**	**38**
mourning dove	*Zenaida macroura*	23	26	1	1	24	27
rock pigeon	*Columba livia*	2	7	2	4	4	11
Passerines		**1,324**	**3,956**	**1,831**	**2,185**	**3,155**	**6,141**
Corvids		*227*	*388*	*102*	*129*	*329*	*517*
American crow	*Corvus brachyrhynchos*	68	203	43	63	111	266

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Table 1. Summary of individuals (obs) and groups (grps) by bird type and species for passerine migration surveys at the Emerson Creek Wind Resource Area from April 4, to November 14, 2012.

Bird Type / Species	Scientific Name	Fall		Spring		Overall	
		# of Grps.	# of Obs.	# of Grps.	# of Obs.	# of Grps.	# of Obs.
blue jay	*Cyanocitta cristata*	159	185	59	66	218	251
unidentified passerine		10	36	11	20	21	56
Blackbirds/Orioles		*94*	*1,681*	*355*	*532*	*449*	*2,213*
Baltimore oriole	*Icterus galbula*	6	6	27	27	33	33
bobolink	*Dolichonyx oryzivorus*	1	2	1	3	2	5
brown-headed cowbird	*Molothrus ater*	3	6	75	103	78	109
common grackle	*Quiscalus quiscula*	1	1	31	49	32	50
eastern meadowlark	*Sturnella magna*	8	8	25	25	33	33
European starling	*Sturnus vulgaris*	12	236	16	91	28	327
orchard oriole	*Icterus spurius*	1	1	0	0	1	1
red-winged blackbird	*Agelaius phoeniceus*	62	1,421	180	234	242	1,655
Creepers/Nuthatches		*135*	*233*	*29*	*30*	*164*	*263*
brown creeper	*Certhia americana*	17	17	0	0	17	17
red-breasted nuthatch	*Sitta canadensis*	2	2	1	1	3	3
white-breasted nuthatch	*Sitta carolinensis*	116	214	28	29	144	243
Finches/Crossbills		*114*	*212*	*101*	*138*	*215*	*350*
American goldfinch	*Carduelis tristis*	114	212	100	137	214	349
pine siskin	*Carduelis pinus*	0	0	1	1	1	1
Flycatchers		*89*	*92*	*75*	*75*	*164*	*167*
Acadian flycatcher	*Empidonax virescens*	1	1	3	3	4	4
eastern kingbird	*Tyrannus tyrannus*	4	4	9	9	13	13
eastern phoebe	*Sayornis phoebe*	0	0	9	9	9	9
eastern wood-pewee	*Contopus virens*	76	79	38	38	114	117
great crested flycatcher	*Myiarchus crinitus*	2	2	9	9	11	11
least flycatcher	*Empidonax minimus*	4	4	0	0	4	4
unidentified flycatcher	*N/A*	0	0	1	1	1	1
willow flycatcher	*Empidonax traillii*	0	0	6	6	6	6
yellow-bellied flycatcher	*Empidonax flaviventris*	2	2	0	0	2	2
Gnatcatchers/Kinglet		*45*	*152*	*57*	*63*	*102*	*215*
blue-gray gnatcatcher	*Polioptila caerulea*	2	2	46	51	48	53
golden-crowned kinglet	*Regulus satrapa*	40	147	6	7	46	154
ruby-crowned kinglet	*Regulus calendula*	3	3	5	5	8	8
Grassland/Sparrows		*155*	*316*	*306*	*323*	*461*	*639*
American pipit	*Anthus rubescens*	3	28	0	0	3	28
American tree sparrow	*Spizella arborea*	6	6	1	1	7	7

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Table 1. Summary of individuals (obs) and groups (grps) by bird type and species for passerine migration surveys at the Emerson Creek Wind Resource Area from April 4, to November 14, 2012.

		Fall		Spring		Overall	
Bird Type / Species	**Scientific Name**	**# of Grps.**	**# of Obs.**	**# of Grps.**	**# of Obs.**	**# of Grps.**	**# of Obs.**
chipping sparrow	*Spizella passerina*	6	8	34	34	40	42
dark-eyed junco	*Junco hyemalis*	8	27	3	5	11	32
eastern towhee	*Pipilo erythrophthalmus*	0	0	6	6	6	6
field sparrow	*Spizella pusilla*	4	4	61	61	65	65
grasshopper sparrow	*Ammodramus savannarum*	0	0	1	1	1	1
Henslow's sparrow	*Ammodramus henslowii*	0	0	1	1	1	1
horned lark	*Eremophila alpestris*	34	130	35	35	69	165
house sparrow	*Passer domesticus*	2	2	8	20	10	22
savannah sparrow	*Passerculus sandwichensis*	13	13	18	18	31	31
song sparrow	*Melospiza melodia*	36	36	113	114	149	150
unidentified sparrow		11	14	5	6	16	20
vesper sparrow	*Pooecetes gramineus*	8	9	16	16	24	25
white-crowned sparrow	*Zonotrichia leucophrys*	12	16	0	0	12	16
white-throated sparrow	*Zonotrichia albicollis*	12	23	4	5	16	28
Mimids		*12*	*12*	*38*	*40*	*50*	*52*
brown thrasher	*Toxostoma rufum*	0	0	1	1	1	1
gray catbird	*Dumetella carolinensis*	12	12	29	31	41	43
northern mockingbird	*Mimus polyglottos*	0	0	8	8	8	8
Swallows		*17*	*159*	*12*	*64*	*29*	*223*
barn swallow	*Hirundo rustica*	14	143	9	58	23	201
tree swallow	*Tachycineta bicolor*	3	16	3	6	6	22
Tanagers/Grosbeaks/Cardinals		*84*	*87*	*158*	*159*	*242*	*246*
indigo bunting	*Passerina cyanea*	13	13	53	53	66	66
northern cardinal	*Cardinalis cardinalis*	65	68	79	80	144	148
rose-breasted grosbeak	*Pheucticus ludovicianus*	3	3	2	2	5	5
scarlet tanager	*Piranga olivacea*	3	3	24	24	27	27
Thrushes		*125*	*256*	*210*	*226*	*335*	*482*
American robin	*Turdus migratorius*	94	177	155	170	249	347
eastern bluebird	*Sialia sialis*	22	70	10	11	32	81
gray-cheeked thrush	*Catharus minimus*	2	2	0	0	2	2
hermit thrush	*Catharus guttatus*	3	3	0	0	3	3
Swainson's thrush	*Catharus ustulatus*	2	2	5	5	7	7
unidentified thrush		*1*	*1*	*0*	*0*	*1*	*1*
wood thrush	*Hylocichla mustelina*	1	1	40	40	41	41
Titmice/Chickadees		*88*	*133*	*111*	*113*	*199*	*246*

Table 1. Summary of individuals (obs) and groups (grps) by bird type and species for passerine migration surveys at the Emerson Creek Wind Resource Area from April 4, to November 14, 2012.

Bird Type / Species	Scientific Name	Fall # of Grps.	Fall # of Obs.	Spring # of Grps.	Spring # of Obs.	Overall # of Grps.	Overall # of Obs.
black-capped chickadee	*Poecile atricapilla*	60	104	37	39	97	143
tufted titmouse	*Baeolophus bicolor*	28	29	74	74	102	103
Vireos		*29*	*29*	*78*	*81*	*107*	*110*
blue-headed vireo	*Vireo solitarius*	0	0	2	2	2	2
red-eyed vireo	*Vireo olivaceus*	27	27	47	49	74	76
warbling vireo	*Vireo gilvus*	0	0	4	5	4	5
white-eyed vireo	*Vireo griseus*	0	0	2	2	2	2
yellow-throated vireo	*Vireo flavifrons*	2	2	23	23	25	25
Warblers		*76*	*140*	*143*	*147*	*219*	*287*
American redstart	*Setophaga ruticilla*	5	5	14	14	19	19
bay-breasted warbler	*Dendroica castanea*	0	0	2	2	2	2
black-and-white warbler	*Mniotilta varia*	11	11	9	10	20	21
black-throated blue warbler	*Dendroica caerulescens*	2	2	1	1	3	3
black-throated green warbler	*Dendroica virens*	2	2	11	11	13	13
Blackburnian warbler	*Dendroica fusca*	0	0	1	1	1	1
blackpoll warbler	*Dendroica striata*	0	0	10	10	10	10
blue-winged warbler	*Vermivora pinus*	0	0	2	2	2	2
Canada warbler	*Wilsonia canadensis*	0	0	2	2	2	2
cerulean warbler	*Dendroica cerulea*	0	0	1	1	1	1
chestnut-sided warbler	*Dendroica pensylvanica*	0	0	1	1	1	1
common yellowthroat	*Geothlypis trichas*	1	1	20	20	21	21
hooded warbler	*Wilsonia citrina*	0	0	2	2	2	2
magnolia warbler	*Dendroica magnolia*	3	3	1	1	4	4
Nashville warbler	*Vermivora ruficapilla*	3	5	1	1	4	6
northern parula	*Parula americana*	0	0	5	5	5	5
ovenbird	*Seiurus aurocapillus*	5	6	14	14	19	20
pine warbler	*Dendroica pinus*	0	0	3	3	3	3
Tennessee warbler	*Vermivora peregrina*	2	2	0	0	2	2
unidentified warbler		5	5	2	2	7	7
yellow-rumped warbler	*Dendroica coronata*	37	98	10	13	47	111
yellow warbler	*Dendroica petechia*	0	0	31	31	31	31
Waxwings		*10*	*16*	*7*	*7*	*17*	*23*
cedar waxwing	*Bombycilla cedrorum*	10	16	7	7	17	23
Wrens		*14*	*14*	*38*	*38*	*52*	*52*
Carolina wren	*Thryothorus ludovicianus*	12	12	1	1	13	13

Table 1. Summary of individuals (obs) and groups (grps) by bird type and species for passerine migration surveys at the Emerson Creek Wind Resource Area from April 4, to November 14, 2012.

		Fall		Spring		Overall	
Bird Type / Species	**Scientific Name**	**# of Grps.**	**# of Obs.**	**# of Grps.**	**# of Obs.**	**# of Grps.**	**# of Obs.**
house wren	*Troglodytes aedon*	1	1	32	32	33	33
winter wren	*Troglodytes troglodytes*	1	1	5	5	6	6
Cuckoos		**0**	**0**	**1**	**1**	**1**	**1**
black-billed cuckoo	*Coccyzus erythropthalmus*	0	0	1	1	1	1
Goatsuckers		**0**	**0**	**2**	**2**	**2**	**2**
common nighthawk	*Chordeiles minor*	0	0	2	2	2	2
Swifts/Hummingbirds		**2**	**6**	**4**	**8**	**6**	**14**
chimney swift	*Chaetura pelagica*	1	5	4	8	5	13
ruby-throated hummingbird	*Archilochus colubris*	1	1	0	0	1	1
Woodpeckers		**152**	**153**	**143**	**148**	**295**	**301**
downy woodpecker	*Picoides pubescens*	60	60	40	44	100	104
hairy woodpecker	*Picoides villosus*	24	24	10	10	34	34
northern flicker	*Colaptes auratus*	23	23	23	23	46	46
pileated woodpecker	*Dryocopus pileatus*	0	0	4	5	4	5
red-bellied woodpecker	*Melanerpes carolinus*	25	26	58	58	83	84
red-headed woodpecker	*Melanerpes erythrocephalus*	19	19	4	4	23	23
unidentified woodpecker		1	1	4	4	5	5
Unidentified Birds		1	1	0	0	1	1
unidentified bird (small)		1	1	0	0	1	1
Overall		**1,567**	**4,275**	**2,052**	**2,508**	**3,619**	**6,783**

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Table 2. Mean bird use (number of birds/plot[a]/10-minute survey), percent of total composition (%), and frequency of occurrence (%) for each major bird type and passerine subtypes by season during passerine migration surveys at the Emerson Creek Wind Resource Area from April 4, to November 14, 2012.

	Mean Use		% Composition		% Frequency	
Bird Type / Subtype	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**
Loons/Grebes	0	0.02	0	<0.1	0	2
Waterbirds	0.06	0	0.2	0	5.6	0
Waterfowl	0.15	0.28	0.5	1.2	3.5	7.3
Shorebirds	0.32	0.12	1.2	0.5	11.2	8.3
Gulls/Terns	0	0.3	0	1.4	0	1
Diurnal Raptors	0.04	0.1	0.2	0.5	4.2	10.2
Vultures	0.03	0.19	0.1	0.9	2.1	5.2
Upland Game Birds	0	0.03	0	0.1	0	3.1
Doves/Pigeons	0.13	0.04	0.5	0.2	9.1	2
Passerines	25.16	19.9	93.4	89.6	97.2	100
Blackbirds/Orioles	*10.46*	*4.49*	*38.8*	*20.2*	*37.1*	*90.9*
Creepers/Nuthatches	*1.63*	*0.3*	*6*	*1.3*	*60.8*	*23.6*
Finches/Crossbills	*1.46*	*1.4*	*5.4*	*6.3*	*46.2*	*65.1*
Flycatchers	*0.62*	*0.72*	*2.3*	*3.2*	*32.9*	*44.5*
Gnatcatchers/Kinglet	*1.06*	*0.64*	*3.9*	*2.9*	*25.9*	*44.5*
Grassland/Sparrows	*2.02*	*2.93*	*7.5*	*13.2*	*62.9*	*96*
Mimids	*0.08*	*0.39*	*0.3*	*1.7*	*7.7*	*28.5*
Swallows	*1.08*	*0.65*	*4*	*2.9*	*9.8*	*9.2*
Tanagers/Grosbeaks/Cardinals	*0.61*	*1.57*	*2.3*	*7.1*	*42.7*	*80.4*
Thrushes	*1.74*	*2.18*	*6.5*	*9.8*	*53.1*	*86.8*
Titmice/Chickadees	*0.93*	*1.13*	*3.5*	*5.1*	*40.6*	*62.3*
Vireos	*0.2*	*0.82*	*0.8*	*3.7*	*15.4*	*41.4*
Warblers	*0.98*	*1.46*	*3.6*	*6.6*	*37.1*	*43.4*
Waxwings	*0.11*	*0.07*	*0.4*	*0.3*	*7*	*7.1*
Wrens	*0.1*	*0.39*	*0.4*	*1.7*	*9.8*	*29.5*
Corvids	1.83	0.56	6.8	2.5	69.9	37.7
Cuckoos	0	0.01	0	<0.1	0	1
Goatsuckers	0	0.02	0	<0.1	0	2
Swifts/Hummingbirds	0.04	0.08	0.2	0.4	1.4	4
Woodpeckers	1.01	1.13	3.8	5.1	67.8	70.6
Unidentified Birds	<0.01	0	<0.1	0	0.7	0
Overall	**26.94**	**22.22**	**100**	**100**		

[a] 200-meter plot regardless of bird size.

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Table 3. Summary of sensitive species observed at the Emerson Creek Wind Resource Area during passerine migration surveys from April 4, to November 14, 2012.

Species	Scientific Name	Status*	# Groups	# Observations
golden-crowned kinglet	*Regulus satrapa*	SSI	46	154
brown creeper	*Certhia americana*	SSI	17	17
dark-eyed junco	*Junco hyemalis*	SSI	11	32
northern harrier	*Circus cyaneus*	E	6	6
winter wren	*Troglodytes troglodytes*	SSI	6	6
least flycatcher	*Empidonax minimus*	SSI	4	4
magnolia warbler	*Dendroica magnolia*	SSI	4	4
black-throated blue warbler	*Dendroica caerulescens*	SSI	3	3
hermit thrush	*Catharus guttatus*	SSI	3	3
red-breasted nuthatch	*Sitta canadensis*	SSI	3	3
bobolink	*Dolichonyx oryzivorus*	SSC	2	5
Canada warbler	*Wilsonia canadensis*	SSI	2	2
bald eagle	*Haliaeetus leucocephalus*	EA	1	1
Blackburnian warbler	*Dendroica fusca*	SSI	1	1
cerulean warbler	*Dendroica cerulea*	SSC	1	1
Henslow's sparrow	*Ammodramus henslowii*	SSC	1	1
pine siskin	*Carduelis pinus*	SSI	1	1
sharp-shinned hawk	*Accipiter striatus*	SSC	1	1
Overall	**18 species**		**113**	**245**

EA=protected under the federal Bald and Golden Eagle Protection Act; SE=state endangered; ST=state threatened; SSC=state species of concern; SSI=state species of special interest

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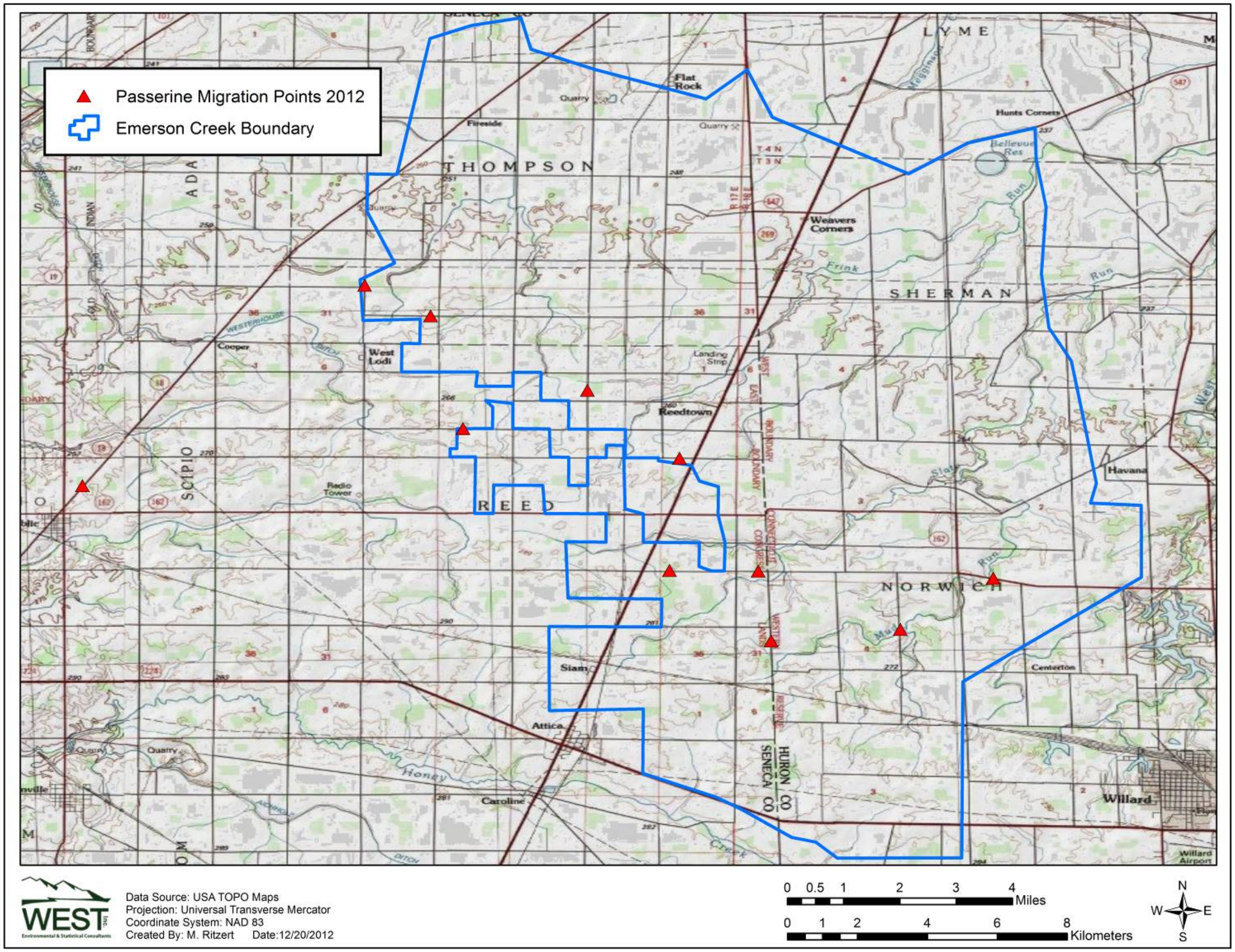

Figure 1. Overview of the passerine migration survey points at the Emerson Creek Wind Resource Area.

Firelands Wind, LLC
Case No. 18-1607-EL-BGN

Exhibit U
Eagle Use Surveys

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STAGE 2-SITE SPECIFIC BALD EAGLE SURVEY REPORT

FIRELANDS/LYME WIND FARM

SENECA, HURON AND ERIE COUNTIES, OHIO

Prepared for:

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Submitted by:

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Tetra Tech Project #: 103P178401

July 2012

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1.0 INTRODUCTION

Firelands Wind Farm, LLC and Lyme Wind Farm LLC (Firelands/Lyme) are proposing to construct a wind energy facility in Erie, Huron and Seneca Counties, Ohio (see Figure 1 – Site Location Map). Firelands/Lyme contracted Tetra Tech EM, Inc. (Tetra Tech) to conduct various surveys and studies required for successful permitting and development of the proposed project. Tetra Tech prepared this report to document the site specific Bald Eagle (*Haliaeetus leucocephalus*) surveys conducted and includes a description of the proposed project, background information, a description of the existing site conditions, survey methodology, results, and discussion.

1.1 Project Description & Background

Firelands/Lyme is proposing to construct a wind energy facility across approximately 43,000 acres (Project Area) of primarily agricultural lands in Erie, Huron and Seneca Counties, Ohio (see Figure 1). The proposed facility will include the construction of approximately 62 turbines, or approximately 99 megawatts (MW) of installed wind capacity. For the purposes of these Bald Eagle surveys, the Firelands Project Area and the Lyme Project Area were evaluated together and hereafter are referred to as the "Project Area". The completed wind energy facility will also include development of infrastructure (transmission lines, substation facilities, access roads, etc.).

The majority (over 98%) of the Project Area has been converted to cropland or other high intensity development. Forest stands and other natural habitats are generally small, scattered and highly fragmented (see Figure 2).

Tetra Tech biologists observed that most of the stream channels occurring within the Project Area have been extensively modified for agricultural practices. Six medium-sized creeks (Megginson Creek, Seymour Creek, Snyder's Ditch, Mills Creek, Pipe Creek, and Zorn Beutal Ditch) are found throughout the Project Area and typically drain to the northeast and east. No large rivers or water bodies occur within the Project Area. Scattered and fragmented forested, emergent, and scrub-shrub wetlands occur in the Project Area; however, most of these have been significantly disturbed by farming and draining activities.

Firelands/Lyme is proposing to utilize turbines that are 100 meters (m) above the ground surface at the hub height with blades 50 m in length. Therefore, for the purposes of this report, Tetra Tech utilized a rotor swept zone (RSZ) from 50 m to 150 m above the ground surface.

1.2 Purpose

As specified in the United States Fish and Wildlife Service (USFWS) Draft Eagle Conservation Plan Guidance (Draft ECPG) dated January 2011, the purpose of the Stage 2 site specific Bald Eagle surveys is to report Bald Eagle activity and quantify Bald Eagle use (i.e. exposure) in the Project Area. Then this data, along with turbine specifications, siting and operational details, can be used by Firelands/Lyme to determine the risk to Bald Eagles during the subsequent Stage 3 risk analysis for the proposed wind energy facility. Additionally, the Firelands/Lyme was classified by the Ohio Department of Natural Resources (ODNR) as a "moderate effort" site in a letter dated May 21, 2011 (Appendix

A), and specific avian surveys required by ODNR under this classification included raptor nest searching and monitoring, diurnal raptor/bird migration surveys, breeding bird surveys, and site specific Bald Eagle nest monitoring and surveys.

The scope of work was conducted in accordance with the *Avian and Bat Study Plan* dated March 23, 2011 (Study Plan), which was submitted to Ms. Melanie Cota of the USFWS Columbus, Ohio Field Office and Ms. Jennifer Norris of the ODNR. Approval of the *Avian and Bat Study Plan* was received from the USFWS in an electronic mail dated April 27, 2011 and ODNR on May 21, 2011 (Appendix A). Additionally, the Bald Eagle surveys followed the ODNR *On-shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in OH* (2009), the 2011 *USFWS Draft Land-Based Wind Energy Guidelines* (ODNR/USFWS wind guidelines), and the survey recommendations outlined in correspondence received by Tetra Tech on May 21, 2011 from ODNR Wind Energy Lead, Jennifer Norris (Appendix A).

The potential impacts to birds are regulated under several federal and state laws. Therefore the approved Study Plan was designed and conducted in accordance with the following state and federal laws including:

- The Endangered Species Act (ESA) of 1973 (7 U.S.C. § 136, 16 U.S.C. § 1531 et seq.)
- The Migratory Bird Treaty Act (MTBA) of 1918 (16 U.S.C. 703-712; Ch. 128; July 13, 1918; 40 Stat. 755)
- The National Environmental Policy Act (NEPA) of 1969 (42 USC 4321)
- The USFWS Draft Eagle Conservation Plan Guidance, January 2011
- The Bald and Golden Eagle Protection Act (BGEPA) of 1940 (16 U.S.C. 668-668d, 54 Stat. 250)
- Ohio Revised Code Title 15 Conservation of Natural Resources (Chapter 1531.01 - 1531.25)

1.3 Scope of Services

As part of preconstruction activities for the proposed project, Tetra Tech completed over one year of site specific surveys for the federally protected and state of Ohio listed species, the Bald Eagle, within and surrounding the Project Area. As outlined in the Study Plan, surveys were conducted to support protocols identified in Stage 2 of the Draft ECPG and fulfill the requirements for “moderate effort” classification Bald Eagle surveys found in the ODNR Wind Guidelines. The Bald Eagle surveys required by the Draft ECPG, included site specific Bald Eagle surveys within the Project Area, Bald Eagle nest searching and monitoring, and diurnal raptor/bird migration surveys.

Tetra Tech initiated field efforts and surveys in the Project Area on March 2, 2011. Specific Bald Eagle surveys that were conducted included the following:

- Two years of Bald Eagle nest and productivity surveys conducted during the 2011 and 2012 breeding seasons;

- One year of diurnal raptor/bird migration surveys; and

- 13 months of fixed radius point counts at forty (40) locations within and surrounding the Firelands/Lyme Project Area.

Tetra Tech biologists applied the calculation procedures described in Appendix C of the Draft ECPG to the Excel table containing the fixed radius point count data to determine the Bald Eagle exposure rate for the one year project survey. A summary of this procedure is found in Appendix B of this document. These same calculation procedures were also used to determine the Bald Eagle exposure rate for each individual sample point as well as the Bald Eagle exposure rate over time through the sampling period.

In addition to the Stage 2 site specific Bald Eagle surveys, the site characteristics for each of the Bald Eagle point count locations are presented. This was done to provide Firelands/Lyme and agency staff with information to help identify potential risk factors for each turbine location during the subsequent Stage 3 risk analysis of the Draft ECPG.

The following sections of the report provide an overview of existing site conditions, survey methods, and results for each of the Stage 2 Bald Eagle data collection efforts conducted for the Firelands/Lyme project. The results of the Stage 2 site specific Bald Eagle survey report will provide Firelands/Lyme and agency staff with the necessary quantitative Bald Eagle data for the subsequent Stage 3 risk analysis of the Draft ECPG. Also included in this report is a summary of the Bald Eagle survey results in a format that will allow Firelands/Lyme, USFWS, and ODNR to subsequently incorporate the Stage 2 results into the Stage 3 Risk Assessment model. Tetra Tech provides a summary of the Fixed Radius Point Count Data Analysis Methods in Appendix B, copies of the Bald Eagle Data Sheets in electronic format in Appendix C, and selected photographs in Appendix D of this report.

2.0 EXISTING SITE CONDITIONS

This section of the report will present the existing site conditions from both a regional and Project Area perspective.

2.1 Region

The Firelands/Lyme Project Area is located in the Maumee and Erie Lake Plain physiographic provinces of north central Ohio (see Figures 1, 2, & 3). This area is characterized by level to gently rolling terrain and clay and loamy clay lakebed soils. Prior to settlement, much of this region was covered by various mixed hardwood forest types; however, due to the fertile soil the area is now predominantly agricultural (crop) land with only scattered forest remnants or woodlots remaining, primarily along stream channels or in isolated stands. Two large waterways, the Sandusky and Huron Rivers are found in the two counties within this region. These rivers flow from south to north through farm country from interior Ohio to Lake Erie. A band of natural habitat, including upland and floodplain forest and wetlands occurs along these river channels. In addition, Lake Erie, including Sandusky Bay, is located approximately 5 to 10 miles to the north of the Project Area and harbors shoreline and open water habitats. Most of the wetlands in the agricultural portion of this region have been greatly reduced in size and extent; however, small areas of emergent marsh/meadow, farm ponds, and floodplain/bottomland forest still occur in isolated patches or along riparian stream corridors.

Given the large scale conversion of much of the regional landscape to agriculture, habitat for Bald Eagle has likely been diminished, especially in the Project Area. While Lake Erie and the Sandusky River and Huron River corridors provide quality habitat, the agricultural portion of this region generally contains relatively low levels of biological diversity. This is evidenced by a lack of Audubon Society designated Important Bird Areas (IBA), wildlife management areas, and rare species element occurrences in the agricultural portion of the region when compared with the Sandusky and Huron River corridors and Lake Erie.

The Sandusky River corridor (approximately 14 miles west of the Project Area) is designated by the Audubon Society as the Sandusky IBA, while a large portion of Lake Erie including Sandusky Bay is designated as the Lake Erie Western Basin IBA. The Sandusky IBA is known as a Bald Eagle migration corridor and is important to a number of other bird species. The Lake Erie Western Basin IBA is known to be an important wintering and nesting area for Bald Eagles as well as numerous waterfowl and water bird species.

2.2 Project Area

The vast majority (over 98%) of the Project Area has been converted to cropland or other high intensity development. Forest stands and other natural habitats are generally small, scattered and highly fragmented. Forest fragments, National Wetland Inventory identified wetlands, and the National Hydrography Dataset are displayed on Figure 2.

Small tributary streams, which comprise approximately 257,000 linear meters, traverse the Project Area, some of which flow through or are adjacent to scattered wooded areas or woodlots (see Figure 2). Many of the stream channels have been modified through agricultural practices; however, some of these drainages contain small forested wetlands or floodplain areas. No larger rivers or water bodies occur within the Project Area. The Project Area is approximately 14 miles east of the Sandusky River corridor, 1-2 miles west of the Huron River corridor, and 6-8 miles south of Lake Erie. However, a few quarries containing ponded water do occur within the Project Area and one artificial reservoir (Bellevue Reservoir) is located adjacent to the southern boundary of the Project Area. Scattered wetlands (approximately 800 acres), such as forested bottoms/floodplains, emergent, and scrub-shrub wetlands occur in the Project Area; however, most of these have been affected by farming and draining activities (see Figure 2).

There are no known Audubon Society designated IBAs, wildlife management areas, or rare species element occurrences in the Project Area.

3.0 SURVEY METHODOLOGY

Methods for the Stage 2 site specific Bald Eagle surveys followed the three recommended components of Appendix C in the Draft ECPG:

1) Characterization of the local-area nesting population;

2) Fixed radius point counts; and

3) Determination of the seasonal Bald Eagle concentration areas.

The protocols found in the approved Study Plan for the Firelands/Lyme Project Area were designed to be in accordance with the Draft ECPG and ODNR wind guidelines for a moderate level site. Specifically, the fixed radius point count survey was conducted in accordance with the protocol found in Appendix C of the Draft ECPG for quantifying eagle minutes and “exposure” and the ODNR wind guidelines for documenting movement patterns of nesting eagles in relation to the Project Area. The migration and concentration area survey was completed in accordance with the protocol found in the ODNR wind guidelines for assessing diurnal raptor and bird (including Bald Eagle) migration patterns, as well as the protocol specified in Appendix C of the Draft ECPG. The Bald Eagle nest and productivity survey was conducted in accordance with the protocol identified in Appendix C of the Draft ECPG for evaluating eagle nest productivity within 10 miles of the Project Area and ODNR wind guidelines for evaluating protected raptor (including Bald Eagle) nest activity within 2 miles of the project boundary.

While not part of the Stage 2 site specific eagle surveys a general site characteristic evaluation for each of the 40 point count locations was completed to provide information to support the subsequent Stage 3 analysis outlined in Appendix D the Draft ECPG. The following sections provide details of the specific methods used for each survey and data evaluation.

3.1 Bald Eagle Nest & Productivity Surveys

In accordance with the approved Study Plan and for two breeding seasons (2011 and 2012)Tetra Tech wildlife biologists conducted a vehicular reconnaissance within Firelands/Lyme Project Area and a 10-mile buffer (see Figure 3) in order to identify Bald Eagle nests. Nest searches were conducted as outlined in the Draft ECPG (10-mile Draft ECPG buffer) during March 2011 and March 2012, which also covered the 2-mile buffer indicated in the ODNR wind guidelines. Each observed nest was identified to species by nest size, material and/or bird activity at the nest. Global Positioning Satellite (GPS) locations of each confirmed nest was recorded using a handheld Trimble GeoX.

Once Bald Eagle nests were positively identified (species present, nest size, nest materials, and/or bird activity at the nest) and their territories established, Tetra Tech biologists generated field forms and figures depicting all identified Bald Eagle nests and then utilized them during the spring months of 2011 and 2012 nest productivity survey efforts to document the behavioral patterns of the adults and eaglets. Additionally, Tetra Tech developed a nest productivity field form which captured activity in and around each Bald Eagle nest during each of the three nest productivity surveys conducted in over two breeding seasons (April, May and June of 2011 and 2012). Electronic copies of these field forms are included in Appendix C of this report.

Nest productivity surveys were conducted at each identified Bald Eagle nest three times for four hours each. During the nest productivity surveys Tetra Tech biologists recorded all activity of Bald Eagles (incubation, feeding young, nest maintenance, flight height and direction, etc…) in order to report; the number, occupancy status and productivity of nesting Bald Eagles (see Appendix C).

3.2 Fixed Radius Point Count Surveys

With the guidance and approval of USFWS and ODNR regional staff, Tetra Tech established 40 locations for the fixed radius point counts (Bald Eagle point count) throughout and immediately adjacent to the Project Area (see Figure 4). Point Count locations #38, #39, and #40 were added in July 2011 at the request of the USFWS. Photographs of selected Bald Eagle point count locations are included in Appendix D. For the 13 month period from March 2011 through March 2012 Bald Eagle data was collected twice a month for a period of 30 minutes at each Bald Eagle point count per the guidance and protocols found in Appendix C of the Draft ECPG. Data recorded during each survey period included the total number of Bald Eagles in flight during each 1-minute interval, referred as Bald Eagle Minutes. Bald Eagle flight heights were estimated using a range finder and recorded using the following categories:

a. 1 - 30 m,
b. 31 - 60 m,
c. 61 - 100 m,
d. 101 - 140 m,
e. 140 - 175 m, and
f. Heights above 175 m were not recorded.

Behavior was recorded and included soaring, flapping-gliding, kiting, perched, etc. Approximate age of each Bald Eagle was categorized and weather observations were recorded. Data forms included a sketch of each 800 m radius plot and the flight paths/heights of Bald Eagles observed. Electronic copies of these field forms are included in Appendix C of this report.

As stated previously in Section 1.1, Firelands/Lyme is proposing to utilize a turbine with a RSZ of 50 to 150 m above the ground surface. However, for the purposes of this evaluation, Tetra Tech added buffers below and above the proposed turbine RSZ to ensure that the range of commercially available turbines are addressed. Therefore flight heights for Bald Eagle observations focused primarily on the buffered RSZ of 31 m to 175 m above the ground surface.

The data were summarized and compiled in an Excel spreadsheet and analyzed to report the following:

1) The total number of Bald Eagle minutes and overall Bald Eagle exposure rate over the entire point count survey effort;

2) The number of Bald Eagle minutes and exposure rate during each point count survey period over the entire year (temporal distribution);

3) The number of Bald Eagle minutes and exposure rate observed at each Bald Eagle point count location (spatial distribution);

4) The total number of Bald Eagle minutes and overall exposure rate of Bald Eagle with flight heights in the buffered RSZ during the point count surveys;

5) The number of Bald Eagle minutes and exposure rate of Bald Eagle with flight heights in the buffered RSZ during each point count survey period; and

6) The number of Bald Eagle minutes and exposure rate within the buffered RSZ at each Bald Eagle point count location.

A summary of all of the calculation procedures for the fixed radius point count data analysis is provided in Appendix B. The following sections provide a more detailed explanation of the fixed radius point count methods and subsequent results.

3.2.1 Bald Eagle Minutes & Overall Exposure Rate

The total number of Bald Eagle minutes was determined by the sum of all minutes over the year-long survey. Overall eagle exposure rate was then determined by dividing the number of Bald Eagle minutes by the total number of survey minutes over the entire one-year period (or 26 Bald Eagle point count survey periods), or via the following equation:

$$\text{Exposure Rate} = \left(\frac{\text{Total Bald Eagle Minutes}}{\begin{gathered}\text{Total Bald Eagle Point Count}\\ \text{Survey Minutes}\end{gathered}} \right)$$

3.2.2 Bald Eagle Temporal Distribution

Temporal distribution was determined by the number of Bald Eagle minutes and exposure rate during each point count survey period, which provides an indication of the level or amount of Bald Eagle use over the course of a calendar year. The various time periods, or seasons, can then be directly compared to one another to evaluate when Bald Eagle use was greatest versus when it was lowest over the year-long survey (i.e. the temporal distribution pattern). The total number of Bald Eagle minutes for each point count survey period was determined by a simple count of Bald Eagle minutes recorded during each point count survey period. The Bald Eagle exposure rate by temporal distribution was then determined by dividing the number of eagle minutes recorded during each point count survey period by the total number of survey minutes for each corresponding point count survey period, as shown by the following equation:

$$\text{Temporal Exposure Rate} = \left(\frac{\begin{gathered}\text{Total Bald Eagle Minutes within a}\\ \text{Point Count Survey Period}\end{gathered}}{\text{Total Bald Eagle Point Count Period Minutes}} \right)$$

3.2.3 Bald Eagle Spatial Distribution

Spatial distribution was determined by the number of Bald Eagle minutes and exposure rate at each Bald Eagle point count location, which provides quantitative data of Bald Eagle use within specific locations in and adjacent to the Project Area. The total number of Bald Eagle minutes at each point count location was determined by the sum of eagle minutes recorded at each location over all twenty-six survey periods. The Bald Eagle exposure rate by spatial distribution was then determined by dividing the total number of Bald Eagle minutes at each Bald Eagle point count by the total number of minutes surveyed over all 26 survey periods at each corresponding Bald Eagle point count, as shown in the following equation:

$$\text{Spatial Distribution Exposure Rate} = \left(\frac{\begin{array}{c}\text{Total Bald Eagle Minutes at}\\ \text{Point Count Location "X"}\end{array}}{\begin{array}{c}\text{Total Bald Eagle Pount Count}\\ \text{Survey Minutes}\\ \text{at Point Count Location "X"}\end{array}} \right)$$

3.2.4 Bald Eagles within the RSZ

As stated previously in Section 1.1, Firelands/Lyme is proposing to utilize a turbine with a RSZ of 50 to 150 m above the ground surface. However, for the purposes of this evaluation, Tetra Tech added buffers below and above the proposed turbine RSZ to ensure that the range of commercially available turbines are addressed. To compute the Bald Eagle minutes/exposure rate for flight heights within the RSZ (31 m to 175 m) only those Bald Eagles observed within the range of RSZs for typical commercial wind turbines were analyzed. This altitude range roughly corresponds to four recorded flight categories during Bald Eagle point count surveys (31 m - 60 m, 61 m - 100 m, 101 m - 140 m, and 141 m – 175 m). Therefore, Bald Eagles observed within the recorded altitude (1 - 30 m) were removed from the eagle minutes dataset. The analysis of Bald Eagle observations with a flight height within the buffered RSZ (31 m – 175 m) was conducted so that these results could be compared to the analysis of all Bald Eagle observations and to provide a more specific indication of only those Bald Eagles directly exposed to the potential RSZ, as shown by the following equation:

$$\text{Exposure Rate within RSZ} = \left(\frac{\begin{array}{c}\text{Total Bald Eagle Minutes}\\ \text{Within RSZ}\end{array}}{\begin{array}{c}\text{Total Bald Eagle Point Count}\\ \text{Survey Minutes}\end{array}} \right)$$

3.3 Diurnal Raptor/Bird Migration Survey

Seasonal diurnal raptor/bird migration survey points per the Draft ECPG were established in potential concentration or migration areas in the Project Area (see Figure 4). A single diurnal raptor/bird migration survey point location with a 1.5 mile observation radius was centrally located in the Firelands portion of the Project Area and surveyed three times weekly from March 15 to April 28, 2011 and from September 1 to October 28, 2011. At the request of ODNR (see letter in Appendix A), a second sample point location within the Lyme portion of the Project Area was added for the fall surveys (September 1 to October 31, 2011). Data was recorded per ODNR and Hawk Monitoring Association of North America (HMANA) standards as recommended in Appendix C of the Draft ECPG. While all raptors and birds were recorded during the Diurnal raptor/bird migration surveys, for the purposes of this report only Bald Eagle observations are discussed. For a complete analysis of all avian data see the *Avian Survey Report Firelands/Lyme Wind Farm* dated July 20, 2012.

3.3.1 Diurnal Raptor/Bird Migration Survey Data Analysis

Diurnal raptor/bird survey data (diurnal survey) was compiled and reported using Excel spreadsheets. As indicated by the approved Study Plan, results are reported in order to determine relative numbers of Bald Eagles, if any, which may migrate through the Project Area. The proportion of Bald Eagles observed flying within the buffered RSZ and the average flight was not calculated due to the relatively limited number of actual Bald Eagle observations over the spring and fall. Individual observations of Bald Eagles and their behavior, including flight height and minutes within the buffered RSZ, were reported on field forms, which are included in Appendix C.

The total number of Bald Eagles observed during the diurnal survey, or overall abundance is reported by both a count of all Bald Eagles observed and by calculating the overall encounter rate. Encounter rate is the average number of Bald Eagles observed per hour of diurnal survey and is calculated by dividing the total number of Bald Eagles recorded by the total number of hours of diurnal survey or by the formula:

$$\text{Encounter Rate} = \left(\frac{\begin{array}{c}\text{Total Count of Bald Eagles Recorded} \\ \text{within Diurnal Survey Period}\end{array}}{\text{Total Diurnal Survey Period Hours}} \right)$$

The time of year when Bald Eagles were least/most abundant, or the overall temporal distribution of Bald Eagles observed was determined by calculating the encounter rate for all individuals recorded during each spring and fall 2011 diurnal surveys. The encounter rate for all individuals recorded for each diurnal survey period was calculated using the formula:

$$\text{Overall Temporal Distribution} = \left(\frac{\begin{array}{c}\text{Total Bald Eagles within each} \\ \text{Diurnal Survey Period}\end{array}}{\text{Total Diurnal Survey Period Hours}} \right)$$

3.4 Site Characteristics

As part of the Stage 2 site specific assessment of the Draft ECPG, a landscape evaluation is to be conducted for each proposed turbine location. As indicated in Appendix D of the Draft ECPG, specific landscape characteristics of the Project Area are to be identified during the Stage 3 Risk Analysis including nest locations and seasonal migration/concentration areas.

While a turbine layout has not been completed for the Firelands/Lyme project, a preliminary assessment of site conditions and other features at each of the forty (40) fixed radius point count locations located within the Project Area was conducted. This included evaluating available aerial photographs and topographic maps and identifying the specific habitat conditions at each of the 40 point count locations during the field investigation. Photographs of Bald Eagle point locations are included in Appendix D. Specific site characteristics and landscape features at each of the Bald Eagle point count locations were then recorded into an excel-based table for the use of Firelands/Lyme and other agencies during the Draft ECPG Stage 3 risk analysis.

4.0 SURVEY RESULTS

Tetra Tech biologists completed Bald Eagle surveys in accordance with the approved Study Plan, within the approximately 43,000 acre Firelands/Lyme Project Area and 10-mile Draft ECPG buffer between March 2011 and June 2012. Prior to the initiation of survey efforts Tetra tech biologists coordinated with ODNR and USFWS to locate and approve 40 fixed radius point count locations and two diurnal raptor/bird migration survey sites (see Figure 4). The results of the Bald Eagle nest searching and productivity monitoring within the 2-mile ODNR wind guidelines and 10-mile Draft ECPG buffer, one-year fixed radius point count surveys, and diurnal raptor/bird survey monitoring are summarized in the sections below, for all survey data, field forms, and results see Appendix C.

4.1 Bald Eagle Nest & Productivity Survey

A vehicular reconnaissance survey was conducted over the period of two breeding seasons (March 2011 and March 2012) to identify all Bald Eagle nests within the 10-mile Draft ECPG buffer (see Figure 3). Bald Eagle nests were identified by Tetra Tech biologists as over 5-feet wide and at least 3-feet tall piles of dry tree limbs and by observed activity at the nest. Tetra Tech biologists confirmed individual raptor species activity at the nest by observing Bald Eagle(s) approaching the nest, performing breeding activity at the nest (nest building, incubation, etc…) perched on and/or within 800 m of the nest. Following identification of Bald Eagle nest locations, Tetra Tech wildlife biologists recorded the following: Bald Eagle nest location (GPS coordinates), activity status, productivity, and mean internest distance/territory size.

During the 2011 vehicular reconnaissance eight Bald Eagle nests were identified and observed on private properties within and surrounding the Project Area (see Figure 3). The identified Bald Eagle nests are primarily located north of the Project Area, near Lake Erie, and along the Huron River corridor. Two Bald Eagle nests were identified in the northwest portion of the Project Area (see Figures 4 & 5).

Tetra Tech wildlife biologists determined the spatial extent of all Bald Eagle territories found within the 2-mile ODNR wind guidelines buffer (see Figure 5). The size of each Bald Eagle territory was based on ½ the mean internest distance between all known Bald Eagle nests in the vicinity. This value was determined to be 0.85 miles and was provided by the USFWS and ODNR. The total acreage of Bald Eagle territory within the Project Area is approximately 2,288 acres. The proportion of the Project Area containing Bald Eagle territory is approximately 5% of the total Project Area (~43,000 acres). Also, the two Bald Eagle territories in the Project Area are located in the extreme northwest portion of the Project Area.

The attached Table 1 includes a summary Bald Eagle nest observations and productivity data during spring/summer 2011. Table 1 provides the 2011 observed nest status and number of fledglings, if applicable. As can be seen in Table 1, seven nests (#1, #3, #4, #5, #6, #7, and #8) were found to be occupied by Bald Eagles. Nest #2 was observed to be occupied by a Red-tailed hawk. Tetra Tech biologists did not observe Bald Eagle fledglings for nests #5 and #6, therefore they were unproductive. Tetra Tech determined that the two nests (#1 and #2) in the Project Area were from the same pair of Bald Eagles that abandoned one nest (#2) and constructed another (#1).

The attached Table 2 summarizes the results of the 2012 vehicular reconnaissance. Tetra tech biologists observed 11 nest locations, which included three new Bald Eagle nests (#7_2012, #8_2012, and #9) (see Figures 3 and 4). Nest #2 was observed to be unoccupied by any birds. Tetra Tech biologists determined that the two nests (#7 and #8) observed in 2011 were destroyed and no longer present. Tetra Tech biologists determined that due to the proximity to the old nest locations (see Figure 3) that the new nests (#7_2012 and #8_2012) were re-nests by breeding pairs from the previous year nests #7 and #8. Thus, a total of nine nest locations were monitored in 2012, eight were occupied by Bald Eagles, and four occupied nests were productive (see Table 2). The Bald Eagle nests within the 2-mile ODNR wind guidelines buffer did not change locations or activity status in 2012, therefore the amount of Bald Eagle territory remained approximately 5% of the total Project Area. It should also be noted that Tetra Tech biologists periodically observed the locations of the original Bald Eagle nests at locations #7 and #8 (Figure 3) through the end of productivity monitoring in 2012 to ensure no other replacement nests were constructed.

4.2 Fixed Radius Point Count Survey

A total of 30,480 minutes (508 hours) of observation were conducted across the 40 sample points during the entire 13 month survey period between March 2011 and March 2012 (see Table 3 and field forms in Appendix C). For the time period from March 2011 through June 2011 the initial 37 point count locations were surveyed for a total of 8,880 minutes and for the time period from July 2011 through March 2012 all 40 point count locations were surveyed for a total of 21,600 minutes. Of the 30,480 minutes of survey time, a total of 226 minutes of Bald Eagle observations (see Table 4) were recorded at 32 of the 40 Bald Eagle point count locations (see Figure 6). Based on these results, the overall mean Bald Eagle exposure rate across all sample points over the entire survey period was found to be 0.0074 Bald Eagles per minute. This means that on average one Bald Eagle was observed during every 135 minutes (2 hours and 25 minutes) of observation.

4.2.1 Bald Eagle Temporal Distribution

Over the course of the 13 month Bald Eagle point count surveys, Tetra Tech biologists conducted 26 (two per month) of the 30 minute Bald Eagle point count surveys. As depicted in Figure 7, Bald Eagle minutes were highest during the spring migration in March and April, and again in late fall - early winter during November and early December. Exposure rates for the same survey periods are depicted in Figure 8 and reflect the same peaks in exposure rates as the Bald Eagle minutes.

4.2.2 Bald Eagle Spatial Distribution

Tetra Tech scientists determined the mean exposure rate for each of the Bald Eagle point count locations where Bald Eagles were observed. A majority of the exposure rates by location were between 0.0010 and 0.0185, even the three Bald Eagle point counts locations (#17, #18, and #36) with the highest exposure rates only had a maximum of 0.0538 (Figure 6). Figures 9 and 10 also depict the spatial distribution of Bald Eagle minutes and mean exposure rate for each Bald Eagle point count location.

Bald Eagle point count locations #17 and #18 had the highest number of Bald Eagle minutes (approximately 40 minutes each) and therefore the highest mean Bald Eagle exposure rate (see Table 4). It should also be noted that of the 226 minutes of Bald Eagles observed at the point count locations, only 84 minutes (37%) were observed at point locations within the Project Area.

4.2.3 Bald Eagles within the RSZ

Of the 226 eagle minutes recorded during the 13 month point count survey, 144 minutes included Bald Eagles observed to be flying within the buffered RSZ of 31 m to 175 m above the ground surface (see Table 5 and Figure 11). Considering only the 144 eagle minutes within the RSZ the overall exposure rate for eagles was 0.0047 Bald Eagles per minute for the entire 13 month period. Thus, the exposure rate within the buffered RSZ for Bald Eagles is nearly half the exposure rate when considering all eagle observations for the entire year. It should also be noted that of the 144 minutes of Bald Eagles observed within the buffered RSZ, only 66 minutes (46%) were observed at point locations within the Project Area.

4.2.4 Bald Eagle Spatial Distribution within RSZ

Tetra Tech determined the spatial distribution within the buffered RSZ or mean exposure rate for Bald Eagles that were observed in the buffered RSZ for each of the 40 sample locations (Table 6). As displayed in Figures 11 and 12, 15 Bald Eagle point count locations had zero eagle minutes within the RSZ. Seven of the 15 “zero eagle minute” locations were within the Project Area, while eight were outside the Project Area.

As with the total Bald Eagle minutes, spatial distribution within the buffered RSZ were also highest at Bald Eagle point count locations 17 and 18 (Table 6).

4.3 Bald Eagle Temporal Distribution within RSZ

Figure 13 provides a graph depicting the temporal distribution of Bald Eagles minutes within the buffered RSZ for the 26 survey periods, while Figure 14 provides a graph depicting the temporal distribution of buffered RSZ exposure rates of Bald Eagles for the 26 survey periods. The temporal distribution of the buffered RSZ did not show any clear trend with the highest exposure rate within the buffered RSZ during March 2011 at 0.0198 and as low as zero (0) during seven different point count survey periods over the entire year (Figure 14 and Table 7).

4.4 Bald Eagle Diurnal Raptor/Bird Migration Survey

The Bald Eagle observations made during the spring and fall 2011 migration periods are summarized in Table 8, which indicates the behavior/flight characteristics, as well as the date of each observation. As can be seen in Tables 8 and 9, a total of 14 Bald Eagles were observed over the course of the entire spring and fall diurnal surveys (336 total hours) with five of the 14 Bald Eagles recorded during the spring and the remaining nine recorded during the fall migration period. Based on the total number of hours of survey the overall average encounter rate was 0.042 Bald Eagles per hour for 2011 (see Table 9). Three of the five Bald Eagles observed during the spring survey periods were within the buffered RSZ. Eight of the nine Bald Eagles observed during the fall 2011 migration season were observed within the buffered RSZ. No clear trend in direction of travel or flight behavior was observed from the diurnal survey data during either the spring or fall (Table 8).

4.5 Point Count Location Characteristics

Tetra Tech biologists completed a site assessment of landscape characteristics for each of the 40 Bald Eagle point count locations for the use of Firelands/Lyme, USFWS and ODNR biologists per Appendix C of the Draft ECPG. Site characteristics are summarized in Table 10, which provides the site features necessary for the Stage 3 risk factor analysis of each of the proposed turbine locations once a preliminary turbine layout is completed. Additionally, photographs of the Bald Eagle point count locations are included in Appendix D.

5.0 DISCUSSION

On behalf of Firelands/Lyme, Tetra Tech successfully completed the Stage 2 components outlined in Appendix C of the Draft ECPG and provides this report of the survey results.

Based on the results of the Bald Eagle nest searches, diurnal raptor/bird migration survey, and fixed radius point counts, Bald Eagles occur within the Project Area boundary and breed within the Draft ECPG 10-mile Buffer. Therefore, Firelands/Lyme and consulting agencies will use the quantitative data collected during Stage 2 surveys along with turbine specifications as input for fatality prediction model to estimate the predicted number of annual eagle fatalities for the proposed project during the Stage 3 Risk Assessment. The output from this model will then be combined with other data, such as data on risk factors and collision probability, to determine a comprehensive risk analysis for the project.

Firelands/Lyme also understands that additional data from the Stage 2 surveys may be used as part of both the fatality prediction model and overall risk analysis for Bald Eagles. Survey results and data inputs were requested by agencies and are provided in an Excel based format in Appendix C. As a result of the Bald Eagle site specific surveys, Firelands/Lyme and consulting agencies are provided with the information that can satisfy the adaptive Bald Eagle management requirements and the regulatory monitoring requirements of the USFWS and ODNR.

5.1 Nest Monitoring & Productivity

Characterization of the Firelands/Lyme local-area nesting population of Bald Eagles is summarized in Tables 1 and 2 for 2011 and 2012. A total of seven Bald Eagle breeding pairs occupied nests within the 10-mile Draft ECPG buffer of the Project Area during both years, and an additional breeding pair occurred in 2012 (Figure 3). However, of those seven breeding pairs of Bald Eagles, only five pairs produced a total of nine fledglings in 2011, and four pairs produced ten fledglings in 2012.

5.2 Fixed Radius Point Counts

The fixed radius point counts resulted in the total number of 226 Bald Eagle minutes (Table 4) and 13844 Bald Eagle minutes within the buffered RSZ of 31 m to 175 m above the ground surface (Tables 5 and 6), which provides Firelands/Lyme and consulting agencies with the necessary data to calculate exposure rates and provide the necessary data to predict potential Bald Eagle fatalities during the Stage 3 Risk assessment. As depicted in Figure 6, the Bald Eagle point counts with the highest exposure rates were located outside the project area and four point counts within the project area resulted in an exposure rate of zero.

Bald Eagle point count locations #17 and #18 resulted in the highest number of Bald Eagle minutes (76 of the total 226 Bald Eagle minutes) and therefore the highest Bald Eagle mean exposure rates (Table 4). These points are located outside the Project Area and immediately adjacent to the Huron River (Figure 6). The Huron River likely provides greater foraging potential than the Project Area due to a greater extent of natural habitat and an open water body. Also, the Huron River may also act as a migration corridor to and from Lake Erie.

