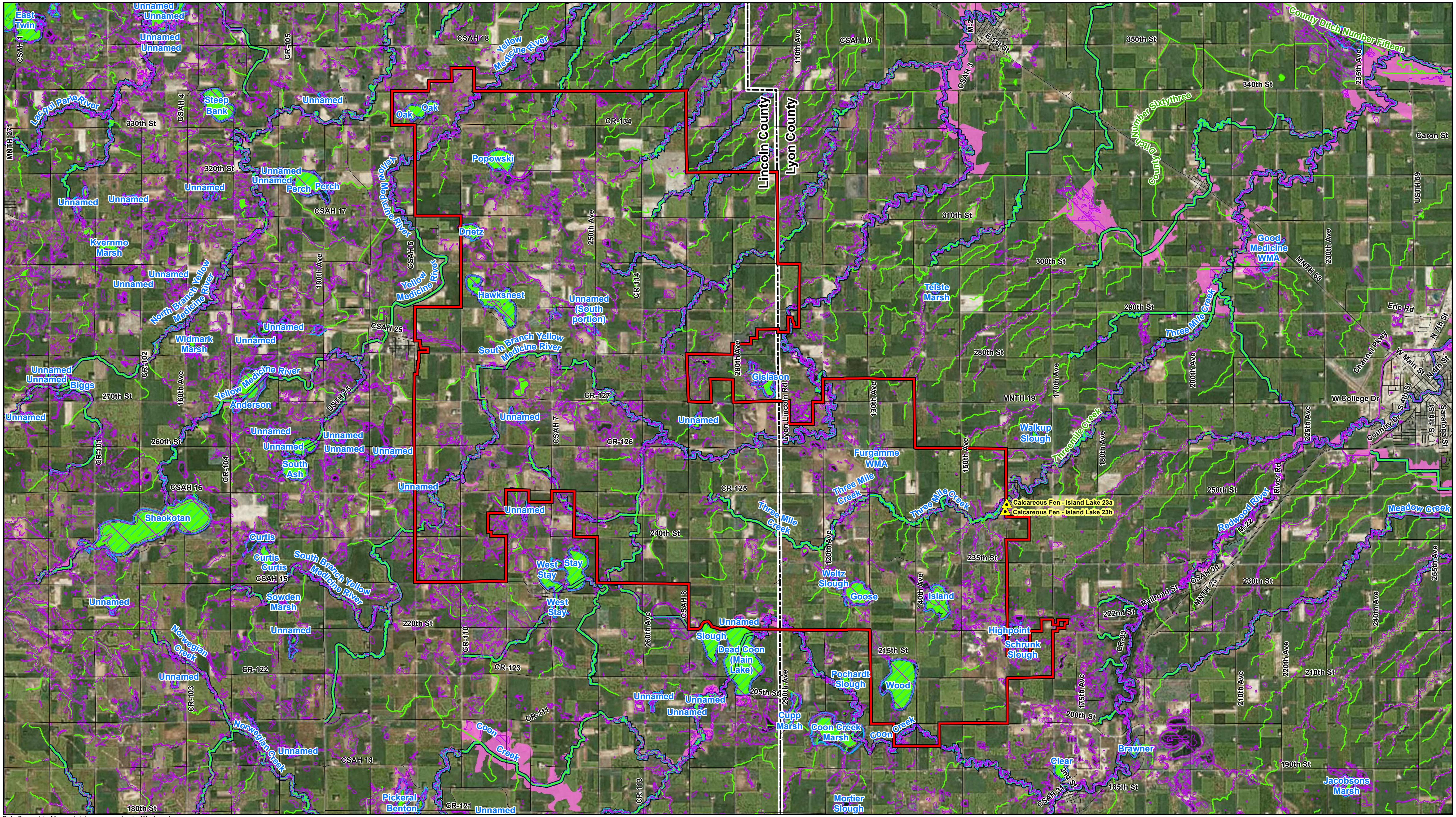

Red Pine Wind Project

Lincoln & Lyon Counties, Minnesota

Water Resources

EXHIBIT 4

Legend

- Project Boundary
- Calcareous Fen Location
- Road
- County Boundary
- PWI Watercourse
- PWI Basin
- NWI
- FEMA Floodplain
- NHD Flowline
- NHD Waterbody

N

0 — 2 Miles

Data Source(s): Map and data are approximate. Westwood (2016); U.S. Fish and Wildlife Service (2013); NWI, MnDnr and Ducks Unlimited (2014); USGS NHD Dataset (2013); Geospatial Data Gateway (various dates); PWI, MnDNR (2008); FEMA (various dates); Minnesota NAIP Imagery (accessed 2016); ESRI (2012); MnDOT (various dates); MnDNR (various dates).

Westwood

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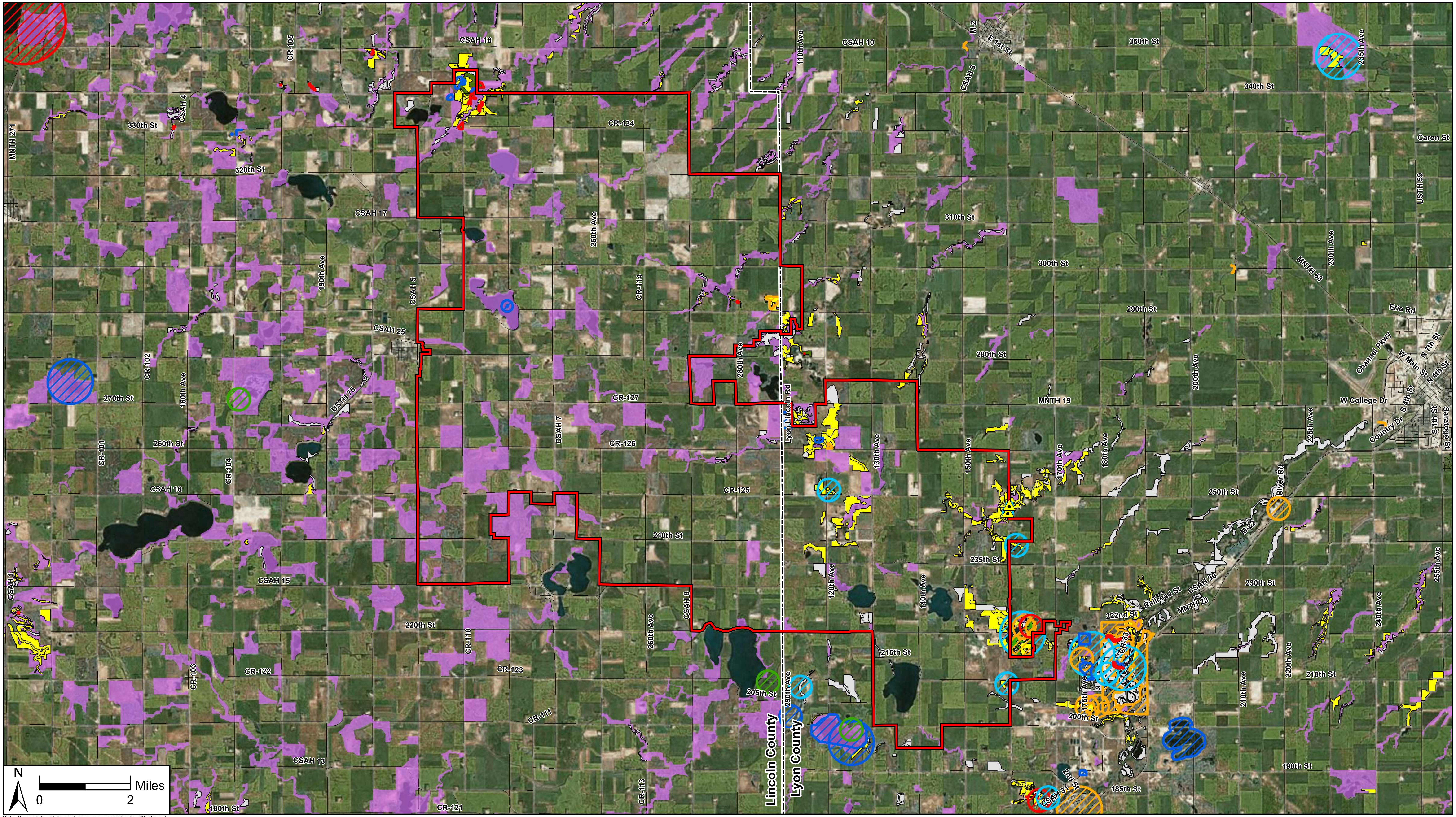
Map Document: P:\0006243.00\GIS\SCS_Maps\RP_WaterResources_SCS_Ex4_160208.mxd 2/29/2016 11:26:59 AM



Data Source(s): Data and map are approximate. Westwood (2016); Geospatial Data Gateway (various dates); Minnesota NAIP Imagery (accessed 2016); ESRI (2012); MnDOT (various dates); MnDNR (various dates); NCED and partners (2014); USGS, GAP Stewardship (2008); MnDNR, NHIS data (2015).

Note: NHIS data included here were provided by the Division of Ecological and Water Resources, Minnesota Department of Natural Resources (DNR), and were current as of May 2015. These data are not based on an exhaustive inventory of the state. The lack of data for any geographic area shall not be

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Legend

- Project Boundary
- Road
- County Boundary
- MBS Site Of Biodiversity Significance
- Calcareous Fen Location
- Railway Right-Of-Way Prairie
- Lek Area

MN DNR Native Plant Comunity Conditions

- A
- AB
- B
- BC; C; CD; D
- NR

NHIS Rare/Endangered Species Areas

- Vertebrate Animal
- Terrestrial Community
- Invertebrate Animal
- Vascular Plant
- Animal Assemblage

Note:
--Project Area within NLE Bat Range & White Nose Syndrome Zone. Bat Range covers the whole Project Area. White Nose Syndrome zone is only for Lyon County.

--Whooping Crane Corridors are outside of Project Area. Whooping crane corridor is approximate 95 miles away from Project Area.

--There are no Railway Right-Of Way Prairie or Leks within the Project Area.

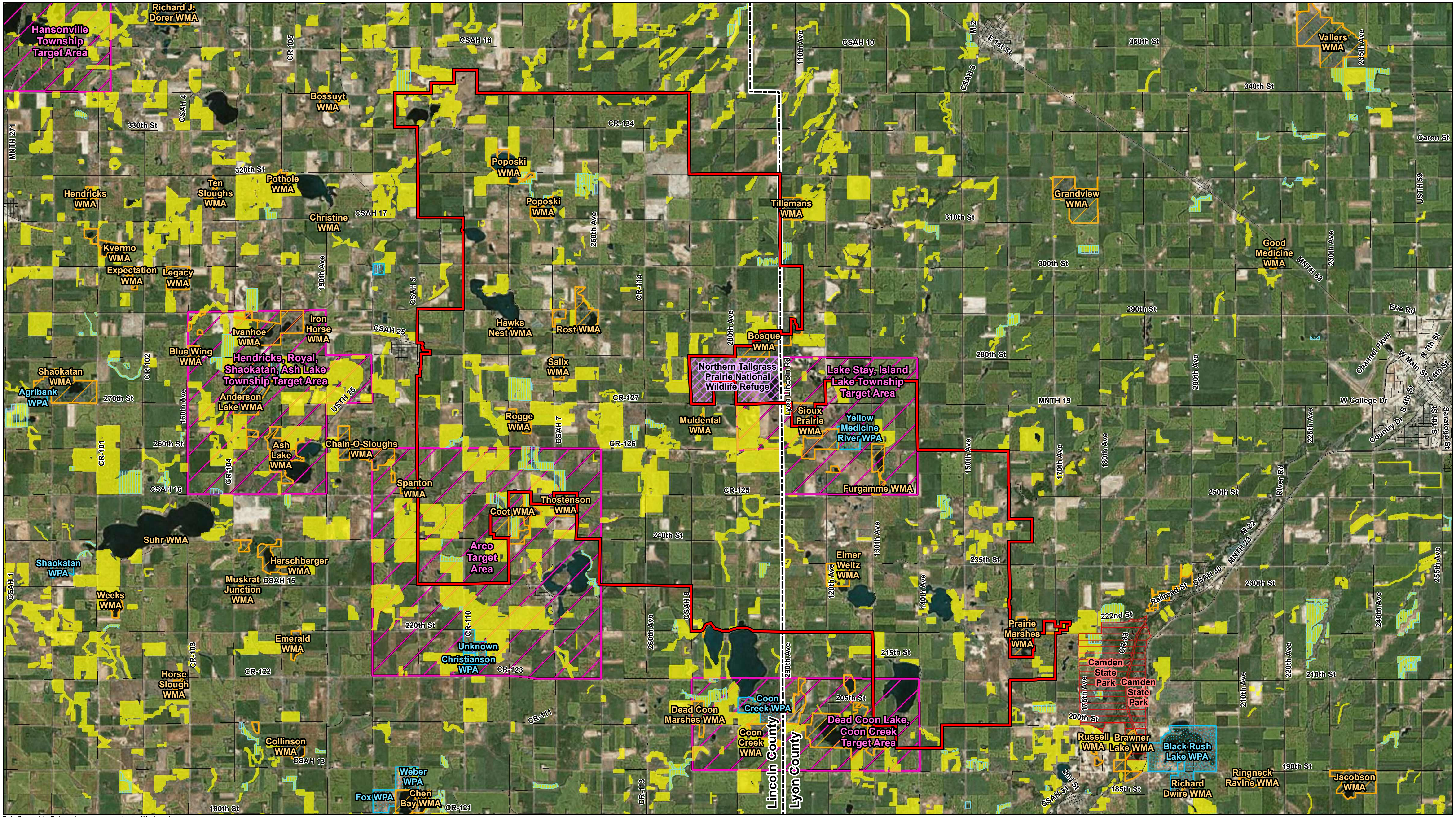
Red Pine Wind Project

Lincoln & Lyon Counties, Minnesota

Biological Resources & Sensitive Habitat

EXHIBIT 5

Map Document: P:\0006243.00\GIS\SCS_Maps\RP_BiologicalResources_SCS_Ex5_160208.mxd 2/29/2016 11:38:22 AM



Data Source(s): Data and map are approximate. Westwood (2016); U.S. Fish and Wildlife Service (2013); Geospatial Data Gateway (various dates); Minnesota NAIP Imagery (accessed 2016); ESRI (2012); MnDOT (various dates); MnDNR (various dates); NCED and partners (2014); USGS, GAP Stewardship (2008).

Westwood

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Legend

- Project Boundary
- Road
- County Boundary
- National Conservation Easement
- Wildlife Management Area
- Scientific & Natural Area
- Waterfowl Production Area
- National Wildlife Refuge
- State Park
- Reinvest in MN Area
- CRP Land
- Working Land Initiative Target Areas
- Federal Land
- State Land
- Native American Land
- Local Land
- Private Conservation Land

N

0 2 Miles

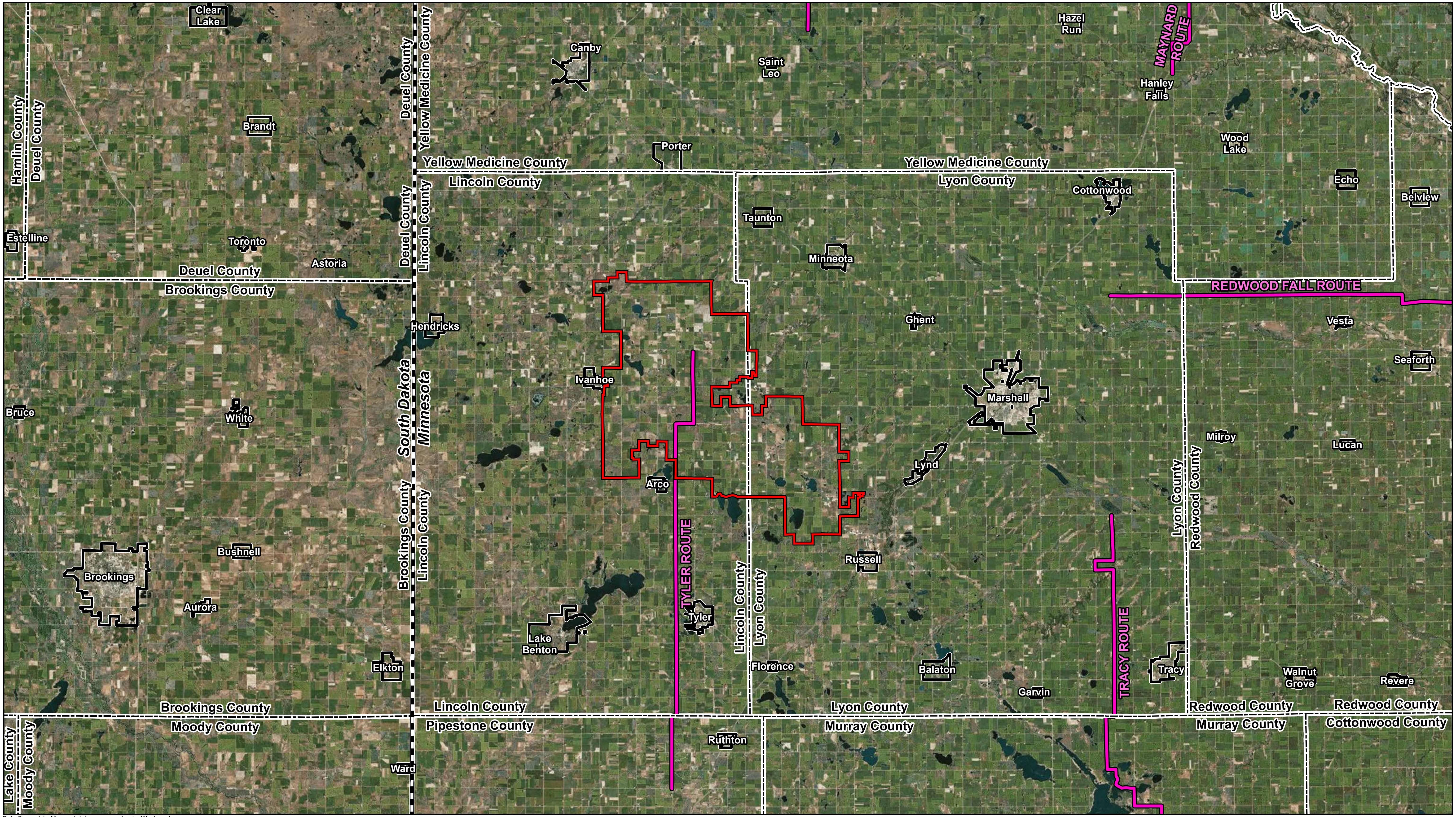
Red Pine Wind Project

Lincoln & Lyon Counties, Minnesota

Public & Private Conservation Lands

EXHIBIT 6

Map Document: P:\0006243.00\GIS\SCS_Maps\RP_PublicConservationLands_SCS_Ex6_160208.mxd 2/29/2016 11:14:57 AM



Data Source(s): Map and data are approximate. Westwood (2016); Geospatial Data Gateway (various dates); Minnesota NAIP Imagery (accessed 2016); ESRI (2012); MnDOT (various dates); Biological Resources Division and Canadian Wildlife Service (2010).

Legend

- Project Boundary
- Municipal Boundary
- County Boundary
- State Boundary
- North American Breeding Bird Survey Route (BBS)

N

0 5 Miles

Red Pine Wind Project

Lincoln & Lyon Counties, Minnesota

BBS Routes

EXHIBIT 7

Westwood

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Map Document: P:\0006243.00\GIS\SCS_Maps\RP_BBCSurveyRoutes_SCS_Ex7_160208.mxd 2/10/2016 8:13:35 PM

Westwood

Appendix A

BBS Routes Species Lists and USFWS Birds of Conservation Concern

Red Pine Wind Farm

Lincoln and Lyon Counties, Minnesota

Family	Subfamily	Genus	Species	Common Name	BBS Route Name			Christmas Bir d Count		State Listed Species	Federally Listed Species	BCC
					Tracy	Tyler	Redwood Falls	Cottonwood	Marshall			
Accipitridae												
		Accipiter	cooperii	Cooper's hawk				x				
		Accipiter	gentilis	northern goshawk				x	x	sc		
		Accipiter	striatus	sharp shinned Hawk				x				
		Aquila	chrysaetos	golden eagle				x	x			
		Buteo	lagopus	rough-legged hawk				x	x			
		Buteo	jamaicensus	red-tailed hawk	x	x	x	x	x			
		Buteo	platypterus	broad-winged hawk	x							
		Buteo	regalis	ferruginous hawk				x				
		Buteo	swainsoni	Swainson's hawk			x					x
		Circus	cyaneus	northern harrier	x	x	x	x	x			
		Haliaeetus	leucocephalus	bald eagle		x		x	x			x
Cathartidae												
		Cathartes	aura	turkey vulture	x	x	x					
Anatidae												
	Anatinae											
		Aix	sponsa	wood duck	x	x	x	x	x			
		Anas	acuta	northern pintail		x	x					
		Anas	clypeata	northern shoveler	x	x						
		Anas	crecca	green-winged teal					x			

		Anas	discors	blue-winged teal	x	x	x					
		Anas	strepera	gadwall	x		x					
		Anas	Platyrhynchos	mallard	x	x	x	x				
		Anas	rubripes	American black duck					x			
		Aythya	americana	redhead		x	x					
		Aythya	valisineria	canvasback			x					
		Mergus	merganser	common merganser					x			
	Anserinae											
		Anser	albifrons	greater white-fronted goose				x				
		Branta	canadensis	Canada goose	x	x	x	x	x			
		Branta	hutchinsii	cackling goose				x				
		Chen	caerulescens	snow goose				x	x			
		Cygnus	columbianus	tundra swan					x			
Apodidae												
	Chaeturinae											
		Chaetura	pelagica	chimney swift	x		x					
Caprimulgidae												
	Chordeilinae											
		Chordeiles	minor	common nighthawk		x						
Charadriidae												
	Charadriinae											
		Charadrius	vociferus	killdeer	x	x	x					
Laridae												
	Larinae											
		Larus	argentatus	herring gull		x		x				

		Leucophaeus	pipixcan	Franklin's gull		x				sc		
	Sterninae											
		Chlidonias	niger	black tern		x	x					x
		Sterna	forsteri	Forster's tern		x	x			sc		
Scolopacidae												
	Scolopacinae											
		Actitis	macularius	spotted sandpiper			x					
		Bartramia	longicauda	upland sandpiper	x	x	x					x
		Caladris	melanotos	pectoral sandpiper				x				
		Gallinago	delicata	Wilson's snipe	x		x					
		Tringa	semipalmata	Willet			x					
Columbidae												
		Streptopelia	decaocto	Eurasian collared-dove		x		x	x			
		Zenaida	macroura	mourning dove	x	x	x	x	x			
		Columba	livia	rock pigeon	x	x	x	x	x			
Alcedinidae												
	Cerylinae											
		Megaceryle	alcyon	belted kingfisher		x	x		x			
Cuculidae												
	Cuculinae											
		Coccyzus	erythropthalmus	black-billed cuckoo		x	x					x
		Coccyzus	americanus	yellow-billed cuckoo		x	x					

Falconidae												
	Falconinae											
		Falco	columbarius	merlin				x	x			
		Falco	mexicanus	prairie falcon				x				
		Falco	sparverius	American kestrel	x	x	x	x	x			
Phasianidae												
	Meleagridinae											
		Meleagris	gallopavo	wild turkey	x	x	x	x	x			
	Phasianinae											
		Perdix	perdix	gray partridge	x	x	x	x	x			
		Phasianus	colchicus	ring-necked pheasant	x	x	x	x	x			
Rallidae												
		Fulica	americana	American coot	x	x	x					
		Porzana	carolina	sora	x		x					
Alaudidae												
		Eremophila	alpestris	horned lark	x		x	x	x			
Bombycillidae												
		Bombycilla	cedrorum	cedar waxwing	x			x				
		Bombycilla	garrulus	bohemian waxwing				x	x			
Calcariidae												
		Calcarius	lapponicus	lapland longspur				x				
		Plectrophenax	nivalis	snow bunting				x	x			
Cardinalidae												
		Cardinalis	cardinalis	northern cardinal	x		x	x	x			

	Passerculus	sandwichensis	savannah sparrow	x		x					
	Passerina	cyanea	indigo bunting	x		x					
	Pheucticus	ludovicianus	rose-breasted grosbeak	x	x	x					
	Piranga	olivacea	scarlet tanager			x					
	Spiza	americana	dickcissel	x	x	x					x
Corvidae											
	Corvus	brachyrhynchos	American crow	x	x	x	x	x			
	Cyanocitta	cristata	blue jay	x	x	x	x	x			
	Perisoreus	canadensis	gray jay					x			
	Pica	hudsonia					x				
Emberizidae											
	Ammodramus	savannarum	grasshopper sparrow	x		x					x
	Chondestes	grammacus	lark sparrow	x	x				SC		
	Melospiza	georgiana	swamp sparrow	x	x		x	x			
	Junco	hyemalis	dark-eyed junco				x	x			
	Melospiza	lincolnii	Lincoln's sparrow				x				
	Melospiza	melodia	song sparrow	x	x	x	x	x			
	Passerella	iliaca	fox sparrow				x				
	Pipilo	erythropthalmus	eastern towhee			x	x				
	Pipilo	maculatus	spotted towhee				x	x			
	Pooecetes	gramineus	vesper sparrow	x	x	x	x				
	Spizella	pallida	clay-colored sparrow	x	x	x	x				
	Spizella	passerina	chipping sparrow	x	x	x	x				
	Spizella	pusilla	field sparrow	x	x	x					

		Spizelloides	arborea	American tree sparrow				x	x			
		Zonotrichia	albicollis	white-throated sparrow				x	x			
		Zonotrichia	leucophrys	white-crowned sparrow				x	x			
		Zonotrichia	querula	Harris's sparrow				x	x			
Fringilidae												
	Carduelinae											
		Acanthis	flammea	common redpoll					x			
		Acanthis	hornemanni	hoary redpoll				x	x			
		Coccuthraustes	vespertinus	evening grosbeak				x	x			
		Haemorhous	mexicanus	house finch	x		x	x	x			
		Haemorhous	purpureus	purple finch				x	x			
		Loxia	curvirostra	red crossbill				x	x			
		Loxia	leucoptera	white-winged crossbill				x	x			
		Pinocola	enucleator	pine grosbeak				x				
		Spinus	pinus	pine siskin				x	x			
		Spinus	tristis	American goldfinch	x	x	x	x	x			
Hirundinidae												
	Hirundininae											
		Hirundo	rustica	barn swallow	x	x	x					
		Petrochelidon	pyrrhonota	cliff swallow	x	x	x					
		Progne	subis	purple martin	x	x	x			sc		
		Riparia	riparia	bank swallow	x	x	x					

	Stegidopteryx	serripennis	northern rough-winged swallow	x	x	x					
	Tachycineta	bicolor	tree swallow	x	x	x					
Icteridae											
	Agelaius	assimilis	red-winged blackbird	x	x	x	x	x			
	Dolichonyx	oryzivorus	bobolink	x	x	x					
	Euphagus	carolinus	rusty blackbird				x	x			
	Euphagus	cyanocephalus	brewer's blackbird		x	x	x				
	Icterus	galbula	Baltimore oriole	x	x	x					
	Icterus	spurius	orchard oriole	x		x					
	Molothrus	ater	brown-headed cowbird	x	x	x	x				
	Quiscalus	quiscula	common grackle	x	x	x	x	x			
	Sturnella	magna	eastern meadowlark			x					
	Sturnella	neglecta	western meadowlark	x	x	x	x	x			
	Xanthocephalus	xanthocephalus	yellow-headed blackbird	x	x	x	x	x			
Laniidae											
	Lanius	excubitor	northern shrike				x	x			
	Lanius	ludovicianus	loggerhead shrike					x	END		
Mimidae											
	Dumetella	carolinesis	gray catbird	x	x	x					
	Mimus	polyglottos	northern mockingbird				x				
	Toxostoma	rufum	brown thrasher	x	x	x	x	x			

Paridae												
		Poecile	atricapillus	black-capped chickadee	x		x	x	x			
Parulidae												
		Geothlypis	trichas	common yellowthroat	x	x	x					
		Seiurus	aurocapilla	ovenbird		x						
		Setophaga	coronata	yellow-rumped warbler				x	x			
		Setophaga	petechia	yellow warbler	x	x	x					
		Setophaga	ruticilla	American redstart			x					
Passeridae												
		Passer	domesticus	house sparrow	x	x	x	x	x			
Regulidae												
		Regulus	calendula	ruby-crowned kinglet					x			
		Regulus	satrapa	golden-crowned kinglet				x	x			
Sittidae												
	Sittinae											
		Sitta	canadensis	red-breasted nuthatch					x			
		Sitta	carolinesis	white-breasted nuthatch	x		x	x	x			
Sturnidae												
		Sturnus	vulgaris	European starling	x	x	x	x	x			
Turdidae												
		Myadestes	townsendi	Townsend's solitaire					x			
		Turdus	migratorius	American robin	x	x	x	x	x			

		Sialia	sialis	eastern bluebird	x	x	x	x				
Troglodytidae												
		Cistothorus	palustris	marsh wren	x	x						
		Cistothorus	platensis	sedge wren	x		x					
		Troglodytes	aedon	house wren	x	x	x					
Tyrannidae												
	Fluvicolinae											
		Contopus	virens	eastern wood-pewee	x		x					
		Empidonax	alnorum	alder flycatcher			x					
		Empidonax	minimus	least flycatcher	x		x					
		Empidonax	traillii	willow flycatcher	x	x	x					
		Sayornis	phoebe	eastern phoebe	x		x					
	Tyranninae											
		Myiarchus	crinitus	great crested flycatcher	x	x	x					
		Tyrannus	tyrannus	eastern kingbird	x	x	x					
		Tyrannus	verticalis	western kingbird		x	x					
Vireonidae												
		Vireo	flavifrons	Yellow-throated vireo			x					
		Vireo	gilvus	warbling vireo	x	x	x					
		Vireo	olivaceous	red-eyed vireo	x		x					
Ardeidae												
		Ardea	alba	great egret	x	x						
		Ardea	cinerea	great blue heron	x	x	x	x	x			

		Botaurus	lentignosus	American bittern	x	x	x					x
		Butorides	virescens	green heron			x					
Pelecanidae												
		Pelecanus	erythrorhynchos	American white pelican	x	x	x			sc		
Picidae												
	Picinae											
		Colaptes	auratus	northern flicker	x	x	x	x	x			
		Dryocopus	pileatus	pileated woodpecker					x			
		Melanerpes	carolinus	red-bellied woodpecker	x		x	x	x			
		Melanerpes	erythrocephalus	red-headed woodpecker	x	x	x	x	x			x
		Picoides	pubescens	downy woodpecker	x		x	x	x			
		Picoides	villosus	hairy woodpecker	x		x	x	x			
		Sphyrapicus	varius	yellow-bellied sapsucker					x			
Podicididae												
		Podilymbus	podiceps	pied-billed grebe	x	x	x					
Strigidae												
		Aegolius	acadicus	norther saw-whet owl				x				
		Asio	flammeus	short-eared owl				x	x	sc		x
		Asio	otus	long-eared owl				x				
		Bubo	scandiacus	snowy owl				x	x			
		Bubo	virginianus	great horned owl		x	x	x	x			

	Megascops	asio	eastern-screech owl				x	x			
	Strix	varia					x	x			
Phalacrocoracidae											
	Phalacrocorax	penicillatus	double-crested cormorant	x	x	x					

Appendix I

Wildlife Studies

Red Pine Wind Project
Lincoln County, Minnesota

1) Bat Activity Studies, April – October 2013,
2) Raptor Nest Survey Memo -2013,
3) Breeding Bird Transect Studies, June-July 2013,
4) Avian Use Surveys, March 2013 to March 2014,
5) Landcover/Habitat Mapping Memo – 2014,
6) Raptor Nest Survey and Eagle Nest Monitoring, July 2015,
7) Northern Long-Eared Bat Presence/Absence Surveys, October 2015, and
8) Eagle Nest Survey Report - 2016

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Bat Activity Studies for the Red Pine Wind Project in Lincoln and Lyon Counties, Minnesota

April 22 – October 17, 2013

Prepared for:

Red Pine Wind Project, LLC

3760 State Street, Suite 200
Santa Barbara, California 93105

Prepared by:

Clayton Derby, Goniela Iskali, and Ann Dahl

Western EcoSystems Technology, Inc.
4007 State Street, Suite 109
Bismarck, North Dakota 58503

February 17, 2014

EXECUTIVE SUMMARY

In April 2013, Western EcoSystems Technology, Inc. (WEST) initiated a bat acoustic survey for the proposed Red Pine Wind Project (RPWP) in Lincoln and Lyon Counties, Minnesota. The bat acoustic survey conducted from April 22 through October 17, 2013 was designed to estimate levels of bat activity within the RPWP during spring, summer, and fall.

Six AnaBat® SD2 detectors were used during the acoustic bat surveys: five were placed at four meteorological (met) tower stations located in pastures and fields, and one was placed at a bat feature station near an ephemeral pond and forested area that was likely to provide habitat for roosting and foraging resident as well as migrant bats. Two detectors were paired at one of the met towers, where one detector was placed near the ground and one was raised within the rotor-swept height of 45 meters (148 feet). Stations were visited to recover data and check equipment on a weekly or bi-monthly basis.

The AnaBat detectors placed at met towers (four ground and one raised) recorded 3,279 bat passes during 757 detector-nights. Ground met tower detectors recorded an average bat pass rate of 4.91 ± 0.41 bat passes per detector-night, and the raised detector recorded 2.93 ± 0.42 bat passes per detector-night. The AnaBat detector placed at the bat feature station recorded 2,292 bat passes during 144 detector-nights for an average bat pass rate of 15.92 ± 1.62.

Bat activity at all stations varied between seasons. At the met tower stations, bat activity was low in the spring and higher in the summer and fall. Higher activity during the late summer and early fall may be due to the presence of both post-lactating adult female bats and newly volant juvenile bats. Bat activity was consistently higher at the bat feature station, and seasonal variation followed a different trend than at the met tower stations. At this station, bat activity was slightly higher in the spring and summer and lower in the fall. The feature station was located in an ephemeral pond, which decreased in water quantity through the season and therefore may have led to a decrease in bat activity.

At met tower stations, 84.7% of bat passes were classified as low-frequency (e.g., big brown bats, hoary bats, and silver-haired bats), and the remaining bat passes were classified as high-frequency (e.g., eastern red bats and most *Myotis* species). At the bat feature station, 61.21% of bat passes were classified as low-frequency and the remaining as high-frequency. Low-frequency bats had higher activity at all stations throughout each season with one exception: high-frequency bat activity was higher during the fall at the bat feature station.

Bat activity recorded at the RPWP by ground met tower detectors during the fall migration period (7.43 ± 0.89 bat passes per detector-night) was higher when compared to the bat activity at some facilities in the Midwest, but lower when compared to all the North American facilities with similarly-collected data, especially those recorded in the Northeastern US. Siting turbines away from wetland and forested areas may minimize the potential risk to wildlife.

STUDY PARTICIPANTS

Western EcoSystems Technology

Clayton Derby	Project Manager
Goniela Iskali	Bat Biologist and Report Compiler
Kimberly Bay	Data and Report Manager
Ann Dahl	GIS Technician
Elizabeth Baumgartner	Technical Editor
Lauren Michelsen	Field Technician

REPORT REFERENCE

Derby, C., G. Iskali, and A. Dahl. 2014. Bat Activity Studies for the Red Pine Wind Project in Lincoln and Lyon Counties, Minnesota. Final Report: April 22 – October 17, 2013. Prepared for Red Pine Wind, LLC, Santa Barbara, California. Prepared by Western EcoSystems Technology, Inc., Bismarck, North Dakota.

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INTRODUCTION

Red Pine Wind, LLC (Red Pine) is considering the development of a wind energy facility in the Red Pine Wind Project (RPWP) in Lincoln and Lyon Counties, Minnesota. Red Pine contracted Western EcoSystems Technology, Inc. (WEST) to complete a study of bat activity following the recommendations of the US Fish and Wildlife Service's (USFWS) Land-based Wind Energy Guidelines (USFWS 2012) based on methods outlined in Kunz et al. (2007a) and as discussed and agreed upon with the Minnesota Department of Natural Resources (MNDNR). WEST conducted acoustic monitoring surveys to estimate levels of bat activity within the RPWP during spring, summer, and fall. The following report describes the results of acoustic monitoring surveys conducted at the RPWP between April 22 and October 17, 2013.

STUDY AREA

The proposed 38,826.9 acre (ac; 15,712.7 hectares [ha]) RPWP is located in eastern Lincoln and western Lyons Counties, Minnesota, approximately 2.5 kilometers (1.6 miles [mi]) east of the town of Wilno, Minnesota (Figure 1). The RPWP has flat to rolling topography and is located on a slight ridge. Elevation of the study area ranges from 421 to 516 meters (m; 1,381 to 1,693 feet [ft]) above mean sea level.

The RPWP contains areas of cultivated agriculture, grasslands, wetlands and lakes, developed areas and rural homes, and small wooded areas (Figure 2). The majority of the study area, approximately 74%, of the facility is cultivated agriculture (Table 1). Of the cultivated crops, corn (*Zea mays*) and soybeans (*Glycine max*) have been the most common crop type (US Department of Agriculture [USDA] National Agricultural Statistics Survey [NASS] 2012). According to the USFWS National Wetlands Inventory (NWI), about 4% of the facility is wetlands; about 74% of those wetlands are freshwater emergent wetlands and about 20% are lakes (USFWS NWI 2007). The RPWP also contains approximately 488 ac (197.5 ha; about 1.3% of entire project area) of trees and shrubs. Both deciduous forest and wetlands provide potential habitat for several bat species.

Three named creeks and rivers are located in the RPWP. Coon Creek briefly loops into the southern portion of the RPWP. The South Branch of the Yellow Medicine River flows west to east through the center of the project area. Three-mile Creek is located in the southern portion of the RPWP and also flows from west to east. Several other unnamed drainages are located throughout the study area.

Ownership within the project area is largely private, but numerous protected areas are located in the RPWP (US Geological Survey [USGS] 2012). The USFWS Lyon County Waterfowl Production Area is located in the southern portion of the RPWP. There are several USDA Farm Service Agency Conservation Reserve Enhancement Program easements located throughout the RPWP. Several Minnesota Department of Natural Resources (MDNR) Wildlife Management

Areas are also present throughout the project area. Camden State Park is about four mi (6.4 km) southeast of the RPWP.

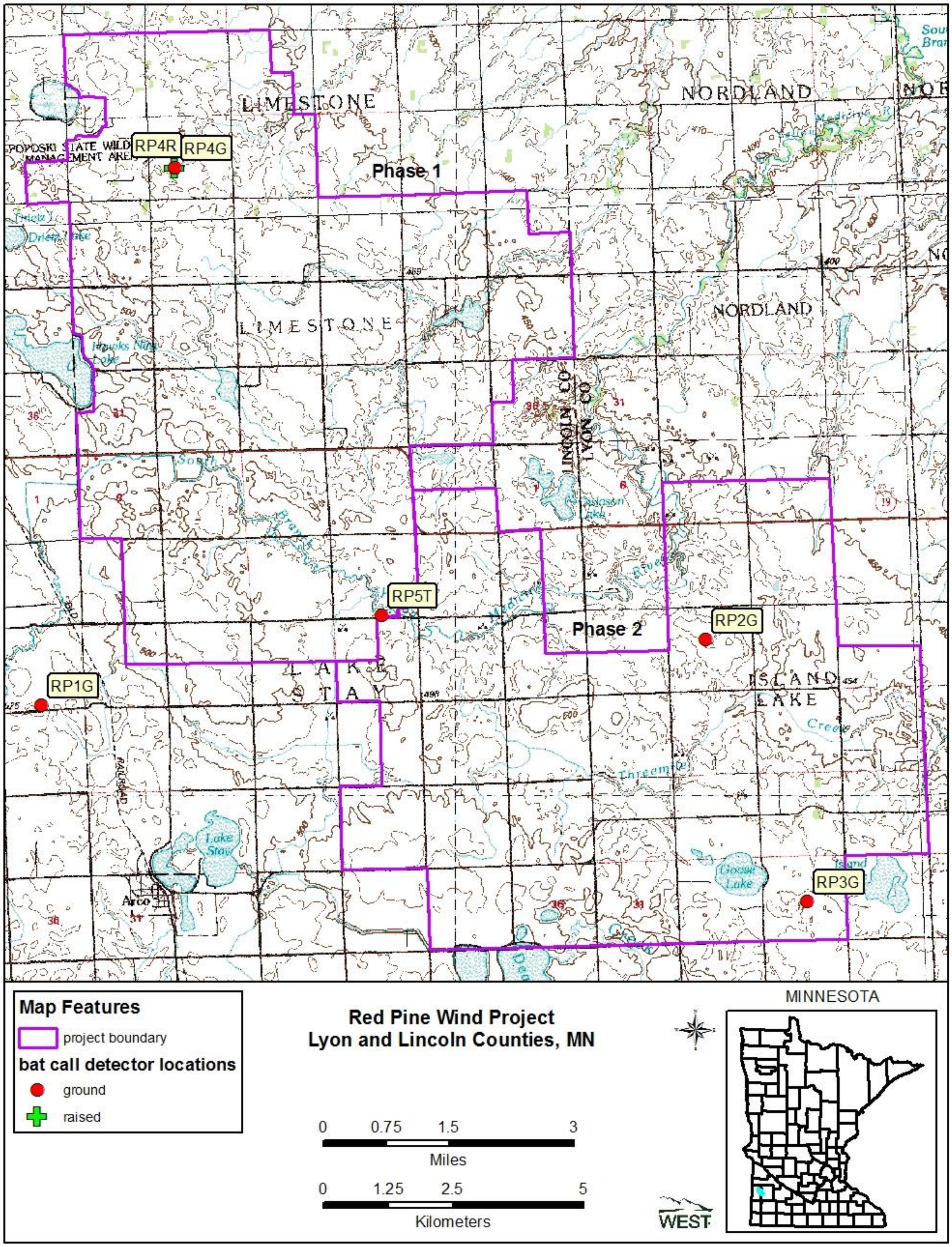


Figure 1. Topographic map showing the location of the Red Pine Wind Project and bat call detector locations.

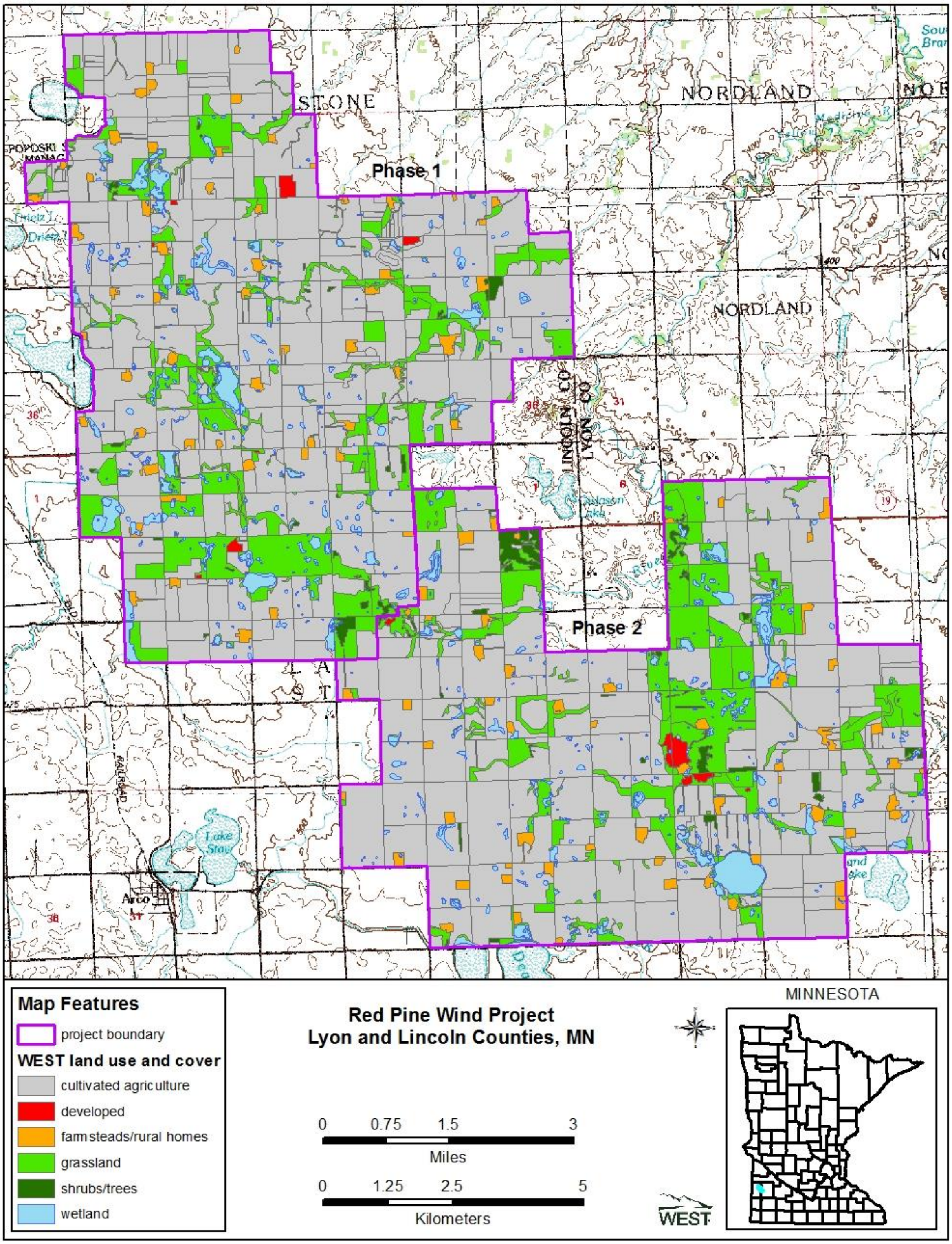


Figure 2. Land use and cover in the Red Pine Wind Project as mapped by WEST in 2013.

