PHASE I AVIAN RISK ASSESSMENT

Clayton Wind Farm

Jefferson County, New York

Report Prepared for:

PPM-Atlantic Renewable Energy

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Executive Summary

This report details the results of a Phase I Avian Risk Assessment for the proposed Clayton Wind Farm (hereafter the "Project") in the towns of Clayton, Orleans, and Brownville in Jefferson County, New York. This assessment includes: 1) a site visit conducted on November 8 and 9, 2004, 2) a review of the literature and available databases, and 3) written consultations with the U.S. Fish and Wildlife Service (USFWS; pending) and New York State Department of Environmental Conservation (NYSDEC; pending). The site visit evaluated habitat in order to determine the type and number of birds likely to nest, forage, rest, or otherwise use the site. The literature and database review examined the avifauna most likely to be present at or surrounding the site and what is known about the impacts to birds at wind power facilities. The written consultations with wildlife agencies sought to clarify bird species of concern in the Project vicinity. Together, this information indicates the type and number of birds that are known or suspected to use the Project site. When incorporated into the risk assessment, this information helps determine the degree of risk to birds from the proposed wind power development.

Of moderate size, the Clayton Wind Farm is proposed by PPM-Atlantic Renewable Energy. The Project plan calls for about 70 wind turbines distributed over an area 8 miles (12.8 km) long and 4.5 miles (7.2 km) wide. Each of the wind turbines would have a nameplate generating capacity of 1.5 to 1.8 MW (megawatts), yielding a total nameplate generating capacity of between 100 and 125 MW. The towers of the wind turbines would be about 80 meters (262 feet) tall and have rotors of about 38.5 m (126 feet) long. With the rotor tip in the twelve o'clock position, the wind turbines would reach a maximum height of about 120 m (394 feet) above ground level (AGL). At the six o'clock position, the rotor tip would be 41.5 meters (136 feet) AGL.

The predominant land-use at the Project site is agricultural, including corn, hay, cover crops, freshly plowed areas, and pasture. There are also extensive areas of fallow, grassy fields, as well as extensive areas of shrubby thickets. About 10% of the site is composed of woodlots and forest fragments. With regard to wetlands, they make up a very small percentage of the habitat on site, consisting mainly of small ponds and willow thickets. Wind turbines would mainly be constructed in existing open areas, but some limited areas with trees could be affected by road and turbine construction. There is a significant number rural residences along a network of roads within the Project area.

Habitats in and around the Project site support typical bird communities, composed mainly of common species associated with grassland, brushy areas, woodland

edge, and woodland. Habitat appears suitable for nesting for a number of state-listed species, particularly those of grassland communities, including the threatened Northern Harrier, Upland Sandpiper, Sedge Wren, and Henslow's Sparrow, and special-concern Horned Lark, Vesper Sparrow, and Grasshopper Sparrow. Wooded areas on site also appear suitable for nesting for the following raptors that nest in forest and forest edge: Sharp-shinned Hawk (special concern), Cooper's Hawk (special concern), Red-tailed Hawk, and American Kestrel. The nesting suitability of on-site habitat is less likely for the threatened Bald Eagle, special-concern Osprey (which has nested in the adjacent Perch River Wildlife Management Area), and special-concern Goshawk. In addition, two species of special concern associated with wooded habitats may also breed within the Clayton Wind Farm area. These are the Whip-poor-will and Golden-winged Warbler.

Regarding waterbirds, the Project site itself contains little suitable nesting habitat. But, high quality waterbird habitat is located adjacent to the Project site in the Perch River Wildlife Management Area. A number of listed species occur there, including the endangered Black Tern, threatened Pied-billed Grebe and Least Bittern, special-concern American Bittern and Osprey, and about twelve species of waterfowl.

There are no known major hawk migration pathways or lookouts at or near the site. Songbirds and other species are likely to migrate over the Project site, although not in numbers, patterns, or altitudes that are significantly different from most other areas in central New York. The site itself is unlikely to be a significant wintering site for birds, but significant wintering of waterfowl has been recorded along the nearby St. Lawrence River, and significant wintering of raptors has been recorded at nearby Point Peninsula, along the shore of Lake Onatrio. Wintering raptors – mostly Red-tailed Hawk, Rough-legged Hawk, Northern Harrier, Short-eared Owl, and American Kestrel – will likely be present at the Project site in winter in small to moderate numbers. It is conceivable that the Project site will attract significant numbers of migrating waterfowl, mainly geese, to feed in its agricultural lands during migratory stopover at the Perch River Wildlife Management Area.

The avian risk assessment makes the following recommendations:

- Electrical lines within the project site should be underground between the turbines, and any new above ground lines from the site and substations to transmission lines should follow Avian Power Line Interaction Committee (APLIC) guidelines for insulation and spacing.

- Permanent meteorology towers should be free-standing (i.e., without guy wires) to prevent the potential for avian collisions.

- Size of roads and turbine pads should be minimal to disturb as little habitat as possible. After construction, any natural habitat should be permitted or encouraged to regenerate as close to the turbines and roads as possible to minimize habitat fragmentation and disturbance/displacement impacts.

- Lighting of turbines and other infrastructure (turbines, substations, buildings) should be minimal to reduce the potential for attraction of night migrating songbirds and similar species. Federal Aviation Administration (FAA) lighting for night use should be flashing lights (red or white) with the longest permissible off cycle. No steady burning FAA lights should be used. Sodium vapor lamps and spotlights should not be used at any facility at night except when emergency maintenance is needed.

- A post-construction study of collision fatalities would be helpful to guide future wind power development in New York State. Such a study would provide information on the number and type of fatalities that occur, and determine the biological significance and potential cumulative impact of turbine development in New York and in the eastern United States.

- Because the habitat on site appears to be suitable for New York State listed species and species of concern, a nesting bird survey should be undertaken to determine the distribution and densities of these species, particularly grassland birds. The threatened Northern Harrier, Upland Sandpiper, Sedge Wren, and Henslow's Sparrow, and the special-concern Horned Lark, Vesper Sparrow, and Grasshopper Sparrow are likely present in grassland habitats that would be occupied by wind turbines and related infrastructure. The special-concern Sharp-shinned Hawk, Cooper's Hawk, Whip-poor-will, Golden-winged Warbler, and possibly other listed species may occur in wooded habitats where turbines and related infrastructure may be located. Such a survey would include mapping areas where these birds nest in relation to planned turbine and road locations. The results of this survey may be used to prevent or mitigate disturbance impacts and displacement of these species. Should a nesting survey be conducted, its design should involve consultation with NYSDEC biologists prior to implementation.

- Raptor and waterfowl use of the Project site, particularly during migration (but also in late fall and winter in the case of raptors, given the high concentration of wintering raptors reported at nearby Point Peninsula), should be determined through a flight-use study. Should such a survey be conducted, its design should involve consultation with NYSDEC biologists prior to implementation.

- Radar studies should be conducted at the site in order to determine flight patterns of night migrants (direction, altitude, and numbers of birds) passing over the wind farm site. Should such a survey be conducted, its design should involve consultation with NYSDEC biologists prior to implementation.

- The future of the grassland and brushland bird communities at the Clayton site depends on the long-term management of their habitats, which farmers are presently accomplishing through their agricultural practices. While wind energy development may displace grassland birds from the areas around where the turbines are located, it would limit other types of development that could more severely impact grassland habitat and its birds. Wind energy development can also provide incentives and funding that maintain grassland habitats. These options should be explored.

With respect to grassland nesting songbirds and perhaps some raptors, some species will likely be displaced to varying degrees from current nesting areas. The degree of this displacement cannot be predicted, nor is it known if these birds will eventually habituate to the turbines, because detailed studies have not yet been conducted in similar habitat in New York State. The level of impact to these birds could be significant at the local level, but it is highly unlikely to be significant at the regional or global level. As a result, the Project will not threaten or jeopardize the overall populations and stability of these species.

Collision risk to birds at the Clayton Wind Farm is likely to be minimal. From what was learned from the site visit and literature search, as well as a documented lack of significant avian fatalities at modern wind power facilities, there is no indication that the Clayton Wind Farm will result in biologically significant collision impacts to birds.

Based on other wind power projects in New York State, it is likely that USFWS and NYSDEC will request pre and post-construction studies in order to minimize and mitigate potential impacts from the proposed project and to help guide future wind power development in New York State.

Table of Contents

Figures

Tables

Appendices

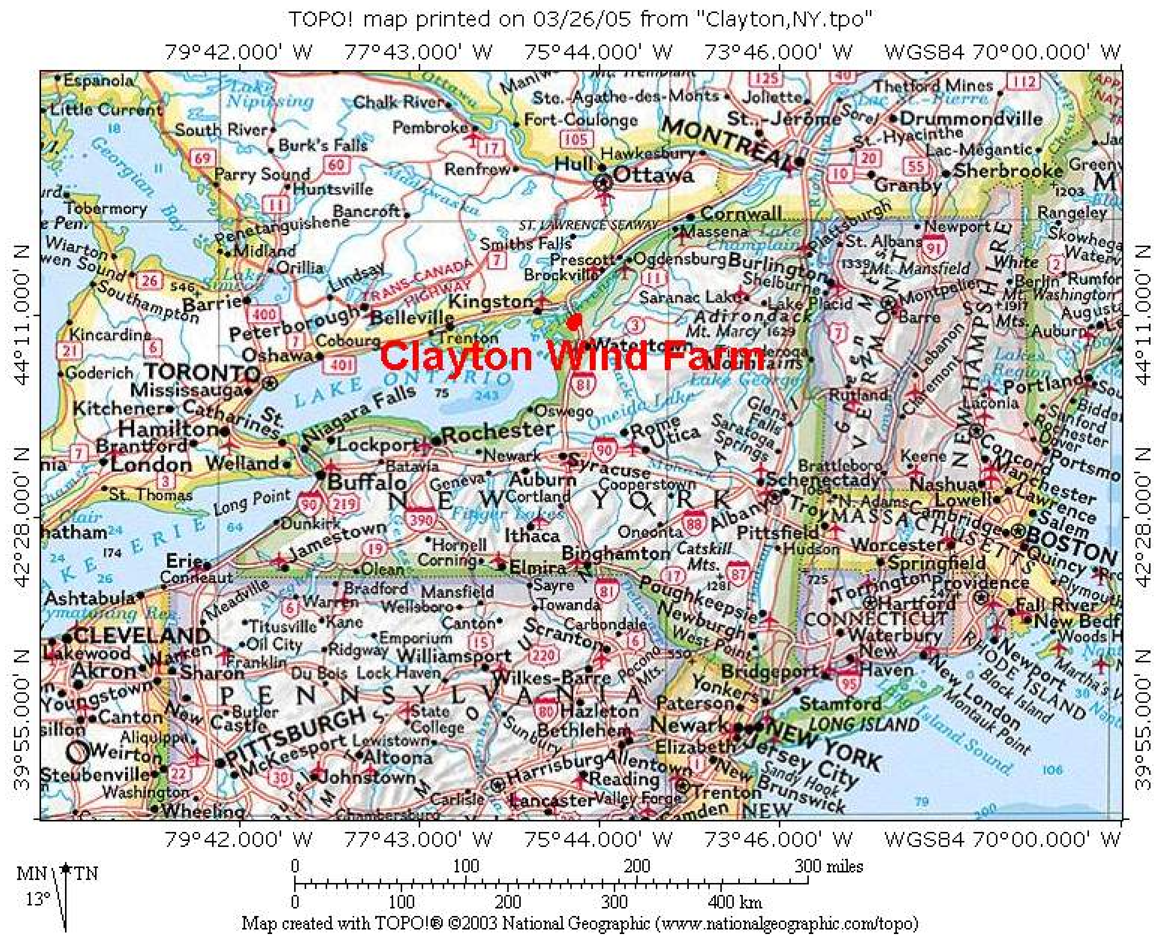

Figure 1. Location of the Proposed Clayton Wind Farm in New York State

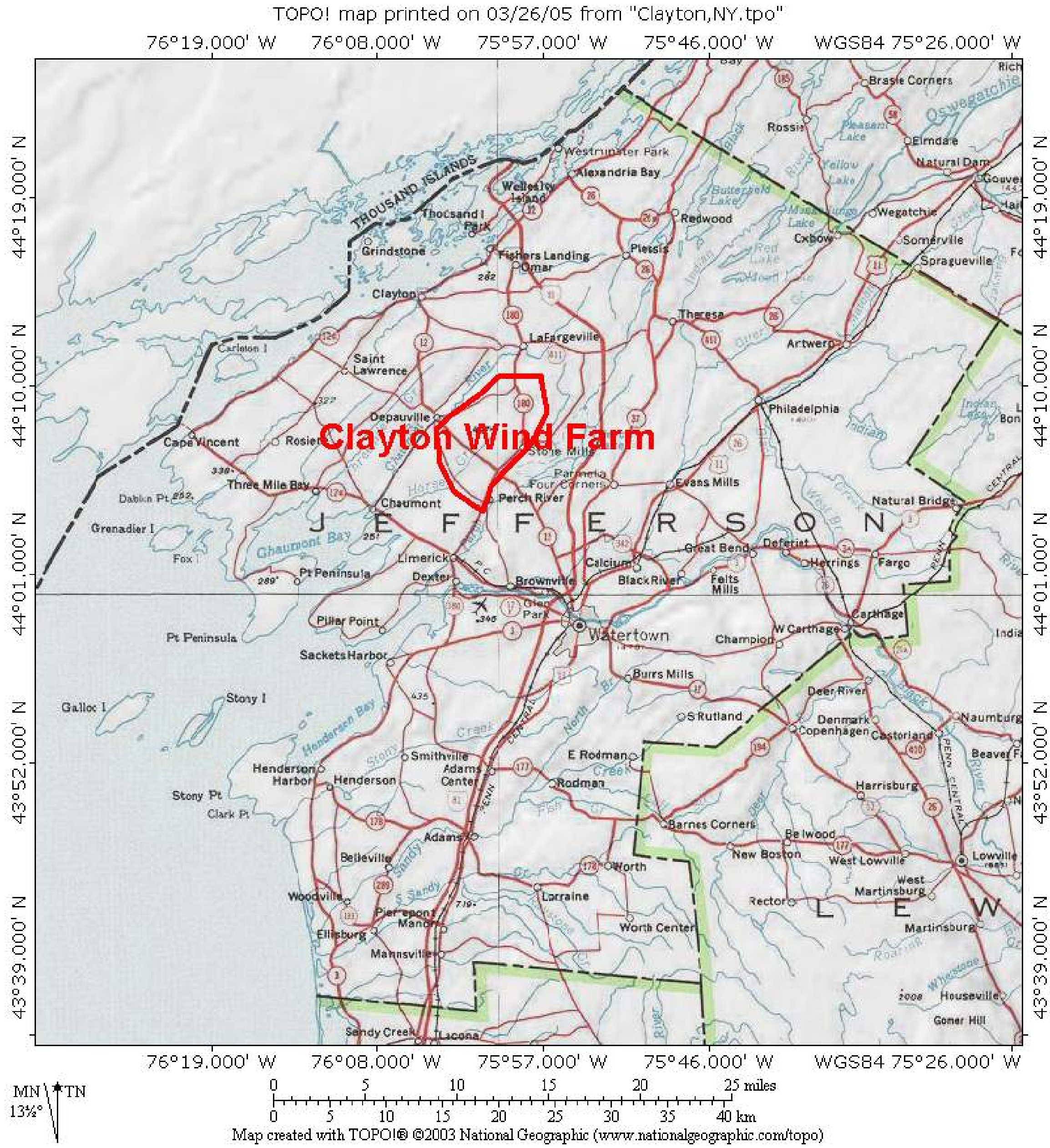

Figure 2. Location of the Proposed Clayton Wind Farm in Jefferson County, New York

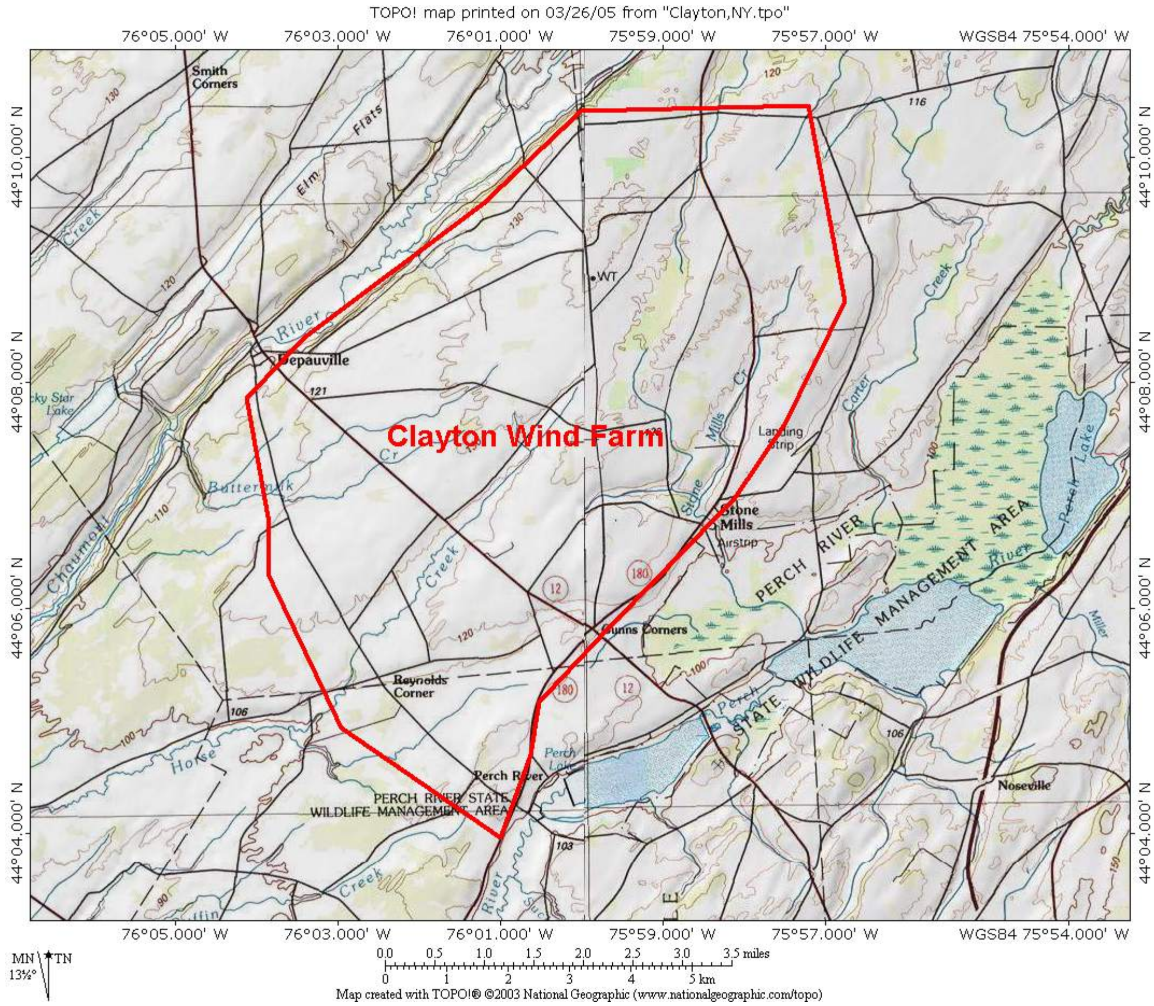

Figure 3. Topography, Forest Cover, and Location of Adjacent State Wildlife Management Area at the Proposed Clayton Wind Farm (boundary approximate)

1.0 Introduction

Wind power is considered to be one of the most environmentally benign sources of electrical power, but impacts to birds have been documented at projects in the United States and Europe. These impacts have included collisions with turbine rotors and meteorology towers and the disturbance and displacement of nesting and feeding birds resulting from construction activities and new infrastructure. Potential bird impacts have become an issue that numerous stakeholders – including wildlife agencies, local government officials, and the public – question in the siting of new wind power projects.

A moderately sized wind power plant (about 70 turbines) has been proposed for a site in the towns of Clayton, Orleans, and Brownville in Jefferson County, New York (see Figures 1, 2, and 3). The project has been named the Clayton Wind Farm (hereafter referred to as the "Project"). This report details a Phase I avian risk assessment conducted for this Project.

The purpose of a Phase I risk assessment is to determine the potential for risk to birds at a proposed project site. Thus, the Phase I risk assessment is designed to guide developers, regulators, environmentalists, and other stakeholders through the risk assessment process at a particular site, including how evaluation of potential impacts may require further study. This assessment includes: 1) a site visit, 2) a literature and database search, and 3) written consultations with wildlife agencies regarding endangered and threatened species. In addition, this report addresses compliance issues and recommendations now being made by the U.S. Fish and Wildlife Service (USFWS) in its document, *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines* (USFWS 2003; please see Appendix E).

A site visit is undertaken by an avian technician with experience in bird identification and in evaluating avian habitat with respect to what species are likely to be present. The site and surrounding area is toured by automobile and walked. The purpose of the site visit is to evaluate habitat and topographic features so that a list of species that might be present can be assembled and the potential for risk to those birds assessed. The site visit is not meant to be an exhaustive inventory of species presence and use.

Avian literature and databases examined include USFWS records (pending), New York Natural Heritage Program (NYNHP; pending), New York State Breeding Bird Atlas (BBA, both the 1980-1984 and 2000-2004 projects), North American Breeding Bird Surveys (BBS), Important Bird Areas (IBA), Audubon Christmas Bird Counts, hawk migration literature and newsletters (e.g., Hawk Migration Association of North America), and other information on birds that might nest, migrate, forage, winter, or concentrate at the site. An additional part of the literature search focuses on what is known about wind turbine impacts to birds.

Consultations are done with wildlife agency biologists, including USFWS and New York State Department of Environmental Conservation (NYSDEC), via a letter requesting information on listed species at or near the Project site. The letters are an effort to determine more about the avifauna at a site and potential risk to birds that are likely to be present. Such consultations are a means of determining the scope of work that may be needed to further assess risk after the Phase I assessment has been completed.

The information developed from the site visit, literature searches, databases, and consultations with wildlife agencies is then integrated into a report, such as this one. The report summarizes habitat and birds likely to be present at a site, potential risk of wind turbine construction at the site, a comparison the project site with other sites where risk has been determined, where detailed studies have not yet been conducted), and recommendations for further studies and mitigation, if indicated.