Tetra Tech biologists did not record any Bald Eagle observations for the month of June 2011 and four of the 26 Bald Eagle point count survey periods did not result in any Bald Eagle minutes (see Table 3 and Figure 7). Table 4 and Figure 10 provide the data for Bald Eagle exposure rates by location.

Tetra Tech biologists did not record any Bald Eagle observations within the RSZ for the months of June 2011 and February 2012, and seven of the 26 Bald Eagle point count survey periods did not result in any Bald Eagle minutes within the buffered RSZ (Figure 13). Table 6 and Figure 12 provide the data for Bald Eagle exposure rates within the buffered RSZ by location and Table 7 and Figure 14 provide Bald Eagle exposure rates within the buffered RSZ over the 26 surveys periods.

5.3 Diurnal Raptor/Bird Migration Survey

The seasonal migration surveys, along with the fixed radius point count surveys provide useful information in predicting potential annual Bald Eagle fatality rates for Firelands/Lyme Project Area. Bald Eagles observed over the spring and fall diurnal survey periods resulted in 14 observations. This equates to an encounter rate of 0.0047 Bald Eagles per hour of diurnal survey for 2011. The encounter rate reported for the Project Area in 2011 was considerably lower than known Hawkwatch sites in the Great lakes region. For example, the nearest hawk watch site (approximately 80 miles north-northwest) to the Project Area is located at Point Mouillee State Game Area on the western shore of Lake Erie near Detroit, Michigan. This location had a Bald Eagle encounter rate in fall 2011 of 1.10 Bald Eagles per hour. While the Presque Isle site near Erie, Pennsylvania (approximately 170 miles north east of the Project Area) site had a passage rate of 1.51 Bald Eagles per hour in the spring of 2011.

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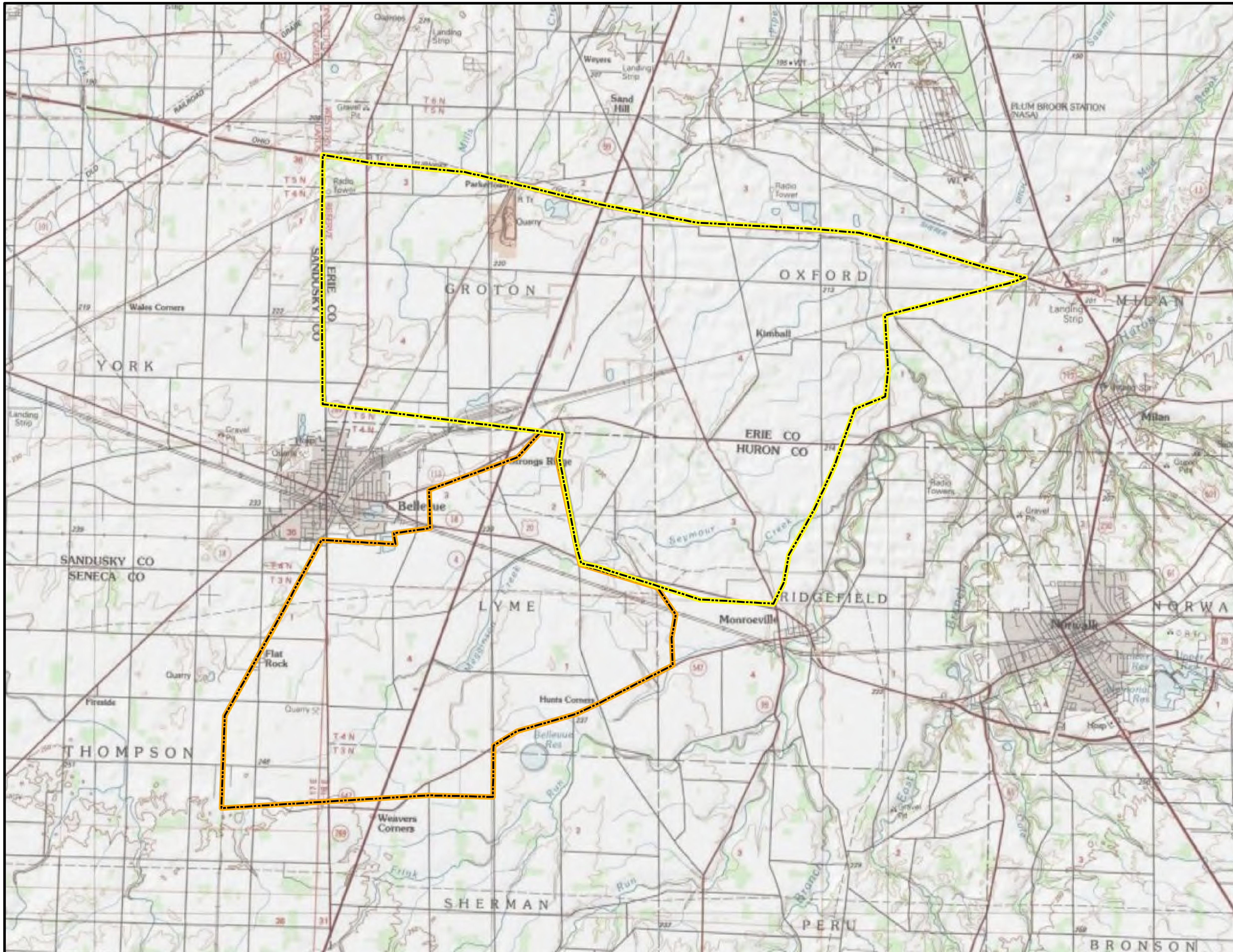
FIGURES



N
W
E
S

LEGEND

Firelands Project Boundary

Lyme Project Boundary

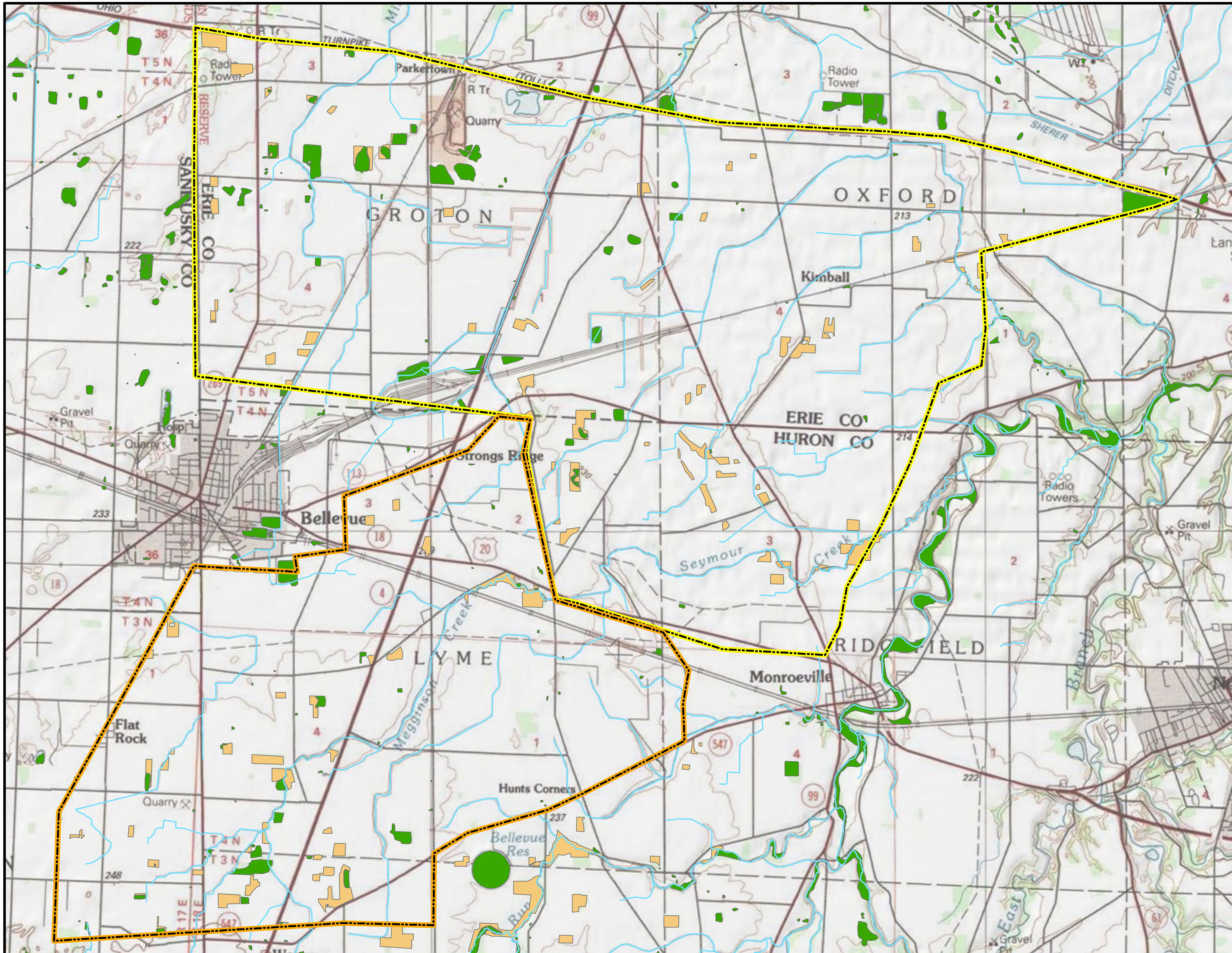
0 0.75 1.5 Miles

FIRELANDS AND LYME PROJECT
ERIE, HURON, AND SENECA COUNTIES, OHIO

FIGURE 1
SITE LOCATION MAP

TETRA TECH

Path: S:\CADD\MJUW\Firelands\005_Eagle\Firelands_Lyme_Avian_Fg1_SiteLocation.mxd Author: joel.peters Date: 5/9/2012



LEGEND

- Lyme Project Boundary
- Firelands Project Boundary
- National Hyrdrography Dataset
- National Wetland Inventory
- Forested Habitat

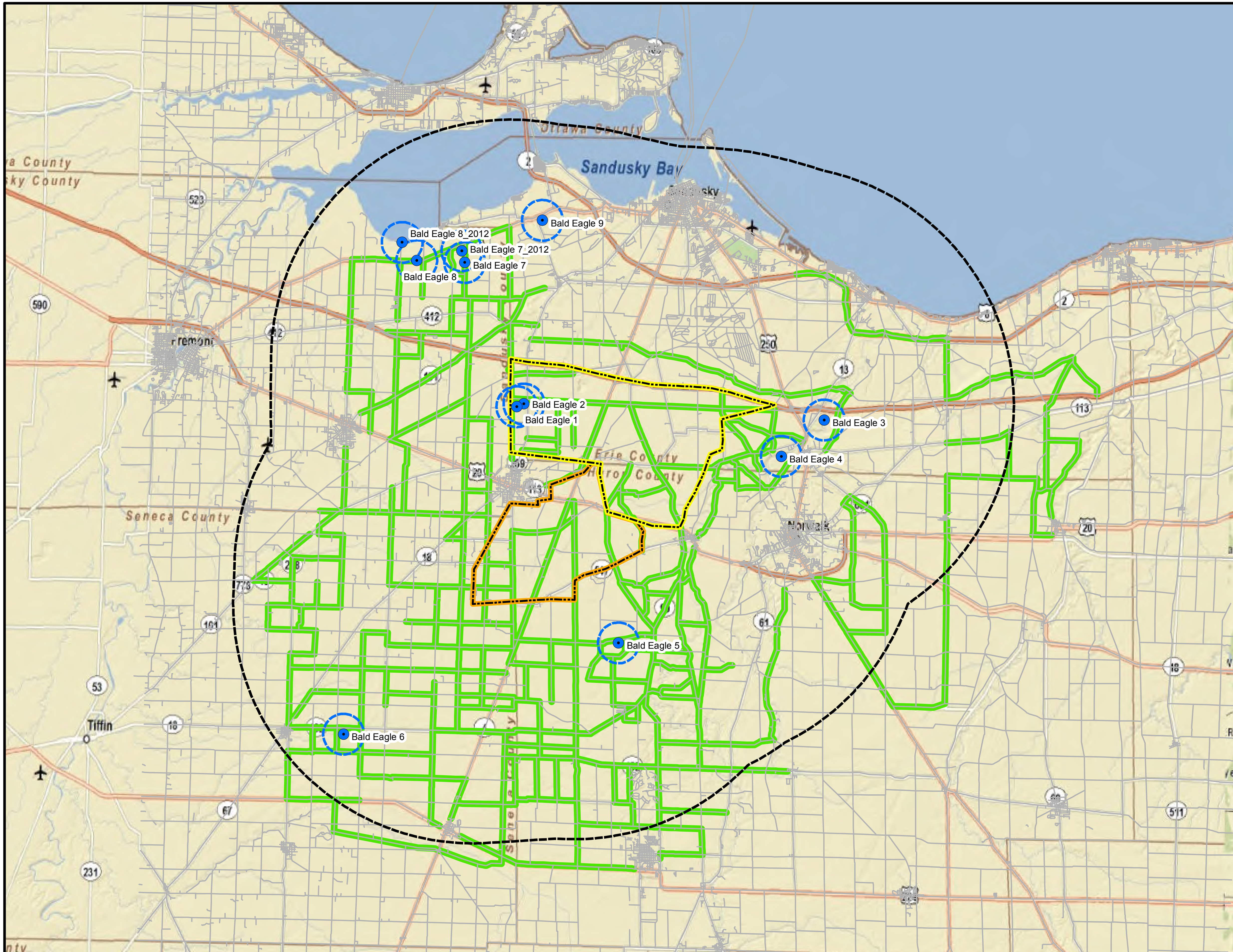
0 0.75 1.5 Miles

JUWI WIND
FIRELANDS AND LYME PROJECT
ERIE, HURON, AND SENECA COUNTIES, OHIO

FIGURE 2
PROJECT AREA EXISTING CONDITIONS

TETRA TECH

Path: C:\JUWI\Firelands\Firelands_MXD\Firelands_Lyme_avian_Fig3_SiteConditions.mxd Author: joel.peters Date: 7/17/2012



LEGEND

- Bald Eagle Nest
- 0.85-Mile Nest Buffer
- Firelands Project Boundary
- Lyme Project Boundary
- Draft ECPG 10-Mile Buffer
- Roads
- Road Surveyed for Bald Eagle Nests

Note: Bald Eagle nests 7 and 8 were destroyed by natural causes between the 2011 and 2012 breeding seasons. Tetra Tech biologists concluded that the breeding pairs constructed new nests in 2012 at different locations (Bald Eagle 7_2012 and Bald Eagle 8_2012).

0 2 4 Miles

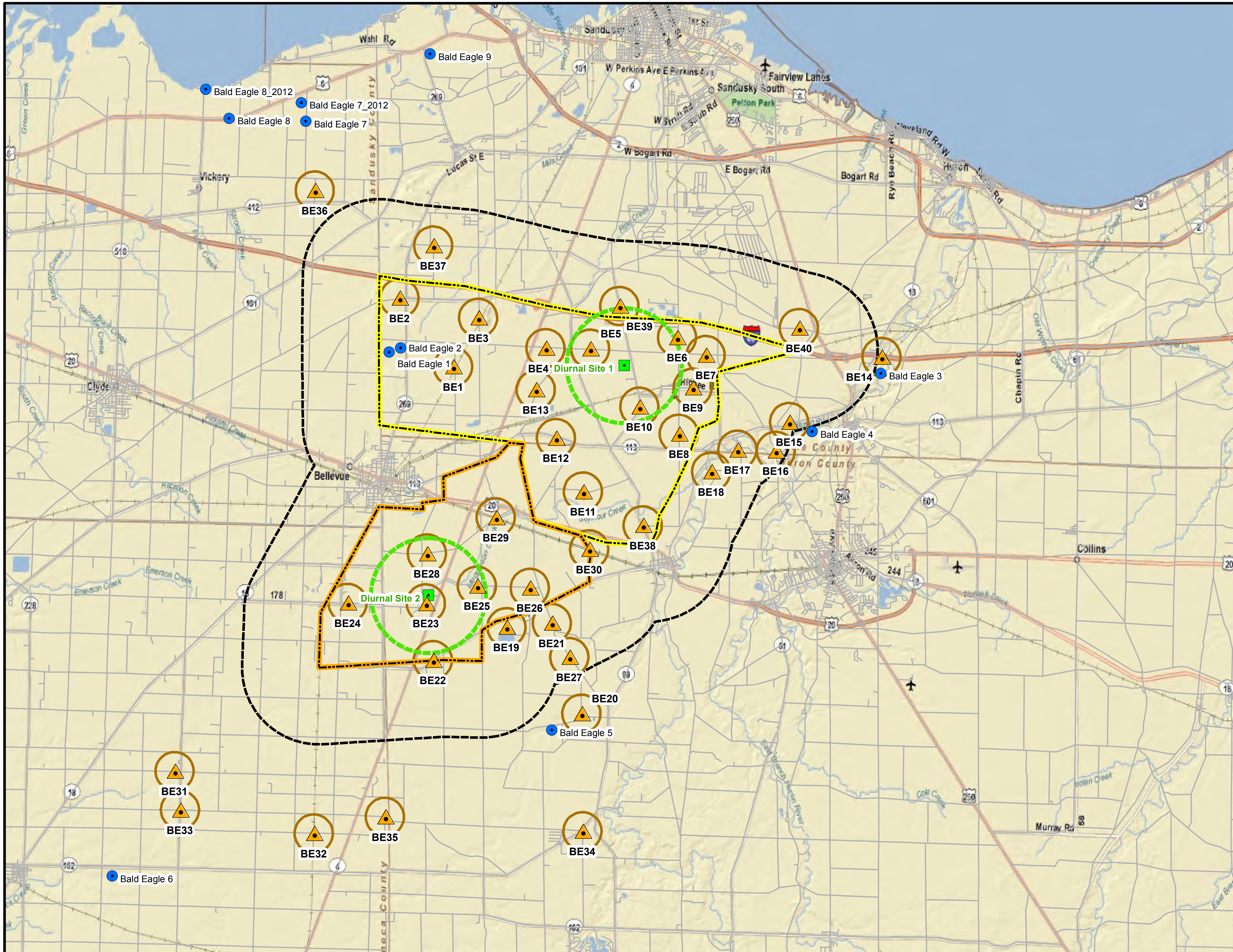
JUWI WIND

FIRELANDS AND LYME PROJECT
ERIE, HURON, AND SENECA COUNTIES, OHIO

FIGURE 3
BALD EAGLE NEST LOCATIONS

TETRA TECH

Path: S:\CADD\M\JUWI\Firelands\005_Eagle\Firelands_Lyme_Eagles_Fig2_NestLocations.mxd Author: joel.peters Date: 5/21/2012



N
W
E
S

LEGEND

- Bald Eagle Nest
- Bald Eagle Point Count Locations
- 800-Meter Buffer
- Diurnal Bird and Raptor Survey Location
- 1.5-Mile Buffer
- Lyme Project Boundary
- Firelands Project Boundary
- ODNR Wind Guidelines 2-Mile Buffer
- Roads

0 1.25 2.5
Miles

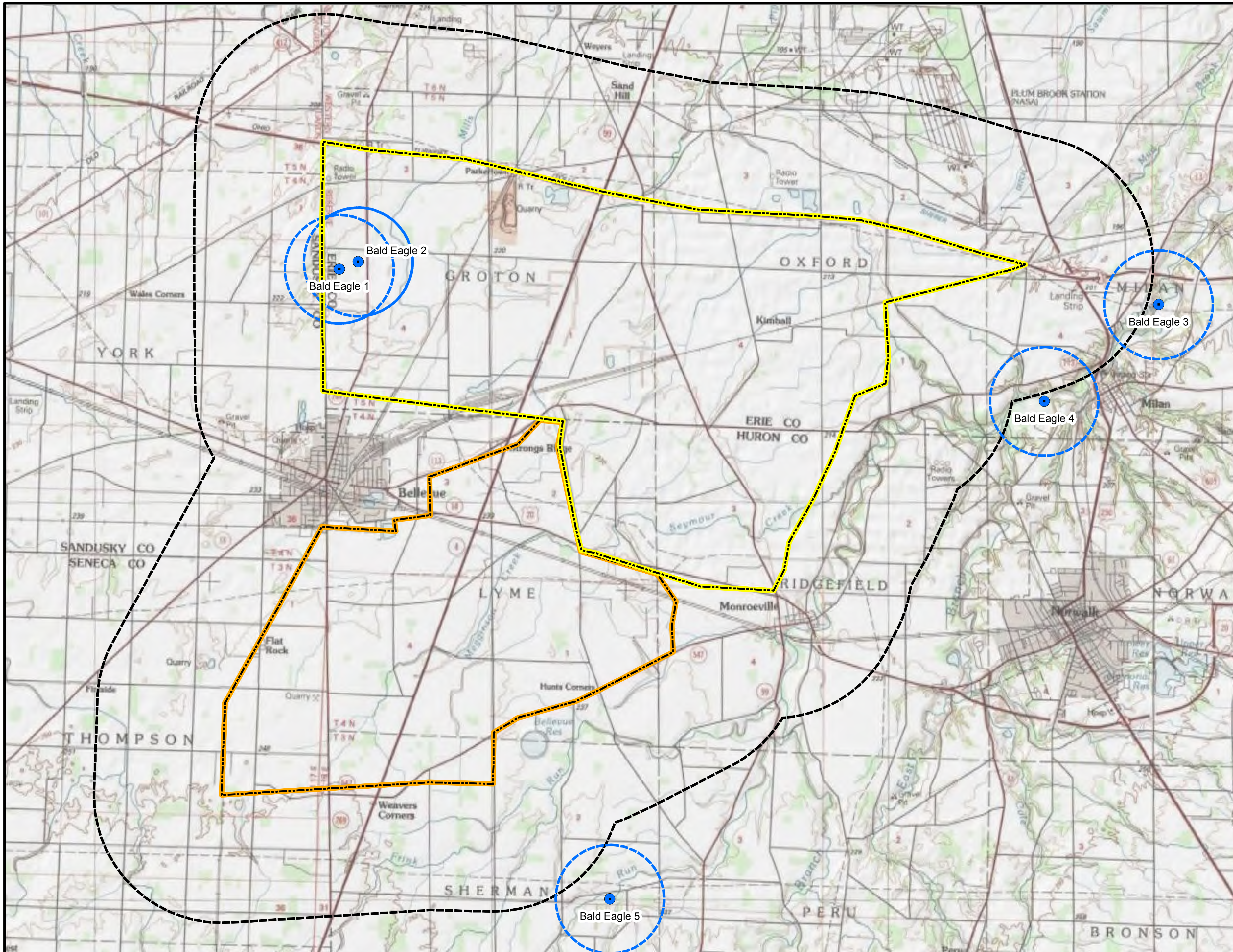
JUWI WIND

FIRELANDS AND LYME PROJECT
ERIE, HURON, AND SENECA COUNTIES, OHIO

FIGURE 4
BALD EAGLE POINT COUNT LOCATIONS AND DIURNAL RAPTOR/BIRD MIGRATION SURVEY POINT LOCATIONS

TETRA TECH

Path: S:\CADD\M\JUWI\Firelands\005_Eagle\Firelands_Lyme_Eagles_Fig3_PointCountLocations.mxd Author: joel.peters Date: 5/22/2012



N
W E
S

LEGEND

- Bald Eagle Nest
- Firelands Project Boundary
- Lyme Project Boundary
- 0.85 Mile Nest Buffer
- ODNR Wind Guidelines 2-Mile Buffer

Notes:

Bald Eagle Nest 1 was not occupied in March 2011, and it is assumed that the pair relocated to Bald Eagle Nest 2.

Inter-nest Distance of 0.85 miles specified by USFWS on September 26, 2011.

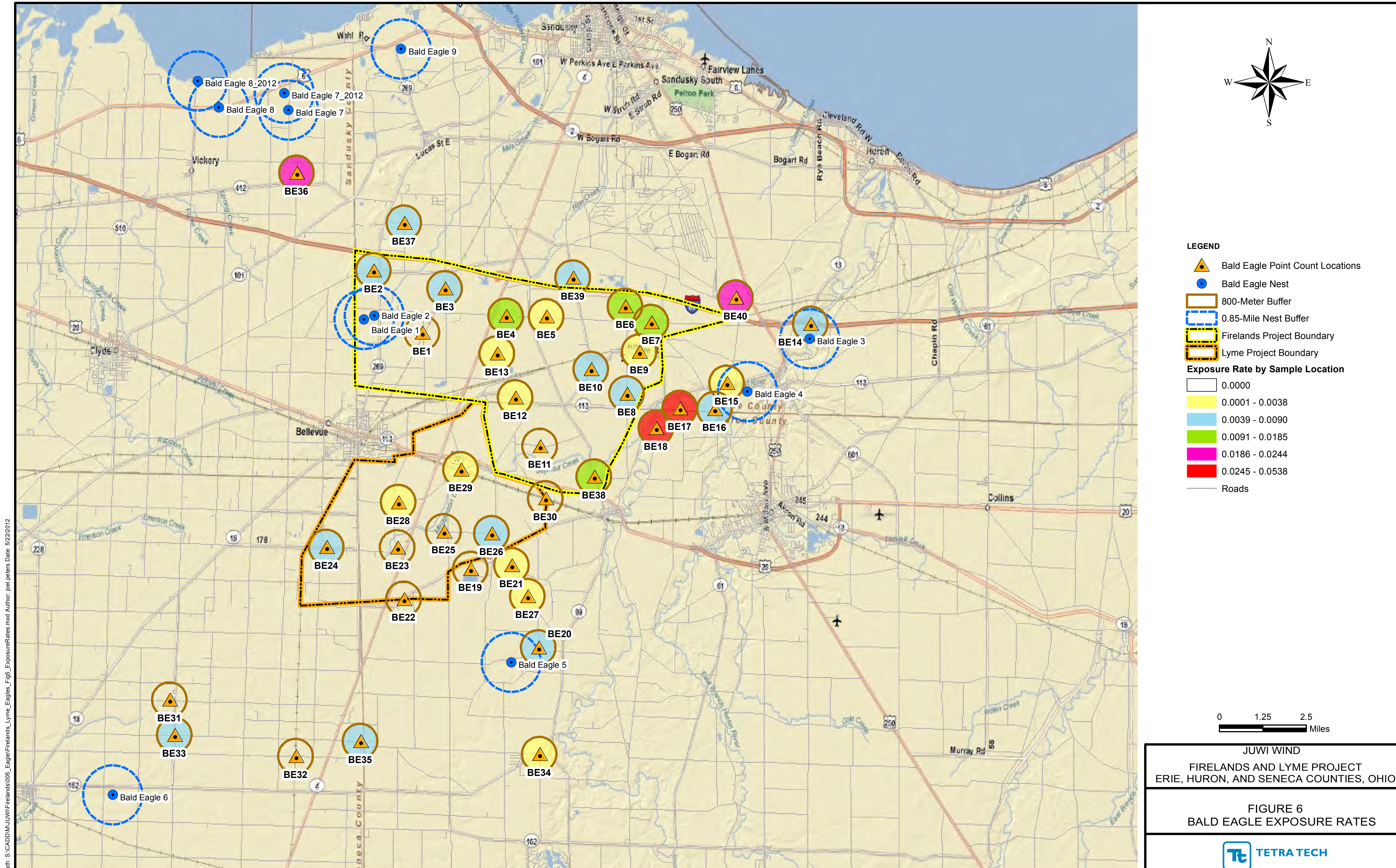
0 0.75 1.5 Miles

FIRELANDS AND LYME PROJECT
ERIE, HURON, AND SENECA COUNTIES, OHIO

FIGURE 5
BALD EAGLE TERRITORIES WITHIN
2 MILES OF THE PROJECT AREA

TETRA TECH

Path: S:\CADD\MJUW\Firelands\005_Eagle\Firelands_Lyme_Eagles_Fig4_Territories.mxd Author: joel.peters Date: 5/21/2012



JUWI WIND
FIRELANDS AND LYME PROJECT
ERIE, HURON, AND SENECA COUNTIES, OHIO

FIGURE 6
BALD EAGLE EXPOSURE RATES

TETRA TECH

TABLES

Notes & Reference Codes

Age Code	Age
A	Adult
J	Juvenile of unknown age
1	1st year juvenile
2	2nd year juvenile
3	3rd year juvenile
UNK	Unknown Age

Flight Code	Flight
0	Below eye level
1	Eye level to approximately 30m
2	Bird seen with unaided eye
3	At limits of unaided eye
4	Beyond limit of eye with binoculars
5	At limit of binoculars
6	Beyond limit of binoculars
7	No Predominate height

Behavior Code	Behaviors
D	Direct Flight
I	Indirect Flight
S	Soaring
H	Hunting
P	Perched

Height Code	Minimum Height (m)	Maximum Height (m)
A	1	30
B	31	60
C	61	100
D	101	140
E	141	175

Flight Heading	Degrees	Direction
N	0	North
NNE	23	North North East
NE	45	North East
ENE	68	East North East
E	90	East
ESE	113	East South East
SE	135	South East
SSE	158	South South East
S	180	South
SSW	203	South South West
SW	225	South West
WSW	248	West South West
W	270	West
WNW	293	West North West
NW	315	North West
NNW	338	North North West

Abbreviation	Notes
RSZ	Rotor Swept Zone (approximately 40 to 120 meters above the ground surface)
m	Meters
BAEA	Bald Eagle
N/A	Not Applicable
#	Number
-	No observation or comment or unable to be determined

Table 1 – 2011 Bald Eagle Nest Productivity Monitoring

Nest Identification	Located Within Project Boundary	Productive	# of Fledglings Observed	Comments
Bald Eagle 1	Yes	Yes	2	-
Bald Eagle 2	Yes	No	N/A	Red-tailed hawk observed occupying nest.
Bald Eagle 3	No	Yes	1	-
Bald Eagle 4	No	Yes	1	This nest was only visible in April until leaf out obscured visibility.
Bald Eagle 5	No	No	0	Adults were incidentally observed in the vicinity in the early portions of the breeding season, and on one occasion an adult was observed in an incubation position.
Bald Eagle 6	No	No	0	Adults were observed nesting and in vicinity early in the breeding season. Following a strong wind storm the nest was damaged and portions of it were blown down.
Bald Eagle 7	No	Yes	2	-
Bald Eagle 8	No	Yes	3	-

See Figure 2 for Bald Eagle nest locations

Table 2 – 2012 Bald Eagle Nest Productivity Monitoring

Nest Identification	Located Within Project Boundary	Productive	# of Fledglings Observed	Comments
Bald Eagle 1	Yes	Yes	2	-
Bald Eagle 2	Yes	No	N/A	Unoccupied, no activity at nest.
Bald Eagle 3	No	No	0	3 adults observed feeding 2 eaglets (<52 days old) in April; no fledglings observed in June.
Bald Eagle 4	No	No	0	Adults observed incubating in March and April; nest not visible in June due to leaf out, no eaglets or fledglings observed.
Bald Eagle 5	No	Yes	2	-
Bald Eagle 6	No	No	0	Adults observed in March incubating and feeding young in April, unoccupied and appears abandoned in June; no fledglings observed.
Bald Eagle 7	No	No	N/A	Nest destroyed by natural causes.
Bald Eagle 7_2012	No	Yes	3	Re-nest by breeding pair from nest #7 that was destroyed.
Bald Eagle 8	No	No	N/A	Nest and tree destroyed by natural causes.
Bald Eagle 8_2012	No	Yes	3	Re-nest by breeding pair from nest #8 that was destroyed.
Bald Eagle 9	No	No	0	Adults observed incubating in April, nest unoccupied in May and June.

See Figure 2 for Bald Eagle nest locations

Table 3 – Bald Eagle Fixed Radius Point Count Observation Data Summary

Date	Point Count Location	Site Visit #	Time	# of BAEA	Age Code	Behavior Code	Minimum Height Code	Maximum Height Code	Flight Code	Flight Heading
3/24/2011	2	1	9:59:00	1	UNK	D	A	A	5	-
3/24/2011	14	1	9:37:00	1	A	D	B	B	2	N
3/31/2011	36	2	15:51:00	1	UNK	S	B	C	2	SE
3/31/2011	36	2	16:19:00	1	UNK	D	C	C	3	SE
3/31/2011	36	2	16:28:00	1	UNK	S	C	D	3	NE
3/31/2011	36	2	16:34:00	1	UNK	D	D	D	3	NE
3/31/2011	37	2	15:32:00	1	UNK	S	B	C	2	SW
3/31/2011	37	2	15:36:00	1	UNK	D	C	C	4	SW
3/31/2011	37	2	15:37:00	1	UNK	D	C	C	5	SW
4/1/2011	16	2	10:39:00	1	A	D	A	A	1	W
4/1/2011	16	2	10:40:00	2	A	D	A	A	1	W
4/1/2011	16	2	10:41:00	3	J	D	A	A	1	W
4/1/2011	17	2	11:22:00	1	A	S	A	C	2	NNW
4/1/2011	17	2	11:22:00	2	A	S	A	C	2	SW
4/1/2011	17	2	11:25:00	1	A	S/H	A	C	0	NNW
4/1/2011	17	2	11:27:00	2	A	S/H	A	C	0	SW
4/1/2011	17	2	11:39:00	1	A	S	A	D	2	NNW
4/1/2011	17	2	11:47:00	1	A	I	D	D	4	NNW
4/1/2011	17	2	11:42:00	2	A	S	A	D	3	SW
4/1/2011	17	2	11:48:00	2	A	D	D	D	3	SW
4/1/2011	17	2	11:49:00	2	A	D	D	D	3	SW
4/1/2011	18	2	12:09:00	2	A	D	C	C	2	W
4/1/2011	18	2	12:12:00	2	A	S	C	D	2	W
4/1/2011	18	2	12:14:00	2	A	D	D	D	2	W

Table 3 – Bald Eagle Fixed Radius Point Count Observation Data Summary

Date	Point Count Location	Site Visit #	Time	# of BAEA	Age Code	Behavior Code	Minimum Height Code	Maximum Height Code	Flight Code	Flight Heading
4/1/2011	18	2	12:13:00	3	A	D	C	D	2	W
4/1/2011	18	2	12:13:00	3	A	S	D	D	2	W
4/1/2011	18	2	12:14:00	3	A	D	D	D	2	W
4/12/2011	4	3	10:50:00	1	A	I/H	A	B	2	SE
4/12/2011	4	3	10:51:00	1	A	I/H	B	B	2	SE
4/12/2011	4	3	10:52:00	1	A	I/H	B	S	2,3	SE
4/12/2011	4	3	10:53:00	1	A	I/H	A	B	3	SE
4/12/2011	4	3	10:54:00	1	A	I/H	B	B	3,4	SE
4/12/2011	4	3	10:55:00	1	A	I/H	B	B	4,5	SE
4/12/2011	4	3	10:56:00	1	A	I/H	B	B	4,5	SE
4/13/2011	18	3	13:22:00	1	A	S/H	B	A	2	NE
4/13/2011	18	3	13:23:00	1	A	S/H	A	A	2	NE
4/13/2011	18	3	13:24:00	1	A	S/H	A	A	2	NE
4/13/2011	18	3	13:25:00	1	A	S/H	A	A	2	NE
4/13/2011	18	3	13:33:00	2	J	S/H	B	B	2	NE
4/13/2011	18	3	13:34:00	2	J	S/H	B	B	2,3	NE
4/13/2011	18	3	13:35:00	2	J	S/H	B	B	2,3	NE
4/16/2011	36	3	9:39:00	1	UNK	H	A	A	2	SSW
4/16/2011	36	3	9:40:00	1	UNK	P	A	A	2	-
4/16/2011	36	3	9:43:00	2	UNK	H/P	A	A	2	SSW
4/16/2011	36	3	9:54:00	1	UNK	H/P	A	A	2	SSW
4/16/2011	36	3	9:58:00	1	UNK	H	A	A	2	SSW
4/16/2011	36	3	10:00:00	1	UNK	P	A	A	2	-
4/16/2011	36	3	10:10:00	1	UNK	P	A	A	2	-
4/16/2011	36	3	10:00:00	2	UNK	P	A	A	2	-

Table 3 – Bald Eagle Fixed Radius Point Count Observation Data Summary

Date	Point Count Location	Site Visit #	Time	# of BAEA	Age Code	Behavior Code	Minimum Height Code	Maximum Height Code	Flight Code	Flight Heading
4/16/2011	36	3	10:10:00	2	UNK	P	A	A	2	-
4/21/2011	15	4	9:39:00	1	A	S	B	D	2	SE
4/21/2011	15	4	9:43:00	1	A	S	B	D	2	SE
4/29/2011	20	4	13:16:00	1	A	S	C	E	4	N
4/29/2011	20	4	13:19:00	1	A	D/H	A	D	4	N
5/12/2011	26	5	14:38:00	1	1	S	A	C	2	ENE
5/12/2011	26	5	14:42:00	1	1	S	A	C	5	ENE
5/13/2011	2	5	9:44:00	1	A	D	B	C	2	-
5/13/2011	2	5	9:45:00	1	A	D	B	C	2	-
5/13/2011	3	5	10:11:00	1	2	S	B	C	2	ENE
5/13/2011	3	5	10:18:00	1	2	S	B	C	2	ENE
5/13/2011	3	5	10:12:00	2	J	D	C	C	2	-
5/13/2011	3	5	10:13:00	2	J	D	C	C	2	-
5/13/2011	6	5	11:56:00	1	J	I	E	E	3	W
5/13/2011	6	5	11:58:00	1	J	D	E	E	3	W
5/13/2011	6	5	11:56:00	2	J	I	E	E	3	SW
5/13/2011	6	5	11:58:00	2	J	I	E	E	4	SW
5/13/2011	9	5	13:13:00	1	J	D	B	B	2	ESE
5/13/2011	9	5	13:14:00	1	J	D	B	B	3	ESE
5/14/2011	17	5	13:04:00	1	J	I	A	A	0	SW
5/14/2011	17	5	13:04:00	1	J	P	A	A	0	-
5/14/2011	17	5	13:11:00	1	J	D/H	A	A	0	SW
5/14/2011	18	5	14:03:00	1	A	S/D	C	C	2	N
5/14/2011	18	5	14:04:00	1	A	D	C	C	2	N
5/14/2011	18	5	14:07:00	2	2	I	C	C	3	W

Table 3 – Bald Eagle Fixed Radius Point Count Observation Data Summary

Date	Point Count Location	Site Visit #	Time	# of BAEA	Age Code	Behavior Code	Minimum Height Code	Maximum Height Code	Flight Code	Flight Heading
5/14/2011	18	5	14:01:00	2	2	I	C	C	3	W
5/26/2011	17	6	14:50:00	1	3	D	A	B	2	W
5/26/2011	17	6	14:50:00	1	3	D	A	B	1	W
5/26/2011	17	6	14:53:00	1	3	D	A	B	2	W
5/26/2011	17	6	15:00:00	1	3	I	A	B	2	W
5/26/2011	17	6	15:02:00	1	3	D	A	B	1	S
5/26/2011	17	6	15:00:00	2	3	S	B	D	3	S
5/26/2011	17	6	15:08:00	2	3	D	C	D	3	S
5/26/2011	17	6	15:00:00	3	J	S	B	C	3	E
5/26/2011	17	6	15:04:00	3	J	D	B	C	3	E
5/26/2011	17	6	15:00:00	4	A	S	C	D	3	NW
5/26/2011	17	6	15:04:00	4	A	S	C	D	3	NW
7/13/2011	29	9	11:46:00	1	J	S	C	C	3	NE
7/13/2011	29	9	11:48:00	1	J	S	C	D	3	NE
7/15/2011	18	9	12:29:00	1	A	S/I	C	D	0	W
7/15/2011	18	9	12:35:00	1	A	D	C	C	0	SE
7/15/2011	18	9	12:38:00	1	A	D	C	C	0	SE
7/19/2011	3	10	12:02:00	1	J	S	B	D	3	SW
7/19/2011	3	10	12:05:00	1	J	S	D	D	4	SW
7/19/2011	6	10	14:15:00	1	1	S	B	B	2	SE
7/19/2011	6	10	14:18:00	1	1	D	C	D	2	SE
7/19/2011	6	10	14:19:00	1	1	S	C	D	3	SE
7/19/2011	6	10	14:21:00	1	1	D	D	D	3	N
7/22/2011	33	10	12:48:00	1	A	I	B	C	2	E
7/22/2011	33	10	12:54:00	1	A	S	B	E	5	E

Table 3 – Bald Eagle Fixed Radius Point Count Observation Data Summary

Date	Point Count Location	Site Visit #	Time	# of BAEA	Age Code	Behavior Code	Minimum Height Code	Maximum Height Code	Flight Code	Flight Heading
7/22/2011	33	10	12:56:00	1	A	S	E	E	5	E
8/10/2011	13	11	14:27:00	1	A	P	A	A	1	-
8/10/2011	13	11	14:30:00	1	A	I	A	A	1	W
8/25/2011	28	12	13:31:00	1	3	S	B	D	3	N
8/25/2011	28	12	13:40:00	1	3	D	D	E	5	N
9/22/2011	18	14	12:15:00	1	2	D	A	E	1	NNE
9/22/2011	18	14	12:21:00	1	2	S	E	E	3	NNE
10/4/2011	12	15	9:00:00	1	J	P	A	A	2	-
10/4/2011	12	15	9:30:00	1	J	P	A	A	2	-
10/23/2011	26	16	11:45:00	1	A	P	A	A	2	-
10/23/2011	26	16	11:54:00	1	A	D/S	A	C	2, 3	N
10/23/2011	26	16	11:58:00	1	A	D/S	C	C	4,5	N
10/31/2011	34	17	13:43:00	1	1	D/S	A	A	0	-
10/31/2011	34	17	13:45:00	1	1	P	A	A	0	-
11/1/2011	4	17	12:06:00	1	A	S	B	C	2	ESE
11/1/2011	4	17	12:10:00	1	A	S	C	C	2	ESE
11/1/2011	4	17	12:11:00	1	A	S	C	C	3	ESE
11/1/2011	4	17	12:14:00	2	2	S	A	A	2	N
11/1/2011	4	17	12:16:00	2	2	S	A	A	2	NNW
11/1/2011	7	17	14:27:00	1	A	I	B	B	3	S
11/1/2011	7	17	14:28:00	1	A	I	B	B	3	NNW
11/1/2011	7	17	14:27:00	2	A	I	B	B	3	S
11/1/2011	7	17	14:28:00	2	A	I	B	B	3	ENE
11/1/2011	40	9	13:44:00	1	A	D	A	A	2	ESE
11/1/2011	40	9	13:45:00	1	A	D	A	B	2	ENE

Table 3 – Bald Eagle Fixed Radius Point Count Observation Data Summary

Date	Point Count Location	Site Visit #	Time	# of BAEA	Age Code	Behavior Code	Minimum Height Code	Maximum Height Code	Flight Code	Flight Heading
11/1/2011	40	9	13:46:00	1	A	D	B	B	3	ENE
11/1/2011	40	9	13:44:00	2	A	D	A	A	2	ESE
11/1/2011	40	9	13:45:00	2	A	D	A	B	2	ESE
11/1/2011	40	9	13:46:00	2	A	D	B	B	2	ESE
11/2/2011	10	17	15:23:00	1	3	S	C	C	3	SW
11/2/2011	10	17	15:24:00	1	3	I	C	C	3	SE
11/2/2011	10	17	15:25:00	1	3	D	C	C	3	SW
11/2/2011	16	17	10:12:00	1	2	D	A	A	2	W
11/2/2011	16	17	10:28:00	2	2	D	A	A	2	W
11/2/2011	17	17	10:47:00	1	2	S	A	A	1	ESE
11/2/2011	17	17	10:47:00	2	3	S	A	A	1	ESE
11/2/2011	17	17	11:00:00	3	2	I	A	A	1	NE
11/2/2011	17	17	11:02:00	1	2	I	A	A	0	ESE
11/2/2011	17	17	10:02:00	2	3	I	A	A	1	ESE
11/2/2011	18	17	11:45:00	1	2	S	A	A	2	WSW
11/2/2011	18	17	11:47:00	2	3	S	A	A	2	WSW
11/2/2011	18	17	11:56:00	1	2	I	A	A	2	N
11/2/2011	18	17	11:56:00	2	3	I	A	B	3	SSE
11/4/2011	27	17	10:36:00	1	2	S	A	B	2	SSW
11/4/2011	27	17	10:36:00	1	2	S	B	B	3	SSW
11/15/2011	6	18	13:49:00	1	3	I	A	A	1	ESE
11/15/2011	6	18	13:53:00	1	3	D	A	A	1	ESE
11/15/2011	6	18	13:54:00	1	3	D	A	A	1	ESE
11/15/2011	6	18	13:53:00	2	A	I	A	A	1	S
11/15/2011	6	18	13:54:00	2	A	D	A	A	1	S

Table 3 – Bald Eagle Fixed Radius Point Count Observation Data Summary

Date	Point Count Location	Site Visit #	Time	# of BAEA	Age Code	Behavior Code	Minimum Height Code	Maximum Height Code	Flight Code	Flight Heading
11/15/2011	7	18	13:02:00	1	2	I	A	A	0	N
11/15/2011	7	18	13:15:00	1	2	D	A	A	1	S
11/16/2011	38	10	12:20:00	1	A	D	A	A	1	WSW
11/16/2011	38	10	12:21:00	1	A	D	A	A	1	WSW
11/16/2011	38	10	12:21:00	2	2	I	A	A	1	WSW
11/16/2011	38	10	12:22:00	2	2	S	A	B	2	S
11/16/2011	38	10	12:25:00	2	2	S	B	B	3	S
12/2/2011	7	19	9:21:00	1	A	I	A	A	1	WSW
12/2/2011	7	19	9:11:00	1	A	I	A	A	1	ESE
12/9/2011	21	19	14:29:00	1	A	I	A	A	2	WSW
12/9/2011	21	19	14:31:00	1	A	I	A	A	2	WSW
12/10/2011	17	19	11:04:00	1	4	I	A	B	2	E
12/10/2011	17	19	11:09:00	1	4	D	B	B	2	WSW
12/10/2011	17	19	11:14:00	1	4	I	A	A	2	SW
12/10/2011	17	19	11:17:00	1	4	I	A	A	2	S
12/10/2011	17	19	11:14:00	2	1	I	A	A	2	S
12/10/2011	17	19	11:17:00	2	1	I	A	A	2	SSW
12/10/2011	17	19	11:14:00	3	A	I	A	A	2	WSW
12/10/2011	17	19	11:17:00	3	A	I	A	A	2	S
12/10/2011	18	19	11:18:00	1	4	I	B	B	2	SW
12/10/2011	18	19	11:25:00	1	4	D	B	B	2	SW
12/10/2011	18	19	11:18:00	2	1	I	B	B	2	SW
12/10/2011	18	19	11:25:00	2	1	D	B	B	2	SW
12/11/2011	8	19	9:42:00	1	A	D	A	B	3	N
12/11/2011	8	19	9:44:00	1	A	D	A	B	3	N

Table 3 – Bald Eagle Fixed Radius Point Count Observation Data Summary

Date	Point Count Location	Site Visit #	Time	# of BAEA	Age Code	Behavior Code	Minimum Height Code	Maximum Height Code	Flight Code	Flight Heading
12/11/2011	8	19	9:42:00	2	UNK	D	A	B	3	N
12/11/2011	8	19	9:44:00	2	A	D	A	B	3	N
12/11/2011	24	19	12:06:00	1	A	D	A	B	2	NE
12/11/2011	24	19	12:09:00	1	A	S	B	D	3	NE
12/11/2011	24	19	12:12:00	1	A	D	D	D	3	S
12/11/2011	24	19	12:13:00	1	A	D	D	D	3	SE
12/11/2011	24	19	12:14:00	1	A	D	D	D	4	-
12/11/2011	24	19	12:06:00	2	4	D	B	C	2	NE
12/11/2011	24	19	12:09:00	2	4	D	C	C	2	NE
1/10/2012	5	21	15:10:00	1	4	I	B	B	2	ENE
1/10/2012	5	21	15:13:00	1	4	I	B	B	3	NNW
1/10/2012	40	13	12:39:00	1	A	I	C	C	3	ESE
1/10/2012	40	13	12:41:00	1	A	I	C	C	3	NNW
1/10/2012	40	13	12:39:00	2	A	I	B	B	3	ESE
1/10/2012	40	13	12:41:00	2	A	I	B	B	3	WNW
1/11/2012	14	21	9:11:00	1	1	D	A	A	2	N
1/23/2012	7	22	12:03:00	1	A	D	A	A	3	SSE
1/23/2012	7	22	12:04:00	1	A	D	A	A	3	ESE
1/25/2012	18	22	11:21:00	1	2	D	B	B	2	S
1/25/2012	18	22	11:22:00	1	2	D	B	B	3	S
1/25/2012	18	22	11:21:00	2	2	I	B	B	2	S
1/25/2012	18	22	11:22:00	2	2	D	B	B	2	S
1/27/2012	20	22	11:16:00	1	A	I	A	A	2	E
2/8/2012	39	15	10:09:00	1	J	S	B	C	3	SSW
2/8/2012	39	15	10:13:00	1	J	D	C	C	3	E

Table 3 – Bald Eagle Fixed Radius Point Count Observation Data Summary

Date	Point Count Location	Site Visit #	Time	# of BAEA	Age Code	Behavior Code	Minimum Height Code	Maximum Height Code	Flight Code	Flight Heading
2/8/2012	39	15	12:16:00	1	J	D	C	C	3	E
2/21/2012	38	16	11:11:00	1	1	I	B	B	2	E
2/21/2012	38	16	11:13:00	1	1	I	B	B	3	NE
2/22/2012	17	24	11:03:00	1	J	D	A	A	3	SW
2/24/2012	33	24	10:53:00	1	A	D	A	A	2	S
2/24/2012	33	24	10:55:00	1	A	D	A	A	2	S
2/24/2012	35	24	12:13:00	1	A	D	A	A	2	SSW
2/24/2012	35	24	12:12:00	1	A	D	A	A	2	SSW
2/24/2012	35	24	12:13:00	2	A	D	A	A	2	NNE
2/24/2012	35	24	12:12:00	2	A	D	A	A	2	NNE
3/6/2012	14	25	9:13:00	1	A	I	B	B	2	E
3/6/2012	38	17	11:59:00	1	A	D	B	B	2	SSW
3/6/2012	38	17	12:01:00	1	A	D	B	B	2	SSW
3/7/2012	37	25	9:46:00	1	A	I	A	A	3	S
3/7/2012	37	25	9:52:00	1	A	I	A	A	4	W
3/20/2012	16	26	14:06:00	1	2	I	A	A	2	NW
3/20/2012	17	26	14:26:00	1	2	S	C	C	3	E
3/20/2012	17	26	14:29:00	1	2	D	C	C	3	E
3/20/2012	17	26	14:30:00	1	2	D	C	C	3	W
3/20/2012	17	26	14:31:00	1	2	H	A	B	3	W
3/20/2012	17	26	14:33:00	1	2	H	A	A	3	W
3/20/2012	18	26	15:26:00	1	2	I	A	A	2	W
3/21/2012	36	26	10:22:00	1	A	P	A	A	3	-
3/21/2012	36	26	10:31:00	1	A	D	A	A	2	E
3/21/2012	36	26	10:32:00	1	A	I	A	A	1	W

Table 3 – Bald Eagle Fixed Radius Point Count Observation Data Summary

Date	Point Count Location	Site Visit #	Time	# of BAEA	Age Code	Behavior Code	Minimum Height Code	Maximum Height Code	Flight Code	Flight Heading
3/21/2012	36	26	10:34:00	1	A	I	A	A	1	N
3/21/2012	36	26	10:32:00	2	A	D	A	A	2	W
3/21/2012	36	26	10:34:00	2	A	D	A	A	3	W

Table 4 - Bald Eagle Fixed Radius Point Count Surveys by Location

Bald Eagle Point Count Location	Bald Eagle Minutes by Point Count Location	Bald Eagle Exposure Rate by Point Count Location	Bald Eagle Point Count Location	Bald Eagle Minutes By Point Count Location	Bald Eagle Exposure Rate by Point Count Location
1	0	0.0000	21	2	0.0026
2	3	0.0038	22	0	0.0000
3	6	0.0077	23	0	0.0000
4	12	0.0154	24	7	0.0090
5	2	0.0026	25	0	0.0000
6	13	0.0167	26	5	0.0064
7	10	0.0128	27	2	0.0026
8	4	0.0051	28	2	0.0026
9	2	0.0026	29	2	0.0026
10	3	0.0038	30	0	0.0000
11	0	0.0000	31	0	0.0000
12	2	0.0026	32	0	0.0000
13	2	0.0026	33	5	0.0064
14	3	0.0038	34	2	0.0026
15	2	0.0026	35	4	0.0051
16	6	0.0077	36	19	0.0244
17	42	0.0538	37	5	0.0064
18	34	0.0436	38	9	0.0167
19	0	0.0000	39	3	0.0056
20	3	0.0038	40	10	0.0185
Total Bald Eagle Minutes				**226**	**N/A**

Table 5 – Bald Eagle Point Count Survey Flight Heights Summary

Flight Height Category	Total Bald Eagle Minutes	% Bald Eagle Minutes	Bald Eagle Exposure Rate within RSZ
A	82	36.28%	N/A
B - D (RSZ)	138	61.06%	0.0045
E	6	2.66%	N/A
Total	**226**	**100%**	**0.0045**

% = Bald Eagle Minutes within Flight Height Category/Total Bald Eagle Minutes X 100

Table 6 – Bald Eagle Minutes and Exposure Rates within the RSZ by Location

Bald Eagle Point Count Location	Total Observation Minutes	Bald Eagle Minutes	Bald Eagle Exposure	Bald Eagle Point Count Location	Total Observation Minutes	Bald Eagle Minutes	Bald Eagle Exposure
1	780	0	0.0000	21	780	0	0.0000
2	780	2	0.0026	22	780	0	0.0000
3	780	6	0.0077	23	780	0	0.0000
4	780	10	0.0128	24	780	7	0.0090
5	780	2	0.0026	25	780	0	0.0000
6	780	4	0.0051	26	780	4	0.0051
7	780	4	0.0051	27	780	2	0.0026
8	780	8	0.0103	28	780	2	0.0026
9	780	2	0.0026	29	780	2	0.0026
10	780	3	0.0038	30	780	0	0.0000
11	780	0	0.0000	31	780	0	0.0000
12	780	0	0.0000	32	780	0	0.0000
13	780	0	0.0000	33	780	2	0.0026
14	780	2	0.0026	34	780	0	0.0000
15	780	2	0.0026	35	780	0	0.0000
16	780	0	0.0000	36	780	4	0.0051
17	780	24	0.0308	37	780	2	0.0026
18	780	25	0.0321	38	540	6	0.0111
19	780	0	0.0000	39	540	3	0.0056
20	780	2	0.0026	40	540	8	0.0148
				Total	**30,480**	**138**	**N/A**

Table 7 – Bald Eagle Point Count Survey Summary by Visit

Bald Eagle Point Count Survey Period	Bald Eagle Point Count Survey Period Date Range	Bald Eagle Minutes within RSZ	Bald Eagle Exposure Rate for RSZ
March Visit #1	3/24/11 - 3/25/11	1	0.0009
March Visit #2	3/31/11 - 4/8/11	22	0.0198
April Visit #1	4/12/11 - 4/16/11	11	0.0099
April Visit #2	4/20/11 - 4/29/11	4	0.0036
May Visit #1	5/12/11 - 5/15/11	14	0.0126
May Visit #2	5/25/11 - 5/31/11	11	0.0099
June Visit #1	6/7/11 - 6/10/11	0	0.0000
June Visit #2	6/27/11 - 6/30/11	0	0.0000
July Visit #1	7/6/11 - 7/15/11	9	0.0075
July Visit #2	7/19/11-7/22/11	10	0.0083
August Visit #1	8/8/11 - 8/11/11	0	0.0000
August Visit #2	8/22/11 - 8/25/11	2	0.0017
September Visit #1	9/8/11 - 9/16/11	4	0.0033
September Visit #2	9/20/11 - 9/30/11	1	0.0008
October Visit #1	10/2/11 - 10/10/11	3	0.0025
October Visit #2	10/19/11 - 10/25/11	4	0.0033
November Visit #1	10/31/11 - 11/4/11	15	0.0125
November Visit #2	11/14/11 - 11/17/11	0	0.0000
December Visit #1	12/2/11 - 12/11/11	17	0.0142
December Visit #2	12/19/11 - 12/22/11	0	0.0000
January Visit #1	1/10/12 - 1/13/12	2	0.0017
January Visit #2	1/23/12 - 1/27/12	3	0.0025
February Visit #1	2/6/12 - 2/9/12	0	0.0000
February Visit #2	2/20/12 - 2/24/12	0	0.0000
March Visit #1	3/5/12 - 3/9/12	1	0.0008
March Visit #2	3/19/12 - 3/22/12	4	0.0033
	Total	**138**	**N/A**

Table 8 – Diurnal Raptor/Bird Migration Survey Bald Eagle Observations

Date	Diurnal Site Location	Species	# (number in flock or Kettle)	Time	Age (UNK=unknown, A=Adult, J=Juvenile)	Observed Height (1=0-40m, 2=40-180m, 3=>180m)	Flight Heading
3/17/2011	1	Bald Eagle	1	14:11	UNK	2	E
4/6/2011	1	Bald Eagle	1	12:03	A	2	W
4/10/2011	1	Bald Eagle	1	12:22	A	1	NW
4/15/2011	1	Bald Eagle	1	13:26	J	1	E
4/27/2011	1	Bald Eagle	1	15:22	A	2	W
9/1/2011	1	Bald Eagle	1	12:54	J	2	W
9/3/2011	2	Bald Eagle	1	13:10	J	2,3	SE
9/29/2011	1	Bald Eagle	1	12:18	A	2	SE
10/1/2011	2	Bald Eagle	1	12:35	J	2	SE
10/6/2011	1	Bald Eagle	1	13:58	A	2	NE
10/11/2011	2	Bald Eagle	1	12:40	J	2	E
10/13/2011	2	Bald Eagle	1	14:29	UNK	2	ENE
10/22/2011	1	Bald Eagle	1	11:01	J	2,3	S
10/22/2011	2	Bald Eagle	1	13:29	J	1	NE

Table 9 - Bald Eagle Encounter Rate for the Diurnal Raptor/Bird Migration Surveys

Diurnal Migration Survey (Period Ending Date)	Number of Bald Eagle Observations	Hours of Survey	Encounter Rate
3/31/11	1	63	0.016
4/15/11	3	42	0.071
4/30/11	1	42	0.024
9/15/11	2	63	0.032
9/30/11	1	35	0.029
10/15/11	4	49	0.081
10/31/11	2	42	0.048
Total	**14**	**336**	**0.042**

Table 10 – Bald Eagle Fixed Radius Point Count Location Characteristics

Location #	Location Characteristics	Top of Topographic Slope	Within 50m of a crest or cliff edge	Ridge Saddle	Near riparian corridor, forest or wetland edge large water body	Near fishery or waterfowl habitat	Near prairie dog or ground squirrel colony	Near rabbit or hare cover	Near Livestock	Near carrion or dumps	Near likely perch or roost sites	Near Territory Boundary
1	Agricultural fields comprised of soy beans and hay with a small woodlot in the surrounding area and adjacent to a railroad line to the East.											
2	Primarily agricultural soy bean fields set atop of rolling hills with a clear line of sight East, South and West to Bald Eagle nest #1 in the distance, and a small cemetery with a grassy area and woodlot to the North.				X						X	X
3	Entire area is comprised of undeveloped fallow fields that are adjacent to a quarry and railroad line to the South with good visibility.											
4	Agricultural fields comprised of soy beans, corn, hay and fallow with a small plot of residential and recreational land.											
5	Grasslands and pasture fields to the north along a small drainage ditch extending North to South and residential properties to the South with agricultural corn fields behind them.				X						X	
6	Agricultural fields comprised of soy beans with a direct line of sight (>3 mi) and scattered peach trees.											
7	Agricultural fields comprised of soy bean and corn with a stream extending North to South and East to West with small woodlots in surrounding areas. Line of sight approximately 2 mi.											