Table 1. Land use and cover in the Red Pine Wind Project mapped by WEST in 2013.

Land Use and Cover	Acres	% Composition
cultivated agriculture	28,886.65	74.5
grassland	6,518.62	16.8
wetland	1,689.54	4.4
farmsteads/rural homes	1,054.42	2.7
shrubs/trees	487.83	1.3
developed	146.14	0.4
Total	**38,783.19**	**100**

Overview of Bat Diversity

Seven bat species are found in Minnesota and may occur within the RPWP (Harvey at el. 1999, BCI 2003; Table 2). One of these, the northern long-eared bat (*Myotis septentrionalis*), was recently proposed to be listed as endangered by the USFWS (2013). The northern long-eared bat is experiencing population declines due to the spread of white-nose syndrome (Frick et al. 2010; Center for Biological Diversity [CBD] 2010). The northern long-eared bat uses caves and underground mines for hibernation. During the summer, it relies upon forested habitat and it roosts in tree cavities and underneath exfoliating bark (BCI 2013). There RPWP occurs within a karst region, but no caves or mines have been identified within the project boundaries or nearby (USGS 2013). The majority of caves in Minnesota occur in the far southeastern part of the state, including Fillmore and Olmsted counties; however, caves also occur in the south-central portion of Minnesota (e.g., Mankato region) and the Twin Cities metropolitan area (Hogberg and Bayed 1967).

Table 2. Bat species with potential to occur within the Red Pine Wind Project (Harvey et al. 1999; Bat Conservation International [BCI] 2003) categorized by echolocation call frequency.

Common Name	Scientific Name
High-Frequency (> 30 kHz)	
eastern red bat[1,3]	*Lasiurus borealis*
little brown bat[1]	*Myotis lucifugus*
northern long-eared bat[1,2]	*Myotis septentrionalis*
tri-colored bat[1]	*Perimyotis subflavus*
Low-Frequency (< 30 kHz)	
big brown bat[1]	*Eptesicus fuscus*
hoary bat[1,3]	*Lasiurus cinereus*
silver-haired bat[1,3]	*Lasionycteris noctivagans*

[1] species known to have been killed at wind energy facilities (Species reported in Anderson et al. 2004, Kunz et al. 2007b, Baerwald 2008);
[2] proposed for listing as a federally endangered species (USFWS 2013); and
[3] long-distance migrant.

METHODS

Bat Acoustic Surveys

WEST conducted acoustic monitoring studies in 2013 to estimate levels of bat activity throughout the RPWP during spring, summer, and fall. Bat call detectors are a primary acoustic survey tool used in pre-construction wind development surveys to calculate an index of bat activity; the levels of bat activity provide some insight into possible impacts of development on bats (Arnett 2007, Kunz et al. 2007a).

Survey Stations

Six AnaBat™ SD2 ultrasonic bat detectors (Titley Scientific™, Australia) were used during the study. Five of the detectors were placed at four meteorological (met) towers that were located in land cover similar to where turbines could be sited. In addition, met towers provide a substrate on which to raise detectors to sample bat activity at heights within the rotor swept area. Species activity levels and composition can vary with altitude (Baerwald and Barclay 2009; Collins and Jones 2009), so it is important to monitor at different heights (Kunz et al. 2007b). Ground-based detectors likely detect a more complete sample of the bat species present within the project area, whereas elevated detectors may give a more accurate assessment of risk to bat species flying at rotor-swept heights (Kunz et al. 2007b). Two detectors were placed at one of the met towers, where a detector at ground level (approximately one m [3.3 ft]) was paired with another that recorded calls within the rotor-swept heights (approximately 45 m [148 ft]; Figure 3). The sixth AnaBat detector was placed at a bat feature station to collect data in a location that has habitat characteristics that are attractive to bats (e.g., forested areas, pond, or streams; Figure 3). An experienced bat biologist selected the location of the RPWP bat feature station, which was placed at an ephemeral pond surrounded by a shelterbelt of trees.

Each AnaBat detector was placed inside a plastic weather-resistant container that had a hole cut in the side through which the microphone extended. Each microphone was encased in a 45-degree angle poly-vinyl chloride (PVC) tube, and holes were drilled in the PVC tube to allow water to drain. At the raised AnaBat station, the microphone was elevated on the met tower using a pulley system, and a modified Bat-Hat was used to protect the microphone from weather. The Bat-Hat weatherproof housing (EME Systems, Berkeley California) was modified by replacing the Plexiglas reflector plate with a 45-degree angle PVC elbow. The Bat-Hat was altered because detectors protected using un-modified Bat-Hats may detect lower activity and species richness than detectors exposed to the environment (Britzke et al. 2010).

Survey Schedule

Bats were surveyed at the RPWP from April 22 to October 17, 2013. AnaBat detectors were programmed to turn on approximately 30 minutes (min) before sunset and turn off approximately 30 min after sunrise each night.

Data Collection and Call Analysis

AnaBat detectors use a broadband high-frequency microphone to detect the echolocation calls of bats. Incoming echolocation calls are digitally processed and stored by the detector on a high capacity compact flash card. The resulting files can be viewed in appropriate software (i.e., Analook©) as digital sonograms that show changes in echolocation call frequency over time. Frequency versus time displays were used to separate bat calls from other types of ultrasonic noise (e.g., wind, insects, etc.) and to identify the call frequency classification and (when possible) the species of bat that generated the calls.

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 atmospheric absorption of echolocation pulses (Fenton 1991). To standardize acoustic sampling effort across the project area, AnaBat detectors were calibrated and sensitivity levels were set to six (Larson and Hayes 2000), a level that balanced the goal of recording bat calls against the need to reduce interference from other sources of ultrasonic noise (Brooks and Ford 2005).

For each survey location, bat passes were sorted by their minimum frequency into two groups that correspond roughly to species groups of interest: high-frequency (HF) and low-frequency (LF). For example, most species of *Myotis* bats, tricolored bats (*Perimyotis subflavus*) and eastern red bats (*Lasiurus borealis*) echolocate at frequencies greater than 30 kHz (HF), whereas species such as the big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), and hoary bat (*Lasiurus cinereus*) typically emit echolocation calls below 30 kHz (LF). To establish which species may have produced passes in each category, a list of species expected to occur in the study area was compiled from range maps (Table 2; Harvey et al. 1999, BCI 2013).

Statistical Analysis

The standard metric used for measuring bat activity was the number of bat passes per detector-night. A bat pass was defined as a sequence of at least two echolocation calls (pulses) produced by an individual bat with no pause between calls of more than one second (White and Gehrt 2001, Gannon et al. 2003). A detector-night was defined as one detector operating for one entire night. The terms bat pass and bat call are used interchangeably in this report. Bat passes per detector-night was calculated for all bats, and for HF and LF categories. Bat pass rates represent indices of bat activity and do not represent numbers of individuals. The number of bat passes was determined by an experienced bat acoustic analyst using Analook. All multi-detector averages in this report were calculated as an un-weighted average of total activity at each detector.

The period of peak sustained bat activity was defined as the seven-day period with the highest average bat activity. If multiple seven-day periods equaled the peak sustained bat activity rate, all dates in these seven-day periods were reported.

To highlight seasonal activity patterns, the study was divided into three survey periods: spring (April 22 – May 31), summer (June 1 – July 31), and fall (August 1 – October 17). Mean bat activity was also calculated for a standardized fall migration period (FMP), defined by WEST biologists as July 30 – October 14, which represents the period between dissolution of maternity colonies and onset of the swarming and hibernation seasons. This period was used to provide a standard for comparison with activity from other wind energy facilities. During this time, bats begin moving toward wintering areas, and many species of bats initiate reproductive behaviors (Cryan 2008). This period of increased landscape-scale movement and reproductive behavior is often associated with increased levels of bat fatalities at operational wind energy facilities (Arnett et al. 2008).

Risk Assessment

To assess potential for bat fatalities, bat activity in the RPWP was compared to existing data at other wind energy facilities in the Midwest. Among studies measuring both activity and fatality rates, most included data collected during the fall using AnaBat detectors placed near the ground near met towers. Therefore, to make valid comparisons to the publically available data, this report uses the activity rate recorded at met tower ground detectors during the FMP as a standard for comparison with activity data from other wind energy facilities. Given the relatively small number of publically-available studies and the ecological differences between geographically dispersed facilities, the risk assessment is qualitative, rather than quantitative.

RESULTS

Bat Acoustic Surveys

Bat activity was monitored at the five sampling locations using six AnaBat detectors for a total of 901 detector-nights between April 22 and October 17, 2013. AnaBat detectors were operating for 89.6% of the sampling period (Figure 3). The primary cause of lost data was weather-related station damage and loss of battery power. During the first week of surveys, excessive noise was recorded due to precipitation and high wind, but noise levels remained relatively low throughout the remainder of the survey period (Figure 4). AnaBat detectors at met tower ground stations recorded 2,814 bat passes on 598 detector-nights for a mean (± standard error) of 4.91 ± 0.41 bat passes per detector-night, while the raised station recorded 466 bat passes on 159 detector-nights (2.93 ± 0.42 passes per detector-night). The AnaBat detector at the bat feature station recorded 2,292 bat passes in 144 detector-nights for a mean of 15.92 ± 1.62 bat passes per detector-night (Table 3).

Table 3. Results of acoustic bat surveys conducted at met tower and bat feature stations within the Red Pine Wind Project from April 22 to October 17, 2013. Passes are sorted into high-frequency (HF) and low-frequency (LF) categories.

Anabat Station	Location	Type	# of HF Bat Passes	# of LF Bat Passes	Total Bat Passes	Detector-Nights	Bat Passes/ Night*
RP1g	ground	met tower	104	303	407	162	2.51±0.32
RP2g	ground	met tower	123	985	1,108	164	6.76±0.75
RP3g	ground	met tower	97	602	699	102	6.84±0.95
RP4g	ground	met tower	126	474	600	170	3.53±0.33

Met Tower Ground Stations	**450**	**2,364**	**2,814**	**598**	**4.91±0.41**
RP4r raised met tower	54	412	466	159	2.93±0.38
Total Met Tower Stations	**504**	**2,776**	**3,280**	**757**	**4.51±0.35**
Bat Feature Station (RP5t)	**889**	**1,403**	**2,292**	**144**	**15.92±1.62**
Total – All Stations	**1,393**	**4,179**	**5,572**	**901**	**6.41±0.38**

[*] ± bootstrapped standard error.

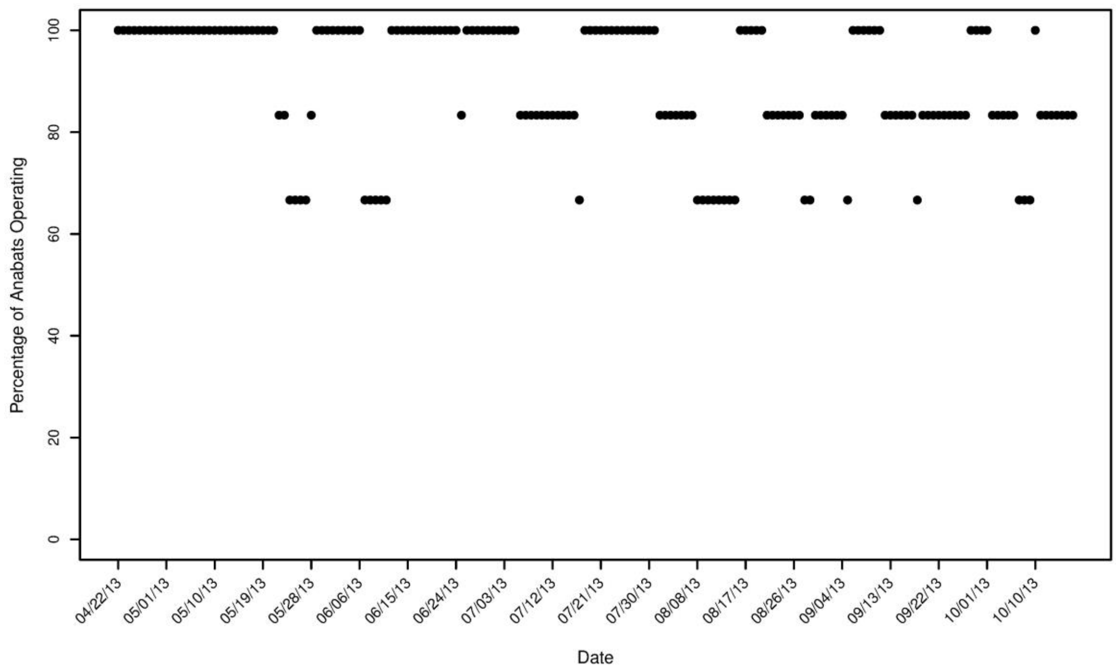


Figure 3. Operational status of AnaBat detectors at the Red Pine Wind Project during each night of the study period from April 22 to October 17, 2013.

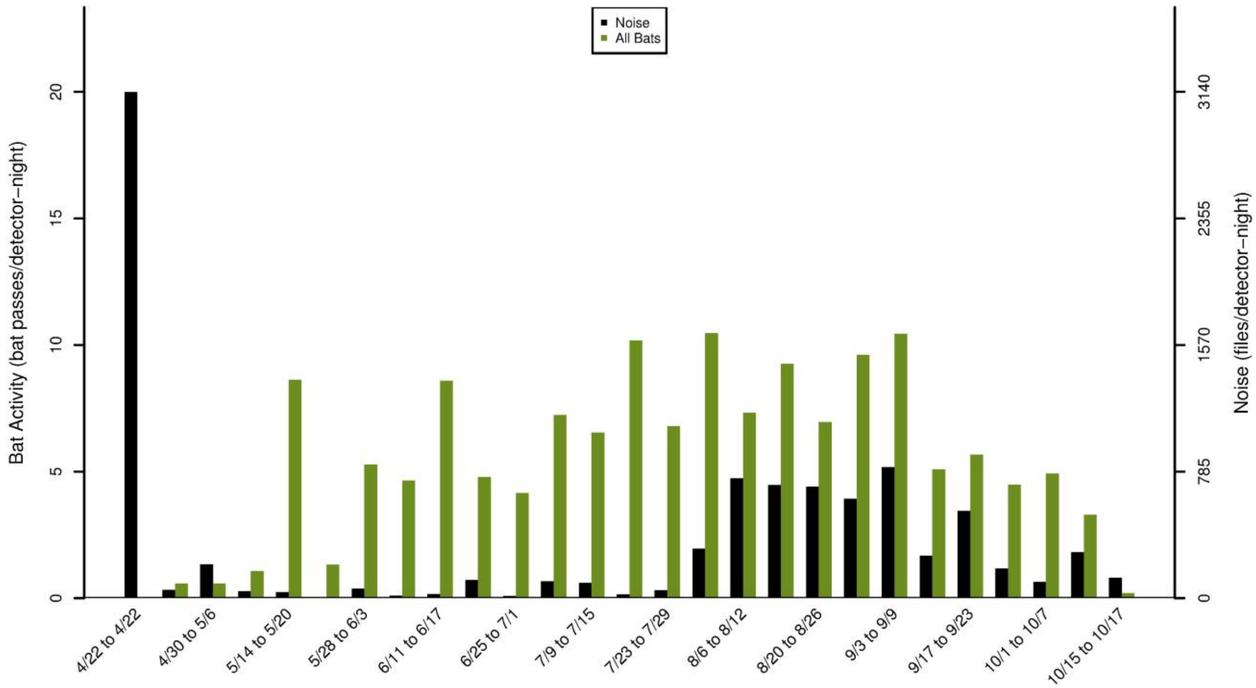


Figure 4. Activity and noise comparison at met tower AnaBat stations for all bats in the Red Pine Wind Project from April 22 to October 17, 2013.

Spatial Variation

On average, bat activity at met tower ground detectors was higher than at the raised detector; however, two ground met tower stations (RP1g and RP4g) recorded similar activity levels as the raised station (Table 3, Figure 5). The two remaining ground met tower stations (RP2g and RP3g) recorded bat activity more than twice as high as the other met stations, whether on the ground or raised. Activity measured at the ground and raised stations were similar, with only slightly higher call rates at the ground station (Figure 5 and 6). Activity at the bat feature station (RP5t) was about twice as high as bat activity recorded at met tower stations RP2g and RP3g and about three times higher than the average bat activity at all met tower stations (Table 3, Figure 5).

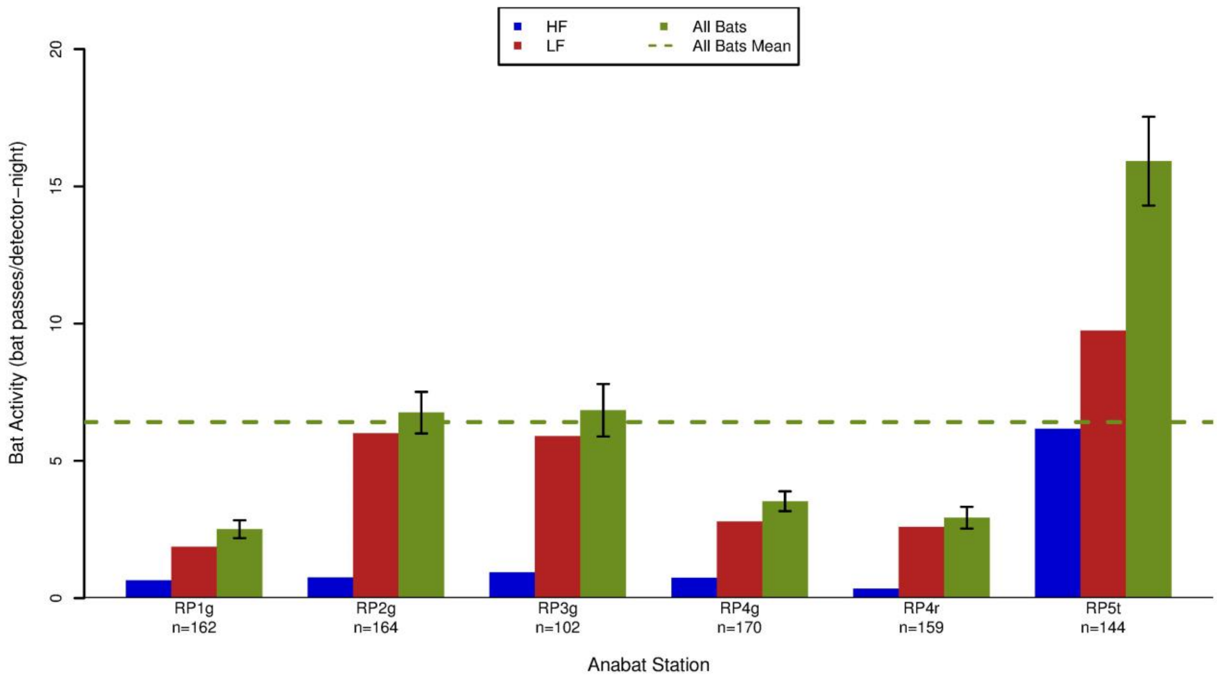


Figure 5. Number of high-frequency (HF), low-frequency (LF), and 'All Bats' bat passes per detector-night recorded at AnaBat stations in the Red Pine Wind Project from April 22 to October 17, 2013. The bootstrapped standard errors are represented by the black error bars on the 'All Bats' columns.

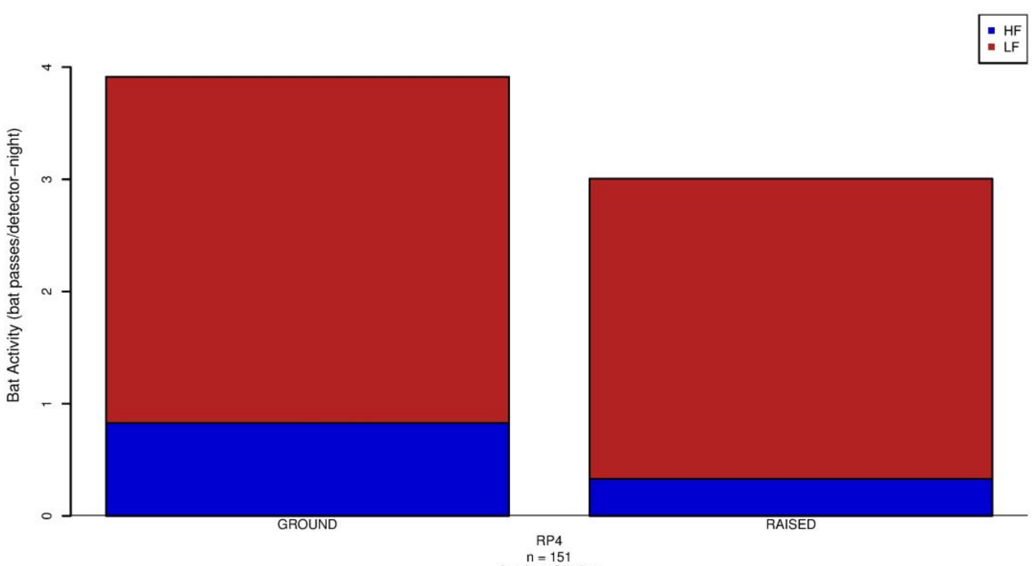


Figure 6. Number of high-frequency (HF) and low-frequency (LF) bat passes per detector-night recorded at the paired AnaBat station (station RP4) in the Red Pine Wind Project from April 22 to October 17, 2013.

Temporal Variation

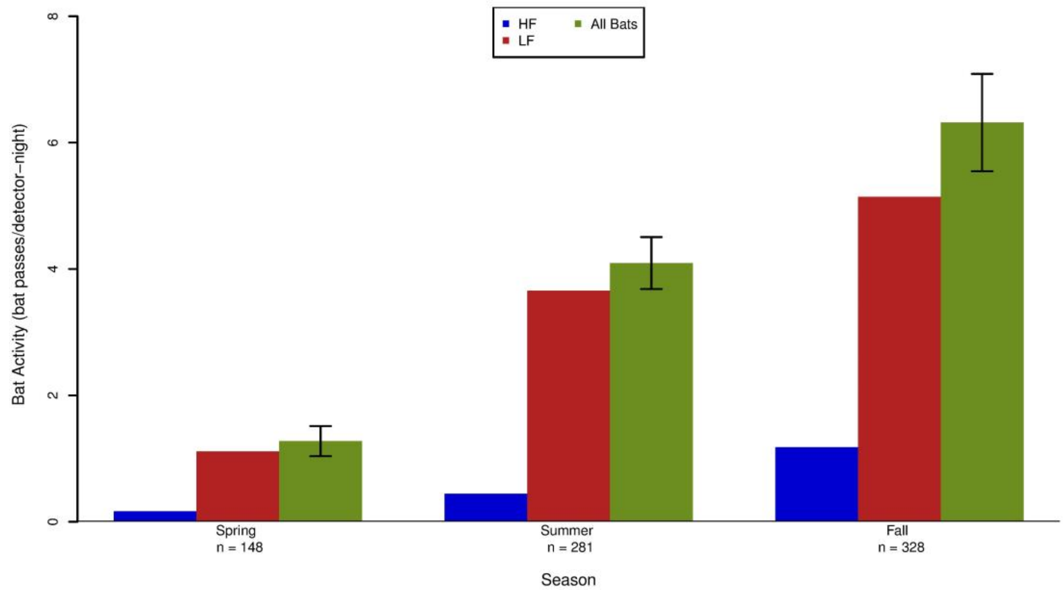
Weekly acoustic activity at the met tower stations was higher during the summer and fall, and lower in the spring (Figure 7, Table 4). Overall bat activity in the met tower stations was higher in August, with activity peaking from August 10 to August 16 at 13.37 bat passes per detector-night (Table 5). Bat activity at the met tower stations gradually increased during study, peaked in August and September, and then decreased for the remainder of the study period (Figure 8).

The temporal pattern at the bat feature station was considerably different than the met tower stations. At the bat feature station, the highest bat activity was recorded in the spring and summer and activity gradually decreased in the fall (Table 4, Figure 7 and 8,). Overall bat activity at the feature station peaked June 8 to June 16 at 48.00 bat passes per detector-night (Table 5).

Comparing weekly activity at the met tower ground detectors and the raised detector, bat activity was higher at ground detectors throughout most of the study period. A spike of bat activity was recorded at the raised station during the week of October 4th (Figure 9).

Table 4. The number of bat passes per detector-night recorded seasonally at stations in the Red Pine Wind Project in 2013. Bat passes are categorized by call frequency: high-frequency (HF), low-frequency (LF), and all bats (AB).

Station	Call Frequency	Spring April 22-May 31	Summer May 25 – Jul 31	Fall Aug 1 – Oct 20	Fall Migration Jul 30 – Oct 14
RP1G	LF	0.80	2.00	2.40	2.64
	HF	0.15	0.61	0.96	1.01
	AB	0.95	2.61	3.35	3.66
RP2G	LF	1.08	5.49	7.99	8.19
	HF	0.24	0.34	1.23	1.25
	AB	1.32	5.84	9.22	9.44
RP3G	LF	1.68	6.29	7.71	9.15
	HF	0.21	0.59	1.88	1.97
	AB	1.89	6.86	9.59	11.12
RP4G	LF	0.87	2.43	4.17	4.28
	HF	0.18	0.54	1.23	1.24
	AB	1.05	2.97	5.40	5.51
RP4R	LF	1.12	2.07	3.44	3.70
	HF	0.04	0.12	0.59	0.61
	AB	1.16	2.20	4.03	4.31
Total Met tower Ground	**LF**	**1.11±0.21**	**4.05±0.40**	**5.57±0.68**	**6.07±0.74**
	HF	**0.20±0.06**	**0.52±0.10**	**1.32±0.21**	**1.37±0.22**
	AB	**1.30±0.23**	**4.57±0.47**	**6.89±0.83**	**7.43±0.89**
Total Met tower Raised	**LF**	**1.12±0.39**	**2.07±0.38**	**3.44±0.65**	**3.70±0.66**
	HF	**0.04±0.05**	**0.12±0.05**	**0.59±0.16**	**0.61±0.16**
	AB	**1.16±0.41**	**2.20±0.39**	**4.03±0.70**	**4.31±0.71**
Bat Feature (Station RP5T)	**LF**	**17.50±8.00**	**13.26±1.97**	**3.87±0.61**	**3.94±0.61**
	HF	**2.75±1.50**	**5.69±0.69**	**7.71±1.50**	**7.82±1.51**
	AB	**20.25±8.08**	**18.95±2.30**	**11.59±1.63**	**11.76±1.62**
Overall	**LF**	**3.84±1.38**	**5.26±0.51**	**4.93±0.51**	**5.32±0.55**
	HF	**0.60±0.26**	**1.31±0.14**	**2.27±0.27**	**2.32±0.27**
	AB	**4.45±1.41**	**6.57±0.57**	**7.20±0.64**	**7.63±0.67**



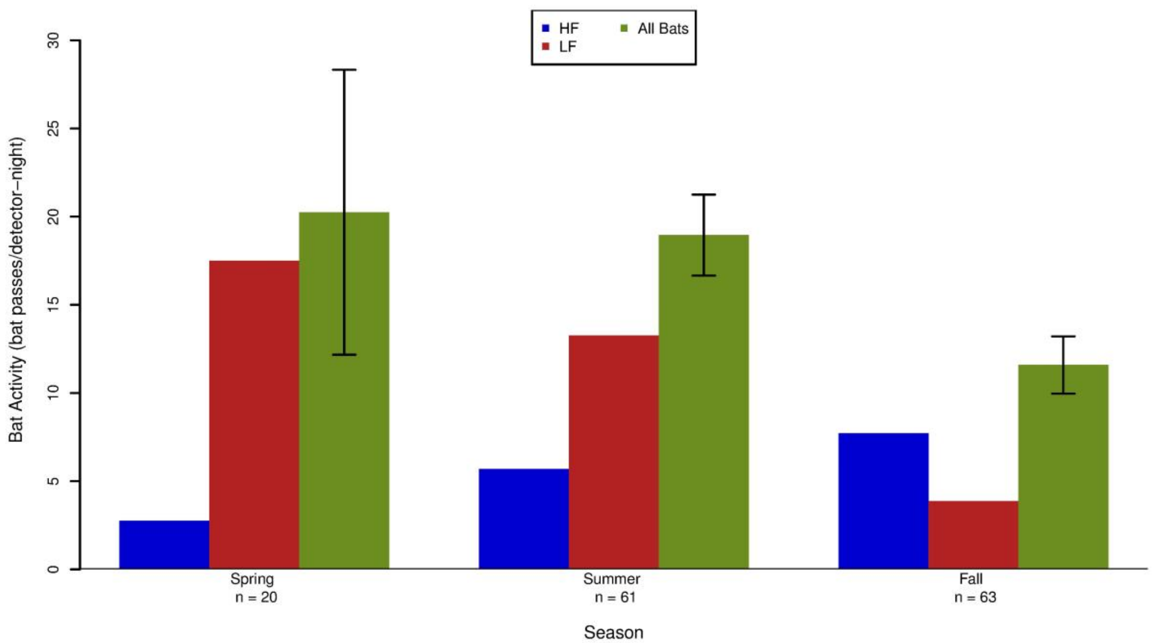


Figure 7. Seasonal bat activity by high-frequency (HF), low-frequency (LF), and 'All Bats' at the met tower stations (top) and bat feature station (bottom)) at the Red Pine Wind Project from April 22 to October 17, 2013. The bootstrapped standard errors are represented on the 'All Bats' columns.

Table 5. Periods of peak activity for high-frequency (HF), low-frequency (LF), and all bats at the Red Pine Wind Project for the study period April 22 to October 17, 2013.

Station Types	Species Group	Start Date of Peak Activity	End Date of Peak Activity	Bat Passes per Detector-Night
	HF	August 21	August 27	3.04
Met tower	LF	August 10	August 16	11.48
	All Bats	August 10	August 16	13.37
	HF	May 24	May 30	22.00
Bat Feature	LF	May 16	May 22	39.86
	All Bats	June 8	June 14	48.00

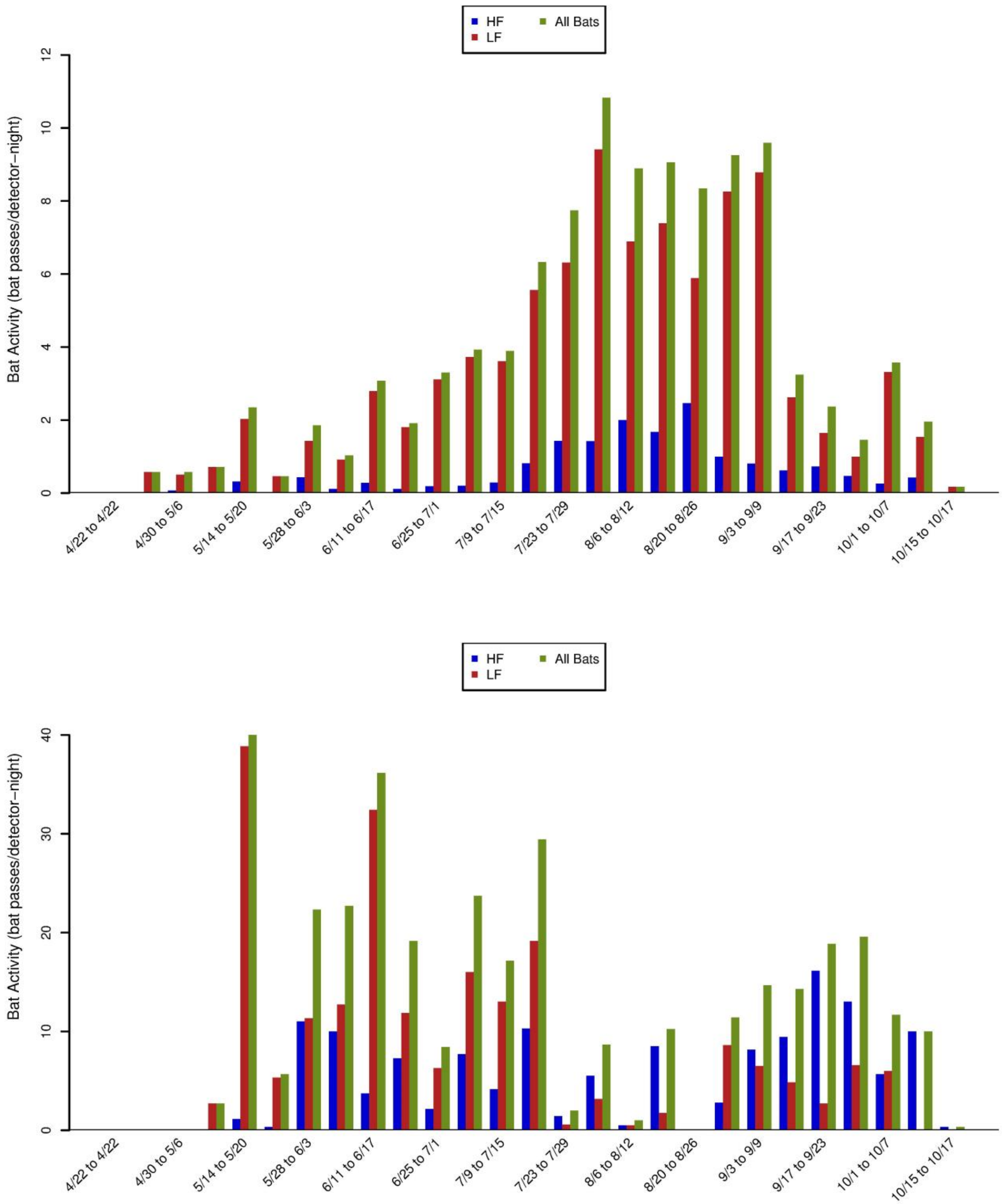


Figure 8. Weekly patterns of bat activity by high-frequency (HF), low-frequency (LF), and all bats at the met tower stations (top) and the bat feature station (bottom) at the Red Pine Wind Project from April 22 to October 17, 2013.

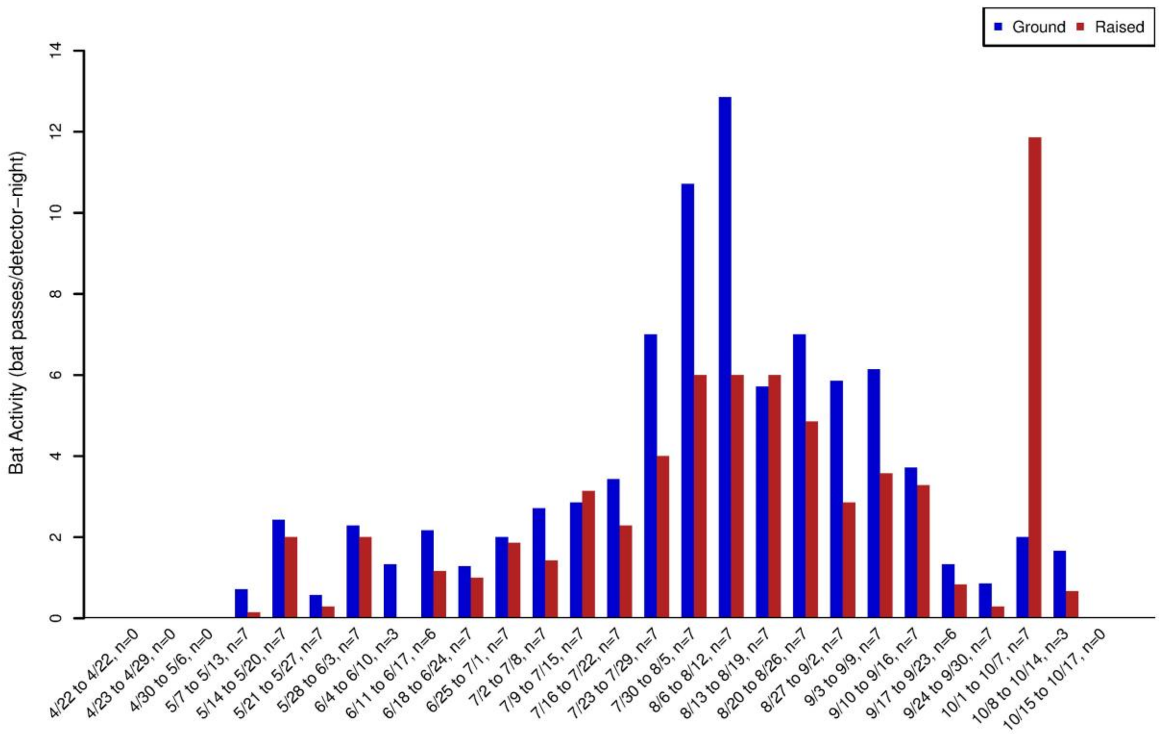


Figure 9. Weekly patterns of bat activity at ground and raised met tower stations at the Red Pine Wind Project from April 22 to October 17, 2013.

Species Composition

Low-frequency bat activity was consistently higher than HF bat activity at all stations and throughout the three seasons, with one exception: HF bat calls were more common than LF calls at the bat feature station during the fall (Tables 2 and 3; Figure 5). At met tower met tower stations, 84.0% of bat passes were classified as LF, with the remainder classified as HF (Tables 2 and 3). Similarly, at the raised met tower station 88.0% of recorded bat calls were classified as LF. Most bat calls were produced by LF bats at the bat feature station as well, but they accounted for a smaller percentage of the recorded calls (61.2%; Tables 2 and 3).

DISCUSSION

Potential Bat Impacts

Assessing the potential impacts of wind energy development on bats at the RPWP is complicated because the causes of bat fatalities at turbines are poorly understood (Kunz et al. 2007a, 2007b; Baerwald et al. 2008; Cryan and Barclay 2009; Long et al. 2010a, 2010b) and monitoring elusive, night-flying animals is inherently difficult (O'Shea et al. 2003). Although the number of wind energy facilities has increased rapidly in recent years, release of study results at these facilities has not occurred as quickly (Kunz et al. 2007b). Therefore, it is often the case that information gleaned from existing wind energy facilities is not available to inform assessments at proposed facilities. To date, post-construction monitoring studies of wind energy facilities suggest that:

1) Bat fatality rates generally show a positive correlation with bat activity (Kunz et al. 2007b);

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

3) Migratory tree-roosting species (e.g., eastern red, hoary, and silver-haired bats) account for approximately 75% of reported bats killed (Arnett et al. 2008, Gruver et al. 2009), and;

4) The level of bat fatalities may depend on many variables, including local environmental characteristics and/or specific weather conditions, but no single predictive factor has yet been identified.

Overall Bat Activity

While inconsistencies among studies (e.g., differences in study period length and timing, type of equipment, placement of equipment, and presentation of data) complicate comparisons across studies, some generalizations can be made. Among publicly-available studies of bat activity at wind energy facilities, most data were collected during the fall using AnaBat detectors placed near the ground in vegetation cover typical of turbine placement, rather than near features attractive to bats. At the RPWP, the met tower stations are representative of vegetation cover typical of turbine placement, and mean bat activity at the RPWP ground met tower detectors during the FMP (7.43 ± 0.89 bat passes per detector-night) was moderate compared to activity at other studies with similar data at North American wind energy facilities (Appendix A). Among Midwestern studies, bat activity was similar to several facilities in Wisconsin that reported relatively high bat fatality rates (e.g., Blue Sky Green Field, Forward Energy Center, Cedar Ridge; Appendix A). However, due to the inconsistencies among facilities, such as differences in habitat and bat species composition, the RPWP may not have fatality rates similar to those Midwest facilities with similar bat activity rates. In addition, it is unclear whether monitoring bat activity near ground level accurately represents activity at all heights (Hayes and Gruver 2000).

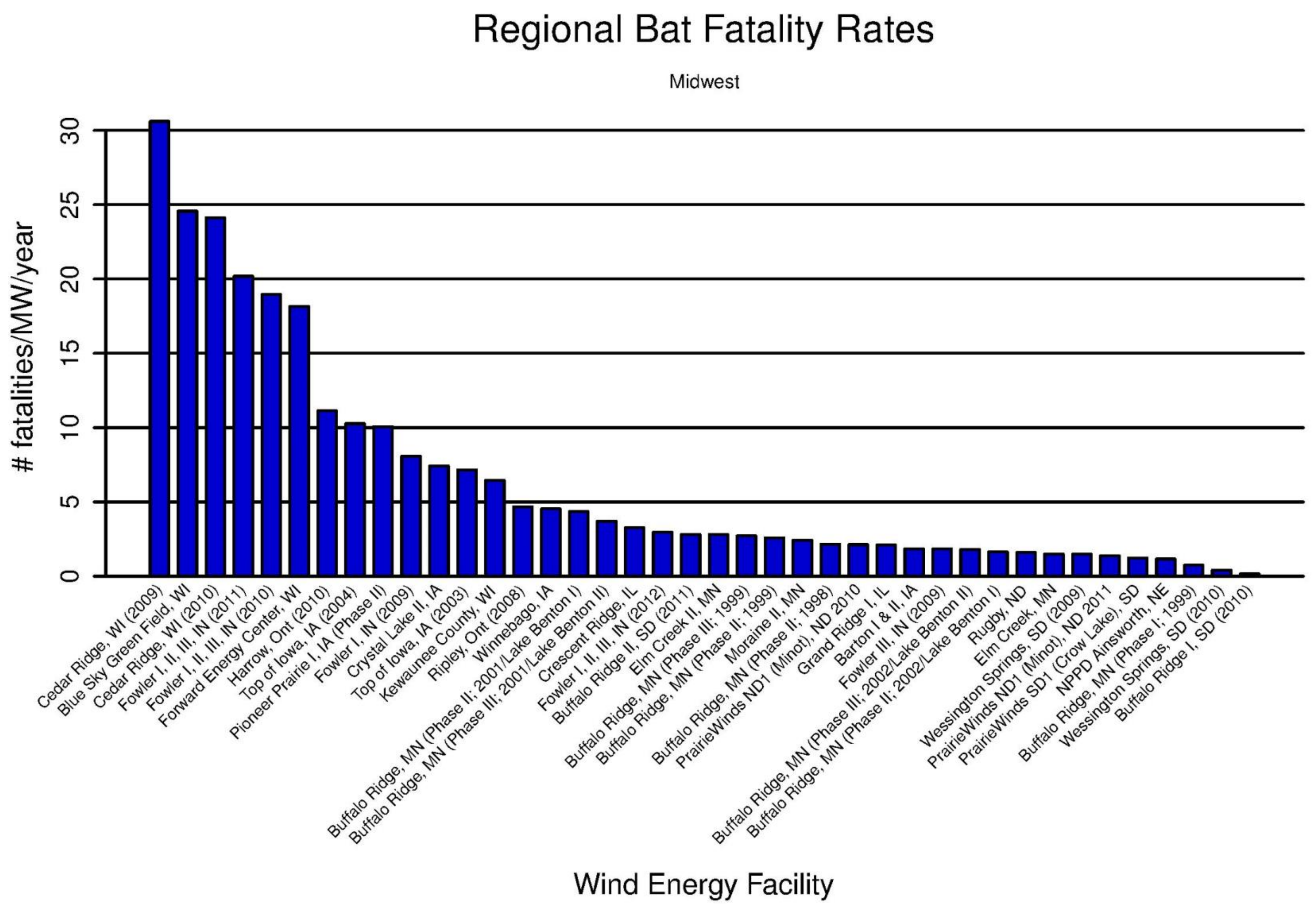


Figure 10. Fatality rates for bats (number of bat fatalities per megawatt per year) from publicly-available studies at wind energy facilities in the Midwest of North America.

Figure 10 (*continued*). Fatality rates for bats (number of bat fatalities per megawatt per year) from publicly-available studies at wind energy facilities in the Midwest of North America.

Data from the following sources:

Wind Energy Facility	Reference	Wind Energy Facility	Reference	Wind Energy Facility	Reference
Cedar Ridge, WI (09)	BHE Environmental 2010	Winnebago, IA	Derby et al. 2010e	Fowler III, IN (09)	Good et al. 2011
Blue Sky Green Field, WI	Gruver et al. 2009	Buffalo Ridge, MN (Ph. II; 01/Lake Benton I)	Johnson et al. 2004	Buffalo Ridge, MN (Ph. III; 02/Lake Benton II)	Johnson et al. 2004
Cedar Ridge, WI (10)	BHE Environmental 2011	Buffalo Ridge, MN (Ph. III; 01/Lake Benton II)	Johnson et al. 2004	Buffalo Ridge, MN (Ph. II; 02/Lake Benton I)	Johnson et al. 2004
Fowler I, II, III, IN (11)	Good et al. 2012	Crescent Ridge, IL	Kerlinger et al. 2007	Rugby, ND	Derby et al. 2011b
Fowler I, II, III, IN (10)	Good et al. 2011	Fowler I, II, III, IN (12)	Good et al. 2013	Elm Creek, MN	Derby et al. 2010c
Forward Energy Center, WI	Grodsky and Drake 2011	Buffalo Ridge II, SD (11)	Derby et al. 2012a	Wessington Springs, SD (09)	Derby et al. 2010f
Harrow, Ont. (10)	NRSI 2011	Elm Creek II, MN	Derby et al. 2012b	PrairieWinds ND1 (Minot), ND (11)	Derby et al. 2012c
Top of Iowa, IA (04)	Jain 2005	Buffalo Ridge, MN (Ph. III; 99)	Johnson et al. 2000	PrairieWinds SD1 (Crow Lake), SD	Derby et al. 2012d
Pioneer Prairie, IA (Ph. II)	Chodachek et al. 2012	Buffalo Ridge, MN (Ph. II; 99)	Johnson et al. 2000	NPPD Ainsworth, NE	Derby et al. 2007
Fowler I, IN (09)	Good et al. 2011	Moraine II, MN	Derby et al. 2010d	Buffalo Ridge, MN (Ph. I; 99)	Johnson et al. 2000
Crystal Lake II, IA	Derby et al. 2010a	Buffalo Ridge, MN (Ph. II; 98)	Johnson et al. 2000	Wessington Springs, SD (10)	Derby et al. 2011d
Top of Iowa, IA (03)	Jain 2005	PrairieWinds ND1 (Minot), ND (10)	Derby et al. 2011c	Buffalo Ridge I, SD (10)	Derby et al. 2010b
Kewaunee County, WI	Howe et al. 2002	Grand Ridge I, IL	Derby et al. 2010g		
Ripley, Ont (08)	Jacques Whitford 2009	Barton I & II, IA	Derby et al. 2011a		

Spatial Variation

Detection rates at the met tower ground detectors varied between locations: the lowest activity was recorded at Stations RP1g, RP4g, and RP4r; relatively moderate levels of activity were recorded at Stations RP2g and RP3g; and Station RP5t (bat feature) recorded much more activity than other stations. The met towers were located in tilled agriculture fields and open areas and represent potential turbine locations. In addition, Stations RP2g and RP3g were located in the general vicinity of wetland features and this may explain the slightly higher levels of bat activity when compared to the rest of the met tower stations. The bat feature station was located in a wetland and forest area, and this detector recorded twice as many bat calls than any other station. However, turbines likely will not be constructed in habitat similar to where the bat feature stations were located. Because bat activity was generally lower at the met tower stations than the bat feature stations, there may a lower potential risk of collision with turbines placed in tilled agriculture fields at the RPWP compared to if turbines were placed in bat feature areas.

