

# Appendix A

Avian Use Monitoring Report  
(Golder Associates, 2011)



May 2011



## GOSHEN WIND ENERGY CENTRE

# Avian Use Monitoring Report - 2010

**Submitted to:**

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REPORT



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## 1.0 INTRODUCTION

During 2010, Golder Associates Ltd. (Golder) was retained by NextEra Energy Canada (NextEra) to undertake a bird monitoring program for a proposed wind power project near Grand Bend, Ontario (Figure 1), called the Goshen Wind Energy Centre (the Project). The purpose of this field program was to collect data on bird use of the Avian Study Area during the winter, spring, summer, and fall of 2010. This field program was implemented with the understanding that the results would later be used to supplement the Natural Heritage Assessment Report (NHA) of a Renewable Energy Approval (REA) submission. Surveys were initiated prior to final determination of project layout, but survey plots were selected to sample the overall Avian Study Area from a landscape perspective. As a result, a protocol for collecting these data was developed to meet the expectations of Environment Canada (EC) and MNR, based on previous discussions with these agencies and a review of guidelines and draft guidelines (e.g., Kingsley and Whittam 2007; OMNR 2010). Specifically, Golder undertook avian use surveys (AUS) to assess the distribution, abundance, and flight behaviour of the avifauna in the Avian Study Area.

## 1.1 Background

Observed effects of wind energy projects on birds are either direct, as in the case of mortality arising from collisions with wind turbines, or indirect, as in the case of habitat loss for infrastructure or disturbance of habitat through changes in existing activity levels or sensory disturbance. In fact, indirect effects may be more substantive than direct mortality. In general, public perception tends to considerably inflate the actual avian mortality attributable to wind energy projects (EC 2007). The actual avian mortality depends on a number of site-specific factors, including bird densities and the types of species and habitats present, as well as the wind farm design features that may either individually, or in combination with each other, influence avian mortality rates. The scope of the study described herein did not account for these details, or specific habitats within 120 m of the Project Location, since they were not known at the time these studies were conducted and will be further outlined within the NHA. Some of these factors include:

- Topography;
- Scale of the facility;
- Tower dimension and design;
- Turbine lighting;
- Blade speed;
- Habitat type;
- Transmission line design and location; and
- Facility configuration.

A large number of studies have been undertaken to investigate concerns related to avian mortality resulting from wind farms (e.g., Osborn *et al.*, 2000; Johnson *et al.*, 2003; Barrios and Rodríguez 2004; Echotrack 2005; Drewitt and Langston 2006). These findings indicate that overall, bird deaths due to wind turbines are low,



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especially when compared to other anthropogenic structures. In one particular study of avian mortality (Erickson *et al.*, 2005), an extensive literature review was conducted and a comparison of annual avian mortality in the U.S. was presented. This same study indicated that the annual average number of birds killed in the USA is estimated at 2.19 birds per turbine per year.

**Table 1: Predicted Annual Avian Mortality Rates, USA**

<b>Anthropogenic Structure</b>	<b>Bird Deaths/Year</b>
Vehicles	80,000,000
Buildings and Windows	550,000,000
Cats	100,000,000
Power Lines	130,000,000
Communication Towers	4,500,000
Wind Power Parks	28,500

Although avian mortality due to wind turbines is reported to be low in comparison to other anthropogenic structures, when selecting and assessing infrastructure layouts during the environmental screening process, it is important to identify bird breeding, staging, and foraging areas, as well as migration routes, to minimize any potentially adverse environmental effects. This technical report documents the avian community characteristics of the Avian Study Area to assess any potentially adverse environmental effects of the proposed Project. We consider the field program to be appropriate for examining the dynamics of bird movements for the Avian Study Area. The surveys provide a representative cross-section of the diversity, abundance, and behaviour of birds using the Avian Study Area.



## 2.0 METHODS

### 2.1 Literature Review

A variety of documents and information sources were reviewed to develop the monitoring protocol, determine important bird-related issues, and to identify site-specific records of natural features, habitats, or species occurrences that were relevant to the proposed Project. Guidance regarding monitoring protocols and report contents was obtained from the following sources:

- Birds and Bird Habitats: Guidelines for Wind Power Projects. (OMNR, October 2010);
- Kingsley, A. and B. Whittam. (2007). Wind Turbines and Birds: A Background Review for Environmental Assessment. Prepared for the Canadian Wildlife Service. Draft April 2, 2007;
- Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds. Prepared by the Canadian Wildlife Service. Final Report, February 2007; and
- Wind Turbines and Birds: A Guidance Document for Environmental Assessment. Final Report (EC, April 2007).

Technical information regarding breeding, resident, wintering and migrant birds, national, provincial, and regional bird status, and species of conservation concern were collected from the following sources:

- Bird Studies Canada. Conservation Priorities for the Birds of Southern Ontario (Couturier 1999);
- Canada *Species at Risk Act* (Species at Risk Act 2002);
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2010);
- Natural Heritage Information Centre (NHIC) database ([www.mnr.gov.on.ca/MNR/nhic/nhic.cfm](http://www.mnr.gov.on.ca/MNR/nhic/nhic.cfm));
- Ontario *Endangered Species Act* (Endangered Species Act 2007); and
- Ontario Partners in Flight. Ontario Landbird Conservation Plan. (Ontario Partners in Flight 2008).

### 2.2 Avian Use Surveys

Avian use surveys were conducted in winter, spring, summer, and fall of 2010, and supplemented with area searches while in the Avian Study Area. For a list of dates refer to Table 2. The majority of surveys were roadside counts, to allow for greater coverage of the Avian Study Area. However some off-road counts in woodlot areas, and along the shore of Lake Huron were conducted where access was available. Bird surveys began at, or within, one-half hour of sunrise, depending upon the season, and continued throughout the day. Surveys were only conducted when weather conditions (i.e., precipitation and wind) were within the parameters required by monitoring programs such as the Breeding Bird Survey (Droege 1990), the Ontario Forest Bird Monitoring Program (Welsh 1995), or Long Point Bird Observatory's Migration Monitoring Protocol (Bird Studies Canada 2010). Although wind conditions were often suitable during the early mornings, wind speeds typically increased through the morning. As a result of increased wind speeds, the ability to detect birds by calls or



sounds was often diminished. Given the location of the Avian Study Area and nature of the proposed undertaking, this was not surprising. To accommodate these conditions, the order of sampling plots was changed with successive visits, where possible, so that plot visits were temporally distributed throughout the morning.

A total of twenty five (25) AUS plots were established to provide adequate landscape coverage throughout the Avian Study Area (Figure 2). AUS counts were ten minutes in duration and all species heard or observed within an unlimited radius were recorded. Information recorded for each observation included the number of birds in the flock (if the observation was of a flock), species, behaviour (either perched, soaring, or in flight, or flying with a specific direction), relative flight height and flight direction, and distance to individuals or flocks.

**Table 2: Survey Types and Dates**

<b>Survey</b>	<b>Date</b>
Winter Bird Survey 1	23 January 2010
Winter Bird Survey 2	20 February 2010
Spring Tundra Swan/Waterfowl Survey	18 March 2010
Spring Migration Survey 1	07 April 2010
Spring Migration Survey 2	04 May 2010
Spring Migration Survey 3	16 May 2010
Breeding Bird Survey 1	01 June 2010
Breeding Bird Survey 2	15 June 2010
Fall Migration Survey 1	30 August 2010
Fall Migration Survey 2	13 September 2010
Fall Migration Survey 3	06 October 2010
Fall Migration Survey 4	10 November 2010

### **2.3 Spring Tundra Swan/Waterfowl Surveys**

In addition to standard Avian Use Surveys, a separate survey was conducted in the Avian Study Area to survey for migrating tundra swans and other waterfowl. All roads within the study area were driven, with frequent stops made to survey fields and other habitats for birds. In addition, the shore of Lake Huron, on the westernmost edge of the Avian Study Area was surveyed. Fields and Lake Huron were scanned using a high power spotting scope and good quality binoculars. All birds identified were recorded.



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3.0 RESULTS

When all data were compiled from all surveys conducted in the winter, spring, summer and fall, calculations were made of the total number of individuals observed (which may include repeat observations of one individual on multiple visits), and the percent of much that species comprised from the total bird observations from that season (Figure 3).

Table 3: Number of Individuals and Percent Composition of Bird Species Recorded in the Avian Study Area during Avian Use Surveys, 2010

Common Name	Scientific Name	Winter		Spring		Summer		Fall		Total
		Number of Individuals	Percent Composition							
alder flycatcher	Empidonax alorum	0	0.00%	3	0.07%	0	0.00%	0	0.00%	3
American crow	Corvus brachyrhynchos	143	27.19%	65	1.57%	103	3.46%	452	5.53%	763
American golden-plover	Pluvialis dominica	0	0.00%	0	0.00%	0	0.00%	49	0.60%	49
American goldfinch	Carduelis tristis	0	0.00%	35	0.84%	7	2.35%	46	0.56%	151
American kestrel	Falco sparverius	0	0.00%	3	0.07%	0	0.00%	2	0.02%	5
American pipit	Anthus rubescens	0	0.00%	26	0.63%	1	0.03%	83	1.02%	110
American redstart	Setophaga ruticilla	0	0.00%	8	0.19%	4	0.13%	3	0.04%	15
American robin	Turdus migratorius	0	0.00%	101	2.44%	68	2.28%	35	0.43%	204
American tree sparrow	Spizella arborea	0	0.00%	0	0.00%	0	0.00%	25	0.31%	25
American wigeon	Anas americana	0	0.00%	0	0.00%	0	0.00%	3	0.04%	3
bald eagle	Haliaeetus leucocephalus	1	0.19%	0	0.00%	0	0.00%	6	0.07%	7
Baltimore oriole	Icterus galbula	0	0.00%	9	0.22%	35	1.18%	2	0.02%	46
bank swallow	Riparia riparia	0	0.00%	25	0.60%	36	1.21%	0	0.00%	61
barn swallow	Hirundo rustica	0	0.00%	58	1.40%	128	4.30%	0	0.00%	186
bay-breasted warbler	Dendroica castanea	0	0.00%	1	0.02%	0	0.00%	0	0.00%	1
belted kingfisher	Ceryle alcyon	0	0.00%	1	0.02%	0	0.00%	0	0.00%	1
black-and-white warbler	Mniotilta varia	0	0.00%	2	0.05%	3	0.10%	0	0.00%	5
black-billed cuckoo	Coccyzus erythrophthalmus	0	0.00%	0	0.00%	1	0.03%	0	0.00%	1
blackburnian warbler	Dendroica fusca	0	0.00%	1	0.02%	3	0.10%	0	0.00%	4
black-capped chickadee	Poecile atricapilla	15	2.85%	17	0.41%	5	1.68%	77	0.94%	159
black-throated green warbler	Dendroica virens	0	0.00%	7	0.17%	5	0.17%	3	0.04%	15
blue jay	Cyanocitta cristata	2	0.38%	377	9.10%	29	0.97%	109	1.33%	517
blue-gray gnatcatcher	Polioptila caerulea	0	0.00%	2	0.05%	3	0.10%	0	0.00%	5
blue-headed vireo	Vireo solitarius	0	0.00%	1	0.02%	0	0.00%	2	0.02%	3
bobolink	Dolichonyx oryzivorus	0	0.00%	23	0.55%	33	1.11%	0	0.00%	56
Bonaparte's gull	Larus philadelphia	0	0.00%	69	1.66%	0	0.00%	0	0.00%	69
broad-winged hawk	Buteo platypterus	0	0.00%	0	0.00%	0	0.00%	1	0.01%	1
brown creeper	Certhia americana	0	0.00%	1	0.02%	1	0.03%	3	0.04%	5
brown thrasher	Toxostoma rufum	0	0.00%	4	0.10%	5	0.17%	1	0.01%	10
brown-headed cowbird	Molothrus ater	0	0.00%	67	1.62%	5	1.68%	14	0.17%	131
Canada goose	Branta canadensis	0	0.00%	107	2.58%	231	7.76%	408	5.00%	746
Cape May warbler	Dendroica tigrina	0	0.00%	6	0.14%	0	0.00%	1	0.01%	7