Table 10 – Bald Eagle Fixed Radius Point Count Location Characteristics

Location #	Location Characteristics	Top of Topographic Slope	Within 50m of a crest or cliff edge	Ridge Saddle	Near riparian corridor, forest or wetland edge large water body	Near fishery or waterfowl habitat	Near prairie dog or ground squirrel colony	Near rabbit or hare cover	Near Livestock	Near carrion or dumps	Near likely perch or roost sites	Near Territory Boundary
8	Agricultural fields comprised of soybeans, corn and fallow with grassland to the East along a stream channel. Line of sight approximately 3 mi.											
9	Agricultural fields comprised of soy beans, corn and hay with two streams nearby and mature woodlots. Line of sight approximately 3 mi.											
10	Agricultural fields with a small wetland to the Northwest and a row of trees and large woodlot to the East. Line of sight approximately 1 mi. West and less than 1 mi East.				X					X	X	
11	Agricultural fields comprised of corn and fallow to the west with a small woodlot and windbreaks nearby.											
12	Agricultural fields of corn to the North and West, and CRP grassland to the East with large mature deciduous woodlot and windbreak. Line of sight <1mi.				X							
13	Agricultural fields comprised of soy bean, corn and pumpkin with two windbreak rows of trees with peach tree present.											
14	A valley within the Erie Metropark limits along the Huron river.	X	X	X	X	X			X	X	X	X
15	A forested ridgeline within the Milan Wildlife Area adjacent to an agricultural corn field and within 0.5km of Bald Eagle nest #4. Line of sight <1mi.	X	X	X	X	X			X	X	X	X
16	A forested valley with high walls along the Huron river, within the Milan Wildlife Area.	X	X	X	X	X			X	X	X	X

Table 10 – Bald Eagle Fixed Radius Point Count Location Characteristics

Location #	Location Characteristics	Top of Topographic Slope	Within 50m of a crest or cliff edge	Ridge Saddle	Near riparian corridor, forest or wetland edge large water body	Near fishery or waterfowl habitat	Near prairie dog or ground squirrel colony	Near rabbit or hare cover	Near Livestock	Near carrion or dumps	Near likely perch or roost sites	Near Territory Boundary
17	Agricultural fields comprised of alfalfa and soy beans with a ridgeline to the Huron River Valley. Line of sight >2mi.	X	X	X	X	X				X	X	
18	Agricultural fields and woods along Huron River Valley.	X	X	X	X	X				X	X	X
19	Agricultural fields and ODNR Bellevue reservoir #5.					X				X	X	
20	A Riparian corridor along a stream and grassland, near Bald Eagle nest #5.				X	X				X	X	X
21	Agricultural fields comprised of soy beans, adjacent to a cemetery and wooded corridor with a stream.				X						X	
22	Agricultural fields comprised of corn and soybeans with a stream and woodlot to the East.				X						X	
23	Agricultural fields comprised of soy bean and corn adjacent to residential housing and a mature hardwood forest with large creek and small cemetery.				X						X	
24	Agricultural fields comprised of corn soy bean, and fallow with mature hardwood tree stands and farmhouses.											
25	Agriculture soy bean fields with sparse mature hardwood trees and farmhouses.											
26	Agricultural fields comprised of soy bean and corn with sparse immature hardwood trees and farmhouses.											
27	Agricultural fields comprised of soy bean and corn with a large riparian creek extending N to S with mature mixed hardwood trees and a large hardwood tree stand.				X						X	

Table 10 – Bald Eagle Fixed Radius Point Count Location Characteristics

Location #	Location Characteristics	Top of Topographic Slope	Within 50m of a crest or cliff edge	Ridge Saddle	Near riparian corridor, forest or wetland edge large water body	Near fishery or waterfowl habitat	Near prairie dog or ground squirrel colony	Near rabbit or hare cover	Near Livestock	Near carrion or dumps	Near likely perch or roost sites	Near Territory Boundary
28	Agricultural fields comprised of soy bean and corn with farmhouses and a large stand of mature hardwood trees.				X							
29	Agricultural fields comprised of corn and soy beans with a large mature mixed hardwood tree stand and creek.				X							
30	Agricultural fields comprised of corn and soybeans with a large mature hardwood forest.											
31	An agricultural corn field to the North and native grassland with a mixed hardwood forest and a wetland area as part of a nature preserve South.											
32	Agricultural fields comprised of corn and soybeans adjacent to a mature conifer and hardwood tree stand with a small creek.											
33	Agricultural fields comprised of corn and soy bean adjacent to a mature riparian hardwood forest along a small creek.											
34	Agricultural fields comprised of soy beans, corn and fallow adjacent to a large hardwood forest.											
35	Agricultural fields comprised of corn and fallow adjacent to a mature hardwood tree stand.				X						X	
36	Agricultural fields comprised of corn and soybeans with a mature hardwood tree stand.											
37	Agricultural fields comprised of corn, soybean and fallow adjacent to residential housing with mature hardwood trees.											

Table 10 – Bald Eagle Fixed Radius Point Count Location Characteristics

Location #	Location Characteristics	Top of Topographic Slope	Within 50m of a crest or cliff edge	Ridge Saddle	Near riparian corridor, forest or wetland edge large water body	Near fishery or waterfowl habitat	Near prairie dog or ground squirrel colony	Near rabbit or hare cover	Near Livestock	Near carrion or dumps	Near likely perch or roost sites	Near Territory Boundary
38	Agricultural fields comprised of soybean and fallow, adjacent to a large hardwood forest and an interstate highway.											
39	Agricultural fields comprised of corn and soy bean, adjacent to a mature hardwood forest.											
40	A small agricultural corn field surrounded by urban development and major roadways.											

Appendix A

CORRESPONDENCE
&
AUTHORIZATION LETTERS

Division of Wildlife
James A. Marshall, Acting Chief
2045 Morse Rd., Bldg. G
Columbus, OH 43229-6693
Phone: (614) 265-6300

September 30, 2010

To all interested parties,

Based upon the revised project boundary map received on 29 September 2010 and site visit conducted on 7 November 2008, the Ohio Department of Natural Resources Division of Wildlife (DOW) has prepared these survey recommendations for JW Great Lake's proposed wind energy project located in Huron and Erie Counties. The DOW has determined that this proposed facility would be classified as a "moderate" effort site under the current monitoring protocols based upon the location and land-use practices (Fig. 1).

The table below was created based upon the project maps provided and summarizes the types and level of effort recommended by the DOW. Results from these studies will help the Department of Natural Resources assess the potential impact these turbines may pose, and influence our recommendations to the Ohio Power Siting Board. Monitoring should follow those criteria listed within the "On-shore Bird and Bat Pre-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio."

For additional ODNR comments, including information on the potential presence of threatened and endangered species within or adjacent to your project area, please contact Brian Mitch at (614) 265-6378 or brian.mitch@dnr.state.oh.us

	Project
Survey type	JWGL Firelands
Breeding bird	Breeding bird surveys should be conducted at all sites. The number of survey points may be based on the amount of available habitat, or twice the maximum number of turbines proposed for the site. Because agricultural land is not considered to be suitable nesting habitat for most species of bird, turbines placed within these types of habitat are exempt of this recommendation.
Raptor nest searches	Nest searches should occur on, and within a 1-mile buffer of the proposed facility.
Raptor nest monitoring	There is at least one nest for a protected species of raptor, a bald eagle nest, on or within 2-miles of the project area. This nest should be monitored in order to

	establish patterns of activity. This information will be used to recommend micro-siting of turbines in such a manner to reduce the likelihood of impacting this state and federally protected species. Any additional discovered during the raptor nest searches should also be monitored.
Bat acoustic monitoring	Monitoring should be conducted at all meteorological towers. As a signatory to the Cooperative Agreement, JWGL may opt not to conduct acoustic monitoring at this site. In exchange, JWGL agrees to not operate turbines when wind speeds are ≤4 m/s (as measured within the rotor swept area) from dusk to dawn, 1 July to 31 October for the life of the facility in order to minimize the likelihood of impacts to bats.
Passerine migration (# of survey points)	Waived
Diurnal bird/raptor migration (# of survey point)	1
Sandhill crane migration (same points as raptor migration)	N/S
Owl playback survey points	N/S
Barn owl surveys	N/S
Bat mist-netting (# of survey points)	5
Nocturnal marsh bird survey points	N/S
Waterfowl survey points	N/S
Shorebird migration points	N/S
Radar monitoring locations	N/S

NS = Not required based on the lack of suitable habitat.

If you have any questions, please feel free to contact me.

Keith Lott, Wind Energy Wildlife Biologist

Old Woman Creek Nat'l Estuarine Research Reserve and State Nature Preserve
Ohio Division of Wildlife
2514 Cleveland Road East
Huron, OH 44839
Office phone: 419-433-4601
Cell: 419-602-3141
Fax: 419-433-2851

cc: Mr. Stuart Siegfried, Ohio Power Siting Board
Ms. Megan Seymour, United States Fish and Wildlife Service

Figure 1.

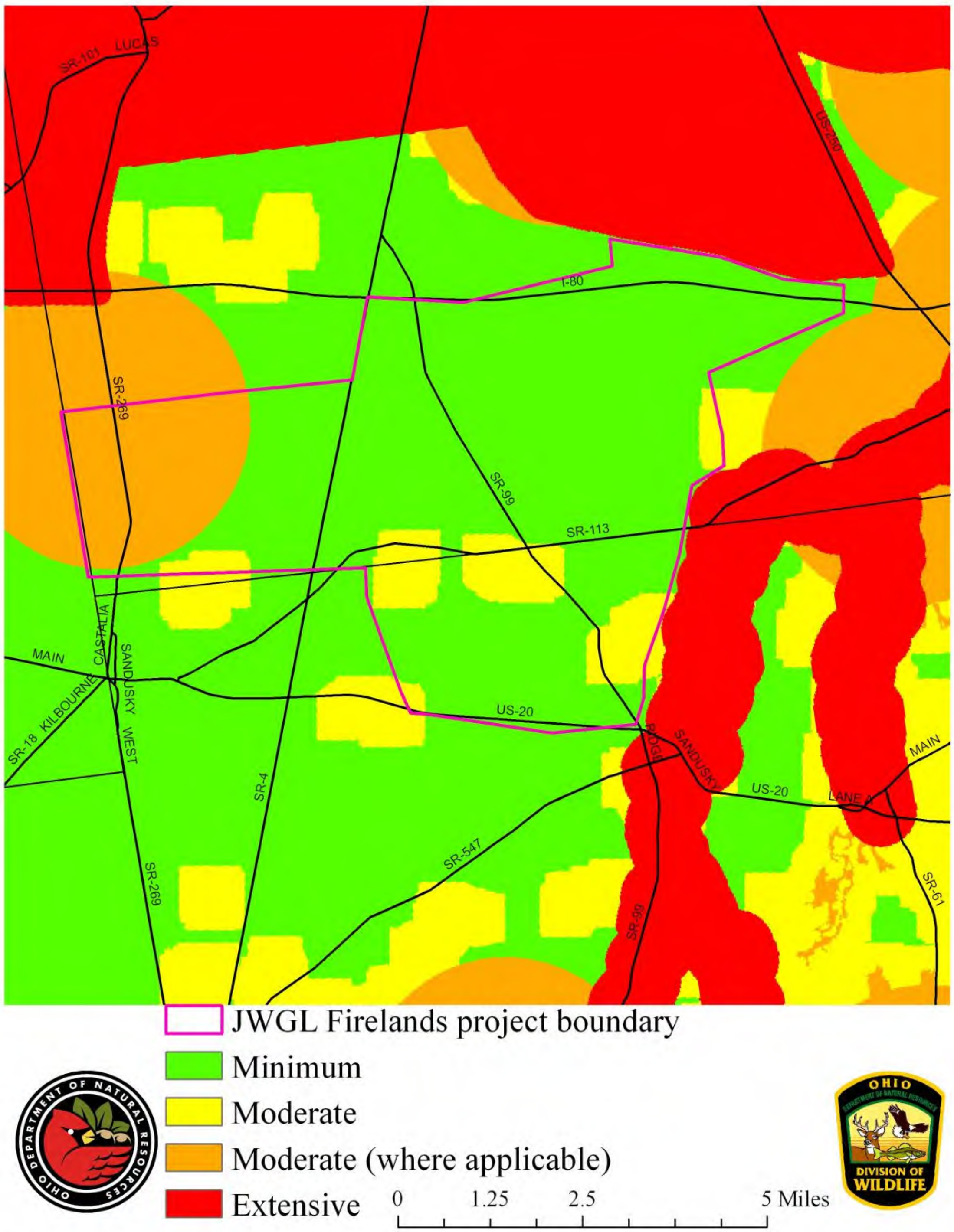

SR-101
LUCAS
US-250
I-80
SR-269
SR-99
SR-113
MAIN
CASTALIA
SANDUSKY
SR-18
KILBOURNE
WEST
US-20
SR-4
SR-547
SANDUSKY
MAIN
LANE
SR-61
SR-99
SR-269
JWGL Firelands project boundary
Minimum
Moderate
Moderate (where applicable)
Extensive
0
1.25
2.5
5 Miles
DIVISION OF WILDLIFE

Figure 2.


SR-101
LUCAS
US-250
I-80
SR-269
SR-99
SR-113
CASTALIA
MAIN
SANDUSKY
WEST
SR-4
US-20
RIDGE
SANDUSKY
US-20
SR-269
SR-547
SR-99
JWGL Firelands project boundary
Forest cover
0
1
2
4 Miles

Ohio Division of Wildlife

Vicki J. Mountz, Acting Chief
2045 Morse Rd., Bldg. G
Columbus, OH 43229-6693
Phone: (614) 265-6300

April 16, 2011

To all interested parties,

Based upon the project boundary map received on April 7, 2011 the Ohio Department of Natural Resources Division of Wildlife (DOW) has prepared these survey recommendations for juwi Wind's proposed Lyme project located in Sandusky, Huron, and Seneca counties.

Currently the project falls within regions of the state that DOW has identified as needing moderate monitoring efforts. Recommendations are based on a GIS analysis of the site and may be reevaluated after a site visit. Additionally, if the developer decides to amend the current boundaries, the DOW will revise our survey recommendations.

The table below was created based upon a review of the project maps provided and summarizes the types and level of effort recommended by the DOW. Please note that these survey recommendations are in addition to those recommended for juwi Wind's adjacent Fireland's project provided on September 30, 2010.

Results from these studies will help the Department of Natural Resources assess the potential impact these turbines may pose, and influence our recommendations to the Ohio Power Siting Board. Monitoring should follow those criteria listed within the "On-shore Bird and Bat Pre-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio."

For additional ODNR comments, including information on the potential presence of threatened and endangered species within or adjacent to your project area, please contact Brian Mitch at (614) 265-6378 or brian.mitch@dnr.state.oh.us

	Project
Survey type	
Breeding bird	Breeding bird surveys should be conducted at all sites. The number of survey points may be based on the amount of available habitat, or twice the maximum number of turbines proposed for the site. Because agricultural land is not considered to be suitable nesting habitat for most species of bird, turbines placed within these types of habitat are exempt of this recommendation.
Raptor nest searches	Nest searches should occur on, and within a 1-mile buffer of the proposed facility.

Raptor nest monitoring	There is 1 eagle nest located on or within the 2 miles of the proposed project. The pair within the 2 mile radius should be monitored to assess their daily movement patterns. Should any additional nests of a protected species of raptor be located during nest searches, monitoring should commence as outlined within the on-shore protocols.
Bat acoustic monitoring	To be conducted at all meteorological towers.
Passerine migration (# of survey points)	Waived
Diurnal bird/raptor migration (# of survey point)	1
Sandhill crane migration (same points as raptor migration)	NS
Owl playback survey points	NS
Barn owl surveys	NS
Bat mist-netting (# of survey points)	6
Nocturnal marsh bird survey points	NS
Waterfowl survey points	NS
Shorebird migration points	NS
Radar monitoring locations	NS

NS = Not required based on the lack of suitable habitat.

If you have any questions, please feel free to contact me.

Jennifer Norris, Wind Energy Wildlife Biologist
Olentangy Wildlife Research Station
Ohio Division of Wildlife
8589 Horseshoe Road
Ashley, OH 43003
Office phone: 740-747-2525 x 26
Cell: 419-602-3141
Fax: 740-747-2278

cc: Mr. Stuart Siegfried, Ohio Power Siting Board
Ms. Megan Seymour, United States Fish and Wildlife Service
Mr. Brian Mitch, Ohio Department of Natural Resources

Figure 1. Survey effort map with the boundary for juwi Wind's proposed Lyme project.

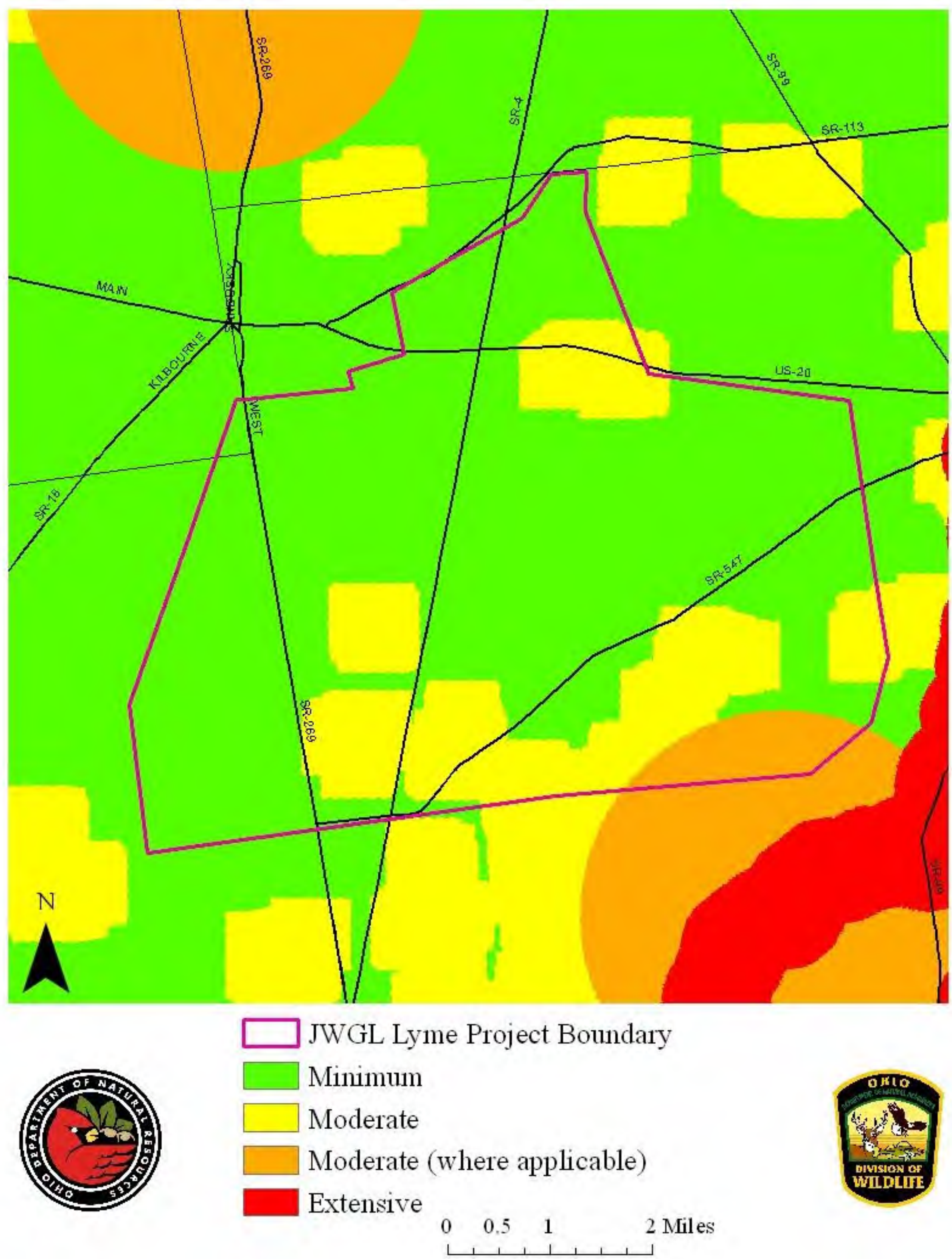
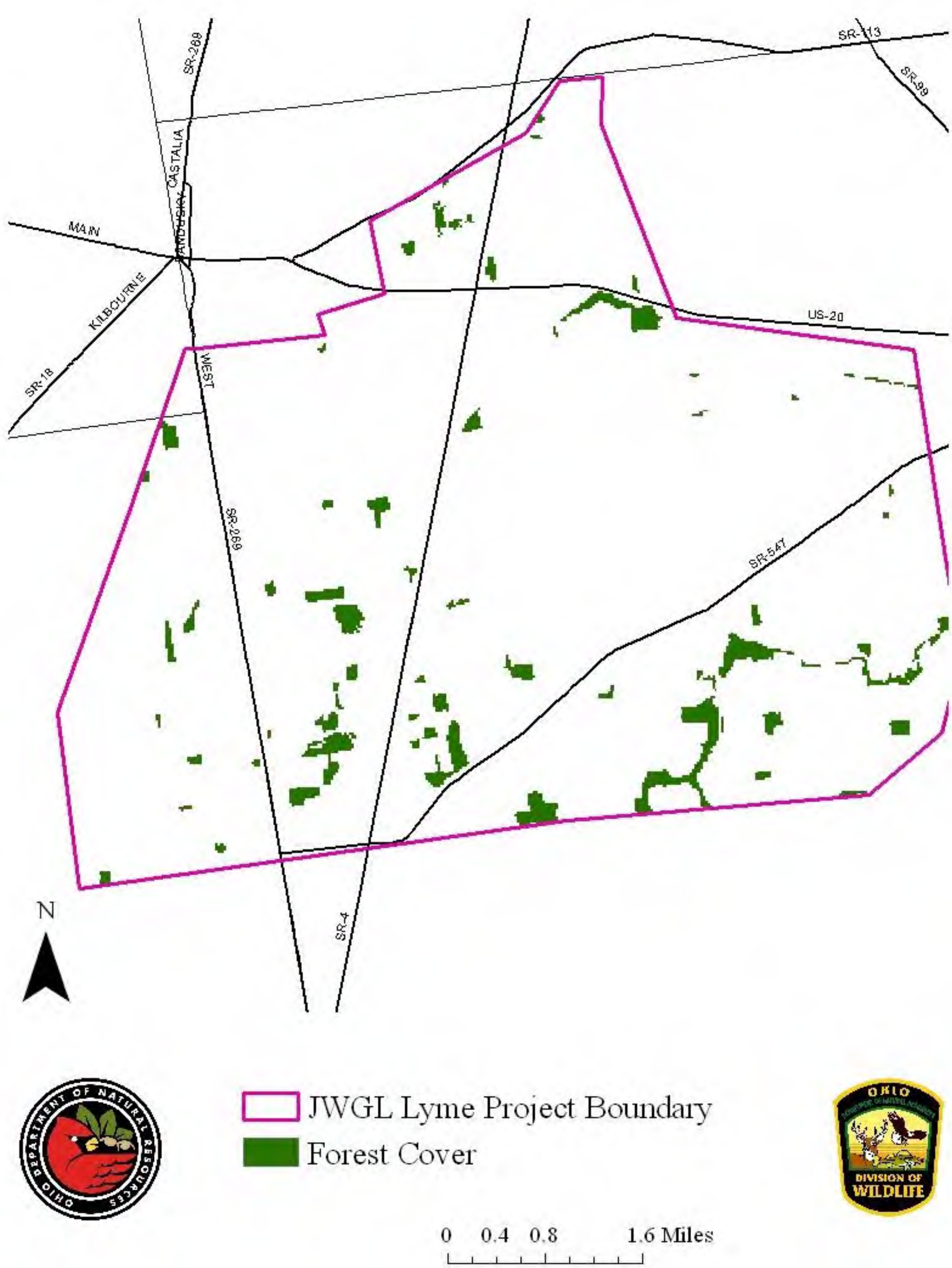


Figure 2. Forest cover with the boundary for juwi Wind's proposed Lyme project.



McIlvain, Douglas

From: Melanie_Cota@fws.gov
Sent: Tuesday, April 19, 2011 2:14 PM
To: McIlvain, Douglas; Krivos, Matthew C.; Myers, Paul
Cc: Norris, Jennifer; matthew_stuber@fws.gov
Subject: Re: Eagle Nest and Point Count Locations

Thanks Doug. I am in the process of finishing up a letter for the Firelands and Lyme project since it looks like FWS has not provided initial recommendations for either project. We calculated the inter nest distance for these projects and it looks like there are 29 bald eagle nests within 10 miles of the projects however, the inter nest distance came out to be 2 miles (which fits nicely with ODNR recommendations!). So only nests within 2 miles of the projects that would need nest monitoring according to the draft ECP guidelines would include the 1 nest within the Firelands project boundary (NW corner) and the 1 nest located approximately 1.3 miles south of the Lyme project on the eastern side of the project boundary. The nest is located just south of Pontiac Section Line Rd and west of SR 99. I will include a map in my letter for your reference. The other nests to the east of the Firelands project are now located outside the 2 mile radius (inter nest distance). We still recommend following Appendix C of the Draft ECP guidelines to include fixed point counts within the project areas and an assessment of eagle concentration areas but we can discuss more on the call tomorrow.

Thanks! ~MC

Melanie Cota
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
4625 Morse Road, Suite 104
Columbus, OH 43230
614-416-8993 Ext. 15
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http://fws.gov/midwest/ohio

Working with others to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.

"McIlvain, Douglas" <Douglas.McIlvain@tetratech.com>

"McIlvain, Douglas" <Douglas.McIlvain@tetratech.com>

04/19/2011 01:27 PM

To "Norris, Jennifer" <Jennifer.Norris@dnr.state.oh.us>, "Melanie_Cota@fws.gov" <Melanie_Cota@fws.gov>

cc

Subject Eagle Nest and Point Count Locations

Jennifer & Melanie,

It is my understanding that the State of Ohio will not provide the exact coordinates for the known eagle nests. So in preparation for our call tomorrow, I will be forwarding you our map showing the eagle nests we have identified and are currently monitoring along with our eagle point count locations. We are in the process of confirming that we have updated all the locations, and will get you the figure probably tomorrow morning. We were able to identify and confirm the two nests along the Huron River that we had previously not been able to access. Hopefully, you can review our map with your information to let us know if we have missed any nests.

Thank you,
Douglas J. McIlvain, CHMM
Senior Project Manager

douglas.mcilvain@tetratech.com | www.tetratech.com

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United States Department of the Interior

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COPY FOR YOUR INFORMATION

April 27, 2011

TAILS : 31420-2011-TA- 0625

Matt Krivos
JUWI Wind, LLC
629 Euclid Ave, Suite 635
Cleveland, OH 44114

Re: Firelands and Phase 2 Lyme Wind Power Projects in Erie, Sandusky, Huron and Seneca Counties

Dear Mr. Krivos:

This letter is in response to the revised Firelands and newly proposed Phase 2 Lyme wind power project in Erie, Sandusky, Huron and Seneca Counties, Ohio. The project areas appear to be a mix of agricultural land with scattered forested areas throughout. The project areas are within ½ mile- 1 mile west of the Huron River. The Firelands project northeast boundary abuts the Lake Erie Western Important Bird Area (IBA). The Firelands project is located approximately 1.5 miles west of the Milan State Wildlife Area. We understand the Firelands and Phase 2 Lyme project is proposed for approximately 100 MW each, including between 100-120 turbines. According to a letter from the Ohio Department of Natural Resources (ODNR) dated September 30, 2010, the Division of Wildlife (DOW) has determined that the Firelands project would be classified as a "moderate" site under the current monitoring protocols based upon the location and land-use practices. In addition, a letter from the ODNR dated April 16, 2011; the DOW has determined the Lyme project would also be classified as "moderate" site.

The following comments are being provided pursuant to the Endangered Species Act (ESA), Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, and Fish and Wildlife Act of 1956. This information is being provided to assist you in making an informed decision regarding wildlife issues, site selection, project design, and compliance with applicable laws. The Service has been working closely with ODNR DOW to develop recommended survey protocols and site evaluations that will satisfy both state and federal wildlife statutes, and this letter describes these measures, in part. The protocols, "On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio" are available on ODNR's website at:
http://www.dnr.state.oh.us/Home/wild_resourcessubhomepage/ResearchandSurveys/WildlifeWind/tabid/21467/Default.aspx
We encourage and appreciate your early coordination with both ourselves and ODNR, and recommend continued collaboration on this project to ensure wildlife issues are fully and appropriately addressed.

The Service supports the development of wind power as an alternative energy source, however, wind farms can have negative impacts on wildlife and their habitats if not sited and designed with potential wildlife and habitat impacts in mind. Selection of the best sites for turbine placement is enhanced by ruling out sites with known, high concentrations of birds and/or bats passing within the rotor-swept area of the turbines or where the effects of habitat fragmentation will be detrimental. In support of wind power generation as a wildlife-friendly, renewable source of power, development sites with comparatively low bird, bat and other wildlife values, would be preferable and would have relatively lower impacts on wildlife.

WATER RESOURCE COMMENTS:

The Service recommends that impacts to streams and wetlands be avoided, and buffers surrounding these systems be preserved. Streams and wetlands provide valuable habitat for fish and wildlife resources, and the filtering capacity of wetlands helps to improve water quality. Naturally vegetated buffers surrounding these systems are also important in preserving their wildlife-habitat and water quality-enhancement properties. Furthermore, forested riparian systems (wooded areas adjacent to streams) provide important stopover habitat for birds migrating through the region. The proposed activities do not constitute a water-dependent activity, as described in the Section 404(b)(1) guidelines, 40 CFR 230.10. Therefore, practicable alternatives that do not impact aquatic sites are presumed to be available, unless clearly demonstrated otherwise. Therefore, before applying for a Section 404 permit, the client should closely evaluate all project alternatives that do not affect streams or wetlands, and if possible, select an alternative that avoids impacts to the aquatic resource. If water resources will be impacted, the Buffalo District of the U.S. Army Corps of Engineers should be contacted for possible need of a Section 404 permit.

ENDANGERED SPECIES COMMENTS:

Because of the potential for wind power projects to impact endangered bird, bat, or other listed species, they are subject to the Endangered Species Act (16 U.S.C. 1531-1544) section 9 provisions governing "take", similar to any other development project. Take incidental to a lawful activity may be authorized through the initiation of formal consultation if a Federal agency is involved; or if a Federal agency, Federal funding, or a Federal permit are not involved in the project, an incidental take permit pursuant to section 10(a)(1)(B) of the ESA may be obtained upon completion of a satisfactory habitat conservation plan for the listed species. However, there is no mechanism for authorizing incidental take "after-the-fact."

The proposed project lies within the range of the **Indiana bat** (*Myotis sodalis*), a federally listed endangered species. Since first listed as endangered in 1967, their population has declined by nearly 60%. Several factors have contributed to the decline of the Indiana bat, including the loss and degradation of suitable hibernacula, human disturbance during hibernation, pesticides, and the loss and degradation of forested habitat, particularly stands of large, mature trees. Fragmentation of forest habitat may also contribute to declines. During the winter Indiana bats hibernate in caves and abandoned mines. Summer habitat requirements for the species are not well defined but the following are considered important:

1. Dead or live trees and snags with peeling or exfoliating bark, split tree trunk and/or branches, or cavities, which may be used as maternity roost areas.

2. Live trees (such as shagbark hickory and oaks) which have exfoliating bark.

3. Stream corridors, riparian areas, and upland woodlots which provide forage sites.

Indiana Bat Maternity Habitat

There are no positive records for Indiana bat captures within Erie, Sandusky, Huron and Seneca Counties and in addition, there are no records within 10 miles of the proposed project boundaries. This may reflect more a function of low survey effort rather than the relative abundance of the species. The project areas appear to be a mix of agricultural land with scattered forested areas throughout, with a number of forested areas exceeding 50-100 acres. It appears that suitable summer foraging and roosting habitat for the Indiana bat likely exists within the project area.

Mist Net Surveys: Based on ODNR's On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio, a total of 5 mist net surveys have been requested for the Firelands project and 6 mist net surveys for the Lyme project. The Service agrees that this is an appropriate level of effort for the proposed project boundaries. The surveys must be conducted by a permitted surveyor (see attached list) and be designed and conducted in coordination with the Endangered Species Coordinator for this office. Survey effort should follow ODNR's protocols, which exceed the Service's standard protocol. The highest quality Indiana bat habitat areas within the project area should be selected for mist netting. We recommend that any Indiana bats captured, especially reproductively active females, be monitored through radio-tracking to determine roost locations and foraging patterns. If an Indiana bat is captured, this office shall be notified within 24 hours, or by the next business day.

Radio Transmitters: Up to four Indiana bats should be fitted with radio transmitters and tracked to roost site(s) and foraging areas until daily activity patterns are fairly well established, or as long as the transmitter remains attached and activated. Preference shall be given to tracking female bats, though one male Indiana bat may be tracked if captured prior to capturing four female Indiana bats. Please see the ODNR's protocols for additional information on radio tracking non-Indiana bats.

Acoustic Surveys: Bat acoustic monitoring is to be conducted at all meteorological towers within the project areas, with 1 unit positioned at 5 meters off the ground and 1 unit within the rotor swept area. Met towers should be erected within both phases of the project to ensure adequate coverage of the project areas. We recommend regular inspection of the AnaBat detectors throughout the survey period to ensure proper functioning.

The results of all bat surveys should be coordinated with this office prior to initiation of any work. Based on the results of the mist net survey, we will evaluate potential impacts to the Indiana bat from the proposed project. If sufficient information is not provided to document that take is unlikely, authorization of incidental take either through Section 7 or Section 10 of the Endangered Species Act of 1973, as amended, will be necessary.

Hibernacula Habitat

The project area lies within an area primarily underlain with Silurian and Devonian carbonate bedrock, indicating that the presence of caves is possible, and several identified karst areas are found within the project area. Please see the Ohio Department of Natural Resources, Division of Geological Survey Ohio Karst Areas Map (www.dnr.state.oh.us/portals/10/pdf/karstmap.pdf,), for additional information. If caves or sinkholes are present within the project area, we recommend further coordination with this office to determine if surveys of these areas are recommended.

Indiana Bat Migratory Habitat

Wind energy facilities in various habitat types across the U.S. and Canada have been documented to cause "widespread and often extensive fatalities of bats" (Arnett *et al.* 2008), primarily during the fall *migratory* season. Further, Indiana bat mortality has been detected at a wind power facility in Indiana, confirming suspicions that fall migrating Indiana bats are also susceptible to mortality from wind turbines. At this time, research into the mechanisms that cause mortality of bats at wind power sites is still ongoing, and few operational tools exist to avoid and minimize take — feathering of turbines during times when bats are most at risk has been shown to reduce mortality in some situations. Based on this, we are advising all operating wind farms and wind farms in planning stages within the range of the listed bats that lethal take is a possibility without curtailment of operations at night during the migratory period regardless of whether summer habitat is present or if Indiana bats are detected during summer mist netting. Due to the potential of take during spring and fall migration, we recommend developers evaluate their exposure to the prohibitions of ESA. This is a risk management decision the developer must make. The Service advises you to consider the following two options to ensure violations of the Endangered Species Act (ESA) Section 9 take prohibition do not occur:

1) Feather turbines during low wind speed conditions at night during the fall and spring migratory seasons as a way to proactively and definitively avoid take of Indiana bats (and other species of bats as well). Based on the Indiana bat Draft Recovery Plan First Revision (Service, 2007), fall migration generally occurs between August 1 and October 15, and spring migration generally occurs between April 1 and May 15.

2) Wind facility developers can work with the Service to apply for an Incidental Take Permit by submitting a Habitat Conservation Plan (HCP), as required under Section 10 of the Endangered Species Act. A HCP can be used to address Indiana bat presence during both summer foraging and migration periods. A HCP does typically require some time and survey effort to complete. Alternatively, you may consider joining in the regional effort to develop a wind power HCP to address Indiana bats and other listed species.

If you plan to implement either of these two options, please contact us for further information.

The proposed project lies within the range of the federally listed endangered **piping plover** (*Charadrius melodus*), as well as the federally threatened **eastern prairie fringed orchid** (*Platanthera leucophaea*), **Lakeside daisy** (*Hymenoxys herbacea*), and **Lake Erie Watersnake** (*Nerodia sipedon insularum*). Due to the location of the proposed project areas, impacts are not anticipated for these species.

The proposed project lies within the range of the **Kirtland's warbler** (*Dendroica kirtlandii*), a federally listed endangered species. The Kirtland's warbler is a small blue-gray songbird with a bright yellow breast. This species migrates through Ohio in the spring and fall, traveling between its breeding grounds in Michigan, Wisconsin, and Ontario and its wintering grounds in the Bahamas. During migration, individual birds usually forage in low vegetation and stay in one area for a few days. This species prefers shrub habitat and the Service recommends a habitat assessment for these project areas to see if surveys are warranted. If habitat is present with the project boundary, pre-construction survey methods should be coordinated with the Service and ODNR and surveys should be conducted in the spring season from April 15- June 1 and fall season from August 1- October 15. Any sightings should be reported to the Service within 24 hours, or the next business day. Survey results will be evaluated to document the extent to which the proposed project may affect the Kirtland's warbler.

The project lies within the range of the **eastern massasauga** (*Sistrurus catenatus catenatus*), a docile rattlesnake that is declining throughout its national range and is currently a Federal Candidate species. The snake is currently listed as endangered by the State of Ohio. Your proactive efforts to conserve this species now may help avoid the need to list the species under the Endangered Species Act in the future. Due to their reclusive nature, we encourage early project coordination to avoid potential impacts to massasaugas and their habitat. At a minimum, project evaluations should contain delineations of whether or not massasauga habitat occurs within project boundaries.

The massasauga is often found in or near wet areas, including wetlands, wet prairie, or nearby woodland or shrub edge habitat. This often includes dry goldenrod meadows with a mosaic of early successional woody species such as dogwood or multiflora rose. Wet habitat and nearby dry edges are utilized by the snakes, especially during the spring and fall. Dry upland areas up to 1.5 miles away are utilized during the summer, if available. For additional information on the eastern massasauga, including project management ideas, please visit the following website: http://www.fws.gov/midwest/Endangered/lists/candidat.html or contact this office directly. There is known population north of the project boundary in Margaretta Township, Erie County. This population is less than 1 mile from the project Firelands boundary however, the current status of this population is unknown. The Service suggests conducting a habitat assessment within the project area to determine if appropriate habitat is present. If habitat is present within the project area, surveys may be warranted and will need to be coordinated with this office.

The proposed project lies within the range of the **rayed bean** (*Villosa fabalis*), a freshwater mussel that is currently proposed for listing as federally endangered. The rayed bean is generally known from smaller, headwater creeks, but records exist in larger rivers. They are usually found in or near shoal or riffle areas, and in the shallow, wave-washed areas of lakes. Substrates typically include gravel and sand, and they are often associated with, and buried under the roots of, vegetation, including water willow (*Justicia americana*) and water milfoil (*Myriophyllum* sp.). Should the proposed project directly or indirectly impact any of the habitat types described above, we recommend that a survey be conducted to determine the presence or probable absence of rayed bean mussels in the vicinity of the proposed site. Any survey should be designed and conducted in coordination with the Endangered Species Coordinator for this office.

MIGRATORY BIRD COMMENTS:

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. While the MBTA has no provision for allowing unauthorized take, the FWS recognizes that some birds may be taken during activities such as wind turbine operation even if all reasonable measures to avoid take are implemented. The U.S. Fish and Wildlife Service's (FWS) Office of Law Enforcement carries out its mission to protect migratory birds not only through investigation and enforcement, but also through fostering relationships with individuals and industries that proactively seeks to eliminate their impacts on migratory birds. Although it is not possible under the MBTA to absolve individuals, companies, or agencies from liability (even if they implement avian mortality avoidance or similar conservation measures), the Office of Law Enforcement focuses on those individuals, companies, or agencies that take migratory birds with disregard for their actions and the law, especially when conservation measures have been developed but are not properly implemented.

At this time, we continue to encourage existing and proposed wind developments to follow current Service recommendations on wind power siting and construction (*Interim Guidelines to Avoid and Minimize Impacts from Wind Turbines – 2003)*. The Service also encourages developers to coordinate with Service biologists regarding their projects. Proper coordination will help developers make informed decisions in siting, constructing, and operating their facilities. Additionally, the Service hopes to work cooperatively with wind developers to advance the state of the art of wind power siting, construction, and operation. Advancements in these areas will represent great strides towards the environmentally safe development of this otherwise renewable and clean source of energy.

The Service and ODNR have worked together to develop a recommended bird survey protocol for wind turbine projects. The details of the protocol are provided in ODNR's On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio. ODNR has documented that the project area qualifies for "moderate" survey effort due to the proximity to possible migratory bird high use areas. We recommend implementation of the ODNR bird survey protocol to document baseline bird use of the project area. Bird survey results will be interpreted to determine if potential risk to birds is relatively high or low in various portions of the project area. Based on survey results we may make recommendations as to turbine placement and operation, or pre- or post-construction monitoring.

Research into the actual causes of bat and bird collisions with wind turbines is limited. To assist Service field staffs in review of wind farm proposals, as well as aid wind energy companies in developing best practices for siting and monitoring of wind farms, the Service published *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines* (2003). On February 8, 2011, the U.S. Fish and Wildlife Service released the Draft Voluntary, Land-Based Wind Energy Guidelines that have now been published in the Federal Register and are now open for public comment until May 19, 2011. The Guidelines can be found at: http://www.fws.gov/windenergy. Until those guidelines are final, the Service recommends following the 2003 Interim Guidelines. We encourage any company/licensee proposing a new wind farm to consider the following excerpted suggestions from the guidelines in an effort to minimize impacts to migratory birds and bats.

1) Pre-development evaluations of potential wind farm sites to be conducted by a team of Federal and/or State agency wildlife professions with no vested interest in potential sites;

2) Rank potential sites by risk to wildlife;

3) Avoid placing turbines in documented locations of federally-listed species;

4) Avoid locating turbines in known bird flyways or migration pathways, or near areas of high bird concentrations. (i.e., rookeries, leks, State or Federal refuges, staging areas, wetlands, riparian corridors, etc.) Avoid known daily movement flyways and areas with a high incidence of fog, mist or low visibility;

5) Avoid placing turbines near known bat hibernation, breeding, or maternity colonies, in migration corridors, or in flight paths between colonies and feeding areas;

6) Configure turbine arrays to avoid potential avian mortality where feasible. (i.e., group turbines and orient rows of turbines parallel to known bird movements) Implement storm water management practices that do not create attractions for birds, and maintain contiguous habitat for area-sensitive species;

7) Avoid fragmenting large, contiguous tracts of wildlife habitat. Wherever practical, place turbines on lands already disturbed and away from intact healthy native habitats. If not practical, select fragmented or degraded habitats over relatively intact areas;

8) Minimize roads, fences, and other infrastructure. Wherever possible, align collection lines and access roads to minimize disturbance;

9) Develop a habitat restoration plan for the proposed site that avoids or minimizes negative impacts on vulnerable wildlife while maintaining or enhancing habitat values for other species. (i.e., avoid attracting prey animals used by raptors;

10) Use tubular supports with pointed tops rather than lattice supports to minimize bird perching and nesting opportunities. Avoid placing external ladders and platforms on tubular towers to minimize perching/nesting. Avoid use of guy wires for turbine or meteorological tower supports. All existing guy wires should be marked with bird deterrents. (Avian Power Line Interaction Committee 1996);

11) If taller turbines (top of rotor-swept area is greater than 199 feet above ground level) require lights for aviation safety, the minimum amount of lighting specified by the Federal Aviation Administration (FAA) should be used. Unless otherwise requested by the FAA, only white strobe lights should be used at night, and should be of the minimum intensity and frequency of flashes allowable;

12) Adjust tower height to reduce risk of strikes in areas of high risk for wildlife.

13) Wherever feasible, place electric power lines underground or on the surface as insulated, shielded wire to avoid electrocution of birds. Use recommendations of the Avian Power Line Interaction Committee (1996) for any required above-ground lines, transformers, or conductors;

The full text of the guidelines is available at http://www.fws.gov/habitatconservation/wind.pdf. The Service believes that implementing these guidelines may help reduce mortality caused by wind turbines. We encourage you to consider these guidelines in the planning and design of the project. We particularly encourage placement of turbines away from any large wetland, stream corridor, or wooded areas, including the areas mentioned previously, and avoid placing turbines between nearby habitat blocks.

BALD AND GOLDEN EAGLE COMMENTS:

Bald and golden eagles are included under the Migratory Bird Treaty Act, but are afforded additional legal protection under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d). The Service recently issued a final rule that authorizes issuance of eagle take permits, where the take to be authorized is associated with otherwise lawful activities. If take of bald eagles is likely, based on the best information available, a bald eagle take permit for this project will be necessary. There is a known bald eagle nest located within the northwest corner of the Firelands project boundary. We understand that some monitoring of this nest was conducted in 2010. In addition, the proposed Lyme Phase 2 project boundary has a bald eagle nest located approximately 1.3 miles south of the project boundary on the eastern side of the project. There are also 3 other bald eagle nests located north (2.2 miles) and east (2.4 and 2.5 miles) of the Firelands project boundary. Raptor nest searches and nest monitoring should be conducted in accordance with ODNR's survey protocol to identify any raptors, including bald eagles that may nest or migrate within or near the project area. The results of this survey should be coordinated with this office.

On February 8, 2011, the U.S. Fish and Wildlife Service released the Draft Eagle Conservation Plan Guidance that have now been published in the Federal Register and are available for public comment until May 19, 2011. The Guidelines can be found at: http://www.fws.gov/windenergy. The Draft Eagle Conservation Plan Guidance was developed to provide interpretive guidance to wind developers, Service biologists who evaluate potential impacts on eagles from proposed wind energy projects, and others in applying the regulatory permit standards as specified by the Bald and Golden Eagle Protection Act and other federal laws. Appendix C of the Draft Eagle Conservation Plan Guidance suggests a monitoring protocol for wind projects that is more extensive that ODNR's current protocol. This guidance suggests a way to estimate relative abundance and eagle exposure rates, characterization of the project area nesting population, and eagle migration and concentration areas. While this guidance is still draft, we believe that it deserves careful attention, as it lays out a proposed process for evaluating risk to eagles from wind power projects and developing an eagle conservation plan, in support of applying for a permit to authorize take. Monitoring data should be interpreted to document potential risk to eagles. If take of eagles is likely, a bald eagle take permit will be necessary.

COORDINATION OF SURVEY RESULTS:

Please submit survey results to this office for review. Survey results will be interpreted to determine areas with relatively low bat and bird activity/diversity as opposed to areas with relatively high bat and bird activity/diversity. Based on the survey results, we may make recommendations as to turbine placement and operation, additional consultation under Section 7 or 10 of the Endangered Species Act of 1973, as amended, additional permits under the Bald and Golden Eagle Protection Act, or pre- or post-construction monitoring.

POST CONSTRUCTION MONITORING:

The Service recommends the project be monitored post-construction to determine impacts to migratory birds and bats. A specific post-construction monitoring plan should be prepared and reviewed by the Service and should include a scientifically robust, peer reviewed methodology of mortality surveys. We recommend that the post-construction monitoring protocol be developed based on the results of pre-construction monitoring, and look forward to working with the project proponent to develop this document.

Thank you for the opportunity to provide comments on this proposed project. Please contact biologist Melanie Cota at extension 15 in this office if I can be of further assistance.

Sincerely,

Jerome M. Gozgh

for Mary Knapp, Ph.D.
Supervisor

Cc: Ms. Jennifer Norris, ODNR, Olentangy Wildlife Research Station, Ashley, OH
Mr. Brian Mitch, ODNR, REALM, Columbus, OH
Mr. Doug McIlvain, Tetra Tech, 250 W Court St. 200W, Cincinnati, OH 45202

Attachment: USFWS Permitted Indiana bat Surveyors in Ohio

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
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Columbus, Ohio 43230
(614) 416-8993 / FAX (614) 416-8994
March 22, 2011

USFWS permittees for Indiana bat surveys in Ohio*

ABR, Inc. – Environmental Research and Services Leslie Rodman P.O. Box 249 Forest Grove, OR 97116 (503) 359-7525 ext. 113 / FAX (503) 359-8875 lrodman@abrinc.com	**Alliance Consulting Inc.** T. Sydney Burke 124 Philpott Lane Beaver, WV 25813 (304) 255-0491 ext. 343 / FAX (304) 255-4232 sburke@aci-wv.com
Apogee Environmental Consultants, Inc. Joel Beverly P.O. Box 338 Ermine, KY 41815 (606) 633-7677 / FAX (606) 632-2626 apogee_env@bellsouth.net	**Appalachian Technical Services** P.O. Box 3537 6741 Indian Creek Road Wise, VA 24293 (276) 328-4200 / FAX (276) 328-4900 wise@atsone.com
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*This list reflects permit data available as of March 22, 2011, and is subject to periodic revision to reflect permit changes

Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR

DAVID MUSTINE, DIRECTOR

Ohio Division of Wildlife

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Phone: (614) 265-6300

May 21, 2011

To all interested parties,

Based upon the revised project boundary map received on April 28, 2011 and conference call on April 20, 2011 the Ohio Department of Natural Resources Division of Wildlife (DOW) has prepared these survey recommendations for juwi Wind's proposed combined Firelands-Lyme project located in Erie, Huron, and Seneca counties.

Currently the project falls within regions of the state that DOW has identified as needing moderate monitoring efforts. Recommendations are based on a GIS analysis of the site and may be reevaluated after a site visit. Additionally, if the developer decides to amend the current boundaries, the DOW will revise our survey recommendations.

The table below was created based upon a review of the project maps provided and summarizes the types and level of effort recommended by the DOW. Please note that monitoring and surveys should follow those criteria listed within the "On-shore Bird and Bat Pre-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio." Tetra Tech's proposed bald eagle nest monitoring methodology following the U.S. Fish and Wildlife Service's draft ECPG is approved for this site, however all other surveys should adhere to ODNR protocol.

Results from these studies will help the Department of Natural Resources assess the potential impact these turbines may pose, and influence our recommendations to the Ohio Power Siting Board.

For additional ODNR comments, including information on the potential presence of threatened and endangered species within or adjacent to your project area, please contact Brian Mitch at (614) 265-6378 or brian.mitch@dnr.state.oh.us

	Project
Survey type	
Breeding bird	Breeding bird surveys should be conducted at all sites. The number of survey points may be based on the amount of available habitat, or twice the maximum number of turbines proposed for the site. If turbines are placed in agricultural land it, this requirement may be waived by DOW after a review of the proposed turbine locations is provided.
Raptor nest searches	Nest searches should occur on, and within a 1-mile buffer of the proposed facility.

Raptor nest monitoring	There are 2 eagle nest located on or within the 2 miles of the proposed project. The pairs within the 2 mile radius should be monitored to assess their daily movement patterns. Should any additional nests of a protected species of raptor be located during nest searches, monitoring should commence as outlined within the on-shore protocols.
Bat acoustic monitoring	To be conducted at all meteorological towers.
Passerine migration (# of survey points)	4 (waived)
Diurnal bird/raptor migration (# of survey point)	1
Sandhill crane migration (same points as raptor migration)	NS
Owl playback survey points	NS
Barn owl surveys	NS
Bat mist-netting (# of survey points)	9
Nocturnal marsh bird survey points	NS
Waterfowl survey points	NS
Shorebird migration points	NS
Radar monitoring locations	NS

NS = Not required based on the lack of suitable habitat.

If you have any questions, please feel free to contact me.