Temporal Variation

When data from all stations were averaged together, the highest bat activity occurred within the RPWP during the summer and fall; however, the temporal trends in bat activity differed between the met tower and bat feature stations. Peak activity at the met tower stations occurred in August (Table 5), which likely corresponds with weaning of young, after which adult females and newly volant juveniles would increase the number of bats foraging in the area, as well as migration. Overall bat pass rates in the spring at met tower stations were relatively low compared to the rest of the survey period, except for one relatively small peak during mid-May, which could represent migratory bats passing through the RPWP (Figure 8). However, bat activity peaked at the bat feature station during the spring and summer, and was lower during the fall. The bat feature station was located near a small ephemeral pond which fluctuated in size throughout the year and may have become less attractive to bats as the season progressed. When data collection ended on October 17, there was a consistent trend of decreasing bat activity from previous weeks indicating that additional peaks in bat activity after October 17 were unlikely (Figure 8).

The lowest number of bat passes at met tower ground stations was recorded during the spring (1.30 ± 0.24 bat passes per detector-night). The highest number of bat passes was recorded during the fall migration (7.43 ± 0.89; Table 5). Most bat fatality studies at wind energy facilities in the US have shown a peak in fatality in August and September (the fall migration period) and generally lower mortality earlier in the summer and low mortality during the spring (Johnson 2005, Arnett et al. 2008). While the survey effort varied among the different studies, a general association between the timing of increased bat activity and timing of mortality was suggested in the studies that combined bat activity and fatality surveys, with both call rates and fatalities peaking during the fall migration period. Based on the available data, it is expected that bat fatalities at the RPWP will be highest in late summer to early fall at potential turbine locations.

Species Composition

All seven of the bat species with the potential to occur in the RPWP are known fatalities at wind energy facilities (Table 2). Low-frequency bats were the most common frequency group detected, representing approximately 85% of the calls at met tower stations and over 60% of the calls at the feature station (Table 3). Some low-frequency species, such as hoary bat and silver-haired bat, have been found as fatalities in higher proportions than other species (Arnett et al. 2008). Hoary bats and silver-haired bats could potentially have a higher collision risk within the RPWP.

At some fatality monitoring studies, carcasses of HF bats (e.g., little brown bat, eastern red bat) have been found in relatively high proportions during fatality monitoring studies (Kerns and Kerlinger 2004, Jain 2005, Brown and Hamilton 2006b, Gruver et al. 2009). However, *Myotis* species are typically less commonly recorded in the rotor-swept height or as fatalities than other species, such as hoary and eastern red bats, during post-construction studies at wind energy facilities (Kunz et al. 2007b, Arnett et al. 2008). Approximately 15% of passes recorded at met tower stations were by high-frequency bats, suggesting lower relative abundance of species such as eastern red bats, tri-colored bats, and *Myotis* bats (Table 2). At the reference stations, HF bats accounted for a higher percentage of calls (38.9% of calls; Table 3), potentially indicating that the HF species stay closer to the treed areas. Higher levels of activity by HF bats recorded at bat feature stations indicated that risk to these bats could be reduced by avoiding wetland and forest habitats when siting turbines.

Potential Bat Fatality Rates

Bat fatality rates from studies at wind energy facilities across North America have ranged from 0.08 (Chatfield et al. 2012) to 39.70 bat fatalities/MW/year (Fiedler et al. 2007; Figure 10, Appendix A). In general, fatality rates exhibit a high degree of variation for most regions (Appendix A). Thus far, bat fatality rates at wind energy facilities located in agricultural regions of the Dakotas, Illinois, Indiana, Iowa, Minnesota, Wisconsin, and Ontario have ranged from 0.16 to 30.61 bats/MW/year (Appendix A). Recent reports of moderate to high levels of bat fatalities in agricultural settings in Wisconsin, Indiana, Iowa, and Ontario, Canada (Appendix A) suggest that the lack of forested areas does not guarantee low bat fatality rates at wind energy facilities.

Bat activity recorded at the RPWP by ground detectors at met towers during the FMP was among the higher activity rates at facilities in the Midwest with similarly-collected data (Appendix A). The efficacy of using pre-construction bat activity surveys to predict post-construction fatality rates is unclear. This may be due to a lack of consistent methodologies between projects. Some bat species may also be attracted to turbines out of curiosity or for mating, foraging, or roosting opportunities (Cryan and Barclay 2009). These two factors further complicate the interpretation of existing data. The pre-construction bat studies completed at RPWP will add to the growing body of research regarding the impacts of wind energy development on bats and will provide a valuable comparison to post-construction studies to be completed at RPWP.

REFERENCES

Anderson, R., N. Neuman, J. Tom, W. P. Erickson, M. D. Strickland, M. Bourassa, K. J. Bay, and K. J. Sernka. 2004. Avian Monitoring and Risk Assessment at the Tehachapi Pass Wind Resource Area, California. Period of Performance: October 2, 1996 - May 27, 1998. NREL/SR-500-36416. National Renewable Energy Laboratory, Golden, Colorado. September 2004. http://www.nrel.gov/docs/fy04osti/36416.pdf

Anderson, R., J. Tom, N. Neumann, W. P. Erickson, M. D. Strickland, M. Bourassa, K. J. Bay, and K. J. Sernka. 2005. Avian Monitoring and Risk Assessment at the San Gorgonio Wind Resource Area. NREL/SR-500-38054. August 2005. Western EcoSytems Technology, Inc. (WEST). Cheyenne, Wyoming. Phase I and II Field Work. http://www.nrel.gov/docs/fy05osti/38054.pdf

Arnett, E. 2007. Report from the Bats and Wind Energy Cooperative (BWEC) on Collaborative Work and Plans. Presentation at the National Wind Coordinating Collaborative (NWCC) Wildlife Workgroup Meeting, Boulder Colorado. Conservation International. November 14th, 2007. Information available at www.nationalwind.org

Arnett, E. B., K. Brown, W. P. Erickson, J. Fiedler, B. L. Hamilton, T. H. Henry, A. Jain, G. D. Johnson, J. Kerns, R. R. Kolford, C. P. Nicholson, T. O'Connell, M. Piorkowski, and R. Tankersley, Jr. 2008. Patterns of Bat Fatalities at Wind Energy Facilities in North America. Journal of Wildlife Management 72(1): 61-78.

Arnett, E. B., W. P. Erickson, J. Kerns, and J. Horn. 2005. Relationships between Bats and Wind Turbines in Pennsylvania and West Virginia: An Assessment of Fatality Search Protocols, Patterns of Fatality, and Behavioral Interactions with Wind Turbines. Prepared for the Bats and Wind Energy Cooperative. March 2005.

Arnett, E. B., M. R. Schirmacher, C. D. Hein, and M. M. P. Huso. 2011. Patterns of Bird and Bat Fatality at the Locust Ridge II Wind Project, Pennsylvania. 2009-2010 Final Report. Prepared for the Bats and Wind Energy Cooperative (BWEC) and the Pennsylvania Game Commission (PGC). Prepared by Bat Conservation International (BCI), Austin, Texas. January 2011.

Arnett, E. B., M. R. Schirmacher, M. M. P. Huso, and J. P. Hayes. 2009a. Effectiveness of Changing Wind Turbine Cut-in Speed to Reduce Bat Fatalities at Wind Facilities: 2008 Annual Report. Prepared for the Bats and Wind Energy Cooperative (BWEC) and the Pennsylvania Game Commission. Bat Conservation International (BCI), Austin, Texas. April 2009. http://www.batsandwind.org/pdf/Curtailment_2008_Final_Report.pdf

Arnett, E. B., M. R. Schirmacher, M. M. P. Huso, and J. P. Hayes. 2009b. Patterns of Bat Fatality at the Casselman Wind Project in South-Central Pennsylvania. 2008 Annual Report. Annual report prepared for the Bats and Wind Energy Cooperative (BWEC) and the Pennsylvania Game Commission. Bat Conservation International (BCI), Austin, Texas. June 2009. Available online at: http://www.batsandwind.org/pdf/2008%20Casselman%20Fatality%20Report.pdf

Arnett, E. B., M. R. Schirmacher, M. M. P. Huso, and J. P. Hayes. 2010. Patterns of Bat Fatality at the Casselman Wind Project in South-Central Pennsylvania. 2009 Annual Report. Annual report prepared for the Bats and Wind Energy Cooperative (BWEC) and the Pennsylvania Game Commission. Bat Conservation International (BCI), Austin, Texas. January 2010.

Baerwald, E. F. 2008. Variation in the Activity and Fatality of Migratory Bats at Wind Energy Facilities in Southern Alberta: Causes and Consequences. Thesis. University of Calgary, Calgary, Alberta, Canada.

Baerwald, E. F. and R. M. R. Barclay. 2009. Geographic Variation in Activity and Fatality of Migratory Bats at Wind Energy Facilities. Journal of Mammalogy 90(6): 1341–1349.

Baerwald, E. F., G. H. D'Amours, B. J. Klug, and R. M. R. Barclay. 2008. Barotrauma Is a Significant Cause of Bat Fatalities at Wind Turbines. Current Biology 18(16): R695-R696.

Bat Conservation International (BCI). 2003. Range Map Data. Range GIS data from 2003. BCI website, BCI, Inc., Austin, Texas. Homepage: http://www.batcon.org, accessed 2013; Species profiles and range maps available online at: http://batcon.org/index.php/all-about-bats/species-profiles.html

Bat Conservation International (BCI). 2013. Myotis septentrionalis. BCI, Inc., Austin, Texas. Homepage: http://www.batcon.org, accessed 2013; Species profile and range map available online at: http://batcon.org/index.php/all-about-bats/species-profiles.html?task=detail&species=2306&country=43&state=all&family=all&start=20

BHE Environmental, Inc. (BHE). 2008. Investigations of Bat Activity and Bat Species Richness at the Proposed Cedar Ridge Wind Farm in Fond Du Lac County, Wisconsin. Interim Report prepared for Wisconsin Power and Light.

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

BHE Environmental, Inc. (BHE). 2011. Post-Construction Bird and Bat Mortality Study: Cedar Ridge Wind Farm, Fond Du Lac County, Wisconsin. Final Report. Prepared for Wisconsin Power and Light, Madison, Wisconsin. Prepared by BHE Environmental, Inc. Cincinnati, Ohio. February 2011.

BioResource Consultants, Inc. (BRC). 2010. 2009/2010 Annual Report: Bird and Bat Mortality Monitoring, Pine Tree Wind Farm, Kern County, California. To the Los Angeles Department of Water and Power, from AECOM, Irvine, California. Report prepared by BioResource Consultants, Inc., Ojai, California. October 14, 2010.

Britzke, E. R., B. A. Slack, M. P. Armstrong, and S. C. Loeb. 2010. Effects of Orientation and Weatherproofing on the Detection of Bat Echolocation Calls. Journal of Fish and Wildlife Management 1(2): 136-141.

Brooks, R. T. and W. M. Ford. 2005. Bat Activity in a Forest Landscape of Central Massachusetts. Northeastern Naturalist 12(4): 447-462.

Brown, W. K. and B. L. Hamilton. 2004. Bird and Bat Monitoring at the Mcbride Lake Wind Farm, Alberta, 2003-2004. Report for Vision Quest Windelectric, Inc., Calgary, Alberta, Canada. September 2004.

Brown, W. K. and B. L. Hamilton. 2006a. Bird and Bat Interactions with Wind Turbines Castle River Wind Facility, Alberta, 2001-2002. Report for Vision Quest Windelectric, Inc., Calgary, Alberta, Canada.

Brown, W. K. and B. L. Hamilton. 2006b. Monitoring of Bird and Bat Collisions with Wind Turbines at the Summerview Wind Power Project, Alberta: 2005-2006. Prepared for Vision Quest Windelectric, Calgary, Alberta by TAEM Ltd., Calgary, Alberta, and BLH Environmental Services, Pincher Creek, Alberta. September 2006. http://www.batsandwind.org/pdf/Brown2006.pdf

Center for Biological Diversity (CBD). 2010. Petition to List the Eastern-Small Footed Bat *Myotis leibii* and Northern Long-Eared Bat *Myotis septentrionalis* as Threatened or Endangered under the Endangered Species Act. CBD, Richmond, Vermont. Available online at: http://www.biologicaldiversity.org/campaigns/bat_crisis_white-nose_syndrome/pdfs/petition-Myotisleibii-Myotisseptentrionalis.pdf

Chatfield, A., W. Erickson, and K. Bay. 2009. Avian and Bat Fatality Study, Dillon Wind-Energy Facility, Riverside County, California. Final Report: March 26, 2008 - March 26, 2009. Prepared for Iberdrola Renewables, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. June 3, 2009.

Chatfield, A., W. P. Erickson, and K. Bay. 2010. Final Report: Avian and Bat Fatality Study at the Alite Wind-Energy Facility, Kern County, California. Final Report: June 15, 2009 – June 15, 2010. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. Prepared for CH2M HILL, Oakland, California.

Chatfield, A., M. Sonnenberg, and K. Bay. 2012. Avian and Bat Mortality Monitoring at the Alta-Oak Creek Mojave Project, Kern County, California. Final Report for the First Year of Operation March 22, 2011 – June 15, 2012. Prepared for Alta Windpower Development, LLC, Mojave, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. September 12, 2012.

Chodachek, K., C. Derby, M. Sonnenberg, and T. Thorn. 2012. Post-Construction Fatality Surveys for the Pioneer Prairie Wind Farm I LLC Phase II, Mitchell County, Iowa: April 4, 2011 – March 31, 2012. Prepared for EDP Renewables, North America LLC, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Collins, J. and G. Jones. 2009. Differences in Bat Activity in Relation to Bat Detector Height: Implications for Bat Surveys at Proposed Wind Farms. Acta Chiropterologica 11: 343:350.

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

Cryan, P.M. and R.M.R. Barclay. 2009. Causes of Bat Fatalities at Wind Turbines: Hypotheses and Predictions. Journal of Mammalogy 90(6): 1330-1340.

Derby, C., K. Chodachek, and K. Bay. 2010a. Post-Construction Bat and Bird Fatality Study Crystal Lake II Wind Energy Center, Hancock and Winnebago Counties, Iowa. Final Report: April 2009- October 2009. Prepared for NextEra Energy Resources, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. June 2, 2010.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010b. Post-Construction Fatality Survey for the Buffalo Ridge I Wind Project. May 2009 - May 2010. Prepared for Iberdrola Renewables, Inc., Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010c. Post-Construction Fatality Surveys for the Elm Creek Wind Project: March 2009- February 2010. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010d. Post-Construction Fatality Surveys for the Moraine II Wind Project: March - December 2009. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010e. Post-Construction Fatality Surveys for the Winnebago Wind Project: March 2009- February 2010. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and S. Nomani. 2011a. Post-Construction Fatality Surveys for the Barton I and II Wind Project: IRI. March 2010 - February 2011. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. Version: September 28, 2011.

Derby, C., K. Chodachek, K. Bay, and S. Nomani. 2011b. Post-Construction Fatality Surveys for the Rugby Wind Project: Iberdrola Renewables, Inc. March 2010 - March 2011. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. Version: October 14, 2011.

Derby, C., K. Chodachek, and M. Sonnenberg. 2012a. Post-Construction Casualty Surveys for the Buffalo Ridge II Wind Project. Iberdrola Renewables: March 2011- February 2012. Prepared for Iberdrola Renewables, LLC, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 31, 2012.

Derby, C., K. Chodachek, and M. Sonnenberg. 2012b. Post-Construction Fatality Surveys for the Elm Creek II Wind Project. Iberdrola Renewables: March 2011-February 2012. Prepared for Iberdrola Renewables, LLC, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. October 8, 2012.

Derby, C., K. Chodachek, T. Thorn, K. Bay, and S. Nomani. 2011c. Post-Construction Fatality Surveys for the PrairieWinds ND1 Wind Facility, Basin Electric Power Cooperative, March - November 2010. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 2, 2011.

Derby, C., K. Chodachek, T. Thorn, and A. Merrill. 2012c. Post-Construction Surveys for the PrairieWinds ND1 (2011) Wind Facility Basin Electric Power Cooperative: March - October 2011. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western Ecosystems Technology, Inc. (WEST), Bismarck, North Dakota. August 31, 2012.

Derby, C., A. Dahl, K. Bay, and L. McManus. 2011d. 2010 Post-Construction Monitoring Results for the Wessington Springs Wind Energy Facility, South Dakota. Final Report: March 9 – November 16, 2010. Prepared for Wessington Wind Energy Center, LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. November 22, 2011.

Derby, C., A. Dahl, W. Erickson, K. Bay, and J. Hoban. 2007. Post-Construction Monitoring Report for Avian and Bat Mortality at the NPPD Ainsworth Wind Farm. Unpublished report prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, for the Nebraska Public Power District.

Derby, C., A. Dahl, and A. Merrill. 2012d. Post-Construction Monitoring Results for the PrairieWinds SD1 Wind Energy Facility, South Dakota. Final Report: March 2011 - February 2012. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. September 27, 2012.

Derby, C., A. Dahl, A. Merrill, and K. Bay. 2010f. 2009 Post-Construction Monitoring Results for the Wessington Springs Wind-Energy Facility, South Dakota. Final Report. Prepared for Wessington Wind Energy Center, LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 19, 2010.

Derby, C., G. Iskali, S. Howlin, T. Thorn, T. Lyon, and A. Dahl. 2013a. Post-Construction Monitoring Results for the Big Smile Wind Farm, Roger Mills County, Oklahoma. Final Report: March 2012 to February 2013. Prepared for Acciona Wind Energy, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. June 12, 2013.

Derby, C., G. Iskali, M. Kauffman, T. Thorn, T. Lyon, and A. Dahl. 2013b. Post-Construction Monitoring Results, Red Hills Wind Farm, Roger Mills and Custer Counties, Oklahoma. Final Report: March 2012 to March 2013. Prepared for Acciona Wind Energy, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. June 12, 2013.

Derby, C., J. Ritzert, and K. Bay. 2010g. Bird and Bat Fatality Study, Grand Ridge Wind Resource Area, Lasalle County, Illinois. January 2009 - January 2010. Prepared for Grand Ridge Energy LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. July 13, 2010. Revised January 2011.

Downes, S. and R. Gritski. 2012a. Harvest Wind Project Wildlife Monitoring Report: January 2010 – January 2012. Prepared for Harvest Wind Project, Roosevelt, Washington. Prepared by Northwest Wildlife Consultants, Inc., Pendleton, Oregon May 1, 2012.

Downes, S. and R. Gritski. 2012b. White Creek Wind I Wildlife Monitoring Report: November 2007 - November 2011. Prepared for White Creek Wind I, LLC, Roosevelt, Washington. Prepared by Northwest Wildlife Consultants, Inc., Pendleton, Oregon May 1, 2012.

Enk, T., K. Bay, M. Sonnenberg, J. Baker, M. Kesterke, J. R. Boehrs, and A. Palochak. 2010. Biglow Canyon Wind Farm Phase I Post-Construction Avian and Bat Monitoring Second Annual Report, Sherman County, Oregon. January 26, 2009 - December 11, 2009. Prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc.(WEST) Cheyenne, Wyoming, and Walla Walla, Washington. April 2010.

Enk, T., K. Bay, M. Sonnenberg, and J. R. Boehrs. 2012a. Year 1 Avian and Bat Monitoring Report: Biglow Canyon Wind Farm Phase III, Sherman County, Oregon. September 13, 2010 - September 9, 2011. Prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington. April 24, 2012.

Enk, T., K. Bay, M. Sonnenberg, and J. R. Boehrs. 2012b. Year 2 Avian and Bat Monitoring Report: Biglow Canyon Wind Farm Phase II, Sherman County, Oregon. September 13, 2010 - September 12, 2011. Prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington. April 23, 2012.

Enk, T., K. Bay, M. Sonnenberg, J. Flaig, J. R. Boehrs, and A. Palochak. 2011a. Year 1 Post-Construction Avian and Bat Monitoring Report: Biglow Canyon Wind Farm Phase II, Sherman County, Oregon. September 10, 2009 - September 12, 2010. Prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington. January 7, 2011.

Enk, T., C. Derby, K. Bay, and M. Sonnenberg. 2011b. 2010 Post-Construction Fatality Monitoring Report, Elkhorn Valley Wind Farm, Union County, Oregon. January – December 2010. Prepared for EDP Renewables, North America LLC, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Walla Walla, Washington, and Cheyenne, Wyoming. December 8, 2011.

Enz, T. and K. Bay. 2010. Post-Construction Avian and Bat Fatality Monitoring Study, Tuolumne Wind Project, Klickitat County, Washington. Final Report: April 20, 2009 - April 7, 2010. Prepared for Turlock Irrigation District, Turlock, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 6, 2010.

Enz, T. and K. Bay. 2011. Post-Construction Monitoring at the Linden Ranch Wind Farm, Klickitat County, Washington. Final Report: June 30, 2010 - July 17, 2011. Prepared for EnXco. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. November 10, 2011.

Enz, T., K. Bay, S. Nomani, and M. Kesterke. 2011. Bird and Bat Fatality Monitoring Study, Windy Flats and Windy Point II Wind Energy Projects, Klickitat County, Washington. Final Report: February 1, 2010 - January 14, 2011. Prepared for Windy Flats Partners, LLC, Goldendale, Washington. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 19, 2011.

Enz, T., K. Bay, M. Sonnenberg, and A. Palochak. 2012. Post-Construction Monitoring Studies for the Combine Hills Turbine Ranch, Umatilla County, Oregon. Final Report: January 7 - December 2, 2011. Prepared for Eurus Energy America Corporation, San Diego, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Walla Walla, Washington.

Erickson, W. P., J. Jeffrey, K. Kronner, and K. Bay. 2004. Stateline Wind Project Wildlife Monitoring Annual Report. July 2001 - December 2003. Technical report peer-reviewed by and submitted to FPL Energy, the Oregon Energy Facility Siting Council, and the Stateline Technical Advisory Committee. Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. December 2004.

Erickson, W. P., J. Jeffrey, and V. K. Poulton. 2008. Avian and Bat Monitoring: Year 1 Report. Puget Sound Energy Wild Horse Wind Project, Kittitas County, Washington. Prepared for Puget Sound Energy, Ellensburg, Washington, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. January 2008.

Erickson, W. P., G. D. Johnson, M. D. Strickland, and K. Kronner. 2000. Avian and Bat Mortality Associated with the Vansycle Wind Project, Umatilla County, Oregon. Technical Report prepared by WEST, Inc., for Umatilla County Department of Resource Services and Development, Pendleton, Oregon. 21 pp.

Erickson, W. P., K. Kronner, and K. J. Bay. 2007. Stateline 2 Wind Project Wildlife Monitoring Report, January - December 2006. Technical report submitted to FPL Energy, the Oregon Energy Facility Siting Council, and the Stateline Technical Advisory Committee.

Erickson, W. P., K. Kronner, and R. Gritski. 2003. Nine Canyon Wind Power Project Avian and Bat Monitoring Report. September 2002 – August 2003. Prepared for the Nine Canyon Technical Advisory Committee and Energy Northwest by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants (NWC), Pendleton, Oregon. October 2003. http://www.west-inc.com/reports/nine_canyon_monitoring_final.pdf

Erickson, W. P. and L. Sharp. 2005. Phase 1 and Phase 1a Avian Mortality Monitoring Report for 2004-2005 for the Smud Solano Wind Project. Prepared for Sacramento Municipal Utility District (SMUD), Sacramento, California. Prepared by URS Sacramento, California and Western EcoSystems Technology, Inc. (WEST). August 2005.

ESRI. 2013. Geographic Information System (GIS) Online Topographic Base Map. ESRI, producers of ArcGIS software. Redlands, California.

Fenton, M. B. 1991. Seeing in the Dark. BATS (Bat Conservation International) 9(2): 9-13.

Fiedler, J. K. 2004. Assessment of Bat Mortality and Activity at Buffalo Mountain Windfarm, Eastern Tennessee. M.S. Thesis. University of Tennessee, Knoxville, Tennessee. August, 2004. http://www.tva.gov/environment/bmw_report/bat_mortality_bmw.pdf

Fiedler, J. K., T. H. Henry, R. D. Tankersley, and C. P. Nicholson. 2007. Results of Bat and Bird Mortality Monitoring at the Expanded Buffalo Mountain Windfarm, 2005. Tennessee Valley Authority. June 28, 2007.

Fishman Ecological Services LLC. 2003. Carcass Survey Results for Seawest Windpower, Inc., Condon Site 2002-2003. Prepared for SeaWest WindPower Inc.

Frick, W. F., J. F. Pollock, A. C. Hicks, K. E. Langwig, D. S. Reynolds, G. G. Turner, C. M. Butchkoski, and T. H. Kunz. 2010. An Emerging Disease Casues Regional Population Collapse of a Common North American Bat Species. Science 329: 679-682.

Fry, J. A., G. Xian, S. Jin, J. A. Dewits, H. J., L. Yang, C. A. Barnes, N. D. Herold, and J. D. Wickham. 2011. Completion of the 2006 National Land Cover Database for the Conterminous United States. Photogrammetric Engineering and Remote Sensing 77(9): 859-864. http://www.mrlc.gov/nlcd06_data.php

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

Golder Associates. 2010. Report on Fall Post-Construction Monitoring, Ripley Wind Power Project, Acciona Wind. Report Number 09-1126-0029. Submitted to Suncor Energy Products Inc., Calgary, Alberta, and Acciona Wind Energy Canada, Toronto, Ontario. February 2010.

Good, R. E., W. P. Erickson, A. Merrill, S. Simon, K. Murray, K. Bay, and C. Fritchman. 2011. Bat Monitoring Studies at the Fowler Ridge Wind Energy Facility, Benton County, Indiana: April 13 - October 15, 2010. Prepared for Fowler Ridge Wind Farm. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. January 28, 2011.

Good, R. E., A. Merrill, S. Simon, K. Murray, and K. Bay. 2012. Bat Monitoring Studies at the Fowler Ridge Wind Farm, Benton County, Indiana: April 1 - October 31, 2011. Prepared for the Fowler Ridge Wind Farm. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. January 31, 2012.

Good, R. E., M. Sonnenburg, and S. Simon. 2013. Bat Evaluation Monitoring Studies at the Fowler Ridge Wind Farm, Benton County, Indiana: August 1 - October 15, 2012. Prepared for the Fowler Ridge Wind Farm. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. January 31, 2013.

Gritski, R., S. Downes, and K. Kronner. 2010. Klondike III (Phase 1) Wind Power Project Wildlife Monitoring: October 2007-October 2009. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon, for Klondike Wind Power III LLC. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. April 21, 2010 (Updated September 2010). Available online at: http://www.oregon.gov/energy/Siting/docs/KWP/KWPWildlifeReport091210.pdf

Gritski, R., S. Downes, and K. Kronner. 2011. Klondike IIIa (Phase 2) Wind Power Project Wildlife Monitoring: August 2008 - August 2010. Updated Final. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon, for Klondike Wind Power III LLC. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. Updated April 2011. Available online at: http://www.oregon.gov/energy/Siting/docs/KWP/KWPWildlifeReport042711.pdf

Gritski, R. and K. Kronner. 2010a. Hay Canyon Wind Power Project Wildlife Monitoring Study: May 2009 - May 2010. Prepared for Iberdrola Renewables, Inc. (IRI), Hay Canyon Wind Power Project LLC. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. September 20, 2010.

Gritski, R. and K. Kronner. 2010b. Pebble Springs Wind Power Project Wildlife Monitoring Study: January 2009 - January 2010. Prepared for Iberdrola Renewables, Inc. (IRI), and the Pebble Springs Advisory Committee. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. April 20, 2010.

Gritski, R., K. Kronner, and S. Downes. 2008. Leaning Juniper Wind Power Project, 2006 − 2008. Wildlife Monitoring Final Report. Prepared for PacifiCorp Energy, Portland, Oregon. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. December 30, 2008.

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

Gruver, J. 2002. Assessment of Bat Community Structure and Roosting Habitat Preferences for the Hoary Bat (*Lasiurus cinereus*) near Foote Creek Rim, Wyoming. M.S. Thesis. University of Wyoming, Laramie, Wyoming. 149 pp.

Gruver, J. 2008. Bat Acoustic Studies for the Blue Sky Green Field Wind Project, Fond Du Lac County, Wisconsin. Final Report: July 24 - October 29, 2007. Prepared for We Energies, Milwaukee, Wisconsin. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. February 26, 2008.

Gruver, J., M. Sonnenberg, K. Bay, and W. Erickson. 2009. Post-Construction Bat and Bird Fatality Study at the Blue Sky Green Field Wind Energy Center, Fond Du Lac County, Wisconsin July 21 - October 31, 2008 and March 15 - June 4, 2009. Unpublished report prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. December 17, 2009.

Harvey, M. J., J. S. Altenbach, and T. L. Best. 1999. Bats of the United States. Arkansas Game and Fish Commission and US Fish and Wildlife Service, Arkansas.

Hayes, J. P. and J. Gruver. 2000. Vertical Stratification of Activity of Bats in an Old-Growth Forest in Western Washington. Northwest Science 74(2): 102-108.

Hogberg, R. K. and T. N. Bayed. 1967. Guide to Caves of Minnesota. Minnesota Geological Survey, Education Series – 4.

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

Insignia Environmental. 2009. 2008/2009 Annual Report for the Buena Vista Avian and Bat Monitoring Project. Prepared for Contra Costa County, Martinez, California. Prepared by Insignia Environmental, Palo Alto, California. September 4, 2009.

Jacques Whitford Stantec Limited (Jacques Whitford). 2009. Ripley Wind Power Project Postconstruction Monitoring Report. Project No. 1037529.01. Report to Suncor Energy Products Inc., Calgary, Alberta, and Acciona Energy Products Inc., Calgary, Alberta. Prepared for the Ripley Wind Power Project Post-Construction Monitoring Program. Prepared by Jacques Whitford, Markham, Ontario. April 30, 2009. www.jacqueswhitford.com

Jain, A. 2005. Bird and Bat Behavior and Mortality at a Northern Iowa Windfarm. M.S. Thesis. Iowa State University, Ames, Iowa.

Jain, A., P. Kerlinger, R. Curry, and L. Slobodnik. 2007. Annual Report for the Maple Ridge Wind Power Project: Post-Construction Bird and Bat Fatality Study – 2006. Final Report. Prepared for PPM Energy and Horizon Energy and Technical Advisory Committee (TAC) for the Maple Ridge Project Study.

Jain, A., P. Kerlinger, R. Curry, and L. Slobodnik. 2009a. Annual Report for the Maple Ridge Wind Power Project: Post-Construction Bird and Bat Fatality Study - 2007. Final report prepared for PPM Energy and Horizon Energy and Technical Advisory Committee (TAC) for the Maple Ridge Project Study. May 6, 2009.

Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, A. Fuerst, and C. Hansen. 2009b. Annual Report for the Noble Ellenburg Windpark, LLC, Postconstruction Bird and Bat Fatality Study - 2008. Prepared for Noble Environmental Power, LLC by Curry and Kerlinger, LLC. April 13, 2009.

Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, J. Histed, and J. Meacham. 2009c. Annual Report for the Noble Clinton Windpark, LLC, Postconstruction Bird and Bat Fatality Study - 2008. Prepared for Noble Environmental Power, LLC by Curry and Kerlinger, LLC. April 13, 2009.

Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, and M. Lehman. 2009d. Maple Ridge Wind Power Avian and Bat Fatality Study Report - 2008. Annual Report for the Maple Ridge Wind Power Project, Post-construction Bird and Bat Fatality Study - 2008. Prepared for Iberdrola Renewables, Inc, Horizon Energy, and the Technical Advisory Committee (TAC) for the Maple Ridge Project Study. Prepared by Curry and Kerlinger, LLC. May 14, 2009.

Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, J. Quant, and D. Pursell. 2009e. Annual Report for the Noble Bliss Windpark, LLC, Postconstruction Bird and Bat Fatality Study - 2008. Prepared for Noble Environmental Power, LLC by Curry and Kerlinger, LLC. April 13, 2009.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, A. Fuerst, and A. Harte. 2010a. Annual Report for the Noble Bliss Windpark, LLC: Postconstruction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. March 9, 2010.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, and A. Harte. 2011a. Annual Report for the Noble Wethersfield Windpark, LLC: Postconstruction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. January 22, 2011.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, and K. Russell. 2010b. Annual Report for the Noble Clinton Windpark, LLC: Postconstruction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. March 9, 2010.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, and K. Russell. 2010c. Annual Report for the Noble Ellenburg Windpark, LLC: Postconstruction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. March 14, 2010.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, and K. Russell. 2011b. Annual Report for the Noble Altona Windpark, LLC: Postconstruction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. January 22, 2011.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, and K. Russell. 2011c. Annual Report for the Noble Chateaugay Windpark, LLC: Postconstruction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. January 22, 2011.

James, R. D. 2008. Erie Shores Wind Farm Port Burwell, Ontario: Fieldwork Report for 2006 and 2007 During the First Two Years of Operation. Report to Environment Canada, Ontario Ministry of Natural Resources, Erie Shores Wind Farm LP - McQuarrie North American and AIM PowerGen Corporation. January 2008.

Jeffrey, J. D., K. Bay, W. P. Erickson, M. Sonneberg, J. Baker, M. Kesterke, J. R. Boehrs, and A. Palochak. 2009a. Portland General Electric Biglow Canyon Wind Farm Phase I Post-Construction Avian and Bat Monitoring First Annual Report, Sherman County, Oregon. January 2008 - December 2008. Technical report prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology (WEST) Inc., Cheyenne, Wyoming, and Walla Walla, Washington. April 29, 2009.

Jeffrey, J. D., W. P. Erickson, K. Bay, M. Sonneberg, J. Baker, J. R. Boehrs, and A. Palochak. 2009b. Horizon Wind Energy, Elkhorn Valley Wind Project, Post-Construction Avian and Bat Monitoring, First Annual Report, January-December 2008. Technical report prepared for Telocaset Wind Power Partners, a subsidiary of Horizon Wind Energy, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc., Cheyenne, Wyoming, and Walla Walla, Washington. May 4, 2009.

Johnson, G. D. 2005. A Review of Bat Mortality at Wind-Energy Developments in the United States. Bat Research News 46(2): 45-49.

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

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, D. A. Shepherd, and S. A. Sarappo. 2003. Mortality of Bats at a Large-Scale Wind Power Development at Buffalo Ridge, Minnesota. The American Midland Naturalist 150: 332-342.

Johnson, G. D., M. K. Perlik, W. P. Erickson, and M. D. Strickland. 2004. Bat Activity, Composition and Collision Mortality at a Large Wind Plant in Minnesota. Wildlife Society Bulletin 32(4): 1278-1288.

Kerlinger, P. 2002a. An Assessment of the Impacts of Green Mountain Power Corporation's Wind Power Facility on Breeding and Migrating Birds in Searsburg, Vermont: July 1996-July 1998. NREL/SR-500-28591. Prepared for Vermont Public Service, Montpelier, Vermont. US Department of Energy, National Renewable Energy Laboratory, Golden, Colorado. March 2002. 95 pp. http://www.nrel.gov/docs/fy02osti/28591.pdf

Kerlinger, P. 2002b. Avian Fatality Study at the Madison Wind Power Project, Madison, New York. Report to PG&E Generating.

Kerlinger, P., R. Curry, L. Culp, A. Hasch, and A. Jain. 2009. Post-Construction Avian Monitoring Study for the Shiloh I Wind Power Project, Solano County, California. Final Report: October 2009. Third Year Report (Revised 2010). Prepared for Iberdrola Renewables, Inc. (IRI). Prepared by Curry and Kerlinger, LLC., McLean, Virginia.

Kerlinger, P., R. Curry, L. Culp, A. Hasch, and A. Jain. 2010a. Post-Construction Avian Monitoring Study for the Shiloh I Wind Power Project, Solano County, California. Final Report: October 2009. Third Year Report (Revised). Prepared for Iberdrola Renewables, Inc. (IRI). Prepared by Curry and Kerlinger, LLC., McLean, Virginia.

Kerlinger, P., R. Curry, L. Culp, A. Hasch, and A. Jain. 2010b. Post-Construction Avian Monitoring Study for the Shiloh II Wind Power Project, Solano County, California. Year One Report. Prepared for enXco Development Inc. Prepared by Curry and Kerlinger, LLC, McLean, Virginia. September 2010.

Kerlinger, P., R. Curry, L. Culp, A. Jain, C. Wilkerson, B. Fischer, and A. Hasch. 2006. Post-Construction Avian and Bat Fatality Monitoring for the High Winds Wind Power Project, Solano County, California: Two Year Report. Prepared for High Winds LLC, FPL Energy by Curry and Kerlinger, LLC. April 2006.

Kerlinger, P., R. Curry, A. Hasch, and J. Guarnaccia. 2007. Migratory Bird and Bat Monitoring Study at the Crescent Ridge Wind Power Project, Bureau County, Illinois: September 2005 - August 2006. Final draft prepared for Orrick Herrington and Sutcliffe, LLP. May 2007.

Kerns, J. and P. Kerlinger. 2004. A Study of Bird and Bat Collisions at the Mountaineer Wind Energy Facility, Tucker County, West Virginia: Annual Report for 2003. Prepared for FPL Energy and the Mountaineer Wind Energy Center Technical Review Committee. February 14, 2004. Technical report prepared by Curry and Kerlinger, LLC., for FPL Energy and Mountaineer Wind Energy Center Technical Review Committee. Curry and Kerlinger, LLC. 39 pp. http://www.wvhighlands.org/Birds/MountaineerFinalAvianRpt-%203-15-04PKJK.pdf

Kronner, K., R. Gritski, and S. Downes. 2008. Big Horn Wind Power Project Wildlife Fatality Monitoring Study: 2006−2007. Final report prepared for PPM Energy and the Big Horn Wind Project Technical Advisory Committee by Northwest Wildlife Consultants, Inc. (NWC), Mid-Columbia Field Office, Goldendale, Washington. June 1, 2008.

Kunz, T. H., E. B. Arnett, B. M. Cooper, W. P. Erickson, R. P. Larkin, T. Mabee, M. L. Morrison, M. D. Strickland, and J. M. Szewczak. 2007a. Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document. Journal of Wildlife Management 71(8): 2449-2486. Available online at: http://www.nationalwind.org/assets/publications/Nocturnal_MM_Final-JWM.pdf

Kunz, T. H., E. B. Arnett, W. P. Erickson, A. R. Hoar, G. D. Johnson, R. P. Larkin, M. D. Strickland, R. W. Thresher, and M. D. Tuttle. 2007b. Ecological Impacts of Wind Energy Development on Bats: Questions, Research Needs, and Hypotheses. Frontiers in Ecology and the Environment 5(6): 315-324.

Larson, D. J. and J. P. Hayes. 2000. Variability in Sensitivity of Anabat II Detectors and a Method of Calibration. Acta Chiropterologica 2: 209-213.

Limpens, H. J. G. A. and G. F. McCracken. 2004. Choosing a Bat Detector: Theoretical and Practical Aspects. Pp. 28-37. *In*: Bat Echolocation Research: Tools, Techniques, and Analysis. R. M. Brigham, E. K. V. Kalko, G. Jones, S. Parsons, and H. J. G. A. Limpens, eds. Bat Conservation International, Austin, Texas.

Long, C., J. Flint, and P. Lepper. 2010a. Insect Attraction to Wind Turbines: Does Colour Play a Role? European Journal of Wildlife Research: 1-9.

Long, C. V., J. A. Flint, and P. A. Lepper. 2010b. Wind Turbines and Bat Mortality: Doppler Shift Profiles and Ultrasonic Bat-Like Pulse Reflection from Moving Turbine Blades. Journal of the Acoustical Society of America 128(4): 2238-2245.

Miller, A. 2008. Patterns of Avian and Bat Mortality at a Utility-Scaled Wind Farm on the Southern High Plains. M.S. Thesis. Texas Tech University, August 2008. Available online at: http://www.batsandwind.org/pdf/Bibliography%20docs/Miller_Amanda_Thesis.pdf

Natural Resource Solutions Inc. (NRSI). 2009. 2006, 2007 and 2008 Bird and Bat Mortality Monitoring, Prince Wind Power Project. Project No. 821, D. Stephenson, Senior Biologist. Prepared for Brookfield Renewable Power, Gatineau, Quebec. Prepared by NSRI, Waterloo, Ontario. May 5, 2009.

Natural Resource Solutions Inc. (NRSI). 2011. Harrow Wind Farm 2010 Post-Construction Monitoring Report. Project No. 0953. Prepared for International Power Canada, Inc., Markham, Ontario. Prepared by NRSI. August 2011.

New Jersey Audubon Society (NJAS). 2008a. Post-Construction Wildlife Monitoring at the Atlantic City Utilities Authority - Jersey Atlantic Wind Power Facility: Periodic Report Covering Work Conducted between 1 August and 30 September 2008. Submitted to New Jersey Board of Public Utilities, New Jersey Clean Energy Program, Newark, New Jersey. Submitted by New Jersey Audubon Society, Center for Research and Education, Cape May Court House, New Jersey. Available online at: http://www.njcleanenergy.com/files/file/Renewable_Programs/Wind/ACUA_Interim%20Report_Jan-Sep08_all.pdf

New Jersey Audubon Society (NJAS). 2008b. Post-Construction Wildlife Monitoring at the Atlantic City Utilities Authority - Jersey Atlantic Wind Power Facility: Periodic Report Covering Work Conducted between 20 July and 31 December 2007. Submitted to New Jersey Board of Public Utilities, New Jersey Clean Energy Program, Newark, New Jersey. Submitted by New Jersey Audubon Society, Center for Research and Education, Cape May Court House, New Jersey. Available online at: http://www.njcleanenergy.com/files/file/Renewable_Programs/CORE/ACUAReportwithimages123107LowRes.pdf

New Jersey Audubon Society (NJAS). 2009. Post-Construction Wildlife Monitoring at the Atlantic City Utilities Authority - Jersey Atlantic Wind Power Facility: Project Status Report IV. Available online at: http://www.njcleanenergy.com/files/file/Renewable_Programs/Wind/ACUA_Quarterly%20report_to-date_Jan-Aug09_1c.pdf

Nicholson, C. P., J. R.D. Tankersley, J. K. Fiedler, and N. S. Nicholas. 2005. Assessment and Prediction of Bird and Bat Mortality at Wind Energy Facilities in the Southeastern United States. Final Report. Tennessee Valley Authority, Knoxville, Tennessee.

Normandeau Associates, Inc. 2010. Stetson Mountain II Wind Project Year 1 Post-Construction Avian and Bat Mortality Monitoring Study, T8 R4 Nbpp, Maine. Prepared for First Wind, LLC, Portland, Maine. Prepared by Normandeau Associates, Inc., Falmouth, Maine. December 2, 2010.

Normandeau Associates, Inc. 2011. Year 3 Post- Construction Avian and Bat Casualty Monitoring at the Stetson I Wind Farm, T8 R4 Nbpp, Maine. Prepared for First Wind Energy, LLC, Portland, Maine. Prepared by Normandeau Associates, Inc., Falmouth, Maine. December 2011.

Northwest Wildlife Consultants, Inc. (NWC) and Western EcoSystems Technology, Inc. (WEST). 2007. Avian and Bat Monitoring Report for the Klondike II Wind Power Project. Sherman County, Oregon. Prepared for PPM Energy, Portland, Oregon. Managed and conducted by NWC, Pendleton, Oregon. Analysis conducted by WEST, Cheyenne, Wyoming. July 17, 2007.

O'Shea, T. J., M. A. Bogan, and L. E. Ellison. 2003. Monitoring Trends in Bat Populations of the US and Territories: Status of the Science and Recommendations for the Future. Wildlife Society Bulletin 31: 16-29.

Osborn, R. G., K. F. Higgins, C. D. Dieter, and R. E. Usgaard. 1996. Bat Collisions with Wind Turbines in Southwestern Minnesota. Bat Research News 37: 105-108.

Osborn, R. G., K. F. Higgins, R. E. Usgaard, C. D. Dieter, and R. G. Neiger. 2000. Bird Mortality Associated with Wind Turbines at the Buffalo Ridge Wind Resource Area, Minnesota. American Midland Naturalist 143: 41-52.

Piorkowski, M. D. and T. J. O'Connell. 2010. Spatial Pattern of Summer Bat Mortality from Collisions with Wind Turbines in Mixed-Grass Prairie. American Midland Naturalist 164: 260-269.

Poulton, V. and W. P. Erickson. 2010. Post-Construction Bat and Bird Fatality Study, Judith Gap Wind Farm, Wheatland County, Montana. Final Report: Results from June–October 2009 Study and Comparison with 2006-2007 Study. Prepared for Judith Gap Energy, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. March 2010.

Reynolds, D. S. 2010a. Post-Construction Acoustic Monitoring, 2009 Sampling Period: Noble Clinton Windpark, Clinton County, New York. Prepared for Noble Environmental Power, LLC, Essex, Connecticut. Prepared by North East Ecological Services, Bow, New Hampshire. April 6, 2010.