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Common Name	Scientific Name	Winter		Spring		Summer		Fall		Total
		Number of Individuals	Percent Composition							
cedar waxwing	Bombycilla cedrorum	0	0.00%	21	0.51%	85	2.86%	8	0.10%	114
chestnut-sided warbler	Dendroica pensylvanica	0	0.00%	0	0.00%	0	0.00%	1	0.01%	1
chimney swift	Chaetura pelagica	0	0.00%	2	0.05%	0	0.00%	0	0.00%	2
chipping sparrow	Spizella passerina	0	0.00%	29	0.70%	29	0.97%	3	0.04%	61
clay-colored sparrow	Spizella pallida	0	0.00%	0	0.00%	1	0.03%	0	0.00%	1
cliff swallow	Petrochelidon pyrrhonota	0	0.00%	1	0.02%	12	0.40%	0	0.00%	13
common goldeneye	Bucephala clangula	0	0.00%	0	0.00%	0	0.00%	2	0.02%	2
common grackle	Quiscalus quiscula	0	0.00%	59	1.42%	86	2.89%	82	1.00%	227
common loon	Gavia immer	0	0.00%	81	1.95%	2	0.07%	10	0.12%	93
common merganser	Mergus merganser	0	0.00%	1	0.02%	0	0.00%	7	0.09%	8
common yellowthroat	Geothlypis trichas	0	0.00%	0	0.00%	13	0.44%	1	0.01%	14
cooper's hawk	Accipiter cooperii	0	0.00%	1	0.02%	3	0.10%	3	0.04%	7
dark-eyed junco	Junco hyemalis	0	0.00%	10	0.24%	0	0.00%	51	0.62%	61
double-crested cormorant	Phalacrocorax auritus	0	0.00%	15	0.36%	5	0.17%	42	0.51%	62
downy woodpecker	Picoides pubescens	3	0.57%	4	0.10%	7	0.24%	8	0.10%	22
eastern bluebird	Sialia sialis	0	0.00%	0	0.00%	0	0.00%	6	0.07%	6
eastern kingbird	Tyrannus tyrannus	0	0.00%	6	0.14%	8	0.27%	0	0.00%	14
eastern meadowlark	Sturnella magna	0	0.00%	5	0.12%	0	0.00%	0	0.00%	5
eastern phoebe	Sayornis phoebe	0	0.00%	3	0.07%	3	0.10%	1	0.01%	7
eastern towhee	Pipilo erythrophthalmus	0	0.00%	0	0.00%	4	0.13%	3	0.04%	7
eastern wood-pewee	Contopus virens	0	0.00%	3	0.07%	14	0.47%	0	0.00%	17
European starling	Sturnus vulgaris	139	26.43%	225	5.43%	325	10.92%	675	8.26%	1364
field sparrow	Spizella pusilla	0	0.00%	2	0.05%	4	0.13%	0	0.00%	6
golden-crowned kinglet	Regulus satrapa	2	0.38%	24	0.58%	0	0.00%	21	0.26%	47
grasshopper sparrow	Ammodramus savannarum	0	0.00%	1	0.02%	2	0.07%	0	0.00%	3
great blue heron	Ardea herodias	0	0.00%	0	0.00%	3	0.10%	1	0.01%	4
great crested flycatcher	Myiarchus crinitus	0	0.00%	9	0.22%	34	1.14%	2	0.02%	45
greater scaup	Aythya marila	0	0.00%	0	0.00%	0	0.00%	1	0.01%	1
green heron	Butorides virescens	0	0.00%	0	0.00%	2	0.07%	0	0.00%	2
green-winged teal	Anas crecca	0	0.00%	0	0.00%	3	0.10%	0	0.00%	3
grey catbird	Dumetella carolinensis	0	0.00%	3	0.07%	2	0.67%	4	0.05%	27
hairy woodpecker	Picoides villosus	0	0.00%	3	0.07%	7	0.24%	2	0.02%	12
hermit thrush	Catharus guttatus	0	0.00%	0	0.00%	0	0.00%	7	0.09%	7
herring gull	Larus argentatus	0	0.00%	46	1.11%	39	1.31%	22	0.27%	107
horned grebe	Podiceps auritus	0	0.00%	0	0.00%	0	0.00%	7	0.09%	7
horned lark	Eremophila alpestris	23	4.37%	100	2.41%	76	2.55%	209	2.56%	408



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Common Name	Scientific Name	Winter		Spring		Summer		Fall		Total
		Number of Individuals	Percent Composition							
house finch	Carpodacus mexicanus	0	0.00%	1	0.02%	4	0.13%	3	0.04%	8
house sparrow	Passer domesticus	9	1.71%	26	0.63%	54	1.81%	16	0.20%	105
house wren	Troglodytes aedon	0	0.00%	14	0.34%	37	1.24%	0	0.00%	51
indigo bunting	Passerina cyanea	0	0.00%	5	0.12%	28	0.94%	0	0.00%	33
killdeer	Charadrius vociferus	0	0.00%	41	0.99%	62	2.08%	89	1.09%	192
least flycatcher	Empidonax minimus	0	0.00%	4	0.10%	3	0.10%	0	0.00%	7
least sandpiper	Calidris minutilla	0	0.00%	5	0.12%	0	0.00%	0	0.00%	5
lesser yellowlegs	Tringa flavipes	0	0.00%	0	0.00%	0	0.00%	1	0.01%	1
Lincoln's sparrow	Melospiza lincolni	0	0.00%	0	0.00%	0	0.00%	1	0.01%	1
long-tailed duck	Clangula hyemalis	0	0.00%	0	0.00%	0	0.00%	14	0.17%	14
magnolia warbler	Dendroica magnolia	0	0.00%	8	0.19%	4	0.13%	4	0.05%	16
mallard	Anas platyrhynchos	0	0.00%	19	0.46%	1	0.03%	87	1.07%	107
merlin	Falco columbarius	0	0.00%	0	0.00%	0	0.00%	1	0.01%	1
mourning dove	Zenaida macroura	1	1.90%	23	0.55%	68	2.28%	54	0.66%	155
mourning warbler	Oporornis philadelphia	0	0.00%	0	0.00%	3	0.10%	0	0.00%	3
Nashville warbler	Vermivora ruficapilla	0	0.00%	1	0.02%	2	0.07%	0	0.00%	3
northern cardinal	Cardinalis cardinalis	1	1.90%	6	0.14%	4	0.13%	5	0.06%	25
northern flicker	Colaptes auratus	0	0.00%	18	0.43%	13	0.44%	6	0.07%	37
northern goshawk	Accipiter gentilis	0	0.00%	1	0.02%	0	0.00%	0	0.00%	1
northern harrier	Circus cyaneus	0	0.00%	0	0.00%	1	0.03%	3	0.04%	4
northern parula	Parula americana	0	0.00%	0	0.00%	0	0.00%	1	0.01%	1
northern rough-winged swallow	Stelgidopteryx serripennis	0	0.00%	0	0.00%	2	0.07%	0	0.00%	2
northern shoveler	Anas clypeata	0	0.00%	0	0.00%	0	0.00%	3	0.04%	3
northern waterthrush	Seiurus noveboracensis	0	0.00%	1	0.02%	1	0.03%	0	0.00%	2
orchard oriole	Icterus spurius	0	0.00%	0	0.00%	2	0.07%	0	0.00%	2
osprey	Pandion haliaetus	0	0.00%	0	0.00%	1	0.03%	1	0.01%	2
ovenbird	Seiurus aurocapilla	0	0.00%	4	0.10%	19	0.64%	0	0.00%	23
palm warbler	Dendroica palmarum	0	0.00%	1	0.02%	0	0.00%	2	0.02%	3
peregrine falcon	Falco peregrinus	0	0.00%	0	0.00%	0	0.00%	1	0.01%	1
Philadelphia vireo	Vireo philadelphicus	0	0.00%	5	0.12%	1	0.03%	1	0.01%	7
pileated woodpecker	Dryocopus pileatus	1	0.19%	1	0.02%	6	0.20%	2	0.02%	10
pine warbler	Dendroica pinus	0	0.00%	1	0.02%	2	0.07%	1	0.01%	4
purple finch	Carpodacus purpureus	0	0.00%	0	0.00%	0	0.00%	2	0.02%	2
purple martin	Progne subis	0	0.00%	6	0.14%	11	0.37%	0	0.00%	17
red-bellied woodpecker	Melanerpes carolinus	1	0.19%	4	0.10%	3	0.10%	0	0.00%	8
red-breasted merganser	Mergus serrator	0	0.00%	231	5.57%	0	0.00%	45	0.55%	276