2.0 Project and Site Description

2.1 Project Description

Located 4.5 miles (7.2 km) northeast from Chaumont Bay on Lake Ontario, 7.5 miles (12.0 km) southeast of the St. Lawrence River, and 8.5 miles (13.6 km) northwest of the city of Watertown (see Figures 1 and 2), the proposed Clayton Wind Farm would consist of about 70 wind turbine generators, each with a nameplate capacity of about 1.5 to 1.8 megawatts. Together, they would produce a total of between 100 and 125 MW (megawatts) of generating capacity. The elevation of the wind farm would range from about 400 to 450 feet (120-140 m) above sea level. The Project site measures about 8 miles (12.8 km) long and 4.5 miles (7.2 km) wide and has an area of approximately 36 square miles (23,000 acres). The center of the Project is located about 3 miles (4.8 km) east of the town of Depauville (see Figure 3).

Tower heights would likely be about 80 meters (262 feet) with rotor lengths of up to 38.5 m (126 feet). Maximum height of the rotor tip when the rotor is in the twelve o'clock position would be up to about 120 m (394 feet) above ground level (AGL). In the six o'clock position, the rotor tip would be 41.5 m (136 feet) AGL. Turbines would mounted on steel tubular towers and all or a subset of them would be lit according to Federal Aviation Administration (FAA) guidelines. As with most new wind farms, FAA lighting would probably be red strobes (L-864) on the nacelle at about 82 m (269 foot) above the ground. Most electrical collection lines within the Project area would be underground. An electric substation for the purpose of connecting the Project to the electric power grid would be constructed somewhere on the Project site. The connection between the substation and existing transmission lines could be above ground.

2.2 Site Description

Information regarding the site's topography, physiography, and habitat was first gathered from a 1:24,000 USGS topographic map. This information was subsequently checked during a site visit conducted in early-mid November, 2004. In addition, several studies (Andrle and Carroll 1988, Levine 1998, and Wells 1998) were examined to determine the type of habitat known to be present in the general vicinity of the proposed

Project. This research allowed a determination of the bird communities and species that are likely to be present.

The Clayton Wind Farm and adjoining portions of Jefferson County are situated in the Eastern Ontario Plains ecozone. According to Anderle and Carroll (1988), the Eastern Ontario Plains are a nearly level region that ranges in elevation from 250 to 500 feet (76-152 m). The region enjoys a climate moderated by Lake Ontario and productive soils derived from lake sediments over limestone bedrock. Agriculture and dairying are the region's principal economic mainstays. As a result, forest cover is greatly reduced. The dominant forest type is elm-red maple and northern hardwoods.

There are no large bodies of water (lakes or rivers) on the Project site itself, but the Chaumont River runs just to the northwest of the site and the Perch Rivers flows just to the south. Both rivers empty into nearby Lake Ontario. The Perch River has been dammed in three sections just southeast of the Project site. These dams have created lakes and marshes that are managed within the Perch River Wildlife Management Area (WMA).

Based on topographic maps, the Project site appears to be mostly open agricultural land, with dispersed woodlots and fragmented forest covering about 10% of the landscape (see photographs in Appendix A). A small swamp appears in the north-central portion of the proposed wind farm.

The Project site is bounded and crossed by a number of paved and dirt roads. Along these roads are a significant number of houses and farms. There are also existing transmission and distribution lines within the Project boundary. In general, the lands where the turbines would be located have been highly disturbed by farming practices.

3.0 Results of Site Visit

The proposed Clayton Wind Farm site was visited on November 8 and 9, 2004. All areas accessible by road were toured by automobile and some areas were walked. The weather on those days was mostly fair and did not impede the observation of habitats and birds. It was windy during the observations, and a few snow squalls obscured the field biologist's vision for five to ten minutes at a time. There was some snow on the ground during the site visit. The areas where turbines would be located are relatively open and gently rolling terrain, permitting a visual evaluation of most of the Project site. During the visit, an effort was made to observe the bird life and habitat on and adjacent to the site, thereby allowing a determination of what birds or ornithological phenomena might be present on site or nearby.

The site visit confirmed that the predominant land-use at the Project site is agricultural, including corn, hay, cover crops, freshly plowed areas, and pasture (see photographs in Appendix A). Extensive areas of fallow, grassy fields were also noted, as well as extensive areas of shrubby thickets. The following tree species were noted in the wooded areas: sugar maple, quaking aspen, gray birch, red maple, white ash, black cherry, apple, and American elm, with some White Pine mixed into most woodlots. Also noted were dense planted stands of red spruce. Red cedar was also present. Wetlands made up a very small percentage of the habitat on site, consisting mainly of small ponds and willow thickets.

A total of 45 bird species were observed during the site visit (see Appendix B). These were mostly common, year-round resident, wintering, and late migratory species. Six NYSDEC-listed species were noted, however. These included two threatened species – the Northern Harrier and Golden Eagle – and four species of special concern – Sharp-shinned hawk, Cooper's Hawk, Northern Goshawk, and Horned Lark.

4.0 Avian Overview of the Clayton Wind Farm Site

Based on the site visit, literature review, and agency consultations, the avifauna in and around the vicinity of the Clayton Wind Farm can be characterized as follows:

4.1 Nesting Birds

Table 4.1-1 summarizes the NYSDEC and USFWS lists of endangered and threatened species, as well as of species of special concern. Given their special status, these species have been given particular attention in assessing avian risk at the Project site. Based on the site visit and other data sources, Table 4.1-1 also grades the suitability of habitat for nesting on the Project site as suitable, marginally suitable, or not suitable.

Based on the visual evaluation of habitat on the Project site afforded by the site visit, available habitat appeared to be suitable for nesting for four species listed by NYSDEC as threatened. These were Northern Harrier, Upland Sandpiper, Sedge Wren, and Henslow's Sparrow. The combination of many large fallow fields, pastures, and hay fields could support the breeding of these four species. On-site habitat could also be suitable for two state-listed endangered species – the Short-eared Owl and Loggerhead Shrike. In the 1980-1985 BBA project, western Jefferson County was one of the few areas that retained these species as breeders. But, while BBA surveys from 2000 to 2004 show the Short-eared Owl hanging on as a breeder in Jefferson County, the shrike appears to have completely disappeared.

The habitats in and around the Project site were also judged to be potentially suitable for nesting for a number of species of special concern. The site's wooded areas and forest edges could conceivably support nesting Sharp-shinned Hawks, Cooper's Hawks, Northern Goshawks, Red-shouldered Hawks, and Whip-poor-wills. The grassland habitats appeared to be suitable nesting habitat for Horned Larks, Vesper Sparrows, and Grasshopper Sparrows. In addition, early successional habitats with grassy patches, thick brush, and small trees could conceivably host nesting Golden-winged Warblers

Table 4.1-1. Listed Species

Species	NYS Status[1]	Federal Status[1]	Nearby BBA Record?[2]	Nearby BBS Record?[3]	Habitat Suitability at Site[4]
Endangered/Threatened					
Pied-billed Grebe	T		Yes	Yes	NS
Least Bittern	T		Yes		NS
Bald Eagle	T	T	Yes		MS?
Northern Harrier	T		Yes	Yes	S
Golden Eagle	T				NS
Peregrine Falcon	E				NS
Spruce Grouse	E				NS
King Rail	T				NS
Black Rail	E				NS
Upland Sandpiper	T		Yes	Yes	S
Piping Plover	E	T			NS
Common Tern	T			Yes	NS
Roseate Tern	E	E			NS
Black Tern	E		Yes		NS
Least Tern	T				NS
Short-eared Owl	E				S?
Loggerhead Shrike	E				S?
Sedge Wren	T		Yes	Yes	S
Henslow's Sparrow	T		Yes		S
Of Special Concern					
Common Loon	SC			Yes	NS
American Bittern	SC		Yes	Yes	NS
Osprey	SC		Yes	Yes	MS?
Sharp-shinned Hawk	SC		Yes	Yes	S?
Cooper's Hawk	SC		Yes		S?
Northern Goshawk	SC		Yes		MS?
Red-shouldered Hawk	SC				S?
Black Skimmer	SC				NS
Common Nighthawk	SC				NS
Whip-poor-will	SC		Yes		S
Red-headed Woodpecker	SC				NS
Horned Lark	SC		Yes	Yes	S
Bicknell's Thrush	SC				NS
Golden-winged Warbler	SC		Yes	Yes	S
Cerulean Warbler	SC			Yes	MS?
Yellow-breasted Chat	SC				NS
Vesper Sparrow	SC		Yes	Yes	S
Grasshopper Sparrow	SC		Yes	Yes	S
Seaside Sparrow	SC				NS

[1] E = Endangered, T = Threatened, and SC = Special Concern.

[2] BBA = Breeding Bird Atlas. Please see Table 4.1-2 for details.

[3] BBS = Breeding Bird Survey. Please see Table 4.1-3 for details.

[4] S = Suitable, MS = Marginally Suitable, NS = Not Suitable, and ? = uncertainty in evaluation.

Letters to USFWS and the NYS Natural Heritage Program (a division of NYSDEC) have been sent, but responses had not been received as of April 18, 2005. Based on past agency consultations related to wind power projects in New York State, the extensive information and data sources checked for this report are likely to cover many wildlife agency concerns, although not all of them.

Two other data sources were examined to determine the potential presence of listed species, species of special concern, and other nesting birds in and around the Clayton Wind Farm site. The most important of these sources was the New York State Breeding Bird Atlas (BBA; specifically the 2000-2004 Atlas project), because its coverage includes the Project site. Of secondary importance were the nearby Breeding Bird Surveys (BBS) of the U.S. Geological Survey (USGS), which do not overlap the Project site but do survey similar habitats in the Project region. Detection of any listed species, species of special concern, or suitable habitat for these species in either of these information sources signaled that these species might be found on or near the proposed wind power site.

4.1.1 Breeding Bird Atlas (BBA) Analysis

The Breeding Bird Atlas (BBA) is a comprehensive, statewide survey that reveals the current distribution of breeding birds in New York State. New York's first BBA was conducted in 1980-1985 and reported in the 1998 publication, *The Atlas of Breeding Birds in New York State* edited by Robert F. Anderle and Janet R. Carroll. In 2000-2004, this effort was repeated in order to determine what changes have occurred in breeding bird distribution. The results of the recent survey are available on the Internet (see http://www.dec.state.ny.us/apps/bba/results/).

The BBA project divided the entire state into ten regions (the Project site is in Region 6) and 5,335 blocks, each of which measured 5 x 5 km (3 x 3 miles). Each block was designated as A, B, C, or D, with A blocks in general given the most importance, in the event volunteers did not have enough time to survey all of the blocks. Blocks were assigned to volunteer birdwatchers who, with detailed topographic maps, visited the various habitats within their assigned blocks in order to record evidence of breeding for the birds they saw. Evidence of breeding was graded as *Possible* (i.e., a species is simply observed in possible nesting habitat), *Probable* (i.e., a species exhibits certain behaviors that indicate breeding, such as territoriality, courtship and display, or nest building), or *Confirmed* (i.e., a species is observed nesting or engaged in behaviors associated with nesting, such as distraction display, carrying a fecal sac, carrying food for young, etc.).

The nine blocks that covered the Clayton Wind Farm site were surveyed during the 2000-2004 Atlas Project (see Table 4.1-2). It is important to note, however, that these blocks cover areas both inside and outside the proposed wind farm development. The species totals for the blocks ranged from 100 to 47 species, with 132 species recorded cumulatively (see Appendix C for a complete list). Of this number, 83 species (63%) were confirmed as breeders, 30 (23%) were recorded as probable breeders, and 19 (14%) were listed as possible breeders.

4.1-2. Breeding Bird Atlas (BBA) Records

Block Number	Wind Farm Section	Total Species	Listed Species[1]	Breeding Status	Notes
4189C	North	58	Northern Harrier (T)	Confirmed	Adult(s) with food for young
			Upland Sandpiper (T)	Probable	Bird (or pair) apparently holding territory
			Horned Lark (SC)	Probable	Bird (or pair) apparently holding territory
			Vesper Sparrow (SC)	Probable	Bird (or pair) apparently holding territory
			Grasshopper Sparrow (SC)	Probable	Bird (or pair) apparently holding territory
4189D	North	47	Upland Sandpiper (T)	Possible	Recorded in possible nesting habitat
			Horned Lark (SC)	Possible	Recorded in possible nesting habitat
			Henslow's Sparrow (T)	Probable	Courtship, display, or agitated behavior noted
4088B	Center	93	American Bittern (SC)	Possible	Recorded in possible nesting habitat
			Bald Eagle (T)	Possible	Recorded in possible nesting habitat
			Northern Harrier (T)	Confirmed	Adult(s) with food for young
			Sharp-shinned Hawk (SC)	Possible	Recorded in possible nesting habitat
			Cooper's Hawk (SC)	Probable	Pair observed in suitable nesting habitat
			Upland Sandpiper (T)	Probable	Pair observed in suitable nesting habitat
			Whip-poor-will (SC)	Probable	Singing male at same place on more than one date
			Horned Lark (SC)	Probable	Singing male at same place on more than one date
			Golden-winged Warbler (SC)	Possible	Recorded in possible nesting habitat
4188A	Center	82	Northern Harrier (T)	Probable	Bird (or pair) apparently holding territory
			Upland Sandpiper (T)	Probable	Pair observed in suitable nesting habitat
			Horned Lark (SC)	Possible	Recorded in possible nesting habitat
			Grasshopper Sparrow (SC)	Probable	Singing male at same place on more than one date
			Henslow's Sparrow (T)	Probable	Bird (or pair) apparently holding territory
4188B	Center	59	Northern Harrier (T)	Probable	Pair observed in suitable nesting habitat
			Upland Sandpiper (T)	Possible	Recorded in possible nesting habitat
			Horned Lark (SC)	Probable	Bird (or pair) apparently holding territory
			Vesper Sparrow (SC)	Probable	Bird (or pair) apparently holding territory
			Grasshopper Sparrow (SC)	Probable	Bird (or pair) apparently holding territory
			Henslow's Sparrow (T)	Probable	Bird (or pair) apparently holding territory

4088D	South	100	Northern Harrier (T)	Confirmed	Recently fledged young observed
			Sharp-shinned Hawk (SC)	Confirmed	Recently fledged young observed
			Northern Goshawk (SC)	Confirmed	Recently fledged young observed
			Upland Sandpiper (T)	Probable	Pair observed in suitable nesting habitat
			Whip-poor-will (SC)	Confirmed	Recently fledged young observed
			Horned Lark (SC)	Possible	Recorded in possible nesting habitat
			Golden-winged Warbler (SC)	Probable	Singing male at same place on more than one date
			Grasshopper Sparrow (SC)	Probable	Singing male at same place on more than one date
			Henslow's Sparrow (T)	Possible	Recorded in possible nesting habitat
4188C	South	75	Pied-billed Grebe (T)	Confirmed	Adult(s) with food for young
			American Bittern (SC)	Possible	Recorded in possible nesting habitat
			Northern Harrier (T)	Possible	Recorded in possible nesting habitat
			Sharp-shinned Hawk (SC)	Possible	Recorded in possible nesting habitat
			Upland Sandpiper (T)	Probable	Pair observed in suitable nesting habitat
			Horned Lark (SC)	Probable	Bird (or pair) apparently holding territory
			Vesper Sparrow (SC)	Probable	Bird (or pair) apparently holding territory
			Grasshopper Sparrow (SC)	Probable	Bird (or pair) apparently holding territory
			Henslow's Sparrow (T)	Probable	Bird (or pair) apparently holding territory
4188D	South	91	Pied-billed Grebe (T)	Confirmed	Nest with young recorded
			American Bittern (SC)	Probable	Courtship, display, or agitated behavior noted
			Least Bittern (T)	Possible	Recorded in possible nesting habitat
			Osprey (SC)	Confirmed	Nest with eggs recorded
			Northern Harrier (T)	Confirmed	Adult(s) with food for young
			Sharp-shinned Hawk (SC)	Probable	Pair observed in suitable nesting habitat
			Upland Sandpiper (T)	Probable	Bird (or pair) apparently holding territory
			Black Tern (E)	Confirmed	Nest with young recorded
			Horned Lark (SC)	Probable	Bird (or pair) apparently holding territory
			Sedge Wren (T)	Probable	Bird (or pair) apparently holding territory
			Vesper Sparrow (SC)	Probable	Pair observed in suitable nesting habitat
			Grasshopper Sparrow (SC)	Probable	Bird (or pair) apparently holding territory
			Henslow's Sparrow (T)	Probable	Bird (or pair) apparently holding territory

4187A	South	90	Northern Harrier (T)	Probable	Pair observed in suitable nesting habitat
			Sharp-shinned Hawk (SC)	Possible	Recorded in possible nesting habitat
			Cooper's Hawk (SC)	Probable	Pair observed in suitable nesting habitat
			Upland Sandpiper (T)	Probable	Pair observed in suitable nesting habitat
			Whip-poor-will (SC)	Confirmed	Nest with eggs recorded
			Horned Lark (SC)	Probable	Singing male at same place on more than one date
			Grasshopper Sparrow (SC)	Probable	Singing male at same place on more than one date
			Henslow's Sparrow (T)	Possible	Recorded in possible nesting habitat

[1] E = Endangered, T = Threatened, and SC = Special Concern.

Most of the species recorded in the 2000-2004 BBA were common nesting species for this region of New York State. However, a large number of state listed species were present on the BBA surveys. Eight threatened or endangered species and ten species of special concern were recorded near the Project site (see Tables 4.1-1 and 4.1-2 and the discussion below).

Waterbirds were very well represented in the BBA survey, mainly because of the high quality aquatic habitat contained in the Perch River Wildlife Management Area (WMA). The Project site and this wildlife management area coincide in Block 4188D. In Table 4.1-2, the listed species recorded in that block included Pied-billed Grebe (threatened), American Bittern (special concern), Least Bittern (threatened), Osprey (special concern), and Black Tern (endangered). The grebe, Osprey, and Black Tern were even confirmed as breeders. Nevertheless, as noted above, waterbird habitat is not well represented on the Project site itself, as can be seen in the records of listed species in blocks 4188A and 4188B, which cover the heart of the proposed wind farm area (see Table 4.1-2).

Six raptors were confirmed as breeders in the BBA blocks that covered portions of the Project site. They were Osprey (special concern), Northern Harrier (threatened), Sharp-shinned Hawk (special concern), Northern Goshawk (special concern), Red-tailed Hawk, and American Kestrel. The Osprey was only recorded in the block that covered a section of the Perch River WMA and is unlikely to nest on the Project site itself. In addition, a Bald Eagle (U. S. threatened) was observed in one block during the survey, making the list of possible breeders, and a pair of Cooper's Hawks (special concern) was observed in suitable nesting habitat most likely south of the Project site. The unlisted Turkey Vulture was recorded as a probable breeder.

A wide variety of songbirds were recorded, including many of the species one would expect in forest, forest-interior, forest-edge, woodland, old field, grassland, and wetland habitats. Many were confirmed as breeders, including Whip-poor-will (special concern). An impressive community of grassland nesting birds was recorded, including probable nesting by Upland Sandpiper (threatened), Horned Lark (special concern), Sedge Wren (threatened), Vesper Sparrow (special concern), Grasshopper Sparrow (special concern), and Henslow's Sparrow (threatened), and confirmed nesting by Savannah Sparrow, Bobolink, and Eastern Meadowlark.

Regarding listed species (see Table 4.1-2), many were widely recorded. For example, Northern Harrier (threatened) was recorded in 8 of the 9 blocks that covered portions of the Project site, including confirmed breeding in four of the blocks. Upland Sandpiper (threatened) and Horned Lark (special concern) were recorded in all nine blocks, mostly as probable breeders. Henslow's Sparrow (threatened) was recorded in 7 of 9 blocks, again mostly as a probable breeder. The large fallow fields and adjacent pastures and hay fields provide almost ideal nesting conditions for many of these species.

Other listed species were less often recorded. Sharp-shinned Hawk (special concern) was recorded in five blocks, including as a confirmed breeder in one. Sharp-shinned Hawks are forest nesting birds and are found frequently in spruce forests like those present within the Project area. Whip-poor-will (special concern) was recorded in three blocks, including one confirmed breeding. Golden-winged Warbler (special concern) was recorded in two blocks, in one as a probable breeder. These declining birds prefer edge and second growth habitats with some brush. Sedge Wren (threatened), a grassland or wet meadow nesting species, was recorded as in one block as a probable breeder. Vesper Sparrow (special concern) and Grasshopper Sparrow (special concern) are two other grassland nesting birds that were documented as probable breeders in more than one block.

The endangered Short-eared Owl and Loggerhead Shrike, both grassland-type habitat nesters, were not recorded in any block that covered a portion of the Project site. In the 1980-1985 BBA Project, both species were recorded sparingly in nearby sections of Jefferson County. At that time, the highest breeding status assigned to the Short-eared Owl in Jefferson County was probable. The shrike was confirmed as a breeding species.

In examining the 2000-2004 BBA results for these two declining species, it was noted that Short-eared Owl was recorded in twenty BBA blocks throughout New York State (down from 36 in 1980-1985), including five in Jefferson County, where it was confirmed breeding at Point Peninsula, 8 miles (12.8 km) southwest of the Project site, and in or in the vicinity of the Fort Drum Military Reservation, about 16 miles (26 km) to the east. Loggerhead Shrike, however, was not recorded at all in Jefferson County. There were four records in 1980-1985 out of a total of 24 statewide records. In 2000-2004, the shrike was recorded in only six Atlas blocks statewide (in all cases as a possible breeder, the lowest status). The closest Atlas block to the Project site was in southwest St. Lawrence County, about 35 miles (56 km) east, in the foothills of the Adirondacks. In light of this information, both species could conceivably turn up as breeders at the Project site, with the owl more likely than the shrike.

In summary, the BBA data indicate that the Project site and surrounding area have a significantly diverse breeding bird community, with a high representation of state-listed species. A large number of these species are grassland nesting species and nest (or forage) in fallow fields, meadows, pastures, and hay and alfalfa fields. Eighteen of the 38 NYSDEC-listed species were recorded in the 2000-2004 BBA, nearly half of the state list. While waterbirds are not well represented on the Project site itself, they are well represented on adjacent lands, particularly the Perch River WMA to the southeast. These include the endangered Black Tern, threatened Pied-billed Grebe and Least Bittern, and special-concern American Bittern and Osprey.