Reynolds, D. S. 2010b. Post-Construction Acoustic Monitoring, 2009 Sampling Period: Noble Ellenburg Windpark, Clinton County, New York. Prepared for Noble Environmental Power, LLC, Essex, Connecticut. Prepared by North East Ecological Services, Bow, New Hampshire. April 6, 2010.

Solick, D., A. Krause, A. Chatfield, and W. P. Erickson. 2010. Bat Acoustic Studies for the Alta East Wind Resource Area, Kern County, California. Final Report: July 7, 2009 – July 9, 2010. Prepared for CH2M HILL, Oakland, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. October 15, 2010.

Stantec Consulting, Inc. (Stantec). 2008. 2007 Spring, Summer, and Fall Post-Construction Bird and Bat Mortality Study at the Mars Hill Wind Farm, Maine. Prepared for UPC Wind Management, LLC, Cumberland, Maine. Prepared by Stantec (formerly Woodlot Alternatives, Inc.), Topsham, Maine. January 2008.

Stantec Consulting, Inc. (Stantec). 2009a. Post-Construction Monitoring at the Mars Hill Wind Farm, Maine - Year 2, 2008. Prepared for First Wind Management, LLC, Portland, Maine. Prepared by Stantec Consulting, Topsham, Maine. January 2009.

Stantec Consulting, Inc. (Stantec). 2009b. Post-Construction Monitoring at the Munnsville Wind Farm, New York: 2008. Prepared for E.ON Climate and Renewables, Austin, Texas. Prepared by Stantec Consulting, Topsham, Maine. January 2009.

Stantec Consulting, Inc. (Stantec). 2009c. Stetson I Mountain Wind Project: Year 1 Post-Construction Monitoring Report, 2009 for the Stetson Mountain Wind Project in Penobscot and Washington Counties, Maine. Prepared for First Wind Management, LLC. Portland, Maine. Prepared by Stantec, Topsham, Maine. January 2009.

Stantec Consulting, Inc. (Stantec). 2010. Cohocton and Dutch Hill Wind Farms Year 1 Post-Construction Monitoring Report, 2009, for the Cohocton and Dutch Hill Wind Farms in Cohocton, New York. Prepared for Canandaigua Power Partners, LLC and Canandaigua Power Partners II, LLC, Portland, Maine. Prepared by Stantec, Topsham, Maine. January 2010.

Stantec Consulting, Inc. (Stantec). 2011. Cohocton and Dutch Hill Wind Farms Year 2 Post-Construction Monitoring Report, 2010, for the Cohocton and Dutch Hill Wind Farms in Cohocton, New York. Prepared for Canandaigua Power Partners, LLC, and Canandaigua Power Partners II, LLC, Portland, Maine. Prepared by Stantec, Topsham, Maine. October 2011.

Stantec Consulting, Inc. (Stantec). 2012. 2011 Post-Construction Monitoring Report, Kibby Wind Power Project, Franklin County, Maine. Prepared for TransCanada Hydro Northeast, Inc., North Walpole, New Hampshire. Prepared by Stantec, Topsham, Maine. March 2012.

Stantec Consulting Ltd. (Stantec Ltd.). 2008. Melancthon I Wind Plant Post-Construction Bird and Bat Monitoring Report: 2007. File No. 160960220. Prepared for Canadian Hydro Developers, Inc., Guelph, Ontario. Prepared by Stantec Ltd., Guelph, Ontario. June 2008.

Stantec Consulting Ltd. (Stantec Ltd.). 2010a. Wolfe Island Ecopower Centre Post-Construction Followup Plan. Bird and Bat Resources Monitoring Report No. 1: May - June 2009. File No. 160960494. Prepared for Canadian Hydro Developers, Inc.'s wholly owned subsidiary, Canadian Renewable Energy Corporation. Prepared by Stantec Ltd., Guelph, Ontario. February 2010.

Stantec Consulting Ltd. (Stantec Ltd.). 2010b. Wolfe Island Ecopower Centre Post-Construction Followup Plan. Bird and Bat Resources Monitoring Report No. 2: July - December 2009. File No. 160960494. Prepared for TransAlta Corporation's wholly owned subsidiary, Canadian Renewable Energy Corporation. Prepared by Stantec Ltd., Guelph, Ontario. May 2010.

Stantec Consulting Ltd. (Stantec Ltd.). 2011a. Wolfe Island Wind Plant Post-Construction Followup Plan. Bird and Bat Resources Monitoring Report No. 3: January - June 2010. File No. 160960494. Prepared for TransAlta Corporation's wholly owned subsidiary, Canadian Renewable Energy Corporation. Prepared by Stantec Consulting Ltd., Guelph, Ontario. January 2011.

Stantec Consulting Ltd. (Stantec Ltd.). 2011b. Wolfe Island Wind Plant Post-Construction Followup Plan. Bird and Bat Resources Monitoring Report No. 4: July - December 2010. File No. 160960494. Prepared for TransAlta Corporation's wholly owned subsidiary, Canadian Renewable Energy Corporation. Prepared by Stantec Consulting Ltd., Guelph, Ontario. July 2011.

Stantec Consulting Ltd. (Stantec Ltd.). 2011c. Wolfe Island Wind Plant Post-Construction Followup Plan. Bird and Bat Resources Monitoring Report No. 5: January - June 2011. File No. 160960494. Prepared for TransAlta Corporation's wholly owned subsidiary, Canadian Renewable Energy Corporation. Prepared by Stantec Consulting Ltd., Guelph, Ontario. December 2011.

Stantec Consulting Ltd. (Stantec Ltd.). 2012. Wolfe Island Wind Plant Post-Construction Follow-up Plan. Bird and Bat Resources Monitoring Report No. 6: July-December 2011. File No. 160960494. Prepared for TransAlta Corporation's wholly owned subsidiary, Canadian Renewable Energy Corporation. Prepared by Stantec Consulting Ltd., Guelph, Ontario. July 2012.

Stantec Consulting Services, Inc. (Stantec Consulting Services). 2012. Post-Construction Monitoring, Summer 2011 - Spring 2012, Year 1 Annual Report: Kittitas Valley Wind Power Project, Cle Elum, Washington. Prepared for Sagebrush Power Partners, LLC, Houston, Texas. Prepared by Stantec, Salt Lake City, Utah.

Thompson, J. and K. Bay. 2012. Post-Construction Fatality Surveys for the Dry Lake II Wind Project: February 2011 – February 2012. Prepared for Iberdrola Renewables, LLC, Portland, Oregon. Prepared by Western Ecosystems Technology, Inc. (WEST), Cheyenne, Wyoming. June 6, 2012.

Thompson, J., D. Solick, and K. Bay. 2011. Post-Construction Fatality Surveys for the Dry Lake Phase I Wind Project. Iberdrola Renewables: September 2009 - November 2010. Prepared for Iberdrola Renewables, Portland, Oregon. Prepared by Western Ecosystems Technology, Inc. (WEST), Cheyenne, Wyoming. February 10, 2011.

Tidhar, D., L. McManus, Z. Courage, and W. L. Tidhar. 2012a. 2010 Post-Construction Fatality Monitoring Study and Bat Acoustic Study for the High Sheldon Wind Farm, Wyoming County, New York. Final Report: April 15 - November 15, 2010. Prepared for High Sheldon Wind Farm, Sheldon Energy LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Waterbury, Vermont. April 15, 2012.

Tidhar, D., L. McManus, D. Solick, Z. Courage, and K. Bay. 2012b. 2011 Post-Construction Fatality Monitoring Study and Bat Acoustic Study for the High Sheldon Wind Farm, Wyoming County, New York. Final Report: April 15 - November 15, 2011. Prepared for High Sheldon Wind Farm, Sheldon Energy LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Waterbury, Vermont. April 25, 2012.

Tidhar, D., M. Sonnenberg, and D.P. Young, Jr. 2013. 2012 Post-Construction Carcass Monitoring Study for the Beech Ridge Wind Farm, Greenbrier County, West Virginia. Final Report: April 1 - October 28, 2012. Prepared for Beech Ridge Wind Farm, Beech Ridge Energy, LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), NE/Mid-Atlantic Branch, Waterbury, Vermont. January 18, 2013.

Tidhar, D., W. Tidhar, and M. Sonnenberg. 2010. Post-Construction Fatality Surveys for Lempster Wind Project, Iberdrola Renewables. Prepared for Lempster Wind, LLC, Lempster Wind Technical Advisory Committee, and Iberdrola Renewables, Inc. Prepared by Western EcoSystems Technology Inc. (WEST), Waterbury, Vermont. September 30, 2010.

Tidhar, D., W. L. Tidhar, L. McManus, and Z. Courage. 2011. 2010 Post-Construction Fatality Surveys for the Lempster Wind Project, Lempster, New Hampshire. Prepared for Iberdrola Renewables, Inc. and the Lempster Wind Technical Committee. Prepared by Western EcoSystems Technology, Inc., Waterbury, Vermont. May 18, 2011.

Tierney, R. 2007. Buffalo Gap I Wind Farm Avian Mortality Study: February 2006-January 2007. Final Survey Report. Prepared for AES SeaWest, Inc. TRC, Albuquerque, New Mexico.TRC Report No. 110766-C-01. May 2007.

Tierney, R. 2009. Buffalo Gap 2 Wind Farm Avian Mortality Study: July 2007 - December 2008. Final Survey Report. Submitted by TRC, Albuquerque, New Mexico. TRC Report No. 151143-B-01. June 2009.

TRC Environmental Corporation. 2008. Post-Construction Avian and Bat Fatality Monitoring and Grassland Bird Displacement Surveys at the Judith Gap Wind Energy Project, Wheatland County, Montana. Prepared for Judith Gap Energy, LLC, Chicago, Illinois. TRC Environmental Corporation, Laramie, Wyoming. TRC Project 51883-01 (112416). January 2008. http://www.newwest.net/pdfs/AvianBatFatalityMonitoring.pdf

URS Corporation. 2010a. Final Goodnoe Hills Wind Project Avian Mortality Monitoring Report. Prepared for PacifiCorp, Salt Lake City, Utah. Prepared by URS Corporation, Seattle, Washington. March 16, 2010.

URS Corporation. 2010b. Final Marengo I Wind Project Year One Avian Mortality Monitoring Report. Prepared for PacifiCorp, Salt Lake City, Utah. Prepared by URS Corporation, Seattle, Washington. March 22, 2010.

URS Corporation. 2010c. Final Marengo II Wind Project Year One Avian Mortality Monitoring Report. Prepared for PacifiCorp, Salt Lake City, Utah. Prepared by URS Corporation, Seattle, Washington. March 22, 2010.

US Department of Agriculture (USDA) National Agricultural Statistics Service (NASS). 2012. Cropscape - Cropland Data Layer. 2012 Minnesota Data. USDA NAS homepage at: http://www.nass.usda.gov/; Cropscape CDL program data available online at: http://nassgeodata.gmu.edu/CropScape/

US Fish and Wildlife Service (USFWS). 2012. Final Land-Based Wind Energy Guidelines. March 23, 2012. 82 pp. Available online at: http://www.fws.gov/windenergy/docs/WEG_final.pdf

US Fish and Wildlife Service (USFWS). 2013. Northern Long-Eared Bat (*Myotis septentrionalis*). USFWS Endangered Species Program: Midwest Region. Updated October 2, 2013. Available online at: http://www.fws.gov/midwest/endangered/mammals/nlba/index.html

US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI). 2007. Region 3 NWI, Midwest Region: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. http://www.fws.gov/wetlands/data/index.html, NWI data at: http://www.fws.gov/wetlands/Data/Mapper.html and http://www.fws.gov/midwest/

US Geological Survey (USGS). 2012. Protected Areas Database of the United States (PADUS), Version 1.2 Data Download. USGS Gap Analysis Program Protected Areas Viewer. Webpage last modified March 2, 2012 Download available online at: http://gapanalysis.usgs.gov/padus/download/

US Geological Survey (USGS). 2013. National Karst Map Project, An Update. USGS Headquarters, USGS National Center. Reston, Virginia. Available online at: http://water.usgs.gov/ogw/karst/kig2002/jbe_map.html

Ventus Environmental Solutions (Ventus). 2012. Vantage Wind Energy Center Avian and Bat Monitoring Study: March 2011- March 2012. Prepared for Vantage Wind Energy, LLC, Chicago, Illinois. Prepared by Ventus, Portland, Oregon. May 16, 2012.

Watt, M. A. and D. Drake. 2011. Assessing Bat Use at the Forward Energy Center. Final Report. PSC REF#:152051. Public Service Commission of Wisconsin. Prepared for Forward Energy LLC. Prepared by Department of Forest and Wildlife Ecology, University of Wisconsin-Madison, Madison, Wisconsin. August 2011.

Western EcoSystems Technology, Inc. (WEST). 2006. Diablo Winds Wildlife Monitoring Progress Report, March 2005 - February 2006. Technical report submitted to FPL Energy and Alameda County California. WEST. Cheyenne, Wyoming.

Western EcoSystems Technology, Inc. (WEST). 2008. Diablo Winds Wildlife Monitoring Progress Report: March 2005 – February 2007. Prepared by WEST, Cheyenne, Wyoming. August 2008.

Western EcoSystems Technology, Inc. (WEST). 2011. Post-Construction Fatality Surveys for the Barton Chapel Wind Project: Iberdrola Renewables. Version: July 2011. Iberdrola Renewables, Portland, Oregon.

White, E. P. and S. D. Gehrt. 2001. Effects of Recording Media on Echolocation Data from Broadband Bat Detectors. Wildlife Society Bulletin 29: 974-978.

Young, D.P. Jr., K. Bay, S. Nomani, and W. Tidhar. 2009a. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: March - June 2009. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming. August 17, 2009.

Young, D.P. Jr., K. Bay, S. Nomani, and W. Tidhar. 2010a. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: April - July 2010. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 27, 2010.

Young, D.P. Jr., K. Bay, S. Nomani, and W. Tidhar. 2010b. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: July - October 2009. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming. February 12, 2010.

Young, D.P. Jr., W. P. Erickson, K. Bay, S. Nomani, and W. Tidhar. 2009b. Mount Storm Wind Energy Facility, Phase 1 Post-Construction Avian and Bat Monitoring, July - October 2008. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming. February 17, 2009.

Young, D.P. Jr., W. P. Erickson, R. E. Good, M. D. Strickland, and G. D. Johnson. 2003a. Avian and Bat Mortality Associated with the Initial Phase of the Foote Creek Rim Windpower Project, Carbon County, Wyoming, Final Report, November 1998 - June 2002. Prepared for Pacificorp, Inc. Portland, Oregon, SeaWest Windpower Inc. San Diego, California, and Bureau of Land Management, Rawlins District Office, Rawlins, Wyoming.

Young, D.P. Jr., W. P. Erickson, J. Jeffrey, and V. K. Poulton. 2007. Puget Sound Energy Hopkins Ridge Wind Project Phase 1 Post-Construction Avian and Bat Monitoring First Annual Report, January - December 2006. Technical report for Puget Sound Energy, Dayton, Washington and Hopkins Ridge Wind Project Technical Advisory Committee, Columbia County, Washington. Western EcoSystems Technology, Inc. (WEST) Cheyenne, Wyoming, and Walla Walla, Washington. 25 pp.

Young, D.P. Jr., W. P. Erickson, M. D. Strickland, R. E. Good, and K. J. Sernka. 2003b. Comparison of Avian Responses to UV-Light-Reflective Paint on Wind Turbines. Subcontract Report July 1999 – December 2000. NREL/SR-500-32840. Prepared for National Renewable Energy Laboratory, Golden, Colorado, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. Foote Creek Rim Wind Plant, Carbon County, Wyoming. January 2003. http://www.west-inc.com

Young, D.P. Jr., J. Jeffrey, W. P. Erickson, K. Bay, V. K. Poulton, K. Kronner, R. Gritski, and J. Baker. 2006. Eurus Combine Hills Turbine Ranch. Phase 1 Post Construction Wildlife Monitoring First Annual Report: February 2004 - February 2005. Technical report prepared for Eurus Energy America Corporation, San Diego, California, and the Combine Hills Technical Advisory Committee, Umatilla County, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla Washington, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. February 21, 2006.

Young, D.P. Jr., J. D. Jeffrey, K. Bay, and W. P. Erickson. 2009c. Puget Sound Energy Hopkins Ridge Wind Project, Phase 1, Columbia County, Washington. Post-Construction Avian and Bat Monitoring, Second Annual Report: January - December, 2008. Prepared for Puget Sound Energy, Dayton, Washington, and the Hopkins Ridge Wind Project Technical Advisory Committee, Columbia County, Washington. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington. May 20, 2009.

Young, D.P. Jr., M. Lout, Z. Courage, S. Nomani, and K. Bay. 2012a. 2011 Post-Construction Monitoring Study, Criterion Wind Project, Garrett County, Maryland: April - November 2011. Prepared for Criterion Power Partners, LLC, Oakland, Maryland. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Waterbury, Vermont. April 20, 2012. Available online at: http://www.exeloncorp.com/assets/energy/powerplants/docs/Criterion/CPP%20Post%20Construction%20Monitoring%20Report%20%28042512%29.pdf

Young, D.P. Jr., C. Nations, M. Lout, and K. Bay. 2013. 2012 Post-Construction Monitoring Study, Criterion Wind Project, Garrett County, Maryland. April - November 2012. Prepared for Criterion Power Partners, LLC, Oakland, Maryland. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Waterbury, Vermont. January 15, 2013.

Young, D.P. Jr., S. Nomani, Z. Courage, and K. Bay. 2011a. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: April - July 2011. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming. August 29, 2011.

Young, D.P. Jr., S. Nomani, Z. Courage, and K. Bay. 2012b. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: July - October 2011. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming. February 27, 2012.

Young, D.P. Jr., S. Nomani, W. Tidhar, and K. Bay. 2011b. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: July - October 2010. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming. February 10, 2011.

Appendix A: North American Fatality Summary Tables

Appendix A1. Wind energy facilities in North America with comparable activity and fatality data for bats, separated by geographic region.

Wind Energy Facility	Bat Activity Estimate[A]	Bat Activity Dates	Fatality Estimate[B]	No. of Turbines	Total MW
Red Pine, MN	**7.43**				
	Midwest				
Cedar Ridge, WI (2009)	9.97[C,D,E,F]	7/16/07-9/30/07	30.61	41	67.6
Blue Sky Green Field, WI	7.7[F]	7/24/07-10/29/07	24.57	88	145
Cedar Ridge, WI (2010)	9.97[C,D,E,F]	7/16/07-9/30/07	24.12	41	68
Fowler I, II, III, IN (2011)			20.19	355	600
Fowler I, II, III, IN (2010)			18.96	355	600
Forward Energy Center, WI	6.97	8/5/08-11/08/08	18.17	86	129
Harrow, Ont (2010)			11.13	24 (four 6-turb facilities)	39.6
Top of Iowa, IA (2004)	35.7	5/26/04-9/24/04	10.27	89	80
Pioneer Prairie I, IA (Phase II)			10.06	62	102.3
Fowler I, IN (2009)			8.09	162	301
Crystal Lake II, IA			7.42	80	200
Top of Iowa, IA (2003)			7.16	89	80
Kewaunee County, WI			6.45	31	20.46
Ripley, Ont (2008)			4.67	38	76
Winnebago, IA			4.54	10	20
Buffalo Ridge, MN (Phase II; 2001/Lake Benton I)	2.2[D]	6/15/01-9/15/01	4.35	143	107.25
Buffalo Ridge, MN (Phase III; 2001/Lake Benton II)	2.2[D]	6/15/01-9/15/01	3.71	138	103.5
Crescent Ridge, IL			3.27	33	49.5
Fowler I, II, III, IN (2012)			2.96	355	600
Elm Creek II, MN			2.81	62	148.8
Buffalo Ridge II, SD (2011)			2.81	105	210
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
PrairieWinds ND1 (Minot), ND 2010			2.13	80	115.5
Grand Ridge I, IL			2.10	66	99
Barton I & II, IA			1.85	80	160
Fowler III, IN (2009)			1.84	60	99
Buffalo Ridge, MN (Phase III; 2002/Lake Benton II)	1.9[D]	6/15/02-9/15/02	1.81	138	103.5
Buffalo Ridge, MN (Phase II; 2002/Lake Benton I)	1.9[D]	6/15/02-9/15/02	1.64	143	107.25
Rugby, ND			1.6	71	149
Elm Creek, MN			1.49	67	100
Wessington Springs, SD (2009)			1.48	34	51
PrairieWinds ND1 (Minot), ND 2011			1.39	80	115.5
PrairieWinds SD1 (Crow Lake), SD			1.23	108	162
NPPD Ainsworth, NE			1.16	36	20.5
Buffalo Ridge, MN (Phase I; 1999)			0.74	73	25
Wessington Springs, SD (2010)			0.41	34	51
Buffalo Ridge I, SD (2010)			0.16	24	50.4

Appendix A1. Wind energy facilities in North America with comparable activity and fatality data for bats, separated by geographic region.

Wind Energy Facility	Bat Activity Estimate[A]	Bat Activity Dates	Fatality Estimate[B]	No. of Turbines	Total MW
Southern Plains					
Barton Chapel, TX			3.06	60	120
Big Smile, OK			2.90	66	132
Buffalo Gap II, TX			0.14	155	233
Red Hills, OK			0.11	82	123
Buffalo Gap I, TX			0.10	67	134
Northeast					
Mountaineer, WV (2003)			31.69	44	66
Mount Storm, WV (2009)	30.09	7/15/09-10/7/09	17.53	132	264
Noble Wethersfield, NY			16.30	84	126
Criterion, MD (2011)			15.61	28	70
Mount Storm, WV (2010)	36.67[G]	4/18/10-10/15/10	15.18	132	264
Locust Ridge, PA (Phase II; 2010)			14.38	51	102
Locust Ridge, PA (Phase II; 2009)			14.11	51	102
Casselman, PA (2008)			12.61	23	34.5
Maple Ridge, NY (2006)			11.21	120	198
Cohocton/Dutch Hills, NY (2010)			10.32	50	125
Wolfe Island, Ont (July-December 2010)			9.50	86	197.8
Maple Ridge, NY (2007)			9.42	195	321.75
Cohocton/Dutch Hill, NY (2009)			8.62	50	125
Casselman, PA (2009)			8.60	23	34.5
Noble Bliss, NY (2008)			7.80	67	100
Criterion, MD (2012)			7.62	28	70
Mount Storm, WV (2011)			7.43	132	264
Mount Storm, WV (Fall 2008)	35.2	7/20/08-10/12/08	6.62	82	164
Wolfe Island, Ont (July-December 2009)			6.42	86	197.8
Maple Ridge, NY (2008)			4.96	195	321.75
Noble Clinton, NY (2009)	1.9[C]	8/1/09-09/31/09	4.50	67	100
Casselman Curtailment, PA (2008)			4.40	23	35.4
Noble Altona, NY			4.34	65	97.5
Noble Ellenburg, NY (2009)	16.1[C]	8/16/09-09/15/09	3.91	54	80
Noble Bliss, NY (2009)			3.85	67	100
Lempster, NH (2010)			3.57	12	24
Noble Ellenburg, NY (2008)			3.46	54	80
Noble Clinton, NY (2008)	2.1[C]	8/8/08-09/31/08	3.14	67	100
Lempster, NH (2009)			3.11	12	24
Mars Hill, ME (2007)			2.91	28	42
Wolfe Island, Ont (July-December 2011)			2.49	86	197.8
Noble Chateaugay, NY			2.44	71	106.5
High Sheldon, NY (2010)			2.33	75	112.5
Beech Ridge, WV			2.03	67	100.5
Munnsville, NY (2008)			1.93	23	34.5
High Sheldon, NY (2011)			1.78	75	112.5
Stetson Mountain II, ME (2010)			1.65	17	25.5
Stetson Mountain I, ME (2009)	28.5; 0.3[H]	7/10/09-10/15/09	1.40	38	57
Mars Hill, ME (2008)			0.45	28	42
Stetson Mountain I, ME (2011)			0.28	38	57
Kibby, ME (2011)			0.12	44	132
Southeast					
Buffalo Mountain, TN (2005)			39.70	18	28.98
Buffalo Mountain, TN (2000-2003)	23.7[E]		31.54	3	1.98

Appendix A1. Wind energy facilities in North America with comparable activity and fatality data for bats, separated by geographic region.

Wind Energy Facility	Bat Activity Estimate[A]	Bat Activity Dates	Fatality Estimate[B]	No. of Turbines	Total MW
		Rocky Mountains			
Summerview, Alb (2008)	7.65[D]	07/15/06-07-09/30/06-07	11.42	39	70.2
Summerview, Alb (2006)			10.27	39	70.2
Judith Gap, MT (2006/2007)			8.93	90	135
Foote Creek Rim, WY (Phase I; 1999)			3.97	69	41.4
Judith Gap, MT (2009)			3.20	90	135
Foote Creek Rim, WY (Phase I; 2001-2002)	2.2[D,E]	6/15/01-9/1/01	1.57	69	41.4
Foote Creek Rim, WY (Phase I; 2000)	2.2[D,E]	6/15/00-9/1/00	1.05	69	41.4
		Southwest			
Dry Lake I, AZ	8.8	4/29/10-11/10/10	3.43	30	63
Dry Lake II, AZ	11.5	5/11/11-10/26/11	1.66	31	65
		Pacific Northwest			
Biglow Canyon, OR (Phase II; 2009/2010)			2.71	65	150
Nine Canyon, WA			2.47	37	48.1
Stateline, OR/WA (2003)			2.29	454	299
Elkhorn, OR (2010)			2.14	61	101
White Creek, WA (2007-2011)			2.04	89	204.7
Biglow Canyon, OR (Phase I; 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 (Phase I; 04/05)			1.88	41	41
Linden Ranch, WA			1.68	25	50
Pebble Springs, OR			1.55	47	98.7
Hopkins Ridge, WA (2008)			1.39	87	156.6
Harvest Wind, WA (2010-2012)			1.27	43	98.9
Elkhorn, OR (2008)			1.26	61	101
Vansycle, OR			1.12	38	24.9
Klondike III (Phase I), OR			1.11	125	223.6
Stateline, OR/WA (2002)			1.09	454	299
Stateline, OR/WA (2006)			0.95	454	299
Tuolumne (Windy Point I), WA			0.94	62	136.6
Klondike, OR			0.77	16	24
Combine Hills, OR (2011)			0.73	104	104
Hopkins Ridge, WA (2006)			0.63	83	150
Biglow Canyon, OR (Phase I; 2009)			0.58	76	125.4
Biglow Canyon, OR (Phase II; 2010/2011)			0.57	65	150
Hay Canyon, OR			0.53	48	100.8
Klondike II, OR			0.41	50	75
Windy Flats, WA			0.41	114	262.2
Vantage, WA			0.40	60	90
Wild Horse, WA			0.39	127	229
Goodnoe, WA			0.34	47	94
Marengo II, WA (2009/2010)			0.27	39	70.2
Biglow Canyon, OR (Phase III; 2010/2011)			0.22	76	174.8
Marengo I, WA (2009/2010)			0.17	78	140.4
Klondike IIIa (Phase II), OR			0.14	51	76.5
Kittitas Valley, WA (2011-2012)			0.12	48	100.8

Appendix A1. Wind energy facilities in North America with comparable activity and fatality data for bats, separated by geographic region.

Wind Energy Facility	Bat Activity Estimate[A]	Bat Activity Dates	Fatality Estimate[B]	No. of Turbines	Total MW
		California			
Shiloh I, CA			3.92	100	150
Shiloh II, CA			2.72	75	150
High Winds, CA (2004)			2.51	90	162
Dillon, CA			2.17	45	45
High Winds, CA (2005)			1.52	90	162
Alta Wind I, CA (2011)	4.42[I]	6/26/2009 - 10/31/2009	1.28	100	150
Diablo Winds, CA			0.82	31	20.46
Alite, CA			0.24	8	24
Alta Wind II-V, CA (2011)	0.78	6/26/2009 - 10/31/2009	0.08	190	570

A = Bat passes per detector-night
B = Number of fatalities per megawatt per year
C = Activity rate based on data collected at various heights all other activity rates are from ground-based units only
D = Activity rate was averaged across phases and/or years
E = Activity rate calculated by WEST from data presented in referenced report
F= Activity rate based on pre-construction monitoring; data for all other activity and fatality rates were collected concurrently
G = Activity rate based on data collected from ground-based units excluding reference stations during the spring, summer, and fall seasons
H = The overall activity rate of 28.5 is from reference stations located along forest edges which may be attractive to bats; the activity rate of 0.3 is from one unit placed on a nacelle
I = Average of ground-based detectors at CPC Proper (Phase I) for late summer/fall period only

Appendix A1 (*continued*). Wind energy facilities in North America with comparable fatality data for bats.

Project, Location	Activity Reference	Fatality Reference	Project, Location	Activity Reference	Fatality Reference
Alite, CA		Chatfield et al. 2010	Kewaunee County, WI		Howe et al. 2002
Alta Wind I, CA (11)	Solick et al. 2010	Chatfield et al. 2012	Kibby, ME (11)		Stantec 2012
Alta Wind II-V, CA (11)	Solick et al. 2010	Chatfield et al. 2012	Kittitas Valley, WA (11-12)		Stantec Consulting Services 2012
Barton I&II, IA		Derby et al. 2011a	Klondike, OR		Johnson et al. 2003
Barton Chapel, TX		WEST 2011	Klondike II, OR		NWC and WEST 2007
Beech Ridge, WV		Tidhar et al. 2013	Klondike III (Phase I), OR		Gritski et al. 2010
Big Horn, WA		Kronner et al. 2008	Klondike IIIa (Phase II), OR		Gritski et al. 2011
Big Smile, OK		Derby et al. 2013a	Leaning Juniper, OR		Gritski et al. 2008
Biglow Canyon, OR (Ph. I; 08)		Jeffrey et al. 2009a	Lempster, NH (09)		Tidhar et al. 2010
Biglow Canyon, OR (Ph. I; 09)		Enk et al. 2010	Lempster, NH (10)		Tidhar et al. 2011
Biglow Canyon, OR (Ph. II; 09/10)		Enk et al. 2011a	Linden Ranch, WA		Enz and Bay 2011
Biglow Canyon, OR (Ph. II; 10/ 11)		Enk et al. 2012b	Locust Ridge, PA (Ph. II; 09)		Arnett et al. 2011
Biglow Canyon, OR (Ph. III; 10/ 11)		Enk et al. 2012a	Locust Ridge, PA (Ph. II; 10)		Arnett et al. 2011
Blue Sky Green Field, WI	Gruver 2008	Gruver et al. 2009	Maple Ridge, NY (06)		Jain et al. 2007
Buffalo Gap I, TX		Tierney 2007	Maple Ridge, NY (07)		Jain et al. 2009a
Buffalo Gap II, TX		Tierney 2009	Maple Ridge, NY (08)		Jain et al. 2009d
Buffalo Mountain, TN (00-03)	Fiedler 2004	Nicholson et al. 2005	Marengo I, WA (09)		URS Corporation 2010b
Buffalo Mountain, TN (05)		Fiedler et al. 2007	Marengo II, WA (09)		URS Corporation 2010c
Buffalo Ridge, MN (Ph. I; 99)		Johnson et al. 2000	Mars Hill, ME (07)		Stantec 2008
Buffalo Ridge, MN (Ph. II; 98)		Johnson et al. 2000	Mars Hill, ME (08)		Stantec 2009a
Buffalo Ridge, MN (Ph. II; 99)		Johnson et al. 2000	Moraine II, MN		Derby et al. 2010d
Buffalo Ridge, MN (Ph. II; 01/Lake Benton I)	Johnson et al. 2004	Johnson et al. 2004	Mount Storm, WV (Fall 08)	Young et al. 2009b	Young et al. 2009b
Buffalo Ridge, MN (Ph. II; 02/Lake Benton I)	Johnson et al. 2004	Johnson et al. 2004	Mount Storm, WV (09)	Young et al. 2009a, 2010b	Young et al. 2009a, 2010b
Buffalo Ridge, MN (Ph. III; 99)		Johnson et al. 2000	Mount Storm, WV (10)	Young et al. 2010a, 2011b	Young et al. 2010a, 2011b
Buffalo Ridge, MN (Ph. III; 01/Lake Benton II)	Johnson et al. 2004	Johnson et al. 2004	Mount Storm, WV (11)		Young et al. 2011a, 2012b
Buffalo Ridge, MN (Ph. III; 02/Lake Benton II)	Johnson et al. 2004	Johnson et al. 2004	Mountaineer, WV (2003)		Kerns and Kerlinger 2004
Buffalo Ridge I, SD (10)		Derby et al. 2010b	Munnsville, NY (08)		Stantec 2009b
Buffalo Ridge II, SD (11)		Derby et al. 2012a	Nine Canyon, WA		Erickson et al. 2003
Casselman, PA (08)		Arnett et al. 2009a	Noble Altona, NY		Jain et al. 2011b
Casselman, PA (09)		Arnett et al. 2010	Noble Bliss, NY (08)		Jain et al.2009e
Casselman Curtailment, PA (08)		Arnett et al. 2009b	Noble Bliss, NY (09)		Jain et al. 2010a
Cedar Ridge, WI (09)	BHE Environmental 2008	BHE Environmental 2010	Noble Chateaugay, NY		Jain et al. 2011c
Cedar Ridge, WI (10)	BHE Environmental 2008	BHE Environmental 2011	Noble Clinton, NY (08)	Reynolds 2010a	Jain et al. 2009c
Cohocton/Dutch Hill, NY (09)		Stantec 2010	Noble Clinton, NY (09)	Reynolds 2010a	Jain et al. 2010b
Cohocton/Dutch Hill, NY (10)		Stantec 2011	Noble Ellenburg, NY (08)		Jain et al. 2009b
Combine Hills, OR		Young et al. 2006	Noble Ellenburg, NY (09)	Reynolds 2010b	Jain et al. 2010c
Combine Hills, OR (11)		Enz et al. 2012	Noble Wethersfield, NY		Jain et al. 2011a
Crescent Ridge, IL		Kerlinger et al. 2007	NPPD Ainsworth, NE		Derby et al. 2007
Criterion, MD (11)		Young et al. 2012a	Pebble Springs, OR		Gritski and Kronner 2010b
Criterion, MD (12)		Young et al. 2013	Pioneer Prairie, IA (Ph. II)		Chodachek et al. 2012
Crystal Lake II, IA		Derby et al. 2010a	PrairieWinds ND1 (Minot), ND		Derby et al. 2011c
Diablo Winds, CA		WEST 2006, 2008	PrairieWinds ND1 (Minot), ND (11)		Derby et al. 2012c
Dillon, CA		Chatfield et al. 2009	PrairieWinds SD1, SD		Derby et al. 2012d
Dry Lake I, AZ	Thompson et al. 2011	Thompson et al. 2011	Red Hills, OK		Derby et al. 2013b
Dry Lake II, AZ	Thompson and Bay 2012	Thompson and Bay 2012	Ripley, Ont (08)		Jacques Whitford 2009

Appendix A1 (*continued*). Wind energy facilities in North America with comparable fatality data for bats.

Project, Location	Activity Reference	Fatality Reference	Project, Location	Activity Reference	Fatality Reference
Elkhorn, OR (08)		Jeffrey et a. 2009b	Rugby, ND		Derby et al. 2011b
Elkhorn, OR (10)		Enk et al. 2011b	Shiloh I, CA		Kerlinger et al. 2009
Elm Creek, MN		Derby et al. 2010c	Shiloh II, CA		Kerlinger et al. 2010b
Elm Creek II, MN		Derby et al. 2012b	Stateline, OR/WA (02)		Erickson et al. 2004
Foote Creek Rim, WY (Ph. I; 99)		Young et al. 2003a	Stateline, OR/WA (03)		Erickson et al. 2004
Foote Creek Rim, WY (Ph. I; 00)	Gruver 2002	Young et al. 2003a, 2003b	Stateline, OR/WA (06)		Erickson et al. 2007
Foote Creek Rim, WY (Ph. I; 01-02)	Gruver 2002	Young et al. 2003a, 2003b	Stetson Mountain, ME (09)	Stantec 2009c	Stantec 2009c
Forward Energy Center, WI	Watt and Drake 2011	Grodsky and Drake 2011	Stetson Mountain I, ME (11)		Normandeau Associates 2011
Fowler I, IN (09)		Good et al. 2011	Stetson Mountain II, ME (10)		Normandeau Associates 2010
Fowler III, IN (09)		Good et al. 2011	Summerview, Alb (06)		Brown and Hamilton 2006b
Fowler I, II, III, IN (10)		Good et al. 2011	Summerview, Alb (08)	Baerwald 2008	Baerwald 2008
Fowler I, II, III, IN (11)		Good et al. 2012	Top of Iowa, IA (03)		Jain 2005
Fowler I, II, III, IN (12)		Good et al. 2013	Top of Iowa, IA (04)	Jain 2005	Jain 2005
Goodnoe, WA		URS Corporation 2010a	Tuolumne (Windy Point I), WA		Enz and Bay 2010
Grand Ridge, IL		Derby et al. 2010g	Vansycle, OR		Erickson et al. 2000
Harrow, Ont. (10)		NRSI 2011	Vantage, WA		Ventus 2012
Harvest Wind, WA (10-12)		Downes and Gritski 2012a	Wessington Springs, SD (09)		Derby et al. 2010f
Hay Canyon, OR		Gritski and Kronner 2010a	Wessington Springs, SD (10)		Derby et al. 2011d
High Sheldon, NY (10)		Tidhar et al. 2012a	White Creek, WA (07-11)		Downes and Gritski 2012b
High Sheldon, NY (11)		Tidhar et al. 2012b	Wild Horse, WA		Erickson et al. 2008
High Winds, CA (04)		Kerlinger et al. 2006	Windy Flats, WA		Enz et al. 2011
High Winds, CA (05)		Kerlinger et al. 2006	Winnebago, IA		Derby et al. 2010e
Hopkins Ridge, WA (06)		Young et al. 2007	Wolfe Island, Ont (Jul-Dec 09)		Stantec Ltd. 2010b
Hopkins Ridge, WA (08)		Young et al. 2009c	Wolfe Island, Ont (Jul-Dec 10)		Stantec Ltd. 2011b
Judith Gap, MT (06-07)		TRC 2008	Wolfe Island, Ont (Jul-Dec 11)		Stantec Ltd. 2012
Judith Gap, MT (09)		Poulton and Erickson 2010			

Appendix A2. All publicly-available post-construction monitoring studies, regardless of comparability.

Data from the following sources:

Project, Location	Reference	Project, Location	Reference
Alite, CA	Chatfield et al. 2010	Klondike II, OR	NWC and WEST 2007
Alta Wind I, CA (11)	Chatfield et al. 2012	Klondike III (Phase I), OR	Gritski et al. 2010
Alta Wind II-V, CA (11)	Chatfield et al. 2012	Klondike IIIa (Phase II), OR	Gritski et al. 2011
Barton I & II, IA	Derby et al. 2011a	Leaning Juniper, OR	Gritski et al. 2008
Barton Chapel, TX	WEST 2011	Lempster, NH (09)	Tidhar et al. 2010
Beech Ridge, WV	Tidhar et al. 2013	Lempster, NH (10)	Tidhar et al. 2011
Big Horn, WA	Kronner et al. 2008	Linden Ranch, WA	Enz and Bay 2011
Big Smile, OK	Derby et al. 2013a	Locust Ridge, PA (Phase II; 09)	Arnett et al. 2011
Biglow Canyon, OR (Phase I; 08)	Jeffrey et al. 2009a	Locust Ridge, PA (Phase II; 10)	Arnett et al. 2011
Biglow Canyon, OR (Phase I; 09)	Enk et al. 2010	Madison, NY	Kerlinger 2002b
Biglow Canyon, OR (Phase II; 09/10)	Enk et al. 2011a	Maple Ridge, NY (06)	Jain et al. 2007
Biglow Canyon, OR (Phase II; 10/11)	Enk et al. 2012b	Maple Ridge, NY (07)	Jain et al. 2009a
Biglow Canyon, OR (Phase III; 10/11)	Enk et al. 2012a	Maple Ridge, NY (08)	Jain et al. 2009d
Blue Sky Green Field, WI	Gruver et al. 2009	Marengo I, WA (09)	URS Corporation 2010b
Buena Vista, CA	Insignia Environmental 2009	Marengo II, WA (09)	URS Corporation 2010c
Buffalo Gap I, TX	Tierney 2007	Mars Hill, ME (07)	Stantec 2008
Buffalo Gap II, TX	Tierney 2009	Mars Hill, ME (08)	Stantec 2009a
Buffalo Mountain, TN (00-03)	Nicholson et al. 2005	McBride, Alb (04)	Brown and Hamilton 2004
Buffalo Mountain, TN (05)	Fiedler et al. 2007	Melancthon, Ont (Phase I)	Stantec Ltd. 2008
Buffalo Ridge, MN (94/95)	Osborn et al. 1996, 2000	Meyersdale, PA (04)	Arnett et al. 2005
Buffalo Ridge, MN (Phase I; 96)	Johnson et al. 2000	Moraine II, MN	Derby et al. 2010d
Buffalo Ridge, MN (Phase I; 97)	Johnson et al. 2000	Mount Storm, WV (Fall 08)	Young et al. 2009b
Buffalo Ridge, MN (Phase I; 98)	Johnson et al. 2000	Mount Storm, WV (09)	Young et al. 2009a, 2010b
Buffalo Ridge, MN (Phase I; 99)	Johnson et al. 2000	Mount Storm, WV (10)	Young et al. 2010a, 2011b
Buffalo Ridge, MN (Phase II;98)	Johnson et al. 2000	Mount Storm, WV (11)	Young et al. 2011a, 2012b
Buffalo Ridge, MN (Phase II; 99)	Johnson et al. 2000	Mountaineer, WV (03)	Kerns and Kerlinger 2004
Buffalo Ridge, MN (Phase II; 01/Lake Benton I)	Johnson et al. 2004	Mountaineer, WV (04)	Arnett et al. 2005
Buffalo Ridge, MN (Phase II; 02/Lake Benton I)	Johnson et al. 2004	Munnsville, NY (08)	Stantec 2009b
Buffalo Ridge, MN (Phase III; 99)	Johnson et al. 2000	Nine Canyon, WA	Erickson et al. 2003
Buffalo Ridge, MN (Phase III; 01/Lake Benton II)	Johnson et al. 2004	Noble Altona, NY	Jain et al. 2011b
Buffalo Ridge, MN (Phase III; 02/Lake Benton II)	Johnson et al. 2004	Noble Bliss, NY (08)	Jain et al.2009e
Buffalo Ridge I, SD (10)	Derby et al. 2010b	Noble Bliss, NY (09)	Jain et al. 2010a
Buffalo Ridge II, SD (11)	Derby et al. 2012a	Noble Chateaugay, NY	Jain et al. 2011c
Casselman, PA (08)	Arnett et al. 2009a	Noble Clinton, NY (08)	Jain et al. 2009c
Casselman, PA (09)	Arnett et al. 2010	Noble Clinton, NY (09)	Jain et al. 2010b
Casselman Curtailment, PA (08)	Arnett et al. 2009b	Noble Ellenburg, NY (08)	Jain et al. 2009b
Castle River, Alb (01)	Brown and Hamilton 2006a	Noble Ellenburg, NY (09)	Jain et al. 2010c
Castle River, Alb (02)	Brown and Hamilton 2006a	Noble Wethersfield, NY	Jain et al. 2011a
Cedar Ridge, WI (09)	BHE Environmental 2010	NPPD Ainsworth, NE	Derby et al. 2007
Cedar Ridge, WI (10)	BHE Environmental 2011	Oklahoma Wind Energy Center, OK	Piorkowski and O'Connell 2010
Cohocton/Dutch Hill, NY (09)	Stantec 2010	Pebble Springs, OR	Gritski and Kronner 2010b
Cohocton/Dutch Hills, NY (10)	Stantec 2011	Pine Tree, CA	BioResource Consultants 2010
Combine Hills, OR	Young et al. 2006	Pioneer Prairie I, IA (Phase II)	Chodachek et al. 2012
Combine Hills, OR (11)	Enz et al. 2012	PrairieWinds ND1 (Minot), ND	Derby et al. 2011c
Condon, OR	Fishman Ecological Services 2003	PrairieWinds ND1 (Minot), ND (11)	Derby et al. 2012c
Crescent Ridge, IL	Kerlinger et al. 2007	PrairieWinds SD1, SD	Derby et al. 2012d
Criterion, MD (11)	Young et al. 2012a	Prince Wind Farm, Ont (06)	Natural Resource Solutions 2009
Criterion, MD (12)	Young et al. 2013	Prince Wind Farm, Ont (07)	Natural Resource Solutions 2009
Crystal Lake II, IA	Derby et al. 2010a	Prince Wind Farm, Ont (08)	Natural Resource Solutions 2009
Diablo Winds, CA	WEST 2006, 2008	Red Canyon, TX	Miller 2008
Dillon, CA	Chatfield et al. 2009	Red Hills, OK	Derby et al. 2013b
Dry Lake I, AZ	Thompson et al. 2011	Ripley, Ont (08)	Jacques Whitford 2009
Dry Lake II, AZ	Thompson and Bay 2012	Ripley, Ont (Fall 09)	Golder Associates 2010
Elkhorn, OR (08)	Jeffrey et a. 2009b	Rugby, ND	Derby et al. 2011b
Elkhorn, OR (10)	Enk et al. 2011b	San Gorgonio, CA	Anderson et al. 2005
Elm Creek, MN	Derby et al. 2010c	Searsburg, VT (07)	Kerlinger 2002a
Elm Creek II, MN	Derby et al. 2012b	Shiloh I, CA	Kerlinger et al. 2009
Erie Shores, Ont	James 2008	Shiloh II, CA	Kerlinger et al. 2010b
Foote Creek Rim, WY (Phase I; 99)	Young et al. 2003a	SMUD Solano, CA	Erickson and Sharp 2005
Foote Creek Rim, WY (Phase I; 00)	Young et al. 2003a	Stateline, OR/WA (02)	Erickson et al. 2004
Foote Creek Rim, WY (Phase I; 01-02)	Young et al. 2003a	Stateline, OR/WA (03)	Erickson et al. 2004
Forward Energy Center, WI	Grodsky and Drake 2011	Stateline, OR/WA (06)	Erickson et al. 2007
Fowler I, IN (09)	Good et al. 2011	Stetson Mountain I, ME (09)	Stantec 2009c
Fowler I, II, III, IN (10)	Good et al. 2011	Stetson Mountain I, ME (11)	Normandeau Associates 2011
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Fowler I, II, III, IN (12)	Good et al. 2013	Summerview, Alb (06)	Brown and Hamilton 2006b
Fowler III, IN (09)	Good et al. 2011	Summerview, Alb (08)	Baerwald 2008
Goodnoe, WA	URS Corporation 2010a	Tehachapi, CA	Anderson et al. 2004
Grand Ridge I, IL	Derby et al. 2010g	Top of Iowa, IA (03)	Jain 2005
Harrow, Ont (10)	Natural Resource Solutions 2011	Top of Iowa, IA (04)	Jain 2005
Harvest Wind, WA (10-12)	Downes and Gritski 2012a	Tuolumne (Windy Point I), WA	Enz and Bay 2010
Hay Canyon, OR	Gritski and Kronner 2010a	Vansycle, OR	Erickson et al. 2000
High Sheldon, NY (10)	Tidhar et al. 2012a	Vantage, WA	Ventus Environmental Solutions 2012
High Sheldon, NY (11)	Tidhar et al. 2012b	Wessington Springs, SD (09)	Derby et al. 2010f
High Winds, CA (04)	Kerlinger et al. 2006	Wessington Springs, SD (10)	Derby et al. 2011d
High Winds, CA (05)	Kerlinger et al. 2006	White Creek, WA (07-11)	Downes and Gritski 2012b
Hopkins Ridge, WA (06)	Young et al. 2007	Wild Horse, WA	Erickson et al. 2008
Hopkins Ridge, WA (08)	Young et al. 2009c	Windy Flats, WA	Enz et al. 2011
Jersey Atlantic, NJ	NJAS 2008a, 2008b, 2009	Winnebago, IA	Derby et al. 2010e
Judith Gap, MT (06-07)	TRC 2008	Wolfe Island, Ont (May-June 09)	Stantec Ltd. 2010a
Judith Gap, MT (09)	Poulton and Erickson 2010	Wolfe Island, Ont (July-Dec 09)	Stantec Ltd. 2010b
Kewaunee County, WI	Howe et al. 2002	Wolfe Island, Ont (Jan-June 10)	Stantec Ltd. 2011a
Kibby, ME (11)	Stantec 2012	Wolfe Island, Ont (July-Dec 10)	Stantec Ltd. 2011b
Kittitas Valley, WA (11-12)	Stantec Consulting 2012	Wolfe Island, Ont (Jan-June 11)	Stantec Ltd. 2011c
Klondike, OR	Johnson et al. 2003	Wolfe Island, Ont (July-Dec 11)	Stantec Ltd. 2012

ENVIRONMENTAL & STATISTICAL CONSULTANTS
4007 State Street, Suite 109, Bismarck, ND 58503
Phone: 701-250-1756 ◆ www.west-inc.com ◆ Fax: 701-250-1761

Draft – Confidential Business Information

July 11, 2013

Casey Willis
Red Pine Wind Project, LLC
3760 State St., Suite 102
Santa Barbara, CA 93105

RE: Red Pine Raptor Nest Surveys

Dear Mr. Willis,

As part of agency approved baseline survey efforts, surveys for raptor nests were completed at the Red Pine Wind Resource Area on May 15-17, 2013 by a qualified biologist from Western EcoSystems Technology, Inc. Surveys were completed by driving and walking public roads and other accessible trails throughout the project area and 2-mile buffer around the project area. Stops were made frequently to look for raptor nests in trees and other potentially suitable structures (e.g., powerline poles) using binoculars. All raptor nests observed were mapped on aerial photographs. All raptor nests were recorded in the project area and a 1-mile buffer. Only eagle nests were to be recorded out to the 2-mile buffer.