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Common Name	Scientific Name	Winter		Spring		Summer		Fall		Total
		Number of Individuals	Percent Composition							
red-breasted nuthatch	<i>Sitta canadensis</i>	2	0.38%	7	0.17%	4	0.13%	9	0.11%	22
red-eyed vireo	<i>Vireo olivaceus</i>	0	0.00%	16	0.39%	35	1.18%	4	0.05%	55
red-necked grebe	<i>Podiceps grisegna</i>	0	0.00%	0	0.00%	0	0.00%	1	0.01%	1
red-tailed hawk	<i>Buteo jamaicensis</i>	8	1.52%	9	0.22%	9	0.30%	18	0.22%	44
red-throated loon	<i>Gavia stellata</i>	0	0.00%	0	0.00%	0	0.00%	2	0.02%	2
red-winged blackbird	<i>Agelaius phoeniceus</i>	0	0.00%	187	4.51%	205	6.89%	412	5.04%	804
ring-billed gull	<i>Larus delawarensis</i>	0	0.00%	1420	34.26%	162	5.44%	3419	41.86%	5001
rock pigeon	<i>Columba livia</i>	73	13.88%	16	0.39%	2	0.67%	47	0.58%	156
rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>	0	0.00%	12	0.29%	28	0.94%	1	0.01%	41
rough-legged hawk	<i>Buteo lagopus</i>	1	0.19%	0	0.00%	0	0.00%	0	0.00%	1
ruby-crowned kinglet	<i>Regulus calendula</i>	0	0.00%	1	0.02%	0	0.00%	11	0.13%	12
ruby-throated hummingbird	<i>Archilochus colubris</i>	0	0.00%	0	0.00%	12	0.40%	4	0.05%	16
ruffed grouse	<i>Bonasa umbellus</i>	0	0.00%	0	0.00%	0	0.00%	1	0.01%	1
rusty blackbird	<i>Euphagus carolinus</i>	0	0.00%	7	0.17%	0	0.00%	4	0.05%	11
savannah sparrow	<i>Passerculus sandwichensis</i>	0	0.00%	54	1.30%	53	1.78%	8	0.10%	115
scarlet tanager	<i>Piranga olivacea</i>	0	0.00%	0	0.00%	7	0.24%	1	0.01%	8
sharp-shinned hawk	<i>Accipiter striatus</i>	1	0.19%	3	0.07%	1	0.03%	4	0.05%	9
snow bunting	<i>Plectrophenax nivalis</i>	66	12.55%	0	0.00%	0	0.00%	1009	12.35%	1075
song sparrow	<i>Melospiza melodia</i>	0	0.00%	63	1.52%	6	2.02%	16	0.20%	139
spotted sandpiper	<i>Actitis macularia</i>	0	0.00%	1	0.02%	2	0.07%	0	0.00%	3
Swainson's thrush	<i>Catharus ustulatus</i>	0	0.00%	0	0.00%	3	0.10%	6	0.07%	9
swamp sparrow	<i>Melospiza georgiana</i>	0	0.00%	0	0.00%	0	0.00%	1	0.01%	1
Tennessee warbler	<i>Vermivora peregrina</i>	0	0.00%	0	0.00%	0	0.00%	1	0.01%	1
tree swallow	<i>Tachycineta bicolor</i>	0	0.00%	23	0.55%	2	0.67%	11	0.13%	54
trumpeter swan	<i>Cygnus buccinator</i>	0	0.00%	2	0.05%	0	0.00%	0	0.00%	2
turkey vulture	<i>Cathartes aura</i>	0	0.00%	137	3.31%	255	8.57%	233	2.85%	625
upland sandpiper	<i>Bartramia longicauda</i>	0	0.00%	0	0.00%	1	0.03%	0	0.00%	1
veery	<i>Catharus fuscescens</i>	0	0.00%	0	0.00%	11	0.37%	0	0.00%	11
vesper sparrow	<i>Pooecetes gramineus</i>	0	0.00%	12	0.29%	25	0.84%	1	0.01%	38
warbling vireo	<i>Vireo gilvus</i>	0	0.00%	10	0.24%	22	0.74%	0	0.00%	32
white-breasted nuthatch	<i>Sitta carolinensis</i>	0	0.00%	7	0.17%	3	0.10%	5	0.06%	15
white-crowned sparrow	<i>Zonotrichia leucophrys</i>	0	0.00%	4	0.10%	0	0.00%	12	0.15%	16
white-throated sparrow	<i>Zonotrichia albicollis</i>	0	0.00%	2	0.05%	0	0.00%	39	0.48%	41
wild turkey	<i>Meleagris gallopava</i>	16	3.04%	2	0.05%	2	0.07%	0	0.00%	20
willow flycatcher	<i>Empidonax traillii</i>	0	0.00%	7	0.17%	3	0.10%	0	0.00%	10
Wilson's warbler	<i>Wilsonia pusilla</i>	0	0.00%	2	0.05%	0	0.00%	2	0.02%	4



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Common Name	Scientific Name	Winter		Spring		Summer		Fall		Total
		Number of Individuals	Percent Composition							
winter wren	Troglodytes troglodytes	0	0.00%	2	0.05%	0	0.00%	2	0.02%	4
wood duck	Aix sponsa	0	0.00%	4	0.10%	0	0.00%	3	0.04%	7
wood thrush	Hylocichla mustelina	0	0.00%	7	0.17%	22	0.74%	0	0.00%	29
yellow warbler	Dendroica petechia	0	0.00%	15	0.36%	21	0.71%	0	0.00%	36
yellow-bellied flycatcher	Empidonax flaviventris	0	0.00%	3	0.07%	0	0.00%	0	0.00%	3
yellow-bellied sapsucker	Sphyrapicus varius	0	0.00%	5	0.12%	2	0.07%	7	0.09%	14
yellow-billed cuckoo	Coccyzus americanus	0	0.00%	0	0.00%	2	0.07%	0	0.00%	2
yellow-rumped warbler	Dendroica coronata	0	0.00%	6	0.14%	0	0.00%	27	0.33%	33
yellow-throated vireo	Vireo flavifrons	0	0.00%	0	0.00%	3	0.10%	0	0.00%	3
<b>Total</b>		<b>526</b>	<b>100.00%</b>	<b>4145</b>	<b>100.00%</b>	<b>2972</b>	<b>100.00%</b>	<b>8168</b>	<b>100.00%</b>	<b>15811</b>

Due to potential differences in risk of collision with turbines of different bird groups (Kingsley and Whittam 2007), data are summarized according to seven bird groups: gamebirds (including turkeys, partridges and grouse); waterfowl (including ducks, geese and swans); waterbirds (including gulls, herons, rails, and cormorants); shorebirds (including plovers and sandpipers); raptors (including hawks, falcons and eagles, and for the purposes of this summary, vultures); passerines (including songbirds and near passerine landbirds); and woodpeckers.

Table 4: Number of Individuals and Percent Composition of Bird Groups in the Avian Study Area during Avian Use Surveys, 2010

Bird Group	Winter		Breeding		Fall		Spring		Total	
	Number of Individuals	Percent Composition								
Gamebirds	16	3.04%	2	0.07%	1	0.01%	2	0.05%	21	0.79%
Passerines	494	93.92%	2150	72.22%	3653	44.72%	1912	46.13%	8209	64.25%
Raptors	11	2.09%	270	9.07%	273	3.34%	154	3.72%	708	4.55%
Shorebirds	0	0.00%	65	2.18%	139	1.70%	47	1.13%	251	1.25%
Waterbirds	0	0.00%	213	7.15%	3549	43.45%	1862	44.92%	5624	23.88%
Waterfowl	0	0.00%	234	8.03%	528	6.46%	133	3.21%	895	4.43%
Woodpeckers	5	0.95%	38	1.28%	25	0.31%	35	0.84%	103	0.84%
<b>Total</b>	<b>526</b>	<b>100.00%</b>	<b>2972</b>	<b>100.00%</b>	<b>8168</b>	<b>100.00%</b>	<b>4145</b>	<b>100.00%</b>	<b>15811</b>	<b>100.00%</b>

Table 5: Average Flight Height of Bird Groups during Avian Use Surveys by Season

Bird Group	Average Flight Height (m)				
	Winter	Spring	Breeding	Fall	Total Average
Gamebirds	none observed	none observed	9.67	none observed	9.67
Passerines	22.66	18.95	14.64	22.03	19.57
Raptors	32.50	80.78	86.74	102.13	75.54
Shorebirds	nd	19.14	13.44	51.25	27.94



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Bird Group	Average Flight Height (m)				
	Winter	Spring	Breeding	Fall	Total Average
Waterbirds	nd	43.81	59.35	80.61	61.26
Waterfowl	nd	20.98	21.89	81.11	41.33
Woodpeckers	nd	16.13	11.64	13.55	13.77
<b>Total Average</b>	27.58	33.30	31.05	58.45	37.59

Birds observed within 30 m of the ground were considered to be below the sweep of the rotor blades, those flying from 30 to 130 m were considered to be within the sweep of the rotor blades, and those birds observed flying above 130 m were described as being above the rotor sweep.

Table 6: Number of Individuals and Percent Composition of Bird Groups Observed Flying During Avian Use Surveys (All Seasons Combined)

Species Common Name	Under 30m		Within 30-130m		Over 130m		Height Unknown		Total
	Number of Individuals	Percent Composition							
Gamebirds	1	0.00%	0	0.00%	0	0.00%	0	0.00%	1
Passerines	2759	26.20%	2401	22.80%	5	0.05%	230	2.18%	5395
Raptors	102	0.97%	556	5.28%	17	0.16%	4	0.04%	679
Shorebirds	64	0.61%	58	0.55%	0	0.00%	6	0.06%	128
Waterbirds	244	2.32%	3413	32.41%	245	2.33%	17	0.16%	3919
Waterfowl	217	2.06%	13	0.12%	131	1.24%	5	0.05%	366
Woodpeckers	41	0.39%	3	0.03%	0	0.00%	0	0.00%	44
<b>Total</b>	3428	32.55%	6444	61.18%	398	3.78%	262	2.49%	10532

Table 7: Number of Individuals and Percent Composition of All Birds Observed Flying During Avian Use Surveys (All Seasons Combined).