The breeding birds of the Project site are mainly those of open and wooded upland habitats, including a noteworthy grassland bird community, which includes the threatened Northern Harrier, Upland Sandpiper, Sedge Wren, and Henslow's Sparrow and special-concern Horned Lark, Vesper Sparrow, and Grasshopper Sparrow. Among the birds that breed in association with wooded habitats, the following special-concern species may well nest on the Project site: Sharp-shinned Hawk, Cooper's Hawk, Northern Goshawk, Whip-poor-will, and Golden-winged Warbler.

4.1.2 Breeding Bird Survey (BBS) Analysis

Now overseen by the Patuxent Wildlife Research Center of the U.S. Geological Survey (USGS), the North American Breeding Bird Survey (BBS) is a long-term, large-scale, international avian monitoring program that tracks the status and trends of North American bird populations. Each year during the height of the breeding season (normally June), mainly volunteer participants skilled in avian identification collect bird population data along roadside survey routes. Each survey route is 24.5 miles (39.4 km) long with stops at 0.5 mile (0.8 km) intervals. At each stop, a three-minute point count is conducted. During the count, every bird seen within a 0.25 mile (0.4 km) radius or heard is recorded. Surveys start one-half hour before local sunrise and take about five hours to complete. Surveys are sometimes repeated several times each spring during the nesting season.

Four BBS routes, all within 35 miles of the Project site and covering similar habitat within the Eastern Ontario Plains, were analyzed in order to evaluate the likelihood of the occurrence of listed species as breeders at the Clayton Wind Farm site (see Table 4.1-3). The closest BBS route to the Project site was Watertown, about 4 miles (6.4 km) distant. Data analysis was limited to the last ten years, beginning in 1994, but none of the routes was surveyed every year during that period.

Overall, waterbirds are not as well represented in the BBS routes as in the BBA quadrants, mainly because no BBS route appeared to sample aquatic habitat as productive as the Perch River State WMA, which shared two BBA quadrants with the Project site. With their loud carrying calls, Pied-billed Grebe (threatened) and American Bittern (special concern) were recorded respectively on two and three of the four BBS routes sampled. Waterfowl records were limited to Canada Goose, Wood Duck, American Black Duck, and Mallard. Ring-billed Gull was well recorded on all four BBS routes, as would be expected from the proximity of Lake Ontario and the St. Lawrence River. One Common Tern was recorded in one year on the Ogdensburg route along the St. Lawrence River.

Regarding raptors, eight species were recorded in the BBS data, as opposed to nine in the BBA. Turkey Vulture, Osprey (special concern), Northern Harrier (threatened), Sharp-shinned Hawk (special concern), Red-tailed Hawk, and American Kestrel were recorded in both surveys. But, the BBS did not record Bald Eagle (threatened), Cooper's Hawk (special concern), and Northern Goshawk (special concern). It did, on the other hand, add Red-shouldered Hawk (special concern) and Broad-winged Hawk. All raptors, however, were recorded in low numbers in the BBS. For example, in some years, common raptor such as the Red-tailed Hawk and American Kestrel went unrecorded, and the maximum number recorded on any route in any year was three and two respectively.

4.1-3. Breeding Bird Survey (BBS) Records[1]

Route Number	Route Name	County	Distance/ Bearing from Site	Years Analyzed	Species Max/Min	Listed Species[2]	# Years	# Birds
61071	Watertown	Jefferson	4 mi S	5	72 / 61	Pied-billed Grebe (T)	1	1
						American Bittern (SC)	4	1-4
						Northern Harrier (T)	2	1-3
						Upland Sandpiper (T)	1	1
						Horned Lark (SC)	2	4-9
						Golden-winged Warbler (SC)	1	1
						Vesper Sparrow (SC)	3	1-2
						Grasshopper Sparrow (SC)	3	1-3
61113	Philadelphia	Jefferson/St. Lawrence	12 mi E	8	89 / 54	Common Loon (SC)	2	1
						Pied-billed Grebe (T)	1	2
						American Bittern (SC)	1	1
						Northern Harrier (T)	2	1
						Sharp-shinned Hawk (SC)	1	1
						Upland Sandpiper (T)	2	1
						Horned Lark (SC)	1	1
						Sedge Wren (T)	1	1
						Golden-winged Warbler (SC)	6	2-11
						Cerulean Warbler (SC)	3	1
61096	Ogdensburg	St. Lawrence	19 mi NNE	6	65 / 42	American Bittern (SC)	2	1
						Northern Harrier (T)	1	1
						Common Tern (T)	1	1
						Horned Lark (SC)	1	2
61072	Pulaski	Oswego	35 mi S	4	72 / 63	Osprey (SC)	1	1
						Northern Harrier (T)	2	1
						Red-shouldered Hawk (SC)	1	1
						Golden-winged Warbler (SC)	4	1-5

[1] From the North American Breeding Bird Survey, 1994-2004

[2] NYSDEC status, E = Endangered, T = Threatened, and SC = Special Concern

Most of the species recorded by the BBS in the Project region were common birds of forest, forest edge, woodland, old field, grassland, and wetland habitats. Nevertheless, Golden-winged Warbler (special concern) was recorded on two of the routes, sometimes in impressive numbers (11 in 1996 and 7 in 2004 on the Philadelphia route). Single Cerulean Warblers (special concern) were recorded in three of eight years along the Philadelphia route.

With regard to grassland birds, the BBS recorded most of the specialty species, including Northern Harrier (threatened), Upland Sandpiper (threatened), Horned Lark (special concern), Sedge Wren (threatened), Vesper Sparrow (special concern), and Grasshopper Sparrow (special concern). Only Henslow's Sparrow (threatened) was missed.

In summary, based on the site visit, BBA analysis, and BBS data, there is a high likelihood that nesting habitat is present at the Project site for a number of state-listed species, particularly those of grassland communities. Among the listed grassland species, the Clayton Wind Farm site probably contains suitable breeding habitat for the threatened Northern Harrier, Upland Sandpiper, Sedge Wren, and Henslow's Sparrow, as well as for the special-concern Horned Lark, Vesper Sparrow, and Grasshopper Sparrow.

The Project site also likely contains suitable nesting habitat for the following raptors that nest in forest and forest edge: Sharp-shinned Hawk (special concern), Cooper's Hawk (special concern), Red-tailed Hawk, and American Kestrel. The nesting suitability of on-site habitat is less likely for the threatened Bald Eagle (one record in the BBA), special-concern Osprey (more likely to nest adjacent to quality aquatic habitat, not in woodlots removed from such habitat), special-concern Goshawk (the woodlots and forest fragments on site may be too small to support this species), and special-concern Red-shouldered Hawk (recorded once on a distant BBS route).

Two special-concern species associated with wooded habitats may also breed within the Clayton Wind Farm area. These are the Whip-poor-will and Golden-winged Warbler. The Project site's habitat is probably not suitable for Cerulean Warbler, which, in this part of New York State, prefers wooded swamps, deciduous forest in stream bottoms, and lake and river shores with numerous tall trees (Bull 1974).

Regarding waterbirds, the Project site itself contains little suitable nesting habitat, limited mainly to small ponds and willow thickets. But, high quality waterbird habitat is located adjacent to the Project site in the Perch River WMA. A number of listed species occur there, including the endangered Black Tern, threatened Pied-billed Grebe and Least Bittern, special-concern American Bittern and Osprey, and about twelve species of waterfowl.

4.2 Migratory Birds

Given its proximity to Lake Ontario and the St. Lawrence River – not far from Cape Vincent, where the one flows into the other – in a region where wildlife management areas are well represented (including the adjacent Perch River WMA), the Project site appears to be located in an area where significant bird migration seems to occur. The above features can be considered ecological magnets that attract migrating birds (Berthold 2001, Alerstam 1990).

The sections that follow examine the migration of songbirds, hawks, and waterbirds (waterfowl, shorebirds, and others).

4.2.1 Nocturnal Songbird Migration

The literature has few references to songbird migration in north-central New York State, including Jefferson County. Thus, little information was found about the Project site or areas nearby. Nonetheless, several sources that would apply to this New York region and other locations were found regarding the night migration of songbirds.

It appears that the night migration of songbirds through northern and central New York occurs over a broad front with no large concentrations of these birds, with the likely exception of the immediate area along the shoreline of Lake Ontario where songbirds probably make stopovers in fairly large numbers. There is also no evidence that songbirds follow topographic structures such as ridges and valleys during night flight and that most night migration occurs over broad fronts (Berthold 2001, Alerstam 1993, Eastwood 1967). Berthold (2001) went so far as to say, "individuals originating from geographically dispersed breeding areas cross all geomorphological features (lowlands, mountains, rivers, and so on) along their routes without deviating much from the orientation of their initial tracks." Berthold uses the term "broad fronts" to describe these migrations. Radar studies conducted in western and upstate New York suggest that migration is generally broad front (Cooper et al. 1995, Cooper and Mabee 1999, Cooper et al. 2004a, 2004b). Perhaps the best evidence from eastern North America to support the contention that birds do not follow topographic features is a study by Cooper et al. (2004) from a ridge in West Virginia, which showed that night migrants simply crossed the ridge at an oblique angle rather than following it. This finding is consistent with the phenomenon of broad front migration.

Even migrants confronted by the Great Lakes in upstate New York (eastern Lake Erie and Lake Ontario) do not turn when they reach the lake shores during night migration (Diehl and Larkin 2003) and continue to cross the lakes as if they were not present. These birds do, however, put down for stopovers in habitats close to the lakeshores, especially in the hours before dawn. Nonetheless, the evidence is overwhelming that most night migrating songbirds are spread across a broad front over most types of topography encountered by these birds.

A short-term marine radar study conducted in spring near Cape Vincent at the eastern end of Lake Ontario showed slightly elevated numbers of night migrants close to the shoreline (Cooper et al. 1995). This may demonstrate slightly elevated numbers of birds, as compared to inland migration away from the lakes. Nevertheless, an in depth study is needed from both spring and fall migration seasons to better determine whether the numbers of migrants near the east end of Lake Ontario is greater than farther from the lake. The Clayton Wind Farm site is inland east-southeast of the radar site at Cape Vincent.

There are two accounts from northeastern states that suggest birds do, at times, change migration direction when confronted by topographic features. In New Hampshire at Franconia Notch, at the northern edge of the White Mountains, birds may turn when they encounter the massive topographic features of these mountains (Williams et al. 2001). This is similar to the European findings of birds flying through passes in the Alps and diverting around the Alps (Bruderer and Liechti 199). However, the Williams et al. (2001) report provides little information on high flying migrants or migrants flying in other than a restricted location near Franconia Notch, so there is limited information from this site. A study done at two New York sites (one along the Hudson River and the other in the Helderberg Mountains, near Albany) suggested that birds might have been following the Hudson River (or the lights along the River) during fall migration (Bingman et al. 1982) when winds were strong from the west.

There is no evidence to suggest that the Project site would experience anything but broad-front nocturnal migration. But, given the site's proximity to the Lake Ontario lakefront, there is the possibility that migratory stopover of songbirds could concentrate the migration of some birds just to the west of the site, both in the spring and fall. Nevertheless, the site is likely too distant from the lakeshore and does not contain enough wooded habitat to be an attractive stopover site for large numbers of nocturnal migrants.

4.2.2 Hawk Migration

Hawk migration throughout New York State has been well documented (including by this report's senior author, who did his doctoral research on this phenomenon in east-central New York between 1975 and 1981). Since the boom of recreational birdwatching in the 1960s, thousands of birdwatchers have searched the state to locate the migration corridors for raptors. Annually, thousands of these birdwatchers visit dozens of sites throughout the state to watch and count migrating hawks. These sites are distributed from eastern Long Island to the shores of Lake Erie. It is safe to say that most of the localities where large numbers of hawks occur during migration are known.

Overall, there are fewer than about a dozen hawk watches in the state where migrating hawks can be reliably seem in impressive numbers of up to ten of thousands of birds. The best hawk watching sites are located either in the far southeastern corner of the state in the lower Hudson Valley and on Long Island, or along the southern shore of Lake Ontario (Derby Hill, Braddock Bay) and Lake Erie (Ripley).

Located about 40 miles (64 km) south-southwest of the proposed Clayton Wind Farm, the Derby Hill hawk watch is the closest major migration site to the Project site. It is considered a significant hawk watch (Zalles and Bildstein 2000), with tens of thousands of hawks passing by on the spring migration as they concentrate along the shore of Lake Ontario. During fall migration, relatively few hawks pass Derby Hill.

Except for Derby Hill, there are no other noteworthy hawk watching sites near the proposed Clayton Wind Farm site.

Most of the migration noted at Derby Hill is concentrated within 1 to 5 miles (1.6 to 8 km) of the lakefront. Once migrating hawks clear the southeast corner of Lake Ontario beyond Derby Hill, they turn northward and disperse above the landscape. Inland, migrating hawks are spread more evenly over large areas. Away from the large bodies of water and steep ridges that concentrate hawk migration, most hawk migration in central New York occurs at relatively high altitudes (generally above 100 m [328 feet]) and is spread over a broad front, as confirmed by radar studies (Kerlinger et al. 1985).

The highly concentrated hawk migration that occurs during spring migration at Derby Hill is not likely to be indicative of the numbers of hawks migrating over the Clayton Project site. By the time the hawks that have passed Derby Hill reach the latitude of the Project site, they will likely be dispersed over the landscape at high altitude, not concentrated along the lakeshore. In the fall, some hawks may concentrate at the northeast corner of Lake Ontario in Canada, but once these birds have cleared the lake and begin to head south, they will again disperse over the landscape. Along the immediate lakefront, a concentrated migration of falcons and accipiters can be expected. Away from the lakefront, in the area of the proposed wind farm, falcons and accipiters will pass by, but not in concentrated numbers. A number of falcons and accipiters, however, will be attracted to the Perch River WMA.

4.2.3 Waterbird Migration

While the Project site itself generally lacks waterbird habitat, it is located adjacent to the 8,000 acre Perch River Wildlife Management Area (WMA), which does attract waterfowl. According to the website of the Important Bird Areas Project in New York State (see http://ny.audubon.org/iba/perchriverwma.html), the following state-listed species have been recorded at Perch River both in spring and fall migration: the endangered Black Tern, the threatened Pied-billed Grebe and Least Bittern, and the special-concern Osprey and American Bittern.

Ducks and geese are also well represented in migration at Perch River. During the November site visit, both Snow Geese and Canada Geese were observed within the proposed wind farm area. This indicates that migratory flocks of geese that stopover at Perch River sometimes feed in the agricultural fields of the Project site.

The Project site is also located about 15 miles (24 km) east of Cape Vincent, where Lake Ontario and the St. Lawrence River meet. Chaumont Bay on Lake Ontario is only 4.5 miles (7.2 km) southwest of the Project site. The St. Lawrence is about 7.5 miles (12.0 km) northwest. This indicates that the region in which the Project site is situated is an important migratory corridor and stopover area for waterbirds.

Most migrating waterbirds fly at night (and to a lesser extent during daytime) at altitudes of 500 to 1,000 feet (152 to 304 m) or more (Bellrose 1976). This phenomenon has been confirmed with radar at many locations for ducks, geese, loons, and other birds (Kerlinger 1982, reviewed by Kerlinger and Moore 1989). But, with the proximity of Perch River WMA, Lake Ontario, the St. Lawrence River, and other wildlife management areas, it is likely that significant numbers of waterbirds will be stopping over on migration in the Project region. This will include migrating Snow and Canada Geese that feed in corn and other agricultural fields during fall and spring migration. This type of agricultural habitat occurs on the Project site.

Small wetlands do occur within the Project boundary, some of which will attract small numbers of migrating waterbirds including rails, bitterns, waterfowl, and, perhaps, some grebes. Because these wetlands are small, and because larger, more productive wetlands are located outside of the site, the relative importance of the wetlands within the Project site is likely to be minimal.

4.3 Wintering Birds

Beginning in mid-November and extending into mid-March, winter in far upstate New York is generally harsh and relatively inhospitable for many birds. The flat terrain beyond Lake Ontario where the Clayton Project would be located is subject to strong winds, low temperatures, and a great amount of snow. Food for birds is likely to be scarce. A much lower diversity and density of birds is to be expected in and around the Project site during winter than at other times of the year.

The Audubon's Christmas Bird Count (CBC) provides an excellent overview of the birds that inhabit an area or region during early winter. Counts take place on a single day during a three-week period around Christmas, when dozens of birdwatchers comb a 15-mile (24 km) diameter circle in order to tally up all the bird species and individuals they see. In preparation for count day, participants also scout for birds during the "count week" period. While most of these birdwatchers are unpaid amateurs, they are usually proficient or highly skilled observers.

Table 4.4-1. Audubon Christmas Bird Counts (CBC's) Examined

Count Name (Code)	County	Distance/ Bearing from Site	Years Analyzed	Number Participants	Number Species Min/Max
Watertown (NYWA)	Jefferson	3 mi SSE	9	6-16	44-64
New Boston (NYNB)	Lewis	17 mi SSE	10	8-17	30-43
Oswego-Fulton (NYOS)	Oswego	45 mi SSW	10	10-15	25-51
Massena-Cornwall (NYMC)	St. Lawrence	68 mi NE	9	9-18	57-69

Available at http://audubon2.org/birds/cbc/hr/count_table.html, CBC data are used by scientists, wildlife agencies, and environmental groups to monitor bird populations. The results over the last ten years for four of the CBC's closest to the Project site (see Table 4.4-1) were examined in order to understand the winter bird populations likely to occur at the Project site. Each CBC surveys an area of about 177 square miles (453 square km). Thus, the four CBC's considered in this report covered a total area of 708 square miles (1,812 square km). Observer participation per count during the analysis period varied from a minimum of 6 observers to a maximum of 18.

Table 4.4-2. CBC Records for Listed Species

Species (Listing[1])	CBC	Number Recorded per Year	Number Years Recorded
Common Loon (SC)	Watertown	2	2
	Oswego-Fulton	1-5	9
	Massena-Cornwall	1-19	6
Pied-billed Grebe (T)	Oswego-Fulton	1-4	7
	Massena-Cornwall	1-2	2
Bald Eagle (T)[2]	Watertown	1	2
	New Boston	1	2
	Oswego-Fulton	1	3
	Massena-Cornwall	1-7	8
Northern Harrier (T)	Watertown	1-13	7
	New Boston	1	1
	Oswego-Fulton	1	2
	Massena-Cornwall	3	1
Sharp-shinned Hawk (SC)	Watertown	1-5	7
	New Boston	1-2	6
	Oswego-Fulton	1-3	7
	Massena-Cornwall	1-4	7
Cooper's Hawk (SC)	Watertown	1-4	7
	New Boston	1-4	5
	Oswego-Fulton	1-4	7
	Massena-Cornwall	1-3	6
Northern Goshawk (SC)	Watertown	1	2
	New Boston	1-3	8
	Oswego-Fulton	1	1
	Massena-Cornwall	1-2	6
Golden Eagle (T)	Massena-Cornwall	1	1
Peregrine Falcon (E)	Massena-Cornwall	1	1
Short-eared Owl (E)	Watertown	2	2
Red-headed Woodpecker (SC)	Watertown	1	1
Horned Lark (SC)	Watertown	1-179	7
	New Boston	3-52	5
	Oswego-Fulton	1	1
	Massena-Cornwall	2-15	4

[1] NYSDEC status, E = Endangered, T = Threatened, and SC = Special Concern

[2] Also listed as Threatened by USFWS

The number of species recorded in these counts ranged from a maximum of between 43 and 69 species to a minimum of between 25 and 57 species. Except for the more inland New Boston count, which recorded a maximum of 43 species, these CBCs were located along Lake Ontario or the St. Lawrence River, which provided open water for waterfowl and other waterbirds and permitted tallies of up to 69 species.

A majority of the birds reported on in the CBC data sets examined were common species of aquatic habitats, agricultural land, grassland, brushland, forest edge, and forest. While the Project site itself lacks open water, it is located adjacent to the Perch River WMA, which offers high quality habitat to waterbirds when not frozen over. When Perch River is open, waterbirds can be expected to fly over the project site, and geese can be expected to feed in the Project site's agricultural fields during the day. When the refuge is frozen over, waterbirds will essentially disappear until spring migration.

Open-country raptor species recorded on the CBC's – Red-tailed Hawk, Rough-legged Hawk, Northern Harrier (threatened), and, to a lesser extent, American Kestrel – are likely to be present on the Project site on a regular basis during winter. Their presence will vary from year to year depending upon snow cover and prey availability. In years with normal or heavy snow, few raptors will be present. But, if voles and mice are at the peak of their abundance fluctuations, more of these hawks are likely to be present foraging in the farm fields.

Many of the grassland, brush, and forest species recorded in the CBC's are likely to be recorded on the Project site during winter, with some found most often around residences, farmyards, and other locations where there is more shelter and food. Only a small subset of the species will be found in large fields (corn, hay, and fallow fields) or in forested and edge situations that are prevalent at the Project site. These will include various sparrows, woodpeckers, open-country passerines, owls, grouse, and a few other species. Their abundances are likely to be relatively low.

No federally listed endangered species were present on any of the counts from the four CBC's examined over the ten-year period. Bald Eagle, now federally listed as threatened (and proposed for delisting in 2000), was generally seen in small numbers on all four CBCs analyzed (Table 4.4-2), but six and seven individuals were seen in two years probably along the St. Lawrence River at the Massena-Cornwall CBC. The Bald Eagle most often inhabits areas near open water, where they eat fish, crippled and sick ducks, or carrion. When the Perch River WMA is not frozen over, Bald Eagles may occur in the vicinity of the Project site in winter.

There were two State-listed endangered species and three State-listed threatened species present on the CBC's (Table 4.4-2). Of these, Pied-billed Grebe (threatened) will not be found on the Project site itself, but it may occur in the Perch River WMA before it freezes over. Peregrine Falcon (endangered) are unlikely to be found on the Project site, as they do not generally forage in upland farm fields during winter, because there is little food for them. Nevertheless, they may be drawn to the Perch River WMA when it still has open water. Golden Eagle (threatened) may forage at times on or near the Project site. This bird, observed during the fall site visit, may have been passing through the area during the migration season, but the presence of occasional Golden Eagles on northern

New York State CBCs shows that they do, at times, winter in upstate New York, usually in very small numbers.