Eighteen raptor nest structures were documented during the surveys. Within the project area and 1-mile buffer, two occupied red-tailed hawk nests, one unknown raptor occupied nest and 15 unoccupied unknown raptor nests were observed (see attached map). No confirmed eagle nests were observed during the survey.

This area has an overall raptor nesting density of 0.027 active nests/square mile.

If you have any questions or require additional information, please feel free to call me at 701-250-1756.

Sincerely,

Clayton Derby
Senior Manager

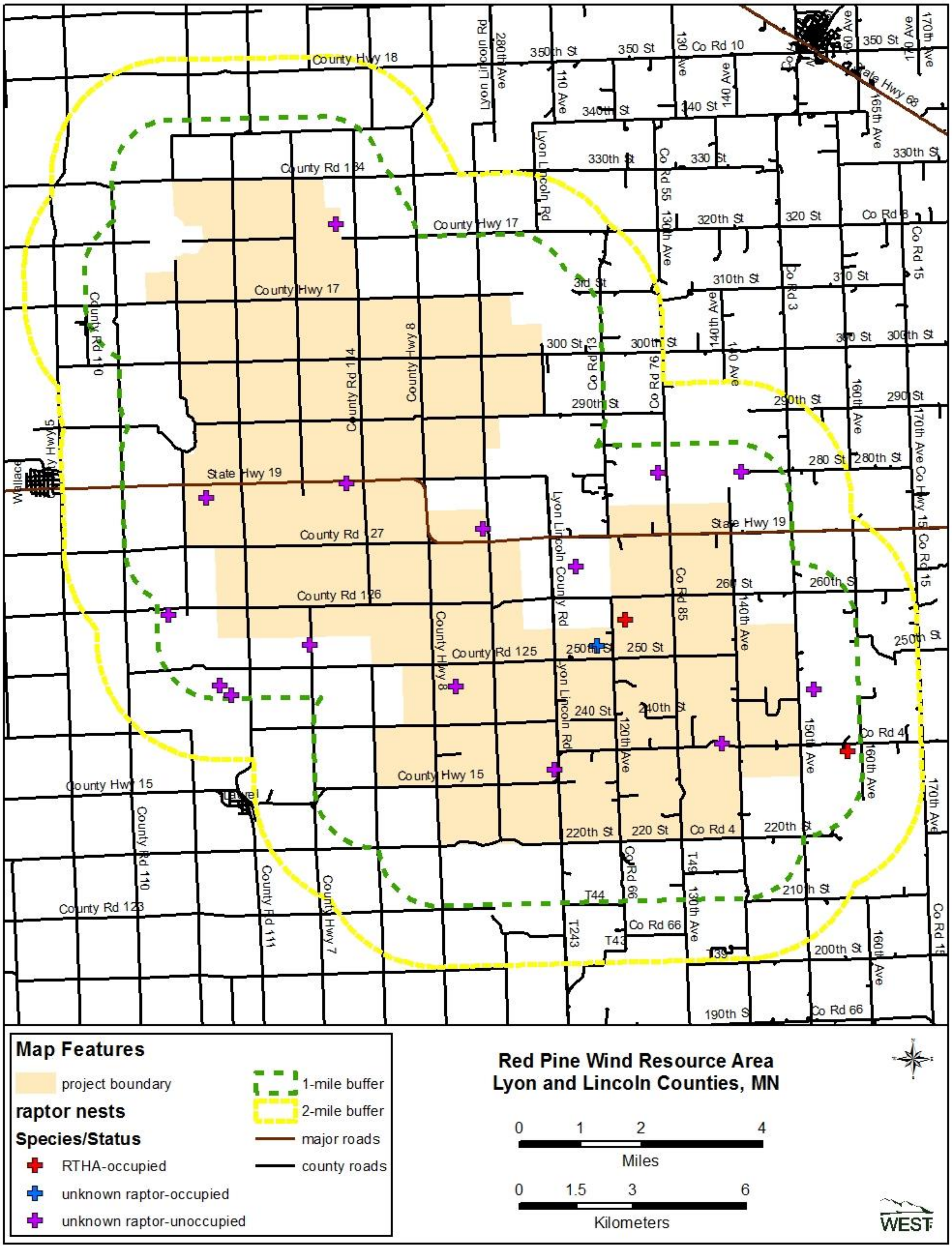

Figure 1. Raptor nests documented at the Red Pine Wind Resource Area in spring 2013.

2013 Breeding Bird Transect Studies for the Red Pine Wind Resource Area Lyon and Lincoln Counties, Minnesota

June – July 2013

Prepared for:

Red Pine Wind Project, LLC

3760 State Street, Suite 200
Santa Barbara, California 93105

Prepared by:

Clayton Derby and Ann Dahl

Western EcoSystems Technology, Inc.
4007 State Street, Suite 109
Bismarck, North Dakota 58503

June 30, 2014

EXECUTIVE SUMMARY

Red Pine Wind Project, LLC (Red Pine) contracted with Western EcoSystems Technology, Inc. (WEST) to conduct surveys and monitor wildlife resources at the Red Pine Wind Resource Area (RPWRA), located in eastern Lincoln and western Lyons Counties, Minnesota. This report contains results from breeding bird transect surveys conducted from June 11 to July 10, 2013. The principal objectives of the study were to: 1) provide site-specific bird resource and use data that would be useful in evaluating potential impacts from the proposed wind energy facility and 2) provide information that could be used in project planning and design of the facility to minimize impacts to birds.

Surveyors walked along 16 pre-determined line transects that were 400 meters (m; 1,312 feet [ft]) long and were located in predominantly grassland habitat. A total of 1,500 individual bird observations within 1,006 separate groups were recorded. Cumulatively, five species (10.6% of all species) accounted for 49.7% of the individual observations: bobolink (243 individuals), red-winged blackbird (131), common yellowthroat (129), cliff swallow (129), and clay-colored sparrow (114). Forty-seven unique species were identified during the transect surveys.

Mean bird use recorded during transect surveys was 31.25 birds/transect/survey. Passerines had the highest use of all bird types recorded during the breeding bird surveys (26.85 birds/transect/survey), followed by doves/pigeons (1.06), and waterfowl (0.98). Passerines made up 85.9% of all birds observed during the surveys and were seen in 100% of the surveys. Within the passerines bird type, blackbirds/orioles were the subtype with highest use (10.02 birds/transect/survey). Blackbirds/orioles accounted for 32.1% of all bird observations during transect surveys and were seen during 93.8% of surveys. Grassland birds/sparrows (grassland/sparrows) were the second most commonly observed subtype, with 7.15 birds/transect/survey, accounting for 22.9% of all observations; grassland/sparrows were observed in 89.6% of surveys.For all bird species combined, use was highest at transects 5N and 5S.

No federal endangered, threatened, candidate or proposed species were observed during transect surveys. No Minnesota endangered, threatened species, or special concern species were observed. Two bird species, the dickcissel (77 individuals) and grasshopper sparrow (four), designated as US Fish and Wildlife Service Bird of Conservation Concern for the Prairie Potholes and Partners in Flight priority species in the Northern Tallgrass Prairie, were observed during surveys. The bobolink (243) and sedge wren (15) are also Partners in Flight priority species in the Northern Tallgrass Prairie.

STUDY PARTICIPANTS

Western EcoSystems Technology

Clayton Derby	Senior Project Manager
Kimberly Bay	Data Analyst, Statistician
Chris Fritchman	Statistician
Ann Dahl	GIS Technician
Andrea Palochak	Technical Editor
Lauren Michelson	Field Technician

REPORT REFERENCE

Derby, C. and A. Dahl. 2014. 2013 Breeding Bird Transect Studies for the Red Pine Wind Resource Area, Lyon and Lincoln Counties, Minnesota. Final Report. June – July 2013. Prepared for Red Pine Wind Power, LLC, Santa Barbara, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

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INTRODUCTION

Red Pine Wind Project, LLC (Red Pine) contracted with Western EcoSystems Technology, Inc. (WEST) to conduct surveys and monitor wildlife resources at the Red Pine Wind Resource Area (RPWRA). This report contains results from breeding bird transect surveys at the RPWRA from June 11 to July 10, 2013. The principal objectives of the study were to: 1) provide site-specific bird resource and use data that would be useful in evaluating potential impacts from the proposed wind energy facility and 2) provide information that could be used in project planning and design of the facility to minimize impacts to birds.

STUDY AREA

The proposed 38,826.9 acre (15,712.7 hectare) RPWRA is located in eastern Lincoln and western Lyons Counties, Minnesota, approximately 2.5 kilometers (km; 1.6 miles [mi]) east of the town of Wilno, Minnesota (Figure 1). The RPWRA has flat to rolling topography and is located on a slight ridge. Elevation of the study area ranges from 421 to 516 meters (m; 1,381 to 1,693 feet [ft]) above mean sea level.

The RPWRA contains areas of cultivated agriculture, grasslands, wetlands and lakes, developed areas and rural homes, and small wooded areas (Derby and Dahl 2014). The majority of the study area, approximately 74%, is cultivated agriculture, the majority of which is corn (*Zea mays*) and soybeans (*Glycine max*; US Department of Agriculture [USDA] National Agricultural Statistics Service [NASS] 2012). According to the US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI), about 4% of the RPWRA is wetlands; about 74% of those wetlands are freshwater emergent wetlands and about 20% are lakes (USFWS NWI 2007).

Three named creeks and rivers are located in the RPWRA. Coon Creek briefly loops into the southern portion of the RPWRA. The South Branch of the Yellow Medicine River flows west to east through the center of the project area. Three-mile Creek is located in the southern portion of the RPWRA and also flows from west to east. Several other unnamed drainages are located throughout the RPWRA.

Ownership within the project area is largely private, but numerous protected areas are located in the RPWRA (US Geological Survey [USGS] 2012). The USFWS Lyon County Waterfowl Production Area is located in the southern portion of the RPWRA. There are several USDA Farm Service Agency Conservation Reserve Enhancement Program easements located throughout the RPWRA. Several Minnesota Department of Natural Resources Wildlife Management Areas are also present. Camden State Park is about 6.4 km (4.0 mi) southeast of the RPWRA.

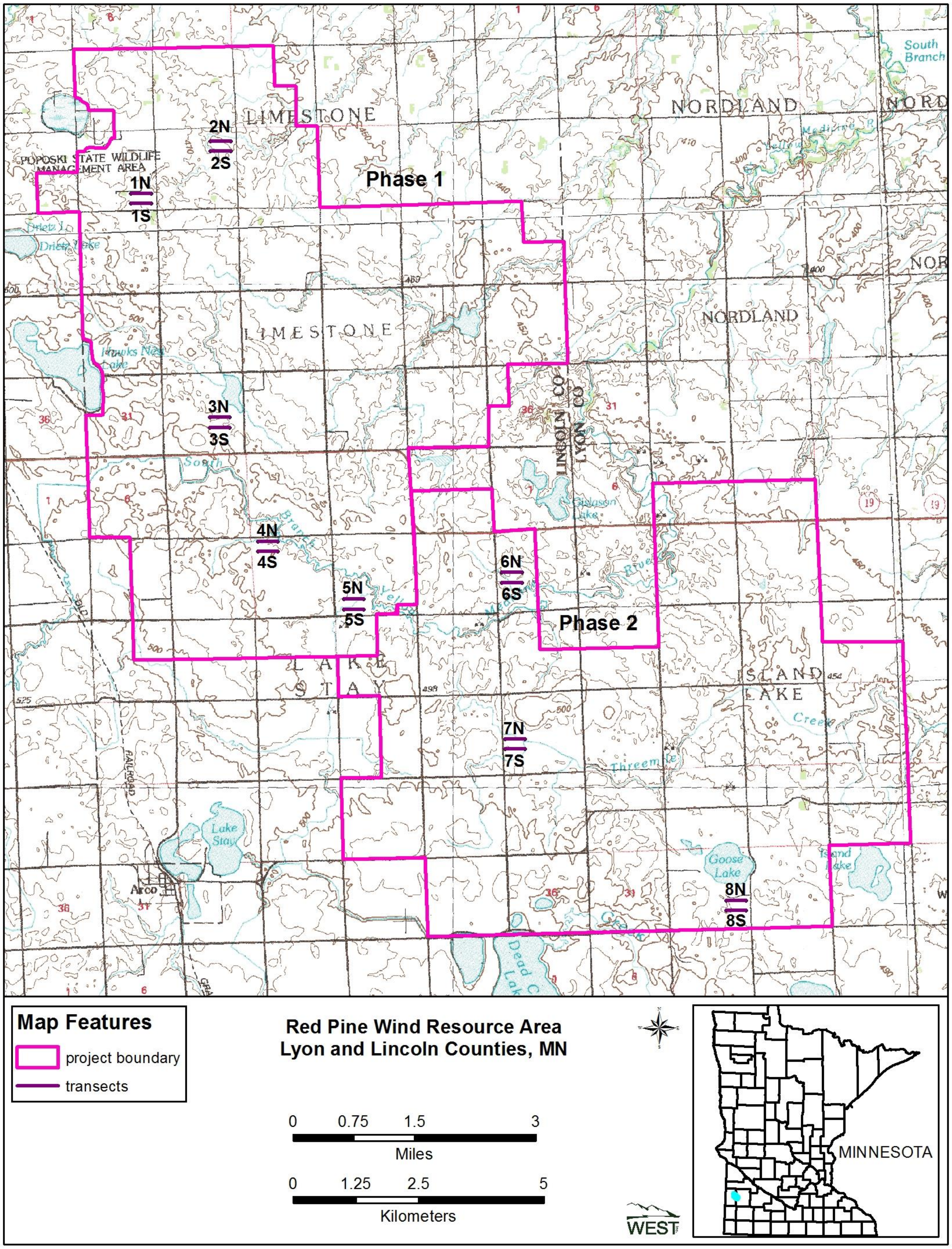


Figure 1. Location of breeding bird transects at the Red Pine Wind Resource Area.

METHODS

Breeding Bird Presence and Use

Breeding Bird Survey Methods

Surveyors slowly walked along 16 pre-determined line transects using global positioning system units to navigate (Figure 1). Transects were 400 m long and were located in predominantly grassland habitat. Surveyors recorded all birds observed or heard within 50 m (164 ft) of either side of the transect line. Raptors and other large birds (e.g., waterfowl, waterbirds) also were recorded during the survey beyond the 50 m survey area. Transects were paired such that the observer recorded species along one 400 m long transect and then returned on another 400 m long transect that was approximately 200 m away.

Breeding Bird Observation Schedule

Each of the 16 transects was surveyed three times from June 11 to July 10, 2013. Surveys were conducted from sunrise to 10:00 a.m. All species observed by sight or sound were recorded.

Breeding Bird Presence and Use Analysis

Species lists, with the number of observations and the number of groups, were generated, including all observations of birds detected, regardless of their distance from the transect.

<u>Species Diversity and Species Richness</u>
Bird species diversity was defined as the total number of unique species observed. Species richness was calculated as the mean number of species observed per transect survey (i.e., number of species/survey).

<u>Bird Use, Percent Composition, and Frequency of Occurrence</u>
For the standardized bird use estimates (i.e., number of birds/transect/survey), only observations of birds detected within 50 m on either side of the transect were used. Mean use was calculated by determining the number of birds observed within 50 m of the transect for each given visit and then averaging by the number of transects surveyed during that visit. A second averaging occurred across the number of visits during the study period. A visit is defined as the required length of time to survey all of the transects once within the wind resource area.

Percent composition was calculated as the proportion of the overall mean use for a particular species or bird type. The frequency of occurrence (% frequency) was calculated as the percent of surveys in which a particular species or bird type is observed. Frequency of occurrence and percent composition provided relative estimates of species exposure to the wind resource area.

RESULTS

Breeding Bird Survey Results

Breeding bird surveys were conducted three times between June 11 to July 10, 2013, at the RPWRA; 48 transect surveys were conducted (Table 1).

Table 1. Number of visits, mean bird use (number of birds/transect/survey), species richness (species/survey), species diversity (number of unique species), and number of surveys conducted during transect bird use surveys at the Red Pine Wind Resource Area, June 11 to July 10, 2013.

Season	Number of Visits	Bird Use	Species Richness	Species Diversity	Number of Surveys Conducted
Breeding	3	31.25	9.35	47	48

A total of 1,500 individual bird observations within 1,006 separate groups were recorded, regardless of distance from observer (Table 2). Cumulatively, five species (10.6% of all species) accounted for 49.7% of the individual observations: bobolink (*Dolichonyx oryzivorus*; 243 individuals), red-winged blackbird (*Agelaius phoeniceus*; 131), common yellowthroat (*Geothlypis trichas*; 129), cliff swallow (*Petrochelidon pyrrhonota*; 129), and clay-colored sparrow (*Spizella pallida*; 114). All other species accounted for less than 6% of the total observations individually (Table 2).

Table 2. Number of groups and individuals for each bird type, subtype, and species observed during the breeding bird transect surveys (regardless of distance from transect) at the Red Pine Wind Resource Area, June 11 to July 10, 2013.

Bird Type/Subtype/Species	Scientific Name	Groups	Individuals
Waterbirds		**15**	**27**
double-crested cormorant	*Phalacrocorax auritus*	13	24
great egret	*Ardea alba*	1	1
unidentified egret		1	2
Waterfowl		**32**	**47**
blue-winged teal	*Anas discors*	3	4
Canada goose	*Branta canadensis*	1	1
mallard	*Anas platyrhynchos*	22	34
northern shoveler	*Anas clypeata*	6	8
Shorebirds		**30**	**41**
killdeer	*Charadrius vociferus*	24	35
upland sandpiper	*Bartramia longicauda*	6	6
Rails/ Coots		**3**	**3**
sora	*Porzana carolina*	3	3
Raptors		**7**	**7**
northen harrier	*Circus cyaneus*	1	1
red-tailed hawk	*Buteo jamaicensis*	6	6
Vultures		**1**	**1**
turkey vulture	*Cathartes aura*	1	1
Upland Game Birds		**30**	**31**
ring-necked pheasant	*Phasianus colchicus*	30	31
Doves/Pigeons		**9**	**51**
mourning dove	*Zenaida macroura*	9	51
Large Corvids		**1**	**1**

Table 2. Number of groups and individuals for each bird type, subtype, and species observed during the breeding bird transect surveys (regardless of distance from transect) at the Red Pine Wind Resource Area, June 11 to July 10, 2013.

Bird Type/Subtype/Species	Scientific Name	Groups	Individuals
American crow	*Corvus brachyrhynchos*	1	1
Passerines		**876**	**1,289**
Blackbirds/Orioles		*259*	*481*
Baltimore oriole	*Icterus galbula*	4	4
bobolink	*Dolichonyx oryzivorus*	120	243
brown-headed cowbird	*Molothrus ater*	7	21
common grackle	*Quiscalus quiscula*	27	60
red-winged blackbird	*Agelaius phoeniceus*	79	131
western meadowlark	*Sturnella neglecta*	16	16
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	6	6
Finches/Crossbills		*41*	*74*
American goldfinch	*Spinus tristis*	41	74
Flycatchers		*15*	*16*
eastern kingbird	*Tyrannus tyrannus*	15	16
Grassland/Sparrows		*290*	*343*
chipping sparrow	*Spizella passerina*	20	26
clay-colored sparrow	*Spizella pallida*	91	114
dickcissel	*Spiza americana*	68	77
field sparrow	*Spizella pusilla*	9	11
grasshopper sparrow	*Ammodramus savannarum*	2	4
Savannah sparrow	*Passerculus sandwichensis*	*80*	*88*
song sparrow	*Melospiza melodia*	17	19
unidentified sparrow		3	4
Mimids		*10*	*10*
brown thrasher	*Toxostoma rufum*	1	1
gray catbird	*Dumetella carolinensis*	9	9
Swallows		76	165
barn swallow	*Hirundo rustica*	8	11
cliff swallow	*Petrochelidon pyrrhonota*	55	129
northern rough-winged swallow	*Stelgidopteryx serripennis*	2	10
tree swallow	*Tachycineta bicolor*	11	15
Tangers/Grosbeaks/Cardinals		*1*	*1*
rose-breasted grosbeak	*Pheucticus ludovicianus*	1	1
Thrushes		*7*	*7*
American robin	*Turdus migratorius*	7	7
Vireos		*8*	*9*
warbling vireo	*Vireo gilvus*	8	9
Warblers		*152*	*165*
American redstart	*Setophaga ruticilla*	1	1
common yellowthroat	*Geothlypis trichas*	118	129
yellow warbler	*Setophaga petechial*	33	35
Waxwings		*1*	*2*
cedar waxwings	*Bombycilla cedrorum*	*1*	*2*
Wrens		*15*	*15*
sedge wren	*Cisothorus platensis*	15	15
Woodpeckers		**3**	**3**
hairy woodpecker	*Picoides villosus*	2	2
red-bellied woodpecker	*Melanerpes carolinus*	1	1
Overall		**1,006**	**1,500**

Species Diversity and Species Richness

Forty-seven unique species (species diversity) were identified during the transect surveys; species richness was 9.35 species/survey (Table 1).

Bird Use, Composition, and Frequency of Occurrence by Species and Type

Mean bird use (number of birds/transect/survey) recorded during transect surveys was 31.25 birds/transect/survey. Passerines had the highest use of all bird types recorded during the breeding bird surveys (26.85 birds/transect/survey), followed by doves/pigeons (1.06), and waterfowl (0.98; Table 3). Mean bird use was less than 0.9 birds/transect/survey for all other bird types. Passerines made up 85.9% of all birds observed during the surveys and were seen in 100% of the surveys.

Within the passerines bird type, blackbirds/orioles were the subtype with highest use (10.02 birds/transect/survey; Table 3). Blackbirds/orioles accounted for 32.1% of all bird observations during transect surveys and were seen during 93.8% of surveys. Grassland birds/sparrows (grassland/sparrows) were the second most commonly observed subtype, with 7.15 birds/transect/survey, accounting for 22.9% of all observations; grassland/sparrows were observed in 89.6% of surveys. For all other passerine subtypes, use was less than 3.5 birds/transect/survey (Table 3).

Table 3. Mean bird use (number of birds/transect/survey), percent of total composition (% composition), and frequency of occurrence (% frequency) for each bird type, subtype, and species observed during the breeding bird transect surveys at the Red Pine Wind Resource Area, June 11 to July 10, 2013.

Bird Type/Subtype/Species	Bird Use	% Composition	% Frequency
Waterbirds	**0.56**	**1.8**	**20.8**
double-crested cormorant	0.50	1.6	18.8
great egret	0.02	0.1	2.1
unidentified egret	0.04	0.1	2.1
Waterfowl	**0.98**	**3.1**	**37.5**
blue-winged teal	0.08	0.3	6.3
Canada goose	0.02	0.1	2.1
mallard	0.71	2.3	31.3
northern shoveler	0.17	0.5	12.5
Shorebirds	**0.85**	**2.7**	**29.2**
killdeer	0.73	2.3	29.2
upland sandpiper	0.13	0.4	4.2
Rails/Coots	**0.06**	**0.2**	**2.1**
sora	0.06	0.2	2.1
Raptors	**0.15**	**0.5**	**12.5**
northern harrier	0.02	0.1	2.1
red-tailed hawk	0.13	0.4	10.4
Vultures	**0.02**	**0.1**	**2.1**
turkey vulture	0.02	0.1	2.1
Upland Game Birds	**0.65**	**2.1**	**41.7**
ring-necked pheasant	0.65	2.1	41.7
Doves/Pigeons	**1.06**	**3.4**	**14.6**
mourning dove	1.06	3.4	14.6
Large Corvids	**0.02**	**0.1**	**2.1**
American crow	0.02	0.1	2.1

Table 3. Mean bird use (number of birds/transect/survey), percent of total composition (% composition), and frequency of occurrence (% frequency) for each bird type, subtype, and species observed during the breeding bird transect surveys at the Red Pine Wind Resource Area, June 11 to July 10, 2013.

Bird Type/Subtype/Species	Bird Use	% Composition	% Frequency
Passerines	**26.85**	**85.9**	**100**
Blackbirds/Orioles	*10.02*	*32.1*	*93.8*
Baltimore oriole	0.08	0.3	8.3
bobolink	5.06	16.2	60.4
brown-headed cowbird	0.44	1.4	12.5
common grackle	1.25	4.0	35.4
red-winged blackbird	2.73	8.7	64.6
western meadowlark	0.33	1.1	16.7
yellow-headed blackbird	0.13	0.4	12.5
Finches/ Crossbills	*1.54*	*4.9*	*47.9*
American goldfinch	1.54	4.9	47.9
Flycatchers	*0.33*	*1.1*	*20.8*
eastern kingbird	0.33	1.1	20.8
Grassland/Sparrows	*7.15*	*22.9*	*89.6*
chipping sparrow	0.54	1.7	22.9
clay-colored sparrow	2.38	7.6	41.7
dickcissel	1.60	5.1	43.8
field sparrow	0.23	0.7	8.3
grasshopper sparrow	*0.08*	*0.3*	*2.1*
Savannah sparrow	1.83	5.9	72.9
song sparrow	0.40	1.3	18.8
unidentified sparrow	*0.08*	*0.3*	*2.1*
Mimids	*0.21*	*0.7*	*16.7*
brown thrasher	0.02	0.1	2.1
gray catbird	0.19	0.6	16.7
Swallows	*3.44*	*11.0*	*66.7*
barn swallow	0.23	0.7	16.7
cliff swallow	2.69	8.6	50.0
northern rough-winged swallow	0.21	0.7	4.2
tree swallow	*0.31*	*1.0*	*20.8*
Tangers/Grosbeaks/Cardinals	*0.02*	*0.1*	*2.1*
rose-breasted grosbeak	0.02	0.1	2.1
Thrushes	*0.15*	*0.5*	*12.5*
American robin	0.15	0.5	12.5
Vireos	*0.19*	*0.6*	*10.4*
warbling vireo	0.19	0.6	10.4
Warblers	*3.44*	*11.0*	*72.9*
American redstart	*0.02*	*0.1*	*2.1*
common yellowthroat	2.69	8.6	70.8
yellow warbler	0.73	2.3	33.3
Waxwings	*0.04*	*0.1*	*2.1*
cedar waxwings	0.04	0.1	2.1
Wrens	*0.31*	*1.0*	*10.4*
sedge wren	0.31	1.0	10.4
Woodpeckers	**0.06**	**0.2**	**6.3**
hairy woodpecker	0.04	0.1	4.2
red-bellied woodpecker	*0.02*	*0.1*	*2.1*
Overall	**31.25**	**100**	

Spatial Use

Mean use (birds/transect/survey) is presented by transect for all birds combined, and bird types and subtypes (Figure 2, Appendix A). For all bird species combined, use was highest at transects 5N (43.7 birds/transect/survey) and 5S (43.0). Use was also greater than 30.0 birds/transect/survey at transects 1N, 1S, 2N, 4N, 7N, and 7S. Raptors were only observed at four of the transects. Passerines had the highest mean use at transect 5N (42.3 birds/transect/survey) and use ranged from 16.3 to 34.3 birds/transect/survey at the other transects (Figure 2). Mean use for the grassland/sparrow subtype was greatest at transect 7N (15.0 birds/transect/survey), 7S (14.7), and 6N (14.0). Use at other transects ranged from 2.67 to 11.0 birds/transect/survey.

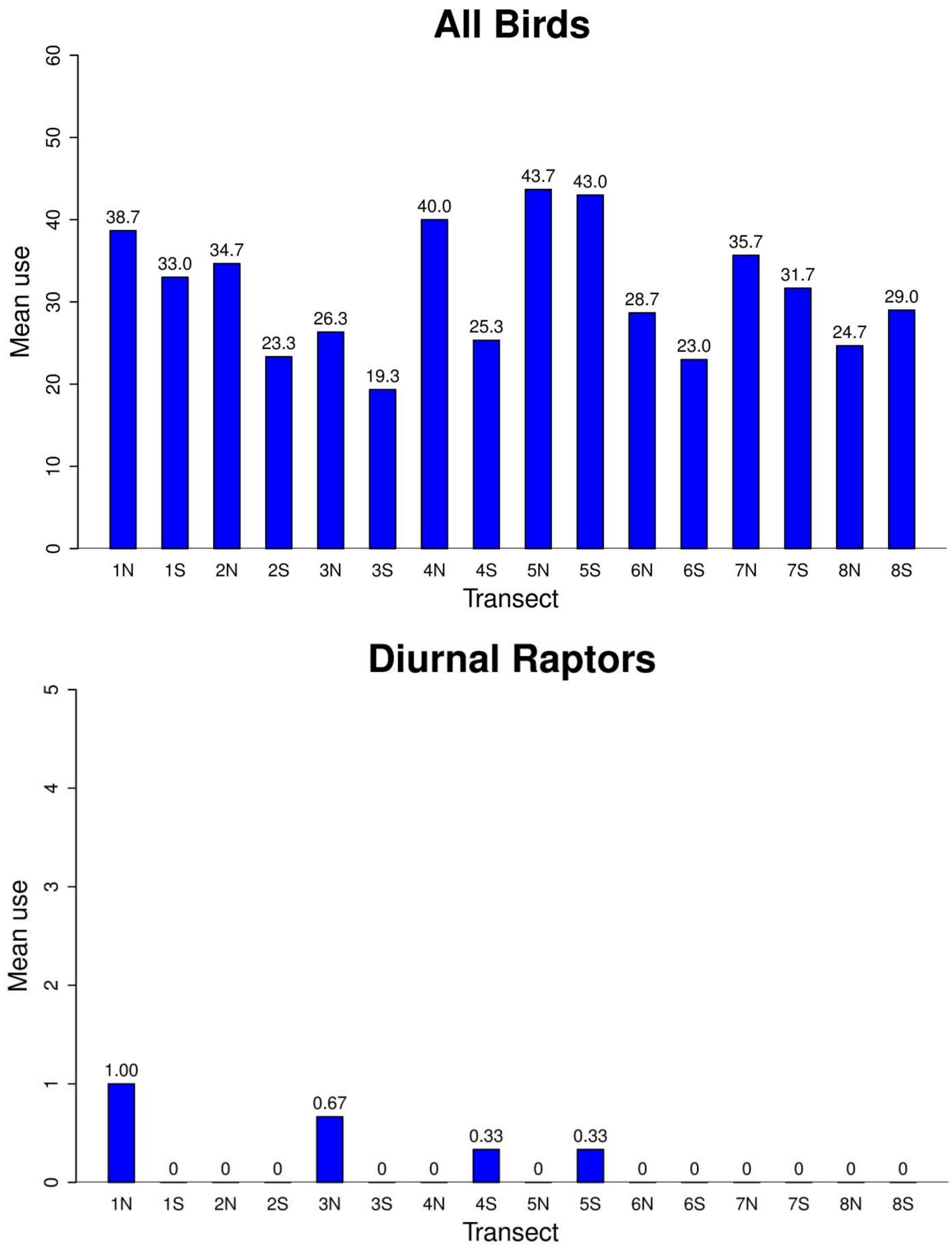
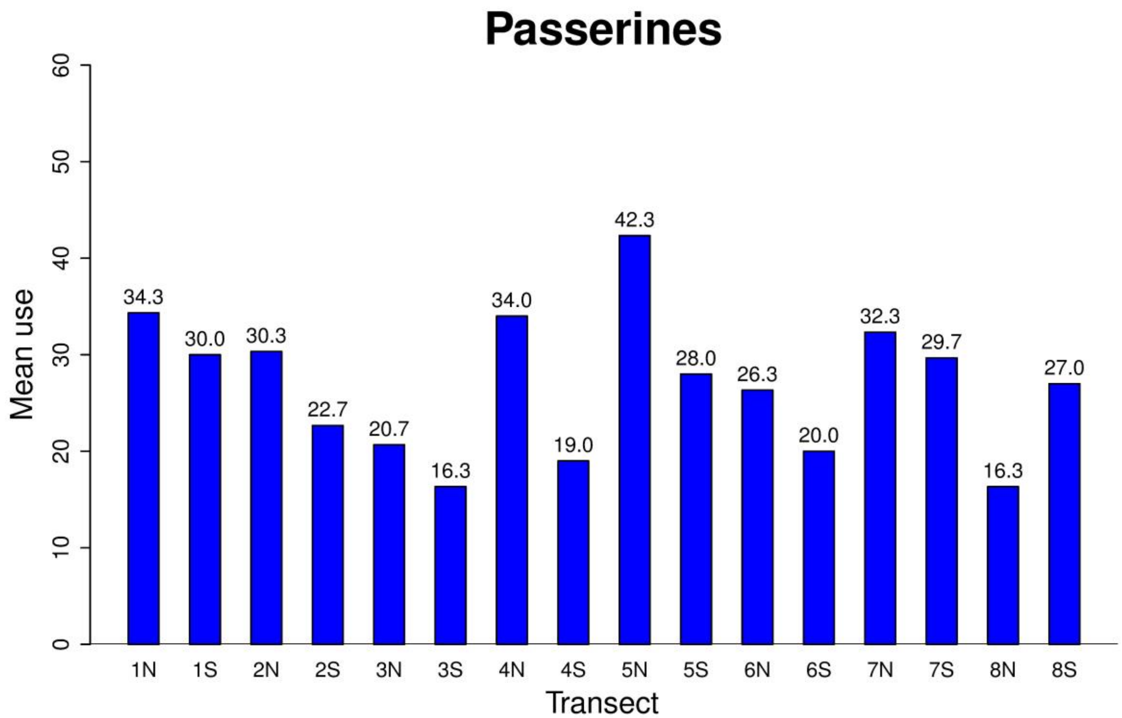


Figure 2. Mean bird use (number of birds/transect/survey) for each breeding bird transect for all birds, major bird types, and subtypes of interest at the Red Pine Wind Resource Area, June 11 to July 10, 2013.



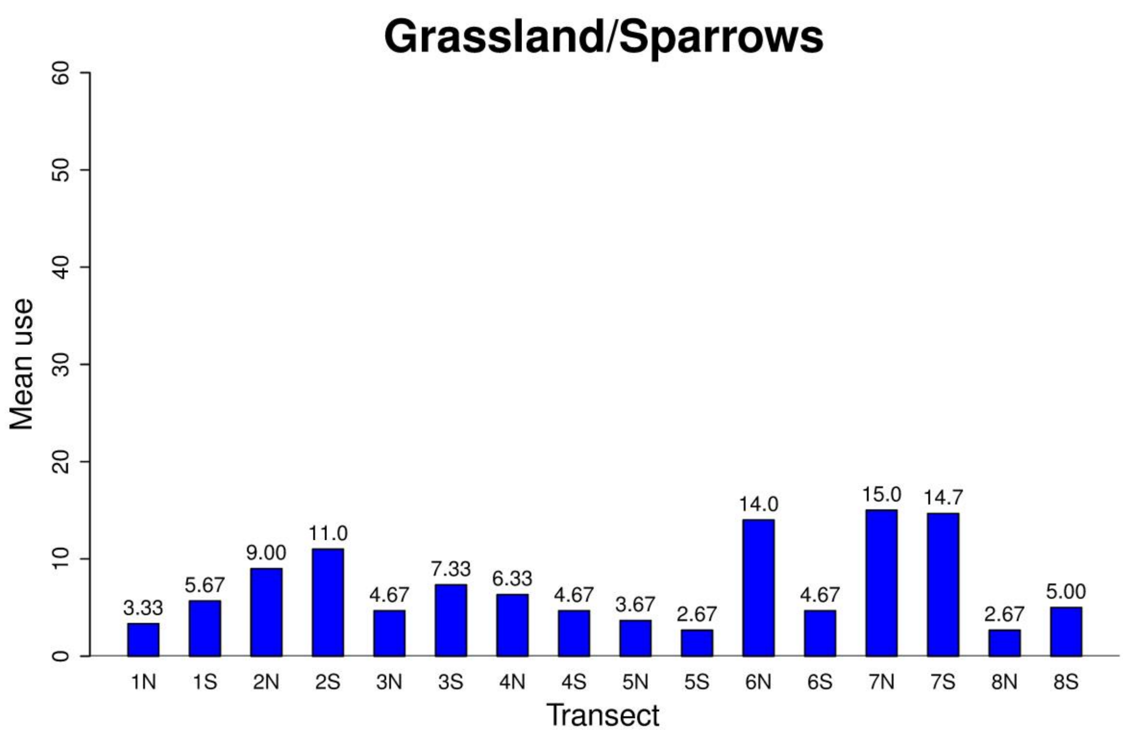


Figure 2 (*continued*). Mean bird use (number of birds/transect/survey) for each breeding bird transect for all birds, major bird types, and subtypes of interest at the Red Pine Wind Resource Area, June 11 to July 10, 2013.

Sensitive Species Observations

No federal endangered, threatened, candidate or proposed species were observed during transect surveys (ESA 1973, USFWS 2014). No Minnesota endangered, threatened species, or special concern species were observed (Minnesota Department of Natural Resources [MDNR] 2013). Two bird species, the dickcissel (*Spiza americana*; 77 individuals) and grasshopper sparrow (*Ammodramus savannarum;* four), designated as USFWS Bird of Conservation Concern for the Prairie Potholes (Bird Conservation Region 11; USFWS 2008) and Partners in Flight priority species in the Northern Tallgrass Prairie (Fitzgerald et al. 1998), were observed during surveys (Table 4). The bobolink (243 observations) and sedge wren (*Cisothorus platensis*; 15) are also Partners in Flight priority species in the Northern Tallgrass Prairie.

Table 4. Number of groups, individuals, and status of sensitive species observed, regardless of distance from observer, during breeding bird transect surveys at the Red Pine Wind Resource Area, June 11 to July 10, 2013.

			Transects	
Species	**Scientific Name**	**Status**	**Groups**	**Individuals**
bobolink	*Dolichonyx oryzivorus*	PIF	120	243
dickcissel	*Spiza americana*	BCC, PIF	68	77
grasshopper sparrow	*Ammodramus savannarum*	BCC, PIF	2	4
sedge wren	*Cisothorus platensis*	PIF	15	15
Total	**4 species**		**205**	**339**

BCC = USFWS Birds of Conservation Concern in Bird Conservation Region 11 (USFWS 2008)
PIF = Partners in Flight priority species in the Northern Tallgrass Prairie (Fitzgerald et al. 1998)

DISCUSSION

The results of the breeding bird surveys appeared to be typical of agricultural/grassland settings in the Midwest. Frequently recorded species included bobolink, red-winged blackbird, common yellowthroat, cliff swallow, and clay-colored sparrow. The closest breeding bird survey (BBS) route, Tyler, has its northern end in the RPWRA. Results of the 2011 BBS survey (the most recent) found similar species occurrences (Sauer et al. 2012); cliff swallow, red-winged blackbird, and common yellowthroat were among the most abundant birds observed during the BBS.

Bird use of the RPWRA appeared to be relatively evenly dispersed. Overall, there did not appear to be any consistent preference for a transect or transects. Based on the breeding bird survey data collected for this study, the RPWRA does not appear to have any large or unusual populations of breeding resident birds.

Sensitive Species

Transects were placed within grasslands to the extent possible to determine the occurrence of grassland-dependent bird species of concern within the site by focusing survey efforts within or near the wildlife areas and native prairie remnants (MDNR 2012). In addition to be located within grasslands, many of the transects were near wetlands, ponds, or streams (Figure 1).

No federal or state endangered, threatened, candidate or proposed species were observed during transect surveys. Four sensitive bird species were observed (Table 4); the dickcissel and grasshopper sparrow are designated as USFWS Bird of Conservation Concern for the Prairie Potholes and Partners in Flight priority species in the Northern Tallgrass Prairie (Fitzgerald et al. 1998). The bobolink, the most commonly observed sensitive species, and sedge wren are also Partners in Flight priority species in the Northern Tallgrass Prairie. All of these species are grassland-dependent; about 25% of breeding grassland-dependent birds species are declining, based on results of the BBS (Fitzgerald et al. 1998). This decline may be attributed to degradation, fragmentation, and loss of habitat, predation, and cowbird parasitism (Fitzgerald et al. 1998). Although the four species have differing microhabitat requirements, they are similar in that they need large areas of a mix of grassland and forbs, a high percent litter, and vegetation of moderate to tall height (Fitzgerald et al. 1998; Dechant et al. 2003a, 2003b, 2003c, 2003d).

Grassland Nesting Bird Displacement

The presence of wind turbines may alter the landscape so that wildlife use patterns are affected, displacing wildlife away from the project facilities and suitable habitat. Small-scale displacement impacts to grassland nesting birds have been documented in some studies (Leddy et al. 1999, Johnson et al. 2000, Shaffer and Johnson 2009). Results of a study of wintering grassland birds in north-central Texas found avoidance of turbines to be species-specific (Stevens et al. 2013). Sprague's pipit (*Anthus spragueii*), Savannah sparrow (*Passerculus sandwichensis*), and meadowlarks (*Sturnella* sp.) did not appear to avoid turbines but the Le Conte's sparrow (*Ammodramus leconteii*) appeared to avoid turbines. Johnson et al. (2000) found reduced use of habitat by seven of 22 grassland-breeding birds following construction of the Buffalo Ridge wind energy facility. Leddy et al. (1999) surveyed bird densities in Conservation Reserve Program grasslands at the Buffalo Ridge wind-energy facility in Minnesota, and found mean densities of 10 grassland bird species were four times higher at areas located 180 m (591 ft) from turbines than they were at grasslands nearer turbines. Conversely, a European study of wintering "seed-eaters" found no evidence of significant avoidance of turbines by these birds (Devereux et al. 2008).

Preliminary results from a long term study of wind energy facilities located in native grasslands in North and South Dakota found that grasshopper and clay-colored sparrows appeared to avoid wind turbines out to 250 m (820 ft). Other grassland nesting species (Savannah sparrow, bobolink, chestnut-collared longspur [*Calcarius ornatus*], and western meadowlark [*Sturnella neglecta*]) showed no avoidance (Shaffer et al. 2012). At the Wessington Springs Wind Energy Facility near Wessington Springs, South Dakota, a small-scale impact of turbines on breeding birds was found in 2009 and 2010 (Derby et al. 2010, 2011). However, the impacts were both negative and positive, so results were not conclusive. At the PrairieWinds ND1 Wind Energy Facility near Minot, North Dakota, no significant displacement of birds away from turbines was observed in 2011 (Derby et al. 2012). In 2012, only the bobolink demonstrated significant displacement away from turbines (Derby et al. 2013).