Species Common Name	Under 30m		Within 30-130m		Over 130m		Height Unknown		Total
	Number of Individuals	Percent Composition							
alder flycatcher	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
American crow	186	1.77%	338	3.21%	5	0.05%	16	0.15%	545
American golden-plover	0	0.00%	49	0.47%	0	0.00%	0	0.00%	49
American goldfinch	104	0.99%	8	0.08%	0	0.00%	15	0.14%	127
American kestrel	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
American pipit	63	0.60%	46	0.44%	0	0.00%	0	0.00%	109
American redstart	4	0.04%	0	0.00%	0	0.00%	0	0.00%	4
American robin	80	0.76%	14	0.13%	0	0.00%	0	0.00%	94
American tree sparrow	6	0.06%	0	0.00%	0	0.00%	0	0.00%	6
American wigeon	0	0.00%	3	0.03%	0	0.00%	0	0.00%	3



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Species Common Name	Under 30m		Within 30-130m		Over 130m		Height Unknown		Total
	Number of Individuals	Percent Composition	Number of Individuals						
bald eagle	0	0.00%	2	0.02%	0	0.00%	0	0.00%	2
Baltimore oriole	5	0.05%	1	0.01%	0	0.00%	1	0.01%	7
bank swallow	30	0.28%	19	0.18%	0	0.00%	12	0.11%	61
barn swallow	154	1.46%	14	0.13%	0	0.00%	16	0.15%	184
bay-breasted warbler	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
belted kingfisher	0	0.00%	0	0.00%	0	0.00%	1	0.01%	1
black-and-white warbler	2	0.02%	0	0.00%	0	0.00%	0	0.00%	2
black-billed cuckoo	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
blackburnian warbler	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
black-capped chickadee	88	0.84%	1	0.01%	0	0.00%	1	0.01%	90
black-throated green warbler	5	0.05%	0	0.00%	0	0.00%	0	0.00%	5
blue jay	51	0.48%	426	4.04%	0	0.00%	1	0.01%	478
blue-gray gnatcatcher	2	0.02%	0	0.00%	0	0.00%	0	0.00%	2
blue-headed vireo	2	0.02%	0	0.00%	0	0.00%	0	0.00%	2
bobolink	25	0.24%	16	0.15%	0	0.00%	6	0.06%	47
Bonaparte's gull	69	0.65%	0	0.00%	0	0.00%	0	0.00%	69
broad-winged hawk	0	0.00%	1	0.01%	0	0.00%	0	0.00%	1
brown creeper	2	0.02%	0	0.00%	0	0.00%	0	0.00%	2
brown thrasher	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
brown-headed cowbird	78	0.74%	23	0.22%	0	0.00%	6	0.06%	107
Canada goose	134	1.27%	7	0.07%	87	0.83%	0	0.00%	228
Cape May warbler	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
cedar waxwing	56	0.53%	35	0.33%	0	0.00%	1	0.01%	92
chestnut-sided warbler	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
chimney swift	0	0.00%	2	0.02%	0	0.00%	0	0.00%	2
chipping sparrow	7	0.07%	1	0.01%	0	0.00%	4	0.04%	12
clay-colored sparrow	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
cliff swallow	11	0.10%	0	0.00%	0	0.00%	2	0.02%	13
common goldeneye	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
common grackle	56	0.53%	151	1.43%	0	0.00%	0	0.00%	207
common loon	12	0.11%	47	0.45%	23	0.22%	11	0.10%	93
common merganser	8	0.08%	0	0.00%	0	0.00%	0	0.00%	8
common yellowthroat	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
cooper's hawk	2	0.02%	2	0.02%	2	0.02%	0	0.00%	6
dark-eyed junco	30	0.28%	0	0.00%	0	0.00%	0	0.00%	30
double-crested cormorant	16	0.15%	0	0.00%	42	0.40%	0	0.00%	58



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Species Common Name	Under 30m		Within 30-130m		Over 130m		Height Unknown		Total
	Number of Individuals	Percent Composition	Number of Individuals						
downy woodpecker	13	0.12%	0	0.00%	0	0.00%	0	0.00%	13
eastern bluebird	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
eastern kingbird	6	0.06%	2	0.02%	0	0.00%	0	0.00%	8
eastern meadowlark	5	0.05%	0	0.00%	0	0.00%	0	0.00%	5
eastern phoebe	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
eastern towhee	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
eastern wood-pewee	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
European starling	529	5.02%	426	4.04%	0	0.00%	84	0.80%	1039
field sparrow	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
golden-crowned kinglet	11	0.10%	0	0.00%	0	0.00%	0	0.00%	11
grasshopper sparrow	2	0.02%	0	0.00%	0	0.00%	0	0.00%	2
great blue heron	0	0.00%	4	0.04%	0	0.00%	0	0.00%	4
great crested flycatcher	3	0.03%	0	0.00%	0	0.00%	0	0.00%	3
greater scaup	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
green heron	1	0.01%	1	0.01%	0	0.00%	0	0.00%	2
green-winged teal	3	0.03%	0	0.00%	0	0.00%	0	0.00%	3
gray catbird	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
hairy woodpecker	7	0.07%	0	0.00%	0	0.00%	0	0.00%	7
hermit thrush	3	0.03%	0	0.00%	0	0.00%	0	0.00%	3
herring gull	32	0.30%	35	0.33%	3	0.03%	0	0.00%	70
horned grebe	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
horned lark	203	1.93%	39	0.37%	0	0.00%	29	0.28%	271
house finch	4	0.04%	0	0.00%	0	0.00%	0	0.00%	4
house sparrow	31	0.29%	0	0.00%	0	0.00%	5	0.05%	36
house wren	4	0.04%	0	0.00%	0	0.00%	1	0.01%	5
indigo bunting	6	0.06%	0	0.00%	0	0.00%	0	0.00%	6
killdeer	63	0.60%	0	0.09%	0	0.00%	6	0.06%	78
least flycatcher	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
least sandpiper	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
lesser yellowlegs	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
Lincoln's sparrow	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
long-tailed duck	14	0.13%	0	0.00%	0	0.00%	0	0.00%	14
magnolia warbler	10	0.09%	0	0.00%	0	0.00%	0	0.00%	10
mallard	53	0.50%	3	0.03%	41	0.39%	1	0.01%	98
merlin	0	0.00%	1	0.01%	0	0.00%	0	0.00%	1
mourning dove	69	0.65%	11	0.10%	0	0.00%	5	0.05%	85



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Species Common Name	Under 30m		Within 30-130m		Over 130m		Height Unknown		Total
	Number of Individuals	Percent Composition	Number of Individuals						
mourning warbler	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
Nashville warbler	2	0.02%	0	0.00%	0	0.00%	0	0.00%	2
northern cardinal	5	0.05%	0	0.00%	0	0.00%	0	0.00%	5
northern flicker	14	0.13%	3	0.03%	0	0.00%	0	0.00%	17
northern goshawk	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
northern harrier	2	0.02%	2	0.02%	0	0.00%	0	0.00%	4
northern parula	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
northern rough-winged swallow	2	0.02%	0	0.00%	0	0.00%	0	0.00%	2
northern shoveler	0	0.00%	0	0.00%	3	0.03%	0	0.00%	3
northern waterthrush	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
orchard oriole	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
osprey	1	0.01%	0	0.00%	1	0.01%	0	0.00%	2
ovenbird	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
palm warbler	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
peregrine falcon	0	0.00%	1	0.01%	0	0.00%	0	0.00%	1
Philadelphia vireo	2	0.02%	0	0.00%	0	0.00%	0	0.00%	2
pileated woodpecker	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
pine warbler	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
purple finch	0	0.00%	0	0.00%	0	0.00%	2	0.02%	2
purple martin	5	0.05%	5	0.05%	0	0.00%	6	0.06%	16
red-bellied woodpecker	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
red-breasted merganser	59	0.56%	0	0.00%	0	0.00%	0	0.00%	59
red-breasted nuthatch	6	0.06%	1	0.01%	0	0.00%	0	0.00%	7
red-eyed vireo	15	0.14%	0	0.00%	0	0.00%	2	0.02%	17
red-necked grebe	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
red-tailed hawk	6	0.06%	23	0.22%	8	0.08%	1	0.01%	38
red-throated loon	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
red-winged blackbird	212	2.01%	442	4.19%	0	0.00%	7	0.07%	661
ring-billed gull	55	0.52%	3326	31.56%	177	1.68%	6	0.06%	3564
rock pigeon	45	0.43%	41	0.39%	0	0.00%	0	0.00%	86
rose-breasted grosbeak	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
rough-legged hawk	6	0.06%	0	0.00%	0	0.00%	0	0.00%	6
ruby-crowned kinglet	15	0.14%	0	0.00%	0	0.00%	1	0.01%	16
ruby-throated hummingbird	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
ruffed grouse	5	0.05%	0	0.00%	0	0.00%	0	0.00%	5
rusty blackbird	33	0.31%	0	0.00%	0	0.00%	0	0.00%	33



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Species Common Name	Under 30m		Within 30-130m		Over 130m		Height Unknown		Total
	Number of Individuals	Percent Composition	Number of Individuals						
savannah sparrow	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
scarlet tanager	0	0.00%	7	0.07%	1	0.01%	0	0.00%	8
sharp-shinned hawk	359	3.41%	303	2.88%	0	0.00%	2	0.02%	664
snow bunting	17	0.16%	0	0.00%	0	0.00%	0	0.00%	17
song sparrow	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
spotted sandpiper	0	0.00%	5	0.05%	0	0.00%	0	0.00%	5
Swainson's thrush	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
swamp sparrow	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
Tennessee warbler	20	0.19%	31	0.29%	0	0.00%	3	0.03%	54
tree swallow	2	0.02%	0	0.00%	0	0.00%	0	0.00%	2
trumpeter swan	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
turkey vulture	89	0.84%	517	4.91%	5	0.05%	3	0.03%	614
upland sandpiper	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
veery	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
vesper sparrow	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
warbling vireo	7	0.07%	0	0.00%	0	0.00%	0	0.00%	7
white-breasted nuthatch	15	0.14%	0	0.00%	0	0.00%	0	0.00%	15
white-crowned sparrow	18	0.17%	0	0.00%	0	0.00%	0	0.00%	18
white-throated sparrow	1	0.01%	0	0.00%	0	0.00%	0	0.00%	1
wild turkey	2	0.02%	0	0.00%	0	0.00%	0	0.00%	2
willow flycatcher	2	0.02%	0	0.00%	0	0.00%	0	0.00%	2
Wilson's warbler	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
winter wren	7	0.07%	0	0.00%	0	0.00%	0	0.00%	7
wood duck	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
wood thrush	4	0.04%	0	0.00%	0	0.00%	0	0.00%	4
yellow warbler	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
yellow-bellied flycatcher	6	0.06%	0	0.00%	0	0.00%	0	0.00%	6
yellow-bellied sapsucker	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
yellow-billed cuckoo	16	0.15%	0	0.00%	0	0.00%	1	0.01%	17
yellow-rumped warbler	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
yellow-throated vireo	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
<b>Grand Total</b>	<b>3433</b>	<b>32.58%</b>	<b>6444</b>	<b>61.16%</b>	<b>398</b>	<b>3.78%</b>	<b>262</b>	<b>2.49%</b>	<b>10532</b>