Short-eared Owl (endangered) and Northern Harrier (threatened) do forage in open farm fields during winter and will likely be present at the Project site, because of its low elevation and the moderating influence of Lake Ontario on the region's climate. Both Short-eared Owls and Northern Harriers sometimes roost communally and are very easy to find as they forage low over fields in daylight or at dawn and dusk. It is important to note that individuals of all these listed species may be migrants from farther north and from populations that are not listed.

Six species of special concern in New York State were present on the CBC's. They were Common Loon, Sharp-shinned Hawk, Cooper's Hawk, Northern Goshawk, Red-headed Woodpecker, and Horned Lark. Because the Project site itself lacks open water, Common Loon will not be attracted to it in winter. While it could occur at Perch River WMA, it is more likely to be found on Lake Ontario. Sharp-shinned and Cooper's Hawk might use the Project site in winter, but in very small numbers. These hawks usually frequent areas where there are bird feeders that attract their avian prey. They are regularly found in residential areas. Northern Goshawk could also be found on the Project site during midwinter. These birds generally eat rabbits, large rodents, and larger birds. Goshawks cover very large areas during winter in search of prey.

It is highly unlikely that a Red-headed Woodpecker would occur on the Project site in winter. It is a rare bird in upstate New York during that season, as the single record in the four counts analyzed over a ten-year period demonstrates.

Of all these species, Horned Lark is the one that will be found most often on the Project site during winter, because it forages in farm fields. Nevertheless, in years with significant snow cover, Horned Larks are unlikely to be present. As the significant fluctuation in numbers on the counts analyzed demonstrates, larks can be numerous and hundreds of individuals can be present in some years.

As with the listed species discussed above, individuals of these species of concern were probably migrants from more northerly populations that are not listed. In other words, it is unlikely that these individuals were from New York State breeding populations that are in decline.

In summary, based on the CBC analysis and what we know of the foraging habits of birds, no species listed as federally endangered will be found on the Project site in winter. The federally threatened Bald Eagle may fly through the Project site, or occasionally roost in its trees, when the Perch River WMA still has significant open water in winter. This may also be true of the State-listed endangered Peregrine Falcon.

On the other hand, the state-listed endangered Short-eared Owl and the state-listed threatened Northern Harrier are likely to be present at the Project site on a regular basis in winter. The state-listed species of concern that are likely to be on site at times during winter include Horned Lark, Sharp-shinned Hawk, Cooper's Hawk, and Northern Goshawk, and they may even occur regularly in small numbers. When the adjacent Perch River WMA still has open water in winter, waterbirds will likely fly through the site, and geese will feed in the site's agricultural fields. Farmland, brush, and forest edge habitats on and near the Project site are likely to attract small numbers of common species during the winter. Raptor numbers will fluctuate between years and among species because of prey fluctuations. The remaining species will be present in modest numbers.

5.0 Important Bird Areas, Reserves, and Sensitive Habitats in Project Vicinity

As part of the avian risk analysis, databases were checked to see if any Important Bird Areas (IBAs) or federal, state, or private protected areas overlap with the Project site or are found in close vicinity. The presence or proximity of such areas could indicate the presence of sensitive bird habitats and increased avian risk.

5.1 Important Bird Areas (IBA's)

A program of BirdLife International and Audubon, the Important Bird Area Program seeks to identify and protect essential habitats to one or more species of breeding or non-breeding birds. The sites vary in size, but usually they are discrete and distinguishable in character, habitat, or ornithological importance from surrounding areas. In general, an IBA should exist as an actual or potential protected area, with or without buffer zones, or should have the potential to be managed in some way for birds and general nature conservation. An IBA, whenever possible, should be large enough to supply all or most of the requirements of the target birds during the season for which it is important.

About 125 IBA's have been designated in New York State, including eight in Jefferson County. Table 5.1-1 lists the nine, closest New York IBA's to the Project site and summarizes information available at the IBA website about their noteworthy features and conservation issues (see http://www.audubon.org/chapter/ny/ny/iba/).

As can be seen from the list in Table 5.1-1, the Project site coincides with one IBA (the Perch River Grasslands are centered in the east-central section of the proposed wind farm), lies adjacent to another (Perch River Wildlife Management Area), and is in the vicinity of a number of others by virtue of its location near Lake Ontario and the St. Lawrence River. Two of the IBA's (Perch River Grasslands and Fort Drum Grasslands) designate grassland breeding bird communities of statewide importance. Two others (Point Peninsula and Derby Hill Bird Observatory) designate important sites for raptors. The Point Peninsula IBA is singled out for its winter raptor population, but high numbers given in the website description (see http://ny.audubon.org/iba/pointpeninsula.html) for the 1987-1988 winter may be from a year with an extraordinary abundance of rodent prey. The other five IBA's (see list) designate important habitat for breeding and migrating waterbirds. The Upper St. Lawrence/Thousand Islands IBA is additionally designated for wintering waterfowl.

Table 5.1-1. Important Bird Areas (IBA's)

IBA Name	County	Distance/ Bearing From Site	Size (acres)	Noteworthy Features	Conservation Issues
Perch River Grasslands	Jefferson	On site E	6,000	One of the most significant concentrations of breeding grassland birds in the state	Loss of grassland habitat as farmer's sell land for development or allow fields to revert to forest
Perch River Wildlife Management Area	Jefferson	Adjacent SE	8,000	Exceptional wetland bird community	Continued monitoring of state-listed species is needed
Eastern Lake Ontario Barrier Beaches/Wetland Complex	Oswego-Jefferson	5 mi SSW	24,000	Wetland complex that supports many migratory and breeding species	Shoreline development; recreational use, particularly of sand beaches
Upper St. Lawrence/Thousand Islands	Jefferson-St. Lawrence	7.5 mi NW	100,000	Important waterfowl migration and wintering area; important Common Tern nesting area	Level of toxins in ecosystem; disturbance of breeding colonies by recreational boating and fishing
Point Peninsula	Jefferson	8 mi SW	6,400	Winter concentration area for various raptors, including Short-eared Owl and Northern Harrier	Loss of grassland habitat as farmer's sell land for development or allow fields to revert to forest
Indian River Lakes-Black Lake	St. Lawrence-Jefferson	10 mi NE	80,000	Mixture of wetlands, shrublands, and agricultural areas that support many state-listed breeders	Management of early and mid-successional habitats
Fort Drum Grasslands	Jefferson	16 mi E	107,000	One of the most significant grassland and shrubland breeding bird communities in the state	Loss of grassland bird community to forest succession if U.S. Army abandons area
Little Galloo Island	Jefferson	21 mi SW	43	Exceptional breeding concentration of colonial waterbirds	No official management agreement in place with landowners
Derby Hill Bird Observatory	Oswego	40 mi SSW	57	Spring hawk concentration	Loss of overlook property to lakefront erosion

On the Canadian side of the St. Lawrence River, the closest IBA is Wolfe Island in Kingston, Ontario. It is noteworthy for its waterfowl congregations in spring and winter concentrations of hawks and owls.

Regarding conservation issues, all the IBA's with grassland habitat are facing the loss of that habitat to forest succession. In the case of the Perch River Grasslands and Point Peninsula, habitat management is in the hands of farmers, who are increasingly pressured financially to sell their land for development or to take land out of production, allowing it to revert to forest, because of decreasing profit margins. In the case of the Fort Drum Grasslands, grassland habitat is managed by the U.S. Army for training activities. Should the Army abandon this military reservation, and no other entity steps forward to manage the grasslands, this habitat will disappear. The waterbird IBA's are faced with issues ranging from the need for population monitoring of listed species (Perch River WMA) to shoreline development (Eastern Lake Ontario Barrier Beaches/Wetland Complex), to environmental toxins (Upper St. Lawrence/Thousand Islands). All of these factors should be considered in determining potential risks to birds using these areas in the long-term.

In summary, based on the location and nature of the closest IBA's, the proposed Clayton Wind Farm is located in a region with important grassland bird communities, waterbird breeding communities, and waterbird migration sites. The wind farm itself is situated in an area recognized for its grassland bird habitat. While the wind farm site lacks significant waterbird habitat, quality waterbird habitat is located nearby. Nevertheless, the loss of grassland bird habitat to forest succession is a significant issue in and around the Clayton Wind Farm site. Management is required to arrest forest succession and allow grassland areas to endure. The development of a wind farm in habitats in this area should be factored into any long-term conservation plan for the area.

5.2 Federal, State, and Private Protected Areas

The Project site is located in the vicinity of a number of wildlife management areas (WMA's). These are owned by New York State and managed by NYSDEC. Their purpose is to establish permanent public access to lands for the protection and promotion of fish and wildlife resources. Since most WMA's were acquired through hunting license fees and the federal tax on guns and ammunition, the WMA program emphasizes game species. Fishing, hunting, and trapping are the most widely practiced activities on many WMA's, but non-game-related uses also take place, such as hiking, cross-country skiing, birdwatching, and nature study. For more information, please see http://www.dec.state.ny.us/website/dfwmr/wma/wmaprog.htm.

The following major WMA's are located in Jefferson County near the Project site:

- Perch River, 7,862 acres of upland and wetland habitats, located adjacent SE
- Dexter Marsh, 1.339 acres of wetland habitats, located 5 miles (8 km) SW
- French Creek, 2,265 acres of upland and wetland habitats, located 5.5 miles (8.8 km) NW

- Ashland Flats, 2,037 acres of upland and wetland habitats, located 6 miles (9.6 km) W
- Indian River, 968 acres of upland and wetland habitats, located 11 miles (17.6 km) NE

Given the scenic values of Lake Ontario and the St. Lawrence River, there are at least five state parks along the waterfront within 10 miles (16 km) of the Project site. These include Long Point, Burnham, Cedar Point, Grass Point, and Wellesly Island. Adirondack Park is located about 35 miles (56 km) east of the Project site.

Canada maintains St. Lawrence Islands National Park along the nearby section of the St. Lawrence River. At its closest point, this national park is located 9 miles (14.4 km) northwest of the Project site.

All other protected areas are too distant from the Project site to be applicable to this avian risk assessment. Such areas include U.S. National Parks, National Forests, National Wildlife Refuges, and Audubon Sanctuaries.

In summary, the Project site is located in a region with a high representation of wildlife management areas (WMA's). Given that all of these WMA's contain wetland habitat, significant number of waterfowl and other waterbirds can be expected to occur, particularly in migration. In addition, raptor use of the area is likely to be significant.

6.0 Risk to Birds at the Proposed Clayton Wind Farm

6.1 Review of Risk to Birds at Wind Power Plants in the United States and Europe

Presently, the best means of assessing risk to birds at prospective wind power development sites is to compare the proposed site's avifauna, geographic and topographic settings, and habitat with empirically demonstrated levels of risk at existing sites. By comparing the types of species present or likely to be present, numbers of individuals, seasonal presence, and behavior of birds that nest, forage, migrate through, or winter on a proposed wind power site with existing facilities where risk has been determined, probabilistic assessments of risk can be made. A review of the literature on empirical studies of avian risk follows. This literature review is then used for assessing risk at the Clayton Wind Farm Project.

Two general types of impacts have been documented at wind power projects: 1) habitat alteration and disturbance with resulting bird avoidance and displacement, and 2) fatalities resulting from collisions with turbines, meteorology towers, and other infrastructure. These two types of impacts are detailed below.

6.1.1 Disturbance and Displacement

Habitat alteration and disturbance resulting from the construction and operation of turbines and other wind farm infrastructure sometimes can result in making a site unsuitable or less suitable for nesting, foraging, resting, or other bird use. Impacts to birds from human activity and the presence of large structures on birds are becoming better documented. The footprint of turbine pads, roads, and other infrastructure at a project site is generally a small percentage of the site after construction. Therefore, overall land use is relatively unchanged by wind power development. But, the true amount of wildlife habitat altered by a wind power project can extend beyond the functional project footprint. This is because of the presence of tall structures and increased human activity. The presence of new infrastructure (primarily tall turbines with moving rotors) has been examined to determine whether birds avoid or are displaced from an area as a result of these new features on the landscape.

Studies documenting disturbance, avoidance, and displacement have focused mainly on birds living in grassland and other open country habitats, including farm fields. At a large wind power plant in southwestern Minnesota, reduced nesting activity was detected in grassland birds in fields close to wind turbines as opposed to farther from the turbines (Leddy et al. 1999). Leddy et al. also found that the activities of many grassland-nesting birds were inhibited within about 80 m (260 feet) to nearly 200 m (650 feet) of turbines. The turbines involved were smaller than those now used at the newest and proposed wind power facilities by at least 100 feet (31 m). An impact gradient study demonstrated that disturbance was greatest within the first 100 m (325 feet) of a turbine and decreased at greater distances. This means that, after the construction of turbines, some birds either do not nest or forage close to the turbines or do so at lower frequency.

At the Foote Creek Rim Wind Plant in Wyoming, nesting Mountain Plovers (a grassland-nesting species) declined after erection of turbines. Plover productivity also declined (Johnson et al. 2000), although successful nesting of Mountain Plovers was noted within 200 m (650 feet) of operating turbines. Thus, the area impacted extended beyond the actual footprint of the project.

The Altamont Pass Wind Resource Area of California (APWRA) hosts very large numbers of raptors and grassland nesting songbirds, which regularly perch on the lattice towers and guy wires of the site's older turbines. In a study in the APWRA, Red-tailed Hawks trained for falconry in Idaho were exposed to turbines in order to study their flight behavior. Upon first seeing the turbines at 100+ feet (30 m), the birds would not fly. Within weeks, however, they appeared to habituate to the turbines in a manner comparable to resident Red-tailed Hawks (R. Curry, personal communication). Unlike most other sites, turbines have been present in the APWRA for about 20 years, giving birds ample time to habituate.

In Europe, studies have shown that some waterfowl, shorebirds, and grassland songbird species avoid the area near turbines. For example, shorebirds (mostly migrants) were displaced by 250-500 m (800-1,650 feet) from turbines (Winkelman 1990). In Denmark, some migrant shorebirds were displaced by up to 800 m (2,600 feet) by the presence of turbines (Pederson and Poulsen 1991). Other studies have shown that some shorebirds and other birds can habituate to turbines to some degree (Ihde and Vauk-Henzelt 1999, Winkelman 1990). No studies have been conducted that examine behavioral changes or habituation of birds to wind turbines over periods as long as 5 to 10 years after construction. Therefore, it is not yet known if these species are permanently displaced.

Other studies conducted in Denmark, have demonstrated species-specific differences in avian avoidance patterns near wind turbines (Larsen and Madsen 2000, Percival 1999, Kruckenberg and Jaene 1999). In general, Pink-footed Geese (Larsen and Madsen 2000) would not forage within 50 m (160 feet) of wind turbine rows and did not forage within 150 m (500 feet) of a cluster of wind turbines. Fewer of these geese foraged within 100 m (325 feet) of wind turbines than foraged farther from the turbines. Barnacle Geese, however, foraged within about 25 m (80 feet) of turbines, showing they are less sensitive than Pink-footed Geese (Percival 1999). Nonetheless, White-fronted Geese did not forage within about 400 to 600 m (1,300 to 1,950 feet) of wind turbines (Kruckenberg and Jaene 1999). A study recently completed at the Top of Iowa wind power project demonstrated that there was virtually no displacement or disturbance of Canada Geese at the new, 90 turbine site (Koford et al. 2005). Anecdotal information from the Fenner Wind Power facility in New York State (Paul Kerlinger), located approximately 75 miles (120 km) south of the Project site, suggests that Canada Geese forage in close proximity to large wind turbines. Resident geese readily habituate to human structures and activities. Thus, different species react differently to wind turbines, and it is not known if species will habituate or, if so, how long the process might take.

A post-construction avian study at the Searsburg, Vermont, wind power project (11 turbines) may be the only study of disturbance/avoidance-type impacts to birds in a mountaintop forest (Kerlinger 2000a, 2002). Point count surveys for breeding birds done before and after the turbines were erected showed that some forest nesting birds – such as Blackpoll Warbler, Yellow-rumped Warbler, White-throated Sparrow, and Dark-eyed Junco – appeared to habituate to the turbines within a year of construction. On the other hand, Swainson's Thrush, and perhaps some other species, seemed to move away from the turbines. This study could not document whether or not the former species nested close to the turbines, but it certainly demonstrated that they foraged and sang within forest edge about 100 feet (30 m) from the turbine bases.

Observations of autumn hawk migration in Vermont showed that the numbers of hawks that flew close to a hill with newly constructed turbines was smaller than in the year prior to turbine construction and operation (Kerlinger 2000b). These migrants may have been avoiding the novel structures.

The overall results of research on bird disturbance and displacement suggest that grassland and other open country birds avoid turbines more than forest species. Forest species may not be averse to having objects over their heads while foraging and nesting. It has also become evident that there are species-specific differences, with some species not displacing as far as other species and habituating to turbines more readily. Nonetheless, which species are capable of habituating is not known, and impact gradient-type studies are needed to quantify the avoidance and displacement of various species.

6.1.2 Collision Fatalities

Avian fatalities at wind plants result from collisions with turbine rotors and guy wires of on-site meteorology towers. Electrocutions have occurred at older wind plants, because electrical lines were above ground and constructed prior to the development of Avian Power Line Interaction Committee (APLIC) guidelines. Collision impacts have been studied at more than 20 wind power projects in more than a dozen states in the United States (Erickson et al. 2001; see Appendix D), as well as at locations in Canada and Europe.

An estimated 28,000 to 33,000 birds were killed at about 15,000 wind turbines in the United States in 2001 (Erickson et al. 2001), yielding an average of 2.1 birds per turbine per year. Fatalities ranged from zero birds per turbine per year to upwards about seven birds per turbine per year at some eastern U.S. sites, with slightly higher rates at eastern as opposed to western wind power facilities. The fatalities were spread among several dozen bird species and showed taxonomic differences in collision susceptibility.

The numbers of fatalities at wind turbines annually are orders of magnitude lower than collision fatalities reported for transmission lines, windows, highways (motor vehicles), and communication towers (Erickson et al. 2001), as well as for non-collision fatalities related to cat predation, hay mowing, oil pits, fishery long lines, acid rain, etc (see www.currykerlinger.com, Hames et al. 2002). Some of these human-related mortality sources are estimated to kill tens of millions to hundreds of millions of birds per year. To put this matter in perspective, turbine collision fatalities are also orders of magnitude smaller than hunting harvests determined by professional wildlife managers (data from USFWS, Martin and Johnson 2002) and lower than depredation permits allowed by the U. S. Department of Agriculture (USDA) and the USFWS. These harvests amount to more than 100 million birds per year and are not deemed biologically significant.

In Europe, avian fatalities have generally been small at wind power plants, although there are a few localities where greater numbers of fatalities have been found. At a wind power site with 18 turbines in the coastal Netherlands, dozens of songbirds and a variety of shorebirds were reported to have collided with wind turbines during the migration season (Winkelman 1995). At another wind plant in the Netherlands, where turbines were erected in a saltwater lake, about 65 waterfowl fatalities were noted in one winter (Winkelman 1995). These sites are adjacent to the North Sea, where migration and wintering birds are densely concentrated. That several species were killed reduced the potential for population impacts in any one species. There are also higher fatality rates reported from Belgium, with respect to terns and gulls, at turbines located on harbors and adjacent to open water (Everaert 2002), and from Navarre in northern Spain (reports on the Internet), where large numbers of raptors have apparently been killed.

Fatalities of migrants have been relatively rare at most other sites in Europe. Perhaps the best example comes from Tarifa, Spain, where more than 100,000 raptors and other soaring birds, and millions of other birds converge on the Straits of Gibraltar (Montes Marti and Barrios Jaque 1995, Janss 2000, Barrios and Rodriguez 2004, and DeLucas et al. 2004). Local Griffon Vultures and kestrels are killed on occasion, apparently because they habituate to the turbines and frequently forage amongst them. Despite large numbers of birds, fatalities of migrants at this site are rare.

The only wind power site in the United States where risk to birds has been suggested to be significant is the Altamont Pass Wind Resource Area (APWRA), where raptor fatalities have been reported for over 15 years. Golden Eagles, Red-tailed Hawks, American Kestrels, and other species collide with turbines in varying numbers. These findings suggest that raptors are the most collision-susceptible group of birds (Anderson et al. 2000). However, such fatalities have not impacted regional populations. A long-term study of the Altamont Golden Eagle population by Hunt (2002) concluded that, despite the high fatality rate, the population remains stable. Large numbers of gulls, ravens, vultures, grassland songbirds, and other species fly amongst the APWRA turbines and rarely collide with the turbines. The raptor fatalities in the APWRA are an anomaly, because they have not been demonstrated elsewhere. Other studies conducted at U.S. wind power facilities outside of the APWRA have not revealed large numbers of raptor fatalities.

Several factors are believed to contribute to raptor risk in the APWRA, and some can be generalized to other species. These factors act alone or together to produce the collision mortality documented in the APWRA (Howell and DiDonato 1991, Orloff and Flannery 1992, 1996). They are:

- Large numbers of turbines (presently about 5,400, down from about 7,000 several years ago) concentrated in a small area and providing many obstacles to flight
- Closely spaced turbines (less that 10 m [30 feet] rotor-to-rotor distance) that may not permit birds to fly safely between them
- Extraordinary numbers of foraging raptors throughout the year, the result of a superabundant population of California ground squirrels
- Steep topography with turbines placed in valleys and along valley and canyon edges, where collision risk is greater
- Turbine rotors that sweep down to less than 10 m (30 feet) of the ground, inhabiting airspace where raptors forage extensively
- Turbines mounted on lattice-type towers that encourage perching and provide shade and cover from sun and rain
- Small turbine rotors that revolve at high rates (40-72 rpm) making the rotor tips difficult to see

West of the Rocky Mountains, avian mortality resulting from collisions with wind turbines has been studied at sites in California, Oregon and Washington State (Appendix D). With the exception of the APWRA, reported fatality numbers have been small. At San Gorgonio Pass and in the Tehachapi Mountains, relatively few birds were killed in two years of searches, including very low representation of raptors (Anderson 2000). One Golden Eagle has been found in the San Gorgonio Wind Resource Area in more than two years of study. At a new wind power site in Oregon, at which there are 38 turbines in farmland, a one-year study documented no raptor fatalities, eight songbird fatalities, and four upland gamebird fatalities (three of which were introduced species). The actual number of fatalities was greater (N = 24 fatalities; 0.63 fatalities per turbine per year) when searcher efficiency and carcass removal (scavenging) estimates are factored in.