Jennifer Norris, Wind Energy Wildlife Biologist
Olentangy Wildlife Research Station
Ohio Division of Wildlife
8589 Horseshoe Road
Ashley, OH 43003
Office phone: 740-747-2525 x 26
Cell: 419-602-3141
Fax: 740-747-2278

cc: Mr. Stuart Siegfried, Ohio Power Siting Board
Ms. Megan Seymour, United States Fish and Wildlife Service
Mr. Brian Mitch, Ohio Department of Natural Resources

Figure 1. Survey effort map with the boundary for juwi Wind's proposed and revised Firelands-Lyme project.

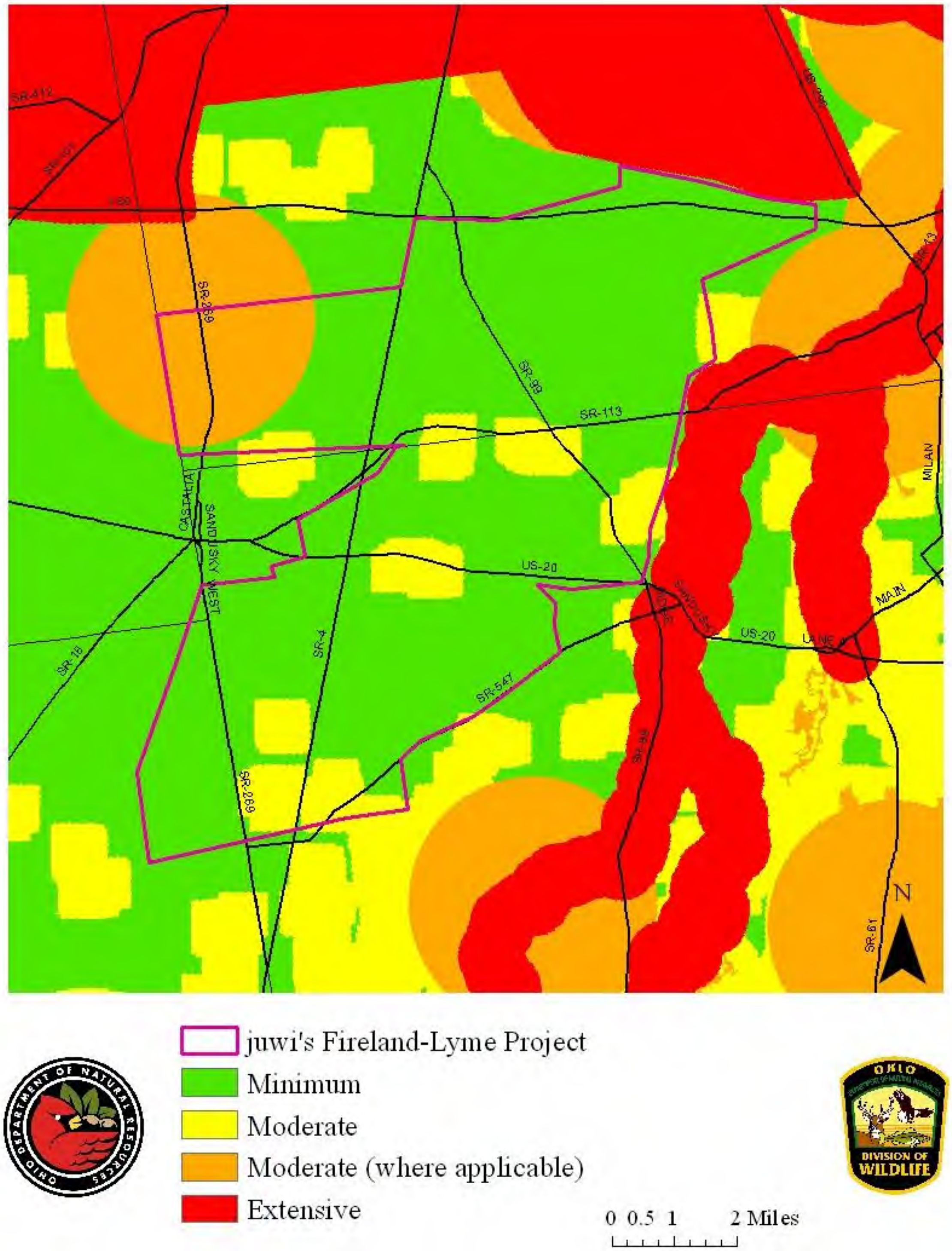
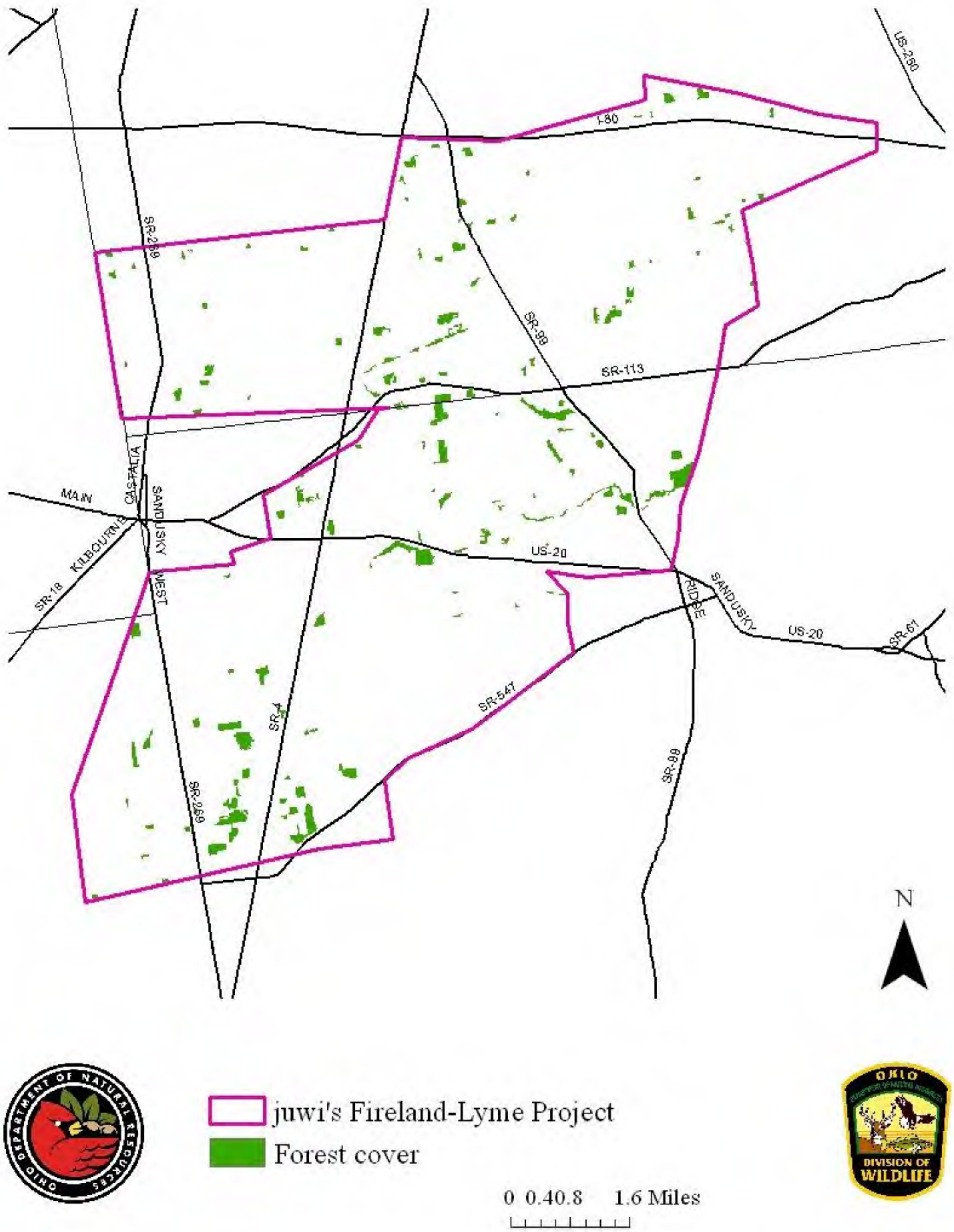


Figure 2. Forest cover with the boundary for juwi Wind's proposed and revised Firelands-Lyme project.



McIlvain, Douglas

From: Matthew_Stuber@fws.gov
Sent: Thursday, March 15, 2012 2:55 PM
To: Kern, Greg
Cc: McIlvain, Douglas; Melanie_Cota@fws.gov
Subject: Re: Firelands-Lyme Status Update

Greg and Doug,

Great talking with you guys a couple weeks ago. Thanks for the update on eagle monitoring at the Firelands / Lyme project.

In general, your eagle monitoring efforts so far seem in line with what the U.S. Fish and Wildlife Service (Service) has been recommending in our Eagle Conservation Plan Guidance (ECP Guidance). I believe your data, once complete, will allow you (and the Service) to conduct a relatively thorough assessment of risk to eagles. Additionally, the information you are gathering will be valuable in planning turbine locations (micro-siting) to avoid eagle impacts. We look forward to seeing your Aug 2011 - Mar 2012 data when it is available.

A few, more specific, comments / thoughts:

1) As we discussed, the Service recommends multiple years of data be collected at a proposed project site to account for any unknown increased or decreased eagle use due to non-project related factors such as weather patterns, prey population dynamics, etc. More years of data means more confidence in a risk assessment.

2) As outlined in the ECP Guidance, where certain levels of eagle risk are thought to exist at a proposed wind facility, the Service recommends either a) abandoning a project at its proposed location or b) that the project proponent apply for an eagle take permit and create an Eagle Conservation Plan (ECP) or similar document. Although we are waiting to evaluate a full year of site-specific data and a complete risk assessment, we think it is likely that this project will pose some risk to eagles during its operational life. As such, a permit may be recommended for this project. If you or the project proponent have any questions about this process or the permit itself please do not hesitate to contact me. Hopefully the next version of the ECP Guidance will be publically available sooner than later.

Note: one of the permit issuance criteria is that the impacts to eagles must be minimized to the extent possible. This is discussed further in the ECP Guidance... but siting of turbines to avoid areas of high eagle use will not only reduce the probability of impacts to eagles, but will likely be a key part of meeting permit issuance criteria. Same concept applies to siting of turbines away from known eagle use areas, such as known active nesting territories. See ECP Guidance for other criteria and for other components to be included in an ECP.

3) **Figure 6** (in Stage 2 - Site Specific Bald Eagle Survey Preliminary Results (March - August 2011) and Risk Assessment Protocol Framework document) illustrates the value of thorough monitoring efforts at a proposed wind development. This figure illustrates, for the first 6 months of monitoring, where eagle "hot-spots" may exist within and around the project boundary. This map, when illustrating all collected data and compared to any flight path and/or behavioral information, can provide the information needed to plan turbine locations (micro-siting) to avoid eagle impacts.

All from me for now. Thanks again for getting in touch to discuss this project and your eagle monitoring thus far. As always, do not hesitate to contact me if you have any questions regarding eagle risk, permits, etc.

Talk soon.

Cheers,
Matt

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Appendix B

FIXED RADIUS POINT COUNT DATA ANALYSIS METHODS

To determine the Bald Eagle Exposure Rate for ALL sample points over the entire project period:

1. Each sample needs to be divided into 1 minute intervals

2. Record number of Bald Eagles observed in each one minute interval (Bald Eagle exposure minutes)

3. Add up all the Bald Eagle exposure minutes from ALL sample points to determine the total the number of Bald Eagle minutes throughout the survey period

4. Divide the total number of Bald Eagle minutes by the total number of sample points to get the mean number of observations per sample point.

5. Determine the total number of hours surveyed for all sample points throughout the survey period

6. Divide the total Bald Eagle exposure minutes by the total hours surveyed to determine the average Bald Eagle exposure per hour over the entire project

7. Determine the proportion of Bald Eagles observed in flight versus perched over the entire project period

8. Determine the proportion of Bald Eagles between 35 and 135 meters (m) or the typical Rotor Swept Zone (RSZ) flight height versus outside of this range over the entire project period

To determine the Bald Eagle Exposure Rate for ALL sample points for EACH SEASON or MONTH (Temporal Distribution of Bald Eagle Exposure):

1. Each sample needs to be divided into 1 minute intervals

2. Record number of Bald Eagles observed in each one minute interval (Bald Eagle exposure minutes)

3. Add up all the Bald Eagle exposure minutes from ALL sample points for EACH SEASON to determine the total the number of Bald Eagle exposure minutes during each seasonal period

4. Divide the total number of Bald Eagle minutes by the total number of sample points to get the mean number of observations per sample point during each season.

5. Determine the total number of hours surveyed for all sample points during EACH SEASON

6. Divide the total Bald Eagle exposure minutes by the total hours surveyed to determine the average Bald Eagle exposure per hour during each season

7. Determine the proportion of Bald Eagles observed in flight versus perched during each season

8. Determine the proportion of Bald Eagles between 35 and 135 m flight height versus outside of this range during each season

To determine the Bald Eagle Exposure Rate for each INDIVIDUAL sample point over entire project period (Spatial Distribution of Bald Eagle Exposure):

1. Each sample needs to be divided into 1 minute intervals
2. Record number of Bald Eagles observed in each one minute interval (Bald Eagle exposure minutes)
3. Add up all the Bald Eagle exposure minutes for each individual sample point to determine the total the number of Bald Eagle exposure minutes for each separate point
4. Determine the total number of hours surveyed for each individual sample point throughout the survey period
5. Divide the total Bald Eagle exposure minutes for each individual sample point by the total hours surveyed at each individual sample point to determine the average Bald Eagle exposure per hour at that sample point
6. Determine the proportion of Bald Eagles observed in flight versus perched at each sample point
7. Determine the proportion of Bald Eagles between 35 and 135 m flight height versus outside of this range at each sample point

Appendix C

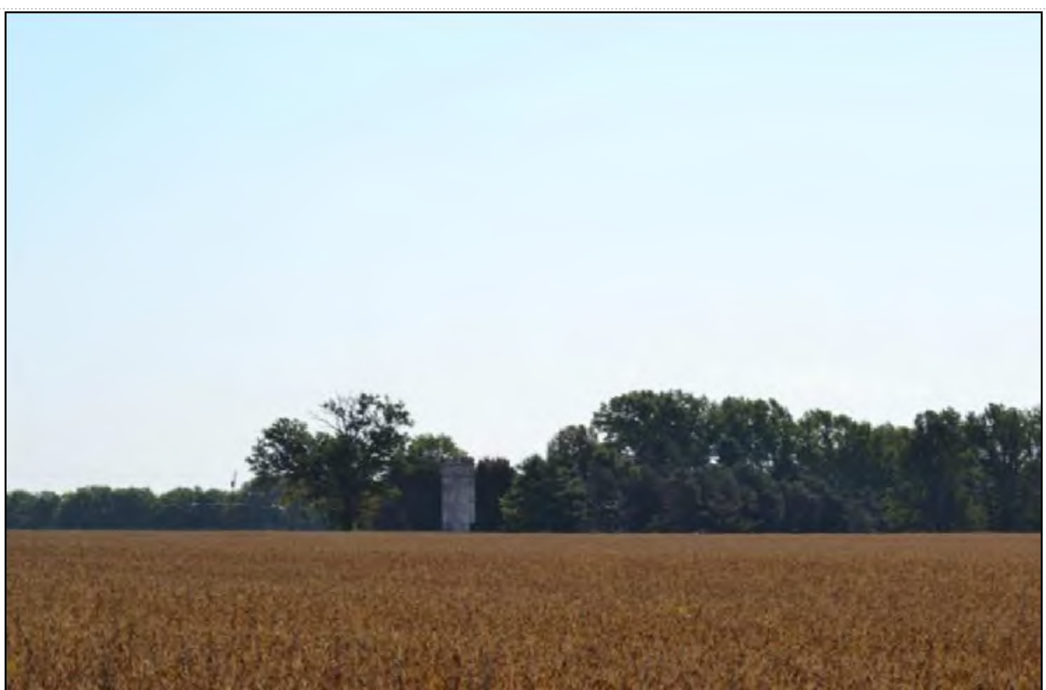
DATA SHEETS AND DOCUMENTATION (SEE INCLOSED CD)

Appendix D
PHOTOGRAPHS

1	DESCRIPTION	Diurnal Site 1 looking north.

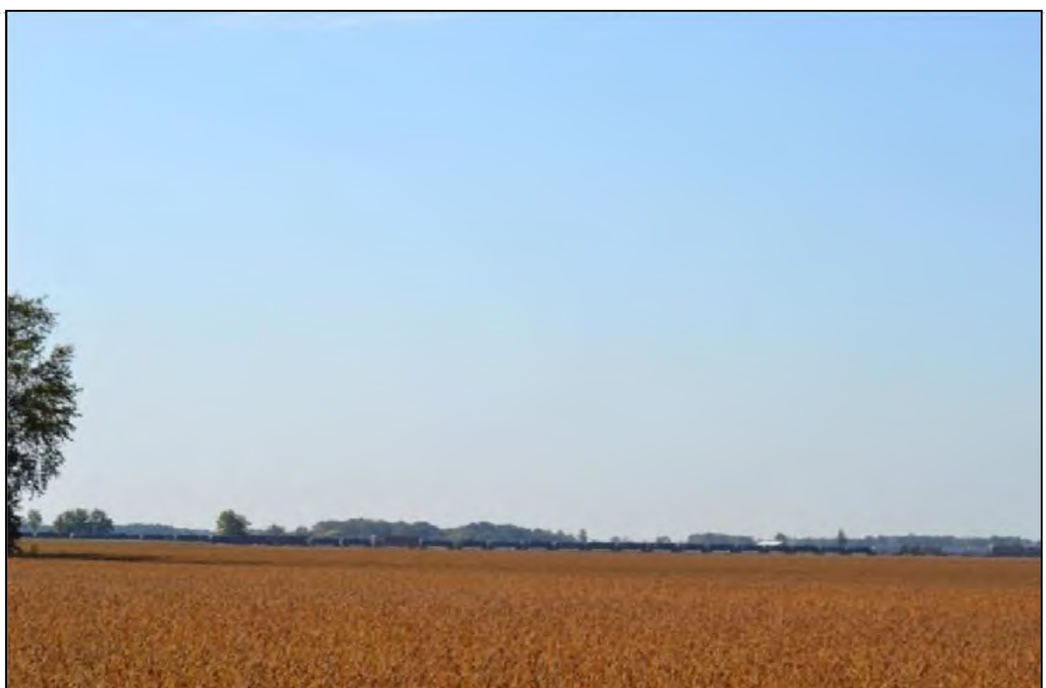
2	DESCRIPTION	Diurnal Site 1 looking northeast.

3	DESCRIPTION	Diurnal Site 1 looking east.



4	DESCRIPTION	Diurnal Site 1 looking southeast.

5	DESCRIPTION	Diurnal Site 1 looking south.



6	DESCRIPTION	Diurnal Site 1 looking southwest.

7	DESCRIPTION	Diurnal Site 1 looking west.

8	DESCRIPTION	Diurnal Site 1 looking northwest.

9	DESCRIPTION	Diurnal Site 2 looking north.

10	DESCRIPTION	Diurnal Site 2 looking northeast.

11	DESCRIPTION	Diurnal Site 2 looking east.

12	DESCRIPTION	Diurnal Site 2 looking southeast.

13	DESCRIPTION	Diurnal Site 2 looking south.

14	DESCRIPTION	Diurnal Site 2 looking southwest.

15	DESCRIPTION	Diurnal Site 2 looking west.

16	DESCRIPTION	Diurnal Site 2 looking northwest.

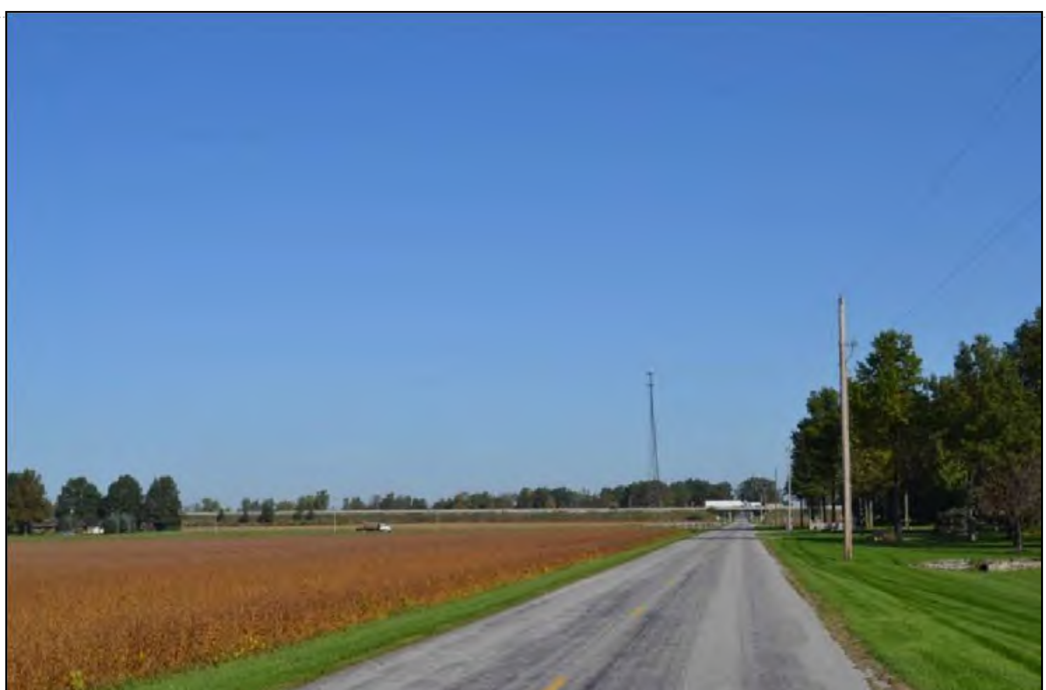
17	DESCRIPTION	Bald Eagle Point Count Location 1 looking north.

18	DESCRIPTION	Bald Eagle Point Count Location 2 looking north.

19	DESCRIPTION	Bald Eagle Point Count Location 3 looking north.

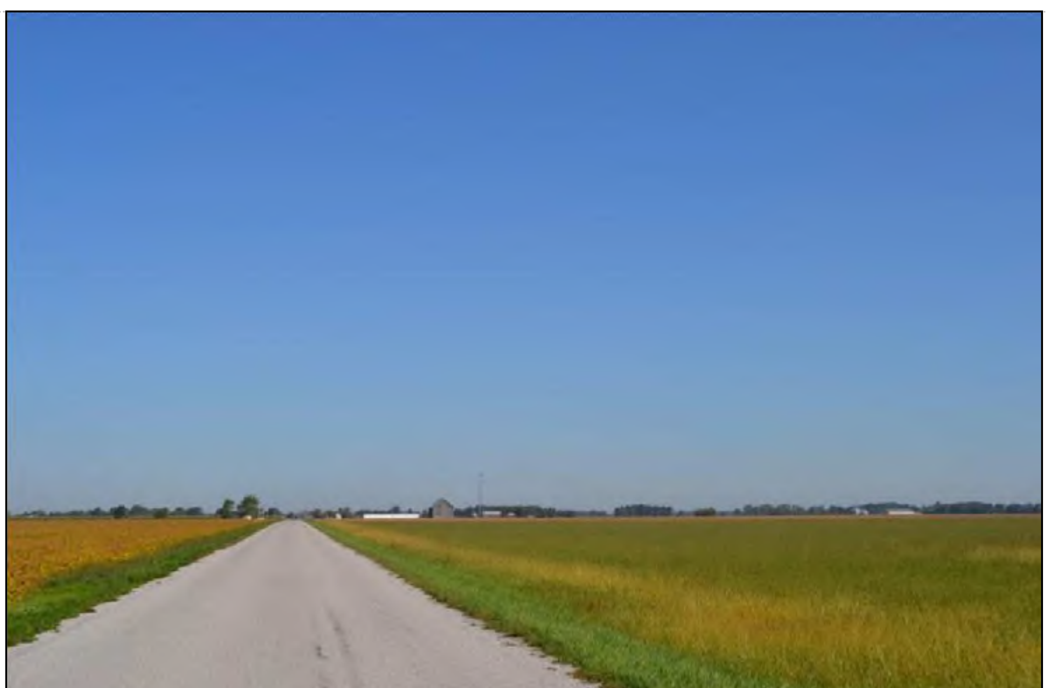
20	DESCRIPTION	Bald Eagle Point Count Location 4 looking north.

21	DESCRIPTION	Bald Eagle Point Count Location 5 looking north.



22	DESCRIPTION	Bald Eagle Point Count Location 6 looking north.

23	DESCRIPTION	Bald Eagle Point Count Location 7 looking north.



24	DESCRIPTION	Bald Eagle Point Count Location 8 looking north.

25	DESCRIPTION	Bald Eagle Point Count Location 9 looking north.

26	DESCRIPTION	Bald Eagle Point Count Location 10 looking north.

27	DESCRIPTION	Bald Eagle Point Count Location 11 looking north.

28	DESCRIPTION	Bald Eagle Point Count Location 12 looking north.

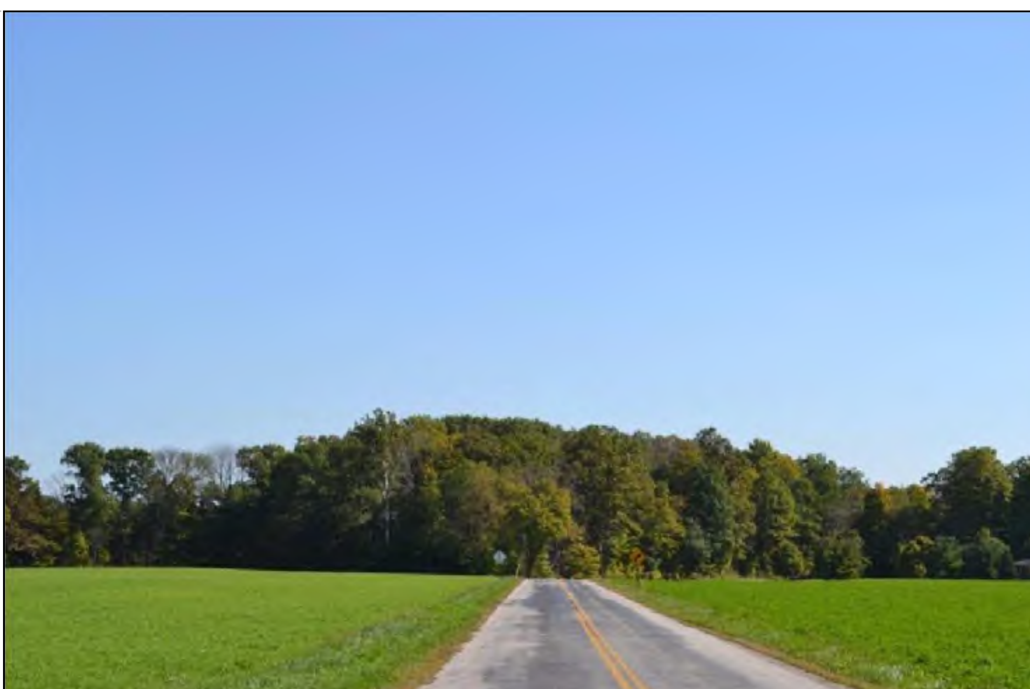
29	DESCRIPTION	Bald Eagle Point Count Location 13 looking north.

30	DESCRIPTION	Bald Eagle Point Count Location 14 looking north.

31	DESCRIPTION	Bald Eagle Point Count Location 15 looking north.

32	DESCRIPTION	Bald Eagle Point Count Location 16 looking north.

33	DESCRIPTION	Bald Eagle Point Count Location 17 looking north.



34	DESCRIPTION	Bald Eagle Point Count Location 17 looking east.

35	DESCRIPTION	Bald Eagle Point Count Location 17 looking south.

36	DESCRIPTION	Bald Eagle Point Count Location 17 looking west.

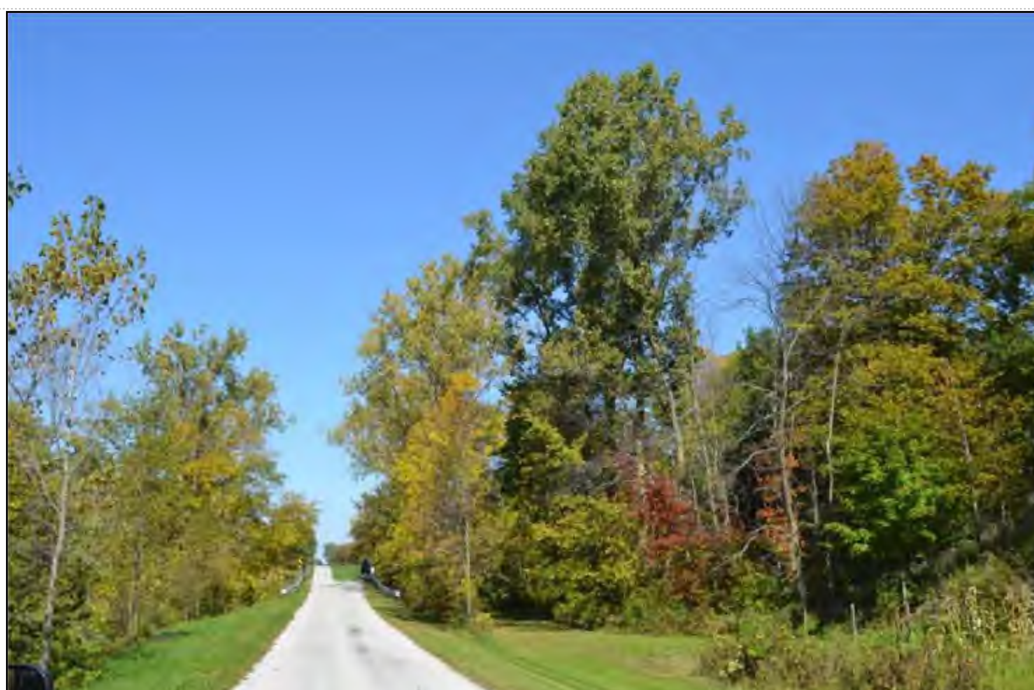
37	DESCRIPTION	Bald Eagle Point Count Location 18 looking north.

38	DESCRIPTION	Bald Eagle Point Count Location 18 looking east.

39	DESCRIPTION	Bald Eagle Point Count Location 18 looking south.

40	DESCRIPTION	Bald Eagle Point Count Location 18 looking west.

41	DESCRIPTION	Bald Eagle Point Count Location 19 looking north.



42	DESCRIPTION	Bald Eagle Point Count Location 20 looking north.

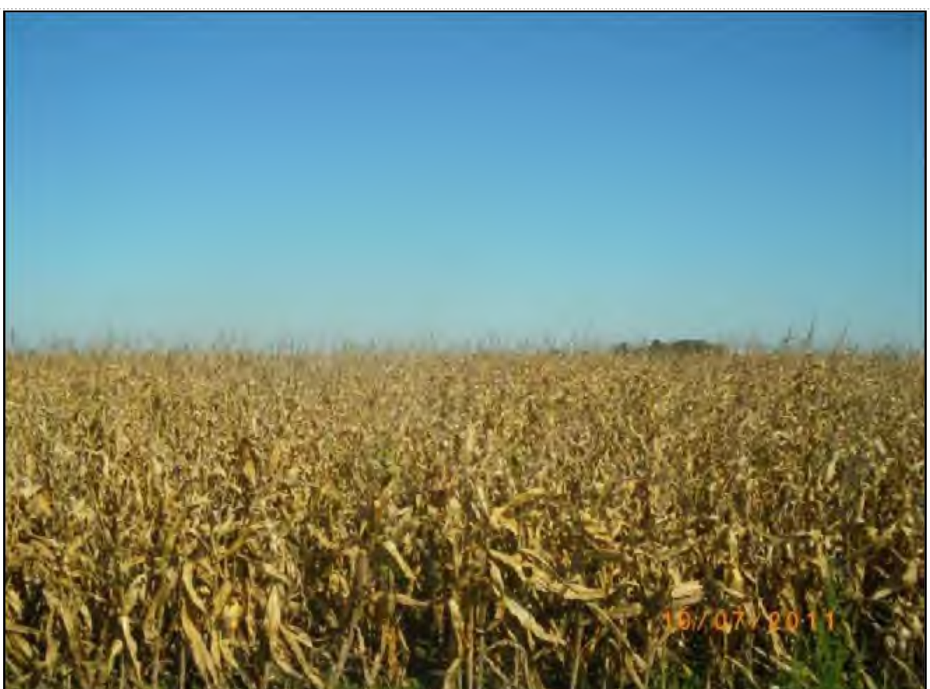
43	DESCRIPTION	Bald Eagle Point Count Location 21 looking north.

44	DESCRIPTION	Bald Eagle Point Count Location 22 looking north.

45	DESCRIPTION	Bald Eagle Point Count Location 23 looking north.

46	DESCRIPTION	Bald Eagle Point Count Location 24 looking north.

47	DESCRIPTION	Bald Eagle Point Count Location 25 looking north.

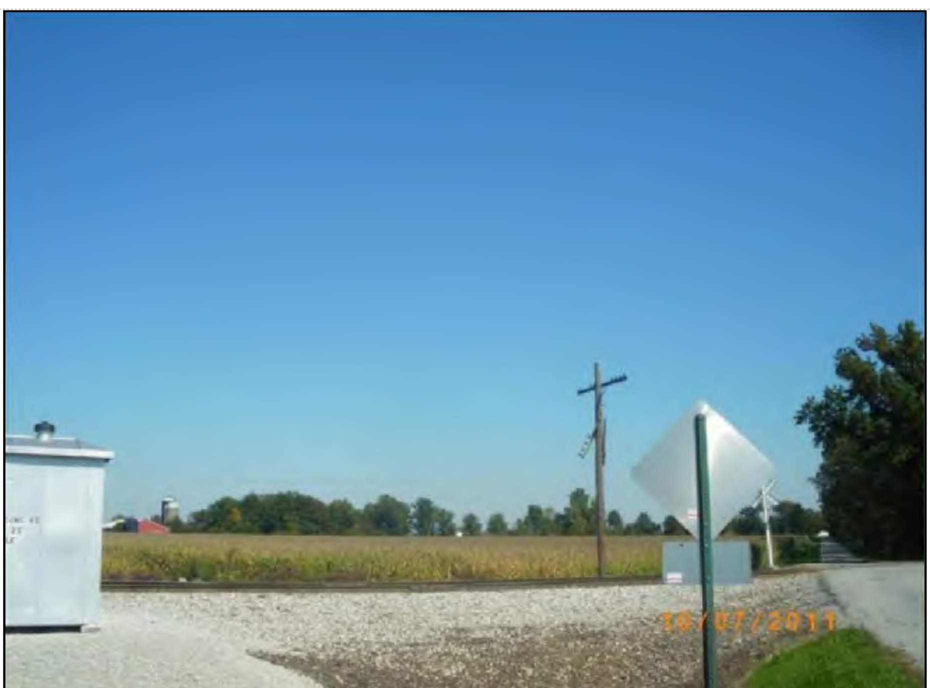


48	DESCRIPTION	Bald Eagle Point Count Location 26 looking north.

49	DESCRIPTION	Bald Eagle Point Count Location 27 looking north.

50	DESCRIPTION	Bald Eagle Point Count Location 28 looking north.

51	DESCRIPTION	Bald Eagle Point Count Location 29 looking north.



52	DESCRIPTION	Bald Eagle Point Count Location 30 looking north.

53	DESCRIPTION	Bald Eagle Point Count Location 31 looking north.

54	DESCRIPTION	Bald Eagle Point Count Location 32 looking north.

55	DESCRIPTION	Bald Eagle Point Count Location 33 looking north.

56	DESCRIPTION	Bald Eagle Point Count Location 34 looking north.

57	DESCRIPTION	Bald Eagle Point Count Location 35 looking north.

58	DESCRIPTION	Bald Eagle Point Count Location 36 looking north.

59	DESCRIPTION	Bald Eagle Point Count Location 37 looking north.

60	DESCRIPTION	Bald Eagle Point Count Location 38 looking north.

61	DESCRIPTION	Bald Eagle Point Count Location 39 looking north.

62	DESCRIPTION	Bald Eagle Point Count Location 40 looking north.

Exhibit V
Breeding Bird Surveys

1. **Breeding Bird Surveys for the Emerson North Wind Project Erie, Huron and Seneca Counties, Ohio dated August 23, 2018**
2. **Breeding Bird Surveys for the Emerson Creek Wind Project Huron County, Ohio dated October 9, 2017**
3. **Summary of results of breeding bird surveys at the Emerson Creek Wind Resource Area dated October 15, 2012**

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Attorneys for Firelands Wind, LLC

Exhibit V
Breeding Bird Surveys

1. Breeding Bird Surveys for the Emerson North Wind Project Erie, Huron and Seneca Counties, Ohio dated August 23, 2018

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Attorneys for Firelands Wind, LLC

Breeding Bird Surveys for the Emerson North Wind Project Erie, Huron and Seneca Counties, Ohio

May – June 2018

Prepared by:

Goniela Iskali and Chad LeBeau

Western EcoSystems Technology, Inc.
408 West 6th Street
Bloomington, Indiana 47404

August 23, 2018

EXECUTIVE SUMMARY

Western EcoSystems Technology, Inc. completed breeding bird surveys from May 21 - June 27, 2018 for the proposed Emerson North Wind Project (Project) located in Huron, Seneca and Erie Counties, Ohio, in accordance with the Ohio Department of Natural Resources (ODNR) *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio.* The objectives of the study were to document the diversity and abundance of bird species observed within the Project during the breeding season, and document occurrences and locations of sensitive species.

A total of 16 fixed points were surveyed once in May and twice in June throughout the Project. Fixed points were located near breeding bird habitat as defined by the ODNR. A total of 959 individual bird observations comprising 64 identified species were detected during the breeding bird survey. The most commonly observed bird species included common grackle, American robin, European starling and red-winged blackbird. No eagles or federally or state-listed species were observed over the course of the breeding bird survey or incidentally. Three species listed as Birds of Conservation Concern were observed during surveys in low numbers: willow flycatcher (n=2), wood thrush (n=1), and red-headed woodpecker (n=2). Bird species occurring within the Project are typical of those found in primarily agricultural landscapes in the Midwest and Ohio.

STUDY PARTICIPANTS

Western EcoSystems Technology, Inc.

Goniela Iskali	Project Manager
Chad LeBeau	Senior Reviewer
Ashley Matteson	Report Writer
David Klein	Technical Editing Manager
Jean-Paul Wilson	Data Analyst
Carmen Boyd	Project Tracking and Data Manager
Stu Geiger	GIS Technician
Katie Wynne	Technical Editing Coordinator
Linda Koepsell	Technical Editor
Dan Kramer	Field Technician

REPORT REFERENCE

Iskali, G, and C. LeBeau. 2018. Breeding Bird Surveys for the Emerson North Wind Project in Erie, Huron and Seneca Counties, Ohio. Final Report: May – June 2018. Prepared for Emerson North Wind, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana.

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LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Western EcoSystems Technology, Inc. (WEST) completed breeding bird surveys from May 21 – June 27, 2018 for the proposed Emerson North Wind Project (Project) located in Huron, Seneca and Erie Counties, Ohio, following the Ohio Department of Natural Resources (ODNR) *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio* (ODNR 2009). The objectives of the study were to document the diversity and abundance of bird species observed within the Project during the breeding season, and document occurrences and locations of sensitive species.

PROJECT AREA

The Project is located within the Huron/Erie Lake Plain ecoregion, which is a broad, flat, fertile plain with some relic sand dunes, beach ridges, and end moraines. Today, most of the forests in the area have been cleared and the swamps artificially drained to make way for highly productive farms which produce corn (*Zea mays*), soybean (*Glycine max*), and livestock (US Environmental Protection Agency 2013).

Approximately 87.1% of the nearly 166.4 square kilometers (41,122.1 acres) in the Project is composed of cultivated cropland (US Geological Survey National Land Cover Database 2011; Homer et al. 2015). Developed areas are the next most common land cover type (6.5%), followed by deciduous forest (4.1%) that consists primarily of shelterbelts and woodlots associated with homesteads, and barren land (1.2%). All other land cover types compose less than 1% of the Project area individually (Table 1 and Figure 1).

Table 1. Land cover types and composition at the Emerson North Wind Project.

Habitat	Acres	Percent Composition
Cultivated Crops	41,122.1	87.1
Developed	3,067.1	6.5
Deciduous Forest	1,918.8	4.1
Barren Land	565.3	1.2
Hay/Pasture	285.6	0.6
Open Water	221.1	0.5
Woody Wetlands	4.7	< 0.1
Shrub/Scrub	3.1	< 0.1
Evergreen Forest	2.9	< 0.1
Herbaceous	1.8	< 0.1
Emergent Herbaceous Wetlands	1.3	< 0.1
Total	**47,193.7**	**100**

Data from US Geological Survey National Land Cover Database 2011, Homer et al. 2015
Sums may not add up due to rounding.

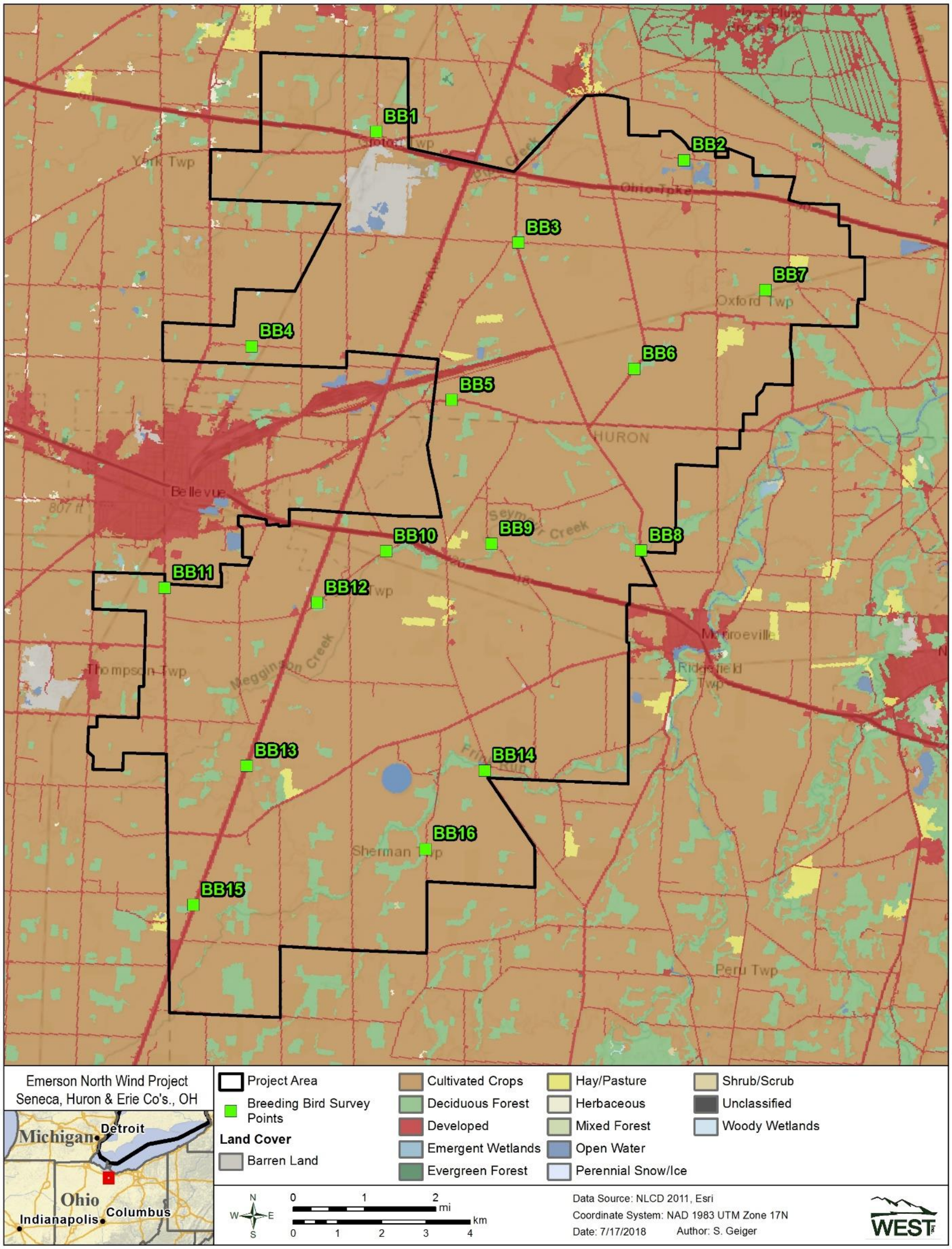

Figure 1. Land cover and fixed-point count locations surveyed during the breeding bird survey from May 31 - June 30, 2018 at the Emerson North Wind Project.

METHODS

ODNR guidelines recommend that breeding bird surveys be completed at all proposed turbine locations within non-cropland habitats and that two points be established for each turbine (ODNR 2009). Since Project turbine locations are unknown at this time, the number of breeding bird survey points needed for the current Project was based on the maximum expected number of turbines (120), for a total of 240 potential fixed-point count locations. However, based on land use and land cover data, only 6.4% of the Project contains potential breeding bird habitat (i.e., forests, wetlands, and hay/pasture), thus 16 fixed-point count locations were recommended for the Project (See Table 1 and Figure 1).

Three 10-minute (min) surveys (one survey in May and two surveys in June) were completed at the 16 fixed-points surveyed from May 21 – June 27, 2018. A specific July survey for Henslow's sparrow (*Ammodramus henslowii*), dickcissel (*Spiza americana*), and/or sedge wren (*Cistothorus platensis*) was not necessary as suitable habitat, as defined by the ODNR, was not present within the Project (ODNR 2009).

Surveys were completed within a 200-meter (m; 656.2-foot [ft]) radius plot at each point by personnel able to distinguish bird species by sight and sound. Surveys began no earlier than 30 min before dawn and did not extend past 10:00 AM. Surveys were not completed on mornings with winds exceeding five meters per second (11 miles per hour), periods of rain lasting more than 20 min, or heavy fog, due to reduced detectability of birds. Weather information, including temperature, wind speed, wind direction, and cloud cover were recorded for each survey. Any comments or unusual observations were noted in the comments section.

All birds observed during fixed-point counts were identified to species, or best possible identification. The distance and flight direction (bearing) to each bird was estimated, and their behavior recorded using the Ohio Breeding Bird Atlas II codes (Ohio State University 2013). Birds that flew over the point and did not originate from or land within 200 m (656.2 ft) of the center of the plot were recorded as a "fly over".

Observations of sensitive species (defined as species afforded protection under the Endangered Species Act [1973], Bald and Golden Eagle Protection Act [1940], listed as threatened or endangered by the state of Ohio [ODNR 2016], or Birds of Special Conservation Concern [BCC; US Fish and Wildlife Service 2018]) were recorded throughout the surveys. Observations of sensitive species beyond the 200-m radius plot and in-transit were recorded as incidental observations to document occurrence on site.

RESULTS

A total of 959 individual bird observations comprising 64 identified species were detected during the survey. The most commonly observed species included common grackle (*Quiscalus quiscula* [12.3%]), American robin (*Turdus migratorius* [10.2%]), European starling (*Sturnus vulgaris* [8.7%]) and red-winged blackbird (*Agelaius phoeniceus* [8.6%]; Table 2). No federally or state-listed species were recorded during surveys or incidentally. There were three species observed that are listed as BCC for the Project; including, willow flycatcher (*Empidonax traillii*, n=2), wood thrush (*Hylocichla mustelina*, n=1), and red-headed woodpecker (*Melanerpes erythrocephalus*, n=2; Table 2). Willow flycatchers were observed at points 7 and 11, the wood thrush was observed at point 16, and both of the red-headed woodpeckers were observed at point 16. All three of these points are located near riparian forest habitat.

Table 2. Total number of groups and individuals for each species observed during breeding bird surveys at thethe Emerson North Wind Project from May 31 - June 30, 2018.

		Total Observations	
Bird Type/Species	**Scientific Name**	**Number of Groups**	**Number of Individuals**
Waterbirds		**1**	**1**
great egret	*Ardea alba*	1	1
Waterfowl		**3**	**5**
Canada goose	*Branta canadensis*	2	4
mallard	*Anas platyrhynchos*	1	1
Shorebirds		**16**	**37**
killdeer	*Charadrius vociferus*	13	28
spotted sandpiper	*Actitis macularius*	2	3
unidentified shorebird		1	6
Gulls/Terns		**10**	**27**
herring gull	*Larus argentatus*	6	17
ring-billed gull	*Larus delawarensis*	4	10
Diurnal Raptors		**3**	**3**
Buteos		*2*	*2*
red-tailed hawk	*Buteo jamaicensis*	2	2
Eagles		*1*	*1*
bald eagle	*Haliaeetus leucocephalus*	1	1
Doves/Pigeons		**38**	**44**
mourning dove	*Zenaida macroura*	37	43
rock pigeon	*Columba livia*	1	1
Large Corvids		**4**	**5**
American crow	*Corvus brachyrhynchos*	4	5
Passerines		**542**	**801**
American goldfinch	*Spinus tristis*	19	26
American robin	*Turdus migratorius*	83	98
Baltimore oriole	*Icterus galbula*	14	14
bank swallow	*Riparia riparia*	1	1
barn swallow	*Hirundo rustica*	21	37
black-capped chickadee	*Poecile atricapillus*	2	2
blue jay	*Cyanocitta cristata*	19	26
brown-headed cowbird	*Molothrus ater*	5	18
brown thrasher	*Toxostoma rufum*	4	4
Carolina wren	*Thryothorus ludovicianus*	1	1
cedar waxwing	*Bombycilla cedrorum*	2	5
chipping sparrow	*Spizella passerina*	12	12
common grackle	*Quiscalus quiscula*	41	118
common yellowthroat	*Geothlypis trichas*	5	5
dickcissel	*Spiza americana*	5	5
eastern bluebird	*Sialia sialis*	5	5
eastern kingbird	*Tyrannus tyrannus*	1	1
eastern meadowlark	*Sturnella magna*	3	3

Table 2. Total number of groups and individuals for each species observed during breeding bird surveys at thethe Emerson North Wind Project from May 31 - June 30, 2018.

		Total Observations	
Bird Type/Species	**Scientific Name**	**Number of Groups**	**Number of Individuals**
eastern phoebe	*Sayornis phoebe*	2	2
eastern wood-pewee	*Contopus virens*	5	5
European starling	*Sturnus vulgaris*	27	83
field sparrow	*Spizella pusilla*	4	4
gray catbird	*Dumetella carolinensis*	12	12
great crested flycatcher	*Myiarchus crinitus*	2	3
horned lark	*Eremophila alpestris*	1	1
house finch	*Haemorhous mexicanus*	6	7
house sparrow	*Passer domesticus*	26	67
house wren	*Troglodytes aedon*	25	25
indigo bunting	*Passerina cyanea*	7	7
northern cardinal	*Cardinalis cardinalis*	33	33
northern mockingbird	*Mimus polyglottos*	1	1
northern rough-winged swallow	*Stelgidopteryx serripennis*	2	3
orchard oriole	*Icterus spurius*	4	4
red-eyed vireo	*Vireo olivaceus*	4	4
red-winged blackbird	*Agelaius phoeniceus*	62	82
rose-breasted grosbeak	*Pheucticus ludovicianus*	2	2
scarlet tanager	*Piranga olivacea*	1	1
song sparrow	*Melospiza melodia*	47	47
tree swallow	*Tachycineta bicolor*	2	3
tufted titmouse	*Baeolophus bicolor*	3	3
vesper sparrow	*Pooecetes gramineus*	1	1
warbling vireo	*Vireo gilvus*	7	7
white-breasted nuthatch	*Sitta carolinensis*	6	6
willow flycatcher	*Empidonax traillii*	2	2
wood thrush	*Hylocichla mustelina*	1	1
yellow warbler	*Setophaga petechia*	4	4
Swifts/Hummingbirds		**7**	**19**
chimney swift	*Chaetura pelagica*	7	19
Woodpeckers		**17**	**17**
downy woodpecker	*Picoides pubescens*	2	2
hairy woodpecker	*Picoides villosus*	1	1
northern flicker	*Colaptes auratus*	3	3
red-bellied woodpecker	*Melanerpes carolinus*	9	9
red-headed woodpecker	*Melanerpes erythrocephalus*	2	2
Total	**64 Identified Species**	**641**	**959**

CONCLUSIONS

Bird species occurring within the Project are typical of primarily agricultural landscapes in the Midwest and Ohio. No federally or state-listed species were observed within the Project during the surveys or incidentally. There were three species observed that are listed as BCC for the Project; including, willow flycatcher, wood thrush, and red-headed woodpecker. These species were observed in low numbers of one or two individuals per species.

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Exhibit V
Breeding Bird Surveys

2. Breeding Bird Surveys for the Emerson Creek Wind Project Huron County, Ohio dated October 9, 2017

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Breeding Bird Surveys for the Emerson Creek Wind Project Huron County, Ohio

May – June 2017

Prepared by:

Goniela Iskali and Rhett Good

Western EcoSystems Technology, Inc.
408 West 6th Street
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October 9, 2017

EXECUTIVE SUMMARY

Western EcoSystems Technology, Inc. completed breeding bird surveys for the proposed Emerson Creek Wind Project (Project) located in Huron County, Ohio, in accordance with the Ohio Department of Natural Resources (ODNR) *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio*. The objective of the surveys was to document the type and number of bird species observed within the Project during the breeding season.

Surveys were originally completed for the Project in 2012, and additional surveys were completed within an expanded portion of the project in 2017. A total of 34 fixed-point breeding bird surveys were conducted at 26 survey points from May 10, 2012 – June 21, 2012 and eight survey points from May 22 - June 23, 2017. Surveys in July were not required due to the lack of contiguous grassland (including hayfields) or wet meadow and freshwater marsh.

A total of 1,692 individual observations of 71 known and one unknown species were recorded over all surveys. Six species composed 32.8% of bird observations: American robin (*Turdus migratorius*), European starling (*Sturnus vulgaris*), red-winged blackbird (*Agelaius phoeniceus*), song sparrow (*Melospiza melodia*), indigo bunting (*Passerina cyanea*), and red-eyed vireo (*Vireo olivaceus*). Bird species occurring within the Project are typical of primarily agricultural landscapes in the Midwest and Ohio. No federally or state-listed species were recorded during surveys.

STUDY PARTICIPANTS

Western EcoSystems Technology, Inc.

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REPORT REFERENCE

Iskali, G. and R. Good. 2017. Breeding Bird Surveys for the Emerson Creek Wind Project in Huron County, Ohio. Final Report. May – June 2017. Prepared for Emerson Creek Wind, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. October 9, 2017.

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INTRODUCTION

Western EcoSystems Technology, Inc. (WEST) conducted breeding bird surveys for the proposed Emerson West Wind Project (Project) located in Huron County, Ohio, following the Ohio Department of Natural Resources (ODNR) *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio* (ODNR 2009). The objective of the surveys was to identify the bird species that may be impacted through habitat disturbance or avoidance within the Project during the breeding season.

PROJECT AREA

The Project is located in Huron County, Ohio, and is characterized by flat to gently rolling topography dominated by cultivated crops such as corn (*Zea mays*) and soybean (*Glycine max*). The Project is located within the Huron/Erie Lake Plain ecoregion, which is a broad, flat, fertile plain with some relic sand dunes, beach ridges, and end moraine (US Environmental Protection Agency 2013).

Approximately 81.2% of the nearly 38,011.1 acres (ac; 15,382.5 hectares [ha]) in the Project is composed of cultivated cropland (US Geological Survey [USGS] National Land Cover Database [NLCD] 2011, Homer et al. 2015). The next most common land cover type is deciduous forest that composes 12.6% of the Project and consists primarily of shelterbelts and woodlots associated with homesteads. Developed areas (e.g., farmsteads) compose approximately 4.7% of the Project, and all other land cover types compose less than 1.1% of the Project individually (Table 1, Figure 1).