### 3.1 Flight Heights of Birds during All Avian Use Surveys in 2010

During the entire duration of the study, a total of 15 811 individual bird observations were identified (Table 3). Of these 10 532 were observed in flight (Table 6 and 7). The majority of these birds were observed at a flight height within the turbine sweep or 30-130m (61.16%), followed by below the turbine sweep or <30m (32.58%), and above the turbine sweep or >130m (3.78%; Table 6). Of those observed flying within the turbine sweep the majority were ring-billed gull (3326 individual observations), followed by turkey vulture, red-winged blackbird, blue jay, European starling, and American crow (517, 442, 426, 426, and 338 individual observations respectively; Table 7). Most of these observations were during the fall migration with the exception of a moderate movement of blue jays in the northern half of the Avian Study Area on 4 May 2010.

### 3.2 Winter Avian Use Surveys

A total of 526 individual observations of 20 species were made during winter bird surveys in January and February 2010 (Table 3). The most abundant species observed in the Avian Study Area during the winter were American crow (*Corvus brachyrhynchos*), European starling (*Sturnus vulgaris*), rock pigeon (*Columba livia*), and snow bunting (*Plectrophenax nivalis*) comprising of 27.19%, 26.43%, 13.88% and 12.55% of all birds, respectively. Due to potential differences in risk of collision with turbines of different bird groups (Kingsley and Whittam 2007), data are summarized according to seven bird groups: gamebirds (including turkeys, partridges and grouse); waterfowl (including ducks, geese and swans); waterbirds (including gulls, herons, rails, and cormorants); shorebirds (including , plovers and sandpipers); raptors (including hawks, falcons and eagles, and for the purposes of this summary, vultures); passerines (including songbirds and near passerine landbirds); and woodpeckers. Of these groups, passerines comprised 93.92% of all individuals (Table 4).

Birds observed within 30 m of the ground were considered to be below the sweep of the rotor blades, those flying from 30 to 130 m were considered to be within the sweep of the rotor blades, and those birds observed flying above 130 m were described as being above the rotor sweep. During winter surveys, passerines flew at an average height of less than 30 m, raptors flew at an average height of 32.5 m and there was no data to indicate the average height of all other bird groups (Table 5). For actual flight heights of bird groups and species for the entire study duration refer to Section 3.1 and Tables 6 and 7.

### 3.3 Spring Migration Avian Use Surveys

A total of 4145 individual observations of 104 species were identified during spring migration bird surveys in April and May 2010 (Table 3). The most common species observed in the Avian Study Area during spring migration were ring-billed gull (*Larus delawarensis*), blue jay (*Cyanocitta cristata*), red-breasted merganser (*Mergus serrator*), and European starling, comprising of 34.26%, 9.10%, 5.57%, and 5.43% of all birds, respectively. Of these groups, passerines comprised 46.13% and waterbirds comprised 44.92% of all individuals (Table 4).

Most bird groups flew at an average height of less than 30 m during spring surveys (Table 5). Raptors and waterbirds flew at average heights within the limits of the turbine blades (80.78 and 43.81m respectively). The vast majority of these individuals were turkey vultures (*Cathartes aura*) and ring-billed gulls which were often in flocks. For actual flight heights of bird groups and species for the entire study duration refer to Section 3.1 and Tables 6 and 7.



### **3.4 Breeding (Summer) Avian Use Surveys**

A total of 2972 individual observations of 97 species were identified during breeding bird surveys in June 2010 (Table 3). The most common species observed in the Avian Study Area during the breeding season were European starling, turkey vulture, Canada goose (*Branta canadensis*), and red-winged blackbird (*Agelaius phoeniceus*), comprising of 10.92%, 8.57%, 7.76%, and 6.89% of all birds, respectively. Due to potential differences in risk of collision with turbines of different bird groups (Kingsley and Whittam 2007), data are summarized according to seven bird groups: gamebirds (including turkeys, partridges and grouse); waterfowl (including ducks, geese and swans); waterbirds (including gulls, herons, rails, and cormorants); shorebirds (including plovers and sandpipers); raptors (including hawks, falcons and eagles, and for the purposes of this summary, vultures); passerines (including songbirds and near passerine landbirds); and woodpeckers. Of these groups, passerines comprised 72.22% of all individuals (Table 4).

Birds observed within 30 m of the ground were considered to be below the sweep of the rotor blades, those flying from 30 to 130 m were considered to be within the sweep of the rotor blades, and those birds observed flying above 130 m were described as being above the rotor sweep. Raptors and waterbirds flew at average heights within the limits of the turbine blades (86.74m and 59.35m respectively; Table 5). The vast majority of these individuals were turkey vultures and ring-billed gulls, which were often in flocks. For actual flight heights of bird groups and species for the entire study duration refer to Section 3.1 and Tables 6 and 7.

### **3.5 Fall Migration Avian Use Surveys**

A total of 8168 individual observations of 102 species were identified during fall migration bird surveys in August, September, October and November 2010 (Table 3). The most common species observed in the Avian Study Area during the fall were ring-billed gull, snow bunting, European starling, and American crow, comprising 41.86%, 12.35%, 8.26%, and 5.53% of all birds, respectively. Due to potential differences in risk of collision with turbines of different bird groups (Kingsley and Whittam 2007), data are summarized according to seven bird groups: gamebirds (including turkeys, partridges and grouse); waterfowl (including ducks, geese and swans); waterbirds (including gulls, herons, rails, and cormorants); shorebirds (including plovers and sandpipers); raptors (including hawks, falcons and eagles, and for the purposes of this summary, vultures); passerines (including songbirds and near passerine landbirds); and woodpeckers. Of these groups, passerines comprised 44.72% and waterbirds comprised 43.45% of all individuals (Table 4).

Birds observed within 30m of the ground were considered to be below the sweep of the rotor blades, those flying from 30 to 130 m were considered to be within the sweep of the rotor blades, and those birds observed flying above 130m were described as being above the rotor sweep. Raptors, shorebirds, waterbirds, and waterfowl flew at average heights within the sweep of the turbine blades (102.13m, 51.25, 80.61, and 81.11 respectively; Table 5). The majority of these individuals were turkey vultures and ring-billed gulls. For actual flight heights of bird groups and species for the entire study duration refer to Section 3.1 and Tables 6 and 7.

### **3.6 Spring Tundra Swan/Waterfowl Surveys**

A separate survey was conducted to observe tundra swans and other waterfowl within the Avian Study Area on 18 March 2010. During surveys two large flocks of tundra swan were located feeding in fields at the south



westernmost corner of the Avian Study Area (Figure 2). This was one flock of about 5000 individuals and another of about 2000 individuals. Other species of waterfowl and waterbirds observed on these surveys included 22 Canada geese and 150 ring-billed gulls. Other taxa observed during these surveys included common agricultural landscape species such as European starling and horned lark (*Eremophila alpestris*). Two raptor species and a vulture species were observed; including two northern harriers (*Circus cyaneus*), two American kestrels (*Falco sparverius*) and two turkey vultures. No species were observed during these surveys that were not observed during other avian use surveys.



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### 3.7 Species at Risk

In this report, Species at Risk (SAR) are those species that are listed under the Federal Governments *Species at Risk Act* (SARA), and the Ontario governments *Endangered Species Act* (ESA). During 2010 avian surveys, five SAR were observed within the Avian Study Area. For a list of all species at risk observed within the Avian Study Area during surveys in 2010 refer to Table 8.

**Table 8: Endangered, Threatened and Special Concern Avian Species Observed Throughout the Study**

Location of Observation (Station #) *	Season of Observation	Common Name	Scientific Name	SARA Listing (Schedule 1)	ESA Listing	Count
Station 01	Breeding	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	5
	Fall	rusty blackbird	Euphagus carolinus	Special Concern	Not Listed	1
	spring	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	1
Station 02	spring	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	1
	spring	rusty blackbird	Euphagus carolinus	Special Concern	Not Listed	7
Station 03	Fall	rusty blackbird	Euphagus carolinus	Special Concern	Not Listed	2
Station 05	Fall	horned grebe	Podiceps auritus	Not Listed	Special Concern	7
Station 06	Breeding	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	2
Station 11	Breeding	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	3
Station 12	Breeding	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	3
	spring	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	2
Station 15	Fall	peregrine falcon	Falco peregrinus	Threatened	Threatened	1
Station 17	Breeding	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	2
	Fall	bald eagle	Haliaeetus leucocephalus	Not Listed	Special Concern	5
	spring	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	5
	spring	chimney swift	Chaetura pelagica	Threatened	Threatened	1
Station 18	spring	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	1
Station 19	Breeding	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	6
	spring	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	2
Station 20	Fall	bald eagle	Haliaeetus leucocephalus	Not Listed	Special Concern	1



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Location of Observation (Station #) *	Season of Observation	Common Name	Scientific Name	SARA Listing (Schedule 1)	ESA Listing	Count
	Winter	bald eagle	Haliaeetus leucocephalus	Not Listed	Special Concern	1
Station 21	Breeding	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	10
	spring	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	5
	spring	chimney swift	Chaetura pelagica	Threatened	Threatened	1
Station 22	Breeding	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	1
	spring	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	5
Station 23	Breeding	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	1
	Fall	rusty blackbird	Euphagus carolinus	Special Concern	Not Listed	1
	spring	Bobolink	Dolichonyx oryzivorus	Not Listed	Threatened	1



### **3.7.1 Special Concern Species**

Three Special Concern species were identified during avian surveys in 2010. This included bald eagle (*Haliaeetus leucocephalus*), horned grebe (*Podiceps auritus*), and rusty blackbird (*Euphagus carolinus*). Bald eagle and horned grebe are listed as Special Concern under ESA and not listed under SARA. Rusty blackbird is listed as Special Concern under SARA and not listed under ESA.