At one of the world's largest wind power facilities, the State Line project in Washington and Oregon, the fatality rate per turbine per year was recently found to be slightly less than two birds per turbine per year (Erickson et al. 2002, 2003). That project has 399 turbines. Among the fatalities were a variety of species, with Horned Larks (locally nesting birds) accounting for 46% of all birds found. Six raptors from three species were killed and about 24% of fatalities were night migrating songbirds. The rates of avian fatalities at smaller wind power sites in Oregon (Klondike) and Washington (Nine Canyon) averaged slightly lower and higher, respectively. Birds killed were divided among night migrants, resident species, very few waterfowl, and small numbers of raptors. The rate of night migrants killed in the far west has been roughly one bird per turbine per year or less, including when factoring in carcass removal and searcher efficiency.

Most of the projects in the far western United States, discussed above, were situated in tilled agricultural fields or pasture/prairie-like habitats. It should be noted that many of the turbines involved in California studies were less than 200 feet in height and did not have FAA lights. All turbines in Oregon and Washington were taller than 275 feet and a subset (perhaps 1 in 3 to 1 in 4) of them had FAA lights (the presence or absence of lights is significant, because, as discussed below, lighting has been implicated in large-scale fatality events at communication towers). There has been no suggestion of population impacts at any of these facilities, nor have fatalities involved endangered or threatened species.

Avian fatality studies also have been conducted at wind plants in the grasslands of Colorado, Wyoming, and a small site in Kansas. After five years of systematic searches at 29 new turbines (expanded to 45 in the third year) in a short-mixed grass prairie/pasture land in northern Colorado, small numbers of fatalities were documented (Kerlinger, Curry and Ryder, unpublished). The fatalities included mostly Horned Larks, with fewer McCown's Longspur, White-throated Swifts, one teal, Lark Bunting, one American Kestrel, and some other songbirds. The prevalence of Horned Larks on the fatality lists is likely a result of their aerial courtship flight during which they display and sing at the elevation of the rotors.

At the Foote Creek Rim project, also in a short-mixed grass prairie habitat, 90 fatalities were recorded, 75 of which were at wind turbines and 15 of which were at meteorology towers with guy wires (Young et al. 2003). Thus about 20% of the fatalities resulted from collisions with guy wires at the meteorology towers and likely would have been avoided by using free-standing towers. Few raptors were found dead at the Foote Creek Rim project (three American Kestrels and one Northern Harrier) and 48% of the fatalities were night migrating birds. Of the migrants, no species accounted for more than 5 to 7 individuals (including Chipping and Vesper Sparrows). Finally, no fatalities were noted by Young (2000) at the two turbines in the Jeffrey Energy Center in Pottawatomie County, Kansas. For all of these studies, the numbers given above are the numbers of carcasses found. The actual number of fatalities is greater because not all carcasses are found by searchers and because scavengers remove some carcasses before searchers can find them. Per turbine per year estimates based on carcass removal and searcher efficiency were made only for the Foote Creek Rim project, for which the rate was about 2.8 birds per turbine per year.

Studies done in the Midwest and eastern United States in tilled agriculture, grassland, and forested settings may be most relevant to the Clayton Project, because: 1) they involve the most similar habitat, and 2) the species that either nest, forage on, or migrate through these sites are similar to those at the Clayton site. These studies have revealed relatively few avian fatalities.

At the Buffalo Ridge wind power facility (approximately 400 turbines) near Lake Benton, Minnesota, relatively small numbers of fatalities have been reported (Johnson et al. 2002) during four years of searching at subsets of the turbines. The fatality rates per turbine ranged between about one bird per turbine per year to nearly 4.5 birds per turbine per year. The species composition included a variety of birds, including one raptor (Red-tailed Hawk), very few waterbirds, and a number of migrating songbirds (about 70% of the 53 documented fatalities). Only about five ducks and coots were found during the study, despite their regular presence around the wind power site and the fact that the wind plant is on a major migration area for waterfowl (Bellrose 1976).

During two years of carcass searches in the Kewaunee County peninsula of Wisconsin about two-dozen songbird (mostly migrants) fatalities were found under 31 turbines situated in farm fields. Perhaps six of the fatalities documented were night migrants. One Mallard and one Herring Gull were the only two waterbirds found dead at this site (Howe et al. 2002). The authors estimated that each turbine killed between one and two birds per year, when searcher efficiency and carcass removal rates were factored into the estimates. A study of two modern wind turbines at Shirley, Wisconsin, revealed one night migrating songbird fatality during a year-long study (Howe and Atwater 1999). A study at a small wind plant in Iowa reported no fatalities (Demastes and Trainor 2000).

In tilled agricultural fields in Iowa, avian fatality rates have been very low (Koford et al. 2005). Roughly 1.5 birds per turbine per year were reported killed at the 89 turbine Top of Iowa project, despite intense use by geese and ducks that feed in the fields surrounding the turbines. No shorebird fatalities were registered. In two years, that study revealed a single raptor fatality and few night migrant fatalities.

In the northeastern United States, where wind farms have only recently been developed, there are fewer in depth studies of collision fatalities at turbines than in the west. But, there is information from six wind power facilities in the eastern United States that are in some ways relevant to the Clayton Project, involving many of the same species and migration behaviors, especially among night migrants. In southeastern Vermont, searches done in June through October 1997 (nesting through fall migration) revealed no fatalities at 11 new, unlit turbines (192 feet [58 m] tall) situated on a forested hilltop (Kerlinger 2000a and 2002). In upstate New York on the Tug Hill Plateau in Lewis County, several months of daily searches during spring and autumn migration beneath two unlit wind turbines (168 feet [51 m] tall) located in open fields revealed no carcasses (Cooper et al. 1995).

At a facility with eight modern turbines (four with red-flashing FAA lights approximately 280 feet [85 m] tall) located in farmland in Somerset County, Pennsylvania, 17 rounds of fatality searches conducted from June 2000 through May 2001 revealed no avian fatalities (Kerlinger 2001). A study conducted in 2003 by biologists at 44 turbines (12 of which were lit with FAA-certified red strobes) at the Mountaineer Wind Energy Center in West Virginia found that the numbers of fatalities (about 4 or more birds per turbine per year, including between two and three night migrants per turbine per year, one duck, and one raptor) did not suggest significant biological impacts (Kerns and Kerlinger 2004).

A more relevant study is from the nearby Madison Wind Power Project, about 85 miles (136 km) south-southeast of the Clayton site. The Madison site has seven modern turbines that reach a maximum height of about 120 m (390 feet) and all lit with FAA red strobes. Four collision fatalities have been recorded below the turbines, plus one at a guyed meteorological tower (Kerlinger 2002). During the spring and fall migrations, each turbine was searched five and six times, respectively. If carcass removal and searcher efficiency rates at the Madison site were similar to those at other projects, the numbers of fatalities would likely be on the order of about 2 to 4+ birds per turbine per year. Of these fatalities, most would be night migrating songbirds and similar species. At another nearby wind power project –Fenner, about 75 miles (120 km) south of the Clayton site, a project with 20 turbines – the plant manager reported no large scale fatality events or raptors or other large bird kills when interviewed in mid 2004 (Paul Kerlinger, pers. comm.). But, it has been reported to author Paul Kerlinger that biologists from the NYSDEC were on site during 2004 and found small numbers of dead bats. Certainly, rigorous post-construction fatality studies are warranted. The results of such studies would make assessing risk at other wind power sites in New York State more reliable.

The greatest fatality rate found for birds at turbines in the United States was about seven birds per turbine per year found under three turbines on a forested mountaintop in eastern Tennessee. The two-year study of the 290 foot (88 m) turbines equipped with white strobes revealed several dozen fatalities, mostly night migrating songbirds (Nicholson 2002). It is ironic that this project was lit with white strobes, the lighting recommended by the USFWS as being the least attractive (risky) to night migrants. Nonetheless, it is possible that the larger rates of fatalities at the Tennessee site are the result of the more southerly latitude of this project, as opposed to others in the eastern United States. There are more migrants at more southerly latitudes, thereby increasing potential risk to night migrants.

Two studies of single turbines situated near or along the shorelines of Lake Ontario near Toronto, Canada, are also of some relevance to the Clayton project. At these sites, these modern wind turbines were found to kill very few birds. One study (James and Coady 2003) was done at a turbine 94 m (308 feet) in height that was within a few hundred meters of the Lake Ontario shoreline. The other turbine (117 m; 384 feet) was located at a marsh a few miles inland from Lake Ontario.

As summarized above, studies at these and other sites have shown fatalities to be relatively infrequent events at wind farms. No federally listed endangered or threatened species have been recorded, and only occasional raptor, waterfowl, or shorebird fatalities have been documented. In the Midwestern and eastern United States, night migrating songbirds have accounted for a majority of the fatalities at wind turbines. In general, the documented level of fatalities has not been large in comparison with the source populations of these species, nor have the fatalities been suggestive of biologically significant impacts.

6.2 Avian Risk Assessment for the Clayton Wind Farm

6.2.1 Disturbance and Displacement Risk at the Clayton Wind Farm

Because much of the habitat within the Project site is grassland, there is the potential for disturbance and displacement of some grassland nesting birds, including state-listed threatened and special-concern species for which the habitat appears suitable. In the wooded areas within the site, the disturbance and displacement potential is likely to be minimal, as explained below. In addition, some birds may be displaced temporarily from both types of habitats during the Project's construction phase, as heavy equipment passes through the area and as new roads are constructed. This impact is likely to be temporary and decrease markedly after construction.

Impacts to grassland-nesting songbirds are likely to include displacement of individuals nesting within 100 to 200 or more meters (325 to 650 or more feet) of turbines in some cases, or reduced densities of species within 100 to 200 m of the turbines. The species that may be affected include Savannah Sparrow, Bobolink, and Eastern Meadowlark, plus the threatened Northern Harrier, Upland Sandpiper, Sedge Wren, and Henslow's Sparrow, and the special-concern Horned Lark, Vesper Sparrow, and Grasshopper Sparrow. The degree to which these species are affected depends of the nesting locations and densities relative to the wind turbine placements. If they are displaced, it is not known how far this displacement would extend from the turbines, because detailed studies have not yet been conducted in New York State.

The long-term significance of this disturbance and displacement cannot entirely be understood without examining the long-term integrity and maintenance of the grassland-like habitats that now compose so much of the Project site. If fields that now support nesting grassland bird species succeed into woodland in ten years, as is the case for much abandoned farmland throughout New York State, grassland birds will be displaced from those areas despite the construction of wind turbines. If the grassland-like habitats are maintained over the long-term, grassland birds can be expected to continue nesting on site. It is also not known if populations of grassland-nesting birds that are impacted by hay mowing on site are viable populations in the long-term, but BBA data from 1980-1985 and 2000-2004 indicate that the diverse grassland bird community in the Project area has persisted. Nevertheless, any attempt to determine the significance of impacts to these birds from wind turbines would have to consider the cumulative impacts of agricultural practices, farm conversion, and other deleterious impacts to these declining species.

It is also not known if grassland birds that would potentially be displaced can or do habituate to the presence of turbines. Some birds do habituate, as stated in the previous section, but long-term studies at wind power facilities have yet to be conducted, so the degree to which grassland birds habituate is not known.

With respect to forest nesting birds, habitat alteration from turbine construction will affect the forest edges and relatively small forest patches within the wind farm area.

This activity will displace some birds that currently nest in these habitats. It is unlikely that the turbines would, in the long term, displace many birds nesting in the forest edges and patches. Living among trees, forest dwelling birds appear to have a greater ability to habituate to tall structures. Kerlinger (2002) found modest disturbance to forest dwelling songbirds at a wind power site in Vermont, but no long term studies on habituation have been conducted. There have also been no quantitative studies on displacement distance for these types of birds.

With respect to raptors that nest in trees at the Project area, minor disturbance impacts may occur if turbines are placed near nesting sites of Red-tailed Hawks and American Kestrels, the most likely raptors to nest in the site's wooded areas. The same would also be true for any Sharp-shinned Hawks, Cooper's Hawks, and Northern Goshawks (all species of special concern recorded in the BBA) that might nest in the site's woodland areas. Disturbance resulting from actual construction activity is likely to be temporary and will occur only over a few months. It is likely that nesting Red-tailed Hawks and American Kestrels will habituate to the presence of turbines, especially after most construction equipment and workers have left the site. It is noteworthy that these species, plus the Northern Harrier, have been recorded to forage near (sometimes even beneath) turbines and are likely with time to habituate to the presence of turbines within their foraging areas. These and other foraging raptors have demonstrated habituation to the presence of wind turbines, as is evident from studies conducted in the APWRA (Orloff and Flannery 1992).

Because of the proximity of the Perch River WMA, migrating waterfowl and some summering Canada Geese can be expected to forage in the farm fields within the proposed wind farm area, sometimes in substantial numbers. Displacement impact on waterfowl – particularly Canada and Snow Geese, the species likeliest to forage in the farm fields – is not likely to be significant, given the large amount of agricultural habitat in the general area and based on some other studies (Koford et al. 2005). Canada Geese often habituate quickly to human structures. .

6.2.2 Collision Risk at the Clayton Wind Farm

6.2.2.1 Listed Species

Available data demonstrate that federally listed species are likely to be absent at the Project site, strongly indicating that there will be no adverse impacts to those species. In the case of the Bald Eagle, which is federally listed as threatened, birds may fly over the site at any time of the year (the BBA has recently confirmed Bald Eagle nesting in Jefferson County). While Bald Eagles are unlikely to use the Project site for nesting or foraging, the bird's expanding population in New York State may eventually bring it to nest in the adjacent Perch River WMA. Bald Eagles, however, are not known to be susceptible to colliding with structures such as wind turbines (see species lists in Erickson et al. 2001) or communication towers (see species list in Shire et al. 2000).

With respect to state-listed grassland species, the weight of evidence from the BBA and IBA's suggests that a number of species nest on the project site. But it is difficult to assess collision risk because the location and density of birds with regard to wind turbine placements is not known. Listed species that have aerial courtship displays could be at risk of collision during those activities, if they regularly fly in circles at 100-200 feet (30-60 m) above the ground. Such species would include Short-eared Owl (endangered), Northern Harrier (threatened), Upland Sandpiper (threatened), and Horned Lark (special concern).

6.2.2.2 Raptors

Risk to listed and unlisted raptors at the Project area is not likely to be biologically significant. The numbers of fatalities will probably be small and limited primarily to Red-tailed Hawk, American Kestrel, and perhaps other species in rare instances. The species most likely to be impacted are those that forage in open country, as opposed to migrating raptors that pass through the site or general area.

The Northern Harrier (threatened) forages and probably nests on site, as was evident from the site visit, BBA data, and IBA analysis. These birds are at some risk of collision with turbines, although documented fatalities involving Northern Harriers at wind power facilities are rare. Harriers occur regularly at wind power sites in the western and Midwestern United States, yet there are only a few records of collisions. The low foraging flight of these birds is generally below the rotor-swept height, but their aerial displays during the nesting season can put them at rotor height and at increased risk of collision.

Sharp-shinned Hawk, Cooper's Hawk, and Northern Goshawk (all special concern) were recorded in the BBA in Project area. During the breeding season, they can be expected to forage within forested areas, not open country. As a consequence, they will not be at particular risk of collision.

As demonstrated in Table 6.2.2.2-1, the known or suspected risk factors for raptors are not apparent at the Clayton Wind Farm site. That the Clayton Project will have relatively few turbines in comparison with the 5,400 that are present in the APWRA, suggests small numbers of fatalities. At the APWRA, raptor numbers are very high throughout the year, and dozens (if not hundreds) of raptors forage there, as opposed to much smaller numbers at the Clayton site.

Table 6.2.2.2-1. Comparison of Risk Factors

Known or Suspected Risk Factors Altamont Pass Wind Resource Area (APWRA)	**Comparison of Risk Factors Proposed Clayton Wind Power Project**
Large concentration of turbines (about 5,400 in 2002)	Up to about 70 turbines
Lattice towers that encourage raptors to perch	Tubular towers, no perching
Fast rotating turbine blades (40-72 rpm)	Slow rotating blades (12-18 rpm)
Closely spaced turbines (less than 30 m [100 feet] apart)	Widely spaced turbines (greater than 250 m [800 feet])
Turbines in steep valleys and canyons	Turbines on gently to moderately rolling hills
Large prey base that attracts raptors	Minimal prey base
Turbine rotors sweep to less than 10 m (30 feet) from ground	Turbine rotors sweep down to about 35 m (115 feet)
High raptor and susceptible species use of area	Low to moderate raptor use of area

Risk to migrating raptors should not be significant at the Clayton site, as there are no noteworthy hawk migration sites in the project's vicinity. The closest site is the Derby Hill Hawk Watch, located 40 miles (64 km) to the south-southwest. Where concentrated hawk migration does occur around wind energy sites, evidence so far shows that risk to migrating raptors is not great and not likely to be biologically significant. At the Mountaineer Wind Energy Facility on Backbone Mountain (a long, linear ridge) in West Virginia, a study by Kerns and Kerlinger (2004) found that only one raptor, a Red-tailed Hawk, was killed during a year of study. Reports from Tarifa, Spain, where raptor migration is highly concentrated, strongly suggest strongly that migrating raptors rarely collide with turbines (DeLucas et al. 2004). At the Meyersdale Wind Power Project site in southwestern Pennsylvania, a few thousand hawks migrate along the ridge each autumn. But, it is not known if these birds collide with turbines at rates that are biologically significant, because no studies have been conducted there during the migration season.

6.2.2.3 Nocturnal Migrants

Night migrating songbirds and other small night migrants comprise the majority of the birds killed at wind power projects, especially at eastern and Midwestern wind farms. Nonetheless, the collision-mortality studies conducted to date (summarized in Appendix D) have not reported large or significant numbers of mortalities of night migrants. Most reports involve single birds killed by a turbine on a given night, unlike the large-scale events documented over the past 60 years at communication towers greater than 500-600 feet (152-183 m) in height (Avery et al. 1980).

That nocturnal migrants collide at a lower rate with wind turbines, compared with tall communication towers, is related to the much greater height of communication towers, as well as to the presence of guy wires (Kerlinger 2000c) and steady-burning FAA red lights (L-810 obstruction lights) on communication towers. A majority of night migrants fly at altitudes between 300 and 2,500 feet (91-915 m) above ground level (Kerlinger 1995, Kerlinger and Moore 1989), with small numbers flying above 5,000 feet (1,524 m). Except for landing and taking off, fewer migrants fly below about 500-600 feet (152-183 m) than above that height range. Mean hourly altitudes usually average about 1,200 to 1,500 feet (366-457 m) (Able 1970, Cooper et al. 2004a, 20004b).

Because the rotors of most modern turbines extend to about 300-390 feet (90-120 m), relatively small numbers of migrants passing over a site such as the proposed Clayton site are likely to fly within the height range of turbine rotors. The turbines proposed for use at Clayton would be about 50 feet (16 m) and 100 feet (31 m) taller than those situated on Appalachian ridges in West Virginia (Kerns and Kerlinger 2004) and Tennessee (Nicholson 2002), respectively. But, the turbine placements in West Virginia and Tennessee have not been demonstrated to present significant risk to night migrants. In addition, the Clayton turbines would be hundreds of miles farther north than those in Appalachia. In addition, they would be to the north of turbines at the Madison and Fenner wind power facilities, also situated in New York State, which have not been reported to impact large numbers of migrants. Wind power sites that are farther north experience a lower passage rate than those farther south because the source area is smaller at more northern sites.

The communication towers that are responsible for a vast majority of avian fatalities, including virtually all of those where large numbers have been killed in a single night, are almost entirely taller than 500-600 feet (152-183 m; from literature and recent unpublished studies). Such towers are much taller than the turbines proposed for the Clayton Project. The most recent literature surveys conducted by the USFWS and the U.S. Department of Energy (Trapp 1998, Kerlinger 2000b, Kerlinger 2000c) reveal virtually no large scale mortality events at communication towers less than 500-600 feet in height. It should be noted that the few communication towers less than 500 feet in height that have been associated with reports of large-scale fatality events have been equipped with steady burning sodium vapor lights or other bright lights (Kerlinger 2004a,b). Very attractive to birds, sodium vapor lights are very different from the lights stipulated by the FAA for wind turbines.

The fact that there are no guy wires on modern wind turbines is of critical importance, because it is the guy wires of tall communication towers that account for almost all of the collisions. The literature does not reveal fatalities at unguyed communication towers that are as tall as 475 feet with very few exceptions (J. Gehring, Central Michigan University, unpublished study of communication towers in Michigan). Recently, studies at 400-475 foot tall unguyed communication towers revealed between about zero and two birds killed per tower per year, although those results are preliminary. No other published studies have revealed collision fatalities at unguyed towers, including unguyed meteorology towers at wind power sites (W. Erickson personal communication, Kerns and Kerlinger 2004).

The last risk factor that has been implicated in collisions of night migrating birds with tall structures is lighting (Kerlinger 2000c). The lights of communication towers and some other structures have been demonstrated to attract migrants that then collide with the structure. The lighting on wind turbines is very different from the lighting on communication towers (FAA Advisory Circular). Wind turbines almost never have the steady-burning red lights (L-810 obstruction lights) that are present on communication towers. There is one exception – a few turbines at Buffalo Ridge in Minnesota have this lighting. Note that on the 1,000 foot tall communication towers where large fatality events have occurred, all have been equipped with up to 12 steady burning red L-810 obstruction lights as well as flashing L-864 red lights.