Table 1. Land cover types and composition at the Emerson Creek Wind Project.

Habitat	Acres	% Composition
Cultivated Crops	30,849.5	81.2
Deciduous Forest	4,798.9	12.6
Developed	1,798.6	4.7
Hay/Pasture	406.5	1.1
Open Water	79.0	0.2
Herbaceous	64.4	0.2
Evergreen Forest	7.6	<0.1
Shrub/Scrub	3.1	<0.1
Mixed Forest	2.5	<0.1
Woody Wetlands	1.1	<0.1
Total	**38,011.1**	**100**

Data from USGS NLCD 2011, Homer et al. 2015

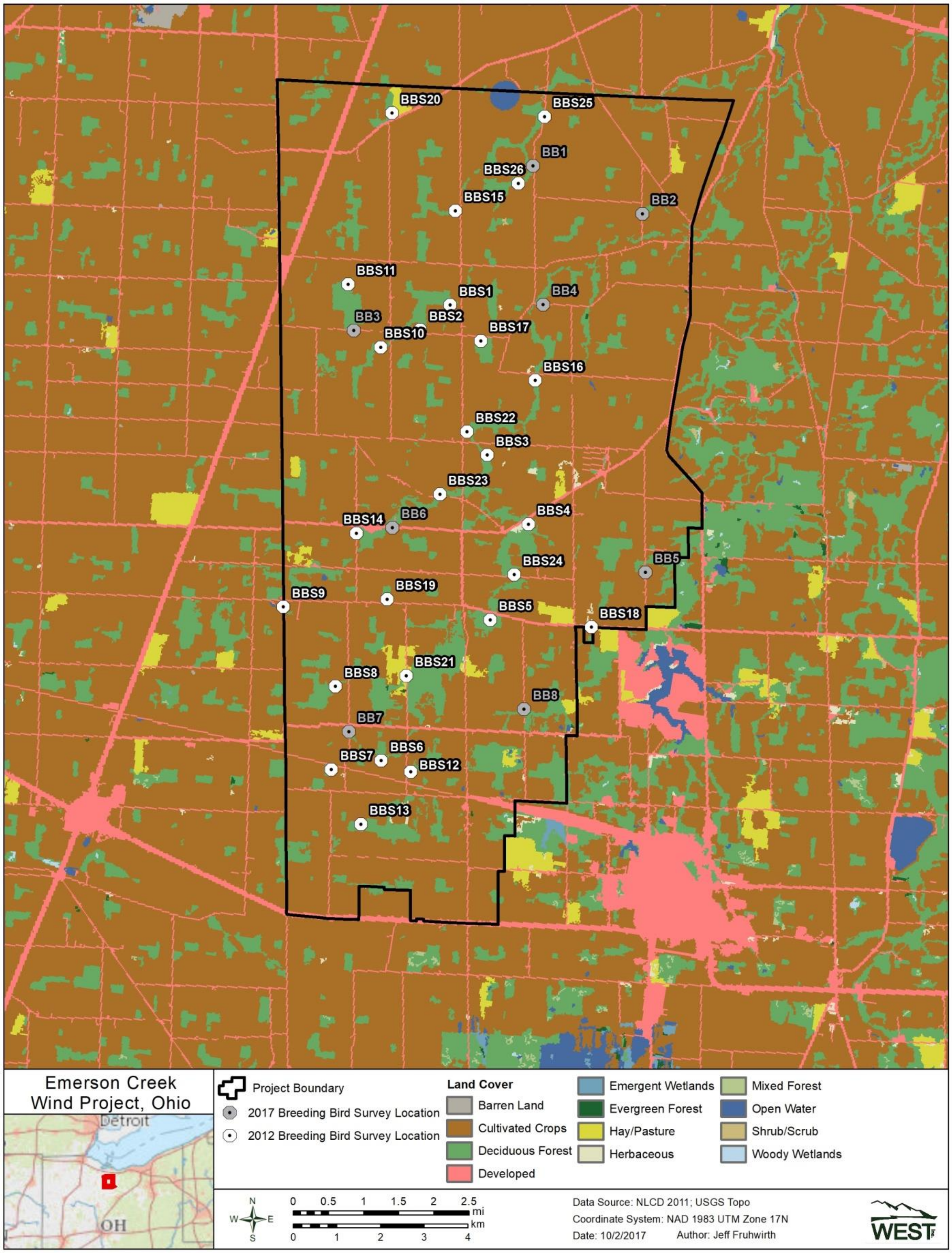

Figure 1. Land cover and breeding bird survey points from 2012 and 2017 at the Emerson Creek Wind Project (USGS NLCD 2011, Homer et al. 2015).

METHODS

ODNR guidelines recommend that breeding bird surveys be conducted at all proposed turbine locations within non-cropland habitats and that two points be established for each turbine (ODNR 2009). Since Project turbine locations are unknown at this time, the number of breeding bird survey points was based on the maximum expected number of turbines (120), for a total of 240 potential fixed-point count locations. Based on land cover data, approximately 13.9% of the Project is located within areas of potential breeding bird habitat (forests, wetlands, shrub/scrub, and hay/pasture); therefore, 34 fixed-point count locations were recommended for the Project (Table 1, Figure 1). Twenty-six points were surveyed in 2012 and eight additional points were surveyed in 2017 due to an expansion of the Project boundary.

Three 10-minute (min) surveys (one in May and two surveys in June) were conducted in 2012 and 2017. Surveys were conducted within a 200-meter (m; 656.2 feet [ft]) radius plot at each point by personnel able to distinguish bird species by sight and sound. In accordance with ODNR guidelines, additional surveys were to be conducted in July in areas with suitable habitat for Henslow's sparrow (*Ammodramus henslowii*), dickcissel (*Spiza americana*), and/or sedge wren (*Cistothorus platensis*) because these species may not sing until later in the breeding season. These additional point count surveys are recommended only if there are >50 ha (123.6 ac) of contiguous grassland (for all three species) or >1 ha (2.5 ac) of wet meadow or freshwater marsh (for sedge wren only). WEST determined that July surveys were not warranted based on the lack of suitable habitat (USGS NLCD 2011, Homer et al. 2015, Ritzert 2012, ODNR 2009).

Surveys began no earlier than 30 min before dawn and did not extend past 10:00 a.m. Surveys were not conducted on mornings with winds exceeding five m/s (11 miles/hr), periods of rain lasting more than 20 min, or heavy fog due to reduced detectability of birds. Weather information, including temperature, wind speed, wind direction, and cloud cover were recorded for each survey. General bird behavior categories recorded during surveys included: perched, soaring, flapping, foraging, gliding, hovering, auditory, and other (noted in comments). Additional Ohio breeding bird atlas codes were also recorded to describe indications of breeding activity (Ohio Breeding Birds Atlas II 2011). Any comments or unusual observations were noted in the comments section (ODNR 2009).

All birds observed during surveys were identified to species, or best possible identification. The distance and flight direction (bearing) to each bird was estimated, and their behavior was recorded using the appropriate reference codes. Birds that flew over the point and did not originate from or land within 200 m (656.2 ft) of the center of the plot were recorded as a "fly over" (ODNR 2009).

RESULTS

A total of 55 species (472 observations) were documented at eight breeding bird points from May 22 – June 23, 2017. The three most frequently observed species in 2017 were common grackle (*Quiscalus quiscula,* n=58), red-winged blackbird (*Agelaius phoeniceus*, n=41), and American robin (*Turdus migratorius,* n=35). These three species made up 28.4% of all birds observed (Table 2).

A total of 68 species (1,220 observations) were documented at 26 breeding bird points from May 10, 2012 – June 21, 2012 (Ritzert 2012). The most commonly observed species in 2012 included indigo bunting (*Passerina cyanea*, n=79), American robin (n=74), European starling (*Sturnus vulgaris*, n=72), song sparrow (*Melospiza melodia*, n=69), and red-eyed vireo (*Vireo olivaceus*, n=67). These five species made up 29.6% of the all birds observed (Table 3).

Table 2. Total number of groups and individuals for each species recorded during breeding bird surveys in the Emerson Creek Wind Project from May 22 – June 23, 2017.

		Total Observations	
Bird Type/Species	**Scientific Name**	**# Groups**	**# Observations**
American crow	*Corvus brachyrhynchos*	4	10
American goldfinch	*Spinus tristis*	11	15
American robin	*Turdus migratorius*	28	35
Baltimore oriole	*Icterus galbula*	7	8
barn swallow	*Hirundo rustica*	9	14
black-capped chickadee	*Poecile atricapilla*	1	1
blue jay	*Cyanocitta cristata*	11	19
brown thrasher	*Toxostoma rufum*	1	2
brown-headed cowbird	*Molothrus ater*	9	13
Canada goose	*Branta canadensis*	3	6
cedar waxwing	*Bombycilla cedrorum*	3	8
chimney swift	*Chaetura pelagica*	1	2
chipping sparrow	*Spizella passerina*	6	8
common grackle	*Quiscalus quiscula*	10	58
common yellowthroat	*Geothlypis trichas*	6	6
eastern bluebird	*Sialia sialis*	4	5
eastern kingbird	*Tyrannus tyrannus*	3	3
eastern meadowlark	*Sturnella magna*	1	1
eastern phoebe	*Sayornis phoebe*	1	1
eastern wood-pewee	*Contopus virens*	3	3
European starling	*Sturnus vulgaris*	7	27
field sparrow	*Spizella pusilla*	3	3
gray catbird	*Dumetella carolinensis*	14	14
great blue heron	*Ardea herodias*	1	1
great crested flycatcher	*Myiarchus crinitus*	3	4
horned lark	*Eremophila alpestris*	3	4
house finch	*Haemorhous mexicanus*	3	5
house sparrow	*Passer domesticus*	5	8
house wren	*Troglodytes aedon*	14	14
indigo bunting	*Passerina cyanea*	4	4
killdeer	*Charadrius vociferus*	6	7
mourning dove	*Zenaida macroura*	12	12
northern cardinal	*Cardinalis cardinalis*	13	13
northern flicker	*Colaptes auratus*	2	2

Table 2. Total number of groups and individuals for each species recorded during breeding bird surveys in the Emerson Creek Wind Project from May 22 – June 23, 2017.

		Total Observations	
Bird Type/Species	**Scientific Name**	**# Groups**	**# Observations**
northern mockingbird	*Mimus polyglottos*	2	2
northern rough-winged swallow	*Stelgidopteryx serripennis*	2	4
orchard oriole	*Icterus spurius*	6	7
red-bellied woodpecker	*Melanerpes carolinus*	3	3
red-eyed vireo	*Vireo olivaceus*	4	5
red-headed woodpecker	*Melanerpes erythrocephalus*	2	2
red-tailed hawk	*Buteo jamaicensis*	1	1
red-winged blackbird	*Agelaius phoeniceus*	23	41
rose-breasted grosbeak	*Pheucticus ludovicianus*	4	4
ruby-throated hummingbird	*Archilochus colubris*	1	1
song sparrow	*Melospiza melodia*	26	27
tree swallow	*Tachycineta bicolor*	1	2
tufted titmouse	*Baeolophus bicolor*	7	9
vesper sparrow	*Pooecetes gramineus*	2	2
warbling vireo	*Vireo gilvus*	2	2
white-breasted nuthatch	*Sitta carolinensis*	5	5
wild turkey	*Meleagris gallopavo*	2	5
willow flycatcher	*Empidonax traillii*	3	3
wood thrush	*Hylocichla mustelina*	3	3
yellow warbler	*Setophaga petechia*	7	7
yellow-throated vireo	*Vireo flavifrons*	1	1
Total	**55 identified species**	**319**	**472**

Table 3. Total number of groups and individuals for each species in the Emerson Creek Wind Project from May 10 – June 21, 2012.

		Total Observations	
Bird Type/Species	**Scientific Name**	**# Groups**	**# Observations**
Acadian flycatcher	*Empidonax virescens*	33	34
American crow	*Corvus brachyrhynchos*	14	18
American goldfinch	*Spinus tristis*	19	24
American redstart	*Setophaga ruticilla*	17	17
American robin	*Turdus migratorius*	72	74
Baltimore oriole	*Icterus galbula*	23	23
barn swallow	*Hirundo rustica*	8	20
barred owl	*Strix varia*	1	1
black-and-white warbler	*Mniotilta varia*	1	1
black-capped chickadee	*Poecile atricapilla*	23	23
black-throated green warbler	*Setophaga virens*	2	2
blue jay	*Cyanocitta cristata*	15	16
blue-gray gnatcatcher	*Polioptila caerulea*	31	38
brown thrasher	*Toxostoma rufum*	1	1
brown-headed cowbird	*Molothrus ater*	17	18
Canada goose	*Branta canadensis*	1	11
cedar waxwing	*Bombycilla cedrorum*	1	1
chimney swift	*Chaetura pelagica*	1	1
chipping sparrow	*Spizella passerina*	9	9
common grackle	*Quiscalus quiscula*	5	12

Table 3. Total number of groups and individuals for each species in the Emerson Creek Wind Project from May 10 – June 21, 2012.

		Total Observations	
Bird Type/Species	**Scientific Name**	**# Groups**	**# Observations**
common yellowthroat	*Geothlypis trichas*	41	42
downy woodpecker	*Picoides pubescens*	19	19
eastern bluebird	*Sialia sialis*	3	3
eastern kingbird	*Tyrannus tyrannus*	3	4
eastern meadowlark	*Sturnella magna*	8	9
eastern phoebe	*Sayornis phoebe*	3	3
eastern towhee	*Pipilo erythrophthalmus*	3	3
eastern wood-pewee	*Contopus virens*	49	49
European starling	*Sturnus vulgaris*	7	72
field sparrow	*Spizella pusilla*	29	29
gray catbird	*Dumetella carolinensis*	25	26
great blue heron	*Ardea herodias*	1	1
great crested flycatcher	*Myiarchus crinitus*	14	14
horned lark	*Eremophila alpestris*	4	4
house sparrow	*Passer domesticus*	3	4
house wren	*Troglodytes aedon*	42	43
indigo bunting	*Passerina cyanea*	77	79
Killdeer	*Charadrius vociferus*	10	13
mourning dove	*Zenaida macroura*	11	11
northern cardinal	*Cardinalis cardinalis*	32	33
northern flicker	*Colaptes auratus*	3	3
northern parula	*Setophaga americana*	1	1
Ovenbird	*Seiurus aurocapilla*	8	8
red-bellied woodpecker	*Melanerpes carolinus*	29	29
red-eyed vireo	*Vireo olivaceus*	66	67
red-headed woodpecker	*Melanerpes erythrocephalus*	2	2
red-tailed hawk	*Buteo jamaicensis*	3	3
red-winged blackbird	*Agelaius phoeniceus*	51	55
rose-breasted grosbeak	*Pheucticus ludovicianus*	6	6
ruby-throated hummingbird	*Archilochus colubris*	2	2
Savannah sparrow	*Passerculus sandwichensis*	3	3
scarlet tanager	*Piranga olivacea*	14	14
song sparrow	*Melospiza melodia*	67	69
tree swallow	*Tachycineta bicolor*	5	5
tufted titmouse	*Baeolophus bicolor*	18	18
turkey vulture	*Cathartes aura*	4	9
Veery	*Catharus fuscescens*	2	2
vesper sparrow	*Pooecetes gramineus*	1	1
warbling vireo	*Vireo gilvus*	1	1
white-breasted nuthatch	*Sitta carolinensis*	15	17
white-crowned sparrow	*Zonotrichia leucophrys*	1	1
white-eyed vireo	*Vireo griseus*	1	1
wild turkey	*Meleagris gallopavo*	4	4
willow flycatcher	*Empidonax traillii*	5	5
wood thrush	*Hylocichla mustelina*	52	52
yellow warbler	*Setophaga petechia*	28	28
yellow-throated vireo	*Vireo flavifrons*	6	6
unidentified woodpecker		3	3
Total	**67 identified species**	**1,079**	**1,220**

No federally and/or state endangered or threatened species were observed over the course of all breeding bird surveys conducted in 2012 and 2017. Three Birds of Conservation Concern (BBC; field sparrow [*Spizella pusilla*], northern flicker [*Colaptes auratus*], red-headed woodpecker [*Melanerpes erythrocephalus*]) were observed during both the 2012 and 2017 surveys (US Fish and Wildlife Service 2008).

CONCLUSIONS

Breeding bird species occurring within the Project were similar across both survey periods, and are typical of primarily agricultural landscapes in the Midwest and Ohio. No federally and/or state listed species and three BCC species were recorded over the course of the breeding bird surveys. Displacement impacts to breeding birds from the Project are likely to be similar to those at currently operating projects in similar habitats (Hale et al 2014, Stevens et al 2013).

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Exhibit V
Breeding Bird Surveys

3. Summary of results of breeding bird surveys at the Emerson Creek Wind Resource Area dated October 15, 2012

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TECHNICAL MEMORANDUM

Date: October 15, 2012

To: Apex Wind Energy

From: Michelle L. Ritzert, WEST, Inc.

Subject: Summary of results of breeding bird surveys at the Emerson Creek Wind Resource Area.

Apex Wind Energy (Apex) is proposing to develop a wind energy facility, known as the Emerson Creek Wind Resource Area (ECWRA), in Seneca and Huron Counties, Ohio. Apex contracted Western EcoSystems Technology, Inc. (WEST) to conduct baseline surveys in the ECWRA. Survey design followed methods described in the final draft of wildlife study guidelines from the Ohio Department of Natural Resources (ODNR). This memo includes results from the breeding bird surveys conducted at the ECWRA between May 10 and July 18, 2012.

The objective of the breeding bird surveys was to document the type and number of bird species observed at ECWRA during the breeding season. During the summer of 2012, turbine locations were unknown for the ECWRA, thus the number of breeding bird survey points was based on the maximum expected number of turbines (250). The ODNR requires two survey points for each turbine within the proposed ECWRA, for a total maximum of 500 point-count locations. However, the ODNR does not require surveys of point-count locations within active agricultural fields since these areas are generally not considered suitable nesting habitat for most bird species. Based on land use/land cover data, approximately 11.2% of the ECWRA is located within non-cropland habitats (forest areas, pasture/hay, and grassland). Assuming that 11.2% of turbines will occur in these habitats, 56 breeding bird points would need to be surveyed. However, based on the initial field visit to setup the survey points several areas classified as grassland or pasture/hay in the land use/land cover dataset were discovered to have been converted to tilled agricultural. Therefore only 45 points were setup in habitats and stratified across the ECWRA (Figure 1). Where possible, point-count locations were placed within each habitat type on leased lands; however, locations were also placed adjacent to habitat areas and surveyed from public roads where access to private land was limited.

Three 10 minute surveys were conducted at each point (1 survey in May 2012, and 2 surveys in June 2012). ODNR guidelines require that one additional survey be conducted in July in areas with suitable habitat for Henslow's sparrow (*Ammodramus henslowii*), dickcissel (*Spiza americana*), and/or sedge wren (*Cistothorus platensis*). Based on Ohio Wetlands Inventory Data (ODNR OWI 1991), two areas within the proposed ECWRA contain potentially suitable habitat for sedge wren (shallow marshes greater than one hectare), thus a July survey consisting of four point-count locations in these areas was conducted. There are no areas of contiguous grasslands greater than 50 hectares within the project boundary. Therefore, no surveys for Henslow's sparrow or dickcissel were conducted in July.

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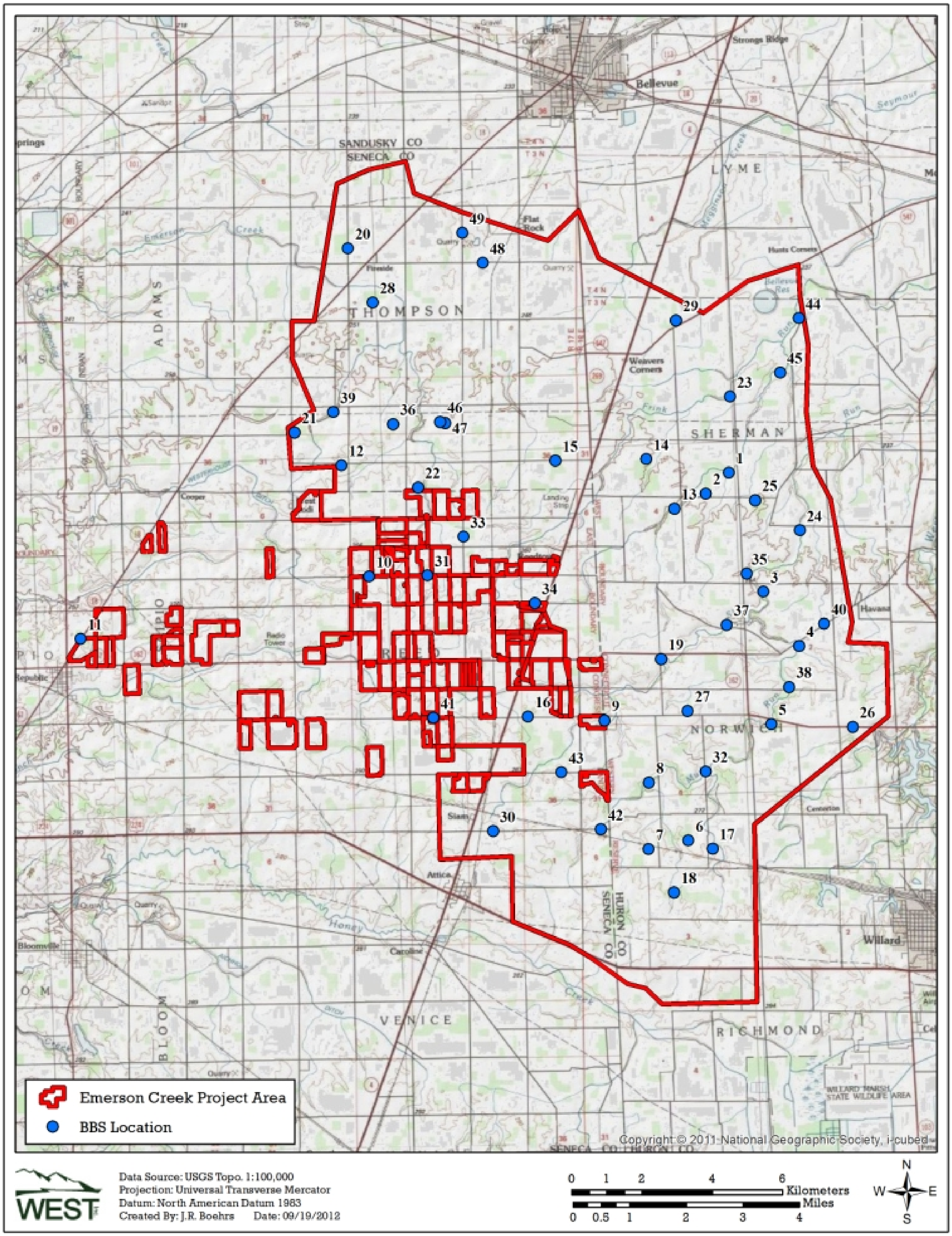

Figure 1. Location of breeding bird survey points within the Emerson Creek Wind Resource Area.

Surveys were conducted by experienced biologists able to distinguish bird species by sight and sound. Surveys began at approximately dawn and did not extend past 1000 hrs. During each survey, each plot was visited once and plots were surveyed for 10 min each survey day. Any bird seen or heard during the survey was recorded, regardless of distance from the observer. However, observations beyond a 100-m radius were excluded in the statistical analyses. Surveys were not conducted on mornings with winds exceeding 5 m/second (m/s; 16 ft/s), periods of rain lasting more than 20 min or heavy fog that may have reduced the biologists' ability to detect bird species.

All birds observed during surveys were identified to species level, or best possible identification. The distance at first observation to each bird was estimated to the nearest m. The flight direction (bearing) of observed birds was recorded and flight characteristics, including height AGL at first observation and overall lowest and highest observations AGL, recorded to the nearest m. Birds that flew over the point and did not originate from or land within 200 m of the center of the plot were recorded as a "fly over".

Using the breeding bird atlas codes (Ohio Breeding Bird Atlas II 2009), indications of breeding activity was recorded in addition to each bird's behavior. Behavior categories recognized included perching, soaring, flapping, foraging, gliding, hovering, singing, and other (noted in comments). Weather information including; temperature, wind speed, wind direction and cloud cover, were recorded for each survey point. Any comments or unusual observations were noted in the comments section and incidental observations of state and federal threatened or endangered species were recorded regardless of whether they were detected during the survey time or while at a plot.

Eighty-eight unique species were identified during breeding bird surveys. A total of 2,446 individual bird observations within 2,001 separate groups were recorded (Table 1). Cumulatively, six species (6.8% of all species) comprised 34.7% of the individual observations; American robin (*Turdus migratorius*; 162 observations), red-winged blackbird (*Agelaius phoeniceus*; 160), European starling (*Sturnus vulgaris*; 151), song sparrow (*Melospiza melodia*; 134), indigo bunting (*Passerina cyanea*; 128), and red-eyed vireo (*Vireo olivaceus*; 113). All other bird types and species comprised less than 4% of the observations individually. Of the species observed during breeding bird surveys, only eight were observed to have confirmed breeding evidence as defined by the ONDR breeding bird atlas codes (2009). These included American robin (adult carrying food; occupied nest; nest with young), blue-gray gnatcatcher (*Polioptila caerulea*; occupied nest), eastern kingbird (*Tyrannus tyrannus*; nest building), gray catbird (*Dumetella carolinensis*; nest building; adult carry food), red-bellied woodpecker (*Melanerpes carolinus*; adult carrying food; occupied nest), red-winged blackbird (adult carrying food; recently fledged young), red-tailed hawk (*Buteo jamaicensis*; recently fledged young) and wild turkey (*Meleagris gallopavo*; recently fledged young).

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Table 1. Summary of individuals and group observations by species and bird group for breeding bird surveys at the Emerson Creek Wind Resource Area from May 10 to July 19, 2012

		Spring	
Type / Species	**Scientific Name**	**# grps**	**# obs**
Waterbirds		**3**	**5**
great blue heron	*Ardea herodias*	2	4
sandhill crane	*Grus canadensis*	1	1
Waterfowl		**6**	**35**
Canada goose	*Branta canadensis*	3	30
mallard	*Anas platyrhynchos*	3	5
Shorebirds		**19**	**24**
killdeer	*Charadrius vociferus*	19	24
Diurnal Raptors		**6**	**7**
northern harrier	*Circus cyaneus*	1	1
red-tailed hawk	*Buteo jamaicensis*	5	6
Owls		**1**	**1**
barred owl	*Strix varia*	1	1
Vultures		**10**	**44**
turkey vulture	*Cathartes aura*	10	44
Upland Game Birds		**7**	**11**
wild turkey	*Meleagris gallopavo*	7	11
Doves/Pigeons		**26**	**37**
mourning dove	*Zenaida macroura*	25	27
rock pigeon	*Columba livia*	1	10
Passerines		**1822**	**2167**
Corvids		*52*	*64*
American crow	*Corvus brachyrhynchos*	21	29
blue jay	*Cyanocitta cristata*	31	35
Blackbirds/Orioles		*267*	*490*
Baltimore oriole	*Icterus galbula*	31	31
bobolink	*Dolichonyx oryzivorus*	13	19
brown-headed cowbird	*Molothrus ater*	36	45
common grackle	*Quiscalus quiscula*	21	58
eastern meadowlark	*Sturnella magna*	25	26
European starling	*Sturnus vulgaris*	26	151
red-winged blackbird	*Agelaius phoeniceus*	115	160
Creepers/Nuthatches		*27*	*31*
white-breasted nuthatch	*Sitta carolinensis*	27	31
Finches/Crossbills		*52*	*66*
American goldfinch	*Carduelis tristis*	52	66
Flycatchers		*158*	*161*
Acadian flycatcher	*Empidonax virescens*	34	35
eastern kingbird	*Tyrannus tyrannus*	3	4
eastern phoebe	*Sayornis phoebe*	3	3
eastern wood-pewee	*Contopus virens*	92	93
great crested flycatcher	*Myiarchus crinitus*	21	21
willow flycatcher	*Empidonax traillii*	5	5
Gnatcatchers/Kinglet		*44*	*54*
blue-gray gnatcatcher	*Polioptila caerulea*	44	54
Grassland/Sparrows		*282*	*295*
chipping sparrow	*Spizella passerina*	38	39
dickcissel	*Spiza americana*	3	3
eastern towhee	*Pipilo erythrophthalmus*	5	5
field sparrow	*Spizella pusilla*	49	49
grasshopper sparrow	*Ammodramus savannarum*	4	4

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Table 1. Summary of individuals and group observations by species and bird group for breeding bird surveys at the Emerson Creek Wind Resource Area from May 10 to July 19, 2012

		Spring	
Type / Species	**Scientific Name**	**# grps**	**# obs**
Henslow's sparrow	*Ammodramus henslowii*	1	1
horned lark	*Eremophila alpestris*	19	20
house sparrow	*Passer domesticus*	8	15
savannah sparrow	*Passerculus sandwichensis*	14	14
song sparrow	*Melospiza melodia*	130	134
unidentified sparrow		3	3
vesper sparrow	*Pooecetes gramineus*	7	7
white-crowned sparrow	*Zonotrichia leucophrys*	1	1
Mimids		*48*	*50*
brown thrasher	*Toxostoma rufum*	2	2
gray catbird	*Dumetella carolinensis*	45	47
northern mockingbird	*Mimus polyglottos*	1	1
Swallows		*30*	*72*
bank swallow	*Riparia riparia*	2	3
barn swallow	*Hirundo rustica*	21	61
northern rough-winged swallow	*Stelgidopteryx serripennis*	1	1
tree swallow	*Tachycineta bicolor*	6	7
Tanagers/Grosbeaks/Cardinals		*216*	*220*
indigo bunting	*Passerina cyanea*	125	128
northern cardinal	*Cardinalis cardinalis*	49	50
rose-breasted grosbeak	*Pheucticus ludovicianus*	10	10
scarlet tanager	*Piranga olivacea*	32	32
Thrushes		*245*	*257*
American robin	*Turdus migratorius*	154	163
eastern bluebird	*Sialia sialis*	10	12
Swainson's thrush	*Catharus ustulatus*	1	1
veery	*Catharus fuscescens*	2	2
wood thrush	*Hylocichla mustelina*	78	79
Titmice/Chickadees		*63*	*63*
black-capped chickadee	*Poecile atricapilla*	28	28
tufted titmouse	*Baeolophus bicolor*	35	35
Vireos		*131*	*134*
red-eyed vireo	*Vireo olivaceus*	110	113
warbling vireo	*Vireo gilvus*	1	1
white-eyed vireo	*Vireo griseus*	3	3
yellow-throated vireo	*Vireo flavifrons*	17	17
Warblers		*147*	*148*
American redstart	*Setophaga ruticilla*	25	25
black-and-white warbler	*Mniotilta varia*	2	2
black-throated blue warbler	*Dendroica caerulescens*	1	1
black-throated green warbler	*Dendroica virens*	3	3
Blackburnian warbler	*Dendroica fusca*	1	1
blackpoll warbler	*Dendroica striata*	6	6
blue-winged warbler	*Vermivora pinus*	1	1
chestnut-sided warbler	*Dendroica pensylvanica*	1	1
common yellowthroat	*Geothlypis trichas*	57	58
northern parula	*Parula americana*	2	2
ovenbird	*Seiurus aurocapillus*	14	14
Wilson's warbler	*Wilsonia pusilla*	1	1
yellow warbler	*Dendroica petechia*	33	33
Waxwings		*3*	*4*

Table 1. Summary of individuals and group observations by species and bird group for breeding bird surveys at the Emerson Creek Wind Resource Area from May 10 to July 19, 2012

		Spring	
Type / Species	**Scientific Name**	**# grps**	**# obs**
cedar waxwing	*Bombycilla cedrorum*	3	4
Wrens		*57*	*58*
house wren	*Troglodytes aedon*	57	58
Cuckoos		*1*	*1*
yellow-billed cuckoo	*Coccyzus americanus*	1	1
Goatsuckers		*1*	*1*
common nighthawk	*Chordeiles minor*	1	1
Swifts/Hummingbirds		*8*	*22*
chimney swift	*Chaetura pelagica*	6	20
ruby-throated hummingbird	*Archilochus colubris*	2	2
Woodpeckers		*91*	*91*
downy woodpecker	*Picoides pubescens*	28	28
hairy woodpecker	*Picoides villosus*	2	2
northern flicker	*Colaptes auratus*	7	7
red-bellied woodpecker	*Melanerpes carolinus*	47	47
red-headed woodpecker	*Melanerpes erythrocephalus*	4	4
unidentified woodpecker		3	3
Overall		**2001**	**2446**

No federally-listed threatened or endangered species were observed during breeding bird surveys within the ECWRA. Two Ohio state-listed endangered species (northern harrier [*Circus cyaneus*; one observation] and sandhill crane [*Grus canadensis*; one]), two species of special concern (bobolink [*Dolichonyx oryzivorus*; 19] and Henslow's sparrow [one]), and two species of special interest (Blackburnian warbler [*Dendroica fusca*; one] and black-throated blue warbler [*D. caerulescens*; one]) were observed during breeding bird surveys at the ECWRA (Table 2). No observations of breeding activity were recorded for these species.

Table 2. Summary of sensitive species observed at the Emerson Creek Wind Resource Area during breeding bird surveys (BBS) and as incidental wildlife observations (Inc.) from May 10 to July 19, 2012.

			BBS		Inc.		Total	
Species	**Scientific Name**	**Status**	**# of grps**	**# of obs**	**# of grps**	**# of obs**	**# of grps**	**# of obs**
bobolink	*Dolichonyx oryzivorus*	SSC	13	19	0	0	13	19
Blackburnian warbler	*Dendroica fusca*	SSI	1	1	0	0	1	1
black-throated blue warbler	*Dendroica caerulescens*	SSI	1	1	0	0	1	1
Henslow's sparrow	*Ammodramus henslowii*	SSC	1	1	0	0	1	1
northern harrier	*Circus cyaneus*	SE	1	1	0	0	1	1
sandhill crane	*Grus canadensis*	SE	1	1	0	0	1	1
Total	**6 species**		**18**	**24**	**0**	**0**	**18**	**24**

SSC= State species of concern; SSI= state species of interest; SE= state endangered species; http://www.dnr.state.oh.us/Portals/9/pdf/pub356.pdf).

During the breeding bird surveys the majority of species observed were typical agricultural species such as American robin, red-winged blackbird, and European starling. A variety of woodland birds were also observed, such as the black-and-white (*Mniotilta varia*) and blackpoll (*Dendroica striata*) warblers (*Wilsonia citrina*), American redstart (*Setophaga ruticilla*) and ovenbird (*Seiurus aurocapillus*), but in relatively limited numbers. The ODNR recommended survey period for breeding birds overlaps with the late migration period for many woodland passerines. Many of these observations likely represent late migrants passing through the ECWRA, rather than observations of birds nesting in the ECWRA.

Firelands Wind, LLC
Case No. 18-1607-EL-BGN

Exhibit W
Owl Surveys

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TECHNICAL MEMORANDUM

Date: May 21, 2013

To: Apex Wind Energy

From: Michelle L. Ritzert, WEST, Inc.

Subject: Summary results of owl surveys at the Emerson Creek Wind Resource Area

---

Apex Wind Energy (Apex) is proposing to develop a wind energy facility, known as the Emerson Creek Wind Resource Area (ECWRA), in Seneca and Huron Counties, Ohio. Apex contracted Western EcoSystems Technology, Inc. (WEST) to conduct baseline surveys in the ECWRA. Survey design followed methods described in the final draft of wildlife study guidelines from the Ohio Department of Natural Resources (ODNR). This memo includes results from the owl surveys conducted at the ECWRA between December 2012 and April 2013.

The objective of the surveys was to determine if three species of owl are present within the ECWRA during the winter (great horned owl [*Bubo virginianus*], barred owl [*Strix varia*], and eastern screech owl [*Otus asio*]). Two survey points were placed within forested areas of the ECWRA (Figure 1) and each point was surveyed once during each month, on a single night. Surveys began 0.5 hours after sunset and calls were played using a portable radio. Three replications of one minute of calls, followed by four minutes of listening (15 minutes total per station) were played at each survey point.

Surveys were conducted monthly for the targeted species: December 18, 2012 (great horned owl), January 28, 2013 (barred owl), and April 29, 2013 (eastern screech owl). No targeted owl species were recorded during the surveys. One eastern screech owl was recorded during the January survey for barred owls and was heard after the barred owl call was played approximately 50 meters from the observer.

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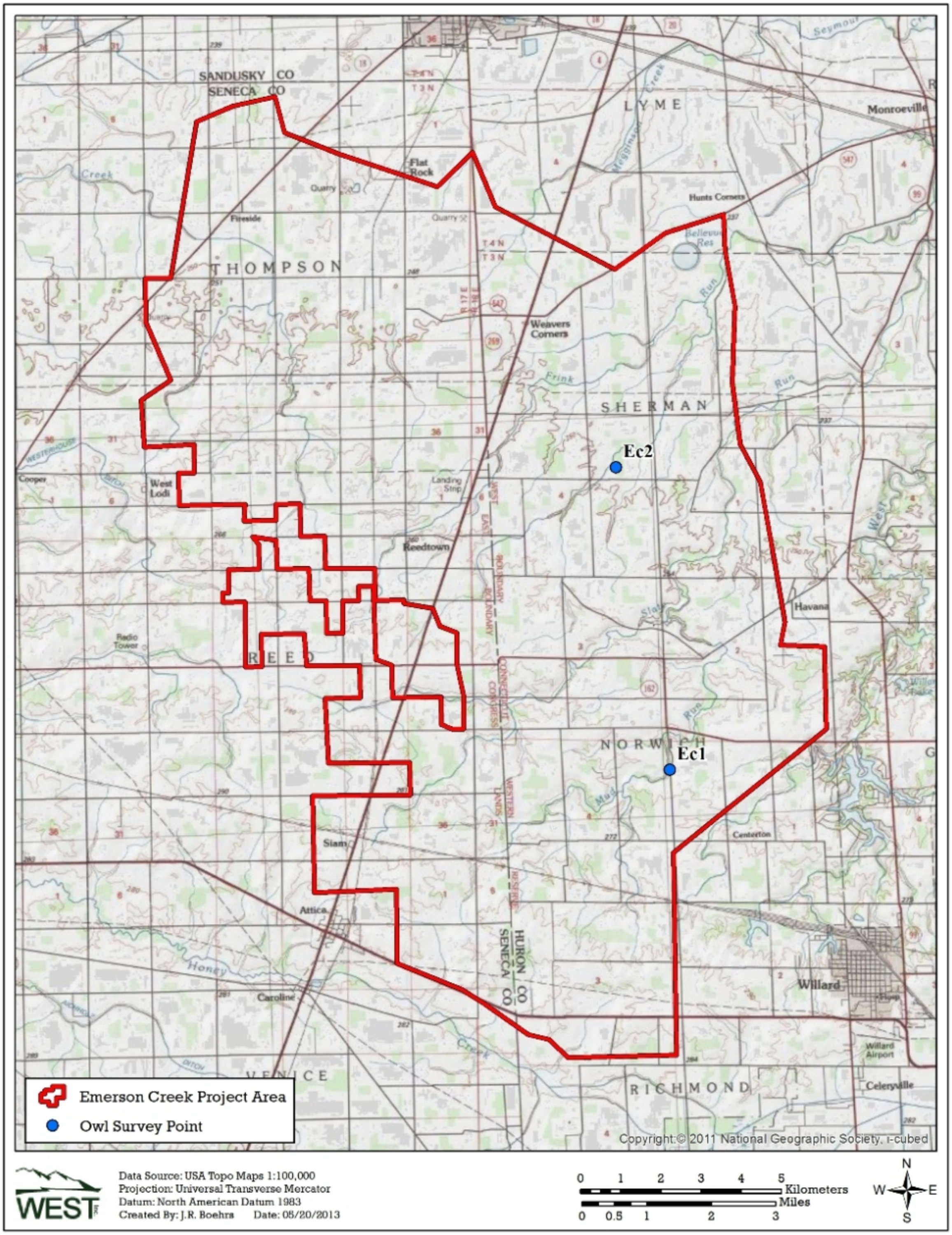

Figure 1. Location of the owl survey points within the Emerson Creek Wind Resource Area.

Exhibit X
Acoustic Bat Surveys

1. **Bat Acoustic Survey Report dated July 20, 2012**
2. **Bat Activity Studies for the Proposed Emerson Creek Wind Resource Area Seneca and Huron Counties, Ohio dated March 11, 2011**

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Exhibit X
Acoustic Bat Surveys

1. Bat Acoustic Survey Report dated July 20, 2012

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TETRA TECH

July 20, 2012

Ms. Jennifer Norris
Olentangy Wildlife Research Station
Ohio Department of Natural Resources-Division of Wildlife
8589 Horseshoe Road
Ashley, Ohio 43003

Re: Bat Acoustic Survey Report
Proposed Firelands/Lyme Wind Project
Seneca, Huron and Erie Counties, Ohio
Tetra Tech Project Number: 103P178401

Dear Ms. Norris:

On behalf of our client, Firelands Wind Farm, LLC and Lyme Wind Farm LLC (Firelands/Lyme), Tetra Tech EM Inc. (Tetra Tech) is pleased to provide the enclosed Bat Acoustic Survey Report for the proposed Firelands/Lyme Wind Energy Project located in Huron and Erie Counties, Ohio. The enclosed report provides a summary of Indiana bat habitat mist netting (report previously submitted in October 2011) and the results of the bat acoustic monitoring for the Firelands/Lyme project. All studies have been performed in accordance with the Firelands/Lyme Avian and Bat Plan submitted and approved by the United Fish and Wildlife Service (USFWS) and Ohio Department of Natural Resources (ODNR) in March 2011.

We appreciate your input and feedback and look forward to continuing our working relationship with the USFWS and ODNR on this important project. Should you have any questions or require additional information, please do not hesitate to contact me directly by phone at 513-333-3662 or via electronic mail at douglas.mcilvain@tetratech.com .

Sincerely,

Tetra Tech

Douglas J McIlvain

Douglas McIlvain
Senior Project Manager

Enclosures

Cc: Keith Lott, USFWS
Matthew Krivos, Firelands/Lyme Project Manager

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BAT ACOUSTIC SURVEY REPORT

FIRELANDS/LYME WIND FARM

SENECA, HURON AND ERIE COUNTIES, OHIO

Prepared for:

Firelands Wind Farm, LLC and Lyme Wind Farm LLC
629 Euclid Avenue, Suite 635
Cleveland, Ohio 44114

Submitted by:

Tetra Tech EM Inc.
250 West Court Street, Suite 200W
Cincinnati, Ohio 45202

Tetra Tech Project #103P178401

July 2012

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1.0 INTRODUCTION

This report describes the Bat Acoustic Survey Report for the proposed Firelands and Lyme Wind Farm Project Area (Project Area). The Project Area is located in Erie, Huron, and Seneca Counties, Ohio (see Figure 1 – Site Location Map).

The purpose of this pre-construction study was to provide information on bat activity within the Project Area and to determine the relative levels of bat activity between acoustic monitoring locations, as well as to identify peak periods of bat activity, and how these peaks may relate to weather conditions. These data may be used to assess the potential risk to bat species from the proposed wind project and are complimentary to the Indiana bat mist-netting survey performed in 2011

The scope of work was performed in accordance with the *Avian and Bat Study Plan* dated March 23, 2011, which was submitted to Ms. Melanie Cota of the United States Fish and Wildlife Service (USFWS) Columbus, Ohio Field Office and Ms. Jennifer Norris of the Ohio Department of Natural Resources (ODNR) Division of Wildlife. Approval of the *Avian and Bat Plan* was received via electronic mail from the USFWS on April 27, 2011 and from ODNR on May 21, 2011 (Appendix A). Additionally, the bat acoustic survey followed the ODNR *On-shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in OH* (2009) and the survey recommendations outlined in correspondence received by Tetra Tech on May 21, 2011 from ODNR Wind Energy Lead, Jennifer Norris (Appendix A).

On behalf of Firelands Wind Farm, LLC and Lyme Wind Farm LLC (Firelands/Lyme), Tetra Tech EM, Inc. (Tetra Tech) respectfully submit this Bat Acoustic Survey Report for the proposed Project Area in Erie, Huron, and Seneca Counties, Ohio. This report includes a description of the proposed project, a summary of the Indiana bat surveys, methodologies used during the bat acoustic survey, results of the bat acoustic survey, and discussion.

1.1 Project Description & Background

Firelands/Lyme is proposing to construct a wind energy facility across approximately 43,000 acres (Project Area) of primarily agricultural lands in Erie, Huron and Seneca Counties, Ohio (see Figure 1). The proposed facility will include the construction of approximately 62 turbines, or approximately 99 megawatts (MW) of installed wind capacity. For the purposes of these avian biological surveys, the Firelands Project Area and the Lyme Project Area were evaluated together and hereafter are referred to as the "Project Area". The completed wind energy facility will also include development of infrastructure (transmission lines, substation facilities, access roads, etc.).

The majority (over 98%) of the Project Area has been converted to cropland or other high intensity development. Forest stands and other natural habitats are generally small, scattered and highly fragmented. Of the approximately 43,000 acres within the Project Area, approximately 870 acres are considered potential Indiana bat habitat (i.e., deciduous forest, scrub/shrub or forested wetlands) (see Figure 2).

Tetra Tech biologists observed that most of the stream channels occurring within the Project Area have been extensively modified for agricultural practices. Six medium-sized creeks (Megginson Creek, Seymour Creek, Snyder's Ditch, Mills Creek, Pipe Creek, and Zorn Beutal Ditch) are found throughout the Project Area and typically drain to the northeast and east. No large rivers or water bodies occur within the Project Area. Scattered and fragmented forested, emergent, and scrub-shrub wetlands occur in the Project Area; however, most of these have been significantly disturbed by farming and draining activities.

1.2 Indiana Bat Mist Net Survey

On behalf of Firelands/Lyme, Tetra Tech and Redwing Ecological Services, Inc. (Redwing) conducted an Indiana Bat Mist Net Survey from July 19, 2011 through July 30, 2011. Results from the Indiana Bat Mist Net Survey were submitted to the USFWS and ODNR in the *Indiana Bat Mist Net Survey Report (Tetra Tech and Redwing, 2011)*, dated October 31, 2011 for the proposed Project Area. For the purposes of this report Tetra Tech has included this brief overview of the survey and results. Tetra Tech believes this information provides additional data and support for the acoustic results obtained during the bat acoustic survey.

Nine mist net set site locations were surveyed within the proposed Project Area (see Figure 2). The nine mist net set sites covered various habitats, including wooded riparian corridors along perennial streams, open flight corridors within woodlots, and edge habitat of woodlots and stream corridors. These locations represented the most suitable areas of Indiana bat summer habitat and the most likely locations to capture Indiana bats throughout the Project Area.

Redwing and Tetra Tech surveyed a total of nine mist net sites, utilized four net sets per site, and surveyed each site for two nights. Therefore, the total of 70 net nights were surveyed between July 19–30, 2011 (note: this result excludes two net nights due to a rainout on July 22, 2011).

The total number of individual bats captured during the mist net survey was 175, which includes the 11 individuals captured prior to the rain-out on July 22, 2011. However, 11 bats escaped prior to being sexually identified. Therefore, a total of 164 bats were able to be sexually identified: 76 were identified as males (46.3%) and 88 were identified as females (53.7%).

The breakdown by species identified is provided below:

Table 1 – Mist Net Survey Results

Species	Count	Percentage
Big brown bat *(Eptesicus fuscus)*	100	57.1%
Eastern red bat *(Lasiurus borealis)*	43	24.6%
Northern long-eared bat *(Myotis septentrionalis)*	20	11.4%
Hoary bat (*Lasiurus cinereus*)	5	2.86%
Little brown bat *(Myotis lucifugus)*	5	2.86%
Evening bat *(Nycticeius humeralis)*	2	1.14%
Total Captured	175	100%

Redwing and Tetra Tech captured 175 bats during 20 nights, including those captured prior to the July 22, 2011 rainout. The average number of bats captured per night was 8.75 bats/night. A total of 36 net sets were surveyed, therefore the average number of bats captured per net set was 4.86 bats/net set.

Excluding those individuals captured prior to the rainout on July 22, 2011, Redwing and Tetra Tech captured 164 bats during 18 nights. The average number of bats captured per night was 9.11 bats/night. A total of 36 net sets were surveyed, therefore the average number of bats captured per net set was 4.56 bats/net set.

A total of 88 individuals were identified as females, and of those, 41 were identified to be reproductive (46.6%). The reproductive/female breakdown by species is provided below:

Table 2 – Reproductive/Female Breakdown by Species

Species	Count	Percentage
Big brown bat *(Eptesicus fuscus)*	21 of 48	43.8%
Eastern red bat *(Lasiurus borealis)*	8 of 23	34.8%
Northern long-eared bat *(Myotis septentrionalis)*	10 of 13	76.9%
Hoary bat (*Lasiurus cinereus*)	1 of 2	50.0%
Little brown bat *(Myotis lucifugus)*	0 of 1	0.00%
Evening bat *(Nycticeius humeralis)*	1 of 1	100%
Total Reproductive Females	41 of 88	46.6%

No Indiana bats were captured during these survey activities.

2.0 BAT ACOUSTIC SURVEY METHODOLOGY

Tetra Tech biologists conducted a bat acoustic survey at the Firelands/Lyme Project Area during the spring, summer, and fall of 2011. Objectives for the bat surveys were to:

1) Identify the levels of bat activity within the Project Area;

2) Determine the relative levels of bat activity between detector sites; and

3) Identify peak periods of bat activity, and how these peaks may be related to weather conditions.

Bat activity was monitored using a total of six AnaBat SD-1 (Titley Scientific, Inc.) ultrasonic acoustic recorders or detectors (AnaBat). Two AnaBats were deployed in each of the two on-site meteorological (MET) towers (identified as "MET tower" detectors) and two were deployed at ground level (identified as "Ground" detectors) in the Project Area (see Figure 2 - Bat Acoustic Monitoring Station Location Map).

2.1 Data Collection

A total of six AnaBats operated in the Project Area in 2011. Tetra Tech deployed two AnaBats on the guy wires at each of the 60 meter (m) high MET towers within the Project Area, known as Firelands North and South met towers (MET locations are shown on Figure 1). Tetra Tech deployed the AnaBats at heights within ('High') and below ('Low') the typical rotor swept zone (RSZ) of the modern wind turbines (approximately 30 to 140 m). Placement of the AnaBats was done in accordance with the ODNR *On-shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in OH* (2009). In each met tower the 'High' and 'Low' detectors were suspended at heights of approximately 40 m (131 feet) and 5 m (16 ft), respectively. Additionally, Tetra Tech placed two (2) monitoring stations within suitable bat habitat within the Project Area at ground level (~5 feet above ground surface). These ground monitoring stations were deployed in the Firelands (Ground 1) and Lyme (Ground 2) portions of the Project Area within potentially suitable bat habitat (Figure 2).

The AnaBats were programmed to begin recording bat calls approximately 30 minutes before sunset, monitor activity all night, and then stop recording 30 minutes after sunrise each night, to ensure that the greatest period of bat activity was monitored. The recording times were adjusted over the course of the survey to compensate for seasonal changes in photoperiod. Tetra Tech deployed the AnaBats on March 21, 2011 and removed them on November 16, 2011. Detectors operated for the majority of the deployment period, although some data were lost due to malfunction, power loss/battery failure, or other unforeseen circumstances.

Each of the six monitoring stations consisted of an AnaBat powered by a 5-watt solar panel and a 12-volt battery encased in a waterproof housing. The housing suspended the AnaBat microphone downward. A polyvinyl tube angled at 45 degrees below the microphone facilitated recording of the airspace above and adjacent to the detector. Detectors were checked manually by Tetra Tech staff approximately every 2 weeks for the duration of the survey.

2.2 Data Analysis

Potential bat call files were extracted from data files using CFCread software (Titley, Inc.). CFCread software screens all data recorded by the bat detector and extracts call files using a filter. Tetra Tech used the default settings for the CFCread software during the file extraction process to ensure comparability between datasets. These settings include a maximum time between calls (TBC) of five seconds, a minimum pulse fragment line length of five milliseconds, and a smoothing factor of 50. The smoothing factor refers to whether or not adjacent pixels can be connected with a smooth line. The higher the smoothing factor, the less restrictive the filter, resulting in more noise files and poor quality call sequences retained within the dataset. A call is defined as a single pulse of sound produced by a bat. A call sequence is defined as a combination of two or more pulses recorded in a single call file.

Tetra Tech made visual comparisons of recorded bat call sequences of sufficient length to established reference libraries of bat calls from hand released and zip-line individuals recorded across the eastern United States. This technique allows for relatively accurate identification of bat species (O'Farrell et al. 1999, O'Farrell and Gannon 1999). All call sequences were also run through a series of conservative filters based on call sequence characteristics outlined in Szewczak et al. (2008) and from known species call sequences (hand released and zip-line individuals) from a regional call library. A call sequence was considered of suitable quality and duration to be included in data analysis if the individual call pulse(s) exhibited the full spectrum of frequency modulation produced by a bat (i.e., consisting of sharp, distinct lines) with a minimum of three pulses. Call data is provided on the enclosed compact disk (Appendix B).

Tetra Tech estimated relative abundance, or the magnitude of each species' contribution to the number of calls recorded per sampling location, by calculating an Index of Activity (IA) modified from Miller (2001). The IA calculation was based on the presence/absence of a species' occurrence within 1-minute time increments. Thus, IA was the sum of minute-increments with a species' presence divided by the unit effort (see equation below). The IA calculations allow a more accurate comparison of samples with different numbers of detector-nights by normalizing the results for level of effort.

$$\text{Index of Activity} = \left(\frac{\text{Number of Detector Minutes}}{\text{Total Detector Nights}}\right)$$

3.0 BAT ACOUSTIC SURVEY RESULTS

This section presents the results of nearly seven months of bat activity monitoring during the spring migration, summer residency, and fall migration periods. Tetra Tech deployed the monitoring stations on March 21, 2011 and demobilized them on November 16, 2011. Tetra Tech checked the status of the monitoring stations on a bi-weekly basis to ensure proper operation and in order to perform maintenance activities on the monitoring stations. During the monitoring effort, several of the monitoring stations experienced equipment malfunctions that were considered typical for remotely deployed, passive monitoring applications and can be caused by a variety of factors such as battery failure, low battery voltage, CF card failure, and lightning strikes in the vicinity of the equipment. As a result, all of the monitoring stations did not monitor for the entirety of the survey period. The date ranges of operation for each monitoring station were shown previously on Table 3.

The longest duration of monitoring was at the North MET Tower High detector and the Ground 2 detector, where each detector operated for a total of 240 detector-nights. The South MET Tower low detector operated for the shortest duration, operating for 160 detector-nights. The Ground 1 detector operated for 225 nights while Ground 2 operated for 240 nights (Table 3). The North MET Tower Low detector recorded for 220 nights. The South MET Tower High detector operated for 202 nights. The combined total of detector nights was 1,287.

A total of 19,252 bat call sequences within 16,948 1-minute intervals of bat activity were recorded during the survey period (see Table 3).