The bald eagle observations included one during winter surveys in February 2010 and six during fall migration surveys in October and November 2010. During winter surveys one juvenile was observed flying at an average height of 33 m in an agricultural area. During fall migration one sub-adult was observed soaring through at an average height of 50 m in an agricultural area. In addition five individuals of various ages were observed perched in a tree in an agricultural area.

The horned grebe observations were a group of seven seen during fall migration swimming about 250 meters from shore on Lake Huron on October 2010. These were actually outside of the study area, although the observer was within.

Seven rusty blackbird were observed during spring migration surveys in April 2010 and four were observed during fall migration surveys in October and November 2010. During spring migration surveys, three individuals were seen flying low over an agricultural field and four were seen perched in a deciduous woodlot. During fall migrations surveys, two individuals were seen flying low and one was seen perched in a deciduous thicket area. Another individual was seen perched in a wet thicket area.

### **3.7.2 Threatened and Endangered Species**

Three Threatened species and no Endangered species were identified during avian surveys in 2010. This included bobolink (*Dolichonyx oryzivorus*), chimney swift (*Chaetura pelagica*), and peregrine falcon (*Falco peregrinus*). Bobolink is listed as Threatened under ESA, chimney swift and peregrine falcon are listed as Threatened under both SARA and ESA.

The bobolink sightings included 23 individual observations during spring migration surveys and 33 individual observations during breeding season surveys. During spring migration 18 were observed flying and 5 were observed perched in pastures, agricultural fields, and small meadows. Of those flying in spring, three individuals were observed at a height between 25 m and 100 m. The remaining were all flying less than 30 m in height, often relatively close to the ground. During breeding season surveys, 29 were observed flying and 4 were observed perched, in pasture, agricultural fields and small meadows. Of those flying in the breeding season, two were observed flying between 50 m and 75 m, and the remaining were all flying less than 30 m in height.

Two chimney swifts were seen flying between 30 m and 40 m during spring migration in May 2010. Both of these individuals were at two different locations over agricultural fields.

The peregrine falcon was a single bird rapidly flying over an agricultural field between 100 m and 150 m during fall migration in October 2010.



### 3.8 Other Species of Conservation Concern

In addition to SAR, there are several other groups of species that can be considered to be of conservation concern by the scientific and conservation community in Ontario. This includes species listed as rare or imperiled in Ontario by the NHIC; species that have been identified as at risk by COSEWIC; species identified as conservation priorities by Partners in Flight (PIF); area sensitive species; shorebirds identified as conservation priorities by the Ontario Shorebird Conservation Plan (OSCP); and waterfowl with declining long term population trends as described by the North American Waterfowl Management Plan (NAWMP). Species identified during 2010 surveys within the Avian Study Area that fall into one or more of these categories are found in Table 9.

Within Ontario the OMNR NHIC is responsible for assigning rarity ranks (S-rank) to tracked species that are found within the province. Individual species are assigned an S-rank based on population size and other factors. Species with a ranking of S1-S3 are considered vulnerable or rare, with S1 being the most imperiled (OMNR 2010). Eight species identified within the Avian Study Area in 2010 fall into this category. This includes five species that are migrants within the Avian Study Area: American golden plover (*Pluvialis dominica*), horned grebe, peregrine falcon (*Falco peregrines*), long-tailed duck (*Clangula hyemalis*), and the red-throated loon (*Gavia stellata*); one overwintering raptor, rough-legged hawk (*Buteo lagopus*); as well as one possible breeder within the Avian Study Area: bald eagle (Table 9).

COSEWIC is a committee made up of various governmental, non-governmental, aboriginal and other organizations, whose role is to determine the national status of wild species that may be at risk in Canada. This process is the first step in a species becoming listed under SARA. However not all species listed by COSEWIC are automatically listed in SARA. This is because COSEWIC does not consider non ecological issues such as socioeconomic and cultural issues; this role is played by the federal government of Canada (COSEWIC 2010). No species identified within the Avian Study Area in 2010 are listed by COSEWIC that are not already listed by SARA or ESA (Table 9).

Area sensitive species are those species listed in the BSC report Conservation Priorities for the Birds of Southern Ontario. Criteria for identifying these species are based on whether a given species' presence or absence is closely related to the amount of available breeding habitat in a spatial unit. That is, those species that only breed in areas containing larger amounts of a specific habitat type are considered area sensitive. Therefore, these species may require special consideration in development activities (Couturier 1999). A total of 44 species that are considered area sensitive were identified within the Avian Study Area in 2010. This includes forest species such as broad-winged hawk (*Buteo platypterus*), thicket and shrubland species such as brown thrasher (*Toxostoma rufum*), and open area species such as savannah sparrow (*Passerculus sandwichensis*).

The PIF Ontario Landbird Conservation Plan for Bird Conservation Region (BCR) 13 was prepared to help guide management and conservation efforts of bird populations that are found within BCR13 in Ontario (i.e. the Great Lakes- St. Lawrence Region) which includes the Avian Study Area. A list of Priority Species for this region was created in this plan by considering several aspects including long term population declines, at risk classifications and various other factors (PIF 2008). A total of 23 priority species under this plan were identified in the Avian Study Area during 2010 field surveys. This includes species such as American kestrel, Baltimore oriole (*Icterus galbula*), and vesper sparrow (*Proocetes gramineus*). This also included some species that are already listed as SAR such as bald eagle and chimney swift (Table 9).



The Canadian Wildlife Service (CWS) Ontario Shorebird Conservation Plan identifies shorebirds with a high conservation priority. For southern Ontario within BCR13, priority species are based on a number of factors such as declining abundance and threats to breeding habitats by anthropogenic disturbance (CWS 2003). One shorebird species of High priority, the upland sandpiper (*Bartramia longicauda*), was identified within the Avian Study Area during 2010 field surveys (Table 9). This was represented by a single individual heard calling in grassy area at the edge of a pasture.

The North American Waterfowl Management Plan (NAWMP) is a joint project by Canada, United States, and Mexico federal governments. Within this plan, long term population trends of North American Waterfowl are shown. Although the majority of waterfowl are showing no trend or increasing, some species are showing a long term decline, and are therefore conservation priorities (NAWMP 2004). One declining waterfowl species, long tailed duck (*Clangula hyemalis*), was identified during 2010 field surveys (Table 9). This was represented by 14 individuals flying low over Lake Huron, during fall migration surveys. Although the observer was within the Avian Study Area, the birds were actually about 450m from shore, and thus outside of the Avian Study Area.



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Table 9: Avian Species of Conservation Concern Identified within the Study Area

Common Name	Scientific Name	Number of Individuals	Ontario S-Rank <sup>a</sup>	COSEWIC <sup>b</sup>	SARA (Sch 1) <sup>c</sup>	ESA <sup>d</sup>	Area Sensitive Species in Southern Ontario <sup>e</sup>	Priority Landbird Species BCR13 <sup>f</sup>	Priority Shorebird Species for BCR13 <sup>g</sup>	Declining Waterfowl Species in North America <sup>h</sup>
alder flycatcher	<i>Empidonax alnorum</i>	3	S5B	Not Listed	Not Listed	Not Listed	No	No	No	No
American golden-plover	<i>Pluvialis dominica</i>	49	<b>S2B,S4N</b>	Not Listed	Not Listed	Not Listed	No	No	No	No
American goldfinch	<i>Carduelis tristis</i>	151	S5B	Not Listed	Not Listed	Not Listed	Yes	Yes	No	No
American kestrel	<i>Falco sparverius</i>	5	S4	Not Listed	Not Listed	Not Listed	Yes	Yes	No	No
American redstart	<i>Setophaga ruticilla</i>	15	S5B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
American tree sparrow	<i>Spizella arborea</i>	25	S4B	Not Listed	Not Listed	Not Listed	No	No	No	No
bald eagle	<i>Haliaeetus leucocephalus</i>	7	<b>S2N,S4B</b>	Not at Risk	Not Listed	<b>Special Concern</b>	No	Yes	No	No
Baltimore oriole	<i>Icterus galbula</i>	46	S4B	Not Listed	Not Listed	Not Listed	No	Yes	No	No
bank swallow	<i>Riparia riparia</i>	61	S4B	Not Listed	Not Listed	Not Listed	Yes	Yes	No	No
barn swallow	<i>Hirundo rustica</i>	186	S4B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
belted kingfisher	<i>Ceryle alcyon</i>	1	S4B	Not Listed	Not Listed	Not Listed	No	Yes	No	No
black-and-white warbler	<i>Mniotilta varia</i>	5	S5B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
black-billed cuckoo	<i>Coccyzus erythrophthalmus</i>	1	S5B	Not Listed	Not Listed	Not Listed	No	Yes	No	No
blackburnian warbler	<i>Dendroica fusca</i>	4	S5B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
black-throated green warbler	<i>Dendroica virens</i>	15	S5B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
blue-headed vireo	<i>Vireo solitarius</i>	3	S5B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
bobolink	<i>Dolichonyx oryzivorus</i>	56	S4B	<b>Threatened</b>	Not Listed	<b>Threatened</b>	Yes	No	No	No
broad-winged hawk	<i>Buteo platypterus</i>	1	S5B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
brown creeper	<i>Certhia americana</i>	5	S5B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
brown thrasher	<i>Toxostoma rufum</i>	10	S4B	Not Listed	Not Listed	Not Listed	Yes	Yes	No	No
chimney swift	<i>Chaetura pelagica</i>	2	S4B,S4N	<b>Threatened</b>	<b>Threatened</b>	<b>Threatened</b>	No	Yes	No	No
clay-colored sparrow	<i>Spizella pallida</i>	1	S4B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
cliff swallow	<i>Petrochelidon pyrrhonota</i>	13	S4B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
cooper's hawk	<i>Accipiter cooperii</i>	7	S4	Not at Risk	Not Listed	Not Listed	Yes	No	No	No
dark-eyed junco	<i>Junco hyemalis</i>	61	S5B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
eastern bluebird	<i>Sialia sialis</i>	6	S5B	Not at Risk	Not Listed	Not Listed	Yes	No	No	No
eastern kingbird	<i>Tyrannus tyrannus</i>	14	S4B	Not Listed	Not Listed	Not Listed	Yes	Yes	No	No
eastern meadowlark	<i>Sturnella magna</i>	5	S4B	Not Listed	Not Listed	Not Listed	Yes	Yes	No	No
eastern towhee	<i>Pipilo erythrophthalmus</i>	7	S4B	Not Listed	Not Listed	Not Listed	No	Yes	No	No
eastern wood-pewee	<i>Contopus virens</i>	17	S4B	Not Listed	Not Listed	Not Listed	No	Yes	No	No
field sparrow	<i>Spizella pusilla</i>	6	S4B	Not Listed	Not Listed	Not Listed	Yes	Yes	No	No
grasshopper sparrow	<i>Ammodramus savannarum</i>	3	S4B	Not Listed	Not Listed	Not Listed	Yes	Yes	No	No
hermit thrush	<i>Catharus guttatus</i>	7	S5B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
herring gull	<i>Larus argentatus</i>	107	S5B,S5N	Not Listed	Not Listed	Not Listed	No	No	No	No