Research by Kerns and Kerlinger (2004) has not demonstrated any large-scale fatality events at wind turbines, nor has it shown any difference in numbers of fatalities at lit versus unlit turbines. Similar results from wind plants in Washington, Oregon, and Minnesota have supported this finding. Kerns and Kerlinger (2004) did find a fatality event involving about 30 night migrating songbirds in May 2003. That event occurred on a very foggy night and it occurred at an electrical substation involving mostly one turbine and the substation fencing. Birds were apparently attracted to four sodium vapor lamps on the substation and collided with the three closest turbines (mostly the closest turbine) and the substation infrastructure. Interestingly, almost no birds were found at the 41 other turbines at that project, despite 11 of them being lit with red flashing, L-864 lights. A smaller fatality event, involving 14 migrants at two adjacent turbines in Minnesota is also of interest. Seven birds were found at each of these turbines and one was equipped with steady burning red lights. This suggests that steady burning red lights can attract birds.

The fact that no large scale mortality events involving night migrating birds have been documented at wind turbines anywhere, combined with the fact that there is no difference between the numbers of birds killed at lit versus unlit wind turbines at sites across the United States, strongly suggests that FAA obstruction lighting for wind turbines (red flashing, L-864 lights) does not have the same attractive effect as the steady burning red lights of communication towers (Kerlinger 2004a, b). Furthermore, the FAA does not stipulate that all wind turbines be lit.

For the reasons presented above, collision risk to night migrating songbirds is likely to be minimal and fatalities are not likely to be biologically significant at the proposed Clayton Wind Farm.

6.2.2.4 Waterbirds

Shorebirds can be expected to migrate over the site, but this would be mostly at night and at high altitudes (Kerlinger and Moore 1989). Moreover, research has demonstrated that very few shorebirds collide with wind turbines or other tall structures. Shorebirds are extremely rare on the lists of birds killed at wind plants (Erickson et al. 2001), and they are almost nonexistent at communication towers (Shire et al. 2000). They are also not known to be attracted to lights (FAA or other types). Therefore, shorebirds are not likely to be at significant risk of colliding with these wind turbines at the Clayton site, even when stopping over at the Perch River WMA.

Risk of collision to waterfowl and other waterbirds during migration is also likely to be minimal, because these birds migrate at such high altitudes (Kerlinger and Moore 1989, Bellrose 1976) and because this group of birds has not demonstrated a propensity to collide with wind turbines (or communication towers). The Canada Geese and Snow Geese that forage on the Clayton Project site, during migration and at other times, may experience a slightly higher level of risk. However, Canada Geese have never demonstrated susceptibility to colliding with turbines (Koford et al. 2005, Erickson et al. 2001) or communication towers (Shire et al. 2000); therefore, they are unlikely to be at significant risk and may be at no risk.

Risk to nesting waterbirds (waterfowl, long-legged waders, shorebirds, rails, etc.) at the Project site is likely to be minimal, even with the high quality aquatic habitat adjacent to the site at the Perch River WMA, because these species are unlikely to forage within the wind farm area. Because there are small wetland areas within the Project boundary, some waterbirds such as bitterns and rails may be present, at which time they could be at risk of colliding with turbines. Waterbirds were poorly represented, however, in the BBA blocks that covered the Project site but not the Perch River WMA or other wetland areas.

7.0 Findings

The following conclusions are based on an examination of the habitat and topography present at the Clayton Wind Farm site and from the literature search:

1. The Project is located on nearly level to gently rolling land within 7.5 miles (12 km) of Lake Ontario and the St. Lawrence River. Land ownership is private, and land use (primarily agriculture with some residential housing and perhaps limited forestry) should continue relatively unchanged following construction of the wind farm. There is the future possibility, however, that grassland areas released from agriculture may, if not managed, succeed into woodland and be lost as habitat for nesting grassland birds, including many state-listed species. Grassland management is an issue highlighted in the description of the Perch River Grasslands, an Important Bird Area (IBA) that overlaps the Project site (see http://ny.audubon.org/iba/perchrivergrasslands.html).

2. All sections of the Clayton site have grassland habitat consisting of hay fields, cover crops, pasture, fallow fields, brushy areas, and old fields. Forest-type habitat throughout the site is highly fragmented and accounts for about 10% of habitat coverage. Wind turbines and related infrastructure would mainly be located in the agricultural lands and grasslands, with some portions of the wind farm adjacent to or within forest patches.

3. Based on an examination of the habitat present, BBA data, IBA descriptions, and other literature sources, the wind farm's predominant agricultural and grassland habitats appear to be high quality nesting habitat for grassland birds. Nesting grassland birds could include all or some of the following species: state-listed threatened Northern Harrier, Upland Sandpiper, Sedge Wren, and Henslow's Sparrow; special-concern Horned Lark, Vesper Sparrow, and Grasshopper Sparrow; and protected Savannah Sparrow, Bobolink, and Eastern Meadowlark. There is the remote possibility that the endangered Short-eared Owl might also breed in these grasslands, although there are no recent records. Birds that inhabit forest edges and forest interiors would be farther from turbine placements than grassland birds. These likely include the following state-listed species of special concern: Sharp-shinned Hawk, Cooper's Hawk, Whip-poor-will, and Golden-winged Warbler. Northern Goshawk, Red-shouldered Hawk, and Cerulean Warbler are less likely to breed on the site.

4. As detailed in the preceding bullet, several New York State-listed species and species of concern likely nest on the site. There is no suitable habitat on site, however, for federally listed endangered or threatened species. On occasion, Bald Eagles (federally threatened) may fly over the site. As its population continues to expand in New York State, the Bald Eagle may eventually nest at the adjacent Perch River Wildlife Management Area (WMA).

5. The Project site is located near a number of ecological features that could attract large numbers of migrants to stopover, particularly waterfowl. These include the adjacent Perch River WMA and nearly Lake Ontario and St. Lawrence River. Night migrating songbirds are likely to be spread rather evenly throughout the region, except closer to Lake Ontario where aggregations of migrants making stopovers probably occur.

6. The habitat on site does not suggest large concentrations of wintering birds or the presence of state or federally listed species during that season, but significant numbers of wintering Short-eared Owls (endangered) and Northern Harriers (threatened) have been recorded at the Point Peninsula IBA, about 8 miles (12.8 km) southwest of the Project site. The upper St. Lawrence River is also known as a wintering area for waterfowl. It is located 7.5 miles (12 km) northwest of the project site. The Perch River WMA likely hosts migratory waterfowl in significant numbers. Waterfowl may remain in the WMA into early winter, until the aquatic habitats freeze over. Other IBA's and wildlife management areas are also located within 5 to 10 miles (8 to 16 km) of the Project site.

7. The Project will likely displace grassland nesting species, including some New York State-listed species, which, based on available evidence, probably nest within the Project site. Such impacts are not likely to be regionally or globally significant, but could affect locally nesting populations. Because there are no indicative studies from other wind energy sites, it is not known if these species would habituate to the presence of turbines. Recommendations are made below to prevent and mitigate potential impacts.

8. The project may also displace forest and forest-edge nesting species, including New York State-listed species of special concern, which, based on available evidence, likely nest within the Project site. Such impacts are not likely to be regionally or globally significant, but could affect locally nesting populations. Given that forest cover is 10% of the available habitat, and that forest birds are more tolerant of tall structures, displacement impact will likely be less than with grassland birds.

9. Collision impacts at the Clayton Project are likely to be similar to those found to date at the Madison Wind Power Project in central New York State, and other existing wind power projects in the Midwestern and eastern United States. As various studies at existing wind energy sites indicate, fatalities at the Clayton site are not likely to be biologically significant.

8.0 Recommendations

The following recommendations for the proposed Clayton Wind Farm Project are based on a site examination of the habitat and on literature and database searches regarding the Project site's avifauna and what is known about the potential risks to birds from wind power development in the United States and Europe.

- Electrical lines within the project site should be underground between the turbines and any new above ground lines from the site and substations to transmission lines should follow APLIC (Avian Power Line Interaction Committee) guidelines for insulation and spacing.

- Permanent meteorology towers should be free-standing (i.e., without guy wires) to prevent the potential for avian collisions.

- Size of roads and turbine pads should be minimal in order to limit habitat disturbance as much as possible. After construction, any natural habitat should be permitted or encouraged to regenerate as close to the turbines and roads as possible. This measure will minimize habitat fragmentation and disturbance impacts.

- Lighting of turbines and other infrastructure (e.g., substations and buildings) should be minimal in order to reduce the potential for attracting night migrating songbirds and similar species. FAA lighting for night use should be flashing lights (red or white) with the longest permissible off cycle. No steady burning FAA lights should be used. Sodium vapor lamps and spotlights should not be used at any facility at night, except when emergency maintenance is needed.

- A post-construction study of collision fatalities would be helpful to expand the existing data base and allow for more informed decisions regarding future wind power development in New York State. Such a study would provide information on the number and type of fatalities that occur. It would also determine the biological significance and potential cumulative impact of turbine development in New York and the eastern United States.

- Because the habitat on site appears to be suitable for New York State listed species and species of concern, a nesting bird survey should be undertaken to determine the distribution and densities of these species, particularly grassland birds. The threatened Northern Harrier, Upland Sandpiper, Sedge Wren, and Henslow's Sparrow, and the special-concern Horned Lark, Vesper Sparrow, and Grasshopper Sparrow are likely present in grassland habitats that would be occupied by wind turbines and related infrastructure. The special-concern Sharp-shinned Hawk, Cooper's Hawk, Whip-poor-will, Golden-winged Warbler, and possibly other listed species may occur in wooded habitats where turbines and related infrastructure may be located. Such a survey would include mapping areas where these birds nest in relation to planned turbine and road locations. The results of this survey may be used to prevent or mitigate disturbance impacts and displacement of these species. Should a nesting survey be conducted, its design should involve consultation with NYSDEC biologists prior to implementation.

- Raptor and waterfowl use of the Project site, particularly during migration (but also in late fall and winter in the case of raptors, given the high concentration of wintering raptors reported at the Point Peninsula IBA), should be determined through a flight-use study. Should such a survey be conducted, its design should involve consultation with NYSDEC biologists prior to implementation.

- Radar studies should be conducted at the site in order to determine flight patterns of night migrants (direction, altitude, and numbers of birds) passing over the wind farm site. Should such a survey be conducted, its design should involve consultation with NYSDEC biologists prior to implementation.

- The future of grassland and brushland bird communities at the Clayton site depends on the long-term management of their habitats, which farmers are presently accomplishing through some agricultural practices. While wind energy development may displace grassland birds from the areas around where the turbines are located, it would limit other types of development that could more severely impact grassland habitat and its birds. Wind energy development can also provide incentives that maintain grassland habitats. These options should be explored, along with cooperative agreements between the NYSDEC and landowners.

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<u>Appendix A-1.</u> Photographs of representative habitat at the proposed Clayton Wind Farm Site, Jefferson County, New York.

Appendix A-2. Photographs of representative habitat at the proposed Clayton Wind Farm Site, Jefferson County, New York.

Appendix B. Birds Observed at the Site of the proposed Clayton Wind Farm on November 8 and 9, 2004.

(NYSDEC-listed species are highlighted; T = Threatened; SC = Special Concern)

Snow Goose
Canada Goose
Northern Harrier (T)
Sharp-shinned Hawk (SC)
Cooper's Hawk (SC)
Northern Goshawk (SC)
Red-tailed Hawk
Rough-legged Hawk
Golden Eagle (T)
American Kestrel
Ring-necked Pheasant
Ruffed Grouse
Wild Turkey
Ring-billed Gull
Herring Gull
Rock Dove
Morning Dove
Downy Woodpecker
Hairy Woodpecker
Blue Jay
Common Raven
American Crow
Horned Lark (SC)
Black-capped Chickadee
White-breasted Nuthatch
Golden-crowned Kinglet
Eastern Bluebird
American Robin
European Starling
American Pipit
Cedar Waxwing
American Tree Sparrow
Fox Sparrow
Song Sparrow
White-throated Sparrow
Dark-eyed Junco
Snow Bunting
Northern Cardinal
Red-winged Blackbird
Brown-headed Cowbird
Purple Finch
House Finch
American Goldfinch
Evening Grosbeak
House Sparrow

<u>Appendix C.</u> Birds Recorded in the Vicinity of the Project Site during the 2000-2004 Breeding Bird Atlas (BBA) Project.

NB: This list was compiled from the nine BBA quadrants that include sections of the proposed Clayton Wind Farm. The breeding status listed (possible, probable, or confirmed) is the highest status recorded in one or more of the nine quadrants. The Project site does not include aquatic or wetland habitats that support many of the waterbirds listed below. But, quality habitat for waterbirds is located adjacent to the proposed wind farm site at the Perch River Wildlife Management Area (see Figure 3).

(NYSDEC-listed species are highlighted; E = Endangered, T = Threatened, SC = Special Concern)

Pied-billed Grebe (T) – Confirmed
Double-crested Cormorant – Confirmed
American Bittern (SC) – Probable
Least Bittern (T) – Possible
Great Blue Heron – Possible
Green Heron – Probable
Black-crowned Night-heron – Confirmed
Turkey Vulture – Probable
Canada Goose – Confirmed
Mute Swan – Possible
Trumpeter Swan – Confirmed
Wood Duck – Confirmed
Gadwall – Possible
American Wigeon – Possible
American Black Duck – Possible
Mallard – Confirmed
Blue-winged Teal – Probable
Northern Shoveler – Probable
Common Merganser – Possible
Hooded Merganser – Possible
Osprey (SC) – Confirmed
Bald Eagle (T) – Possible
Northern Harrier (T) – Confirmed
Sharp-shinned Hawk (SC) – Confirmed
Cooper's Hawk (SC) – Probable
Northern Goshawk (SC) – Confirmed
Red-tailed Hawk – Confirmed
American Kestrel – Confirmed
Ring-necked Pheasant – Confirmed
Ruffed Grouse – Confirmed
Wild Turkey – Confirmed
Virginia Rail – Probable
Common Moorhen – Confirmed
American Coot – Confirmed
Killdeer – Confirmed
Spotted Sandpiper – Confirmed
Upland Sandpiper (T) – Probable
Wilson's Snipe – Probable
American Woodcock – Confirmed
Ring-billed Gull – Possible
White-winged Tern – Confirmed
Black Tern (E) – Confirmed
Rock Pigeon – Confirmed
Mourning Dove – Confirmed
Black-billed Cuckoo – Probable
Yellow-billed Cuckoo – Possible
Eastern Screech-Owl – Confirmed
Great Horned Owl –Probable
Whip-poor-will (SC) – Confirmed
Chimney Swift – Confirmed
Ruby-throated Hummingbird – Confirmed
Belted Kingfisher – Confirmed
Red-bellied Woodpecker – Possible
Downy Woodpecker – Confirmed
Hairy Woodpecker – Confirmed
Northern Flicker – Confirmed
Pileated Woodpecker – Confirmed
Eastern Wood-Pewee – Probable
Yellow-bellied Flycatcher – Possible
Alder Flycatcher – Probable
Willow Flycatcher – Probable
Least Flycatcher – Probable
Eastern Phoebe – Confirmed
Great Crested Flycatcher – Confirmed
Eastern Kingbird – Confirmed
Yellow-throated Vireo – Probable
Warbling Vireo – Confirmed
Red-eyed Vireo – Confirmed
Blue Jay – Confirmed
American Crow – Confirmed
Horned Lark (SC) – Probable
Tree Swallow – Confirmed
N. Rough-winged Swallow – Confirmed
Bank Swallow – Confirmed

Cliff Swallow – Confirmed
Barn Swallow – Confirmed
Black-capped Chickadee – Confirmed
Red-breasted Nuthatch – Confirmed
White-breasted Nuthatch – Confirmed
Brown Creeper – Possible
House Wren – Confirmed
Sedge Wren (T) – Probable
Marsh Wren – Confirmed
Eastern Bluebird – Confirmed
Veery – Probable
Hermit Thrush – Probable
Wood Thrush – Probable
American Robin – Confirmed
Gray Catbird – Confirmed
Northern Mockingbird – Confirmed
Brown Thrasher – Confirmed
European Starling – Confirmed
Cedar Waxwing – Confirmed
Blue-winged Warbler – Probable
Golden-Winged Warbler (SC) – Probable
Nashville Warbler – Confirmed
Yellow-Warbler – Confirmed
Chestnut-sided Warbler – Probable
Yellow-rumped Warbler – Confirmed
Black-throated Green Warbler – Probable
Pine Warbler – Possible
Prairie Warbler – Confirmed
Black-and-white Warbler – Confirmed
American Redstart – Confirmed
Ovenbird – Confirmed
Common Yellowthroat – Confirmed
Scarlet Tanager – Probable
Eastern Towhee – Confirmed
Chipping Sparrow – Confirmed
Clay-colored Sparrow – Probable
Field Sparrow – Confirmed
Vesper Sparrow (SC) – Probable
Savannah Sparrow – Confirmed
Grasshopper Sparrow (SC) – Probable
Henslow's Sparrow (T) – Probable
Song Sparrow – Confirmed
Swamp Sparrow – Confirmed
White-throated Sparrow – Confirmed
Dark-eyed Junco – Possible
Northern Cardinal – Probable
Rose-breasted Grosbeak – Confirmed
Indigo Bunting – Probable
Bobolink – Confirmed
Red-winged Blackbird – Confirmed
Eastern Meadowlark – Confirmed
Common Grackle – Confirmed
Brown-headed Cowbird – Confirmed
Baltimore Oriole – Probable
Purple Finch – Confirmed
House Finch – Confirmed
American Goldfinch – Confirmed
House Sparrow – Confirmed

Total Species:	132	
Confirmed Breeders:	65	(58%)
Probable Breeders:	24	(21%)
Possible Breeders:	24	(21%)

<u>Appendix D.</u> Review of Avian Mortality Studies

The numbers provided are, in most cases, recorded fatalities. When observer efficiency and carcass removal by scavengers are factored in, the actual numbers of fatalities are greater.

- **New York -** Tug Hill Plateau, 2 modern turbines in farmland, 2 migration seasons, 0 fatalities, Cooper et al. 1995

- **New York –** Madison, 7 modern turbines on farmland, 1 year, 4 fatalities (2 songbird migrants, 1 owl, 1 woodpecker), Kerlinger 2002

- **Vermont –** Searsburg near Green Mountain National Forest, 11 modern turbines on forested mountain top studied during nesting and fall migration season, 0 fatalities, Kerlinger 2002

- **Pennsylvania –** Garrett (Somerset County), 8 modern turbines, farm fields, 12 months, 0 fatalities, Kerlinger 2001

- **West Virginia –** Mountaineer WEC, 44 modern turbines on forested ridge, 1 year study (22 searches of all turbines), 69 fatalities found, 200+ fatalities (4+ fatalities per turbine per year; mostly night migrating songbirds, 1 Red-tailed Hawk), Kerns and Kerlinger 2004

- **Tennessee –** Buffalo Mountain, 3 turbines on forested/strip-mined mountain, 2 years, ~7 fatalities per turbine per year (night migrating song and other birds), Nicholson 2001, 2002

- **Massachusetts** - Hull, 1 modern turbine, open grassy fields adjacent to school and ferry terminal on island in Boston Harbor, informal searches for at least 1 year on dozens of occasions have revealed no fatalities, Malcolm Brown, personal communication, 2002

- **Minnesota –** Buffalo Ridge near Lake Benton, 200+ modern turbines in farm and grassland, 4 years (1996-1999), 53 fatalities found, 2-4 fatalities per turbine per year (mostly songbirds and 1 hawk); displacement found among grassland nesting songbirds; Johnson et al. 2002

- **Kansas –** St. Mary’s, 2 modern turbines in grassland prairie, 2 migration seasons; 33 surveys, 0 fatalities, Young 1999

- **Wisconsin –** Kewaunee County Peninsula, 31 modern turbines in farmland, 2 years (4 migration seasons), 25 fatalities, ~1.3 fatalities per turbine per year, (3 waterfowl, 14 songbirds, some night migrants), Howe et al. 2002

- **Wisconsin –** Shirley, 2 modern turbines in farmland, 54 surveys, 1 fatality (night migrating songbird), report to Wisconsin Department of Natural Resources Bureau of Integrated Science Services, Richter Museum of Natural History Special Report, and Howe and Atwater 1999

- **Iowa –** Algona, 3 modern turbines in farmland, three seasons, 0 fatalities, Demastes & Trainer 2000

- **Iowa –** Top of Iowa, 89 modern turbines in tilled agriculture, 2 years, 7 carcasses found at 26 turbine searched, ~1.5 birds per turbine per year, 1 Red-tailed Hawk, few night migrants, no waterfowl or shorebirds killed; Koford et al. 2005

- **Colorado –** Ponnequin, 29 (44 in 2001) modern turbines in rangeland, 5 years - 1999-2003, ~ two dozen birds per year, 1 duck, 1 American Kestrel fatality, Curry & Kerlinger unpublished data

- **Wyoming –** Foote Creek Rim, 69 modern turbines in rangeland, 2 years, 75 turbine fatalities (songbirds, including 48% night migrants, plus 4 raptors), 1.8 fatalities per turbine per year, Young et al. 2003 (15 additional fatalities were at guyed meteorology towers)

- **Oregon –** Klondike, 16 modern turbines in rangeland and shrub-steppe, 1 year, 8 fatalities found (songbirds, including 50% night migrants, plus two Canada Geese), 1.3 fatalities per turbine per year, Johnson et al. 2003

- **Oregon –** Vansycle, 38 modern turbines in farm and rangeland, 1 year, 11 birds (7 songbirds, including about 4 night migrants, and 4 gamebirds), Erickson et al. 2000

- **Oregon-Washington –** Stateline Project, 1.5 years, 106 fatalities including 7 raptors (28+ bird species total) at 124 or 399 modern turbines in farmland, 1.7 fatalities per turbine per year, 1.0 fatalities per turbine per year, Erickson et al. 2003

- **Washington –** Nine Canyons – 37 modern turbines, 1 year, prairie and farmland, 36 bird fatalities found (mostly songbirds, 1 kestrel, 1 Short-eared Owl), 3.6 fatalities per turbine per year, Erickson 2003

- **California** - Altamont Pass Wind Resource Area (APWRA), 5,400 older turbines mostly on lattice towers in grazing and tilled land, many years, large numbers of raptor fatalities (>400 reported) and some other birds, Howell and DiDonato,1991, Howell 1997, Orloff and Flannery 1992, 1996, Kerlinger and Curry 1997, Thelander and Rugge 2000

- **California –** Montezuma Hills, 237 older turbines, 11 modern turbines in tilled farmland, 2+ years, 30+ fatalities found (including 10 raptors, 2 songbirds, 1 duck), Howell 1997

- **California** - San Gorgonio Pass Wind Resource Area, thousands of older turbines, 120 studied in desert, 2 years, 30 fatalities (9 waterfowl, 2 raptors, 4 songbirds, etc.), Anderson et al. 2000

- **California** - Tehachapi Pass Wind Resource Area, thousands of turbines, 100s of mostly older turbines studied, in Mojave Desert mountains (grazing grassland and scrub), 2+ years, 84 fatalities (raptors, songbirds), Orloff 1992, Anderson et al. 2000

Canada

- **Ontario –** Pickering Wind Turbine, 1 modern turbine (384 feet, 117 m) near a marsh, 2 migration seasons, 2 nocturnal migrant fatalities (James, unpublished report)

- **Ontario –** Exhibition Place, 1 modern turbine (308 feet; 94 m) in Toronto on the lakefront, 2 migration seasons, 1 starling and 1 American Robin fatality; mortality projected at 3 birds per year (James and Coady 2003)

Appendix E

Conformance with U. S. Fish and Wildlife Service Guidelines

This addendum addresses the recent issuance by the U.S. Fish and Wildlife Service's (USFWS) of the document, *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines* (USFWS 2003). The Federal Register published these guidelines in early July 2003, and USFWS briefed the National Wind Coordinating Committee on them on July 29, 2003. USFWS has emphasized that the guidelines are interim and voluntary. The Federal Register has opened a comment period that will last two years. The guidance document has not yet been reviewed by professional wildlife biologists outside the USFWS, nor has USFWS amended the document based on the significant public comment it has received over the past year. In April 2004, USFWS Director Williams sent a letter to the Service's state offices directing them regarding the implementation of the guidance document and its recommendations.