Table 3 – Acoustic Monitoring Summary

Detector Location		Period of Operation	Total Detector Nights	Total Number of Call Sequences	Number of Minutes with Activity	Overall Index of Activity	Pooled Index of Activity
Ground Detectors	Ground 1	Mar. 21 - Sep. 11 Sep. 27 - Nov. 15	225	6787	5855	2,602.2	3,004.1
	Ground 2	Mar. 21 - Nov. 15	240	9394	8114	3,380.8	
North MET Tower	North High	Mar. 21 - Nov. 15	240	845	826	344.2	254.6
	North Low	Mar. 21 - May 16 Jun. 15 - Nov. 15	220	347	345	156.8	
South MET Tower	South High	Mar. 30 - May. 16 Jun. 15 - Nov. 15	202	903	877	434.2	499.4
	South Low	Mar. 30 - Jun. 15 Jul. 6 - Aug. 2 Sep. 6 - Sep. 10 Sep. 28 - Nov. 15	160	976	931	581.9	
Total			**1,287**	**19,252**	**16,948**	**2,062**	**--**

3.1 Call Sequence Analysis

Tetra Tech analyzed the recorded call sequences and identified recorded call sequences which could be classified to the lowest possible taxonomic level (Table 4). Approximately 50% of the recorded calls were classified to species (*n* = 9,670).

Calls were then combined into four ‘Known Species Groups’ based on similarities in call sequence structure (Table 4):

1. Low Frequency Species;
2. Middle Frequency Species;
3. High Frequency Myotis Species; and
4. High Frequency non-Myotis Species.

Call sequences that did not meet the parameters as outline in Section 2.1.2 required for identification could not be classified to species level (*n* = 9,582) and were grouped into ‘Unknown Species Groups.’ These Unknown Species Groups consisted of bat call sequences with insufficient quality to identify to species or ‘Known Species Group’ level (Table 4).

Table 4 – Call Sequences by Taxonomic Level

Group	Characteristic Frequencies*	Species	Total Call Sequences	Total # of Minutes with Activity
Low Frequency	12 kHz–24 kHz	Hoary bat	815	755
		Unknown low frequency call seq.	1,853	1,742
Middle Frequency	24 kHz–38 kHz	Big brown bat	2,406	1,980
		Silver-haired bat	3,516	2,918
		Unknown middle frequency call seq.	4,822	4,285
High Frequency (Non- *Myotis*)	44–45 kHz	Evening bat	726	653
		Tri-colored bat	667	640
		Eastern red bat	461	430
High Frequency (Myotis)	39–45 kHz	Little brown myotis	1,074	908
		Northern long-eared myotis	5	5
		Unknown *Myotis* species	134	130
		Unknown high frequency call seq.	2,527	2,261
Unknown	Variable	Unknown call seq.	246	241
--	--	**Total**	**19,252**	**16,948**

*** Characteristic frequency (Fc) is generally defined as the frequency of the call pulse at the lowest slope, or the lowest frequency of the consistent frequency modulation sweeps. Fc represents the single most useful parameter for species identification.**

The following eight species were identified from the 2011 recorded call sequences collected at the Firelands/Lyme Project Area:

1. hoary bat;
2. silver-haired bat;
3. eastern red bat;
4. evening bat;
5. little brown bat;
6. tri-colored bat;
7. northern long-eared bat; and
8. big brown bat

A total of 4,792 calls (49.5 %) were attributed to typical long-distance migratory bats including, hoary bat, silver-haired bat, and eastern red bat. Tetra Tech grouped the tree-roosting evening bat with the archetypal long-distance migratory bats (lasiurine) for analysis and discussion purposes. Hoary bat accounted for 4.2% of the identified call sequences (n = 815). Silver-haired bat calls accounted for 18.3% (n = 3,516) of detections, and eastern red bat calls accounted for 2.4% (n = 461) of detections. The Eastern red bat produces call sequences with relatively unique characteristics that can generally be accurately identified to species level. These calls were identified by their variability in characteristic frequency, distinct mean minimum and maximum frequency, and centered amplitude concentration. Evening bat calls constituted 3.7% (n = 726) of the calls recorded in 2011.

Four Ohio state listed species of special concern were recorded during the survey period: little brown bat, tri-colored bat, northern long-eared bat, and big brown bat (ODNR 2010). Calls from these four species represented 21.6% (n = 4,152) of all bat calls recorded (Table 4). No calls of federally or state listed threatened or endangered bat species were identified during the surveys, although unidentified *Myotis* species call were recorded.

3.2 Relative Level of Bat Activity Determination

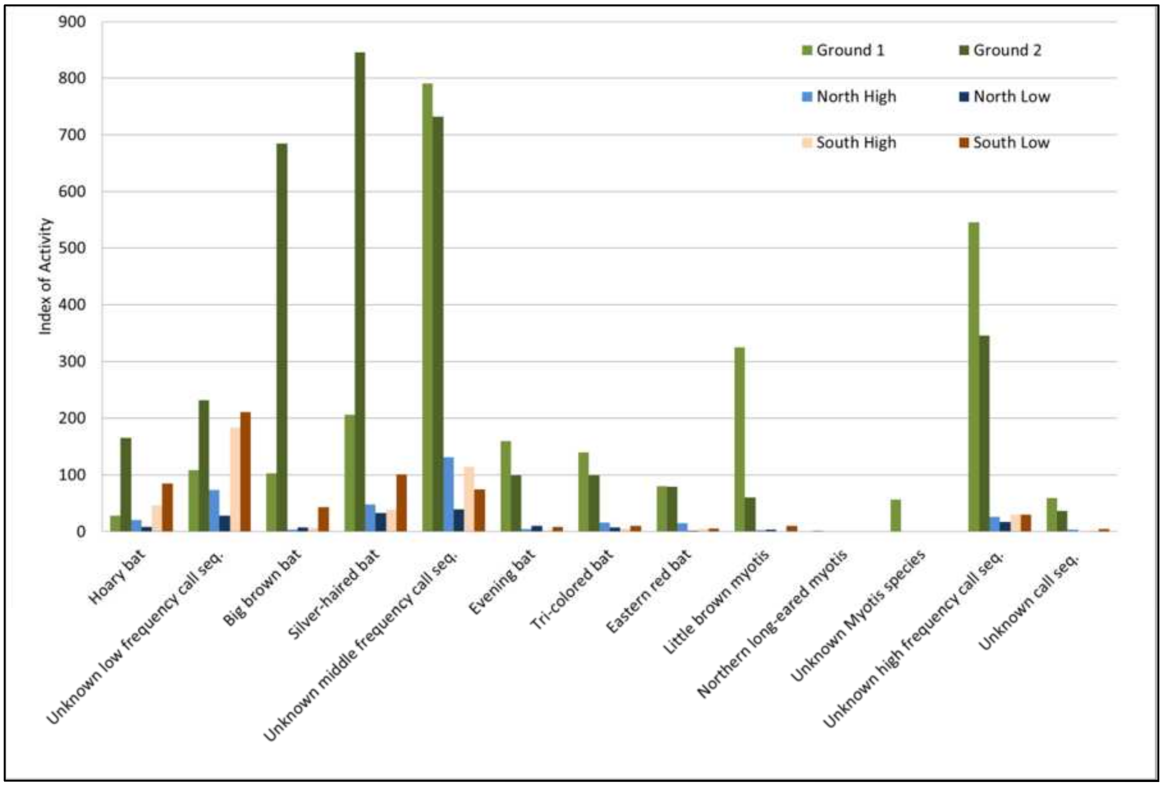
Relative activity levels were calculated for each species and call group at each of the six monitoring station locations (Table 5 and Figure 3). IA values for hoary bat, big brown bat, silver-haired bat were considerably higher at the Ground 2 detector than at the other monitoring stations. Tri-colored bats were most active near the Ground Detectors, especially at Ground 1. Evening bat was also most active at the Ground Detectors. Eastern red bat was most active at Ground 1, as was little brown bat. Northern long eared myotis was only detected at the Ground 1 station.

Table 5 – Index of Activity by Species and Location

Detector Location		Ground Detectors		North MET Tower		South MET Tower		Total IA
		Ground 1	Ground 2	North High	North Low	South High	South Low	
Species	Hoary bat	27.6	165.4	20.4	8.6	46.0	84.4	58.7
	Unknown low frequency call seq.	108.4	231.7	72.9	27.3	183.2	210.6	135.4
	Big brown bat	103.1	684.2	3.3	7.7	6.4	42.5	153.8
	Silver-haired bat	206.2	845.4	47.9	32.3	38.1	101.3	226.7
	Unknown middle frequency call seq.	790.2	732.1	131.3	38.6	114.4	74.4	332.9
	Evening bat	160.0	100.4	4.6	10.0	3.0	8.1	50.7
	Tri-colored bat	140.4	100.4	16.3	7.3	5.4	10.6	49.7
	Eastern red bat	80.0	79.2	15.4	1.8	5.0	5.6	33.4
	Little brown myotis	324.0	60.4	2.9	4.1	1.0	10.0	70.6
	Northern long-eared myotis	2.2	0.0	0.0	0.0	0.0	0.0	0.4
	Unknown Myotis species	56.0	0.4	0.4	0.9	0.0	0.0	10.1
	Unknown high frequency call seq.	545.3	345.0	25.4	17.3	29.7	29.4	175.7
	Unknown call seq.	58.7	36.3	3.3	0.9	2.0	5.0	18.7
Total		**2,602.2**	**3,380.8**	**344.2**	**156.8**	**434.2**	**581.9**	**1,316.9**

Silver-haired bat was the most active species with a Total IA (across all detectors) of 226.7. Big brown bat represented the second most active species across all detectors with a Total IA of 153.8, and little brown myotis had the third highest Total IA of 70.6. Activity, as measured by IA, was greatest at the Ground 2 detector station (3,380.8). This detector recorded a total of 9,394 call sequences during 8,114 one-minute intervals with bat activity over the course of 240 detector-nights. The North MET Tower Low detector station yielded the lowest IA rate (156.8). Overall, there was substantially more activity at the Ground detectors (Ground 1 and Ground 2) than at the MET Tower detectors.

Figure 3 – Species Index of Activity by Location



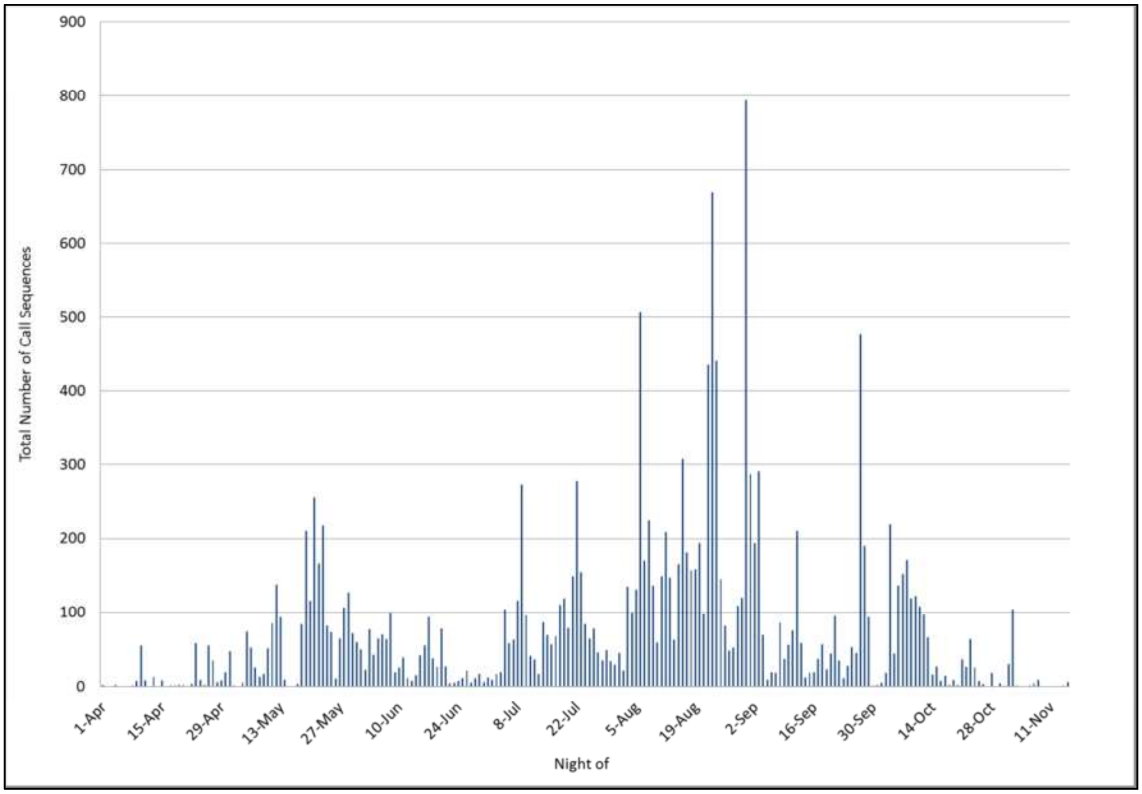
Pooled or combined IA values were calculated for the high and low detectors at each met tower location (Table 3). The Pooled IA value for the North MET Tower detectors was 254.6, and the Pooled IA for the South MET Tower detectors was 499.4. Although, overall bat activity was greatest at the Ground Detector stations (Pooled IA of 3,004.1). The Ground 2 detector had more activity than either Ground 1 or the MET Tower detector stations.

The South MET Tower detectors recorded more bat activity than the North MET Tower detectors (Table 5). Additionally, the South MET Tower Low detector recorded more activity for each identified species (although not for unknown call groups) than the South MET Tower High detector. However the North MET Tower High detector recorded more activity than the North MET Tower Low detector for four of the species recorded, hoary bat, silver-haired bat, tricolored bat, and eastern red bat.

3.3 Peak Periods of Bat Activity and Relation to Weather Conditions

The greatest number of bat call sequences was recorded from mid-August to early September (Figure 4). Tetra Tech anticipated an increase in activity during this period when bats are known to swarm prior to migration or hibernation (Clark et al. 2002, Parsons et al. 2003, and Holland and Wikelski 2009). Few call sequences were recorded prior to mid-May, and activity declined noticeably after mid-October.

Figure 4 – Total Number of Call Sequences by Date



The total number of recorded call sequences for each set of MET Tower detectors pooled was compared to the mean nightly wind speed and temperature recorded by the highest set of instruments in each tower provided by Firelands/Lyme. The total number of call sequences recorded per night was loosely correlated with temperature at both the South and North MET Tower detectors ($r = 0.48$ and $r = 0.26$, respectively) (Figures 5 and 6).

Wind speed was not strongly correlated with bat activity, although there was a slight negative correlation at both the South and North MET Tower detectors ($r = -0.2$ and $r = -0.12$, respectively). The strongest correlation was between the pooled total number of call sequences recorded at the South MET Tower detectors and temperature ($r = 0.48$). This indicates that at South MET Tower detectors bat activity was generally greater when mean nightly temperatures were higher. The r^2 for mean nightly temperature and call sequences recorded at the South MET Tower was 0.23, which indicates that 23% of the variability in call detection rates is explained by mean nightly temperatures leaving 77% of the variance due to some other factor.

Figure 5 – South MET Tower Total Calls and Weather Data

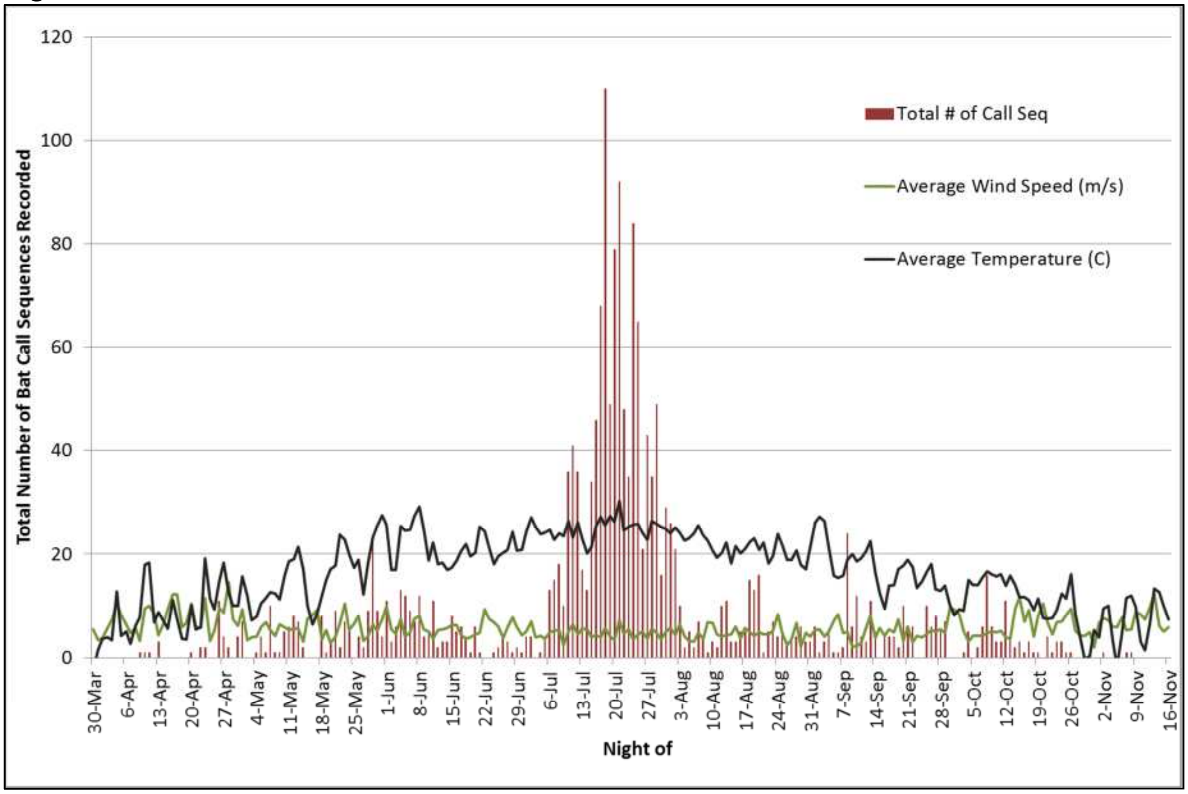
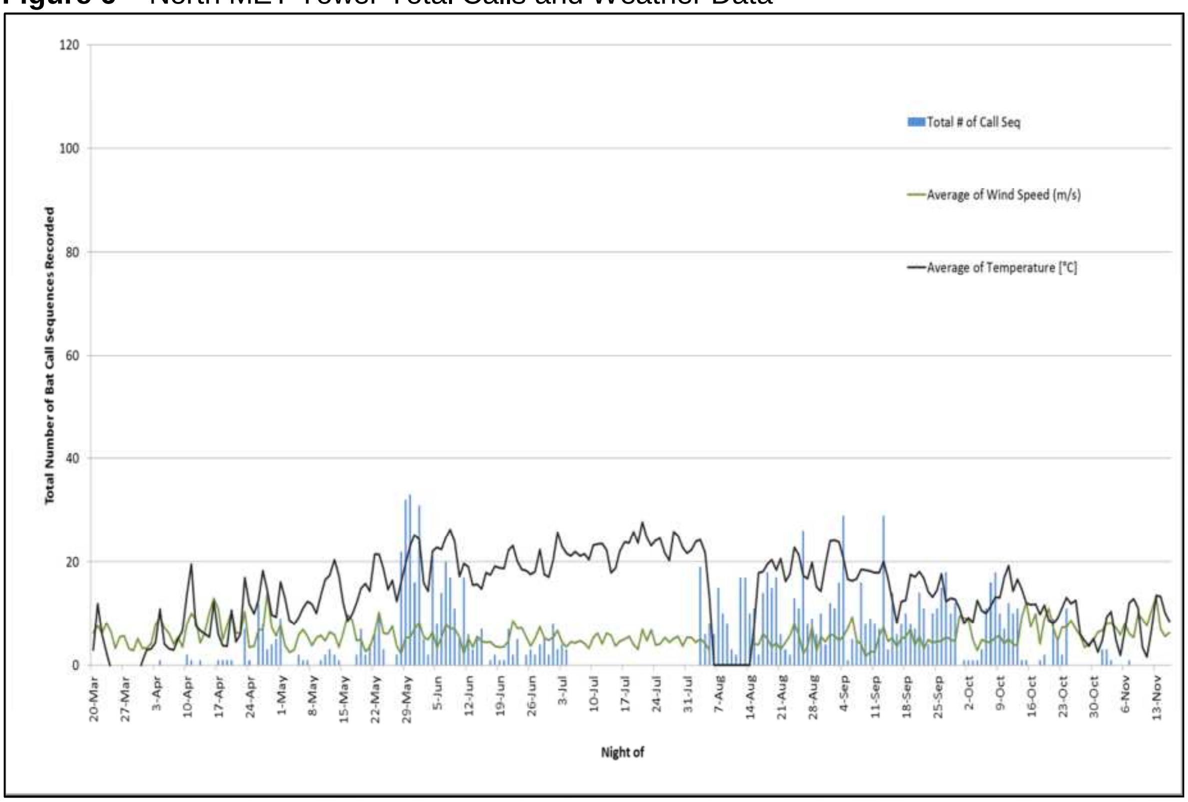


Figure 6 – North MET Tower Total Calls and Weather Data



4.0 DISCUSSION

Recent research has demonstrated that tree and tree-crevasse roosting migratory bats have been the predominant species found during post-construction mortality studies at operational wind farms in North America (Arnett et al. 2008). Results from these mortality studies show the three bat species most commonly encountered during ground searches were long-distance (lasiurine) migratory bats: hoary bat, silver-haired bat, and eastern red bat (Kunz et. al 2007, Arnett et al. 2008). Long-distance migratory bats such as hoary bat, silver-haired bat, eastern red bat, as well as evening bats, were identified in the recordings made during the 2011 survey period. Overall, there was more migratory species activity than non-migratory species activity recorded in the Project Area. The Ground 1 and Ground 2 detectors recorded the majority of migratory and non-migratory bat call sequences.

Bat activity (IA) was relatively lower at the North MET Tower High detector than at the North MET Tower Low detector, while bat activity was higher at the South MET Tower Low detector than at the South MET Tower High detector. However, activity at each of the four MET Tower detectors was considerably lower than at either of the Ground Detector stations. This indicates that bat activity nearest the typical RSZ was low compared to bat activity levels below the RSZ, especially near ground level. Migratory species (hoary bat, silver-haired bat, eastern red bat, and evening bat) we recorded primarily just above ground level by the Ground and Low detectors. Myotis species exhibited low levels of activity, as measured by IA, and were not as active at the North MET Tower High and South MET Tower High detectors as they were at the Ground 1 and Ground 2 detectors. Some bat species, especially those adapted to forage in cluttered habitat (in forest interiors and along forest edges) tend to fly lower than species adapted to forage in open areas (such as fields and above forest canopies) (Meyer et al. 2005, Kalko et al. 2008). These differences in adaptive foraging strategies and associated differences in wing morphology may be partly responsible for the greater activity levels of some species near ground level (Reynolds 2006).

Indiana bats were not captured during the mist net surveys (Tetra Tech and Redwing 2011) and were not positively identified in the passive acoustic monitoring data recorded during the same year. The absence of Indiana bat in the acoustic data set may be results of a variety of factors. Agricultural habitat is not considered optimal foraging habitat for Indiana bat, and it is not likely that they use the areas adjacent to the met towers to forage, thereby reducing the potential for detection (USFWS 2007). It is unlikely that the unknown high frequency bat call sequences could have been Indiana bat due to the absence of the species in the mist net results, which sampled more appropriate habitats.

The scope of this document is not to assess potential risk to Indiana bats, but it is appropriate to briefly address the occurrence of Indiana bat in the Project Area in the context of potential impacts and the acoustic monitoring results. Because Indiana bat was not positively identified in the recorded passive monitoring data set, a surrogate species must be used to attempt to assess potential risk. Little brown bat is often used as a surrogate species for Indiana bat when Indiana bat are not present, or where not detected in a recorded data set (USFWS 2007). With this in mind, we observed that little brown bats were not as active at the higher altitude MET Tower Detectors as they were at the Ground Detectors. Assuming that our sample is representative of the little brown bat community within the Project Area, it is reasonable to expect that potential direct collision or barotrauma impacts to little brown bat from the proposed Project will be low, as activity in the RSZ was very low; however, to date no clear correlation between preconstruction activity levels and post-construction impacts has been confirmed (Arnett et al. 2008). Presuming that little brown bats have similar foraging behavior and flight ecology as Indiana bat we can project our conclusions about potential risk to little brown bats to Indiana bat (USFWS 2007). It should be noted that very few little brown bats (n = 5) were captured during mist-net surveys although many call sequences were determined to be little brown bat (n = 1,074).

The results of the 2011 mist net survey confirm the species identified in the passive acoustic monitoring surveys. Each species of the six species captured during mist netting were also recorded during the passive acoustic monitoring survey, including; big brown bat, eastern red bat, hoary bat, little brown bat, northern long-eared bat, and evening bat (Tetra Tech and Redwing 2011). Two additional species, tricolored bat and silver-haired bat, were recorded during acoustic monitoring but were not captured during mist-netting.

Patterns of activity in the Project Area do not suggest the presence of a large bat migration corridor in the vicinity of the MET towers. There was an observed increase in activity during the late-summer early fall swarming / migratory staging period. The sporadic and diffused occurrence of long-distance migratory species in the recording indicates that few individuals use the open area near the met towers. There did not appear to be an episode of dramatic fluctuation in recorded activity that could be definitively attributed to large-scale migration, although the observed increase in activity during August and September was apparent and likely indicates increased use of the area during that time period (Cryan and Veilleux 2007).

Weather conditions seem to explain part of the variance in bat activity recorded by the acoustic detector sets. A portion of the variance (less than 25%) can be attributed to mean nightly temperature, and less than 10% is attributable to mean nightly wind speed. This indicates that other factors may be influencing bat activity, such as prey distribution. The increase in bat call sequences recorded in August may have resulted from the following: (1) increased foraging activity near the detectors due to a rise in mean nightly temperatures (Racey and Swift 1985, O'Donnell 2000, Kusch et al. 2004); (2) increases in food resource concentrations near the detectors, (3) an episode of bats leaving a roost and transiting to an established area of concentrated food resource passing the detectors *en route; or,* (4) bat swarming near the met tower. The increase in activity of hoary bat, silver-haired bat, and eastern red bat at the met tower detectors during September was almost certainly attributable to migration and/or pre-migration staging (Cryan and Veilleux 2007).

There is inherent difficulty in attempting to interpret the number of recorded call sequences as an indication of activity levels; however, detection rates, recorded minutes of activity, and IA values do provide a relative measure of bat activity near sampling locations. The limited maximum range of a single AnaBat detector (approximately 30 m or 100 ft) makes the characterization of landscape-scale movements, such as migration, difficult to assess. However, a comparative assessment of the results from detectors arrayed within a tower at different elevations can facilitate the characterization of spatial distribution and phenology of bat activity.

The total number of bat call sequences and minutes of activity recorded each night by a given detector may or may not reflect the absolute level of bat activity present in the Project Area, although some studies have suggested that there may be a relationship between the relative numbers of calls recorded and absolute bat activity levels (Gorresen et al. 2008). The bias in passive acoustic surveys of this type stems from the unknowns that go along with automated monitoring. For example, a single foraging individual may produce a large number of call sequences that are within the range of a given detector set. Conversely, a large number of individual bats may pass the detector set and produce an equally large number of call sequences. Normalization of the recorded data for the level of effort, and the calculation of the IA, provide for enhanced accuracy in comparing relative activity levels. It is important to note that the survey results are a sample of bat activity in the airspace surrounding the detectors and are not necessarily indicative of bat activity throughout the entire Project Area.

5.0 LITERATURE CITED

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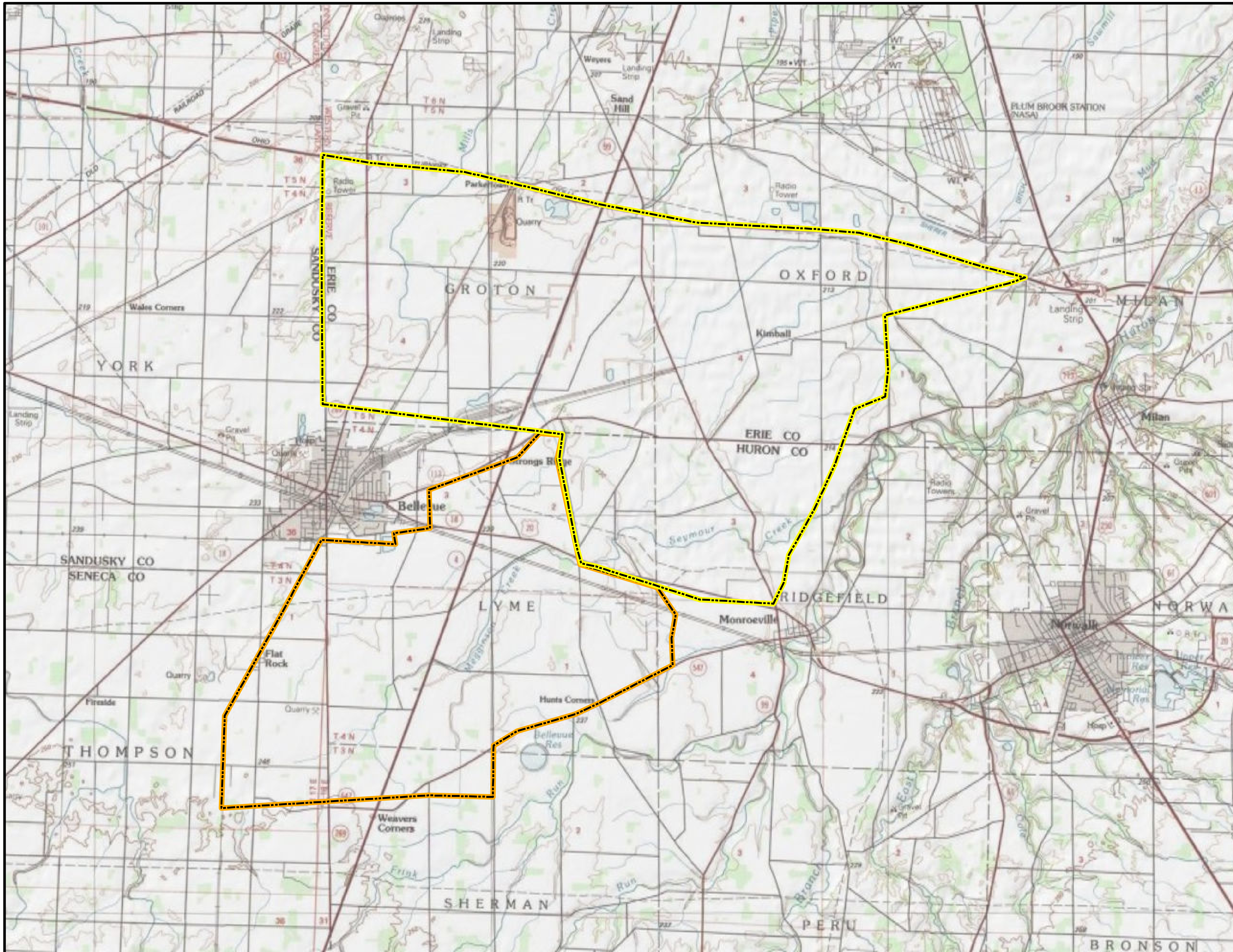
FIGURES



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Firelands Project Boundary

Lyme Project Boundary

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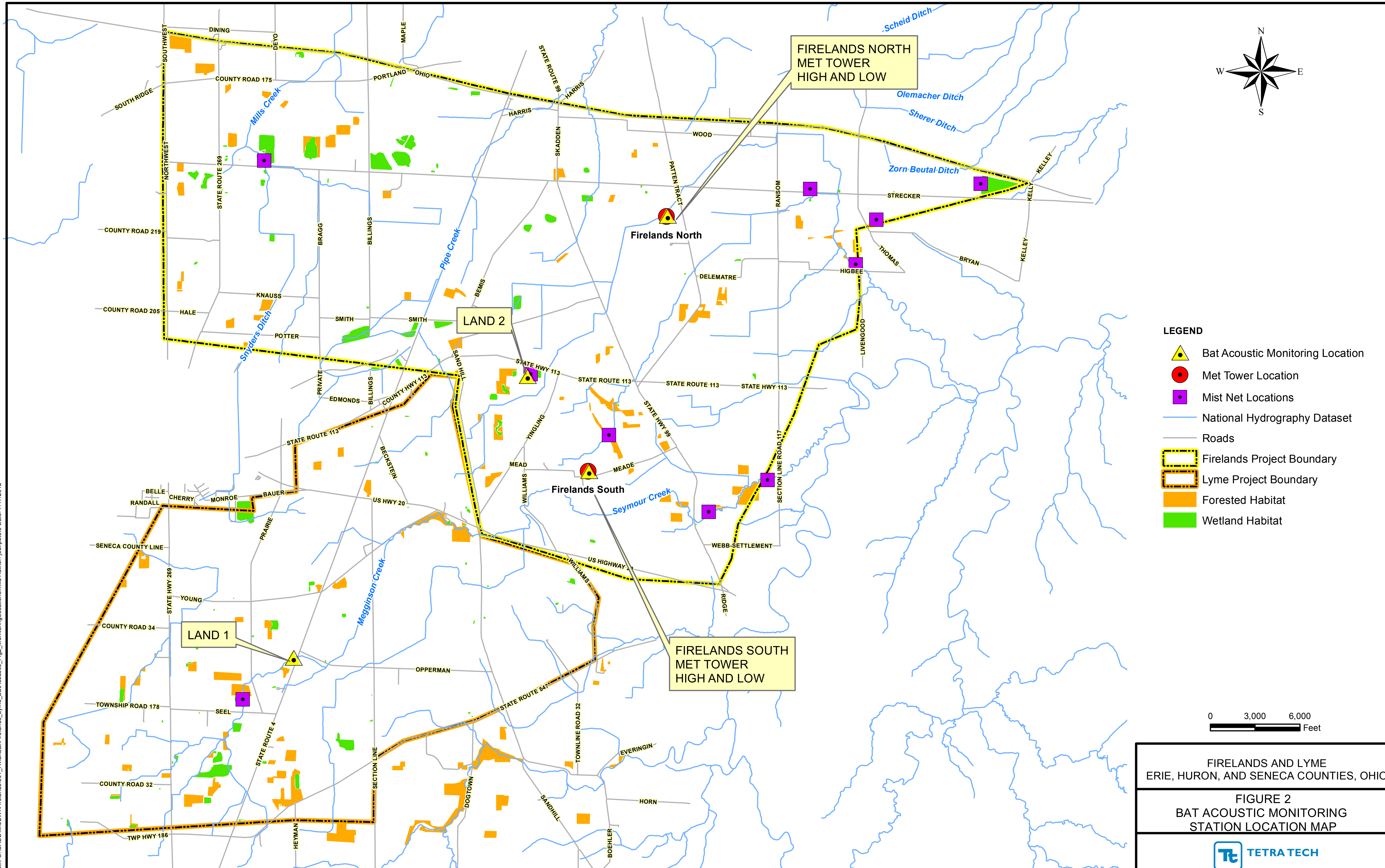
FIRELANDS AND LYME PROJECT
ERIE, HURON, AND SENECA COUNTIES, OHIO

FIGURE 1
SITE LOCATION MAP

TETRA TECH

Path: S:\CADD\MJUW\Firelands\005_Eagle\Firelands_Lyme_Avian_Fig1_SiteLocation.mxd Author: joel.peters Date: 5/9/2012



FIRELANDS AND LYME
ERIE, HURON, AND SENECA COUNTIES, OHIO

FIGURE 2
BAT ACOUSTIC MONITORING
STATION LOCATION MAP

Path: S:\CADD\MJUW\Firelands\001_AvianBat\Firelands_Lyme_BatAcoustic_Fig2_MonitoringLocations.mxd Author: joel.peters Date: 7/17/2012

Appendix A

AGENCY CORRESPONDENCE AND APPROVALS

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
4625 Morse Road, Suite 104
Columbus, Ohio 43230
(614) 416-8993 / FAX (614) 416-8994

April 27, 2011

COPY FOR YOUR INFORMATION

Matt Krivos
JUWI Wind, LLC
629 Euclid Ave, Suite 635
Cleveland, OH 44114

TAILS : 31420-2011-TA- 0625

Re: Firelands and Phase 2 Lyme Wind Power Projects in Erie, Sandusky, Huron and Seneca Counties

Dear Mr. Krivos:

This letter is in response to the revised Firelands and newly proposed Phase 2 Lyme wind power project in Erie, Sandusky, Huron and Seneca Counties, Ohio. The project areas appear to be a mix of agricultural land with scattered forested areas throughout. The project areas are within ½ mile- 1 mile west of the Huron River. The Firelands project northeast boundary abuts the Lake Erie Western Important Bird Area (IBA). The Firelands project is located approximately 1.5 miles west of the Milan State Wildlife Area. We understand the Firelands and Phase 2 Lyme project is proposed for approximately 100 MW each, including between 100-120 turbines. According to a letter from the Ohio Department of Natural Resources (ODNR) dated September 30, 2010, the Division of Wildlife (DOW) has determined that the Firelands project would be classified as a "moderate" site under the current monitoring protocols based upon the location and land-use practices. In addition, a letter from the ODNR dated April 16, 2011; the DOW has determined the Lyme project would also be classified as "moderate" site.

The following comments are being provided pursuant to the Endangered Species Act (ESA), Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, and Fish and Wildlife Act of 1956. This information is being provided to assist you in making an informed decision regarding wildlife issues, site selection, project design, and compliance with applicable laws. The Service has been working closely with ODNR DOW to develop recommended survey protocols and site evaluations that will satisfy both state and federal wildlife statutes, and this letter describes these measures, in part. The protocols, "On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio" are available on ODNR's website at:
http://www.dnr.state.oh.us/Home/wild_resourcessubhomepage/ResearchandSurveys/WildlifeWind/tabid/21467/Default.aspx
We encourage and appreciate your early coordination with both ourselves and ODNR, and recommend continued collaboration on this project to ensure wildlife issues are fully and appropriately addressed.

The Service supports the development of wind power as an alternative energy source, however, wind farms can have negative impacts on wildlife and their habitats if not sited and designed with potential wildlife and habitat impacts in mind. Selection of the best sites for turbine placement is enhanced by ruling out sites with known, high concentrations of birds and/or bats passing within the rotor-swept area of the turbines or where the effects of habitat fragmentation will be detrimental. In support of wind power generation as a wildlife-friendly, renewable source of power, development sites with comparatively low bird, bat and other wildlife values, would be preferable and would have relatively lower impacts on wildlife.

WATER RESOURCE COMMENTS:

The Service recommends that impacts to streams and wetlands be avoided, and buffers surrounding these systems be preserved. Streams and wetlands provide valuable habitat for fish and wildlife resources, and the filtering capacity of wetlands helps to improve water quality. Naturally vegetated buffers surrounding these systems are also important in preserving their wildlife-habitat and water quality-enhancement properties. Furthermore, forested riparian systems (wooded areas adjacent to streams) provide important stopover habitat for birds migrating through the region. The proposed activities do not constitute a water-dependent activity, as described in the Section 404(b)(1) guidelines, 40 CFR 230.10. Therefore, practicable alternatives that do not impact aquatic sites are presumed to be available, unless clearly demonstrated otherwise. Therefore, before applying for a Section 404 permit, the client should closely evaluate all project alternatives that do not affect streams or wetlands, and if possible, select an alternative that avoids impacts to the aquatic resource. If water resources will be impacted, the Buffalo District of the U.S. Army Corps of Engineers should be contacted for possible need of a Section 404 permit.

ENDANGERED SPECIES COMMENTS:

Because of the potential for wind power projects to impact endangered bird, bat, or other listed species, they are subject to the Endangered Species Act (16 U.S.C. 1531-1544) section 9 provisions governing "take", similar to any other development project. Take incidental to a lawful activity may be authorized through the initiation of formal consultation if a Federal agency is involved; or if a Federal agency, Federal funding, or a Federal permit are not involved in the project, an incidental take permit pursuant to section 10(a)(1)(B) of the ESA may be obtained upon completion of a satisfactory habitat conservation plan for the listed species. However, there is no mechanism for authorizing incidental take "after-the-fact."

The proposed project lies within the range of the **Indiana bat** (*Myotis sodalis*), a federally listed endangered species. Since first listed as endangered in 1967, their population has declined by nearly 60%. Several factors have contributed to the decline of the Indiana bat, including the loss and degradation of suitable hibernacula, human disturbance during hibernation, pesticides, and the loss and degradation of forested habitat, particularly stands of large, mature trees. Fragmentation of forest habitat may also contribute to declines. During the winter Indiana bats hibernate in caves and abandoned mines. Summer habitat requirements for the species are not well defined but the following are considered important:

1. Dead or live trees and snags with peeling or exfoliating bark, split tree trunk and/or branches, or cavities, which may be used as maternity roost areas.

2. Live trees (such as shagbark hickory and oaks) which have exfoliating bark.

3. Stream corridors, riparian areas, and upland woodlots which provide forage sites.

Indiana Bat Maternity Habitat

There are no positive records for Indiana bat captures within Erie, Sandusky, Huron and Seneca Counties and in addition, there are no records within 10 miles of the proposed project boundaries. This may reflect more a function of low survey effort rather than the relative abundance of the species. The project areas appear to be a mix of agricultural land with scattered forested areas throughout, with a number of forested areas exceeding 50-100 acres. It appears that suitable summer foraging and roosting habitat for the Indiana bat likely exists within the project area.

Mist Net Surveys: Based on ODNR's On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio, a total of 5 mist net surveys have been requested for the Firelands project and 6 mist net surveys for the Lyme project. The Service agrees that this is an appropriate level of effort for the proposed project boundaries. The surveys must be conducted by a permitted surveyor (see attached list) and be designed and conducted in coordination with the Endangered Species Coordinator for this office. Survey effort should follow ODNR's protocols, which exceed the Service's standard protocol. The highest quality Indiana bat habitat areas within the project area should be selected for mist netting. We recommend that any Indiana bats captured, especially reproductively active females, be monitored through radio-tracking to determine roost locations and foraging patterns. If an Indiana bat is captured, this office shall be notified within 24 hours, or by the next business day.

Radio Transmitters: Up to four Indiana bats should be fitted with radio transmitters and tracked to roost site(s) and foraging areas until daily activity patterns are fairly well established, or as long as the transmitter remains attached and activated. Preference shall be given to tracking female bats, though one male Indiana bat may be tracked if captured prior to capturing four female Indiana bats. Please see the ODNR's protocols for additional information on radio tracking non-Indiana bats.

Acoustic Surveys: Bat acoustic monitoring is to be conducted at all meteorological towers within the project areas, with 1 unit positioned at 5 meters off the ground and 1 unit within the rotor swept area. Met towers should be erected within both phases of the project to ensure adequate coverage of the project areas. We recommend regular inspection of the AnaBat detectors throughout the survey period to ensure proper functioning.

The results of all bat surveys should be coordinated with this office prior to initiation of any work. Based on the results of the mist net survey, we will evaluate potential impacts to the Indiana bat from the proposed project. If sufficient information is not provided to document that take is unlikely, authorization of incidental take either through Section 7 or Section 10 of the Endangered Species Act of 1973, as amended, will be necessary.

Hibernacula Habitat

The project area lies within an area primarily underlain with Silurian and Devonian carbonate bedrock, indicating that the presence of caves is possible, and several identified karst areas are found within the project area. Please see the Ohio Department of Natural Resources, Division of Geological Survey Ohio Karst Areas Map (www.dnr.state.oh.us/portals/10/pdf/karstmap.pdf,), for additional information. If caves or sinkholes are present within the project area, we recommend further coordination with this office to determine if surveys of these areas are recommended.

Indiana Bat Migratory Habitat

Wind energy facilities in various habitat types across the U.S. and Canada have been documented to cause "widespread and often extensive fatalities of bats" (Arnett *et al.* 2008), primarily during the fall *migratory* season. Further, Indiana bat mortality has been detected at a wind power facility in Indiana, confirming suspicions that fall migrating Indiana bats are also susceptible to mortality from wind turbines. At this time, research into the mechanisms that cause mortality of bats at wind power sites is still ongoing, and few operational tools exist to avoid and minimize take — feathering of turbines during times when bats are most at risk has been shown to reduce mortality in some situations. Based on this, we are advising all operating wind farms and wind farms in planning stages within the range of the listed bats that lethal take is a possibility without curtailment of operations at night during the migratory period regardless of whether summer habitat is present or if Indiana bats are detected during summer mist netting. Due to the potential of take during spring and fall migration, we recommend developers evaluate their exposure to the prohibitions of ESA. This is a risk management decision the developer must make. The Service advises you to consider the following two options to ensure violations of the Endangered Species Act (ESA) Section 9 take prohibition do not occur:

1) Feather turbines during low wind speed conditions at night during the fall and spring migratory seasons as a way to proactively and definitively avoid take of Indiana bats (and other species of bats as well). Based on the Indiana bat Draft Recovery Plan First Revision (Service, 2007), fall migration generally occurs between August 1 and October 15, and spring migration generally occurs between April 1 and May 15.

2) Wind facility developers can work with the Service to apply for an Incidental Take Permit by submitting a Habitat Conservation Plan (HCP), as required under Section 10 of the Endangered Species Act. A HCP can be used to address Indiana bat presence during both summer foraging and migration periods. A HCP does typically require some time and survey effort to complete. Alternatively, you may consider joining in the regional effort to develop a wind power HCP to address Indiana bats and other listed species.

If you plan to implement either of these two options, please contact us for further information.

The proposed project lies within the range of the federally listed endangered **piping plover** (*Charadrius melodus*), as well as the federally threatened **eastern prairie fringed orchid** (*Platanthera leucophaea*), **Lakeside daisy** (*Hymenoxys herbacea*), and **Lake Erie Watersnake** (*Nerodia sipedon insularum*). Due to the location of the proposed project areas, impacts are not anticipated for these species.

The proposed project lies within the range of the **Kirtland's warbler** (*Dendroica kirtlandii*), a federally listed endangered species. The Kirtland's warbler is a small blue-gray songbird with a bright yellow breast. This species migrates through Ohio in the spring and fall, traveling between its breeding grounds in Michigan, Wisconsin, and Ontario and its wintering grounds in the Bahamas. During migration, individual birds usually forage in low vegetation and stay in one area for a few days. This species prefers shrub habitat and the Service recommends a habitat assessment for these project areas to see if surveys are warranted. If habitat is present with the project boundary, pre-construction survey methods should be coordinated with the Service and ODNR and surveys should be conducted in the spring season from April 15- June 1 and fall season from August 1- October 15. Any sightings should be reported to the Service within 24 hours, or the next business day. Survey results will be evaluated to document the extent to which the proposed project may affect the Kirtland's warbler.

The project lies within the range of the **eastern massasauga** (*Sistrurus catenatus catenatus*), a docile rattlesnake that is declining throughout its national range and is currently a Federal Candidate species. The snake is currently listed as endangered by the State of Ohio. Your proactive efforts to conserve this species now may help avoid the need to list the species under the Endangered Species Act in the future. Due to their reclusive nature, we encourage early project coordination to avoid potential impacts to massasaugas and their habitat. At a minimum, project evaluations should contain delineations of whether or not massasauga habitat occurs within project boundaries.

The massasauga is often found in or near wet areas, including wetlands, wet prairie, or nearby woodland or shrub edge habitat. This often includes dry goldenrod meadows with a mosaic of early successional woody species such as dogwood or multiflora rose. Wet habitat and nearby dry edges are utilized by the snakes, especially during the spring and fall. Dry upland areas up to 1.5 miles away are utilized during the summer, if available. For additional information on the eastern massasauga, including project management ideas, please visit the following website: http://www.fws.gov/midwest/Endangered/lists/candidat.html or contact this office directly. There is known population north of the project boundary in Margaretta Township, Erie County. This population is less than 1 mile from the project Firelands boundary however, the current status of this population is unknown. The Service suggests conducting a habitat assessment within the project area to determine if appropriate habitat is present. If habitat is present within the project area, surveys may be warranted and will need to be coordinated with this office.

The proposed project lies within the range of the **rayed bean** (*Villosa fabalis*), a freshwater mussel that is currently proposed for listing as federally endangered. The rayed bean is generally known from smaller, headwater creeks, but records exist in larger rivers. They are usually found in or near shoal or riffle areas, and in the shallow, wave-washed areas of lakes. Substrates typically include gravel and sand, and they are often associated with, and buried under the roots of, vegetation, including water willow (*Justicia americana*) and water milfoil (*Myriophyllum* sp.). Should the proposed project directly or indirectly impact any of the habitat types described above, we recommend that a survey be conducted to determine the presence or probable absence of rayed bean mussels in the vicinity of the proposed site. Any survey should be designed and conducted in coordination with the Endangered Species Coordinator for this office.

MIGRATORY BIRD COMMENTS:

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. While the MBTA has no provision for allowing unauthorized take, the FWS recognizes that some birds may be taken during activities such as wind turbine operation even if all reasonable measures to avoid take are implemented. The U.S. Fish and Wildlife Service's (FWS) Office of Law Enforcement carries out its mission to protect migratory birds not only through investigation and enforcement, but also through fostering relationships with individuals and industries that proactively seeks to eliminate their impacts on migratory birds. Although it is not possible under the MBTA to absolve individuals, companies, or agencies from liability (even if they implement avian mortality avoidance or similar conservation measures), the Office of Law Enforcement focuses on those individuals, companies, or agencies that take migratory birds with disregard for their actions and the law, especially when conservation measures have been developed but are not properly implemented.

At this time, we continue to encourage existing and proposed wind developments to follow current Service recommendations on wind power siting and construction (*Interim Guidelines to Avoid and Minimize Impacts from Wind Turbines – 2003)*. The Service also encourages developers to coordinate with Service biologists regarding their projects. Proper coordination will help developers make informed decisions in siting, constructing, and operating their facilities. Additionally, the Service hopes to work cooperatively with wind developers to advance the state of the art of wind power siting, construction, and operation. Advancements in these areas will represent great strides towards the environmentally safe development of this otherwise renewable and clean source of energy.

The Service and ODNR have worked together to develop a recommended bird survey protocol for wind turbine projects. The details of the protocol are provided in ODNR's On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio. ODNR has documented that the project area qualifies for "moderate" survey effort due to the proximity to possible migratory bird high use areas. We recommend implementation of the ODNR bird survey protocol to document baseline bird use of the project area. Bird survey results will be interpreted to determine if potential risk to birds is relatively high or low in various portions of the project area. Based on survey results we may make recommendations as to turbine placement and operation, or pre- or post-construction monitoring.

Research into the actual causes of bat and bird collisions with wind turbines is limited. To assist Service field staffs in review of wind farm proposals, as well as aid wind energy companies in developing best practices for siting and monitoring of wind farms, the Service published *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines* (2003). On February 8, 2011, the U.S. Fish and Wildlife Service released the Draft Voluntary, Land-Based Wind Energy Guidelines that have now been published in the Federal Register and are now open for public comment until May 19, 2011. The Guidelines can be found at: http://www.fws.gov/windenergy. Until those guidelines are final, the Service recommends following the 2003 Interim Guidelines. We encourage any company/licensee proposing a new wind farm to consider the following excerpted suggestions from the guidelines in an effort to minimize impacts to migratory birds and bats.

1) Pre-development evaluations of potential wind farm sites to be conducted by a team of Federal and/or State agency wildlife professions with no vested interest in potential sites;

2) Rank potential sites by risk to wildlife;

3) Avoid placing turbines in documented locations of federally-listed species;

4) Avoid locating turbines in known bird flyways or migration pathways, or near areas of high bird concentrations. (i.e., rookeries, leks, State or Federal refuges, staging areas, wetlands, riparian corridors, etc.) Avoid known daily movement flyways and areas with a high incidence of fog, mist or low visibility;

5) Avoid placing turbines near known bat hibernation, breeding, or maternity colonies, in migration corridors, or in flight paths between colonies and feeding areas;

6) Configure turbine arrays to avoid potential avian mortality where feasible. (i.e., group turbines and orient rows of turbines parallel to known bird movements) Implement storm water management practices that do not create attractions for birds, and maintain contiguous habitat for area-sensitive species;

7) Avoid fragmenting large, contiguous tracts of wildlife habitat. Wherever practical, place turbines on lands already disturbed and away from intact healthy native habitats. If not practical, select fragmented or degraded habitats over relatively intact areas;

8) Minimize roads, fences, and other infrastructure. Wherever possible, align collection lines and access roads to minimize disturbance;

9) Develop a habitat restoration plan for the proposed site that avoids or minimizes negative impacts on vulnerable wildlife while maintaining or enhancing habitat values for other species. (i.e., avoid attracting prey animals used by raptors;

10) Use tubular supports with pointed tops rather than lattice supports to minimize bird perching and nesting opportunities. Avoid placing external ladders and platforms on tubular towers to minimize perching/nesting. Avoid use of guy wires for turbine or meteorological tower supports. All existing guy wires should be marked with bird deterrents. (Avian Power Line Interaction Committee 1996);

11) If taller turbines (top of rotor-swept area is greater than 199 feet above ground level) require lights for aviation safety, the minimum amount of lighting specified by the Federal Aviation Administration (FAA) should be used. Unless otherwise requested by the FAA, only white strobe lights should be used at night, and should be of the minimum intensity and frequency of flashes allowable;

12) Adjust tower height to reduce risk of strikes in areas of high risk for wildlife.

13) Wherever feasible, place electric power lines underground or on the surface as insulated, shielded wire to avoid electrocution of birds. Use recommendations of the Avian Power Line Interaction Committee (1996) for any required above-ground lines, transformers, or conductors;

The full text of the guidelines is available at http://www.fws.gov/habitatconservation/wind.pdf. The Service believes that implementing these guidelines may help reduce mortality caused by wind turbines. We encourage you to consider these guidelines in the planning and design of the project. We particularly encourage placement of turbines away from any large wetland, stream corridor, or wooded areas, including the areas mentioned previously, and avoid placing turbines between nearby habitat blocks.

BALD AND GOLDEN EAGLE COMMENTS:

Bald and golden eagles are included under the Migratory Bird Treaty Act, but are afforded additional legal protection under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d). The Service recently issued a final rule that authorizes issuance of eagle take permits, where the take to be authorized is associated with otherwise lawful activities. If take of bald eagles is likely, based on the best information available, a bald eagle take permit for this project will be necessary. There is a known bald eagle nest located within the northwest corner of the Firelands project boundary. We understand that some monitoring of this nest was conducted in 2010. In addition, the proposed Lyme Phase 2 project boundary has a bald eagle nest located approximately 1.3 miles south of the project boundary on the eastern side of the project. There are also 3 other bald eagle nests located north (2.2 miles) and east (2.4 and 2.5 miles) of the Firelands project boundary. Raptor nest searches and nest monitoring should be conducted in accordance with ODNR's survey protocol to identify any raptors, including bald eagles that may nest or migrate within or near the project area. The results of this survey should be coordinated with this office.

On February 8, 2011, the U.S. Fish and Wildlife Service released the Draft Eagle Conservation Plan Guidance that have now been published in the Federal Register and are available for public comment until May 19, 2011. The Guidelines can be found at: http://www.fws.gov/windenergy. The Draft Eagle Conservation Plan Guidance was developed to provide interpretive guidance to wind developers, Service biologists who evaluate potential impacts on eagles from proposed wind energy projects, and others in applying the regulatory permit standards as specified by the Bald and Golden Eagle Protection Act and other federal laws. Appendix C of the Draft Eagle Conservation Plan Guidance suggests a monitoring protocol for wind projects that is more extensive that ODNR's current protocol. This guidance suggests a way to estimate relative abundance and eagle exposure rates, characterization of the project area nesting population, and eagle migration and concentration areas. While this guidance is still draft, we believe that it deserves careful attention, as it lays out a proposed process for evaluating risk to eagles from wind power projects and developing an eagle conservation plan, in support of applying for a permit to authorize take. Monitoring data should be interpreted to document potential risk to eagles. If take of eagles is likely, a bald eagle take permit will be necessary.