Based on results from these other studies, it is possible that some of the sensitive grassland-dependent birds observed during breeding bird surveys at the RPWRA could be displaced by construction and operation of the wind facility if turbines are placed in grassland or wetland areas. However, negative effects could be minimized or avoided by avoid grassland areas when determining turbine location.

REFERENCES

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, M. P. Nenneman, and B. R. Euliss. 2003a. Effects of Management Practices on Grassland Birds: Grasshopper Sparrow. Northern Prairie Wildlife Research Center, Jamestown, North Dakota. Northern Prairie Wildlife Research Center Online. (Version 12AUG2004) http://www.npwrc.usgs.gov/resource/literatr/grasbird/grsp/grsp.htm

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, B. D. Parkin, and B. R. Euliss. 2003b. Effects of Management Practices on Grassland Birds: Sedge Wren. Northern Prairie Wildlife Research Center, Jamestown, North Dakota. Northern Prairie Wildlife Research Center Online. (Version 12DEC2003) http://www.npwrc.usgs.gov/resource/literatr/grasbird/sewr/sewr.htm

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, A. L. Zimmerman, and B. R. Euliss. 2003c. Effects of Management Practices on Grassland Birds: Bobolink. Northern Prairie Wildlife Research Center, Jamestown, North Dakota. Northern Prairie Wildlife Research Center Online. (Version 12DEC2003) http://www.npwrc.usgs.gov/resource/literatr/grasbird/bobo/bobo.htm

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, A. L. Zimmerman, and B. R. Euliss. 2003d. Effects of Management Practices on Grassland Birds: Dickcissel. Northern Prairie Wildlife Research Center, Jamestown, North Dakota. Northern Prairie Wildlife Research Center Online. (Version 12DEC2003) http://www.npwrc.usgs.gov/resource/literatr/grasbird/dick/dick.htm

Derby, C. and A. Dahl. 2014. Red Pine Wind Project Habitat Mapping. Technical memo prepared for Red Pine Wind Power, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., A. Dahl, K. Bay, and L. McManus. 2011. 2010 Post-Construction Monitoring Results for the Wessington Springs Wind Energy Facility, South Dakota. Final Report: March 9 – November 16, 2010. Prepared for Wessington Wind Energy Center, LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. November 22, 2011.

Derby, C., A. Dahl, A. Merrill, and K. Bay. 2010. 2009 Post-Construction Monitoring Results for the Wessington Springs Wind-Energy Facility, South Dakota. Final Report. Prepared for Wessington Wind Energy Center, LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 19, 2010.

Derby, C., T. Thorn, and C. LeBeau. 2013. 2012 Breeding Bird Transect Survey Report: PrairieWinds ND1, Ward County, North Dakota. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., T. Thorn, and A. Merrill. 2012. 2011 Breeding Bird Transect Survey Report: PrairieWinds ND1, Ward County, North Dakota. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 31, 2012.

Devereux, C. L., M. J. H. Denny, and M. J. Whittingham. 2008. Minimal Effects of Wind Turbines on the Distribution of Wintering Farmland Birds. Journal of Applied Ecology Windfarms and Farmland Birds: 1365-2664. doi: 1310.1111/j.1365-2664.2008.01560.x.

Endangered Species Act (ESA). 1973. 16 United States Code (USC) § 1531-1544, Public Law (PL) 93-205, December 28, 1973, as amended, PL 100-478 [16 USC 1531 *et seq.*]; 50 Code of Federal Regulations (CFR) 402.

Fitzgerald, J. A., D. N. Pashley, S. J. Lewis, and B. Pardo. 1998. Partners in Flight Bird Conservation Plan for the Northern Tallgrass Prairie (Physiographic Area 40). Version 1.0. August 4, 1998. Available online at: http://www.partnersinflight.org/bcps/plan/pl_40all.pdf

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

Leddy, K. L., K. F. Higgins, and D. E. Naugle. 1999. Effects of Wind Turbines on Upland Nesting Birds in Conservation Reserve Program Grasslands. Wilson Bulletin 111(1): 100-104.

Minnesota Department of Natural Resources (MDNR). 2012. Avian and Bat Survey Protocols for Large Wind Energy Conversion Systems in Minnesota. Draft. MDNR, Division of Ecological and Water Resources. October 2, 2012.

Minnesota Department of Natural Resources (MNDNR). 2013. Minnesota's List of Endangered, Threatened, and Special Concern Species. Effective August 19, 2013. Available online at: http://files.dnr.state.mn.us/natural_resources/ets/endlist.pdf

Sauer, J. R., J. E. Hines, J. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2012. The North American Breeding Bird Survey, Results and Analysis 1966 - 2011. Version 07.03.2013. USGS Patuxent Wildlife Research Center. Laurel, Maryland. BBS Routes available online at: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Shaffer, J. A. and D. H. Johnson. 2009. Displacement Effects of Wind Developments on Grassland Birds in the Northern Great Plains. Presented at the National Wind Coordinating Collaborative (NWCC) Wildlife and Wind Research Meeting VII, October 28-29, 2008, Milwaukee, Wisconsin. Pre-Conference Session, October 27, 2008. Prepared for the NWCC by S.S. Schwartz. Published June 2009.

Shaffer, J. A., D. H. Johnson, and D. A. Buhl. 2012. Avoidance of Wind Generators by Breeding Grassland Birds. Poster presented at the 5th North American Ornithological Conference, August 14 - 18, Vancouver, Canada.

Stevens, T. K., A. M. Hale, K. B. Karsten, and V. J. Bennett. 2013. An Analysis of Displacement from Wind Turbines in a Wintering Grassland Bird Community. Biodiversity and Conservation 22(8): 1755-1767.

US Department of Agriculture (USDA) National Agricultural Statistics Service (NASS). 2012. Cropscape - Cropland Data Layer. 2012 Minnesota Data. USDA NAS homepage at: http://www.nass.usda.gov/; Cropscape CDL program data available online at: http://nassgeodata.gmu.edu/CropScape/

US Fish and Wildlife Service (USFWS). 2008. Birds of Conservation Concern 2008. December 2008. Division of Migratory Bird Management. Arlington, Virginia. http://www.fws.gov/migratorybirds/NewReportsPublications/SpecialTopics/BCC2008/BCC2008.pdf

US Fish and Wildlife Service (USFWS). 2014. USFWS Website. Accessed January 31, 2014. USFWS Endangered Species Program homepage: http://www.fws.gov/endangered/; Environmental Conservation Online System (ECOS): http://ecos.fws.gov/ecos/indexPublic.do; Threatened and Endangered Species System (TESS) listings by state: http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrence.jsp; Individual species profiles and status information available from the ECOS webpage.

US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI). 2007. Region 3 NWI, Midwest Region: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. http://www.fws.gov/wetlands/data/index.html, NWI data at: http://www.fws.gov/wetlands/Data/Mapper.html and http://www.fws.gov/midwest/

US Geological Survey (USGS). 2012. Protected Areas Database of the United States (PADUS), Version 1.2 Data Download. . USGS Gap Analysis Program Protected Areas Viewer. Webpage last modified March 2, 2012 Download available online at: http://gapanalysis.usgs.gov/padus/download/

APPENDICES

Appendix A. Mean bird use[a] (number of birds/transect/survey) by transect for all birds, major bird types, and passerine subtypes observed during breeding bird transect surveys at the Red Pine Wind Resource Area, June 11 to July 10, 2013.

	Transect														
Bird Type/Subtype	**1N**	**1S**	**2N**	**2S**	**3N**	**3S**	**4N**	**4S**	**5N**	**5S**	**6N**	**6S**	**7N**	**7S**	**8N**
Waterbirds	1	0	0	0	0.33	0.67	1.67	3	0.67	1.67	0	0	0	0	0
Waterfowl	0.33	0.67	1.67	0.33	2.33	1.67	2	2	0	0	0	2.33	1.33	0	1
Shorebirds	0	0	0	0	1.67	0.67	1	0.67	0	0	0	0.33	0.67	0	6.67
Rails/Coots	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Diurnal Raptors	1	0	0	0	0.67	0	0	0.33	0	0.33	0	0	0	0	0
Vultures	0	0	0	0	0	0	0.33	0	0	0	0	0	0	0	0
Upland Game Birds	1.33	1	1.67	0.33	0.67	0	1	0.33	0.33	0	0.33	0.33	1.33	1.67	0
Doves/Pigeons	0.33	1.33	0	0	0	0	0	0	0	12.67	1.67	0	0	0.33	0.67
Large Corvids	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0
Passerines	34.33	30	30.33	22.67	20.67	16.33	34	19	42.33	28	26.67	20	32.33	29.67	16.33
Blackbirds/Orioles	*14*	*10.33*	*12*	*8*	*4.67*	*3.33*	*18*	*8.33*	*24*	*15.33*	*3*	*7.33*	*2.67*	*1.33*	*10*
Finches/Crossbills	*3.67*	*3.33*	*1*	*0.33*	*0.33*	*0.67*	*2.67*	*0*	*1.67*	*0*	*3*	*1.67*	*1.67*	*3.67*	*0.33*
Flycatchers	*0.33*	*0.67*	*0.33*	*0*	*0.33*	*0.67*	*0*	*0*	*1*	*1.67*	*0*	*0*	*0*	*0*	*0.33*
Grassland/Sparrows	*3.33*	*5.67*	*9*	*11*	*4.67*	*7.33*	*6.33*	*4.67*	*3.67*	*2.67*	*14*	*4.67*	*15*	*14.67*	*2.67*
Mimids	*0.67*	*1*	*0.33*	*0*	*0.33*	*0*	*0*	*0*	*0*	*0*	*0.67*	*0*	*0.33*	*0*	*0*
Swallows	*2*	*0.67*	*3.67*	*0*	*7.67*	*3.67*	*4.67*	*5.67*	*5.67*	*6.33*	*1.33*	*5.33*	*2.33*	*0.33*	*2.33*
Tanager/Grosbeak/Cardinal	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0.33*	*0*	*0*
Thrushes	*0.33*	*0*	*0*	*0*	*0*	*0.33*	*0*	*0*	*0*	*0.33*	*0.33*	*0*	*0.33*	*0*	*0.67*
Vireos	*0*	*1.67*	*0*	*0*	*0*	*0*	*0*	*0*	*0.67*	*0.67*	*0*	*0*	*0*	*0*	*0*
Warblers	*10*	*6*	*4*	*3.33*	*2.67*	*0.33*	*2.33*	*0.33*	*4.67*	*1*	*4*	*1*	*8.33*	*7*	*0*
Waxwings	*0*	*0.67*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Wrens	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*1.33*	*2.67*	*0*
Woodpeckers	0.33	0	0	0	0	0	0	0	0.33	0.33	0	0	0	0	0
All Birds	**38.67**	**33.00**	**34.67**	**23.33**	**26.33**	**19.33**	**40.00**	**25.33**	**43.67**	**43.00**	**28.67**	**23.00**	**35.67**	**31.67**	**24.67**

[a] within 50 meters of transect

Avian Use Surveys for the
Red Pine Wind Resource Area
Lincoln and Lyon Counties, Minnesota

March 2013 through March 2014

Prepared for:

Red Pine Wind Project, LLC

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June 25, 2014

EXECUTIVE SUMMARY

Red Pine Wind Project, LLC (Red Pine) has proposed a wind energy facility in Lincoln and Lyon Counties, Minnesota, referred to as the Red Pine Wind Resource Area (RPWRA). Red Pine contracted with Western EcoSystems Technology, Inc. to conduct field surveys developed in coordination with the US Fish and Wildlife Service and Minnesota Department of Natural Resources. These surveys were designed to assess wildlife resources in the RPWRA and assess risk to species of concern by addressing the issues posed under Tier 3 of the US Fish and Wildlife Service's Final Land-Based Wind Energy Guidelines. The principal objectives of the fixed-point bird use surveys were to: 1) assess the relative abundance and spatial distribution of species in the RPWRA during all seasons, and 2) identify and assess the potential risk of adverse impacts. The following document contains results for the general fixed-point bird use surveys and incidental wildlife observations.

Surveys were completed within the RPWRA from March 22, 2013 to March 16, 2014. Twenty fixed-points were selected to encompass representative habitats and topography of the RPWRA. Each survey plot was an 800-meter (m; 2,625-foot [ft]) radius circle centered on the point; large birds, particularly eagles, were recorded out to a 1,600-m (5,249-ft) radius. Each survey plot was surveyed for 60 minutes (min). All birds observed during the first 20 min of each fixed-point survey were recorded. Observations of large birds beyond the 800-m radius were recorded, but were not included in analyses. Locations and flight paths, if applicable, of large birds were recorded.

A total of 336 fixed-point bird use surveys were conducted during 18 visits to the RPWRA. One-hundred-thirty-eight unique bird species totaling 4,410 observations in 272 groups were recorded. Overall species richness was higher for large birds (0.43); species richness was calculated as the mean number of species observed per plot per survey (i.e., number of species/plot/20-min survey). Species richness was highest in the spring and lowest in the winter for large birds and lowest in the spring and summer for small birds.

Eighty-eight raptor observations within 56 groups were recorded during the first 20 min of fixed-point bird use surveys at the RPWRA. Red-tailed hawk was the most commonly observed raptor, accounting for 42% of all raptors (37 observations). Northern harrier (40.9% of observations), and bald eagle (12.5%) accounted for all but three observations.

Large birds detected within the 800-m radius plot and small birds recorded within a 100-m radius were used to calculate mean use and frequency of occurrence. The metric used to measure mean bird use was number of birds per plot per 20-min survey. Diurnal raptor use was highest in spring (0.58 raptors/800-m plot/20-min survey) followed by summer (0.21), fall (0.14) and winter (0.02). Most raptor use was attributable to northern harriers (0.33 raptors/800-m plot/20-min survey) and red-tailed hawks (0.19) during spring and red-tailed hawks in the summer (0.19) and fall (0.07). Mean use for bald eagles was 0.05 raptors/800-m plot/20-min survey or less in each season.

Diurnal raptor use (raptors/800-m plot/60-min survey) values calculated from the full 60-min surveys demonstrated a seasonal pattern of use, with spring exhibiting the highest mean use. Data from the first 20 min of the standard 60-min survey captured a significant portion of the observed use (spring, 0.58/0.77=75.3%; summer, 84%; fall, 46.7%; winter, 50%). However, by assuming bird observations to be equally spread across the 60-minute survey period, the mean use calculated by dividing by three underestimated raptor use in all seasons compared to the 20-minute survey.

The flight height recorded during the initial observation was used to calculate mean flight height and the percentage of birds flying within the likely rotor-swept height (RSH) for collision with turbine blades of 25 – 150 m (82 to 492 ft) above ground level. Overall, 76.8% of raptors observed flying were recorded initially within the RSH, 22.3% were below the RSH, and 0.9% were observed flying above the RSH. No discernible patterns of bird use concentration were observed during fixed-point surveys nor did eagle flight paths show an apparent pattern.

No federally endangered, threatened, candidate, or proposed species were observed during fixed-point surveys or incidentally. One hundred thirty common terns were observed during fixed-point surveys; common terns are a Minnesota state threatened species. Two Minnesota special concern bird species were recorded: the Franklin’s gull and American white pelican. There were 2,455 observations of Franklin’s gull and 209 individuals of American white pelican observed during fixed-point surveys. Thirty-four individual bald eagles were observed at the RPWRA during fixed-point surveys or incidentally. Overall, 90.4% of Franklin’s gulls observed flying were recorded initially within the RSH. American white pelican observed flying at the RPWRA during fixed-point surveys were all recorded within the RSH as were flying common terns. Eighty percent of bald eagle groups which were observed flying were recorded within the RSH.

STUDY PARTICIPANTS

Western EcoSystems Technology

Clayton Derby	Project Manager
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Troy Rintz	Report Writer
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REPORT REFERENCE

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INTRODUCTION

Red Pine Wind Project, LLC (Red Pine) has proposed the development of a wind energy facility in Lincoln and Lyon Counties, Minnesota, referred to as the Red Pine Wind Resource Area (RPWRA or project area). Red Pine contracted with Western EcoSystems Technology, Inc. (WEST) to conduct field surveys in accordance with agency recommendations to quantify wildlife resources at the RPWRA and to address the issues posed under Tier 3 of the US Fish and Wildlife Service (USFWS) Final Land-Based Wind Energy Guidelines (Guidelines; USFWS 2012b) and pre-construction surveys are recommended by the Minnesota Department of Natural Resources (MDNR).

Fixed-point bird use surveys were conducted to achieve these principal objectives: 1) assess the relative abundance and spatial distribution of avian species in the RPWRA, and 2) identify and assess the potential risk of adverse impacts to avian species or groups. This report contains results for the general fixed-point bird use surveys and incidental wildlife observations.

STUDY AREA

The proposed 38,826.9 acre (15,712.7 hectare) RPWRA is located in eastern Lincoln and western Lyons Counties, Minnesota, approximately 2.5 kilometers (km; 1.6 miles [mi]) east of the town of Wilno, Minnesota (Figure 1). The RPWRA has flat to rolling topography and is located on a slight ridge. Elevation of the study area ranges from 421 to 516 meters (m; 1,381 to 1,693 feet [ft]) above mean sea level.

The RPWRA contains areas of cultivated agriculture, grasslands, wetlands and lakes, developed areas and rural homes, and small wooded areas; as determined through a combination of existing information and heads up digitizing (Derby 2014). The majority of the study area, approximately 74%, is cultivated agriculture, the majority of which is corn (*Zea mays*) and soybeans (*Glycine max*; US Department of Agriculture [USDA] National Agricultural Statistics Service [NASS] 2012). According to the US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI), about 4% of the RPWRA is wetlands; about 74% of those wetlands are freshwater emergent wetlands and about 20% are lakes (USFWS NWI 2007).

Three named creeks and rivers are located in the RPWRA. Coon Creek briefly loops into the southern portion of the RPWRA. The South Branch of the Yellow Medicine River flows west to east through the center of the project area. Three-mile Creek is located in the southern portion of the RPWRA and also flows from west to east. Several other unnamed drainages are located throughout the RPWRA.

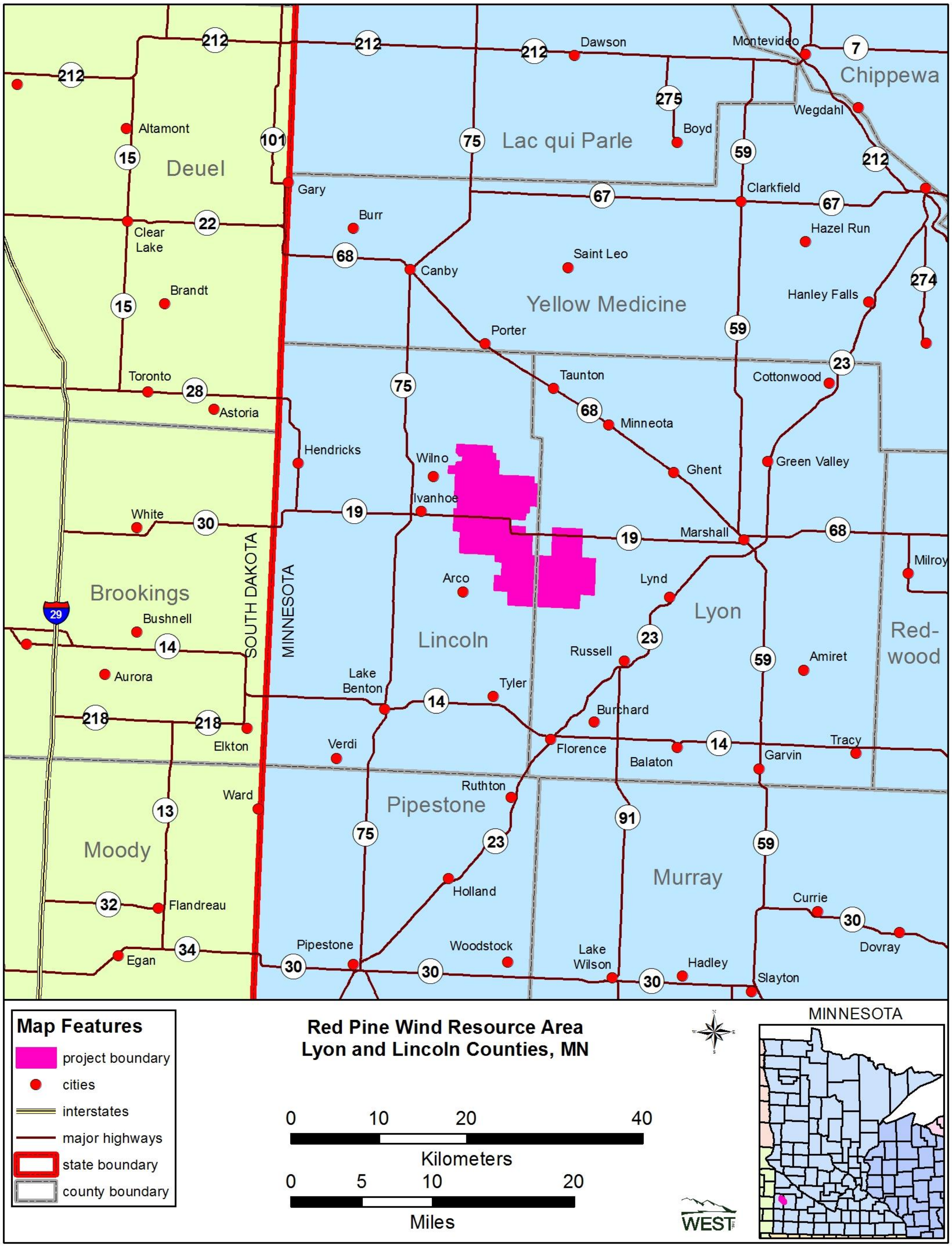

Figure 1. Location of the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota.

Ownership within the project area is largely private, but numerous protected areas are located in the RPWRA (US Geological Survey [USGS] 2012). The USFWS Lyon County Waterfowl Production Area is located in the southern portion of the RPWRA. There are several USDA Farm Service Agency Conservation Reserve Enhancement Program easements located throughout the RPWRA. Several Minnesota Department of Natural Resources Wildlife Management Areas are also present. Camden State Park is about 6.4 km (4.0 mi) southeast of the RPWRA.

METHODS

Fixed-point bird use surveys (variable circular plots) were conducted using methods described by Reynolds et al. (1980). Methodologies employed at the RPWRA surveys were generally comparable to those used at past wind energy facilities in Minnesota and were approved by the USFWS and Minnesota Department of Natural Resources (MDNR) prior to implementation.

Survey Plots

Twenty points were selected to encompass representative habitats and topography of the RPWRA, while also providing relatively even coverage of the area (Figure 2). Each survey plot was an 800-m (2,625-ft) radius circle centered on the point; large birds, particularly eagles, were recorded out to a 1,600-m (5,249-ft) radius.

Survey Methods

Each survey plot was surveyed for 60 minutes (min). Although the surveys focused on eagles and other raptors, all birds observed during the first 20 min of each fixed-point survey were recorded. Observations of large birds beyond the 800-m radius were recorded, but were not included in statistical analyses. Large birds included waterbirds, waterfowl, rails and coots, grebes and loons, gulls and terns, shorebirds, diurnal raptors, owls, vultures, upland game birds, doves/pigeons, and large corvids (e.g., ravens, magpies, and crows), and goatsuckers. For small birds, observations beyond the 100-m (328-ft) radius were excluded from analysis. Passerines (excluding large corvids), kingfishers, swifts/hummingbirds, woodpeckers, and most cuckoos were considered small birds.

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 plot center when first observed, closest distance, altitude above ground, activity (behavior), and habitat(s) were recorded for each observation. Approximate flight height and distance from plot center at first observation were recorded to the nearest 5-m (16-ft) interval. Other information collected included whether the observation was auditory only and the 10 min-interval of the survey in which the detection first occurred.

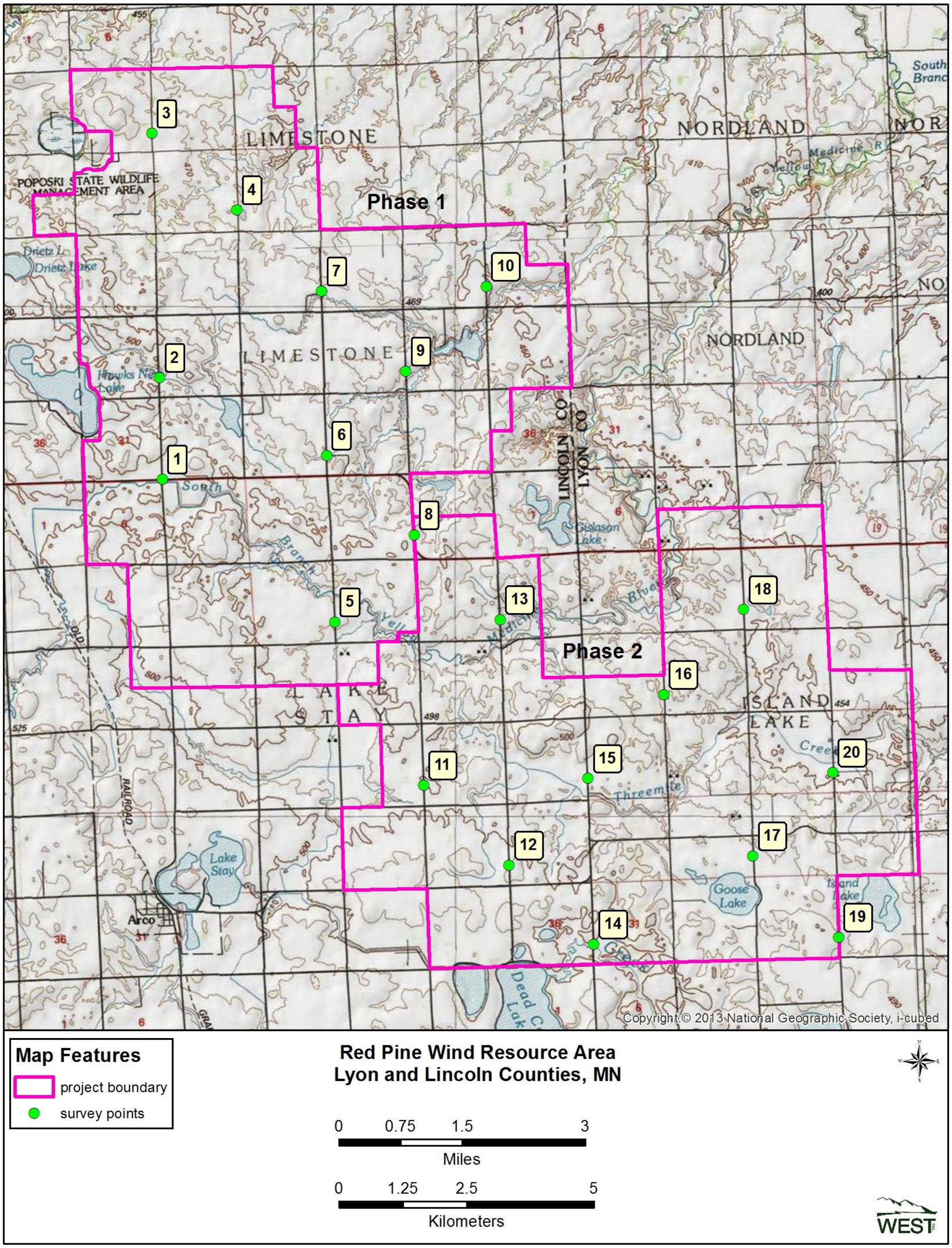

Figure 2. Location of fixed-point bird use points at the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota.

Locations and flight paths, if applicable, of large birds were recorded during fixed-point bird use surveys on field maps. For each period of time that eagles were observed, distance from observer, activity and flight height, if applicable, were recorded on a per minute basis as specified in the draft Eagle Guidelines (USFWS 2012a).

Incidental wildlife observations were recorded while conducting all surveys, moving between fixed-point locations, and traveling in the RPWRA. All raptors, unusual or unique birds, and sensitive bird species were documented. The observation number, date, time, species, number of individuals, sex/age class, distance from observer, activity, height above ground (for bird species), and habitat were recorded. The location of sensitive species was recorded.

Survey Schedule

Fixed-point bird use surveys were conducted approximately once per week in the spring (March 15 to May 31) and fall (September 1 to November 15) and twice monthly during winter (November 16 to March 14) and summer (June 1 to August 31). Half (10) of the points were surveyed during each visit, with evens visited on one visit followed by odds on the next visit such that it took two visits to complete one round of surveys at all 20 points. Surveys were conducted during daylight hours and survey periods were varied to approximately cover all daylight hours during a season. To the extent practical, each point was surveyed roughly the same number of times.

Statistical Analysis

For analysis purposes, a visit was defined as the required length of time, in days, to survey all of the plots once within the study area. Under certain circumstances, such as extreme weather conditions, all plots may not have been surveyed during a visit. In these cases, a visit might not have constituted a survey of all plots.

Species lists, (with number of observations and groups) were generated by season and can be found in Appendix A.

Bird Diversity and Species Richness

Bird diversity was illustrated by the total number of unique species observed. Species richness was calculated as the mean number of species observed per plot per survey (i.e., number of species/plot/20-min survey). 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.

Bird Use, Percent of Use, and Frequency of Occurrence

Large birds detected within the 800-m radius plot and small birds recorded within a 100-m radius were used to calculate mean use and frequency of occurrence. The metric used to measure mean bird use was number of birds per plot per 20-min survey. Birds seen after the first 20 min of the survey or outside of the plot were excluded from mean use calculations. Mean use by season was calculated by first averaging the total number of birds observed 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. Percent of use was calculated as the proportion of large or small bird mean use that was attributable to a particular bird type or species. Frequency of occurrence was calculated as the percent of surveys in which a particular bird type or species was observed. Mean bird use, percent of use, and frequency of occurrence were generated by season for large bird species (Appendix B-1) and small bird species (Appendix B-2). Use for raptor types and subtypes was calculated by survey length (20-min versus 60-min).

When considered together, frequency of occurrence and percent composition provide relative measures of species use of the proposed wind energy facility. For example, a particular species might have high use estimates based on just a few observations of large groups and the frequency of occurrence would indicate that the species only occurred during a few of the surveys. Therefore, even though the species exhibited high use, only a few, large groups accounted for that use, suggesting that the species might be less likely to be negatively affected by the construction and operation of the wind energy facility. Conversely, a species that has a relatively low percentage of use, but a relatively high frequency of occurrence would have longer-term exposure to the facility, increasing the likelihood that this species may be affected by the facility.

Bird Flight Height and Behavior

The flight height recorded during the initial observation was used to calculate mean flight height and the percentage of birds flying within the likely rotor-swept height (RSH) for collision with turbine blades of 25 – 150 m (82 to 492 ft) above ground level. The percentage of individuals flying within the RSH at any time was calculated using the lowest and highest flight heights recorded.

Spatial Use

Spatial use of the RPWRA by raptors was evaluated using mean use for each survey point. For each species and bird type, the number of individuals observed at each point during the 20-min survey was divided by the total number of surveys at that point.

RESULTS

Surveys were completed within the RPWRA from March 22, 2013 to March 16, 2014. Summary statistics for the full suite of species observed at the RPWRA are primarily presented in Appendix A, B-1, and B-2; whereas results related to diurnal raptors, bald eagles, federal and state listed species, and Minnesota special concern species (MDNR 2013) are more thoroughly covered in the body of this report.

A total of 336 fixed-point bird use surveys were conducted during 18 visits to the RPWRA (Table 1). One-hundred-thirty-eight unique bird species totaling 4,410 observations in 272 groups were recorded (Table 1; Appendix A). Species richness was highest in the spring and lowest in the winter for large birds (Table 1).

Table 1. Number of visits, surveys, unique species, and species richness (species/plot[a]/20-min survey) by season, observed during fixed-point bird use surveys[b] at the Red Pine Wind Resource Area from March 22, 2013 to March 16, 2014.

Season	Number of Visits	Number of Surveys	Number of Unique Species	Species Richness	
				Large Birds	Small Birds[c]
Spring	5	100	21	0.85	0
Summer	4	70	15	0.36	0
Fall	5	100	36	0.43	0.34
Winter	4	66	18	0.19	0.17
Overall	**18**	**336**	**138**	**0.43**	**0.13**

[a] 800-meter radius for large birds and 100-meter radius for small birds
[b] first 20 minutes of surveys only
[c] Field technician incorrectly did not record small birds during spring and summer as specific small bird surveys were implemented through transect surveys.

Eighty-eight raptor observations within 56 groups were recorded during the first 20 min of fixed-point bird use surveys at the RPWRA (Table 2). Red-tailed hawk (*Buteo jamaicensis*) was the most commonly observed raptor, accounting for 42% of all raptors (37 observations in 32 groups). Northern harrier (*Circus* cyaneus; 40.9% of observations), and bald eagle (*Haliaeetus* leucocephalus; 12.5%) accounted for all but three observations (Table 2).

Table 2. Number of bird groups (# grps) and individuals (# obs) for raptors observed during 20-min fixed-point bird use surveys[a] at the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota, from March 22, 2013 to March 16, 2014[b].

Type / Subtype	Scientific Name	Spring # grps	Spring # obs	Summer # grps	Summer # obs	Fall # grps	Fall # obs	Winter # grps	Winter # obs	Total # grps	Total # obs
Diurnal Raptors											
Buteos		*15*	*19*	*10*	*11*	*8*	*8*	*1*	*1*	*34*	*39*
red-tailed hawk	*Buteo jamaicensis*	15	19	10	11	7	7	0	0	32	37
Swainson's hawk	*Buteo swainsoni*	0	0	0	0	0	0	1	1	1	1
unidentified buteo	*Buteo spp*	0	0	0	0	1	1	0	0	1	1
Northern Harrier		*7*	*33*	*1*	*1*	*2*	*2*	*0*	*0*	*10*	*36*
northern harrier	*Circus cyaneus*	7	33	1	1	2	2	0	0	10	36
Eagles		*5*	*5*	*1*	*1*	*3*	*4*	*1*	*1*	*10*	*11*
bald eagle	*Haliaeetus leucocephalus*	5	5	1	1	3	4	1	1	10	11
Falcons		*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*1*
American kestrel	*Falco sparverius*	1	1	0	0	0	0	0	0	1	1
Other Raptors		*0*	*0*	*0*	*0*	*1*	*1*	*0*	*0*	*1*	*1*
unidentified hawk		0	0	0	0	1	1	0	0	1	1
All Diurnal Raptors		**28**	**58**	**12**	**13**	**14**	**15**	**2**	**2**	**56**	**88**

[a] 800-meter radius
[b] Rough-legged hawk was also observed but outside of the initial 20 min survey period only.

Mean Use and Frequency of Occurrence

Diurnal raptor use was highest in spring (0.58 raptors/800-m plot/20-min survey) followed by summer (0.21), fall (0.14) and winter (0.02; Table 3). Raptors were observed during in 24% of surveys in spring and 18.6% during the summer. During the fall season, raptors were observed during 12% of surveys and 2.7% of winter surveys (Table 3). Most raptor use was attributable to northern harriers (0.33 raptors/800-m plot/20-min survey) and red-tailed hawks (0.19) during spring and red-tailed hawks in the summer (0.19) and fall (0.07). Mean use for bald eagles was 0.05 raptors/800-m plot/20-min survey or less in each season; bald eagles were observed in 4% of spring surveys, followed by fall (2%), winter (1.5%), and summer (1.2%).

Table 3. Mean bird use (number of birds/plot[a]/20-min survey) and frequency of occurrence (%) by large bird type, raptor subtypes, species, and season observed during fixed-point bird use surveys[b] at the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota, from March 22, 2013 to March 16 , 2014.

	Mean Use				% Frequency			
Type/Subtype/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Diurnal Raptors								
Buteos	*0.19*	*0.19*	*0.08*	*0.01*	*14.0*	*16.2*	*8.0*	*1.2*
red-tailed hawk	0.19	0.19	0.07	0	14.0	16.2	7.0	0
Swainson's hawk	0	0	0	0.01	0	0	0	1.2
unidentified buteo	0	0	0.01	0	0	0	1.0	0
Northern Harrier	*0.33*	*0.01*	*0.02*	*0*	*5.0*	*1.2*	*2.0*	*0*
northern harrier	0.33	0.01	0.02	0	5.0	1.2	2.0	0
Eagles	*0.05*	*0.01*	*0.04*	*0.01*	*4.0*	*1.2*	*2.0*	*1.5*
bald eagle	0.05	0.01	0.04	0.01	4.0	1.2	2.0	1.5
Falcons	*0.01*	*0*	*0*	*0*	*1.0*	*0*	*0*	*0*
American kestrel	0.01	0	0	0	1.0	0	0	0
Total	**0.58**	**0.21**	**0.14**	**0.02**	**24.0**	**18.6**	**12.0**	**2.7**
Other Species								
Waterbirds	**0.21**	**0.2**	**0.05**	**0**	**3**	**8.8**	**1**	**0**
American white pelican	0	0.06	0	0	0	1.2	0	0
double-crested cormorant	0.21	0.11	0.05	0	3	5	1	0
great blue heron	0	0.01	0	0	0	1.2	0	0
great egret	0	0.01	0	0	0	1.2	0	0
Waterfowl	**15.08**	**0.06**	**1.01**	**0.4**	**38**	**5**	**5**	**7.5**
blue-winged teal	0.93	0.02	0	0	10	2.5	0	0
bufflehead	0.02	0	0	0	1	0	0	0
Canada goose	6.96	0	0.95	0.4	15	0	4	7.5
greater white-fronted goose	4.95	0	0	0	1	0	0	0
mallard	0.8	0.01	0.06	0	18	1.2	1	0
northern shoveler	1.11	0.02	0	0	7	1.2	0	0
ruddy duck	0.04	0	0	0	1	0	0	0
snow goose	0.25	0	0	0	2	0	0	0
wood duck	0.02	0	0	0	1	0	0	0
Shorebirds	**0**	**0.01**	**0.1**	**0**	**0**	**1.2**	**4**	**0**
killdeer	0	0	0.1	0	0	0	4	0
upland sandpiper	0	0.01	0	0	0	1.2	0	0
Gulls/Terns	**0.14**	**0.04**	**5.17**	**0**	**1**	**1.2**	**6**	**0**
Franklin's gull	0	0	5.17	0	0	0	6	0
ring-billed gull	0.14	0.04	0	0	1	1.2	0	0

Table 3. Mean bird use (number of birds/plot[a]/20-min survey) and frequency of occurrence (%) by large bird type, raptor subtypes, species, and season observed during fixed-point bird use surveys[b] at the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota, from March 22, 2013 to March 16 , 2014.

	Mean Use				% Frequency			
Type/Subtype/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Owls	**0**	**0**	**0**	**0.01**	**0**	**0**	**0**	**1.2**
great horned owl	0	0	0	0.01	0	0	0	1.2
Vultures	**0.02**	**0**	**0.01**	**0**	**1**	**0**	**1**	**0**
turkey vulture	0.02	0	0.01	0	1	0	1	0
Upland Game Birds	**0**	**0**	**0.04**	**0.04**	**0**	**0**	**4**	**2.6**
ring-necked pheasant	0	0	0.04	0.04	0	0	4	2.6
Doves/Pigeons	**0**	**0**	**0.14**	**0.05**	**0**	**0**	**4**	**1.2**
mourning dove	0	0	0.03	0	0	0	2	0
rock pigeon	0	0	0.11	0.05	0	0	2	1.2
Large Corvids	**0**	**0.04**	**0.94**	**0.45**	**0**	**1.2**	**6**	**4**
American crow	0	0.04	0.94	0.45	0	1.2	6	4
Total	**15.45**	**0.35**	**7.46**	**0.95**	**43.0**	**17.4**	**31.0**	**16.5**

[a] 800-meter radius
[b] first 20 minutes of surveys only

Special Status Species

No federally endangered, threatened, candidate, or proposed species were observed during fixed-point surveys or incidentally (Endangered Species Act [ESA] 1973). One-hundred-thirty common terns (*Sterna hirundo*) in two groups were observed during fixed-point surveys; common terns are a Minnesota state threatened species (MDNR 2013; Table 4). Two Minnesota special concern bird species (MDNR 2013) were recorded: the Franklin's gull (*Leucophaeus pipixcan*) and American white pelican (*Pelecanus erythrorhynchos*). There were 2,455 observations in 28 groups of Franklin's gull and 209 individuals in 19 groups of American white pelican observed during fixed-point surveys. Thirty-four individual bald eagles in 27 groups were observed at the RPWRA during fixed-point surveys or incidentally (Table 4). Bald eagles are protected under the Federal Bald and Golden Eagle Protection Act (BGEPA 1940).

Table 4. Number of groups, individuals (number of observations), and status of sensitive species observed during fixed-point bird use surveys[a,b] (FP) and as incidental wildlife observations (Inc) at the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota, from March 22, 2013 to March 16, 2014.

			FP		Inc		Total	
Species	**Scientific Name**	**Status**	**Number of Groups**	**Number of Observations**	**Number of Groups**	**Number of Observations**	**Number of Groups**	**Number of Observations**
Franklin's gull	*Leucophaeus pipixcan*	SCS	28	2,455	0	0	28	2,455
American white pelican	*Pelecanus erythrorhynchos*	SCS	19	209	0	0	19	209
common tern	*Sterna hirundo*	MNT	2	130	0	0	2	130
bald eagle	*Haliaeetus leucocephalus*	EA	14	15	13	19	27	34
Bird Total	**4 Species**		**63**	**2,809**	**13**	**19**	**76**	**2,828**

SCS = MN Special Concern Species (MDNR 2013);
MNT = MN Threatened Species (MDNR 2013);
EA = Federal Bald and Golden Eagle Protection Act (BGEPA 1940)
[a] 60-minute survey period
[b] regardless of distance from observer

Bird Flight Height and Behavior

For diurnal raptors, 82 single birds or groups totaling 112 individuals were observed flying within the 800-m plot (Table 5). Overall, 76.8% of raptors observed flying were recorded initially within the RSH, 22.3% were below the RSH, and 0.9% were observed flying above the RSH. Eighty percent of flying bald eagles (five individuals) were observed flying within the RSH while just over half (56.0%) of northern harriers were recorded within the RSH (Table 5).

Twenty-four single birds or groups of Franklin's gulls totaling 2,192 individuals were observed flying within the 800-m plot (Table 6). Overall, 90.4% of Franklin's gulls observed flying were recorded initially within the RSH, 9.6% were below the RSH, and none were observed flying above the RSH. American white pelican observed flying at the RPWRA during fixed-point surveys were all recorded within the RSH. Eighty percent of bald eagle groups which were observed flying were recorded within the RSH; twenty percent flew below the RSH (Table 6). All of the flying common terns were observed flying within the RSH.

Table 5. Raptor flight height characteristics by subtype observed during fixed-point bird use surveys[a,b] at the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota, from March 22, 2013 to March 16, 2014.

Subtype	Number of Groups Flying	Number Observed Flying	Mean Flight Height (m)	% Observed Flying	% within Flight Height Categories		
					0 - 25 m	25 - 150 m[c]	> 150 m
Buteos	51	55	62.06	85.9	3.6	94.5	1.8
Northern Harrier	24	50	21.04	100	44.0	56.0	0
Eagles	5	5	57.00	45.5	20.0	80.0	0
Falcons	2	2	35.00	100	0	100	0
Diurnal Raptors	**82**	**112**	**49.09**	**88.2**	**22.3**	**76.8**	**0.9**

[a] 60-minute survey period
[b] 800-meter radius
[c] The likely rotor-swept heights for potential collision with a turbine blade, or 25 to 150 m (82 to 492 ft) above ground level

Table 6. Flight characteristics for species of concern observed during fixed-point bird use surveys[a,b] at the Red Pine Wind Project, Lincoln and Lyon Counties, Minnesota, from March 22, 2013 to March 16, 2014.

Species	Number of Groups Flying	Number Observed Flying	Mean Flight Height (m)	% Observed Flying	% within Flight Height Categories		
					0 - 25 m	25 - 150 m[c]	> 150 m
Franklin's gull	24	2,192	72.29	93.6	9.6	90.4	0
American. white pelican	9	106	73.33	100.0	0	100.0	0
bald eagle	5	5	57.00	45.5	20.0	80.0	0
common tern	1	100	60.00	100.0	0	100.0	0

[a] 60-minute survey period
[b] 800-meter radius
[c.] RSH: the likely rotor-swept heights for potential collision with a turbine blade, or 25 to 150 m (82 to 492 ft) above ground level

Spatial Use

No discernible patterns of bird use concentration were observed during fixed-point surveys (Table 7). Large bird use was highest at points 2 (31.1 birds/20-min survey) and 4 (31.7). This high use was mainly due to waterfowl use. Small bird use was highest at points 10 (6.11) and 11 (9.53). Mean diurnal raptor use was highest at point 5 (1.8) mainly due to use by the northern harrier (Table 7).

Comparison of Raptor Use for 20-min and 60-min Surveys

Diurnal raptor use (number of birds/plot/survey time) values calculated from the full 60-min surveys demonstrated a seasonal pattern of use, with spring exhibiting the highest, summer and fall less than half of that, and winter with the lowest mean use (Table 8). Data from the first 20 min of the standard 60-min survey captured a considerable portion of the observed use (spring 75.3%; summer, 84%; fall, 46.7%; winter, 50%) and mirrored the seasonal use pattern. On the contrary, by assuming bird observations to be equally spread across the 60-min survey period, the mean use calculated by dividing by three underestimates raptor use in all seasons compared to the 20-min survey.

Eagle Use and Flight Paths

Overall, there were 336 hours of bald eagle fixed-point use surveys conducted at the RPWRA. During this time, bald eagles were visible for 306-min (including perched birds) and 12 flight paths were recorded. Flight paths for eagles showed no apparent pattern (Figure 3).