It should be noted that the risk assessment conducted for the Clayton Project relied on procedures similar to those presented in the USFWS guidelines, as well as other procedures that exceed what is usually requested by USFWS. For many years, the standard Phase I Avian Risk Assessment process has incorporated most of the guidelines and recommendations made by USFWS, particularly those that have been shown to be scientifically valid. Therefore, the risk assessment presented above fulfills the intent of the guidance document and follows its recommendations in order to avoid or minimize impacts to wildlife, specifically birds and their habitats.

Specific Conformance to Guidelines

<u>Teaming With Agencies</u>. Letters have been sent to the New York State Natural Heritage Program (NHP) and the USFWS Cortland, New York office requesting information on listed species and species of special concern, as well as other bird information. Approaching these agencies meets the recommendation by USFWS that developers should attempt to team or involve such agencies in the site evaluation process. There does not appear to be a federal nexus for the Clayton Project, although the New York State Department of Environmental Conservation (NYSDEC) will likely be involved through New York State Environmental Quality Review (SEQR) process. If work within wetlands is required for roads or turbine locations, a federal nexus will occur through the U.S. Army Corps of Engineers (USACOE), which often defers to USFWS with respect to wildlife issues.

<u>Reference Sites</u>. The Clayton Wind Farm site was compared to other wind power facilities in the United States, including about ten existing wind power projects in the Midwest and east, as well as projects in the western United States and Europe. Selecting a worst-case scenario site for comparison with the Project site was not possible because choosing such sites would necessitate tenuous assumptions about high risk at wind power projects that have not been demonstrated. Selection of a worst-case scenario site at this time would not be based on biologically documented impacts. None of the other wind

power projects in the United States, with the possible exception of the APWRA of California, have resulted in biologically significant impacts to birds. In terms of collision risk to birds, comparisons made suggest that risk at the Clayton site is no greater than at other wind power facilities in the United States.

While it is not possible to compare the Clayton Project with a site that could be construed as worst-case scenario, comparisons to the APWRA and sites where risk has been documented to be negligible were made. Clearly, the Clayton Project site does not have the collision risk factors present in the APWRA (see Table 6.2.2.2-1). Further comparisons were made to the impacts of communication towers of various sizes, lighting specifications, and construction types (guyed versus unguyed). This type of comparison is particularly important because there is a large body of research on communication towers, including towers in the eastern and Midwestern United States.

The potential for biologically significant fatalities at wind power facilities was assessed by comparing numbers of known fatalities and likely fatalities at the Clayton site with the hundreds of millions of bird fatalities permitted by the USFWS via depredation, hunting, and falconry permits. This comparison strongly suggests that impacts of wind turbines – estimated at tens of thousands of bird fatalities per year nationally – are not biologically significant. These comparisons are relevant because they provide actual numbers of takings permitted by the USFWS and the NYSDEC. In comparison, fatalities from wind power projects cannot be deemed biologically significant.

With respect to habitat disturbance and displacement of nesting birds, comparisons were made with various sites where such disturbance has been determined to occur. Because these types of impacts are likely to occur among some grassland nesting species at the Clayton Project site, further research has been recommended to prevent or mitigate such impacts.

Alternate Sites. In the case of the Clayton Project, there are problems with requiring an alternative site analysis. No alternative sites were available for this study, because the habitat for several miles surrounding the Project is very similar and likely to support the same bird community. It should also be noted that if no federal permits appear to be necessary for this project. Therefore, a NEPA review is not triggered, and an alternative sites analysis is not required. The Phase I Avian Risk Assessment did, however, compare potential impacts at the Clayton Project to other wind power projects.

Checklists. Instead of using the PII and checklists supplied in the USFWS guidelines, the Phase I assessment included detailed descriptions of the habitat and topography of the site and surrounding areas. For example, the risk assessment included determination of actual or potential migration pathways and the presence of ecological magnets and/or other attractive habitats located within or adjacent to the Project boundary. This included descriptions of the grasslands, farm fields, forests, forest edges, brushland, abandoned farmland, wildlife and natural areas, degree of habitat (grassland and forest) fragmentation, and degree of landscape alteration by farming and other land use practices within and around the site that could influence avian impacts potentially resulting from the proposed development.

Regarding other specific guidance and recommendations, in the area of site development, the Phase I Avian Risk Assessment covers the following concerns:

- Letters of inquiry were sent to USFWS and NHP requesting records of listed species. In addition, habitat was examined to determine whether listed avian species are likely to nest or use the site.
- Except perhaps for waterfowl, which use Lake Ontario, the St. Lawrence River, and the numerous wildlife management areas to varying degrees, the Clayton site is not on a known migration pathway for birds, including hawks, songbirds, and shorebirds. In addition, it has not been demonstrated that wind turbines produce biologically significant impacts on migrating birds. The Phase I assessment explains this.
- Raptor use of the area appears to be moderate, so setbacks from soaring and updraft locations do not appear to be applicable. Raptor fatalities at wind power projects outside of the 5,400 turbine APWRA have totaled very few birds. Even in the APWRA, mortality does not appear to be biologically significant. It should be noted that none of the turbines at the Clayton site would be at the edge of steep terrain that could be used for soaring.
- The USFWS recommendation to configure turbines in ways that would avoid potential mortality has not been demonstrated empirically to reduce or prevent impact, because fatality numbers are small to begin with.
- Habitat fragmentation issues have been addressed in this risk assessment.
- There are no prairie grouse or similar species present at the Clayton site. Other grassland nesting species that may be disturbed or displaced have been addressed in the Phase I assessment.
- Road areas and habitat restoration are addressed in this risk assessment.
- Carrion availability is not applicable at the Project site.

Regarding wind turbine design and operation, many of the USFWS recommendations are either covered in this risk assessment or routinely done at modern wind plants. Some USFWS recommendations, however, are incorrect or not applicable.

- Tubular (unguyed) towers will be used to prevent perching.
- Permanent meteorology towers have been recommended to be free-standing, without guy wires, in the risk assessment.
- The USFWS recommendation that only white strobes should be used at night to avoid attracting night migrants is only partially correct. That red lights should be avoided is also only partially correct. There is strong evidence (Kerlinger 2004a, 2004b) that, in the absence of steady burning red L-810 lights, red strobe-like Federal Aviation Administration (FAA) lights do not attract birds to wind turbines. Red strobe-like lights (L-864) are likely to be recommended by the FAA for the Clayton Project. This has been addressed in detail in the text of this risk assessment.

- ➢ Adjustment of tower/rotor height is problematic and cannot be addressed in this report. However, the turbines that are proposed are much less than 500 feet in height and, therefore, unlikely to cause large-scale fatality events, such as those at tall communication towers. Such turbines have not been documented to cause biologically significant impacts to migrants.
- ➢ Underground electric lines and APLIC guidelines have been recommended in the risk assessment.
- ➢ Seasonal concentrations of birds are addressed in the risk assessment. The appropriateness of shutting down turbines or other mitigation is dependent on the level of demonstrated impacts, which cannot be determined during the preconstruction phase.
- ➢ The USFWS guidance document stipulates that radar or other remote sensing methodologies should be used if large concentrations of migrants are suspected. A detailed discussion of the geographic and topographic patterns of migration is presented in this Phase I assessment. Although this discussion provides strong evidence that concentrated migration does not occur at the Project site, the proximity to Lake Ontario suggests that larger numbers of night migrants may be present only a short distance from the Project site. Therefore, we recommend a radar study of night migration at the Project site for a period of one spring and one fall migration.
- ➢ Post-construction fatality monitoring would provide a means of determining the Project's impact to birds and has been recommended in this risk assessment.

Overall, the USFWS's interim and voluntary guidance document promises to provide a means of evaluating wind power sites for wildlife impacts. Some of the guidance and recommendations are integral to adequately assessing risk, although some have not been substantiated or are only partially correct. The guidance and recommendations set forth by USFWS are in need of a thorough review by the scientific community, industry, and environmental organizations prior to being required for wind power projects. Most importantly, there is need to validate the recommendations and protocols for ranking sites as to potential risk. Until such validation has been done, it is difficult to determine how valuable the guidance and recommendations document is.

It should be noted that the American Wind Energy Association (AWEA) has reviewed the USFWS guidelines and recommendations. In December 2003, it submitted a detailed review to Interior Secretary Norton. AWEA requested several changes, most of which addressed the lack of scientific validation of recommendations and protocols. USFWS has publicly stated that it will not address any comments or revise the guidelines and recommendations until mid-2005.

A Spring 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Clayton Wind Project in Clayton, New York

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September 2005

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Executive Summary

During Spring 2005, Woodlot Alternatives, Inc. (Woodlot) conducted field surveys of bird and bat migration activity in Clayton, New York. The surveys are part of the planning process by PPM Atlantic Renewable for a proposed wind project. Surveys included daytime surveys of migrating raptors, visual observations of waterfowl and other bird movements at dusk and dawn, and nighttime surveys of birds and bats using radar and bat echolocation detectors.

The results of the field surveys provide useful information about site-specific migration activity and patterns in the vicinity of the Clayton project area. This analysis is a valuable tool for the assessment of risk to birds and bats during migration through the area.

Raptor Migration – Spring 2005

The spring field surveys included 10 days of visual observation between March 30 and May 7, 2005. A total of 700 raptors, representing 14 species, were observed during the surveys. Approximately 61 percent of the raptors observed were flying less than 150 meters (m) (492') above the ground.

Bird Migration – Spring 2005

The spring field survey included 36 nights of radar surveys to collect 1-minute video samples in horizontal operation, which documents the abundance, flight path and speed of avian targets moving through the project area, and 10-minute samples in vertical operation, which documents the altitude of targets.

A total of 2,778 one-minute horizontal radar video samples, including 53,134 targets, were analyzed to determine passage rate and flight direction. Nightly passage rates varied from 71 ± 14 t/km/hr to 1,769 ± 87 t/km/hr, with the overall passage rate for the entire survey period at 450 ± 62 t/km/hr.

Mean flight direction through the project area was 30º ± 53º.

A total of 226 ten-minute radar video samples, including 12,727 targets, were analyzed to determine flight altitude. The mean flight height of all targets was 443 m ± 38 m (1,453' ± 125') above the radar site. The average nightly flight height ranged from 199 m ± 8 m (653' ± 26') to 753 m ± 36 m (2,470' ± 118'). The percent of targets observed flying below 150 m (492') also varied by night, from 2 to 42 percent. The seasonal average percentage of targets flying below 150 m was 14 percent.

The mean flight direction, qualitative analysis of the surrounding topography and landscape, and mean flight altitude of targets passing over the project area indicates that avian migration in this area involves a broad front type of landscape movement. This type of broad front movement, particularly in conjunction with the high-elevation passage levels, demonstrates a limited avian mortality risk during spring migration. Additionally, the flight height of targets indicates that the vast majority of bird migration in the area occurs well above the height of the proposed wind turbines.

Bat Migration – Spring 2005

The fall field survey included deployment of 1 to 2 Anabat II detectors on 42 separate nights, yielding a total of 78 detector-nights. Sampling occurred from April 20 to May 30. On nights when only one detector was operated, the detector was deployed at a height of approximately 20 m (66') in a meteorological measurement tower (met tower). On nights when two detectors were operating simultaneously, the second detector was deployed at a height of approximately 15 m (49') from the same tower.

The detectors were set to collect data from 7:00 p.m. to 7:00 a.m., which meant that sampling occurred from before sunset to after sunrise on each night of sampling.

A total of 67 bat call sequences were recorded during the spring survey period. Calls were detected throughout the sampling period, with the greatest number of calls per night (15 calls) occurring on May 6. Due to the relatively low numbers of calls detected, hourly passage rates were not calculated. In general, most bat call sequences were detected between sunset and midnight.

When possible, recorded bat calls were identified to species, genus (in the case of *Myotis*), or as "unknown," based upon the shape of the call sequence, the slope, and the maximum and minimum frequencies. Recorded calls were compared to reference libraries of known calls created using the same equipment. Of the 67 calls recorded at Clayton, 27 were identified as big brown bats (*Eptesicus fuscus*), 18 as silver-haired bats (*Lasiurus noctivagans*), 12 as *Myotis* sp., and 1 as a hoary bat (*Lasiurus cinereus*). Nine were classified as unknown, due to lack of sufficient material on which to base an identification.

Table of Contents

List of Appendices

List of Tables

List of Figures

1.0 Introduction

1.1 Project Context

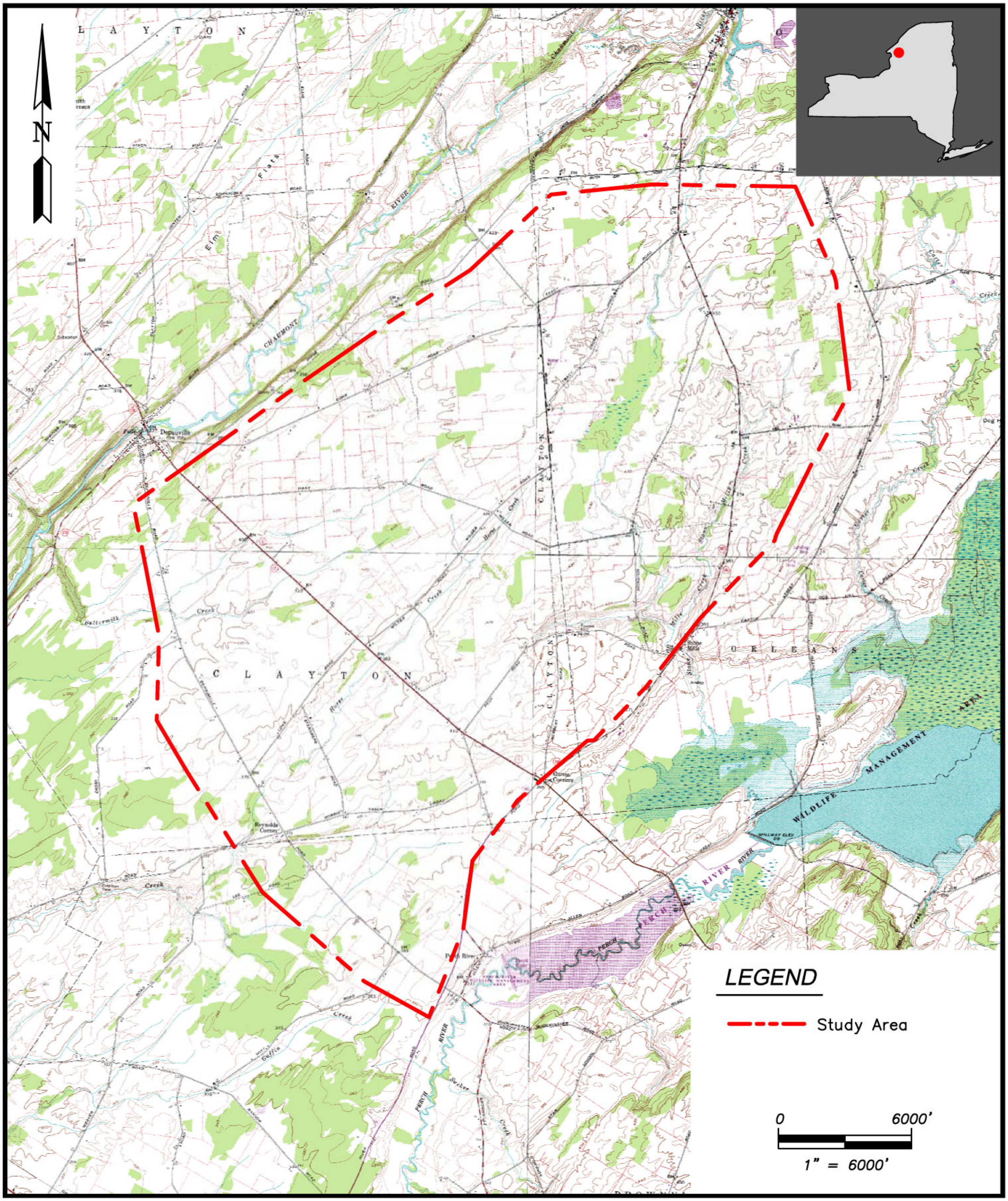
PPM Atlantic Renewable has proposed the construction of a wind project to be located in Clayton, Orleans, and Brownville, New York (Figure 1-1). The project would include up to approximately 54 2.75-megawatt (MW) wind turbines that could generate up to 150 MW of power annually. Turbines would have a maximum height of approximately 150 meters (m) (492') and would be located predominantly in active agricultural fields being used for hay and crop production, as well as for pasturing.

Birds and bats are known to collide with tall structures during the migration season, such as buildings and communication towers, particularly when weather conditions are suboptimal for migration (Crawford 1981; Avery *et al.* 1976, 1977). Depending on their height and location, wind turbines can also pose a potential threat to migrating birds because they are relatively tall structures, have moving parts, and may be lit. The mortality of migrating and resident birds and bats has been documented at wind farms as a result of collisions with turbines, meteorological measurement towers (met towers), and guy wires (Anderson *et al.* 2004; Erickson *et al.* 2000, 2003; Johnson *et al.* 2003; Thelander and Rugge 2000).

The surveys for this project were conducted to provide data that will be used to help assess the potential risk to birds and bats from this proposed project. The scope of the surveys was based on some standard methods that are developing within the wind power industry and consultation with the NY Department of Environmental Conservation (NYDEC).

1.2 Project Area Description

The project area is located within the Eastern Ontario Plain ecozone of NY (Andrle and Carroll 1988). This is a relatively flat region, with elevation ranging from approximately 76 m to 152 m (250' to 500'). Forest communities in the area are dominated by American elm (*Ulmus americana*), red maple (*Acer rubrum*), and northern hardwoods on soils of lake sediments that overlie limestone bedrock. Lake Ontario moderates the local climate, which has resulted in the widespread development of agricultural land uses, predominantly dairying.



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DATE: September 2005
SCALE: 1" = 6000'
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Figure 1-1
Study Area Location Map
Clayton Wind Project
Clayton, New York

REV.

1.3 Survey Overview

Woodlot Alternatives, Inc. (Woodlot) conducted field investigations for bird and bat migration during the spring of 2005. The overall goals of the investigations were to:

- document the occurrence and flight patterns of diurnally-migrating raptors (hawks, falcons, harriers, and eagles) in the project area, including number and species, general flight direction, and approximate flight height;
- document the overall passage rates for nocturnal migration in the vicinity of the project area, including the number of migrants, their flight direction, and their flight altitude; and
- document the presence of bats in the area, including the rate of occurrence and, when possible, species presence.

The field surveys included day-time raptor migration surveys, a radar study of bird and bat migration activity, and recordings of bat echolocation calls in several landscape settings and heights. Surveys were conducted from April 15 to May 30, 2005, although effort for the different aspects of the work varied within this time period. A total of 10 days of raptor surveys, 36 nights of radar surveys, and 78 nights of bat detector recordings were completed.

Raptor surveys were conducted near a meteorological met tower off of Lowe Road in Clayton. Methods employed were the same as those used by the Hawk Migration Association of North America (HMANA).

Radar surveys were targeted for 45 nights from April 15 to May 30, 2005. Radar surveys were conducted from the vicinity of the same met tower as raptor surveys, which provided wind data for the time period of sampling. Radar data provide insight on the flight patterns of birds (and bats) migrating over the project area, including abundance, flight direction, and flight altitude.

Bat surveys included the use of Anabat II (Titley Electronics Pty Ltd) bat detectors to record the location and timing of bat activity. One or 2 detectors were used during the survey, resulting in a total of 78 detector-nights that were recorded over the course of the 45 nights when the detectors were deployed. The detectors were deployed within the guy wire system of the met tower at heights of 15 m and 20 m (49’ and 66’) or, if one detector was used, at 20 m (66’) above the ground. Deployment in this fashion provided information on the bat community in the project area.

This report is divided into three primary sections that discuss the methods and results for each field survey. Each section includes summary graphs of the survey results. In addition, supporting data tables are provided in a separate appendix for each chapter.

2.0 Diurnal Raptor Surveys

2.1 Introduction

The Clayton project site is located in the northeast portion of the Central Continental Hawk Flyway. The Great Lakes, specifically Lake Ontario, play a central role in shaping migration dynamics near and in the project area. Rather than crossing these large water bodies, migrating hawks will typically circumvent them by traveling along the shoreline until they can again proceed in their desired direction. During northbound migration each spring, hawks generally bypass the Lakes by moving east along the southern lake shorelines they encounter, while typically moving west along the northern lake shorelines they encounter to circumvent the Lakes during southbound movements each fall. Given these observed trends, the eastern portion of the Central Flyway and specifically, the southern and eastern shores of Lakes Erie and Ontario, could be expected to concentrate large numbers of northbound raptors during spring migration.