COORDINATION OF SURVEY RESULTS:

Please submit survey results to this office for review. Survey results will be interpreted to determine areas with relatively low bat and bird activity/diversity as opposed to areas with relatively high bat and bird activity/diversity. Based on the survey results, we may make recommendations as to turbine placement and operation, additional consultation under Section 7 or 10 of the Endangered Species Act of 1973, as amended, additional permits under the Bald and Golden Eagle Protection Act, or pre- or post-construction monitoring.

POST CONSTRUCTION MONITORING:

The Service recommends the project be monitored post-construction to determine impacts to migratory birds and bats. A specific post-construction monitoring plan should be prepared and reviewed by the Service and should include a scientifically robust, peer reviewed methodology of mortality surveys. We recommend that the post-construction monitoring protocol be developed based on the results of pre-construction monitoring, and look forward to working with the project proponent to develop this document.

Thank you for the opportunity to provide comments on this proposed project. Please contact biologist Melanie Cota at extension 15 in this office if I can be of further assistance.

Sincerely,

Jeromy M. Ggolb

for Mary Knapp, Ph.D.
Supervisor

Cc: Ms. Jennifer Norris, ODNR, Olentangy Wildlife Research Station, Ashley, OH
Mr. Brian Mitch, ODNR, REALM, Columbus, OH
Mr. Doug McIlvain, Tetra Tech, 250 W Court St. 200W, Cincinnati, OH 45202

Attachment: USFWS Permitted Indiana bat Surveyors in Ohio

United States Department of the Interior

FISH AND WILDLIFE SERVICE

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March 22, 2011

USFWS permittees for Indiana bat surveys in Ohio*

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Apogee Environmental Consultants, Inc. Joel Beverly P.O. Box 338 Ermine, KY 41815 (606) 633-7677 / FAX (606) 632-2626 apogee_env@bellsouth.net	**Appalachian Technical Services** P.O. Box 3537 6741 Indian Creek Road Wise, VA 24293 (276) 328-4200 / FAX (276) 328-4900 wise@atsone.com
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Timothy Carter Ball State University Department of Biology, CL 121 Muncie, IN 47306-0440 (765) 285-8842 / FAX (765) 285-8804 tccarter@bsu.edu **Copperhead Environmental Consulting, Inc.** P.O. Box 73 11641 Richmond Road Paint Lick, KY 40461 (859) 925-9012 mwgumbert@copperheadconsulting.com	**Civil & Environmental Consultants** Katie Dunlap 8740 Orion Place, Suite 100 Columbus, OH 43240 (614) 710-0175 / (888) 598-6808 FAX (614) 540-6638 kdunlap@cecinc.com 3600 Park 42 Drive, Suite 130B Cincinnati, OH 45241-2072 (513) 985-0226 / (800) 759-5614 333 Baldwin Road Pittsburgh, PA 15205-9702 (412) 429-2324 / (800) 365-2324 FAX (412) 429-2114

Davey Resource Group Jessica Hickey 1500 N. Mantua St., P.O. Box 5193 Kent, OH 44240-5193 (800) 828-8312 / FAX (330) 673-0860 jessica.hickey@davey.com	**Ecological Specialties** LLC William D. Hendricks 1785 Symsonia Road Symsonia, KY 42082 (270) 851-4362 / FAX (270) 851-4363 myotis@hughes.net
Ecology and Environment, Inc. Josh Flinn 55 Corporate Woods 9300 West 110th St., Suite 645 Overland Park, KS 66210 (913) 339-9519 / FAX (913) 458-0972 jflinn@ene.com	**Eco-Tech, Inc.** Peter Lee Droppelman 1003 E. Main St. Frankfort, KY 40601 (502) 695-8060 / FAX (510) 695-8061 ldroppelman@ecotechinc.com
Environmental Solutions & Innovations Virgil Brack, Jr. 781 Neeb Road Cincinnati, OH 45233 (513) 451-1777 / FAX (513) 451-3321 vbrack@evironmentalsi.com	**Jackson Environmental Consulting** Jeremy Jackson 203 North Mayo Trail Pikeville, KY 41501 (606) 432-9345 / FAX (606) 437-6563 jlj@jacksonenvironmental.com
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Robert Kiser 38 Kiser Lane Whitesburg, KY 41858	**Andrew Kniowski** 2021 Coffey Road 210 Kottman Hall Columbus, OH 43210 (540) 420-5213 kniowski.1@osu.edu
Allen Kurta Eastern Michigan University Department of Biology 316 Mark Jefferson Ypsilanti, MI 48197 (734) 487-4242 / FAX (734) 487-9235 akurta@emich.edu	**Michelle Malcosky** 266 Atterbury Blvd. Hudson, OH 44236 (330) 968-8272 mmalcosky@gmail.com

Rodney McClanahan 265 Moss Lane Anna, IL 62906 (618) 658-1317 turkeyctr@earthlink.net	**Mountain State Biosurveys, LLC** Thomas Risch 6703 Ohio River Road Lesage, WV 25537 (304) 762-2453 www.mtnstatebio.com
Marlo Perdicas 9186 Baer Road Marshallville, OH 44645	**Pittsburgh Wildlife & Environmental, Inc.** Neil Bossart 853 Beagle Club Road McDonald, PA 15057 (724) 796-5137 nbossart@windstream.net
Redwing Ecological Services, Inc. Benjamin Deetsch 129 South Sixth Street Louisville, KY 40202 (502) 625-3009 FAX (502) 625-3077 kfuchs@rewing.win.net **Lynn Robbins** Southwest Missouri State University Department of Biology 901 South National Avenue Springfield, MO 65804-0095 (417) 836-5366 FAX (417) 836-4204 lwr704f@smsu.edu	**Stantec Consulting Services, Inc.** Jeff Brown 11687 Lebanon Road Cincinnati, OH 45241 (513) 842-8205 / FAX (513) 842-8250 jeff.brown@stantec.com Bob Madej 1500 Lakeshore Drive, Suite 100 Columbus, OH 43204 (614) 486-4383 / FAX (614) 486-4387 robert.madej@stantec.com James Kiser 1901 Nelson Miller Parkway Louisville, KY 40223 (502) 212-5000 / FAX (502) 212-5055 james.kiser@stantec.com
Merrill Tawse 791 Woodland Road Mansfield, OH 44906 (419) 756-1203 / cell (419) 989-2335 mtawsebats@yahoo.com	**Third Rock Consultants, LLC** Rain Storm 2514 Regency Rd., Suite 104 Lexington, KY 40503 (859) 977-2000 / FAX (859) 977-2001 mforee@thirdrockconsultants.com
John Timpone 427 Terrington Drive Ballwin, MO 63021 (417) 894-5554 wanderingwolverine13@yahoo.com	**Tragus Environmental Consulting** Mike Johnson Endangered Species Consultants 37 North Highland Avenue Akron, OH 44303 (330) 472-7013 mike@tragusinc.com

Brianne Lorraine Walters Dept. of Ecology and Organisimal Biology Indiana State University Terre Haute, IN 47809 (812) 237-8294 / FAX (812) 237-2526 bwalters2@isugw.indstate.edu	**Western Ecosystems Technology, Inc.** Stephen Brandebura 2003 Central Avenue Cheyenne, WY 82001 (307) 634-1756 / FAX (307) 637-6981 sbrandebura@west-inc.com
John O. Whitaker, Jr. Department of Life Sciences Indiana State University Terre Haute, IN 47809 (812) 237-2383 / FAX (812) 237-2526 jwhitaker3@isugw.indstate.edu	

*This list reflects permit data available as of March 22, 2011, and is subject to periodic revision to reflect permit changes

Ohio Division of Wildlife

David B. Lane, Chief
2045 Morse Rd., Bldg. G
Columbus, OH 43229-6693
Phone: (614) 265-6300

May 21, 2011

To all interested parties,

Based upon the revised project boundary map received on April 28, 2011 and conference call on April 20, 2011 the Ohio Department of Natural Resources Division of Wildlife (DOW) has prepared these survey recommendations for juwi Wind's proposed combined Firelands-Lyme project located in Erie, Huron, and Seneca counties.

Currently the project falls within regions of the state that DOW has identified as needing moderate monitoring efforts. Recommendations are based on a GIS analysis of the site and may be reevaluated after a site visit. Additionally, if the developer decides to amend the current boundaries, the DOW will revise our survey recommendations.

The table below was created based upon a review of the project maps provided and summarizes the types and level of effort recommended by the DOW. Please note that monitoring and surveys should follow those criteria listed within the "On-shore Bird and Bat Pre-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio." Tetra Tech's proposed bald eagle nest monitoring methodology following the U.S. Fish and Wildlife Service's draft ECPG is approved for this site, however all other surveys should adhere to ODNR protocol.

Results from these studies will help the Department of Natural Resources assess the potential impact these turbines may pose, and influence our recommendations to the Ohio Power Siting Board.

For additional ODNR comments, including information on the potential presence of threatened and endangered species within or adjacent to your project area, please contact Brian Mitch at (614) 265-6378 or brian.mitch@dnr.state.oh.us

	Project
Survey type	
Breeding bird	Breeding bird surveys should be conducted at all sites. The number of survey points may be based on the amount of available habitat, or twice the maximum number of turbines proposed for the site. If turbines are placed in agricultural land it, this requirement may be waived by DOW after a review of the proposed turbine locations is provided.
Raptor nest searches	Nest searches should occur on, and within a 1-mile buffer of the proposed facility.

Raptor nest monitoring	There are 2 eagle nest located on or within the 2 miles of the proposed project. The pairs within the 2 mile radius should be monitored to assess their daily movement patterns. Should any additional nests of a protected species of raptor be located during nest searches, monitoring should commence as outlined within the on-shore protocols.
Bat acoustic monitoring	To be conducted at all meteorological towers.
Passerine migration (# of survey points)	4 (waived)
Diurnal bird/raptor migration (# of survey point)	1
Sandhill crane migration (same points as raptor migration)	NS
Owl playback survey points	NS
Barn owl surveys	NS
Bat mist-netting (# of survey points)	9
Nocturnal marsh bird survey points	NS
Waterfowl survey points	NS
Shorebird migration points	NS
Radar monitoring locations	NS

NS = Not required based on the lack of suitable habitat.

If you have any questions, please feel free to contact me.

Jennifer Norris, Wind Energy Wildlife Biologist
Olentangy Wildlife Research Station
Ohio Division of Wildlife
8589 Horseshoe Road
Ashley, OH 43003
Office phone: 740-747-2525 x 26
Cell: 419-602-3141
Fax: 740-747-2278

Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR DAVID MUSTINE, DIRECTOR

cc: Mr. Stuart Siegfried, Ohio Power Siting Board
Ms. Megan Seymour, United States Fish and Wildlife Service
Mr. Brian Mitch, Ohio Department of Natural Resources

Figure 1. Survey effort map with the boundary for juwi Wind's proposed and revised Firelands-Lyme project.

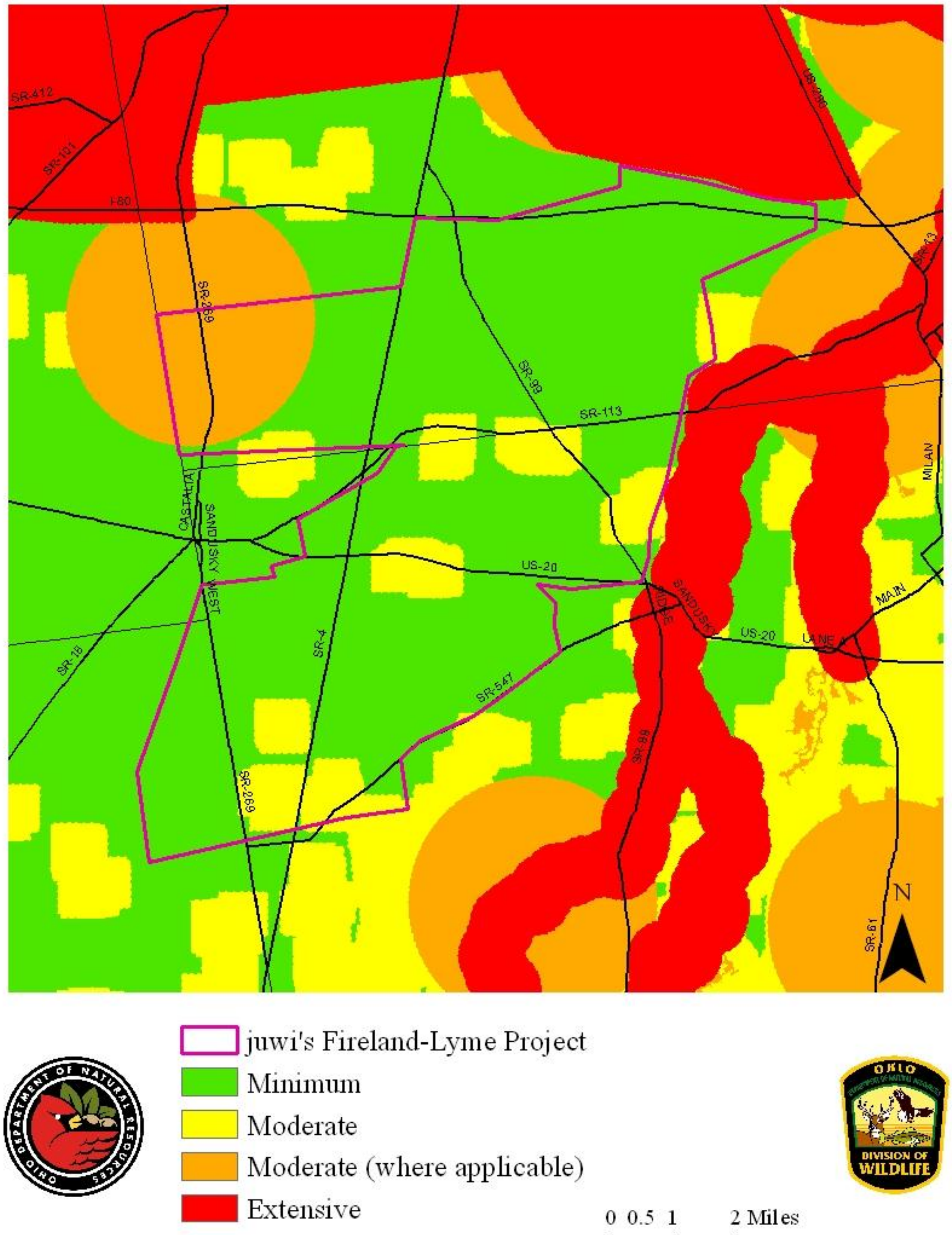
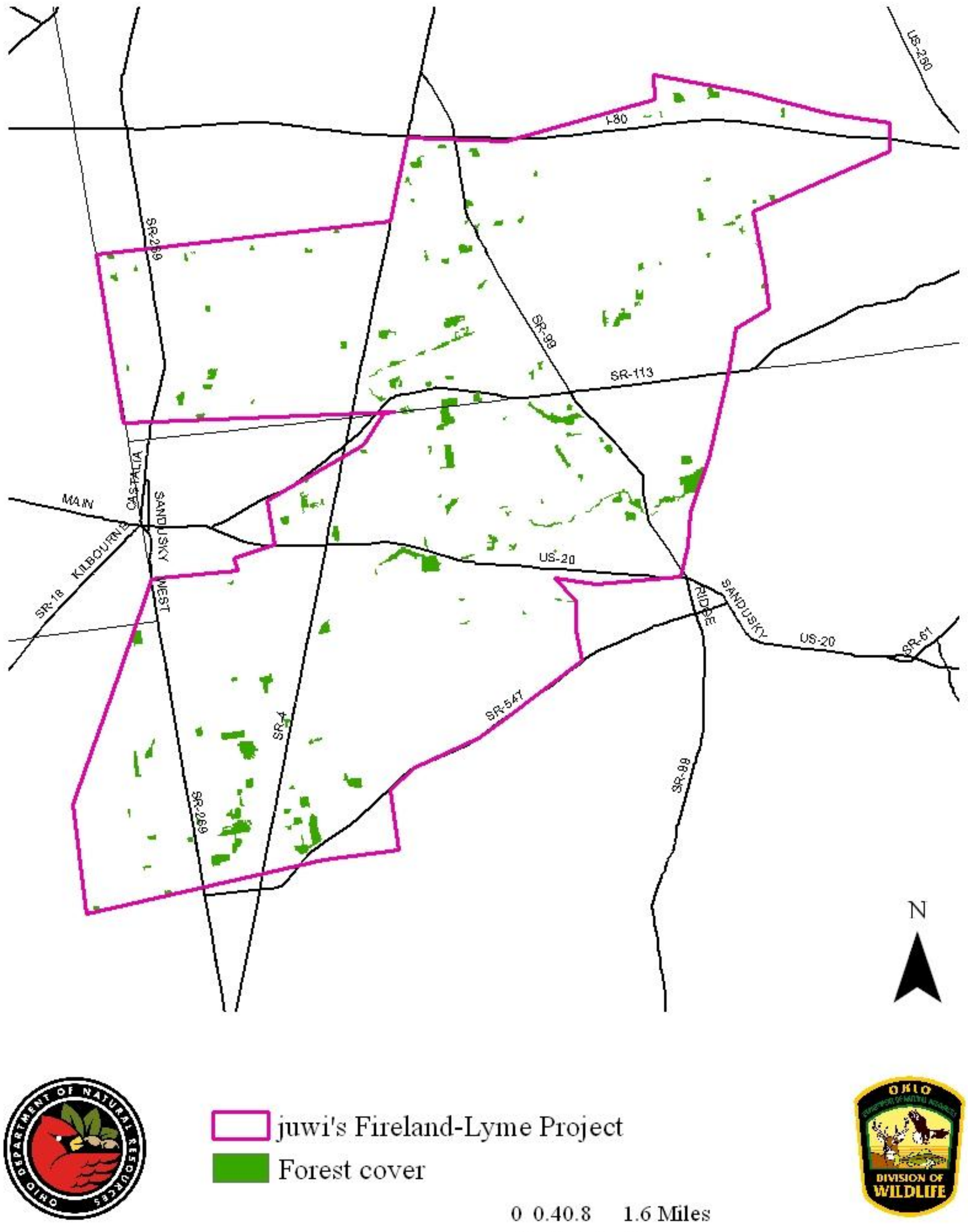


Figure 2. Forest cover with the boundary for juwi Wind's proposed and revised Firelands-Lyme project.



Kern, Greg

From: Angela_Boyer@fws.gov
Sent: Friday, July 08, 2011 10:23 AM
To: Benjamin Deetsch
Cc: Melanie_Cota@fws.gov; Kern, Greg
Subject: Fw: Firelands/Lyme Indiana Bat Mist Netting Survey Plan
Attachments: WNSDecontaminationProtocol_January 25 2011.pdf; FINAL - I Bat Survey Plan-07012011-1100.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Redwing,

This is in response to a July 1, 2011 request for an amendment to your Federal Fish and Wildlife Permit No. TE151107-1 to conduct a 2011 mist net survey for the Indiana bat (*Myotis sodalis*) at the Firelands and Lyme Wind Energy Project site in Erie, Huron, and Seneca counties, Ohio.

This notification serves as written concurrence that Redwing Ecological Services is authorized to proceed with the Indiana bat survey as described in the request. Upon completion of the survey, we request that you submit an electronic copy of the survey results to this office for review. Please include the latitude and longitude coordinates for each survey site in the report. If any Indiana bats are found during the survey, please notify this office within 48 hours.

Due to concerns over White-nose Syndrome, **we are requiring that the White-nose Syndrome Decontamination Protocol be followed for all bat survey work conducted in Ohio.** Please be advised that the current protocol (attached) is subject to revision. Please visit the following link prior to conducting the survey to ensure the most current protocol is being followed.
http://www.fws.gov/midwest/endangered/mammals/BatDisinfectionProtocol.html

(See attached file: WNSDecontaminationProtocol_January 25 2011.pdf)

We request that all Indiana bats be banded utilizing the Ohio Department of Natural Resources, Division of Wildlife (DOW) bands. Please contact Jennifer Norris (DOW) to request bands @ (740) 747-2525, ext. 26.

Please carry a copy of this site specific authorization and your Federal permit while conducting the survey. Please contact me if you have questions, or we may be of further assistance in this matter.

Sincerely,
Angela Boyer
Endangered Species Coordinator for Ohio
U.S. Fish and Wildlife Service
4625 Morse Road, Suite 104
Columbus, Ohio 43230
(614) 416-8993, ext. 22
(614) 416-8994 FAX
angela_boyer@fws.gov
----- Forwarded by Angela Boyer/R3/FWS/DOI on 07/08/2011 10:14 AM -----

Melanie Cota/R3/FWS/DOI

To"Kern, Greg" <Greg.Kern@tetratech.com>, Angela

Boyer/R3/FWS/DOI

07/01/2011 12:50 PM

cc Benjamin Deetsch <bdeetsch@redwing.win.net>, "McIlvain, Douglas" <Douglas.McIlvain@tetratech.com>, "Endres, Peter" <Endres@juwi.com>, "Norris, Jennifer" <Jennifer.Norris@dnr.state.oh.us>, Kiersten Fuchs <kfuchs@redwing.win.net>, "Krivos, Matthew C." <Krivos@juwi.com>, "Megan_Seymour@fws.gov" <Megan_Seymour@fws.gov>, "Simons, Eric" <simons@juwi.com>

Subject Re: Firelands/Lyme Indiana Bat Mist Netting Survey Plan

Greg,

All Indiana bat mist net survey protocols need to be sent to our endangered species coordinator, Angela Boyer for review and approval. I have copied her on this email.

Thanks! ~MC

Melanie Cota
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
4625 Morse Road, Suite 104
Columbus, OH 43230
614-416-8993 Ext. 15
614-416-8994 (Fax)
Melanie_Cota@fws.gov
http://fws.gov/midwest/ohio

Working with others to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.

"Kern, Greg" <Greg.Kern@tetratech.com>

"Kern, Greg" <Greg.Kern@tetratech.com>

07/01/2011 11:22 AM

To "Norris, Jennifer" <Jennifer.Norris@dnr.state.oh.us>, "Melanie_Cota@fws.gov" <Melanie_Cota@fws.gov>, "Megan_Seymour@fws.gov" <Megan_Seymour@fws.gov>

cc "McIlvain, Douglas" <Douglas.McIlvain@tetratech.com>, Benjamin Deetsch <bdeetsch@redwing.win.net>, Kiersten Fuchs <kfuchs@redwing.win.net>, "Simons, Eric" <simons@juwi.com>, "Krivos, Matthew C." <Krivos@juwi.com>, "Endres, Peter" <Endres@juwi.com>

Subject Firelands/Lyme Indiana Bat Mist Netting Survey Plan

Ms. Norris, Ms. Seymour, and Ms. Cota,

Please find attached our Indiana Bat Mist Net Survey Plan for your review and comment. If desired, I can coordinate a conference call with our team to answer your questions directly.

Time is of the essence so we cordially request that you review the attached plan at your earliest possible convenience. We intend to begin our mist netting event on July 19th, 2011.

Gregory M. Kern
Wind Energy Development Project Manager/Wildlife Biologist

TETRA TECH INC.
250 West Court Street, Suite 200W
Cincinnati, Ohio 45202
Office: (513) 564-8342
Cell: (513) 288-2213
Fax: (513) 241-0354
Email: greg.kern@tetratech.com
(See attached file: FINAL - I Bat Survey Plan-07012011-1100.pdf)

Kern, Greg

From: Norris, Jennifer [Jennifer.Norris@dnr.state.oh.us]
Sent: Sunday, July 10, 2011 3:43 PM
To: Kern, Greg
Subject: approved Firelands/Lyme Indiana Bat Mist Netting Survey Plan

Importance: High

Greg,
This email is in response to your July 1, 2011 email request for concurrence of the mist-netting survey plan for the Firelands/ Lyme Wind Energy Project site in Erie, Huron, and Seneca counties. The plan follows ODNR's 2009, *On-shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in OH*, provides the recommended effort of 9 netting sites, and the sites have been located in what appears to be sufficient habitat, therefore the plan is approved.

Upon completion of the survey, I request that you submit an electronic copy of the survey results to me for review. Please include the latitude and longitude coordinates for each survey site in the report. If any state-listed species (to include Indiana, Rafinesque's, and eastern small-footed bats) or larger numbers (>15 bats) of lactating females that are common colonial species are captured during the survey, please notify this office within 24 hours.

Please also remember that we are requiring strict adherence to the USFWS *White-nose Syndrome Decontamination Protocol* for all bat survey work conducted in Ohio. Please visit the following link prior to conducting the survey to ensure the most current protocol is being followed.
http://www.fws.gov/midwest/endangered/mammals/BatDisinfectionProtocol.html

As per Redwing's state permit and the 2009 protocol, all Indiana bats must be banded. Please contact me if Redwing (Ben Deetsch) needs bands.

Please contact me if you have questions, or we may be of further assistance in this matter.

Thanks, Jennifer

Jennifer L. Norris
Wildlife Research Biologist
Olentangy Wildlife Research Station
ODNR, Division of Wildlife
8589 Horseshoe Road
Ashley, OH 43003
Tel: 740 747-2525 Ext: 26
Cell: 419 602 3141
Email: jennifer.norris@dnr.state.oh.us

-----Original Message-----
From: Kern, Greg [mailto:Greg.Kern@tetratech.com]
Sent: Friday, July 01, 2011 11:23 AM
To: Norris, Jennifer; Melanie_Cota@fws.gov; Megan_Seymour@fws.gov
Cc: McIlvain, Douglas; Benjamin Deetsch; Kiersten Fuchs; Simons, Eric; Krivos, Matthew C.; Endres, Peter
Subject: Firelands/Lyme Indiana Bat Mist Netting Survey Plan

Ms. Norris, Ms. Seymour, and Ms. Cota,

Please find attached our Indiana Bat Mist Net Survey Plan for your review and comment. If desired, I can coordinate a conference call with our team to answer your questions directly.

Time is of the essence so we cordially request that you review the attached plan at your earliest possible convenience. We intend to begin our mist netting event on July 19th, 2011.

Gregory M. Kern
Wind Energy Development Project Manager/Wildlife Biologist

TETRA TECH INC.
250 West Court Street, Suite 200W
Cincinnati, Ohio 45202
Office: (513) 564-8342
Cell: (513) 288-2213
Fax: (513) 241-0354
Email: greg.kern@tetratech.com

Appendix B

ANABAT DATA
(SEE ENCLOSED CD)

Exhibit X
Acoustic Bat Surveys

2. Bat Activity Studies for the Proposed Emerson Creek Wind Resource Area Seneca and Huron Counties, Ohio dated March 11, 2011

Christine M.T. Pirik (0029759)
(Counsel of Record)
Terrence O'Donnell (0074213)
William V. Vorys (0093479)
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Email: cpirik@dickinsonwright.com
todonnell@dickinsonwright.com
wvorys@dickinsonwright.com

Attorneys for Firelands Wind, LLC

Bat Activity Studies for the Proposed Emerson Creek Wind Resource Area Seneca and Huron Counties, Ohio

Final Report
March 11 – November 17, 2010

Prepared for:

Apex Wind Energy, Inc.

Queen Charlotte Building
212 East High Street
Charlottesville, Virginia 22902

Prepared by:

Michelle L. Ritzert, Rhett E. Good, Kimberly Bay, Kevin Murray, and Matt Clement

Western EcoSystems Technology, Inc.
804 North College Avenue
Bloomington, Indiana 47404

March 11, 2011

NATURAL RESOURCES ◆ SCIENTIFIC SOLUTIONS

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EXECUTIVE SUMMARY

In March 2010, Western EcoSystems Technology, Inc. (WEST) initiated bat acoustic surveys within the proposed Emerson Creek Wind Resource Area (ECWRA) in Seneca and Huron Counties, Ohio. The objective of the bat acoustic surveys was to estimate the seasonal and spatial use of the ECWRA by bats and the methods used to survey for bats followed recommendations received from the Ohio Department of Natural Resources (ODNR). Acoustic surveys for bats were conducted using two Anabat^{TM} SD1 ultrasonic detectors from March 11 to November 17, 2010. To compare bat activity at different heights and monitor bat activity in the rotor swept heights (RSH), two detectors were placed at one fixed station; one detector was elevated on a meteorological (met) tower to five meters (m; 16.4 feet [ft]) above ground level (AGL) and paired with another detector raised to approximately 50 m (164 ft) AGL.

Together, the paired Anabat units recorded 3,243 bat passes during 457 detector-nights. Averaged across all locations, (mean ± standard error) 7.10 ± 0.74 bat passes per detector-night were recorded. The average pass rate was 7.12 ± 0.76 bat passes per detector-night for the 5-m detector, and 7.07 ± 0.88 bat passes per detector-night for the 50-m detector. For the fall migration period, the average rate for the 5-m detector was 11.70 ± 1.67 bat passes per detector-night, and 10.60 ± 1.74 bat passes per detector-night for the 50-m detector.

For both detectors combined, the majority (70.5%) of the recorded calls were below 30 kilohertz (kHz) in frequency (e.g., big brown bat, hoary bat, and silver-haired bat), while 18.1% were above 40 kHz in frequency (e.g. *Myotis* species). The remaining calls (11.4%) were by mid-frequency (greater than 30 kHz but less than 40 kHz) bat species (e.g. eastern red bat). Activity levels for all bat passes peaked from mid-July through mid-August. Higher activity levels during this time likely represents migratory bats passing through the ECWRA in the fall.

The mean number of bat passes per detector-night was compared to existing data from other wind energy facilities where both bat activity levels and fatality rates have been measured. Bat activity recorded in the ECWRA by the 5-m detector between July 30 and October 14 (11.70 bat passes per detector-night) was higher than activity at other facilities in Minnesota and Wyoming where bat fatality rates were relatively low, but lower than activity recorded at other facilities in West Virginia, Iowa and Tennessee, where bat fatality rates were higher. No bat fatality rates for publicly available studies of wind energy facilities in Ohio are available. Currently, pre-construction activity data is available from one wind energy facility in Ohio and bat pass rates at the ECWRA were higher than activity levels at that facility. Assuming a relationship between pre-construction bat activity and post-construction bat fatality rates exists, fatality rates at the ECWRA may be higher than those found at Phase II of the Buffalo Ridge wind energy facility in Minnesota, the Wessington Springs facility in South Dakota, or Stetson Mountain facility in Maine, but lower than found at the Mountaineer facility in West Virginia, the Blue Sky Green Field facility in Wisconsin, or Buffalo Mountain facility in Tennessee. Based on the available data, it is expected that bat mortality at the Emerson Creek Wind Resource Area will be highest from mid-July through mid-August.

STUDY PARTICIPANTS

Western EcoSystems Technology

Rhett Good	Senior Manager
Michelle Ritzert	Project Manager
Kevin Murray	Bat Biologist and Bat Data Analyst
Matt Clement	Bat Biologist
Kimberly Bay	Data Analyst and Report Manager
Fawn Hornsby	Statistician
Jon Circarelli	GIS Technician
Andrea Palochak	Technical Editor
Aaron Rinker	Report Compiler and Field Technician

REPORT REFERENCE

Ritzert, M.L., Good, R.E., K. Bay, K. Murray, and M. Clement. 2011. Bat Activity Studies for the Proposed Emerson Creek Wind Resource Area, Seneca and Huron Counties, Ohio. Final Report: March 11 – November 17, 2010. Prepared for Apex Wind Energy, Charlottesville, Virginia. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana.

ACKNOWLEDGEMENTS

A number of individuals from different organizations were instrumental in the completion of the bat acoustic study at the Emerson Creek Wind Project. Keith Lott of the Ohio Department of Natural Resources and Megan Seymour of the US Fish and Wildlife Service reviewed the protocols used in this study. Apex Wind Energy provided funding for the project. John Aerhart III and Kevin Davis served as project managers and developers with Apex Wind Energy, and provided access and important project coordination. Deb Bumb of Apex monitored the Anabat units.

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INTRODUCTION

Apex Wind Energy (Apex) is proposing to develop a wind energy facility, known as the Emerson Creek Wind Resource Area (ECWRA), in Seneca and Huron Counties. Apex Wind Energy requested that Western EcoSystems Technology, Inc. (WEST) implement a study of bat activity consistent with survey recommendations received from the Ohio Department of Natural Resources (ODNR) at the ECWRA (Figure 1). The protocol included passive acoustic sampling using Anabat™ bat detectors to quantify bat use in the study area.

This study described within this report was based on the final draft of wildlife study guidelines from the Ohio Department of Natural Resources (ODNR 2009), a meeting held with ODNR and US Fish and Wildlife Service (USFWS) officials on February 17, 2010 and a letter sent to Apex from the ODNR dated June 9, 2010 (Appendix A).

STUDY AREA

The ECWRA encompasses approximately 45,920 acres in Seneca and Huron Counties, Ohio (Figure 1) and covers three Level III Ecoregions: the Eastern Corn Belt Plains Ecoregion, Huron/Erie Lake Plains Ecoregion, and Erie/Ontario Drift and Lake Plain Ecoregion (Woods et al. 1998). The Eastern Corn Belt Plains Ecoregion is a rolling plain with local end moraines. This region originally had more natural tree cover than the Central Corn Belt Plains Ecoregion and has loamier and better drained soils than the Huron/Erie Lake Plains Ecoregion. The Huron/Erie Lake Plains Ecoregion encompasses much of northwestern Ohio and is a broad, fertile, and nearly flat plain punctuated by relict sand dunes, beach ridges, and end moraines that remain after the retreat of glaciers following the last ice age (Woods et al. 1998). A small portion of the ECWRA also occurs within the Erie/Ontario Drift and Lake Plain, which is characterized by a flat, coastal strip of lacustrine deposits punctuated by beach ridges and swales. Elevations in the ECWRA range from 230 to 280 meters (m; 755 to 919 feet [ft]) above mean sea level.

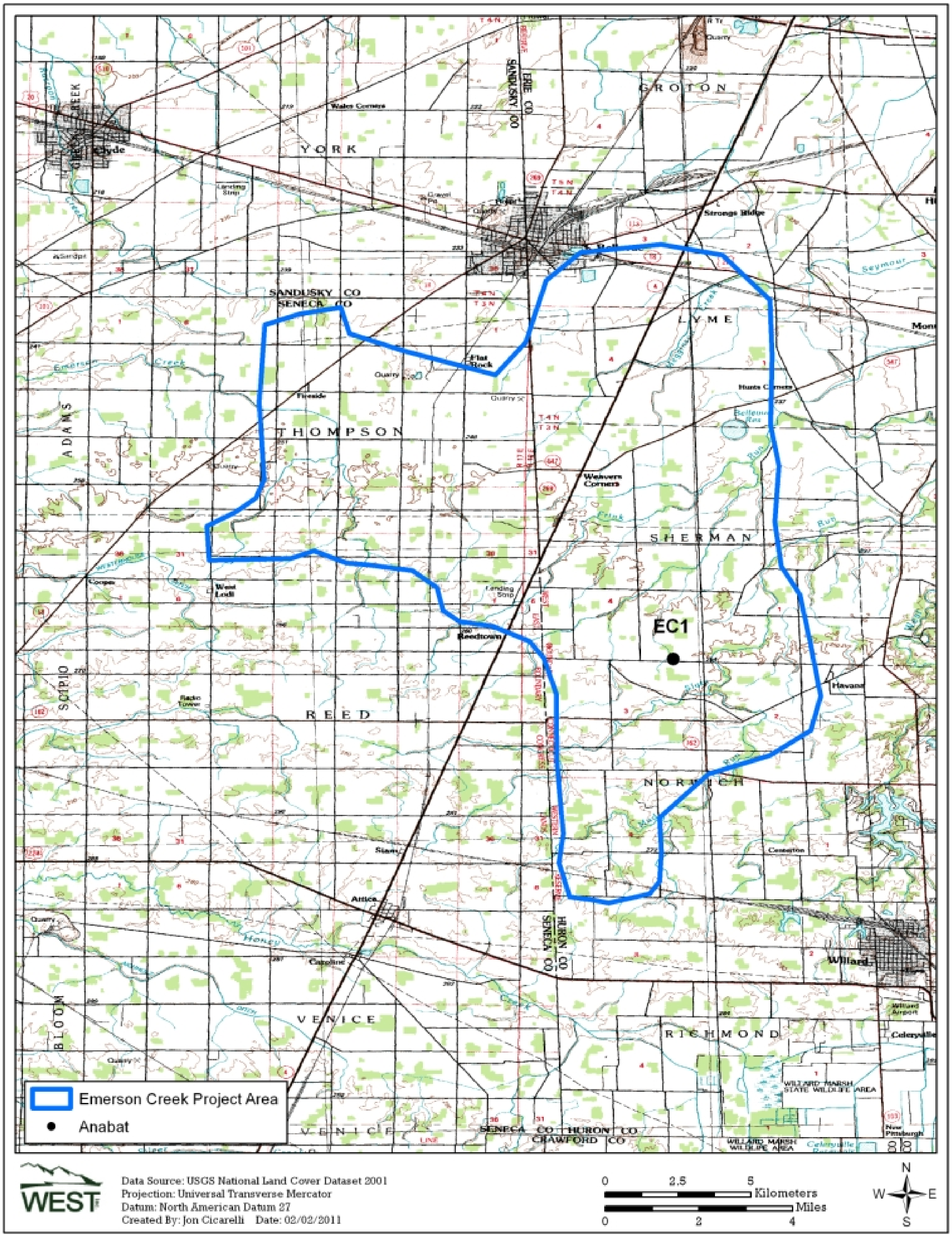

Figure 1. Study area map and Anabat sampling station at the Emerson Creek Wind Resource Area.

According to the National Land Cover Dataset (USGS NLCD 2001; Table 1 and Figure 2), the dominant cover type within the ECWRA is cultivated cropland (corn [*Zea mays*] and soybean [*Glycine max*]), which composed 84.1% (38,565 acres) of the total land area. The second most common cover type is deciduous forest, which composed 8.4% (3,859 acres) of the ECWRA, followed by developed areas (5.7%; 2,604 acres). Pasture/hay, barren areas, open water, grasslands, mixed forest, emergent wetlands, evergreen forests, and woody wetlands composed less than 1% of the total area individually (Table 1). Developed areas are generally confined to residences and farms scattered throughout the ECWRA.

Table 1. Summary of habitats within the Emerson Creek Wind Resource Area according to the National Land Cover Dataset (NLCD).

Habitat Type	Acres	% Composition
Agriculture	38,565.00	84.1
Deciduous Forest	3,858.65	8.4
Developed, Open Space	2,142.62	4.7
Pasture/Hay	436.15	1.0
Developed, Low Intensity	406.53	0.9
Barren	239.57	0.5
Open Water	133.93	0.3
Grassland	73.45	0.2
Developed, Medium Intensity	48.32	0.1
Developed, High Intensity	6.89	<0.1
Mixed Forest	2.59	<0.1
Emergent Wetlands	2.37	<0.1
Evergreen Forest	2.29	<0.1
Woody Wetlands	1.51	<0.1
Total	**45,919.86**	**100**

Data from the USGS NLCD (2001).

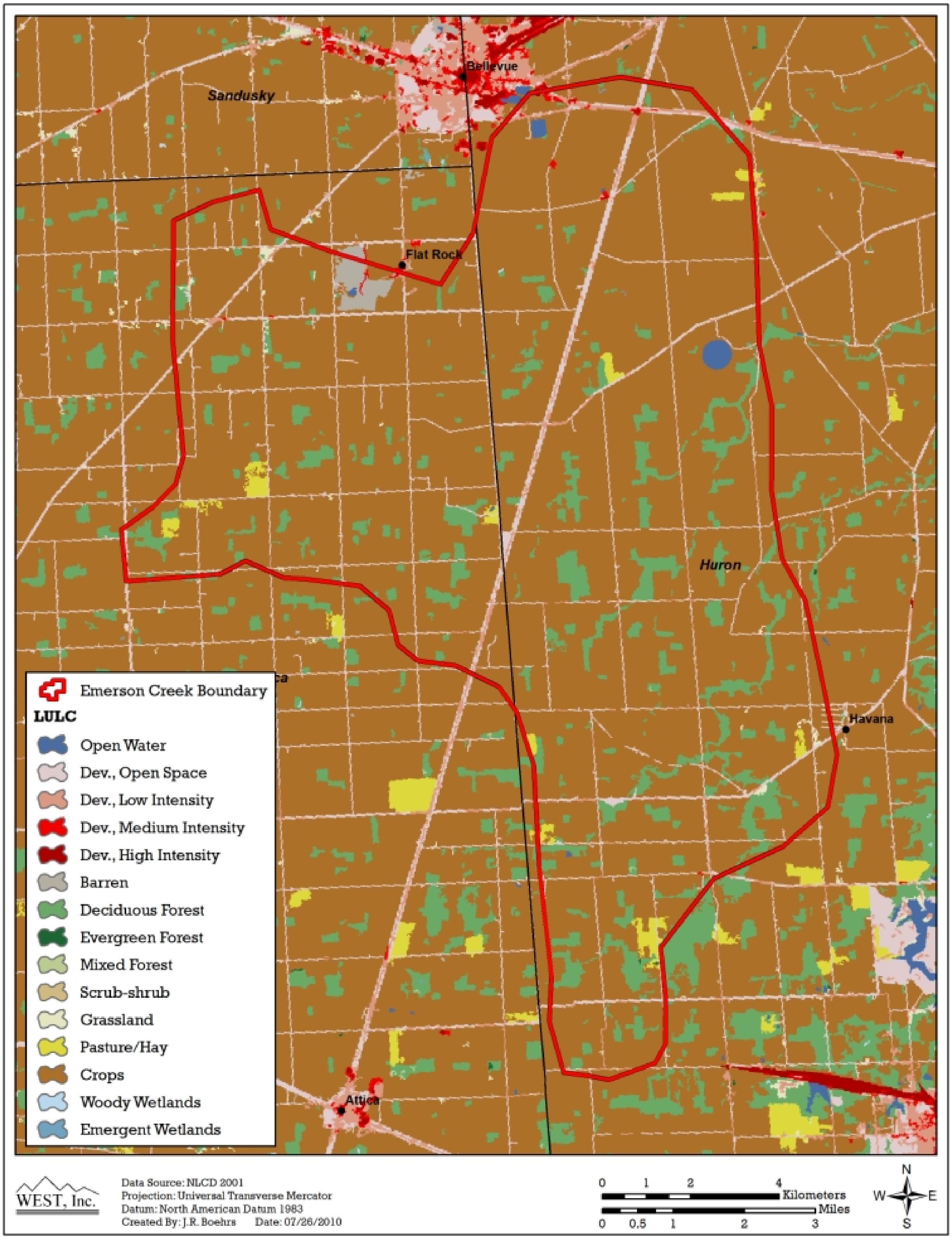

Figure 2. Land use/land cover within the Emerson Creek Wind Resource Area (USGS NLCD 2001).

There are several small creeks and streams within the ECWRA, including Frink Run Creek and its tributaries bisecting the study area. Slate Run Creek and its tributaries occur within the south part of the study area, and Megginson Creek occurs in the north section of the study area (Figure 1).

METHODS

Bat Acoustic Surveys

The objective of the bat activity surveys was to estimate the seasonal and spatial use of the ECWRA by bats. Bats were surveyed using Anabat™ SD1 bat detectors (Titley Scientific™, Australia). Bat detectors are a recommended method to index and compare habitat use by bats and the use of bat detectors for assessing potential bat impacts is a primary bat risk assessment tool for baseline wind-development surveys (Arnett 2007, Kunz et al. 2007a). Bat activity was surveyed using two detectors placed at one fixed station from March 11 to November 17, 2010 (Figure 1). To compare bat activity at different heights and monitor bat activity in the rotor swept heights (RSH), one detector was raised on a meteorological (met) tower to 5 m (16.4 ft) above ground level (AGL) and paired with a detector raised to approximately 50 m (164 ft) AGL on the same met tower

The unit that recorded at 5-m AGL had its microphone encased in a Bat-Hat weatherproof housing (EME Systems, Berkeley, California) with a 45-degree angle PVC elbow, which was attached to the towers using large circular clamps and/or high strength Gorilla™ duct tape (Appendix B). A connected coaxial cable transmitted ultrasonic sounds to an Anabat unit at the base of the tower (Appendix B).

The unit at 50-m AGL had its microphone encased in a modified Bat-Hat weatherproof housing (EME Systems, Berkeley, California) and attached to a coaxial cable that transmitted ultrasonic sounds to an Anabat unit at the base of the tower (Appendix B). The Bat-Hat weatherproof housing was modified by replacing the Plexiglas reflector plate with a 45-degree angle PVC elbow for better comparability with data collected by the 5-m detector (Appendix B). A recent study found that detectors protected by using Plexiglas reflectors in Bat-Hats may record lower activity and fewer species than microphones encased in PVC tubing (Britzke et al. 2010). Detectors were visited weekly throughout the study period to download data, exchange batteries and data cards, and to ensure detectors were functioning properly.

Anabat detectors record bat echolocation calls with a broadband microphone. Echolocation sounds are then made audible to humans by dividing the frequencies by a predetermined ratio. A division ratio of 16 was used for the study. Bat detectors also detect other ultrasonic sounds, such as those sounds made by insects, raindrops hitting vegetation, and other sources. A sensitivity level of six was used to balance the goal of recording bat calls against the need to reduce interference from these other sources of ultrasonic noise. Calls were recorded to a compact flash memory card with large storage capacity. The detection range of Anabat detectors depends on a number of factors (e.g., echolocation call characteristics, microphone sensitivity, habitat, the orientation of the bat, atmospheric conditions; Limpens and McCracken 2004), but is generally less than 30 m (98 ft) due to the atmospheric absorption (attenuation) of echolocation pulses (Fenton 1991). To ensure similar detection ranges among detectors, microphone sensitivities were calibrated to detect a calibration tone at 20 m (66 ft), as per ODNR guidelines (ODNR 2009), and using a BatChirp (Tony Messina, Las Vegas, Nevada) ultrasonic emitter as described in Larson and Hayes (2000). All units were programmed to turn on each night at 0.5 hours (hrs) before sunset and turn off at 0.5 hrs after sunrise.

Statistical Analysis

Bat Acoustic Surveys

The units of activity were number of bat passes (Hayes 1997). A pass was defined as a continuous series of two or more call notes produced by an individual bat with no pauses between call notes of more than one second (White and Gehrt 2001, Gannon et al. 2003). In this report, the terms bat pass and bat call are used interchangeably. The number of bat passes was determined by downloading the data files to a computer and tallying the number of echolocation passes recorded. Total number of passes was corrected for effort by dividing by the number of detector-nights. One detector collecting data for one night was a detector-night.

To highlight seasonal activity patterns, the study was divided into three survey periods: spring (March 11 – May 31), summer (June 1 – July 31), and fall (August 1 – November 17). Mean bat activity was also calculated for a standardized fall migration period, defined here as July 30 – October 14.

The period of peak sustained bat activity was defined as the 7-day period with the highest average bat activity. This and all multi-detector averages in this report were calculated by averaging the average activity of each detector. If multiple 7-day periods equaled the peak sustained bat activity rate, all dates in these 7-day periods were reported.

For each station, bat calls were sorted into three groups, based on minimum call frequency, that correspond roughly to species groups of interest. For example, most species of *Myotis* and *Perimyotis* bats echolocate at frequencies above 40 kilohertz (kHz), whereas species such as the evening bat (*Nycticeius humeralis*) typically have echolocation calls that fall between 30 kHz and 40 kHz, and species such as big brown (*Eptesicus fuscus*), silver-haired (*Lasionycteris noctivagans*), and hoary bat (*Lasiurus cinereus*) have echolocation frequencies that fall at or below 30 kHz. Therefore, WEST classified calls as being given by high-frequency (HF; more than 40 kHz), mid-frequency (MF; 30 to 40 kHz), or low-frequency (LF; less than 30 kHz) species. The echolocation calls of the eastern red bat (*Lasiurus borealis*) are extremely variable and could be classified as either MF or HF species. To establish which species may have produced calls in each category, a list of species expected to occur in the ECWRA was compiled from range maps (Table 2; Harvey et al. 1999, BCI 2011). Data determined to be noise (ultrasound produced by a source other than a bat) or call notes that did not meet the pre-specified criteria to be termed a pass were removed from the analysis.

Table 2. Bat species that have ranges that potentially overlap with the Emerson Creek Wind Resource Area, sorted by call frequency.

Common Name	Scientific Name
High-Frequency (> 40 kHz)	
little brown bat[2]	*Myotis lucifugus*
northern long-eared bat[2]	*Myotis septentrionalis*
Indiana bat[*,2]	*Myotis sodalis*
eastern small-footed bat[2]	*Myotis leibii*
tri-colored bat[2]	*Perimyotis subflavus*
Mid-Frequency (30 kHz-40 kHz)	
eastern red bat[1,2]	*Lasiurus borealis*
evening bat	*Nycticeius humeralis*
Low-Frequency (< 30 kHz)	
big brown bat[2]	*Eptesicus fuscus*
silver-haired bat[1,2]	*Lasionycteris noctivagans*
hoary bat[1,2]	*Lasiurus cinereus*

1 = long-distance migrant ; 2 = known casualty from wind turbines; *= Federally listed species
Ranges determined from Harvey et al. 1999, BCI 2011. Fatality information from Kunz et al. 2007b, Jacques Whitford 2009, USFWS 2010.

Within these frequency groups, WEST identified calls made by two *Lasiurus* species: hoary bats and eastern red bats. Call notes that had a distinct U-shape and exhibited variability in the minimum frequency within a call sequence were identified as belonging to the *Lasiurus* genus (C. Corben, pers comm.). Hoary and eastern red bats were distinguished based on minimum frequency; hoary bats typically produce calls with minimum frequencies between 18 kHz and 24 kHz, whereas eastern red bats typically emit calls with minimum frequencies between 30 kHz and 43 kHz (J. Szewczak, pers comm.). Only sequences containing three or more calls were used for species identification. These are conservative parameters; given the high intra-specific variability of *Lasiurus* calls, and the number of call files that were too fragmented for proper identification, it is certain that more hoary and eastern red bat calls were recorded than were positively identified.

Bat activity for this report was defined as the number of bat passes per detector-night, and was used as an index for bat use in the ECWRA. As individuals cannot be differentiated by their calls, bat pass data represent relative levels of bat activity rather than the total number of individuals present. To assess potential for bat mortality, mean bat passes per detector-night were compared to existing data from wind energy facilities where both bat activity and bat fatality rates have been measured.

RESULTS

Bat Acoustic Surveys

Bat activity was monitored by two detectors at one station on a total of 252 nights between March 11 and November 17, 2010. Anabat units were operating for 90.7% of the sampling period (Figure 3). A malfunctioning coaxial cable at the 50-m detector caused delays in data collection during the study peroid. Levels of wind and insect noise were generally low throughout the recording period (Figure 3).

Anabat units recorded 3,243 bat passes on 457 detector-nights (Table 3). Across all detectors, a mean (± standard error) of 7.10 ± 0.74 bat passes per detector-night was recorded. Average bat activity for the 5-m detector was 7.12 ± 0.76 bat passes per detector-night, and average bat activity for the raised detector was 7.07 ± 0.88 bat passes per detector-night (Table 3). Overall bat activity from July 30 – October 14, the period when most bat fatalities occur at wind energy facilities (Kunz et al. 2007b, Arnett et al. 2008), was 11.70 ± 1.67 at the 5-m detector and 10.60 ± 1.74 at the raised detector (Table 4).

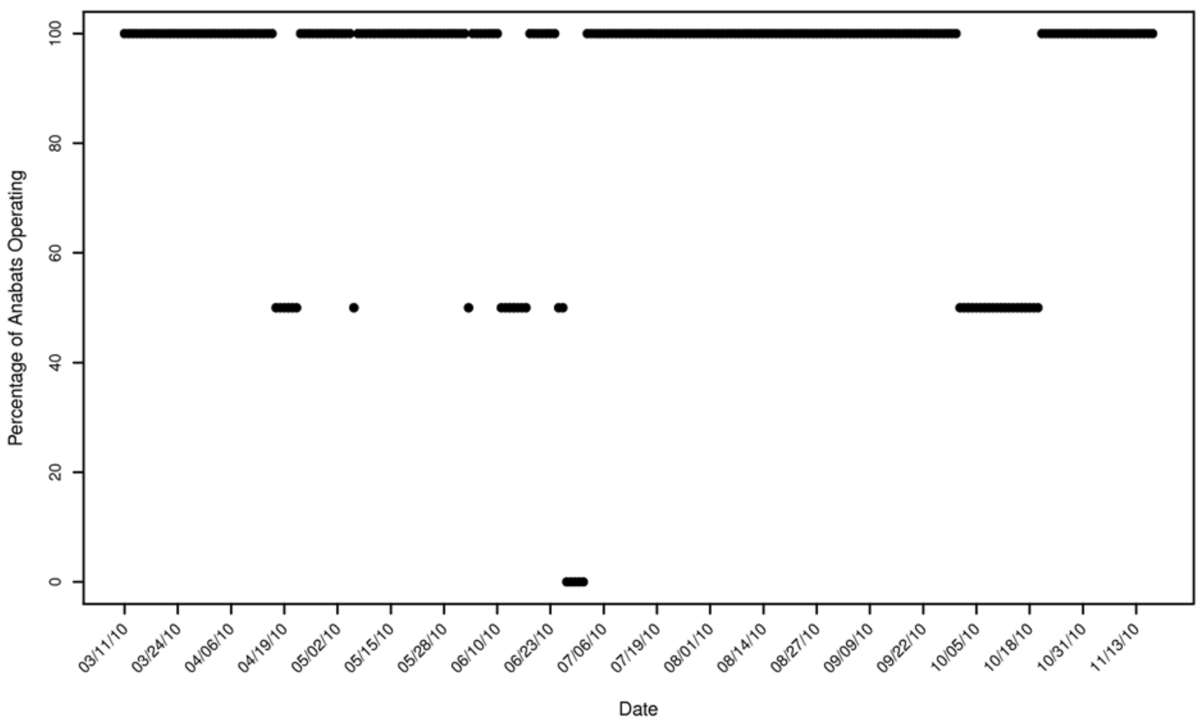

Figure 3. Percentage of Anabat detectors (n = 2) at the Emerson Creek Wind Resource Area operating during each night of the study period March 11 – November 17, 2010.

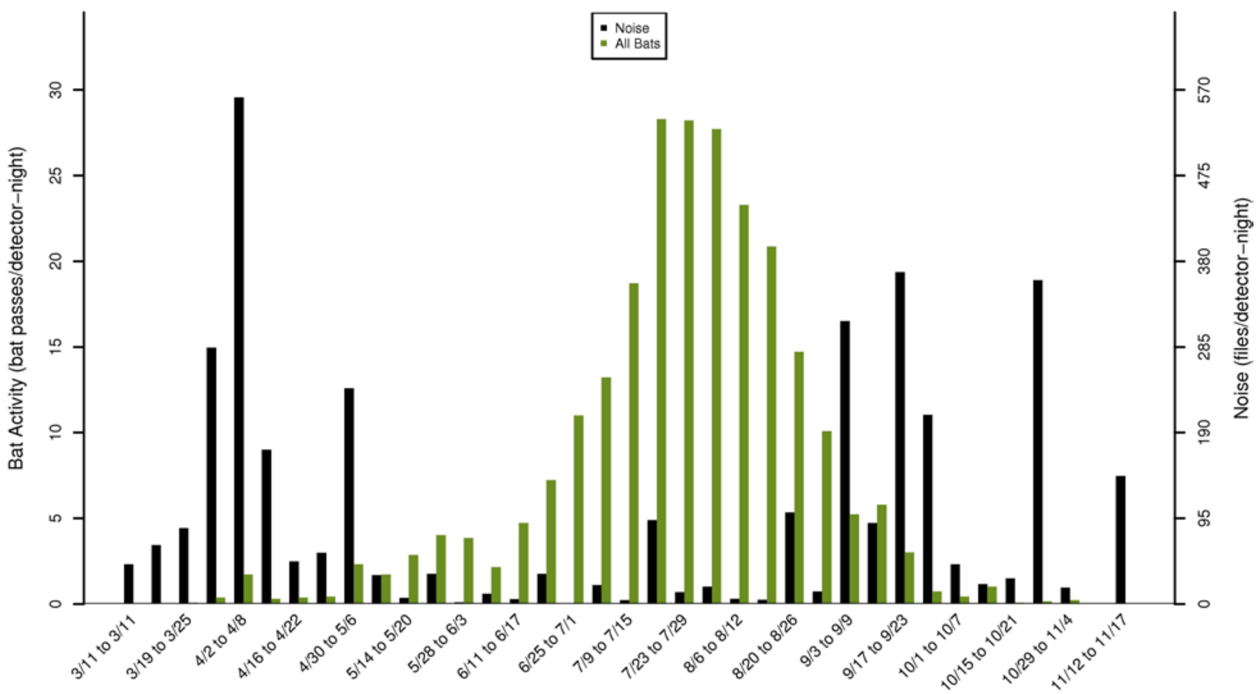

Figure 4. Number of bat passes and noise files detected per detector-night at the Emerson Creek Wind Resource Area for the study period March 11 – November 17, 2010, presented weekly. Noise files are indicated on the second axis.