Table 7. Mean use (number of birds/20-min survey) by each survey point raptor subtype observed during fixed-point bird use surveys[a,b] at the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota, from March 22, 2013 to March 16, 2014.

	Survey Point																			
Subtype / Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Buteos	0.12	0.11	0	0.11	0.07	0.11	0.12	0.11	0.06	0.06	0	0.06	0.12	0.11	0	0.5	0.19	0.17	0	0.17
Northern Harrier	0.38	0.06	0	0	1.73	0	0	0	0.06	0	0	0	0	0	0	0	0	0.06	0	0.06
Eagles	0	0	0.06	0	0	0	0	0.06	0	0	0.07	0	0	0	0	0.06	0.25	0.11	0.07	0
Falcons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.07	0
All Raptors	**0.5**	**0.17**	**0.06**	**0.11**	**1.8**	**0.11**	**0.12**	**0.17**	**0.12**	**0.06**	**0.07**	**0.06**	**0.12**	**0.11**	**0**	**0.56**	**0.44**	**0.33**	**0.14**	**0.22**

[a] 800-meter radius
[b] first 20 minutes of surveys only

Table 8. Change in mean use estimates[a] (number of birds/plot/survey time) for all raptors and raptor subtypes by season and in response to survey length (60-min versus 20-min surveys) and method of calculating 20-min mean use observed at the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota, from March 22, 2013 to March 16, 2014.

		Mean Use			
Survey Length	**Raptors**	**Spring**	**Summer**	**Fall**	**Winter**
All observations recorded during 60-min surveys	**Diurnal Raptors**	**0.77**	**0.25**	**0.30**	**0.06**
	Buteos	0.29	0.21	0.19	0.05
	Northern Harrier	0.42	0.02	0.06	0
	Eagles	0.05	0.01	0.04	0.01
	Falcons	0.01	0	0.01	0
Mean use per 20 minutes calculated by scaling the mean use from the 60-min surveys	**Diurnal Raptors**	**0.26**	**0.08**	**0.10**	**0.02**
	Buteos	0.10	0.07	0.06	0.02
	Northern Harrier	0.14	0.01	0.02	0
	Eagles	0.02	<0.01	0.01	<0.01
	Falcons	<0.01	0	<0.01	0
Mean use during the first 20 minutes of surveys	**Diurnal Raptors**	**0.58**	**0.21**	**0.14**	**0.03**
	Buteos	0.19	0.19	0.08	0.01
	Northern Harrier	0.33	0.01	0.02	0
	Eagles	0.05	0.01	0.04	0.01
	Falcons	0.01	0	0	0

[a] 800-meter radius

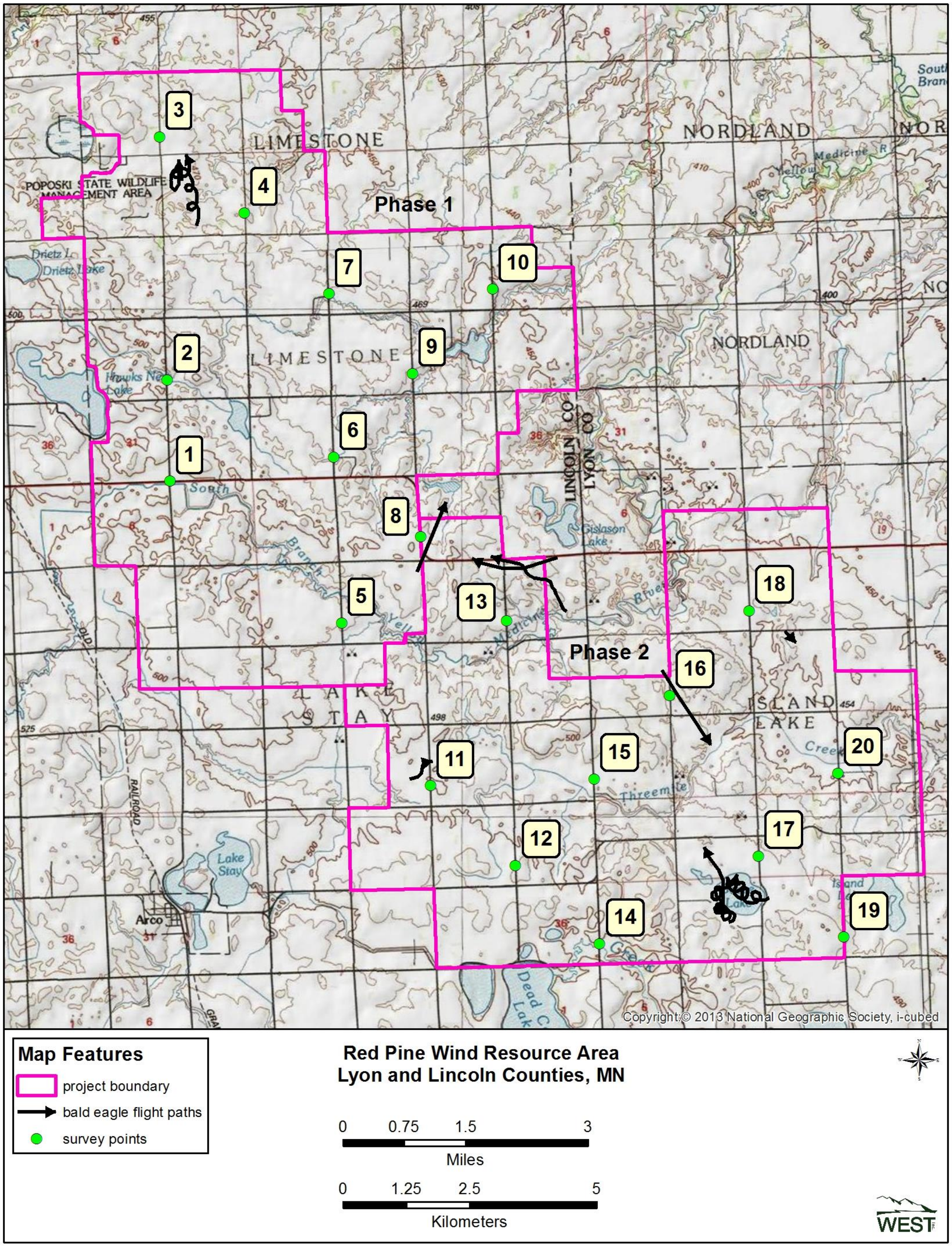

Figure 3. Bald eagle flight paths observed during 60-min fixed-point bird use surveys at the Red Pine Wind Resource Area, Lincoln and Lyon Counties, Minnesota.

DISCUSSION

The Wind Energy Guidelines (USFWS 2012b) use a tiered approach to assess impacts to species and their habitats. Tier 3 studies, as defined in the Wind Energy Guidelines, were targeted to address questions regarding impact that could not be sufficiently addressed using available literature (i.e., Tiers 1 and 2 desktop analysis). Similar efforts have been promoted by the MDNR. These studies provide additional data that, when combined with available literature reviewed in previous Tiers, allows for a confident assessment of the risk of significant adverse impacts to species of concern; identify measures to mitigate significant adverse impacts, if necessary; and/or identify a need for more field studies. While the avian use surveys reported herein were conducted across all species observed, the report focuses on a smaller group of species – diurnal raptors, eagles, state/federally listed species, and Minnesota special concern species; avian use surveys are one of a suite of Tier 3 studies used as part of risk analyses at the RPWRA.

Raptor Use and Fatalities

Overall mean diurnal raptor use observed during this study was 0.22 raptors/800-m plot/20-min survey (Figure 4). Compared to other publicly available project data from the central and western US with similar study seasons, mean raptor use at RPWRA is relatively low. Of 49 projects with raptor use, RPWRA ranked 41st (Figure 4). Results of post-construction bird fatality monitoring in the Midwest ranged from 0.27 to 8.25 bird fatalities per megawatt (MW) per year (Table 9). Bird mortality at the RPWRA would likely be within this range and potentially similar to those rates observed at other wind projects in Minnesota (1.43 to 5.59 bird fatalities/MW/year).

Raptor fatality rates reported at other Minnesota wind energy facilities have been relatively low (zero at Buffalo Ridge and Elm Creek and 0.37 fatalities/MW/year at Moraine II (Table 9). Publicly available data containing both mean raptor use and raptor fatality information in the Midwest is scarce, while data having this information for four seasons is even rarer. The only directly comparable data is from Grand Ridge I in Illinois, which had a mean raptor use of 0.19 raptors/800-m plot/20-min survey and no raptor fatalities (Derby et al. 2010g). Although not directly comparable, a project in South Dakota (Wessington Springs, which only had spring and fall use) had a mean raptor use for the spring and fall seasons of 0.23 raptors/800-m plot/20-min survey (Derby et al. 2008) and raptor fatality rates of 0.06 and 0.07 fatalities/MW/year (Derby et al. 2010f, 2011b). Mean raptor use at the RPWRA is similar to that reported at the above-mentioned facilities, but still relatively low, which may suggest low overall impact to diurnal raptors should this project be constructed.

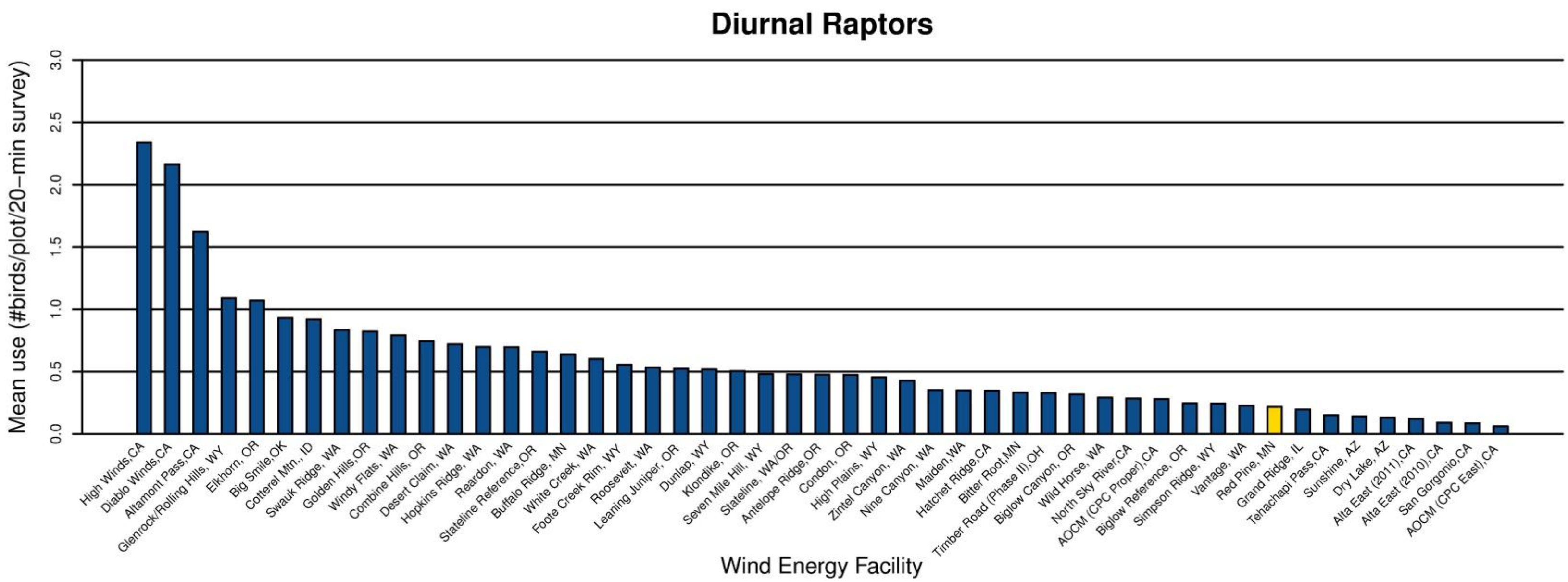

Figure 4. Annual diurnal raptor use (raptor/plot/20-min survey) observed during fixed-point bird use surveys at the Red Pine Wind Resource Area from March 22, 2013 to March 16, 2014, and raptor use observed at other US wind resource areas.

Data from the following sources:

Study and Location	Reference	Study and Location	Reference	Study and Location	Reference
Red Pine, MN	This study				
High Winds, CA	Kerlinger et al. 2005	White Creek, WA	NWC and WEST 2005	Timber Road (Phase II), OH	Good et al. 2010
Diablo Winds, CA	WEST 2006	Foote Creek Rim, WY	Johnson et al. 2000b	Biglow Canyon, OR	WEST 2005c
Altamont Pass, CA	Orloff and Flannery 1992	Roosevelt, WA	NWC and WEST 2004	Wild Horse, WA	Erickson et al. 2003d
Glenrock/Rolling Hills, WY	Johnson et al. 2008a	Leaning Juniper, OR	Kronner et al. 2005	North Sky River, CA	Erickson et al. 2011
Elkhorn, OR	WEST 2005a	Dunlap, WY	Johnson et al. 2009a	AOCM (CPC Proper), CA	Chatfield et al. 2010
Big Smile (Dempsey), OK	Derby et al. 2010a	Klondike, OR	Johnson et al. 2002	Biglow Reference, OR	WEST 2005c
Cotterel Mtn., ID	BLM 2006	Seven Mile Hill, WY	Johnson et al. 2008b	Simpson Ridge, WY	Johnson et al. 2000b
Swauk Ridge, WA	Erickson et al. 2003b	Stateline, WA/OR	Erickson et al. 2003a	Vantage, WA	WEST 2007
Golden Hills, OR	Jeffrey et al. 2008	Antelope Ridge, OR	WEST 2009	Grand Ridge, IL	Derby et al. 2009
Windy Flats, WA	Johnson et al. 2007	Condon, OR	Erickson et al. 2002b	Tehachapi Pass, CA	Anderson et al. 2000, Erickson et al. 2002b
Combine Hills, OR	Young et al. 2003c	High Plains, WY	Johnson et al. 2009b	Sunshine, AZ	WEST and the CPRS 2006
Desert Claim, WA	Young et al. 2003b	Zintel Canyon, WA	Erickson et al. 2002a, 2003c	Dry Lake, AZ	Young et al. 2007b
Hopkins Ridge, WA	Young et al. 2003a	Nine Canyon, WA	Erickson et al. 2001	Alta East (2011), CA	Chatfield et al. 2011
Reardon, WA	WEST 2005b	Maiden, WA	Young et al. 2002	Alta East (2010), CA	Chatfield et al. 2011
Stateline Reference, OR	URS et al. 2001	Hatchet Ridge, CA	Young et al. 2007a	San Gorgonio, CA	Anderson et al. 2000, Erickson et al. 2002b
Buffalo Ridge, MN	Johnson et al. 2000a	Bitter Root. MN	Derby and Dahl 2009	AOCM (CPC East), CA	Chatfield et al. 2010

Table 9. Raptor and all bird fatality estimates (number of fatalities per megawatt [MW] per year) and dominant land cover for wind energy facilities in the Midwest.

Facility/Project Name	All Bird Fatalities /MW/Year	Raptor Fatalities /MW/Year	Dominant Land Cover	Reference
Barton I & II, IA (2010-2011)	5.5	0	agriculture	Derby et al. 2011a
Blue Sky Green Field, WI (2008; 2009)	7.17	0	agriculture	Gruver et al. 2009
Buffalo Ridge, MN (Phase I; 1996)	4.14	0	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1997)	2.51	0	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1998)	3.14	0	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1999)	1.43	0	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase II; 1998)	2.47	0	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase II; 1999)	3.57	0	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase III; 1999)	5.93	0	agriculture	Johnson et al. 2000a
Buffalo Ridge I, SD (2009-2010)	5.06	0.2	agriculture/grassland	Derby et al. 2010b
Buffalo Ridge II, SD (2011-2012)	1.99	0	agriculture, grassland	Derby et al. 2012a
Cedar Ridge, WI (2009)	6.55	0.18	agriculture	BHE Environmental 2010
Cedar Ridge, WI (2010)	3.72	0.13	agriculture	BHE Environmental 2011
Elm Creek, MN (2009-2010)	1.55	0	agriculture	Derby et al. 2010c
Elm Creek II, MN (2011-2012)	3.64	0	agriculture, grassland	Derby et al. 2012b
Fowler I, IN (2009)	2.83	0	agriculture	Good et al. 2011
Grand Ridge I, IL (2009-2010)	0.48	0	agriculture	Derby et al. 2010g
Kewaunee County, WI (1999-2001)	1.95	0	agriculture	Howe et al. 2002
Moraine II, MN (2009)	5.59	0.37	agriculture/grassland	Derby et al. 2010d
NPPD Ainsworth, NE (2006)	1.63	0.06	agriculture/grassland	Derby et al. 2007
Pioneer Prairie I, IA (Phase II; 2011-2012)	0.27	0	agriculture, grassland	Chodachek et al. 2012
PrairieWinds ND1 (Minot), ND (2010)	1.48	0.05	agriculture	Derby et al. 2011c
PrairieWinds ND1 (Minot), ND (2011)	1.56	0.05	agriculture, grassland	Derby et al. 2012c
PrairieWinds SD1, SD (2011-2012)	1.41	0	grassland	Derby et al. 2012d
Ripley, Ont (2008)	3.09	0.1	agriculture	Jacques Whitford 2009
Rugby, ND (2010-2011)	3.82	0.06	agriculture	Derby et al. 2011b
Top of Iowa, IA (2003)	0.42	0	agriculture	Jain 2005
Top of Iowa, IA (2004)	0.81	0.17	agriculture	Jain 2005
Wessington Springs, SD (2009)	8.25	0.06	grassland	Derby et al. 2010f
Wessington Springs, SD (2010)	0.89	0.07	grassland	Derby et al. 2011d
Winnebago, IA (2009-2010)	3.88	0.27	agriculture/grassland	Derby et al. 2010e

While abundance is intuitively connected to raptor fatality risk to some degree, risk is likely influenced by other factors as well, such as species-specific flight behaviors. Almost 80% of flying diurnal raptors at the RPWRA were observed within the RSH. A higher proportion of buteos, eagles, and falcons flew within the RSH compared to northern harriers, potentially indicating that species in those raptor groups may have a higher risk for collision with wind turbines compared to northern harriers.

This fixed-point bird use survey was designed to provide a relative index of use by raptors during all seasons at the RPWRA. Mean diurnal raptor use was higher during the spring (0.58; Table 3), yet still relatively low when compared to other wind facilities in central and western US. The RPWRA is not within a known raptor migration corridor, and there are no features unique to the RPWRA that would appear to attract large numbers of diurnal raptors. Furthermore, raptor fatality rates reported from studies in the Midwest are typically low. Site-specific and regional data suggest there is some potential for raptor mortality, but these potential impacts to individuals are unlikely to cause significant adverse impacts to raptor populations. Further, there is some potential for habitat loss and displacement of individuals, but the resources available in the RPWRA are widely available in the local landscape.

Comparison of Raptor Use for 20-min and 60-min Surveys

Raptor observations were not equally distributed across the 60-min survey period. The results indicated that, for the buteos and the northern harrier groups, the majority of birds were first observed in the first 20-min segment of the survey (Table 8). This was true in spring and summer, but less obvious in fall. For eagles, the observations from the first 20-min survey period were indicative of the mean use observed during the 60-min survey period. The bald eagle was rarely observed throughout the year and the observations recorded after the first 20-min period coincided with observations well outside the 800 m area used in mean use analysis. If observations beyond 800 m were included in the summary statistics, the majority of bald eagle use was still observed in the first 20-min of the 60-min survey.

Survey length is analogous to sampling area: the longer you survey (or the larger the area surveyed), the more observations you will make. A 60-min survey generally results in more bird observations. However, for this study, the information regarding raptor seasonal use and group composition generally considers the 20-min survey period as this is more directly comparable to historic studies for comparison.

Sensitive Species

Common Tern

One-hundred-thirty individuals in two groups of common terns were observed after the first 20-min fixed point surveys and outside the 100-m radius (Table 4). The terns were observed in September and October and could possibly be migrating birds; both observations were over water. RPWRA is not located near the six primary nesting areas and, based on natural history, the potential for nesting in the vicinity is small (MDNR 2014b). One group of flying common terns flew within the RSH, suggesting collision with turbine blades is possible (Table 6). If turbines are sited away from potential common tern habitat (lakes), then impacts to common terns could be reduced.

Bald Eagle

Fifteen observations of bald eagles (11 observations during all bird 20-min fixed point surveys and four observations after the first 20-min of surveys) were also recorded during this study; nineteen additional incidental observations was recorded (Table 4). These results suggest that bald eagles are year around residents in the vicinity of the RPWRA but do not appear to utilize the project area to any great degree during any season. Four of the five flying bald eagles flew within the RSH (Table 6), suggesting some risk of collision with turbines. However, given the low susceptibility of bald eagles to collisions with wind turbines (six bald eagle fatalities have been publicly reported nationwide; Pagel et al. 2013), and their low use of the project area but overall population increase across the species range, the RPWRA is unlikely to have significant adverse impacts on bald eagle populations.

Franklin's Gull

Franklin's gulls were observed 2,455 times in 28 groups (Table 4), with most groups observed in the fall, suggesting that the birds were migrating. Most birds were observed over cultivated agriculture fields. Breeding colonies are rare in the state. During non-breeding seasons, Franklin's gulls utilize prairie wetlands and lakes, feeding both over water and in fields (MDNR 2014c). All flying Franklin's gulls were observed flying within the RSH. Given the number of gulls observed and their propensity to fly within the RSH (Table 6), there could be potential for turbine-related fatalities to occur. However, the lack of documented fatalities at wind facilities with publicly available data within the breeding range and migratory pathway of Franklin's gulls appear to indicate a low risk of collision with turbines (Tetra Tech 2012).

American White Pelican

Two-hundred-nine observations in nineteen groups of American white pelicans were observed at RPWRA (Table 4). All observations were recorded in the spring, summer, and fall seasons and were of flying birds or birds on water. No evidence of breeding colonies (MDNR 2014a) was observed during surveys. Flying pelicans were observed 100% of the time within the RSH (Table 6). Impacts to pelicans may be reduced by placing turbines away from potential habitat such as wetlands and lakes.

REFERENCES

Anderson, R. L., D. Strickland, J. Tom, N. Neumann, W. Erickson, J. Cleckler, G. Mayorga, G. Nuhn, A. Leuders, J. Schneider, L. Backus, P. Becker, and N. Flagg. 2000. Avian Monitoring and Risk Assessment at Tehachapi Pass and San Gorgonio Pass Wind Resource Areas, California: Phase 1 Preliminary Results. *In*: Proceedings of the National AvianWind Power Planning Meeting III (PNAWPPM-III), May 1998, San Diego, California. National Wind Coordinating Collaborative (NWCC)/RESOLVE, Washington, D.C. Pp 31-46.

Bald and Golden Eagle Protection Act (BGEPA). 1940. 16 United States Code (USC) § 668-668d. Bald Eagle Protection Act of 1940, June 8, 1940, Chapter 278, § 2, 54 Statute (Stat.) 251; Expanded to include the related species of the golden eagle October 24, 1962, Public Law (P.L.) 87-884, 76 Stat. 1246. As amended: October 23, 1972, P.L. 92-535, § 2, 86 Stat. 1065; Nov. 8, 1978, P.L. 95-616, § 9, 92 Stat. 3114.

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

BHE Environmental, Inc. (BHE). 2011. Post-Construction Bird and Bat Mortality Study: Cedar Ridge Wind Farm, Fond Du Lac County, Wisconsin. Final Report. Prepared for Wisconsin Power and Light, Madison, Wisconsin. Prepared by BHE Environmental, Inc. Cincinnati, Ohio. February 2011.

Bureau of Land Management (BLM). 2005. Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM Administered Land in the Western United States. US Department of the Interior (USDOI), BLM, Washington, D.C. http://windeis.anl.gov/

Bureau of Land Management (BLM). 2006. Final Environmental Impact Statement for the Proposed Cotterel Wind Power Project and Proposed Resource Management Plan Amendment. FES 06-07. Serial No. IDI-33676. Prepared for the US Department of the Interior (USDOI), BLM, Twin Falls District, Burley Field Office, Cassia County, Idaho, on behalf of Windland, Inc., Boise, Idaho, and Shell WindEnergy Inc., Houston, Texas. March 2006.

Chatfield, A., W. P. Erickson, and K. Bay. 2010. Baseline Avian Studies at the Sun Creek Wind Resource Area Kern County, California. Final Report: May 2009 - May 2010. Prepared for CH2M HILL, Oakland, California. Prepared by Western EcoSystems Technology, Inc., Cheyenne, Wyoming.

Chatfield, A., W. P. Erickson, and K. Bay. 2011. Avian Baseline Studies for the Alta East Wind Resource Area, Kern County, California. Draft Final Report: July 10, 2010 - June 1, 2011. Prepared for CH2M HILL, Oakland, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming.

Chodachek, K., C. Derby, M. Sonnenberg, and T. Thorn. 2012. Post-Construction Fatality Surveys for the Pioneer Prairie Wind Farm I LLC Phase II, Mitchell County, Iowa: April 4, 2011 – March 31, 2012. Prepared for EDP Renewables, North America LLC, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Denholm, P., M. Hand, M. Jackson, and S. Ong. 2009. Land-Use Requirements of Modern Wind Power Plants in the United States. NREL/TP-6A2-45834. National Renewable Energy Laboratory (NREL), Golden, Colorado. August 2009. Available online at: ftp://ftp.manomet.org/WildlifeandEnergy/Literature_8July10/NREL_Land_Use_2009.pdf

Derby, C. 2014. Red Pine Wind Project Habitat Mapping. Prepared for Red Pine Wind Power, Santa Barbara, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Bay, and A. Dahl. 2010a. Wildlife Baseline Studies for the Dempsey Wind Resource Area, Roger Mills County, Oklahoma. Final Report: March 2008 – February 2009. Prepared for HDR Engineering, Minneapolis, Minnesota, and Dempsey Ridge Wind Farm, LLC, a wholly owned subsidiary of Acciona Wind Energy USA LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. February 10, 2010.

Derby, C., K. Bay, and J. Ritzert. 2009. Bird Use Monitoring, Grand Ridge Wind Resource Area, La Salle County, Illinois. Year One Final Report, March 2008 - February 2009. Prepared for Grand Ridge Energy LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 29, 2009.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010b. Post-Construction Fatality Survey for the Buffalo Ridge I Wind Project. May 2009 - May 2010. Prepared for Iberdrola Renewables, Inc., Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010c. Post-Construction Fatality Surveys for the Elm Creek Wind Project: March 2009- February 2010. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010d. Post-Construction Fatality Surveys for the Moraine II Wind Project: March - December 2009. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010e. Post-Construction Fatality Surveys for the Winnebago Wind Project: March 2009- February 2010. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and S. Nomani. 2011a. Post-Construction Fatality Surveys for the Barton I and II Wind Project: IRI. March 2010 - February 2011. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. Version: September 28, 2011.

Derby, C., K. Chodachek, K. Bay, and S. Nomani. 2011b. Post-Construction Fatality Surveys for the Rugby Wind Project: Iberdrola Renewables, Inc. March 2010 - March 2011. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. Version: October 14, 2011.

Derby, C., K. Chodachek, and M. Sonnenberg. 2012a. Post-Construction Casualty Surveys for the Buffalo Ridge II Wind Project. Iberdrola Renewables: March 2011- February 2012. Prepared for Iberdrola Renewables, LLC, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 31, 2012.

Derby, C., K. Chodachek, and M. Sonnenberg. 2012b. Post-Construction Fatality Surveys for the Elm Creek II Wind Project. Iberdrola Renewables: March 2011-February 2012. Prepared for Iberdrola Renewables, LLC, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. October 8, 2012.

Derby, C., K. Chodachek, T. Thorn, K. Bay, and S. Nomani. 2011c. Post-Construction Fatality Surveys for the PrairieWinds ND1 Wind Facility, Basin Electric Power Cooperative, March - November 2010. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 2, 2011.

Derby, C., K. Chodachek, T. Thorn, and A. Merrill. 2012c. Post-Construction Surveys for the PrairieWinds ND1 (2011) Wind Facility Basin Electric Power Cooperative: March - October 2011. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western Ecosystems Technology, Inc. (WEST), Bismarck, North Dakota. August 31, 2012.

Derby, C. and A. Dahl. 2009. Wildlife Studies for the Bitter Root Wind Resource Area, Yellow, Medicine, and Lincoln Counties, Minnesota. Annual Report: March 25, 2008 - October 8, 2008. Prepared for Buffalo Ridge Power Partners, Argyle, New York. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismark, North Dakota. April 16, 2009. *In:* Minnesota Department of Commerce, Office of Energy Security. 2010. Bitter Root Wind Farm Project, Environmental Report. Site Permit Application, Appendix F. Minnesota Public Utilities Commission, Docket 25538. March 2010. Available online at: http://www.calco.state.mn.us/commerce/energyfacilities/documents/25538/Appendix_%20F_Wildlife_Studies.pdf

Derby, C., A. Dahl, K. Bay, and L. McManus. 2011d. 2010 Post-Construction Monitoring Results for the Wessington Springs Wind Energy Facility, South Dakota. Final Report: March 9 – November 16, 2010. Prepared for Wessington Wind Energy Center, LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. November 22, 2011.

Derby, C., A. Dahl, W. Erickson, K. Bay, and J. Hoban. 2007. Post-Construction Monitoring Report for Avian and Bat Mortality at the NPPD Ainsworth Wind Farm. Unpublished report prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, for the Nebraska Public Power District.

Derby, C., A. Dahl, and A. Merrill. 2012d. Post-Construction Monitoring Results for the PrairieWinds SD1 Wind Energy Facility, South Dakota. Final Report: March 2011 - February 2012. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. September 27, 2012.

Derby, C., A. Dahl, A. Merrill, and K. Bay. 2010f. 2009 Post-Construction Monitoring Results for the Wessington Springs Wind-Energy Facility, South Dakota. Final Report. Prepared for Wessington Wind Energy Center, LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 19, 2010.

Derby, C., A. Dahl, K. Taylor, K. Bay, and K. Seginak. 2008. Wildlife Baseline Studies for the Wessington Springs Wind Resource Area, Jearald County, South Dakota, March 2007-November 2007. Technical report prepapred for Power Engineers, Inc. and Babcock and Brown Renewable Holdings, Inc. by Western EcoSystems Technology, Inc. (WEST).

Derby, C., J. Ritzert, and K. Bay. 2010g. Bird and Bat Fatality Study, Grand Ridge Wind Resource Area, Lasalle County, Illinois. January 2009 - January 2010. Prepared for Grand Ridge Energy LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. July 13, 2010. Revised January 2011.

Endangered Species Act (ESA). 1973. 16 United States Code (USC) § 1531-1544, Public Law (PL) 93-205, December 28, 1973, as amended, PL 100-478 [16 USC 1531 *et seq.*]; 50 Code of Federal Regulations (CFR) 402.

Erickson, W. P., A. Chatfield, and K. Bay. 2011. Avian Baseline Studies for the North Sky River Wind Energy Project, Kern County, California. Final Report: May 18, 2010 – May 26, 2011. Final Report. Prepared for CH2M HILL, Portland Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 7, 2011.

Erickson, W. P., J. Jeffrey, K. Kronner, and K. Bay. 2003a. Stateline Wind Project Wildlife Monitoring Annual Report, Results for the Period July 2001 - December 2002. Technical report submitted to FPL Energy, the Oregon Office of Energy, and the Stateline Technical Advisory Committee. Western EcoSystems Technology, Inc., Cheyenne, Wyoming. May 2003.

Erickson, W. P., J. Jeffrey, D. P. Young, K. Bay, R. Good, K. Sernka, and K. Kronner. 2003b. Wildlife Baseline Study for the Kittitas Valley Wind Project: Summary of Results from 2002 Wildlife Surveys. Final Report February 2002– November 2002. Prepared for Zilkha Renewable Energy, Portland, Oregon, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. January 2003.

Erickson, W. P., G. D. Johnson, K. Bay, and K. Kronner. 2002a. Ecological Baseline Study for the Zintel Canyon Wind Project. Final Report April 2001 – June 2002. Technical report prepared for Energy Northwest. Prepared for Energy Northwest by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. June 2002.

Erickson, W. P., G. D. Johnson, D. P. Young, D. Strickland, R. Good, M. Bourassa, K. Bay, and K. Sernka. 2002b. Synthesis and Comparison of Baseline Avian and Bat Use, Raptor Nesting and Mortality Information from Proposed and Existing Wind Developments. Technical report prepared for Bonneville Power Administration, Portland, Oregon by WEST, Inc., Cheyenne, Wyoming. December 2002. http://www.bpa.gov/Power/pgc/wind/Avian_and_Bat_Study_12-2002.pdf

Erickson, W. P., K. Kronner, and R. Gritski. 2003c. Nine Canyon Wind Power Project Avian and Bat Monitoring Report. September 2002 – August 2003. Prepared for the Nine Canyon Technical Advisory Committee and Energy Northwest by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants (NWC), Pendleton, Oregon. October 2003. http://www.west-inc.com/reports/nine_canyon_monitoring_final.pdf

Erickson, W. P., E. Lack, M. Bourassa, K. Sernka, and K. Kronner. 2001. Wildlife Baseline Study for the Nine Canyon Wind Project, Final Report May 2000-October 2001. Technical report prepared for Energy Northwest, Richland, Washington. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon.

Erickson, W. P., D. P. Young, G. Johnson, J. Jeffrey, K. Bay, R. Good, and H. Sawyer. 2003d. Wildlife Baseline Study for the Wild Horse Wind Project. Summary of Results from 2002-2003 Wildlife Surveys May 10, 2002- May 22, 2003. Draft report prepared for Zilkha Renewable Energy, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. November 2003.

Good, R. E., W. P. Erickson, A. Merrill, S. Simon, K. Murray, K. Bay, and C. Fritchman. 2011. Bat Monitoring Studies at the Fowler Ridge Wind Energy Facility, Benton County, Indiana: April 13 - October 15, 2010. Prepared for Fowler Ridge Wind Farm. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. January 28, 2011.

Good, R. E., M. Ritzert, and K. Bay. 2010. Wildlife Baseline Studies for the Timber Road Phase II Wind Resource Area, Paulding County, Ohio. Final Report: September 2, 2008 - August 19, 2009. Prepared for Horizon Wind Energy, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. April 28, 2010.

Gruver, J., M. Sonnenberg, K. Bay, and W. Erickson. 2009. Post-Construction Bat and Bird Fatality Study at the Blue Sky Green Field Wind Energy Center, Fond Du Lac County, Wisconsin July 21 - October 31, 2008 and March 15 - June 4, 2009. Unpublished report prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. December 17, 2009.

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

Jacques Whitford Stantec Limited (Jacques Whitford). 2009. Ripley Wind Power Project Postconstruction Monitoring Report. Project No. 1037529.01. Report to Suncor Energy Products Inc., Calgary, Alberta, and Acciona Energy Products Inc., Calgary, Alberta. Prepared for the Ripley Wind Power Project Post-Construction Monitoring Program. Prepared by Jacques Whitford, Markham, Ontario. April 30, 2009. www.jacqueswhitford.com

Jain, A. 2005. Bird and Bat Behavior and Mortality at a Northern Iowa Windfarm. M.S. Thesis. Iowa State University, Ames, Iowa.

Jeffrey, J. D., W. P. Erickson, K. J. Bay, V. K. Poulton, W. L. Tidhar, and J. E. Baker. 2008. Wildlife Baseline Studies for the Golden Hills Wind Resource Area, Sherman County, Oregon. Final Report May 2006 – October 2007. Prepared for BP Alternative Energy North America Inc., Houston, Texas, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming.

Johnson, G. D., K. Bay, and J. Eddy. 2009a. Wildlife Baseline Studies for the Dunlap Ranch Wind Resource Area, Carbon and Albany Counties, Wyoming. June 4, 2008 - May 27, 2009. Prepared for CH2M HILL, Englewood, Colorado. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming.

Johnson, G. D., K. Bay, and J. Eddy. 2009b. Wildlife Baseline Studies for the High Plains Wind Resource Area, Carbon and Albany Counties, Wyoming. Prepared for CH2M HILL. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming.

Johnson, G. D., K. Bay, J. Eddy, and T. Rintz. 2008a. Wildlife Baseline Studies for the Glenrock Wind Resource Area, Converse County, Wyoming. Prepared for CH2M HILL. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming.

Johnson, G. D., J. Eddy, K. Bay, and A. Chatfield. 2008b. Wildlife Baseline Studies for the Seven Mile Hill Wind Resource Area, Carbon County, Wyoming: April 30 - November 15, 2007. Prepared for CH2M HILL, Englewood, Colorado. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming.

Johnson, G. D., W. P. Erickson, K. Bay, and K. Kronner. 2002. Baseline Ecological Studies for the Klondike Wind Project, Sherman County, Oregon. Final report prepared for Northwestern Wind Power, Goldendale, Washington, by Western EcoSystems Technology, Inc. (WEST) Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. May 29, 2002.

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

Johnson, G. D., J. Jeffrey, J. Baker, and K. Bay. 2007. Baseline Avian Studies for the Windy Flats Wind Energy Project, Klickitat County, Washington. Prepared for Windy Point Partners, LLC., by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. May 29, 2007.

Johnson, G. D., D. P. Young, W. P. Erickson, C. E. Derby, M. D. Strickland, R. E. Good, and J. W. Kern. 2000b. Wildlife Monitoring Studies, Seawest Windpower Plant, Carbon County, Wyoming, 1995-1999. Final report prepared for SeaWest Energy Corporation, San Diego, California, and the Bureau of Land Management, Rawlins, Wyoming, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 9, 2000.

Kerlinger, P., L. Culp, and R. Curry. 2005. Post-Construction Avian Monitoring Study for the High Winds Wind Power Project, Solano County, California. Year One Report. Prepared for High Winds, LLC and FPL Energy.

Kronner, K., B. Gritski, J. Baker, V. Marr, G. D. Johnson, and K.Bay. 2005. Wildlife Baseline Study for the Leaning Juniper Wind Power Project, Gilliam County, Oregon. Prepared for PPM Energy, Portland, Oregon and CH2MHILL, Portland, Oregon by NWC, Pendleton, Oregon, and WEST, Inc., Cheyenne, Wyoming. November 3, 2005.

Minnesota Department of Natural Resources (MDNR). 2013. Minnesota's List of Endangered, Threatened, and Special Concern Species. Effective August 19, 2013. Available online at: http://files.dnr.state.mn.us/natural_resources/ets/endlist.pdf

Minnesota Department of Natural Resources (MDNR). 2014a. Species Profile: American White Pelican. Rare Species Guide. Accessed June 2014. Available online at: http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=ABNFC01010

Minnesota Department of Natural Resources (MDNR). 2014b. Species Profile: Common Tern. Rare Species Guide. Accessed June 2014. Available online at: http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=ABNNM08070

Minnesota Department of Natural Resources (MDNR). 2014c. Species Profile: Franklin's Gull. Rare Species Guide. Accessed June 2014. Available online at: http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=ABNNM03020

Northwest Wildlife Consultants, Inc. (NWC) and Western Ecosystems Technology, Inc. (WEST). 2004. Ecological Baseline Studies for the Roosevelt Wind Project, Klickitat County, Washington. Final Report. Prepared by NWC, Pendleton, Oregon, and WEST, Inc., Cheyenne, Wyoming. September 2004

Northwest Wildlife Consultants, Inc. (NWC) and Western Ecosystems Technology, Inc. (WEST). 2005. Ecological Baseline Studies and Wildlife Impact Assessment for the White Creek Wind Power Project, Klickitat County, Washington. Prepared for Last Mile Electric Cooperative, Goldendale, Washington, by Northwest Wildlife Consultants, Inc., Goldendale, Washington, and Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. January 12, 2005.

Orloff, S. and A. Flannery. 1992. Wind Turbine Effects on Avian Activity, Habitat Use, and Mortality in Altamont Pass and Solano County Wind Resource Areas, 1989-1991. Final Report P700-92-001 to Alameda, Contra Costa, and Solano Counties, and the California Energy Commission, Sacramento, California, by Biosystems Analysis, Inc., Tiburon, California. March 1992.

Pagel, J. E., K. J. Kritz, B. A. Millsap, R. K. Murphy, E. L. Kershner, and S. Covington. 2013. Bald Eagle and Golden Eagle Mortalities at Wind Energy Facilities in the Contiguous United States. Journal of Raptor Research 47(3): 311-315.

Reynolds, R. T., J. M. Scott, and R. A. Nussbaum. 1980. A Variable Circular-Plot Method for Estimating Bird Numbers. Condor 82(3): 309-313.

Strickland, D. and G. D. Johnson. 2006. Overview of What We Know About Avian/Wind Interaction. Presented at the National Wind Coordinating Collaborative (NWCC) Wildlife Workgroup Research Meeting VI, November 14, San Antonio, Texas.

URS Corporation, Western EcoSystems Technology, Inc. (WEST), and Northwest Wildlife Consultants, Inc. (NWC). 2001. Avian Baseline Study for the Stateline Project. Prepared for FPL Energy Vansycle, LLC, Juno Beach, Florida.

US Department of Agriculture (USDA) National Agricultural Statistics Service (NASS). 2012. Cropscape - Cropland Data Layer. 2012 Minnesota Data. USDA NAS homepage at: http://www.nass.usda.gov/; Cropscape CDL program data available online at: http://nassgeodata.gmu.edu/CropScape/

US Fish and Wildlife Service (USFWS). 2012a. Eagle Conservation Plan Guidance. Module 1 - Land-Based Wind Energy Technical Appendices. Division of Migratory Bird Management, USFWS. August 2012.

US Fish and Wildlife Service (USFWS). 2012b. Final Land-Based Wind Energy Guidelines. March 23, 2012. 82 pp. Available online at: http://www.fws.gov/windenergy/docs/WEG_final.pdf

US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI). 2007. Region 3 NWI, Midwest Region: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. http://www.fws.gov/wetlands/data/index.html, NWI data at: http://www.fws.gov/wetlands/Data/Mapper.html and http://www.fws.gov/midwest/

US Geological Survey (USGS). 2012. Protected Areas Database of the United States (Padus), Version 1.2 Data Download. . USGS Gap Analysis Program Protected Areas Viewer. Webpage last modified March 2, 2012 Download available online at: http://gapanalysis.usgs.gov/padus/download/

Western Ecosystems Technology, Inc. (WEST). 2005a. Ecological Baseline Study at the Elkhorn Wind Power Project. Exhibit A. Final report prepared for Zilkha Renewable Energy, LLC., Portland, Oregon, by WEST, Cheyenne, Wyoming. June 2005.

Western EcoSystems Technology, Inc. (WEST). 2005b. Ecological Baseline Study for the Proposed Reardan Wind Project, Lincoln County, Washington. Draft Final Report. Prepared for Energy Northwest, Richland, Washington, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. June 2005.

Western EcoSystems Technology, Inc. (WEST). 2005c. Wildlife and Habitat Baseline Study for the Proposed Biglow Canyon Wind Power Project, Sherman County, Oregon. March 2004 - August 2005. Prepared for Orion Energy LLC., Oakland, California. WEST, Cheyenne, Wyoming. October, 2005.

Western EcoSystems Technology, Inc. (WEST). 2006. Diablo Winds Wildlife Monitoring Progress Report, March 2005 - February 2006. Technical report submitted to FPL Energy and Alameda County California. WEST. Cheyenne, Wyoming.

Western EcoSystems Technology, Inc. (WEST). 2007. Wildlife and Habitat Baseline Study for the Vantage Wind Power Project, Kittitas County, Washington. Draft report prepared for Invenergy by Western EcoSystems Technology, Inc. (WEST), Cheyenne Wyoming and Walla Walla, Washington. June 2007.

Western EcoSystems Technology, Inc. (WEST). 2009. Wildlife Baseline Studies for the Antelope Ridge Wind Resource Area, Union County, Oregon. August 28, 2008 - August 12, 2009. Draft final report prepared for Horizon Wind Energy, Houston, Texas. Prepared by WEST, Cheyenne, Wyoming.

Western EcoSystems Technology, Inc. (WEST), the Colorado Plateau Research Station (CPRS), and the Ecological Monitoring and Assessment Program. 2006. Avian Studies for the Proposed Sunshine Wind Park, Coconino County, Arizona. Prepared for Sunshine Arizona Wind Energy, LLC., Flagstaff, Arizona, by WEST, Cheyenne, Wyoming, and the CPRS and the Ecological Monitoring and Assessment Program, Northern Arizona University, Flagstaff, Arizona. May 2006.

Young, D.P. Jr., W. P. Erickson, K. Bay, and R. Good. 2002. Baseline Avian Studies for the Proposed Maiden Wind Farm, Yakima and Benton Counties, Washington. Final Report, April 2001-April 2002. Prepared for Bonneville Power Administration, Portland, Oregon, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. November 20, 2002.

Young, D.P. Jr., W. P. Erickson, K. Bay, J. Jeffrey, E. G. Lack, R. E. Good, and H. H. Sawyer. 2003a. Baseline Avian Studies for the Proposed Hopkins Ridge Wind Project, Columbia County, Washington. Final Report, March 2002 - March 2003. Prepared for RES North America, LLC., Portland, Oregon, by Western EcoSystems Technology, Inc.(WEST), Cheyenne, Wyoming. April 30, 2003.

Young, D.P. Jr., W. P. Erickson, K. Bay, J. Jeffrey, E. G. Lack, and H. H. Sawyer. 2003b. Baseline Avian Studies for the Proposed Desert Claim Wind Power Project, Kittitas County, Washington. Final Report. Prepared for Desert Claim Wind Power, LLC, Ellensburg, Washington, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 2003.

Young, D.P. Jr., W. P. Erickson, J. Jeffrey, K. Bay, R. E. Good, and E. G. Lack. 2003c. Avian and Sensitive Species Baseline Study Plan and Final Report. Eurus Combine Hills Turbine Ranch, Umatilla County, Oregon. Technical report prepared for Eurus Energy America Corporation, San Diego, California and Aeropower Services, Inc., Portland, Oregon, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. March 10, 2003.