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Common Name	Scientific Name	Number of Individuals	Ontario S-Rank <sup>a</sup>	COSEWIC <sup>b</sup>	SARA (Sch 1) <sup>c</sup>	ESA <sup>d</sup>	Area Sensitive Species in Southern Ontario <sup>e</sup>	Priority Landbird Species BCR13 <sup>f</sup>	Priority Shorebird Species for BCR13 <sup>g</sup>	Declining Waterfowl Species in North America <sup>h</sup>
horned grebe	<i>Podiceps auritus</i>	7	S1B,S4N	Special Concern	Not Listed	Special Concern	No	No	No	No
horned lark	<i>Eremophila alpestris</i>	408	S5B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
long-tailed duck	<i>Clangula hyemalis</i>	14	S3B	Not Listed	Not Listed	Not Listed	No	No	No	Yes
magnolia warbler	<i>Dendroica magnolia</i>	16	S5B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
Nashville warbler	<i>Vermivora ruficapilla</i>	3	S5B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
northern flicker	<i>Colaptes auratus</i>	37	S4B	Not Listed	Not Listed	Not Listed	No	Yes	No	No
northern goshawk	<i>Accipiter gentilis</i>	1	S4	Not at Risk	Not Listed	Not Listed	Yes	No	No	No
northern harrier	<i>Circus cyaneus</i>	4	S4B	Not at Risk	Not Listed	Not Listed	No	Yes	No	No
northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	2	S4B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
northern waterthrush	<i>Seiurus noveboracensis</i>	2	S5B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
ovenbird	<i>Seiurus aurocapilla</i>	23	S4B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
peregrine falcon	<i>Falco peregrinus</i>	1	S3B	Special Concern	Special Concern	Not Listed	No	Yes	No	No
pileated woodpecker	<i>Dryocopus pileatus</i>	10	S5	Not Listed	Not Listed	Not Listed	Yes	No	No	No
pine warbler	<i>Dendroica pinus</i>	4	S5B		Not Listed	Not Listed	Yes	No	No	No
red-breasted nuthatch	<i>Sitta canadensis</i>	22	S5	Not Listed	Not Listed	Not Listed	Yes	No	No	No
red-eyed vireo	<i>Vireo olivaceus</i>	55	S5B	Not Listed	Not Listed	Not Listed	No	No	No	No
red-throated loon	<i>Gavia stellata</i>	2	S1N,S3B	Not Listed	Not Listed	Not Listed	No	No	No	No
rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>	41	S4B	Not Listed	Not Listed	Not Listed	No	Yes	No	No
ruby-crowned kinglet	<i>Regulus calendula</i>	12	S4B	Not Listed	Not Listed	Not Listed	No	No	No	No
rusty blackbird	<i>Euphagus carolinus</i>	11	S4B	Special Concern	Special Concern	Not Listed	No	No	No	No
savannah sparrow	<i>Passerculus sandwichensis</i>	115	S4B	Not Listed	Not Listed	Not Listed	Yes	Yes	No	No
scarlet tanager	<i>Piranga olivacea</i>	8	S4B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
sharp-shinned hawk	<i>Accipiter striatus</i>	9	S5	Not at Risk	Not Listed	Not Listed	Yes	No	No	No
spotted sandpiper	<i>Actitis macularia</i>	3	S5	Not Listed	Not Listed	Not Listed	Yes	No	No	No
Swainson's thrush	<i>Catharus ustulatus</i>	9	S4B	Not Listed	Not Listed	Not Listed	No	No	No	No
upland sandpiper	<i>Bartramia longicauda</i>	1	S4B	Not Listed	Not Listed	Not Listed	Yes	No	High	No
veery	<i>Catharus fuscescens</i>	11	S4B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
vesper sparrow	<i>Pooecetes gramineus</i>	38	S4B	Not Listed	Not Listed	Not Listed	Yes	Yes	No	No
white-throated sparrow	<i>Zonotrichia albicollis</i>	41	S5B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
wild turkey	<i>Meleagris gallopava</i>	20	S5	Not Listed	Not Listed	Not Listed	No	No	No	No
willow flycatcher	<i>Empidonax traillii</i>	10	S5B	Not Listed	Not Listed	Not Listed	No	Yes	No	No
winter wren	<i>Troglodytes troglodytes</i>	4	S5B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
wood thrush	<i>Hylocichla mustelina</i>	29	S4B	Not Listed	Not Listed	Not Listed	No	Yes	No	No



AVIAN USE MONITORING REPORT - GOSHEN WIND ENERGY PROJECT

Common Name	Scientific Name	Number of Individuals	Ontario S-Rank <sup>a</sup>	COSEWIC <sup>b</sup>	SARA (Sch 1) <sup>c</sup>	ESA <sup>d</sup>	Area Sensitive Species in Southern Ontario <sup>e</sup>	Priority Landbird Species BCR13 <sup>f</sup>	Priority Shorebird Species for BCR13 <sup>g</sup>	Declining Waterfowl Species in North America <sup>h</sup>
yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	14	S5B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
yellow-rumped warbler	<i>Dendroica coronata</i>	33	S5B	Not Listed	Not Listed	Not Listed	Yes	No	No	No
<b>Total</b>		<b>1925</b>								

a - Provincial (or Subnational) ranks, used by the Natural Heritage Information Centre to set protection priorities for rare species and natural communities. Retrieved from the NHIC Biodiversity Explorer.

b - COSEWIC 2010. Committee on the Status of Endangered Wildlife in Canada. [http://www.cosewic.gc.ca/eng/sct5/index\\_e.cfm](http://www.cosewic.gc.ca/eng/sct5/index_e.cfm)

c - Species at Risk Act, 2002. <http://laws.justice.gc.ca/en/S-15.3/text.html>

d - Endangered Species Act, 2007. [http://www.elaws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_07e06\\_e.htm](http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_07e06_e.htm)

e - Conservation Priorities for the Birds of Southern Ontario, Part 2, page A25

f - Ontario Partners in Flight (PIF). 2008. Ontario Landbird Conservation Plan: Lower Great Lakes/St. Lawrence Plain, North American Bird Conservation Region 13. Ontario Ministry of Natural Resources, Bird Studies Canada, Environment Canada. Draft Version 2.0. Table 3, page 23.

g - Ontario Shorebird Conservation Plan. Environment Canada, Canadian Wildlife Service. <http://www.on.ec.gc.ca/wildlife/plans/pdf/plans-shorebird-e.pdf>

h - North American Waterfowl Management Plan: Strengthening the Biological Function 2004 Strategic Guidance. <http://www.nawmp.ca/pdf/04update-en.pdf> Table, 2 pages 8-9.



## **4.0 DISCUSSION**

### **4.1 Direct Effects**

The main direct effect of wind power projects on birds is mortality due to collision with the wind turbines. Background information reviewed and field studies undertaken have suggested that, although the Avian Study Area is located within the Mississippi and Atlantic migratory flyways for birds, intensive agricultural practices during the twentieth century have reduced suitable staging and roosting habitat for many species. In addition, the majority of birds within the Avian Study Area flew below and above the rotor sweep (<30m, and >130m). Although a notable number of birds were observed flying within the rotor sweep (30-130m), the majority of these were limited to a few common species such as ring-billed gull. Of the 25 observations of the 3 Special Concern species observed only two were within the rotor sweep. Of the 58 observations of the 3 Threatened or Endangered species observed only eight were within the rotor sweep. With careful siting of turbines, the potential for direct avian mortality during operation of the Project is likely to be limited. This is further supported by several recent scientific studies on turbine related mortalities (e.g., Osborn *et al.*, 2000; Johnson *et al.*, 2003; Barrios and Rodríguez 2004; Echotrack 2005; Erickson et al 2001; Drewitt and Langston 2006).

### **4.2 Indirect Effects**

For most wind projects, the indirect effects arising from the loss, fragmentation, or disturbance of habitat during the construction, operation, and maintenance of the wind energy facility have a larger potential to negatively affect birds than the direct mortality discussed above. An effective tool in minimizing potential indirect effects, especially to wetlands and woodlands, is to avoid, wherever possible, construction of turbines and ancillary facilities in or across any remaining natural habitats.

Sensory disturbance (visual and auditory), as a result of site preparation and construction activities may result in, under exceptional circumstances, habitat alienation, displacement, or nest desertion. Studies in the Netherlands suggest that, landbird, and in particular woodland songbird, population densities begin to decline at an average noise level of 42 dB (Reijnen *et al.*, 1996). Forman and Hersperger (1996) further suggest that noise associated with traffic can affect bird populations by disrupting vocal communication required for mate selection, mate location, foraging communication, predator detection and avoidance and parent-nestling communication. However these disturbances are likely intermittent, and the local bird communities will have adapted to local traffic and farm equipment noise.

Species that are thought to be the most sensitive to disturbance, as a result of fragmentation, include area-sensitive species. Installation of wind turbines in existing agricultural lands is expected to have a limited effect on bird habitat, since we have assumed that no permanent natural vegetation (trees and grasses) will be removed in the Avian Study Area.