Table 3. Results of acoustic bat surveys conducted at the Emerson Creek Wind Resource Area for the study period March 11 – November 17, 2010

Anabat Detector	Location	# of HF Bat Passes	# of MF Bat Passes	# of LF Bat Passes	# of Eastern Red Bat Passes*	# of Hoary Bat Passes**	Total Bat Passes	Detector-Nights	Bat Passes/ Night
5-m	ground	524	224	953	28	10	1,701	239	7.12±0.76
50-m	raised	62	147	1,333	68	545	1,542	218	7.07±0.88
	Total	**586**	**371**	**2,286**	**96**	**555**	**3,243**	**457**	**7.10±0.74**

*Passes by eastern red bats included in mid-frequency (MF) numbers.
**Passes by hoary bat included in low-frequency (LF) numbers.

Table 4. Mean nightly pass rates by pass type, station, and season. Pass types are high-frequency (HF), mid-frequency (MF), low-frequency (LF), and all bats (AB) at the Emerson Creek Wind Resource Area.

Anabat Detector	Call	Spring (3/11 to 5/31/2010)	Summer (6/1 to 7/31/2010)	Fall (8/1 to 11/17/2010)	Fall Migration Period (7/30 to 10/14/2010)	Totals
5-m	LF	0.95	9.16	3.92	5.61	3.99
	MF	0.36	1.84	0.96	1.42	0.94
	HF	0.47	2.88	3.17	4.68	2.19
	AB	1.78	13.88	8.05	11.70	7.12
50-m	LF	0.82	14.57	5.61	8.27	6.11
	MF	0.05	0.94	1.04	1.62	0.67
	HF	0.07	0.28	0.47	0.71	0.28
	AB	0.93	15.79	7.12	10.60	7.07
5-m totals	**LF**	**0.95±0.19**	**9.16±1.43**	**3.92±0.69**	**5.61±0.93**	**-**
	MF	**0.36±0.08**	**1.84±0.31**	**0.96±0.21**	**1.42±0.30**	**-**
	HF	**0.47±0.09**	**2.88±0.40**	**3.17±0.46**	**4.68±0.61**	**-**
	AB	**1.78±0.25**	**13.88±1.85**	**8.05±1.26**	**11.70±1.67**	**-**
50-m totals	**LF**	**0.82±0.18**	**14.57±2.53**	**5.61±1.13**	**8.27±1.51**	**-**
	MF	**0.05±0.03**	**0.94±0.23**	**1.04±0.22**	**1.62±0.31**	**-**
	HF	**0.07±0.04**	**0.28±0.09**	**0.47±0.10**	**0.71±0.14**	**-**
	AB	**0.93±0.20**	**15.79±2.64**	**7.12±1.30**	**10.60±1.74**	**-**
Season totals	**LF**	**0.88±0.17**	**11.86±1.70**	**4.76±0.85**	**6.94±1.10**	**-**
	MF	**0.21±0.04**	**1.39±0.22**	**1.00±0.20**	**1.52±0.28**	**-**
	HF	**0.27±0.05**	**1.58±0.19**	**1.82±0.26**	**2.69±0.32**	**-**
	AB	**1.36±0.21**	**14.84±1.90**	**7.58±1.23**	**11.15±1.56**	**-**

Temporal Variation

Bat activity varied among seasons (Table 4; Figure 5). Overall bat activity was highest during summer, averaging 14.84 bat passes per detector-night. Bat activity was relatively low during spring (1.36 bat passes per detector-night), with intermediate use recorded during fall (7.58 bat passes per detector-night; Table 4 and Figure 5).

Although overall bat activity varied from week to week, it generally followed an increasing trend throughout spring and summer (Figure 6). Bat activity then maintained an elevated level from July 9 to August 26 with the seven day period of peak sustained activity occurring from July 18 – 24, shortly before the fall migration period (Table 5). Activity levels then declined until reaching very low levels by early October.

Table 5. Highest weekly activity rates for the overall study period and the fall migration period at the Emerson Creek Wind Resource Area, sorted by call frequency (high-frequency [HF], mid-frequency [MF], and low-frequency [LF]), *Lasiurus* species (eastern red bat [LABO] and silver-haired bats [LACI]), and all bats.

	Overall March 11 – November 17, 2010		Fall Migration Period July 30 – October 14, 2010	
Species Group	Week(s) of Highest Passage Rate	Bat Passes per Detector-Night	Week(s) of Highest Passage Rate	Bat Passes per Detector-Night
HF	08/08 to 08/14/10	7.21	08/08 to 08/14/10	7.21
MF	08/08 to 08/14/10	5.86	08/08 to 08/14/10	5.86
LF	07/18 to 07/24/10	31.36	08/03 to 08/09/10	19.64
LABO	07/28 to 08/03/10, 08/09 to 08/15/10	1.5	08/09 to 08/15/10	1.5
LACI	07/22 to 07/28/10	11.29	08/03 to 08/09/10	8.38
All Bats	07/18 to 07/24/10	37.35	08/08 to 08/14/10	30.93

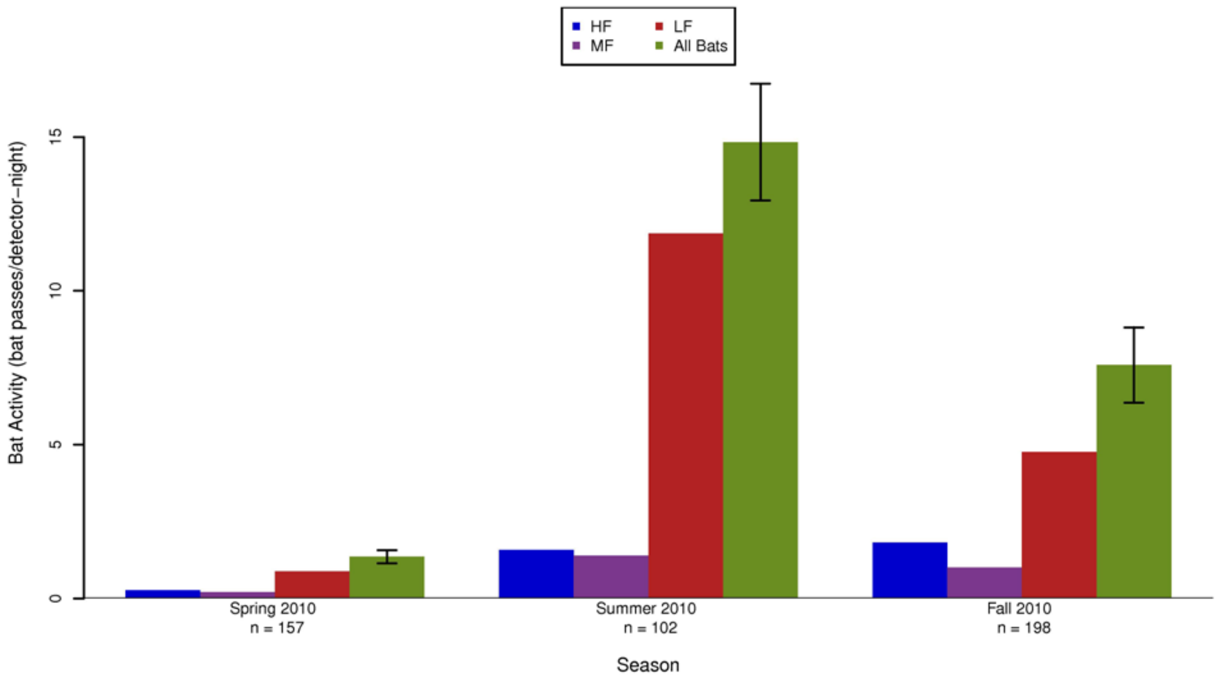

Figure 5. Seasonal bat activity at the Emerson Creek Wind Resource Area. Vertical bars represent ± 1 standard error of the mean and the bootstrapped standard errors are represented on the 'All Bats' columns.

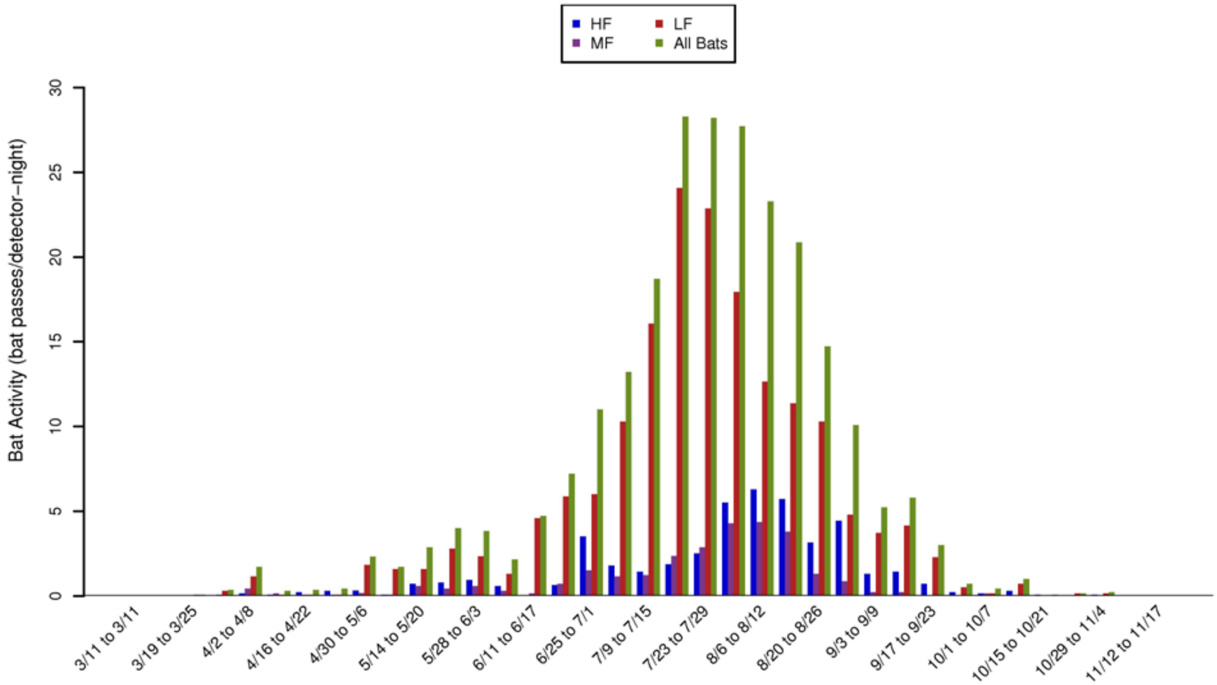

Figure 6. Bat activity by high-frequency (HF), mid-frequency (MF), and low-frequency (LF) bats at the Emerson Creek Wind Resource Area for the study period March 11 – November 17, 2010, presented weekly.

Temporal patterns for the 5-m and 50-m detectors diverged during the fall migration period (Figure 7). Although the temporal trend at both heights followed the familiar bell-shaped pattern, the timing of the peak week differed. Peak activity at the 5-m detector occurred during mid-July and quickly decreased. Peak activity at the 50-m detector occurred two weeks earlier and declined more slowly.

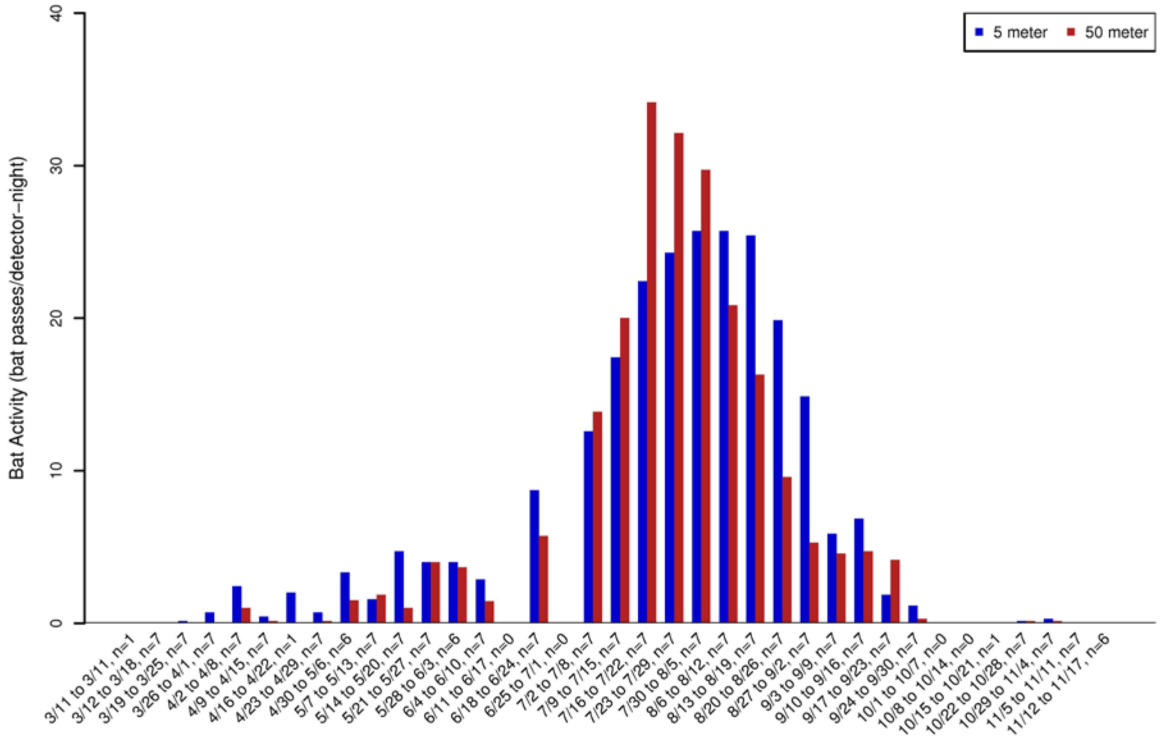

Figure 7. Bat activity at the 5-m and 50-m detectors at the Emerson Creek Wind Resource Area for the study period March 11 – November 17, 2010, presented weekly.

Species Composition

Overall, passes by LF bats (70.5% of all passes) outnumbered passes by HF bats (18.1%) and MF bats (11.4%; Table 3; Figures 8, 9, and 10). For HF bats, activity was higher at the 5-m detector (2.19 bat passes per detector-night) relative to the 50-m detector (0.28 bat passes per detector night; Table 3; Figures 9 and 10). In contrast, activity of LF bats was nearly twice as high at the 50-m detector (6.11 bat passes per detector-night) relative to the 5-m detector (3.99 bat passes per detector-night). Passes by MF bats showed similar activity levels at both the 5-m (0.94 bat passes per detector-night) and 50-m detectors (0.67 bat passes per detector-night; Table 3; Figures 9 and 10).

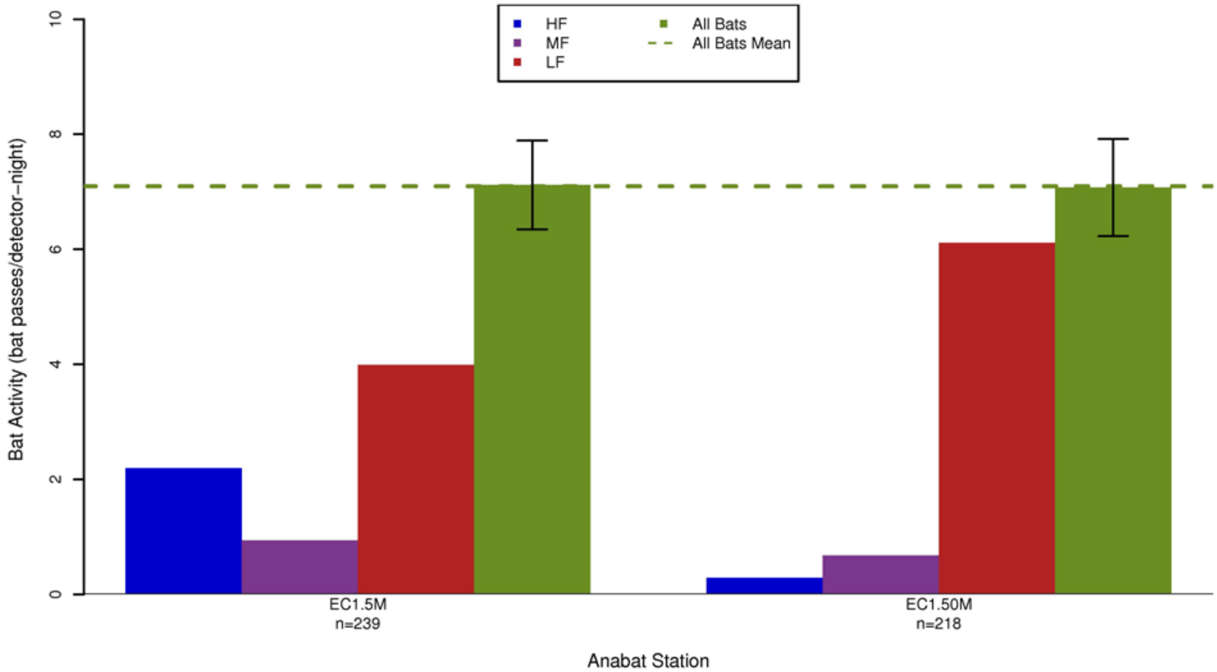

Figure 8. Number of bat passes per detector-night by Anabat location at the Emerson Creek Wind Resource Area for the study period March 11 – November 17, 2010. The bootstrapped standard errors are represented by the black error bars on the 'All Bats' columns.

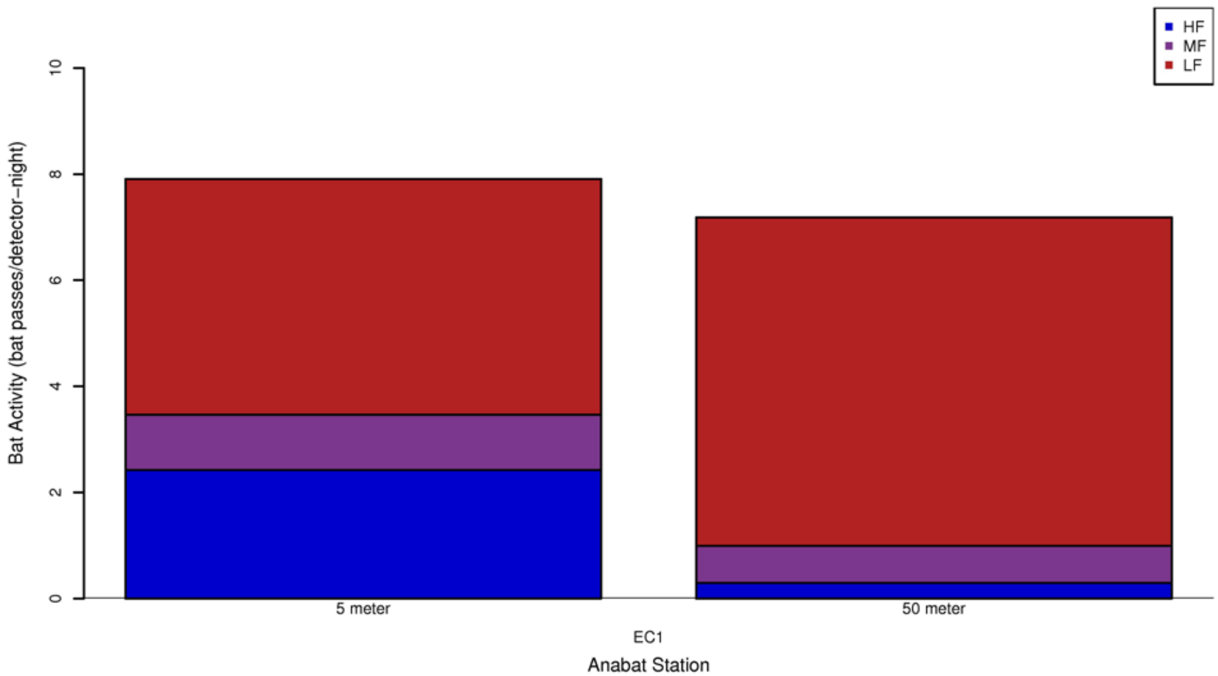

Figure 9. Number of high-frequency (HF), mid-frequency (MF), and low-frequency (LF) bat passes per detector-night recorded only on nights when at the paired 5-m and 50-m Anabat detectors were both operating at the Emerson Creek Wind Resource Area for the study period March 11 – November 17, 2010.

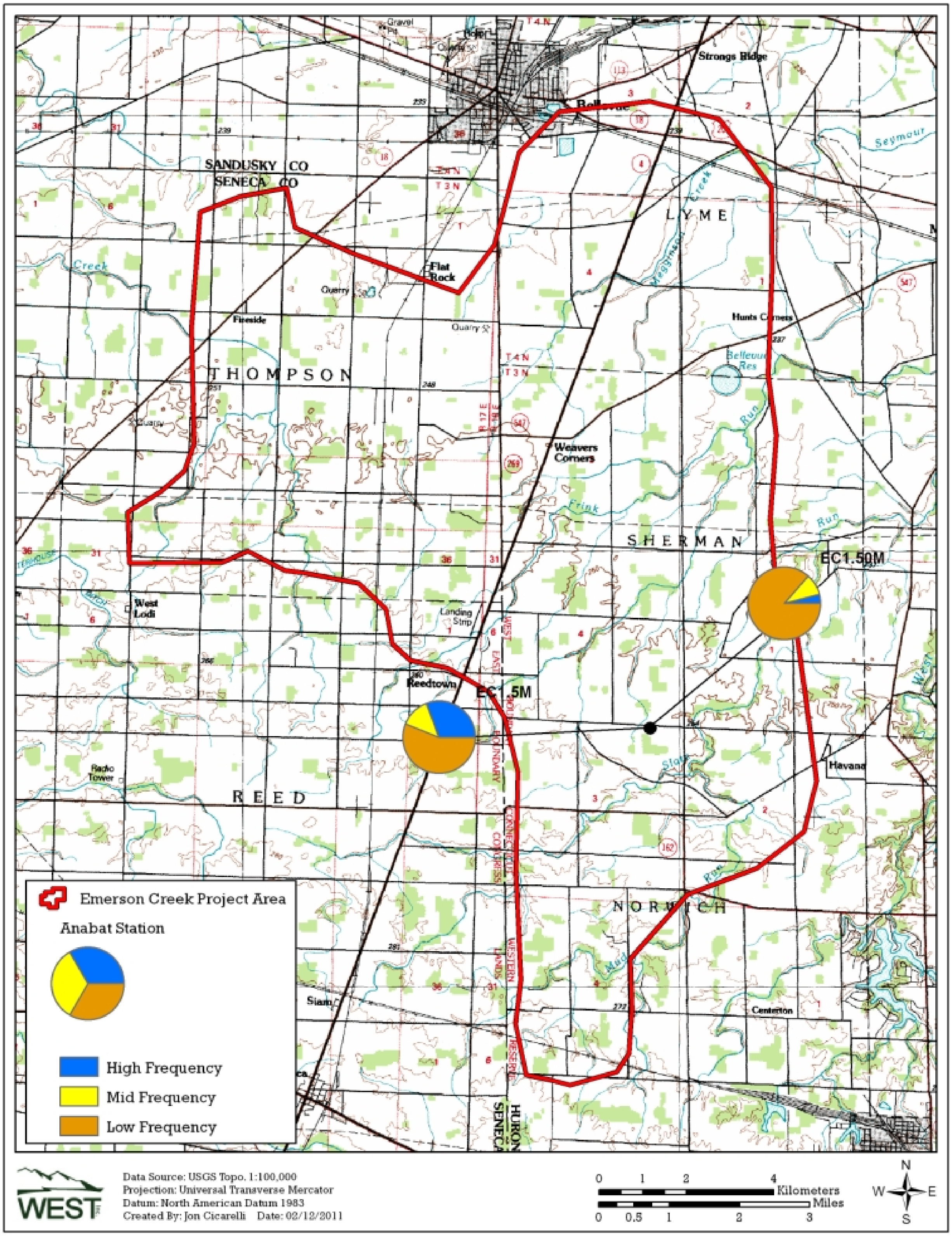

Figure 10. Bat activity, sorted by call frequency, by station within the Emerson Creek Wind Resource Area for the study period March 11 – November 17, 2010.

All three frequency groups followed a general pattern of increasing activity in the spring and summer followed by decreasing activity in the fall (Figure 5). However, the LF bats entered their seven day peak sustained activity period on July 18, while MF and HF bat activity peaked three weeks later, when LF activity had already been reduced by half (Table 5; Figure 6).

Of bat passes that could be identified as hoary bats, almost all (98.2%) were recorded at raised stations (Table 3; Figure 11). Hoary bat activity was elevated from July 2 to August 12 and reached a seven day period of sustained peak activity from July 22 to 28 (Table 5; Figure 12). Most eastern red bat passes were recorded at raised detectors at the ECWRA (70.8%; Table 3; Figure 11). Eastern red bat activity was highest from late June to late August, with no readily discernible peak in activity (Figure 12).

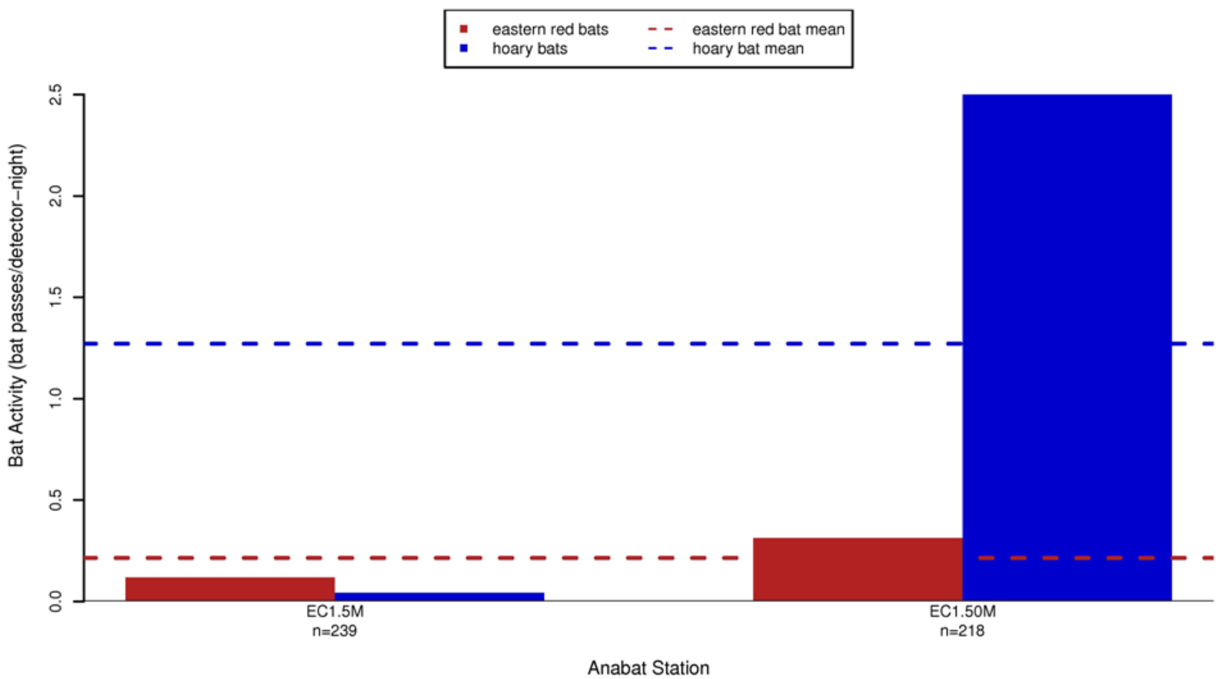

Figure 11. Number of passes per detector-night by hoary bats and eastern red bats, by Anabat detector at the Emerson Creek Wind Resource Area, for the study period March 11 – November 17, 2010.

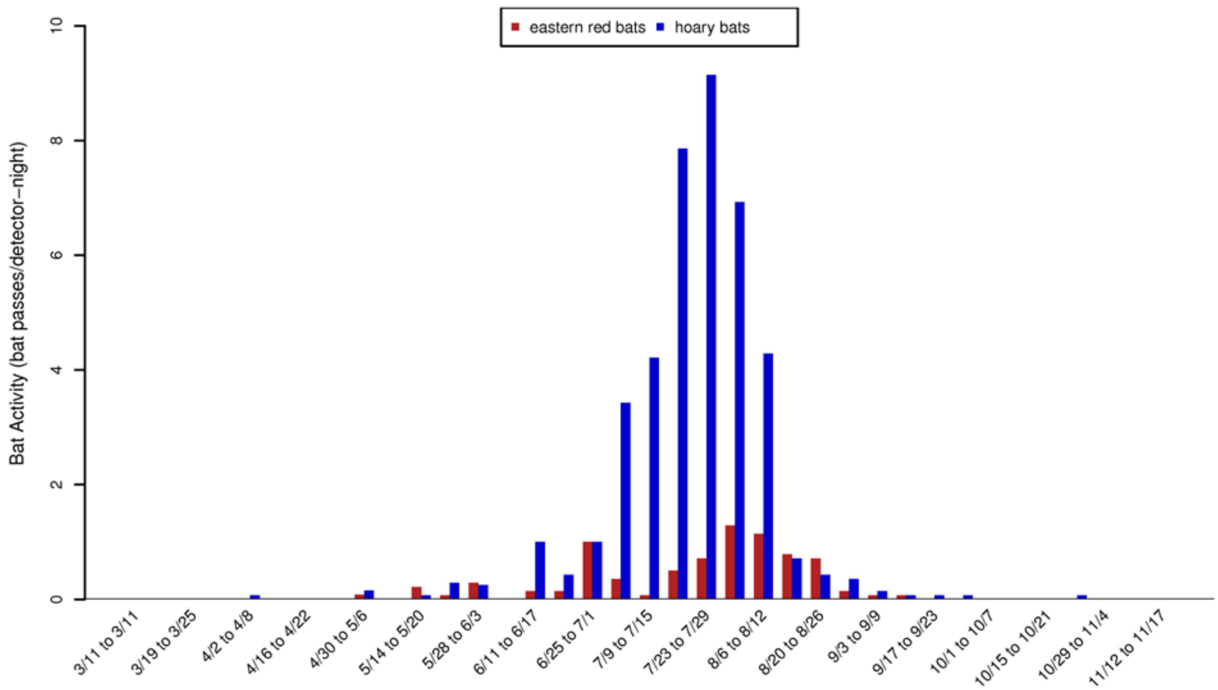

Figure 12. Weekly activity by hoary bats and eastern red bats at the Emerson Creek Wind Resource Area for the study period, March 11 – November 17, 2010.

DISCUSSION

Potential Bat Impacts

Assessing the potential impacts of wind energy development to bats at the ECWRA is complicated because the proximate and ultimate causes of bat fatalities at turbines are poorly understood (Kunz et al. 2007b; Baerwald et al. 2008; Cryan and Barclay 2009; Long et al. 2010a, 2010b), and because monitoring elusive, night-flying animals is inherently difficult (O'Shea et al. 2003). In addition, although installed capacity for wind has increased rapidly in recent years, release of study results from these existing wind energy facilities has lagged the wave of newly proposed facilities (Kunz et al. 2007b). Therefore, it is often the case that information gleaned from existing wind energy facilities is not available to help inform assessments at proposed facilities. To date, monitoring studies of wind energy facilities suggest that:

1) bat mortality shows a rough correlation with bat activity (Kunz et al. 2007b; Appendix C);

2) the majority of fatalities occur during the post-breeding or fall migration season (roughly August and September; Johnson 2005, Arnett et al. 2008); and

3) migratory tree-roosting species (eastern red, hoary, and silver-haired bats) comprise almost 75% of reported bats killed (Arnett et al. 2008, Kunz et al. 2007b, Gruver et al. 2009).

Based on these patterns, current guidance to estimate potential mortality levels at a proposed wind energy facility involves evaluation of the on-site bat acoustic data in terms of activity levels, seasonal variation, and species composition (Kunz et al. 2007b), as well as comparison to regional fatality patterns.

Overall Bat Activity

While detectors placed near met towers or at potential turbine locations may be used to compare activity relative to previous studies that measured both activity and fatality levels (i.e., Appendix C), such sampling locations are not generally at locations likely to attract or retain bats. Thus, in all likelihood, met tower locations provide a lower bound on the estimate of potential facility-wide bat activity. To date, relatively few studies of wind energy facilities have recorded both bat passes per night and bat fatality rates (Appendix C). Those that have generally show correlation between activity and fatalities, and the expectation among the scientific and resource-management communities is that an association may exist for pre-construction activity and post-construction fatalities. However, to date such a relationship has not been established empirically due to lack of sufficient data. For the studies that have measured both activity and fatalities, data were collected during fall using Anabat detectors placed near the ground (i.e., not raised on met towers) and none of the detectors were located near features attractive to bats. Therefore, mean bat activity for near ground-based (5-m) detectors during the fall migration period is most comparable to the other studies that reported both activity and fatality data.

Bat activity recorded in the ECWRA by the 5-m detector between July 30 and October 14 (11.70 bat passes per detector-night) was higher than activity at other facilities in Minnesota and Wyoming, where bat fatality rates were relatively low, but lower than activity recorded at other facilities in West Virginia, Iowa, and Tennessee, where bat fatality rates were higher (Appendix C).

Elevation Variation

Although bat activity for ground-based (5-m) detectors during the fall migration period is most comparable to activity from available pre-construction surveys, some researchers have suggested that activity monitored near the ground may not be representative of bat fatality rates (Hayes and Gruver 2000, Kunz et al. 2007a, Baerwald and Barclay 2009). At the ECWRA, overall recorded bat activity was similar at 5-m and 50-m units. However, species composition was quite different, with most HF bat passes recorded at the 5-m detector and most LF bat passes recorded at the 50-m detector. Consequently, LF species such as hoary bat and silver-haired bat generally compose a much greater proportion of bat fatalities at wind energy facilities (Arnett et al. 2008) than HF species, which fly and echolocate below proposed blade heights of turbines. However, a few notable exceptions have been documented. Little brown bats composed a larger proportion of fatalities at sites in Wisconsin (Gruver et al. 2009), Iowa (Jain 2005) and Alberta (Brown and Hamilton 2006).

Temporal Variation

The highest number of bat passes detected per night at the ECWRA occurred from late June through mid-September (Figures 3 and 6). Higher bat activity in late June likely corresponds with the period when pups are being weaned and foraging rates are high among females and the young. Higher bat activity in August likely reflects the movement of bats through the ECWRA to winter areas or hibernacula. Bat passage rates from mid-March through mid-June were relatively low compared to the rest of the study period. After mid-September, activity was much lower, indicating that most bats had left the area for winter hibernacula or warmer climates. This temporal pattern is seen in other studies, both in the Midwest and elsewhere (see Kunz et al. 2007a), and likely reflects the general phenology of temperate-zone bats.

Many fatality studies of bats at wind energy facilities in the US have shown a peak in mortality in August and September and generally lower mortality earlier in the summer (Johnson 2005, Arnett et al. 2008). While survey effort varies, studies that combine Anabat surveys and fatality studies show a general association between the timing of increased bat call rates and mortality, with both peaking during the fall. Based on data collected during this study, and the timing of bat fatalities at other wind energy facilities, it is expected that bat mortality at the ECWRA will be highest from mid-July through mid-August.

Species Composition

Of the ten species of bat that potentially occur in the study area, nine are known fatalities at wind energy facilities (Table 2). Analysis of acoustic data classified bat calls to frequency groups that correspond roughly to groups of relative risk. Approximately 70% of passes were by LF bats, suggesting higher relative abundance of species such as big brown bats, silver-haired bats, and hoary bats. However, it is not possible to precisely estimate relative abundance because detection rates differ between bat species (Kunz et al. 2007a).

Most HF bat calls were recorded by the 5-m unit, indicating that HF bat species at the ECWRA may not fly or echolocate as often within the rotor swept area of turbines (Table 3). Nonetheless, HF species are sometimes found as fatalities in relatively high proportions during fatality monitoring studies (e.g., Kerns and Kerlinger 2004, Jain 2005, Brown and Hamilton 2006, Gruver et al. 2009). In contrast, the majority of LF bat calls at the ECWRA were recorded by the 50-m unit. This most likely reflects the different foraging behavior among species. Generally, LF species tend to forage in less cluttered conditions (e.g., at greater heights) than HF species due to their wing morphology and echolocation call structure (Norberg and Rayner 1987). In some regions, MF bats compose the majority of bat fatalities found during searches, while LF bats have composed the majority in other studies (see Arnett et al. 2008).

In addition to the frequency group analysis, data on bat species indicated some species might be at elevated risk from wind turbines. Calls identified as those of eastern red bats or hoary bats were recorded more often at the 50-m detector (Figure 11), which may increase the likelihood of collisions. Eastern red bat and hoary bat activity at the ECWRA was concentrated during the fall migration period (Figure 11). Given that most bat fatalities occur during the migration period (Johnson 2005, Arnett et al. 2008, Cryan and Barclay 2009), these bat species may face a higher risk of mortality relative to other bat species at the ECWRA. In addition to the data recorded at the ECWRA, data from other sites also point towards a relatively high mortality risk for these species. At five Midwestern wind energy facilities, eastern red bats composed 22.3% of all bat fatalities and were the second most commonly found species (Jain 2005; Johnson et al. 2002, 2003a, 2004; Howe et al. 2002; Kerlinger et al. 2007; Gruver et al. 2009). Hoary bats have also been among the most common fatalities at several wind energy facilities (Erickson et al. 2000b; Johnson et al. 2003a, 2003b; Young et al. 2003).

Lastly, although the ECWRA is a relatively large site (45,920 acres), bat activity was monitored at only one location. Therefore, it is not possible to draw conclusions about spatial variation within the site.

Potential Bat Fatality Rates

Early studies of bat fatalities at wind energy facilities found the highest levels of bat fatalities have been reported from turbines set on forested Appalachian ridges (Arnett et al. 2008). However, recent reports of moderate to high levels of bat fatalities in agricultural settings in Iowa (Jain 2005); Alberta, Canada (Baerwald 2008); and Wisconsin (Gruver et al. 2009b, BHE Environmental 2010) suggest that the lack of forested areas does not guarantee low bat fatality rates at wind energy facilities.

Bat fatality studies at wind energy facilities across North America show a wide range of bat fatality rates, ranging from 0.10 to 39.70 bat fatalities/MW/study period (Appendix C). Although the pool of available data for the Midwest is somewhat limited, to date studies from the Midwest have indicated that bat fatality rates for Midwestern wind energy facilities located in agricultural regions of Illinois, Indiana, Iowa, Wisconsin, and Minnesota may range between 0.76 to 30.6 bats/megawatt/study period (Appendix C). No bat fatality rates for publically available studies of wind energy facilities in Ohio are available.

Bat pass rates recorded at the ECWRA were moderate compared to other wind energy facilities where bat pass rates and bat fatality rates have been measured. Currently, pre-construction activity data from one wind energy facility in Ohio is publically available, and bat pass rates at the ECWRA were higher than the 2.78 bat passes/detector night recorded at the Timber Road II facility (Good et al. 2009). However, bat activity at the ECWRA was estimated from just one recording station, and there is no way to determine if that station was representative of the entire site, especially in different land cover types.

Assuming that a relationship between bat activity and bat fatality rates exists, and based on the bat activity rates observed during this study and habitats present within the ECWRA, bat fatality rates at the ECWRA will likely be higher than the 1.73 bats/MW/year found at Phases II and III of the Buffalo Ridge wind energy facility in Minnesota, the 1.48 bats/MW/year found at the Wessington Springs facility in South Dakota, or the 1.40 bats/MW/year at the Stetson Mountain facility in Maine, but fatality rates at the ECWRA are expected to be lower than the 31.69 bats/MW/year found at the Mountaineer facility in West Virginia, the 31.54 bats/MW/year found at the Buffalo Mountain facility in Tennessee, or the 24.57 bats/MW/year found at the Blue Sky Green Field facility in Wisconsin (Appendix C).

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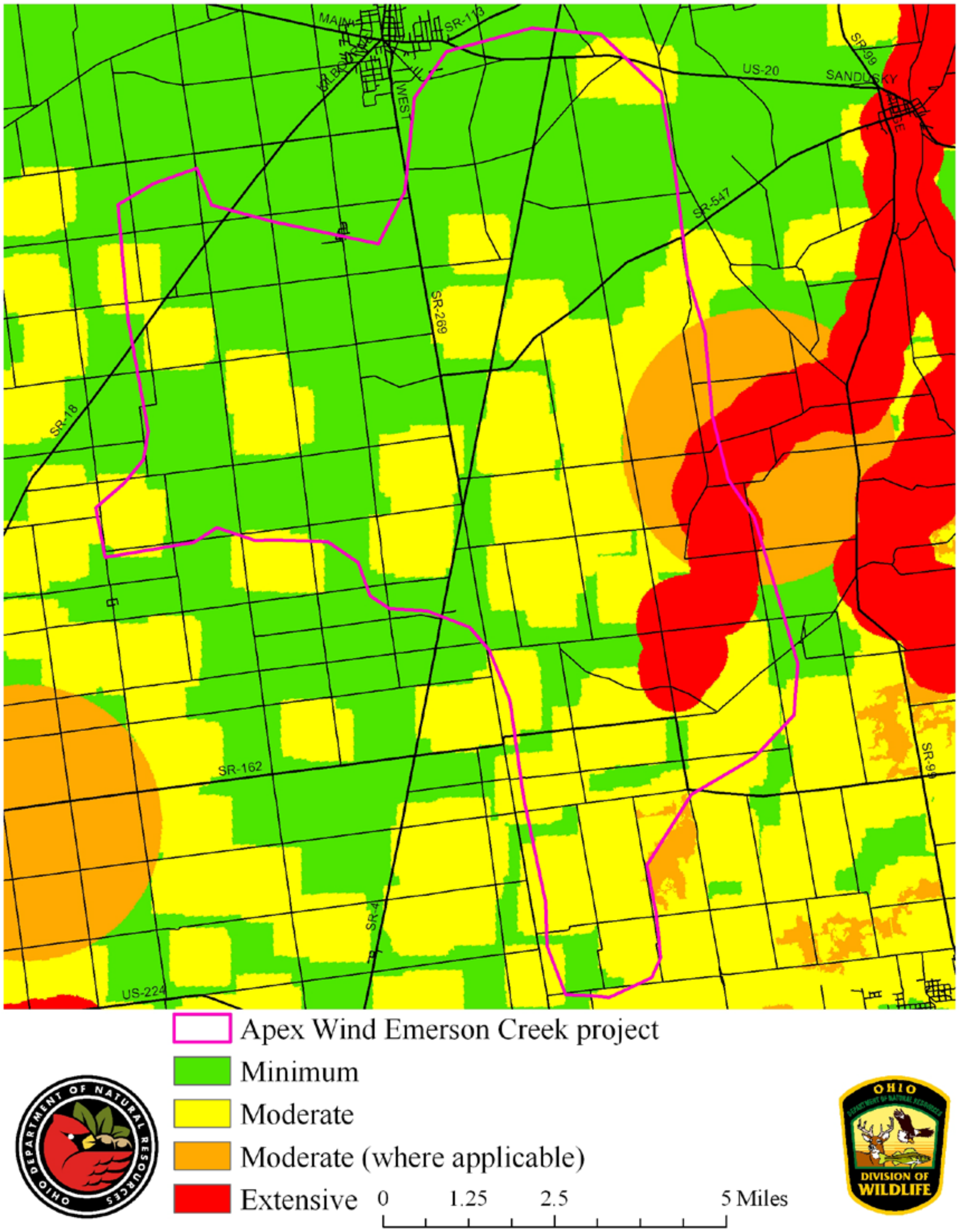
Appendix A: ODNR Recommendations for Wildlife Surveys at Emerson Creek



MAIN
SR-113
US-20
SANDUSKY
SR-99
SR-547
SR-269
SR-18
SR-162
SR-4
US-224
Apex Wind Emerson Creek project
Minimum
Moderate
Moderate (where applicable)
Extensive
0
1.25
2.5
5 Miles
OHIO DEPARTMENT OF NATURAL RESOURCES
OHIO
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE

Appendix B. Photographs of the Weatherproof Housing for Anabat Microphones, 5-m Anabat Setup, and 50-m Bat-Hat Hardware Assembly

Appendix B. The 45-degree angle PVC elbow housing mount used to mount the microphone for both the 5-m and 50-m heights on the met tower.

Appendix B. The 5-m Anabat setup on the met tower.

Appendix B. Bat-Hat hardware assembly used to elevate the microphone to 50-m on the met tower.

Appendix C. Regional Bat Fatality Data

Appendix C. Wind energy facilities in North America with activity and fatality data for bats, grouped by geographic region.

Wind Energy Facility	Bat Activity Estimate[A]	Fatality Estimate[B]	No. of Turbines	Total MW
Overall Emerson Creek, OH (5-m detectors March 11 – November 17)	**7.10**			
Fall Emerson Creek, OH (5-m detectors July 30 – Oct 14)	**11.70**			
Midwest				
Cedar Ridge, WI		30.6[F]	41	68
Blue Sky Green Field, WI	7.7[D]	24.57	88	145
Top of Iowa, IA (2004)	34.9[C]	10.27	89	80
Fowler Ridge I, IN (2009)		8.09	162	301
Crystal Lake II, IA		7.42[E]	80	200
Top of Iowa, IA (2003)	34.9[C]	7.16	89	80
Kewaunee County, WI		6.55	31	20
Ripley, Ont.		4.67	38	76
Winnebago, IA		4.54	10	20
Buffalo Ridge, MN (Phases II & III; 2001)	2.2	4.03	281	210.75
Crescent Ridge, IL		3.27	33	49.5
Buffalo Ridge, MN (Phase III; 1999)		2.72	138	103.5
Buffalo Ridge, MN (Phase II; 1999)		2.59	143	107.25
Moraine II, MN		2.42	33	49.5
Buffalo Ridge, MN (Phase II; 1998)		2.16	143	107.25
Grand Ridge, IL		2.10	66	99
Fowler Ridge III, IN (2009)		1.84[G]	60	99
Buffalo Ridge, MN (Phases II & III; 2002)	1.9	1.73	281	210.75
Elm Creek, MN		1.49	67	100
Wessington Springs, SD	0.18	1.48	34	51
NPPD Ainsworth, NE		1.16	36	59.4
Buffalo Ridge, MN (Phase I; 1999)		0.76	73	25
Buffalo Ridge I, SD		0.16	24	50.4
Timber Road II, OH	2.78			
Pacific Northwest				
Stateline, OR/WA (2003)		2.52	454	300
Nine Canyon, WA		2.47	37	48
Biglow Canyon I, OR (2008)		1.99	76	125.4
Leaning Juniper, OR		1.98	67	100.5
Big Horn, WA		1.90	133	199.5
Combine Hills, OR		1.88	41	41
Elk Horn, OR		1.26	61	101
Stateline, OR/WA (2002)		1.20	454	300
Vansycle, OR		1.12	38	24.9
Klondike, OR		0.77	16	24
Hopkins Ridge, WA		0.63	83	150
Biglow Canyon I, OR (2009)		0.58	76	125.4
Klondike II, OR		0.41	50	75
Wild Horse, WA		0.39	127	229
Marengo II, WA		0.27	39	70.2
Marengo I, WA		0.17	78	140.4

Appendix C. Wind energy facilities in North America with activity and fatality data for bats, grouped by geographic region.

Wind Energy Facility	Bat Activity Estimate[A]	Fatality Estimate[B]	No. of Turbines	Total MW
California				
High Winds, CA (2004)		2.51	90	162
Dillon, CA		2.17	45	45
High Winds, CA (2005)		1.52	90	162
SMUD, CA		0.07		15
Alta-Oak Creek Mojave, CA	2.5			
Rocky Mountains				
Summerview, Alb. (2006)	7.6	14.62	39	70.2
Summerview, Alb. (2005/2006)		10.27	39	70.2
Judith Gap, MT		8.93	90	135
Summerview, Alb. (2007)		8.23	39	70.2
Foote Creek Rim, WY (Phase I; 1999)		3.97	69	41.4
Foote Creek Rim, WY (Phase I; 2001/2002)		1.57	69	41.4
Foote Creek Rim, WY (Phase I; 2000)	2.2	1.05	69	41.4
Northeastern				
Buffalo Mountain, TN (2006)		39.70	18	29
Mountaineer, WV	38.3	31.69	44	66
Buffalo Mountain, TN (2000-2003)	23.7	31.54	3	2
Meyersdale, PA		18.00	20	30
Cohocton/Dutch Hill, NY		16.02	50	125
Maple Ridge, NY (2006)		15.00	120	198
Noble Bliss, NY (2008)		14.66	67	100
Cassleman, PA (Spring & Fall 2008)		12.61	23	34.5
Mount Storm, WV (2008)	35.2	12.11	82	164
Casselman, PA (Fall 2008)		9.91	23	34.5
Maple Ridge, NY (2007)		9.42	195	321.75
Noble Clinton, NY (2009)		6.48	67	100
Wolfe Island, Ont.		6.42	86	197.8
Noble Bliss, NY (2009)		5.50	67	100
Noble Ellenburg, NY (2008)		5.45	54	80
Noble Ellenburg, NY (2009)		5.34	54	80
Noble Clinton, NY (2008)		3.63	67	100
Mars Hill, ME (2007)		2.91	28	42
Stetson Mountain, ME	0.30	1.40	38	57
Munnsville, NY		0.46	23	34.5
Mars Hill, ME (2008)		0.45	28	42
Southern Plains				
Oklahoma Wind Energy Center, OK		0.53	68	102
Buffalo Gap, TX		0.10	67	134

A = bat passes per detector night
B = number of bat fatalities/MW/study period
C = averaged across phases and/or study years, and may not be directly related to mortality estimates
D = bat activity not measured concurrently with bat mortality studies
E = number of bat fatalities/MW/spring and fall survey period only
F = number of bat fatalities/MW/spring season only

Appendiux C (*continued*). Wind energy facilities in North America with activity and fatality data for bats, grouped by geographic region.

Data from the following sources:

Facility	Activity Estimate	Fatality Estimate	Facility	Activity Estimate	Fatality Estimate
Cedar Ridge, WI		BHE Environmental 2010	Marengo II, WA		URS Corporation 2010b
Blue Sky Green Field, WI	Gruver 2008	Gruver et al. 2009	Marengo I, WA		URS Corporation 2010a
Top of Iowa, IA (2004)	Jain 2005	Jain 2005	High Winds, CA (04)		Kerlinger et al. 2006
Fowler Ridge I, IN		Johnson et al. 2010a	Dillon, CA		Chatfield et al. 2009
Top of Iowa, IA (2003)	Jain 2005	Jain 2005	High Winds, CA (05)		Kerlinger et al. 2006
Kewaunee County, WI		Howe et al. 2002	SMUD, CA		Erickson and Sharp 2005
Ripley, Ont.		Jacques Whitford 2009	Alta-Oak Creek Mojave, CA	Erickson et al. 2009	
Winnebago, IA		Derby et al. 2010a	Summerview, Alb. (06)	Baerwald 2008	Baerwald 2008
Buffalo Ridge, MN (Phase II& III; 01)	Johnson et al. 2004	Johnson et al. 2004	Summerview, Alb. (05/06)		Brown and Hamilton 2006
Crescent Ridge, IL		Kerlinger et al. 2007	Judith Gap, MT		TRC 2008
Buffalo Ridge, MN (Phase III; 99)		Johnson et al. 2004	Summerview, Alb. (07)		Baerwald 2008
Buffalo Ridge, MN (Phase II; 99)		Johnson et al. 2004	Foote Creek Rim, WY (Phase I; 99)		Young et al. 2003
Moraine II, MN		Derby et al. 2010c	Foote Creek Rim, WY (Phase I; 01/02)		Young et al. 2003
Buffalo Ridge, MN (Phase II; 98)		Johnson et al. 2004	Foote Creek Rim, WY (Phase I; 00)	Gruver 2002	Young et al. 2003
Grand Ridge, IL		Derby et al. 2010e	Buffalo Mountain, TN (06)		Fiedler et al. 2007
Fowler Ridge III, IN		Johnson et al. 2010b	Mountaineer, WV	Arnett (pers comm. 2005)	Kerns and Kerlinger 2004
Buffalo Ridge, MN (Phase II& III; 02)	Johnson et al. 2004	Johnson et al. 2004	Buffalo Mountain, TN (00-03)	Fiedler 2004	Nicholson et al. 2005
Elm Creek, MN		Derby et al. 2010c	Meyersdale, PA		Arnett et al. 2005
Wessington Springs, SD	Derby et al. 2008	Derby et al. 2010d	Cohocton/Dutch Hill, NY		Stantec 2010
NPPD Ainsworth, NE		Derby et al. 2007	Maple Ridge, NY (06)		Jain et al. 2007
Buffalo Ridge, MN (Phase I; 99)		Johnson et al. 2000	Noble Bliss, NY (08)		Jain et al. 2009c
Buffalo Ridge, SD		Derby et al. 2010b	Casselman, PA (Spring & Fall 08)		Arnett et al. 2009b
Timber Road II, OH	Good et al. 2009		Mount Storm, WV (08)	Young et al. 2009	Young et al. 2009
Stateline, OR/WA (03)		Erickson et al. 2004	Casselman, PA (Fall 08)		Arnett et al. 2009a
Nine Canyon, WA		Erickson et al. 2003	Maple Ridge, NY (07)		Jain et al. 2008
Biglow Canyon I, OR (08)		Jeffrey et al. 2009a	Noble Clinton, NY (09)		Jain et al. 2010b
Leaning Juniper, OR		Gritski et al. 2008	Wolfe Island, Ont.		Stantec, Ltd. 2010
Big Horn, WA		Kronner et al. 2008	Noble Bliss, NY (09)		Jain et al. 2010a
Combine Hills, OR		Young et al. 2006	Noble Ellenburg, NY (08)		Jain et al. 2009a
Elk Horn, OR		Jeffrey et al. 2009b	Noble Ellenburg, NY (09)		Jain et al. 2010c
Stateline, OR/WA (02)		Erickson et al. 2004	Noble Clinton, NY (08)		Jain et al. 2009b
Vansycle, OR		Erickson et al. 2000a	Mars Hill, ME (07)		Stantec 2008a
Klondike, OR		Johnson et al. 2003b	Stetson Mountain, ME	Stantec 2009c	Stantec 2009c
Hopkins Ridge, WA		Young et al. 2007	Munnsville, NY		Stantec 2008b
Biglow Canyon I, (09)		Enk et al. 2010	Mars Hill, ME (08)		Stantec 2009a
Klondike II, OR		NWC and WEST 2007	Oklahoma Wind Energy Center, OK		Piorkowski 2006
Wild Horse, WA		Erickson et al. 2008	Buffalo Gap, TX		Tierney 2007