Young, D.P. Jr., G. D. Johnson, V. K. Poulton, and K. Bay. 2007a. Ecological Baseline Studies for the Hatchet Ridge Wind Energy Project, Shasta County, California. Prepared for Hatchet Ridge Wind, LLC, Portland, Oregon by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 31, 2007. Available online from: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentVersionID=41939

Young, D.P. Jr., V. K. Poulton, and K. Bay. 2007b. Ecological Baseline Studies Report. Proposed Dry Lake Wind Project, Navajo County, Arizona. Prepared for PPM Energy, Portland, Oregon, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 1, 2007.

Appendix A. Individual (# obs) and group (# grps) observations by bird type, raptor subtype, and species observed during fixed-point bird use surveys[a,b] at the Red Pine Wind Resource Area[a] from March 22, 2013 to March 16, 2014.

		Spring		Summer		Fall		Winter		Total	
Type / Common Name	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Waterbirds		**7**	**55**	**16**	**50**	**1**	**5**	**0**	**0**	**24**	**110**
American white pelican	*Pelecanus erythrorhynchos*	3	25	3	21	0	0	0	0	6	46
double-crested cormorant	*Phalacrocorax auritus*	4	30	6	17	1	5	0	0	11	52
great blue heron	*Ardea herodias*	0	0	3	6	0	0	0	0	3	6
great egret	*Ardea alba*	0	0	4	6	0	0	0	0	4	6
Waterfowl		**82**	**2,543**	**5**	**9**	**8**	**277**	**7**	**49**	**101**	**2,878**
blue-winged teal	*Anas discors*	11	93	1	1	0	0	0	0	12	94
bufflehead	*Bucephala albeola*	1	2	0	0	0	0	0	0	1	2
Canada goose	*Branta canadensis*	29	1,109	1	2	7	271	6	29	43	1,411
greater white-fronted goose	*Anser albifrons*	1	495	0	0	0	0	0	0	1	495
mallard	*Anas platyrhynchos*	21	80	2	4	1	6	0	0	24	90
northern shoveler	*Anas clypeata*	11	111	1	2	0	0	0	0	12	113
ruddy duck	*Oxyura jamaicensis*	2	4	0	0	0	0	0	0	2	4
snow goose	*Chen caerulescens*	3	25	0	0	0	0	0	0	3	25
unidentified duck		0	0	0	0	0	0	1	20	1	20
unidentified swan	*Cygnus spp*	1	22	0	0	0	0	0	0	1	22
unidentified waterfowl		1	600	0	0	0	0	0	0	0	600
wood duck	*Aix sponsa*	1	2	0	0	0	0	0	0	1	2
Shorebirds		**0**	**0**	**1**	**1**	**4**	**10**	**0**	**0**	**5**	**11**
killdeer	*Charadrius vociferus*	0	0	0	0	4	10	0	0	4	10
upland sandpiper	*Bartramia longicauda*	0	0	1	1	0	0	0	0	1	1
Gulls/Terns		1	14	5	43	8	551	0	0	14	608
Franklin's gull	*Leucophaeus pipixcan*	0	0	0	0	7	547	0	0	7	547
ring-billed gull	*Larus delawarensis*	1	14	5	43	0	0	0	0	6	57
unidentified gull		0	0	0	0	1	4	0	0	1	4
Diurnal Raptors		**28**	**58**	**12**	**13**	**14**	**15**	**2**	**2**	**56**	**88**
Buteos		*15*	*19*	*10*	*11*	*8*	*8*	*1*	*1*	*34*	*39*
red-tailed hawk	*Buteo jamaicensis*	15	19	10	11	7	7	0	0	32	37
Swainson's hawk	*Buteo swainsoni*	0	0	0	0	0	0	1	1	1	1
unidentified buteo	*Buteo spp*	0	0	0	0	1	1	0	0	1	1
Northern Harrier		*7*	*33*	*1*	*1*	*2*	*2*	*0*	*0*	*10*	*36*
northern harrier	*Circus cyaneus*	7	33	1	1	2	2	0	0	10	36
Eagles		*5*	*5*	*1*	*1*	*3*	*4*	*1*	*1*	*10*	*11*
bald eagle	*Haliaeetus leucocephalus*	5	5	1	1	3	4	1	1	10	11
Falcons		*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*1*
American kestrel	*Falco sparverius*	1	1	0	0	0	0	0	0	1	1
Other Raptors		*0*	*0*	*0*	*0*	*1*	*1*	*0*	*0*	*1*	*1*

Appendix A. Individual (# obs) and group (# grps) observations by bird type, raptor subtype, and species observed during fixed-point bird use surveys[a,b] at the Red Pine Wind Resource Area[a] from March 22, 2013 to March 16, 2014.

		Spring		Summer		Fall		Winter		Total	
Type / Common Name	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
unidentified hawk		0	0	0	0	1	1	0	0	1	1
Owls		**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**1**
great horned owl	*Bubo virginianus*	0	0	0	0	0	0	1	1	1	1
Vultures		**1**	**2**	**0**	**0**	**1**	**1**	**0**	**0**	**2**	**3**
turkey vulture	*Cathartes aura*	1	2	0	0	1	1	0	0	2	3
Upland Game Birds		**0**	**0**	**0**	**0**	**4**	**4**	**2**	**3**	**6**	**7**
ring-necked pheasant	*Phasianus colchicus*	0	0	0	0	4	4	2	3	6	7
Doves/Pigeons		**0**	**0**	**0**	**0**	**4**	**14**	**1**	**4**	**5**	**18**
mourning dove	*Zenaida macroura*	0	0	0	0	2	3	0	0	2	3
rock pigeon	*Columba livia*	0	0	0	0	2	11	1	4	3	15
Large Corvids		**0**	**0**	**1**	**3**	**7**	**94**	**3**	**31**	**11**	**128**
American crow	*Corvus brachyrhynchos*	0	0	1	3	7	94	3	31	11	128
Passerines[c]		**0**	**0**	**0**	**0**	**33**	**376**	**11**	**180**	**44**	**556**
American goldfinch	*Spinus tristis*	0	0	0	0	7	25	1	1	8	26
American robin	*Turdus migratorius*	0	0	0	0	4	71	1	10	5	81
barn swallow	*Hirundo rustica*	0	0	0	0	2	10	0	0	2	10
blue jay	*Cyanocitta cristata*	0	0	0	0	1	1	0	0	1	1
brown-headed cowbird	*Molothrus ater*	0	0	0	0	1	12	0	0	1	12
cliff swallow	*Petrochelidon pyrrhonota*	0	0	0	0	2	9	0	0	2	9
common grackle	*Quiscalus quiscula*	0	0	0	0	5	142	0	0	5	142
dark-eyed junco	*Junco hyemalis*	0	0	0	0	4	34	1	22	5	56
European starling	*Sturnus vulgaris*	0	0	0	0	1	32	1	1	2	33
horned lark	*Eremophila alpestris*	0	0	0	0	0	0	4	110	4	110
Lapland longspur	*Calcarius lapponicus*	0	0	0	0	0	0	1	3	1	3
red-winged blackbird	*Agelaius phoeniceus*	0	0	0	0	1	10	0	0	1	10
snow bunting	*Plectrophenax nivalis*	0	0	0	0	1	6	2	33	3	39
unidentified sparrow		0	0	0	0	2	21	0	0	2	21
western meadowlark	*Sturnella neglecta*	0	0	0	0	2	3	0	0	2	3
Woodpeckers		0	0	0	0	2	2	0	0	2	2
downy woodpecker	*Picoides pubescens*	0	0	0	0	1	1	0	0	1	1
northern flicker	*Colaptes auratus*	0	0	0	0	1	1	0	0	1	1
Overall		**119**	**2,672**	**40**	**119**	**86**	**1,349**	**27**	**270**	**272**	**4,410**

[a] regardless of distance from observer
[b] first 20 minutes of surveys only
[c] Excluding large corvids
[d] Species only observed after the initial 20 minutes of survey

Appendix B-1. Mean bird use (number of birds/800-m plot/20-min survey), percent of total use (%), and frequency of occurrence (%) for large bird types, raptor subtypes, and species by season observed during fixed-point bird use surveys[a,b] at the Red Pine Wind Resource Area from March 22, 2013 to March 16, 2014.

	Mean Use				% of Use				% Frequency			
Type / Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Waterbirds	0.21	0.20	0.05	0	1.3	35.6	0.7	0	3.0	8.8	1.0	0
American white pelican	0	0.06	0	0	0	11.1	0	0	0	1.2	0	0
double-crested cormorant	0.21	0.11	0.05	0	1.3	20.0	0.7	0	3.0	5.0	1.0	0
great blue heron	0	0.01	0	0	0	2.2	0	0	0	1.2	0	0
great egret	0	0.01	0	0	0	2.2	0	0	0	1.2	0	0
Waterfowl	15.08	0.06	1.01	0.40	94.1	11.1	13.3	41.0	38.0	5.0	5.0	7.5
blue-winged teal	0.93	0.02	0	0	5.8	4.4	0	0	10.0	2.5	0	0
bufflehead	0.02	0	0	0	0.1	0	0	0	1.0	0	0	0
Canada goose	6.96	0	0.95	0.40	43.4	0	12.5	41.0	15.0	0	4.0	7.5
greater white-fronted goose	4.95	0	0	0	30.9	0	0	0	1.0	0	0	0
mallard	0.80	0.01	0.06	0	5.0	2.2	0.8	0	18.0	1.2	1.0	0
northern shoveler	1.11	0.02	0	0	6.9	4.4	0	0	7.0	1.2	0	0
ruddy duck	0.04	0	0	0	0.2	0	0	0	1.0	0	0	0
snow goose	0.25	0	0	0	1.6	0	0	0	2.0	0	0	0
wood duck	0.02	0	0	0	0.1	0	0	0	1.0	0	0	0
Shorebirds	0	0.01	0.10	0	0	2.2	1.3	0	0	1.2	4.0	0
killdeer	0	0	0.10	0	0	0	1.3	0	0	0	4.0	0
upland sandpiper	0	0.01	0	0	0	2.2	0	0	0	1.2	0	0
Gulls/Terns	0.14	0.04	5.17	0	0.9	6.7	68.0	0	1.0	1.2	6.0	0
Franklin's gull	0	0.00	5.17	0	0	0	68.0	0	0	0	6.0	0
ring-billed gull	0.14	0.04	0	0	0.9	6.7	0	0	1.0	1.2	0	0
Diurnal Raptors	0.58	0.21	0.14	0.03	3.6	37.8	1.8	2.8	24.0	18.8	12.0	2.7
Buteos	*0.19*	*0.19*	*0.08*	*0.01*	*1.2*	*33.3*	*1.1*	*1.3*	*14.0*	*16.2*	*8.0*	*1.2*
red-tailed hawk	0.19	0.19	0.07	0	1.2	33.3	0.9	0	14.0	16.2	7.0	0
Swainson's hawk	0	0	0	0.01	0	0	0	1.3	0	0	0	1.2
unidentified buteo	0	0	0.01	0	0	0	0.1	0	0	0	1.0	0
Northern Harrier	*0.33*	*0.01*	*0.02*	*0*	*2.1*	*2.2*	*0.3*	*0*	*5.0*	*1.2*	*2.0*	*0*
northern harrier	0.33	0.01	0.02	0	2.1	2.2	0.3	0	5.0	1.2	2.0	0
Eagles	*0.05*	*0.01*	*0.04*	*0.01*	*0.3*	*2.2*	*0.5*	*1.5*	*4.0*	*1.2*	*2.0*	*1.5*
bald eagle	0.05	0.01	0.04	0.01	0.3	2.2	0.5	1.5	4.0	1.2	2.0	1.5
Falcons	*0.01*	*0*	*0*	*0*	*<0.1*	*0*	*0*	*0*	*1.0*	*0*	*0*	*0*
American kestrel	0.01	0	0	0	<0.1	0	0	0	1.0	0	0	0
Owls	0	0	0	0.01	0	0	0	1.3	0	0	0	1.2
great horned owl	0	0	0	0.01	0	0	0	1.3	0	0	0	1.2

Appendix B-1. Mean bird use (number of birds/800-m plot/20-min survey), percent of total use (%), and frequency of occurrence (%) for large bird types, raptor subtypes, and species by season observed during fixed-point bird use surveys[a,b] at the Red Pine Wind Resource Area from March 22, 2013 to March 16, 2014.

	Mean Use				% of Use				% Frequency			
Type / Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Vultures	0.02	0	0.01	0	0.1	0	0.1	0	1.0	0	1.0	0
turkey vulture	0.02	0	0.01	0	0.1	0	0.1	0	1.0	0	1.0	0
Upland Game Birds	0	0	0.04	0.04	0	0	0.5	4.0	0	0	4.0	2.6
ring-necked pheasant	0	0	0.04	0.04	0	0	0.5	4.0	0	0	4.0	2.6
Doves/Pigeons	0	0	0.14	0.05	0	0	1.8	5.1	0	0	4.0	1.2
mourning dove	0	0	0.03	0	0	0	0.4	0	0	0	2.0	0
rock pigeon	0	0	0.11	0.05	0	0	1.4	5.1	0	0	2.0	1.2
Large Corvids	0	0.04	0.94	0.45	0	6.7	12.4	45.8	0	1.2	6.0	4.0
American crow	0	0.04	0.94	0.45	0	6.7	12.4	45.8	0	1.2	6.0	4.0
Overall	**16.03**	**0.56**	**7.60**	**0.98**								

[a] 800-m radius

[b] first 20 minutes of surveys only

Appendix B-2. Mean bird use (number of birds/100-m plot/20-min survey), percent of total use (%), and frequency of occurrence (%) for small bird types and species by season observed during fixed-point bird use surveys[a,b] at the Red Pine Wind Resource Area from March 22, 2013 to March 16, 2014.

	Mean Use				% of Use				% Frequency			
Type / Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Passerines[c]	**0**	**0**	**3.76**	**2.43**	**0**	**0**	**99.5**	**100.0**	**0**	**0**	**26.0**	**15.5**
American goldfinch	0	0	0.25	0.01	0	0	6.6	0.5	0	0	7.0	1.2
American robin	0	0	0.71	0.25	0	0	18.8	10.3	0	0	4.0	2.5
barn swallow	0	0	0.10	0	0	0	2.6	0	0	0	2.0	0
blue jay	0	0	0.01	0	0	0	0.3	0	0	0	1.0	0
brown-headed cowbird	0	0	0.12	0	0	0	3.2	0	0	0	1.0	0
cliff swallow	0	0	0.09	0	0	0	2.4	0	0	0	2.0	0
common grackle	0	0	1.42	0	0	0	37.6	0	0	0	4.0	0
dark-eyed junco	0	0	0.34	0.28	0	0	9.0	11.3	0	0	4.0	1.2
European starling	0	0	0.32	0.01	0	0	8.5	0.5	0	0	1.0	1.2
horned lark	0	0	0	1.40	0	0	0	57.4	0	0	0	5.5
Lapland longspur	0	0	0	0.08	0	0	0	3.1	0	0	0	2.5
red-winged blackbird	0	0	0.10	0	0	0	2.6	0	0	0	1.0	0
snow bunting	0	0	0.06	0.41	0	0	1.6	17.0	0	0	1.0	2.5
unidentified sparrow	0	0	0.21	0	0	0	5.6	0	0	0	2.0	0
western meadowlark	0	0	0.03	0	0	0	0.8	0	0	0	2.0	0
Woodpeckers	**0**	**0**	**0.02**	**0**	**0**	**0**	**0.5**	**0**	**0**	**0**	**2.0**	**0**
downy woodpecker	0	0	0.01	0	0	0	0.3	0	0	0	1.0	0
northern flicker	0	0	0.01	0	0	0	0.3	0	0	0	1.0	0
Overall	**0**	**0**	**3.78**	**2.43**								

[a] 100-meter radius
[b] first 20 minutes of surveys only
[c] excluding large corvids

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May 22, 2014

Casey Willis
Red Pine Wind Project, LLC
3760 State St., Suite 200
Santa Barbara, CA 93105

RE: Red Pine Wind Project Habitat Mapping

Dear Mr. Willis,

Land use and cover were delineated using ArcGIS, ArcMap 10.1 within the Red Pine Wind Resource Area (RPWRA or Project Area). Using 2012 USDA NAIP aerial imagery in combination with 2002 Gap land cover data, 2012 USDA NASS cropland data layer, and Minnesota Biological Survey Native Plant Communities data, all land within the Project Area was digitized and assigned one of nine land use/cover types (excluding National Wetland Inventory [NWI] wetlands; Table 1). NWI polygons were used to represent water within the Project Area. Those water features visible on the aerial imagery but not in the NWI data were digitized and categorized as "wetland WEST".

The RPWRA, at the time of the delineation effort, contained about 38,827 acres (Phase 1 – 20,156.7 acres, Phase 2 – 18,670.3 acres). Agriculture accounted for over 74% of the RPWRA, followed by grassland (16.8%; Table 1). Just over 3% of the RPWRA is wetland. When comparing the Phases, Phase 1 was almost 80% agriculture while Phase 2 was about 73% agriculture. Phase 2 (17.4%) had slightly more grassland than Phase 1 (16.3%). The Phases had almost the same acreage of wetland.

Land use and cover types generally appeared to be evenly distributed across the RPWRA (Figure 1). Phase 2 appeared to have larger individual blocks of grassland in the eastern portion.

Let me know if you have any questions or need further details.

Sincerely,

Clayton Derby
Senior Manager

Table 1. Land use and cover within the Red Pine Wind Project as digitized by WEST.

	RPWRA		Phase 1		Phase 2	
Land Use and Cover	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
agriculture	28,914.5	74.47	15,268.7	75.75	13,648.0	73.10
grassland	6,526.8	16.81	3,277.5	16.26	3,250.5	17.41
wetland NWI[a]	1,506.5	3.88	745.8	3.70	758.0	4.06
wetland WEST	186.4	0.48	137.1	0.68	50.4	0.27
farmsteads/rural homes	1,056.1	2.72	501.9	2.49	552.6	2.96
shrubs/trees	489.2	1.26	161.3	0.80	328.6	1.76
developed	147.5	0.38	64.5	0.32	82.1	0.44
Totals	38,827.0	100.00	20,156.7	100.00	18,670.3	100.00

[a] USFWS National Wetland Inventory

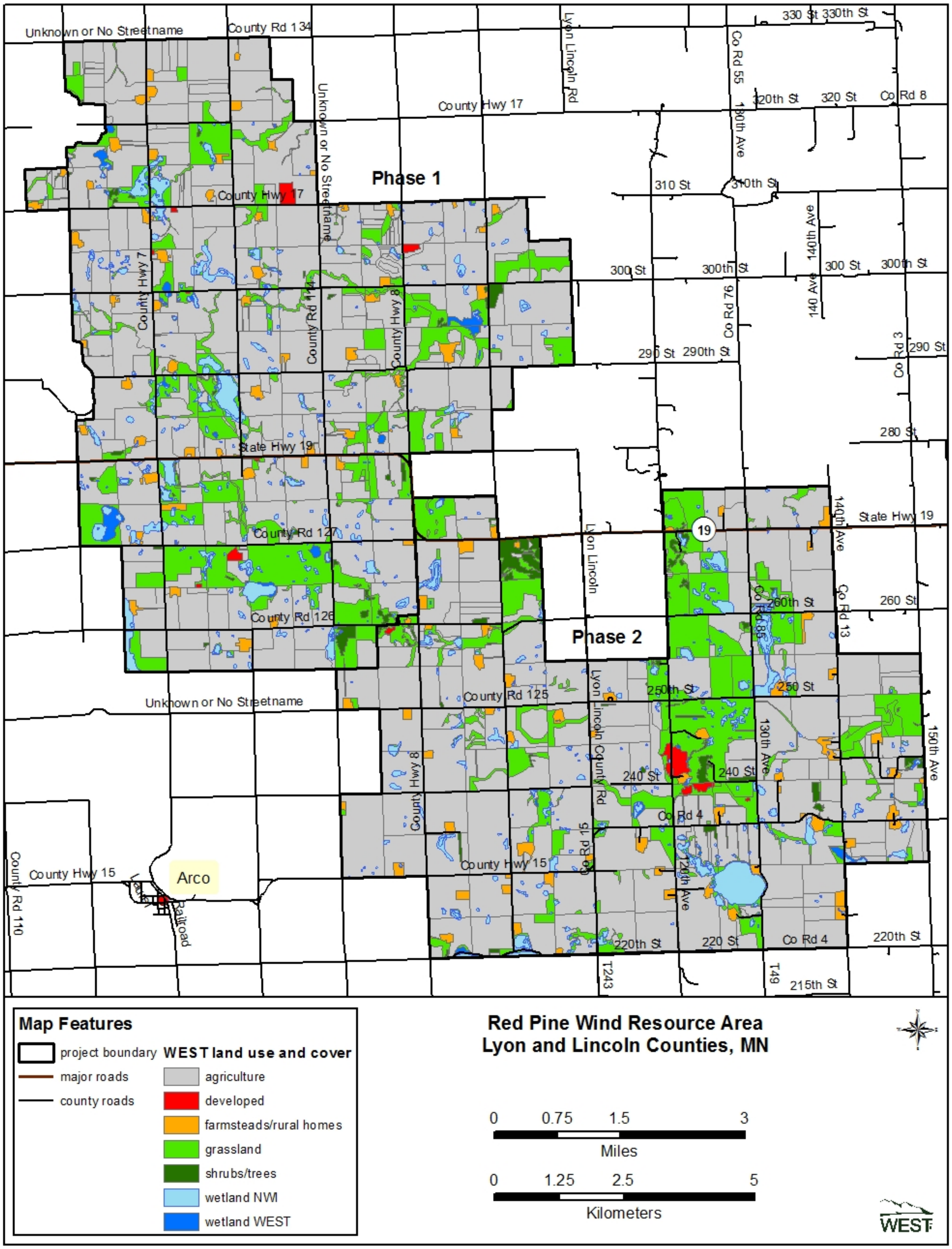

Figure 1. Land use and cover as delineated by WEST within the Red Pine Wind Resource Area.

Raptor Nest Survey and Eagle Nest Monitoring for the Red Pine Wind Project
Lincoln and Lyon Counties, Minnesota

Prepared for:

EDF Renewable Energy, Inc.

Prepared by:

Adam Kreger, Kristen Chodacheck, Sarah Hamilton and Joyce Pickle

Western EcoSystems Technology, Inc.
1710 Douglas Drive, Suite 283
Golden Valley, Minnesota 55422

July 2, 2015

STUDY PARTICIPANTS

Western EcoSystems Technology

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Sarah Hamilton	GIS Specialist
Kristen Chodachek	Research Biologist

REPORT REFERENCE

Kreger, A., Chodachek, K. and Pickle, J. 2015. Raptor Nest Survey Results for the Red Pine Wind Project in Lincoln and Lyon Counties, Minnesota. Final Report: July 2, 2015. Prepared for EDF Renewable Energy, Inc. Prepared by Western EcoSystems Technology, Inc. (WEST), Golden Valley, Minnesota.

TABLE OF CONTENTS

INTRODUCTION

EDF Renewable Energy, Inc. (EDF) has proposed development of the Red Pine Wind Project (Project) in Lincoln and Lyon counties, Minnesota (Figure 1). EDF requested that Western EcoSystems Technology, Inc. (WEST) conduct a ground-based raptor nest survey within two miles of the Project. A majority of the current Project area was previously surveyed for raptor nests in spring 2013 (WEST 2013). This survey was conducted in order to document potential nests within the portions of the expanded Project area that were not previously surveyed as well as to document any new or newly active nests.

This report provides results of the general raptor nest survey conducted at the Project on April 14, 2015. Additional follow up survey efforts include the monitoring of two occupied bald eagle (*Haliaeetus leucocephalus*) nests documented during the ground-based surveys of the Project in mid-May and early June; results are discussed below.

STUDY AREA

The 46,064-acre (72 square miles) Project is located in Lincoln and Lyon counties, in southwest Minnesota, approximately 8 miles west of the city of Marshall (Figure 1). The project falls within the Northern Glaciated Plains Ecoregion, which covers much of the western portion of Minnesota (Bryce et Al. 1996). The Northern Glaciated Plains are characterized by a flat to gently rolling landscape composed of glacial drift. This ecoregion serves as a transitional zone between tall and shortgrass prairie with high concentrations of temporary and seasonal wetlands that are favorable for duck nesting and migration.

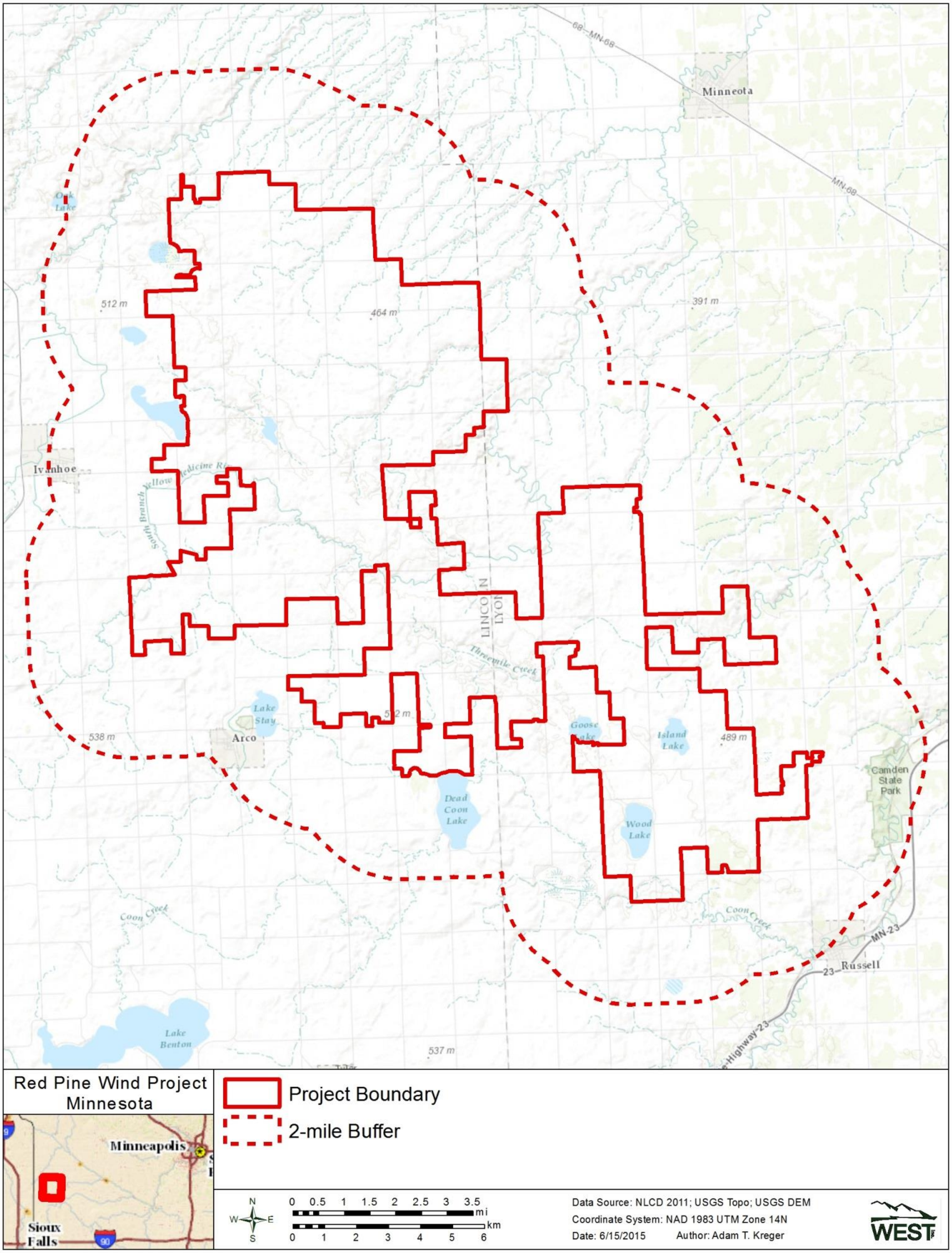

Figure 1. Location of the Red Pine Wind Energy Project

METHODS

Aerial Raptor Nest Survey

One ground-based survey was conducted from public access roads in mid-April, a period before leaf out when raptors would be actively tending to a nest or incubating eggs. Surveys were conducted in accordance with the guidance provided in the US Fish and Wildlife Service (USFWS) Eagle Conservation Plan Guidance (April 2013) and USFWS Inventory and Monitoring Protocols (Pagel et al. 2010). An experienced raptor ecologist conducted the survey. Raptors are defined here as kites, accipiters, buteos, harriers, eagles, falcons, and owls. However, the main focus of the survey was to identify bald eagle (*Haliaeetus leucocephalus*) nests. Bald eagle nest surveys focused on locating eyries (large, stick nest structures) in suitable eagle nesting substrate (trees, transmission lines, cliff faces, etc.) within the proposed Project and a two mile buffer (Figure 1); the overall survey area was 132,416 acres (207 square miles). Efforts were made to minimize disturbance to breeding raptors; the greatest possible distance at which the species could be identified was maintained, with distances varying depending upon nest location.

In general, all potential bald eagle and raptor nest habitat was surveyed by driving along public roads and stopping to survey potential raptor nest habitat using binoculars and a tripod mounted spotting scope. Surveys were conducted between 0800 hours and 1700 hours. The locations of all potential raptor nests were recorded using a hand-held Global Positioning System (GPS); coordinates were set at Universal Transverse Mercator (UTMs) North American Datum (NAD) 83 unit. This included all confirmed and potential nests regardless of their activity status. To determine the status of a nest, the biologist relied on clues that included behavior of adults and presence of eggs, young, or whitewash. Attempts were made to identify the species of raptor associated with each active nest. Raptor species, nest type, nest status, nest condition, and substrate, were recorded at each nest location.

Terminology

Included below are descriptions of terms used during the documentation of nests (see Results section).

Nest ID - WEST assigned a unique nest identification number for each nest documented.

Species - A species was assigned to each nest where possible; when a nest could not be identified to species it was classified as an unknown raptor nest. Nests documented as unknown raptor species are defined as any stick nest that did not have an occupant associated with it at the time of the survey. Many times nests will become abandoned or no longer used, and over time, may become a historic nest site. Additionally, an unknown number/type of stick nests are used by corvid (ravens and crows) or owl species and may not have been detected as such during aerial raptor surveys based on differences in nesting chronology. Unknown raptor nests, including old nests or nests that could become suitable for raptors, are documented in order to populate a nest database to ensure that future surveys include all potentially suitable nest sites.

Nest Condition - Nest condition was categorized using descriptions ranging from poor to excellent. Although the determination of nest condition can be subjective and may vary between observers, it gives a general sense of when a nest or nest site may have last been used. Nests in poor to fair condition are typically in disrepair, sloughing, or sagging heavily, and would require some level of effort to rebuild in order to be suitable for successful nesting. Nests in good to excellent condition are those that appear to have been well maintained, have a well-defined bowl shape, are not sagging or sloughing, and appear to be suitable for nesting.

Substrate - The substrate in which a nest was observed was recorded to provide observers a visual reference. Substrates range from manmade structures (such as power lines, nest platforms, and dock hoists) to conifer and deciduous tree species to cliff faces.

Nest Status - WEST categorizes basic nest use consistent with definitions from the USFWS Eagle Conservation Plan Guidance (April 2013). Nests were classified as occupied if any of the following were observed at the nest structure: (1) an adult in an incubating position, (2) eggs, (3) nestlings or fledglings, (4) occurrence of a pair of adults (or, sometimes sub-adults), (5) a newly constructed or refurbished stick nest in the area where territorial behavior of a raptor had been observed early in the breeding season, or (6) a recently repaired nest with fresh sticks (clean breaks) or fresh boughs on top, and/or droppings and/or molted feathers on its rim or underneath. Occupied nests were further classified as active if an egg or eggs had been laid or nestlings were observed, or inactive if no eggs or chicks were present. A nest that does not meet the above criteria for “occupied” was classified as “unoccupied”.

Follow-up Ground Nest Monitoring Surveys

WEST biologists conducted follow-up ground bald eagle nest monitoring surveys at the two potential bald eagle nests that were located in the 2-mi buffer, southwest and southeast of the Project. Two bald eagle nest monitoring surveys were conducted at both occupied nests, on May 20-21, 2015 and June 9-10, 2015.

The bald eagle nest monitoring surveys consisted of one 1,600 m radius fixed-point established on public roads for each potential bald eagle nest, following methods similar to Reynolds et al. (1980); and consistent with recommendations outlined in the ECPG. The monitoring plot for nest 11 was located approximately 250 feet (76 m) from the nest. The monitoring plot for nest 42 was located approximately 0.3 mi (0.5 km) from the bald eagle nest. The nest monitoring plots were established to attempt to document flight paths of the bald eagles in an effort to determine the nesting territory and surrounding use area within the Project.

Biologists recorded all eagles seen during each survey, regardless of distance to the observer. Estimated distance to each bird observed was recorded to the nearest five meters. Landmarks were located to aid in estimating distances to each bird. Point count duration was for four hours at each nest. The date, start, and end time of observation period, plot number, number of individuals, sex and age class (if possible), distance from plot center when first observed (in m), closest distance (m), height above ground (m), activity, and habitat were recorded.

Biologists recorded eagle behavior and habitat for each eagle observation during each one-minute interval the bird was within view, per the USFWS ECPG. Behavior categories included soaring flight, flapping-gliding, hunting, kiting-hovering, stooping/diving at prey, stooping or diving in an antagonistic context with other bird species perched, being mobbed, undulating/territorial flight, auditory, and other (noted in comments). The initial flight patterns and habitat types (at first observation) were uniquely identified on the data sheet and subsequent patterns and habitats were also recorded. The flight directions of observed bald eagles were recorded on the data sheet map. Approximate flight height at first observation was recorded to the nearest five meters; the approximate lowest and highest flight heights observed were also recorded. Any comments or unusual observations were noted in the comments section. Weather information recorded for each survey point included temperature, wind speed, wind direction, precipitation, and cloud cover.

RESULTS

Aerial Raptor Nest Survey

WEST biologists detected a total of 46 raptor nests representing two species during surveys conducted on April 14, 2015 (Table 1, Figure 2). Of these nests, three were identified as red-tailed hawk nests (RTHA), one as a bald eagle nest (BAEA), one as a potential BAEA, and 41 unknown raptor species nests (UNKN) (Table 1; Figure 2).

One occupied active bald eagle nest was located within approximately 300 feet of the Project boundary in the southeastern portion of the Project (Nest ID 11; Table 1, Figure 2). This nest was not documented during the previous 2013 surveys conducted at the Project. Two adult bald eagles were seen in the nest and appeared to be feeding chicks, though the chicks could not be directly observed.

One potential bald eagle nest was located within a quarter mile of the boundary in the southwestern portion of the Project (Nest ID 42; Table 1, Figure 2). The nest was a stick nest in good condition that was large enough to support nesting eagles. No eagles were documented in the vicinity of this nest. This nest was also documented in the 2013 nest survey, as an unoccupied raptor nest.

Table 1. Raptor nest location and features for identified nests during 2015 survey for the Red Pine Wind Project, Lincoln and Lyon counties, Minnesota (NAD83, Zone 14).

ID	Northing	Easting	Species	Nest Substrate	Status at time of Survey	Condition	Year First Detected	Within Project Boundary?
0	260158	4927221	unknown	tree	inactive	dilapidated	2013	No
1	254466	4929024	unknown	tree	inactive	fair	2015	Yes
2	255595	4925027	unknown	tree	inactive	good	2013	No
3	255996	4922888	unknown	tree	inactive	good	2013	No
4	254626	4919695	unknown	tree	inactive	good	2013	No
5	253225	4918280	unknown	tree	inactive	good	2015	Yes
6	255480	4913201	unknown	tree	inactive	fair	2015	No
7	256151	4912758	unknown	tree	inactive	poor	2015	No
8	253758	4917033	unknown	tree	inactive	fair	2015	No
9	259196	4915147	RTHA	tree	inactive	good	2015	Yes
10	257435	4918455	unknown	tree	inactive	good	2015	Yes
11	257888	4920706	BAEA	tree	active	excellent	2015	No
12	256778	4923529	RTHA	tree	active	excellent	2013	Yes
13	257620	4930292	unknown	tree	inactive	good	2015	No
14	256722	4930205	unknown	tree	inactive	good	2015	No
15	256459	4929243	unknown	tree	inactive	good	2015	No
16	258283	4928322	unknown	tree	inactive	good	2015	No
17	258052	4930989	unknown	tree	inactive	good	2015	No
18	258309	4931666	unknown	tree	inactive	good	2015	No
19	258487	4932196	unknown	tree	inactive	good	2015	No
20	257058	4934062	unknown	tree	inactive	fair	2015	No
21	257048	4933962	unknown	tree	inactive	fair	2015	No
22	262167	4926918	unknown	tree	inactive	fair	2015	No
23	261652	4921310	RTHA	tree	active	excellent	2013	No
24	262423	4919622	unknown	tree	active	excellent	2013	No
25	260486	4918584	unknown	tree	inactive	good	2015	Yes
26	243706	4938164	unknown	tree	inactive	fair	2015	No
27	241833	4931177	unknown	tree	inactive	poor	2015	No
28	241149	4924158	unknown	tree	inactive	fair	2015	No
29	244889	4920860	unknown	tree	inactive	fair	2015	No
30	246141	4937171	unknown	tree	inactive	poor	2015	Yes
31	245801	4920146	unknown	tree	inactive	fair	2015	No
32	247768	4920083	unknown	tree	inactive	fair	2015	No
33	247895	4920236	unknown	tree	inactive	good	2015	No
34	248435	4928527	unknown	tree	inactive	poor	2015	Yes

35	248722	4930296	unknown	tree	inactive	fair	2015	Yes
36	250503	4929044	unknown	tree	inactive	fair	2015	Yes
37	253630	4921541	unknown	tree	inactive	fair	2015	Yes
38	243021	4929468	unknown	tree	inactive	good	2015	No
39	245953	4927557	unknown	tree	active	good	2013	Yes
40	249676	4927668	unknown	tree	inactive	poor	2013	Yes
41	253207	4926201	unknown	tree	inactive	good	2013	Yes
42	246226	4922288	BAEA	tree	inactive	good	2013	No
43	245935	4922564	unknown	tree	inactive	fair	2013	No
44	252192	4922076	unknown	tree	inactive	good	2013	No
45	246096	4920339	unknown	tree	inactive	poor	2013	Yes

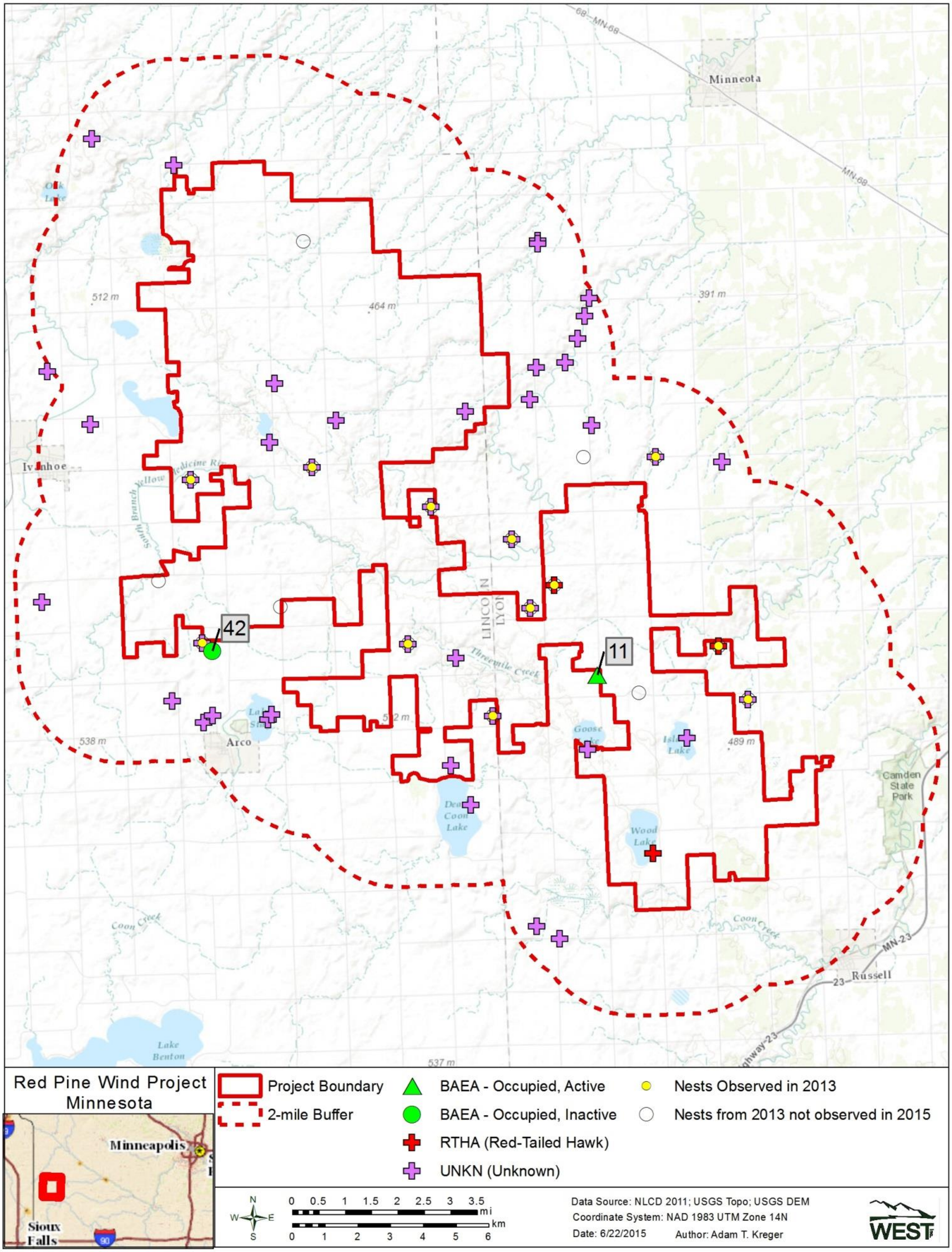

Figure 2. Raptor Nests at the Red Pine Wind Energy Project

Follow-up Ground Nest Surveys

Biologists completed 24 total survey observation hours of eagle nest monitoring. Eagle nest monitoring surveys were conducted May 20, 2015 and June 9, 2015 at the eastern eagle nest and May 21 and June 10, 2015 at the western eagle nest. During the 18 total hours of nest observation, two bald eagle chicks and two adult bald eagles were documented at the eastern nest (Figure 2, nest 11) confirming that this is an active and occupied bald eagle nest. The bald eagle chicks at nest 11 had not fledged at the time of the survey and were observed flapping wings and jumping to test wings at the nest. Adults at nest 11 were observed flying above the nest and flying away from the nest in a south to southwest direction to forage and returning with fish to feed chicks. This flight pattern suggests that Goose Lake (0.9 mi south of the nest) and Dead Coon Lake (3.2 mi southwest of the nest) may be primary foraging areas for this breeding pair.

There were no chicks observed in the western nest (Figure 2, nest 42) and adult activity at the nest consisted of occasional and infrequent perching on or near the nest, confirming that it is inactive.

DISCUSSION/CONCLUSION

These surveys provided additional information on raptor and eagle use within the vicinity of the Project. Nest survey results suggest that there are no bald eagle nests within the Project, although there are two located within 250 feet to a quarter mile of the boundary. The Project site is dominated by cultivated agricultural lands with relatively little forest cover. In summary, a total of 46 occupied and unoccupied nest locations were recorded. The majority of raptor nests observed within the Project area and a 2-mile buffer (40 nests) appeared to be unoccupied and not identified to a particular species. Three raptor nest locations that had previously been recorded in 2013 were not located during this survey, and 32 raptor nests were documented in this 2015 survey that were not located during the 2013 survey (both within and outside of the 2013 survey boundaries). One active bald eagle nest was observed during the ground-based survey as well as one potential bald eagle nest. This potential nest was later confirmed to be an occupied, but inactive, bald eagle nest. The remaining three nests were identified as occupied red-tailed hawk nests.

The bald eagle nest monitoring conducted at the Project confirmed that nest 11 is an occupied active bald eagle nest with a breeding pair of eagles fledging two chicks. Flight patterns observed during eagle nest monitoring showed a lot of flights directly above the next (within 800 meters of nest, but did also show adults leaving the nest and flying in a south to southwest direction and returning with fish to feed the fledgling eagle chicks. These observations suggest that the eagles may be using nearby Goose Lake to the south and Dead Coon Lake to the southwest as hunting and foraging habitat. Both of these lakes are outside the Project boundary, with some portion of the shoreline bordering the Project boundary. Monitoring of nest 42 showed only occasional occupancy by adult eagles perching on or nearby the nest for short periods of time. This nest does not contain chicks and is not occupied by an active breeding pair of eagles. The infrequent presence of adult eagles at nest 42 confirms that it is an occupied but inactive nest.

LITERATURE CITED

Bryce, S.A., Omernik, J.M., Pater, D.A., Ulmer, M., Schaar, J., Freeouf, J., Johnson, R., Kuck, P., and Azevedo, S.H., 1996, Ecoregions of North Dakota and Minnesota, (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,500,000).

Pagel, J.E., D.M. Whittington, and G.T. Allen. 2010. Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance. US Fish and Wildlife Service (USFWS). February 2010. Available online at: http://steinadlerschutz.lbv.de/fileadmin/www.steinadlerschutz.de/terimGoldenEagleTechnicalGuidanceProtocols25March2010_1_.pdf

US Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance. Module 1 - Land-Based Wind Energy. Version 2. Division of Migratory Bird Management, USFWS. April 2013. Available online at: http://www.fws.gov/migratorybirds/Eagle_Conservation_Plan_Guidance-Module%201.pdf

Western Ecosystems Technology, Inc. 2013. Red Pine Raptor Nest Surveys. Report developed for Red Pine Wind Project, LLC, Santa Barbara, CA.