## **5.0 CONCLUSIONS AND RECOMMENDATIONS**

The Avian Study Area supports a relatively diverse community of birds that are typical of agricultural landscapes in south western Ontario including some Special Concern and Threatened species.

With careful siting of turbines, such as the avoidance of SAR and other species of conservation concern habitat, large woodlots, valley lands, and riparian areas, the potential for direct and indirect avian mortality during operation of the project can be reduced.

## **6.0 CLOSURE**

We trust that this report meets your current needs. If you have any questions, or if we may be of further assistance, please contact the undersigned.



## Report Signature Page

**GOLDER ASSOCIATES LTD.**

Handwritten signature of Derek Morningstar in black ink.

Derek Morningstar, B.Sc.  
Terrestrial Ecologist

Handwritten signature of Kevin Trimble in black ink.

Kevin Trimble, M.Sc.  
Principal, Senior Ecologist

DM/LO/FN/KT/am

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## AVIAN USE MONITORING REPORT - GOSHEN WIND ENERGY PROJECT

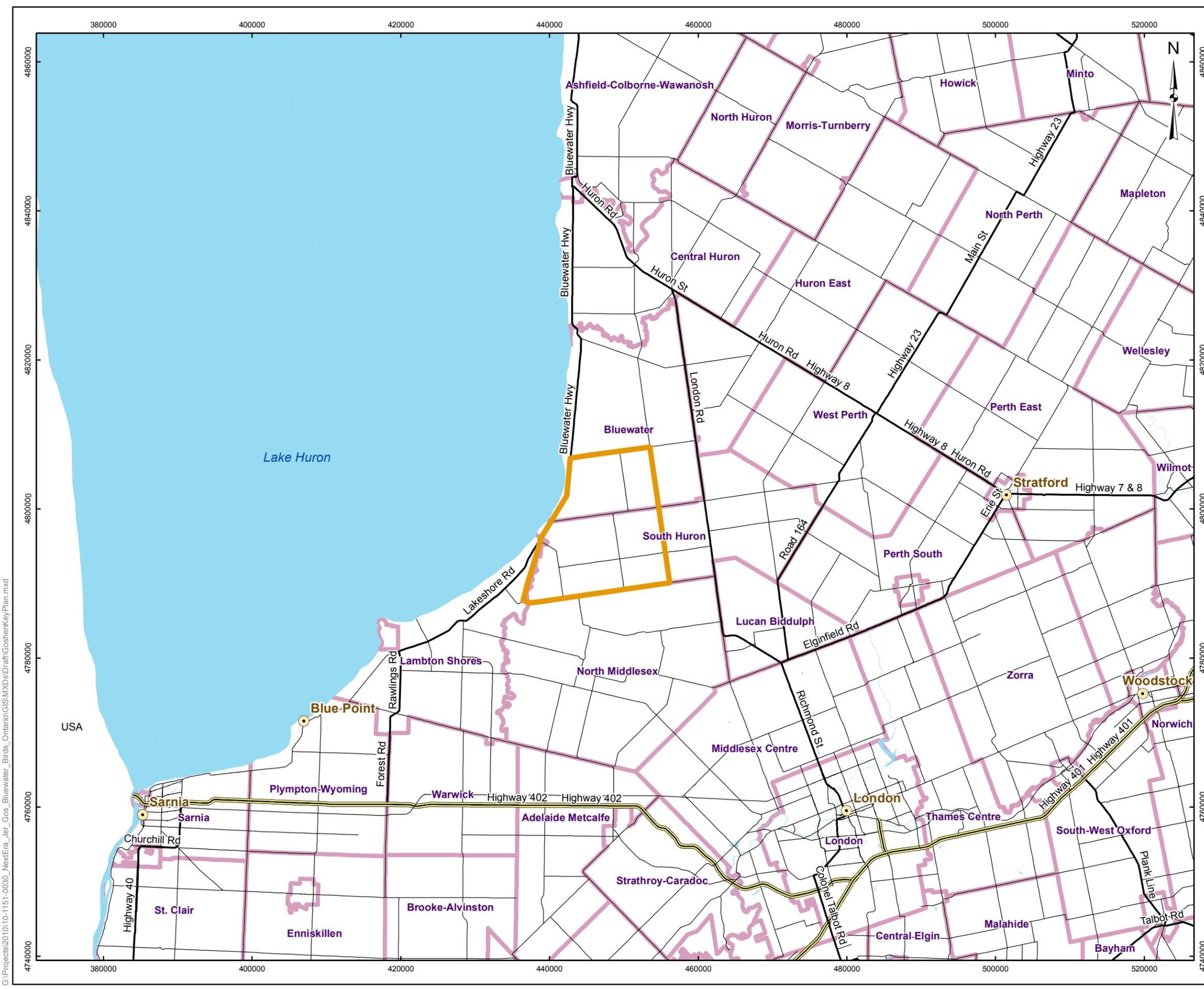
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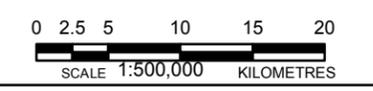
# FIGURES



- LEGEND**
- Community
  - Project Area
  - Expressway
  - Highway
  - Major Road
  - Municipality

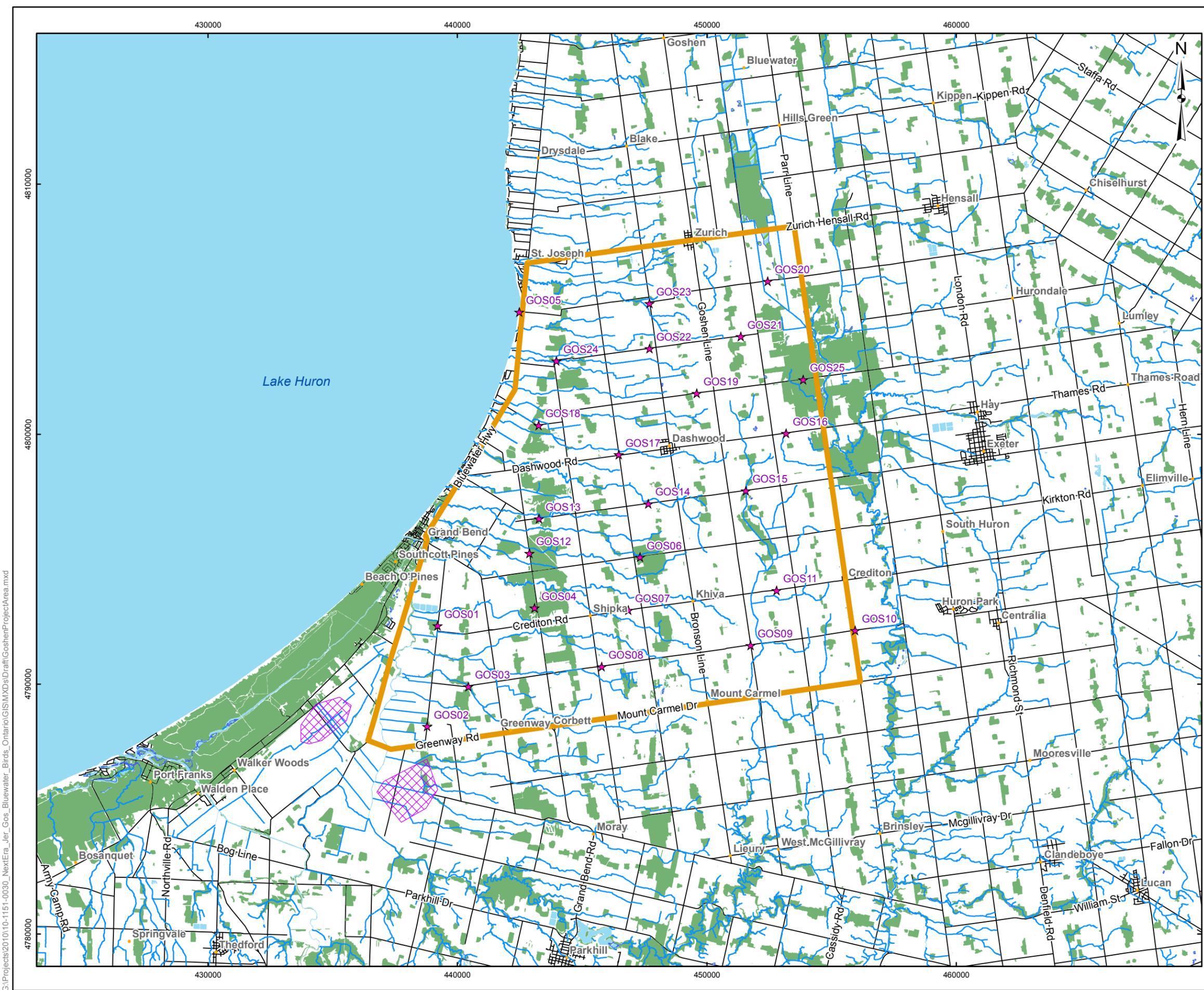
**REFERENCE** **DRAFT**

Base Data - MNR NRVIS, obtained 2004, CANMAP v2008.4  
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PROJECT			
<b>NEXTERA JERICO, GOSHEN AND BLUEWATER WIND FARMS AVIAN MONITORING</b>			
TITLE			
<b>GOSHEN KEY PLAN</b>			
PROJECT NO.	10-1151-0030	SCALE AS SHOWN	REV.
DESIGN	PP 19 Jan. 2010		
CHECK	PP 4 Jan. 2011		
REVIEW			
<b>Golder Associates</b> Mississauga, Ontario		<b>FIGURE: 1</b>	

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**LEGEND**

- ★ Bird Survey Location
- Community
- Watercourse
- Road
- ▭ Project Area
- ▨ Tundra Swan Flocks
- Wooded Area
- Waterbody
- ▨ Wetland



**DRAFT**

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PROJECT			
<b>NEXTERA JERICO, GOSHEN AND BLUEWATER WIND FARMS AVIAN MONITORING</b>			
TITLE			
<b>GOSHEN AVIAN MONITORING</b>			
 Golder Associates Mississauga, Ontario	PROJECT NO.	10-1151-0030	SCALE AS SHOWN
	DESIGN	PP 19 Jan. 2010	REV.
	CHECK	PP 4 Jan. 2011	
	REVIEW		
			<b>FIGURE: 2</b>

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