Woodlot conducted raptor surveys to determine if significant movement occurred in the vicinity of the proposed project location. The survey was conducted on 10 days spanning late March to early May, 2005, with the intent of documenting the dynamics of raptor migration in the project area, including species, abundance, approximate flight height, general direction and flight path, and other notable behaviors.

2.2 Methods

Field Surveys

Raptor surveys were conducted from a flat hayfield approximately 8 miles southeast of Clayton, NY. The survey site was adjacent to a 60 m (200') met tower located off of Lowe Road (Figure 2-1). This site, at an elevation of 122 m (400'), is surrounded by flat agricultural fields interspersed with small woodland fragments and wetlands. It afforded unobstructed views in all directions, except for perhaps very low-flying birds beyond nearby low treelines.

Raptor surveys occurred on 10 days from March 30 to May 7, 2005, and were generally conducted from 9 a.m. to 3 p.m. to include the time of day when the strongest thermal lift is produced and the majority of raptor migration occurs. Surveys were usually, but not always, conducted on days with favorable flight conditions produced by low-pressure systems bringing southerly winds and/or days following the passage of a weather front. Survey days were typically coordinated with strong migration flight forecasts made by the nearby Derby Hill Bird Observatory, which has been documenting spring raptor migrations for decades.

Surveys were based on methods used by the HMANA. Observers scanned the surrounding airspace for raptors flying into the survey area and recorded detailed notes on each bird's location, flight path, approximate flight height, and behavior onto HMANA data sheets. Objects with known heights, such as the met towers and surrounding trees, were used to estimate flight height. Additionally, on some occasions, the nearby radar was used to verify estimated flight heights. Flight heights were categorized as less than or greater than 150 m (492') above the ground, which is the maximum height of the proposed wind turbine blades.

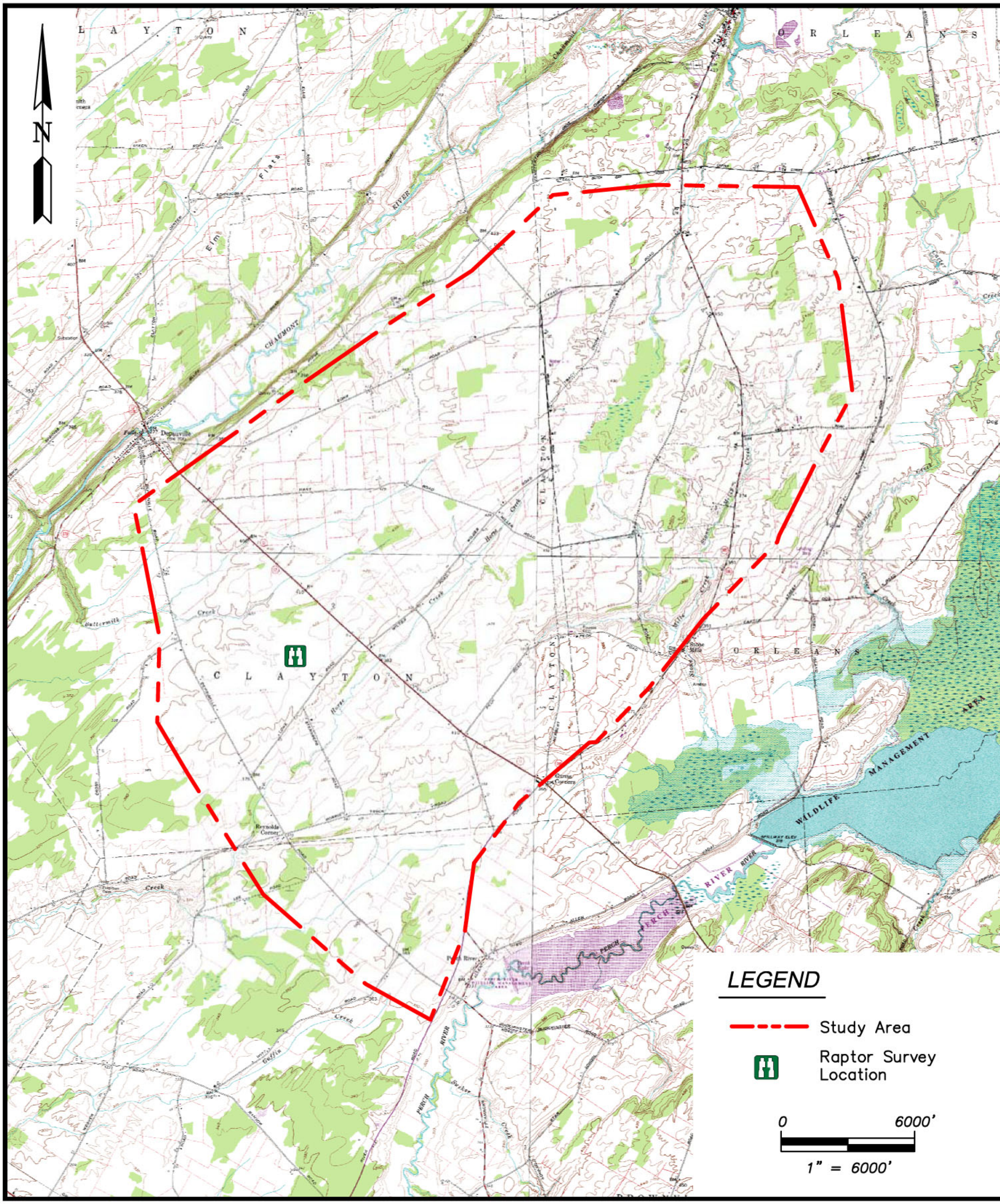

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Figure 2-1
Raptor Survey Location Map
Clayton Wind Project
Clayton, New York

REV.

Information regarding an individual's behavior; such as known breeding range and habitat preferences, mating and breeding displays, and specific location within the project site; was incorporated to differentiate between migrant and resident birds. For most observations, flight paths of individuals were plotted on topographic maps of the project area.

Hourly weather observations, including wind speed and direction, temperature, percent cloud cover, and precipitation, were recorded on HMANA data sheets. Birds that flew too rapidly or were too distant to accurately identify were recorded to their genus or, if identification to genus was impossible, as unidentified raptor.

Data Analysis

Field observations were summarized for each survey day and for the entire survey period. This included totaling the number of individuals for each species, height class (above or below 150 m), and hour of observation. In addition, the observation rate (birds per hour) was calculated and the overall abundance and identity of resident birds was estimated. Finally, the mapped flight paths of individuals were reviewed to identify if any patterns in migration activity over the project area occurred.

Observations from the project area were compared to data obtained from local or regional HMANA hawk watch sites available from www.hmana.org. The HMANA watch site used for direct comparisons with the project site included Derby Hill in Mexico, NY; Braddock Bay in Greece, NY; and Hamburg, NY. The former two sites are located on the southern shoreline of Lake Ontario and the latter is located at the eastern end of Lake Erie.

2.3 Results

A majority of the 10 surveys were conducted on clear days with light or moderate southerly winds. Throughout the survey period, most observations were made under clear skies, while three days experienced partly or mostly cloudy conditions. However, cloud cover did not seem to influence migratory movements as much as passing weather fronts. In fact, the largest count (N=271 birds), made on April 28, followed the passing of overnight rain and early morning drizzle. In general, visibility on most survey days was excellent and only twice was limited because of heavy cloud cover. Further, four surveys were conducted on days with light to moderate north or northeasterly winds, which is suboptimal for northbound raptor migration but did not appear to greatly affect overall totals. On these days, which account for 40 percent of all survey days, nearly one-third of the season's birds were observed.

Surveys were conducted for a total of 58 hours during the 10 survey days. A total of 700 raptors, representing 14[1] species, were observed during that time, yielding an observation rate of 12.1 birds/hour (Appendix A Table 1; Figure 2-2). Broad-winged hawks (*Buteo platypterus*) N=252) and turkey vultures (*Cathartes aura*) (N=260) were the most commonly observed species and together accounted for 73.1 percent of the season's total birds. In decreasing order of abundance were red-tailed hawks (*Buteo jamaicensis*) (N=73; 10.4% of total), sharp-shinned hawks (*Accipiter striatus*) (N=25; 3.6% of total), and northern harrier (*Circus cyaneus*) (N=14; 2.0% of total).

The remainder of observed species each comprised less than 1.5 percent of the total (each with ≤ 10 individuals) and include osprey (*Pandion haliaetus*), American kestrel (*Falco sparverius*), rough-legged hawk (*Buteo lagopus*), red-shouldered hawk (*Buteo lineatus*), Merlin (*Falco columbarius*), peregrine

[1] Additional individuals that were not definitively identified were observed during the survey. While these were likely of the same species documented during the surveys, they have not been used in the calculation of the total number of species observed.

falcon (*Falco peregrinus*), bald eagle (*Haliaeetus leucocephalus*), golden eagle (*Aquila chrysaetos*), and Cooper's hawk (*Accipiter cooperii*). Some individuals remained unidentified (N=44) attributable to long distances or very brief looks. These were mostly from the genus *Buteo* (N=26), although several unidentified *Accipiter* (N=4) individuals were also observed. Of the aforementioned species, the golden eagle and peregrine falcon are listed as Endangered in NY, while the northern harrier and bald eagle are listed as Threatened. Species listed by the State as Species of Special Concern include osprey, red-shouldered hawk, sharp-shinned hawk, and Cooper's hawk. Only one federally listed species was observed: the bald eagle, which is listed as Threatened.

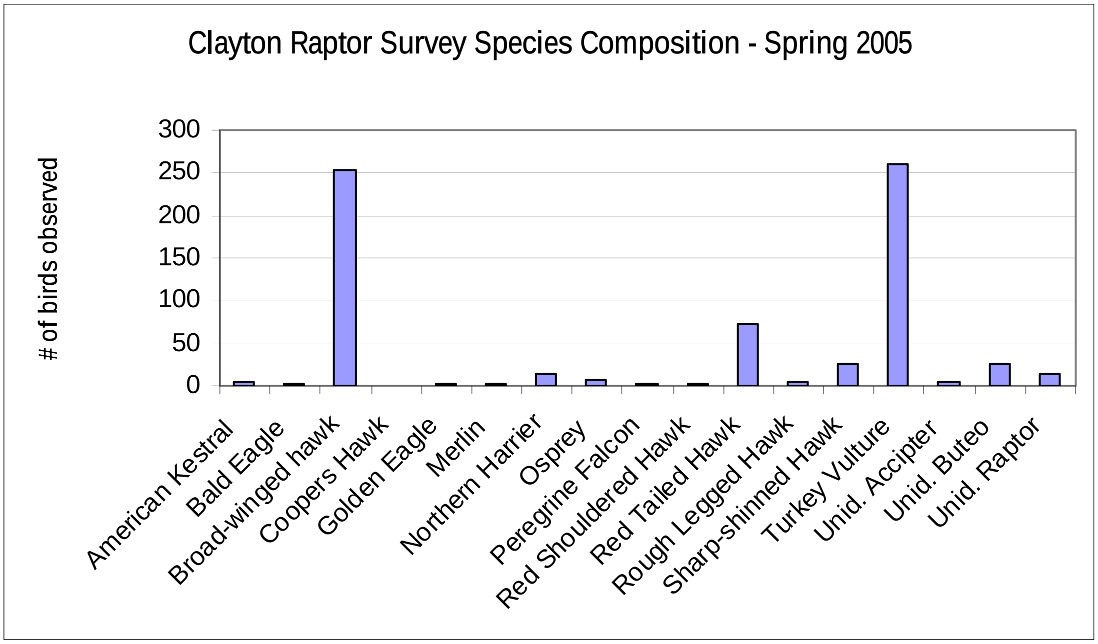

Figure 2-2. Species composition of raptors observed during raptor surveys.

Some observations of sharp-shinned hawks, American kestrels, and northern harriers were determined to be repeated sightings of the same individuals. In these cases, a particular bird may have been observed flying back and forth across the site or perching in an area repeatedly throughout one day or on multiple days. However, the vast majority of observed raptors were believed to be actively migrating and all observations are included in the count data reported. In general, those species with the highest seasonal totals (≥ 10 birds) were consistently observed throughout the season. An exception to this was the broad-winged hawk; of the 252 individuals observed, 242 (96%) were seen over a consecutive 2-day period in late April.

In addition to some seasonal variation, the timing of raptor movement varied within each survey day. Typically, relatively few birds were observed during the first and last 2 hours of each day. The majority of birds (60.1%) were seen at mid-day from 11:00 a.m. to 1:00 p.m. (Figure 2-3) and this pattern remained consistent for all frequently observed species.

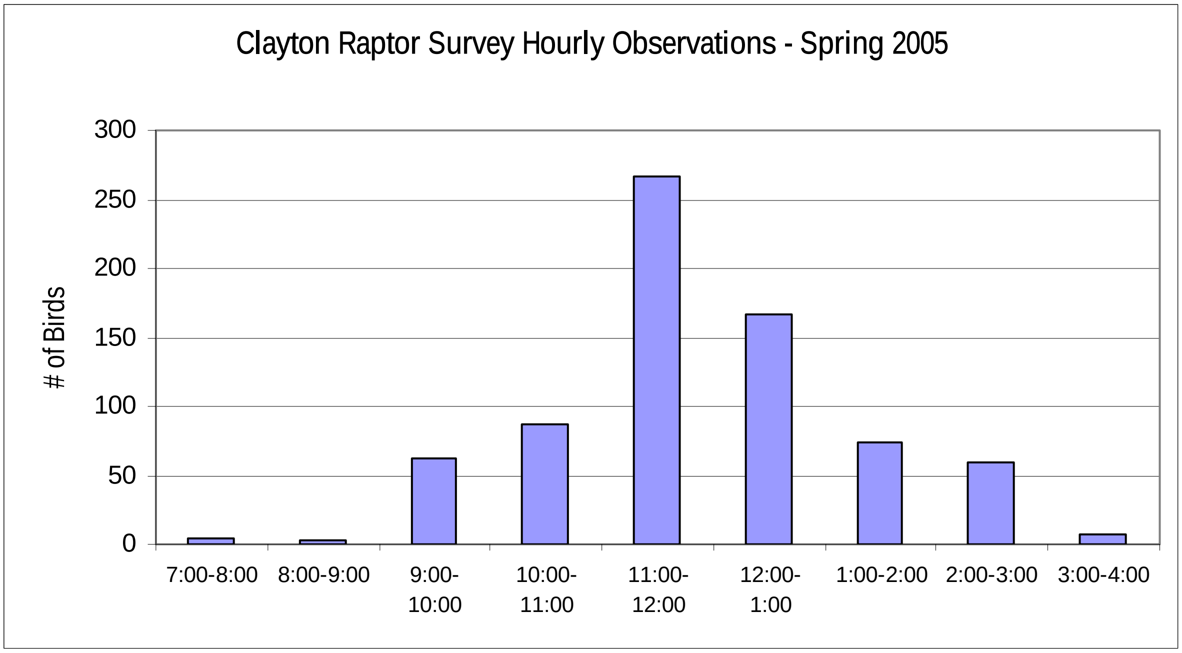

Figure 2-3. Hourly observation rates

Flight heights were categorized as below or above 150 m (492'), or the approximate maximum height of the proposed turbine blades. Overall, 61 percent of the observed raptors were estimated to be flying lower than 150 m.

Differences in flight altitudes between species were also observed (Figure 2-4; Appendix A Table 3). Some species assemblages, such as the accipiters, vultures, and falcons, were consistently observed flying lower than 150 m (492'). In fact, all of the falcons observed were flying below this height. Exceptions to this low-flying trend included broad-winged and red-tailed hawks, of which 58 percent and 41 percent, respectively, were flying less than 150 m above the ground. Overall, no species flew predominately above the 150 m threshold, while several species concentrated below 150 m. We acknowledge that issues of detectability may influence the counts of high-flying raptors.

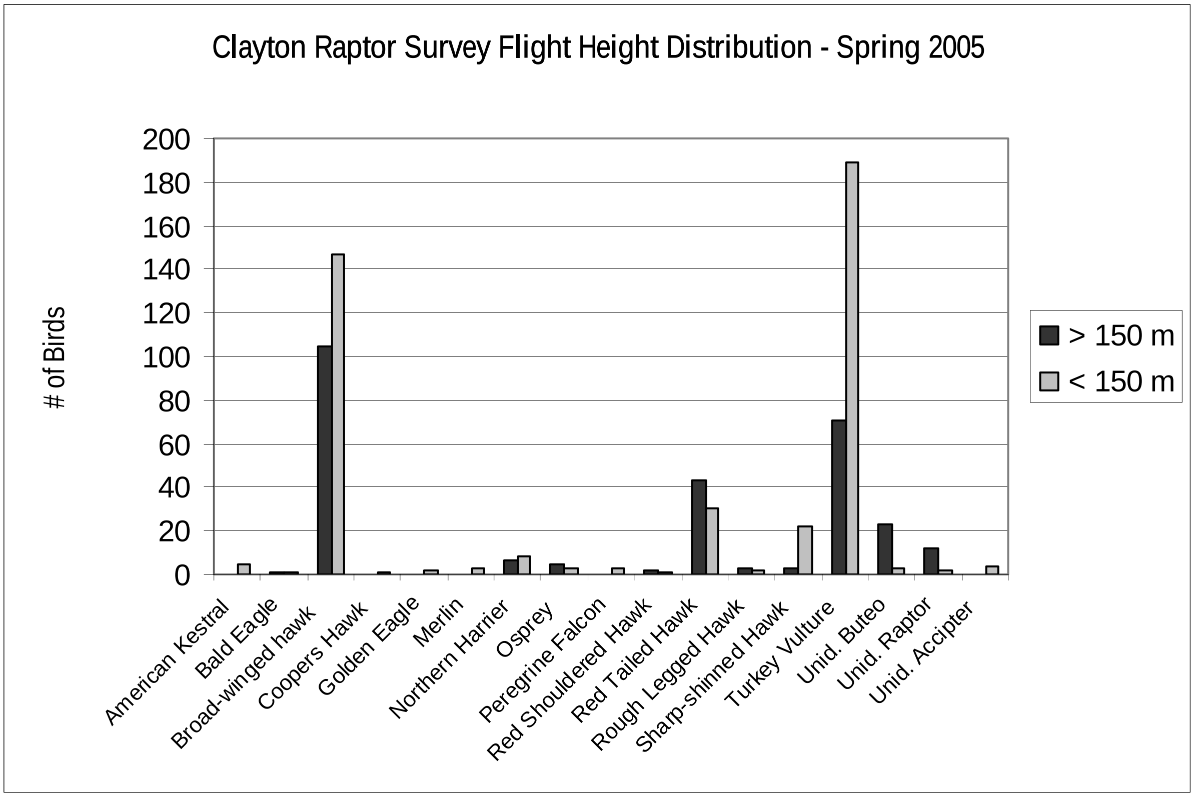

Figure 2-4. Raptor flight height distribution

2.4 Discussion

Raptor migration is a dynamic process responsive to both biotic and abiotic factors, migratory fitness, post-breeding dispersal, individual preferences, weather, and local and regional landscape characteristics. Migration varies by species both temporally and spatially, such that raptors are on the move almost every month of the year in some part of North America. In western NY, raptors moving north each spring become concentrated along the southern and eastern shores of Lake Erie and Lake Ontario because raptors generally prefer to not cross large bodies of water. In fact, raptor migration is so concentrated along these shores that popular hawk-watching sites have been established in Mexico (Derby Hill) and Hilton (Braddock Bay), NY; both along the southeastern shoreline of Lake Ontario. Hawk counts at these sites documented over 23,000 and 30,000 raptors, respectively, in spring 2005. Many of these raptors are presumed to continue flying along the eastern shoreline as they continue their annual migration northward. The Clayton project site is located along this flyway, slightly inland from the northeastern shore of Lake Ontario.

Regional location can affect the intensity of raptor migration at a particular site. Two well-known examples include the coastal observatory at Cape May, New Jersey, and a ridgeline site at Hawk Mountain, Pennsylvania. The location of these sites relative to large, landscape-scale features (coasts, mountain ridges) results in large concentrations of migrating raptors. This likely happens at smaller scales as well, as river valleys and smaller ridgelines may result in more suitable migration conditions (i.e., strong thermal development, crosswinds, and updrafts) with the effect of concentrating raptors along organized pathways. Established hawk survey locations target these areas of known, concentrated raptor migration activity.

At the Clayton project site, the absence of proximate landscape-scale features such as river corridors or mountain ridges played a significant role in the migratory patterns through the project area. This lack of major topography served to distribute migrants fairly evenly across the project area, rather than in a concentrated flight corridor. Also, because of the lack of features to concentrate migrating raptors, relatively few were observed at Clayton than at other lake-side sites. More than 20,000 migrating raptors were observed at each of the two Lake Ontario hawk watch locations (Braddock Bay and Derby Hill). At the Lake Erie site in Hamburg, NY, more than 13,000 raptors were observed. By comparison, only 700 raptors were observed at Clayton. To correct for sampling effort (those sites included counts during nearly every day of the migration period) the passage rate, birds/observation hour, can be observed. The overall passage rate over Clayton was 12.1 birds/hour. Passage rates at Braddock Bay and Derby Hill were 68.8 birds/hour and 61.1 birds/hour, respectively, and the passage rate in Hamburg, NY was 33.2 birds/hour (Appendix A Table 4).

The temporal and spatial flight dynamics of migrating raptors in the project area were variable and were often affected by temperature and wind patterns. Flight paths varied between survey dates and were most influenced by wind direction and speed. The lack of landscape-scale features suitable for creating updrafts meant that most migration movement occurred either via powered flight or after the ground had sufficiently heated to produce thermals (i.e., after 11:00 a.m. on most days). The most abundant species had a protracted migration pattern spanning most survey days, except for broad-winged hawks, the majority of which migrated through the area in a relatively brief, intense push in late April.

Temperatures influenced the daily timing of flights, with the effect of delaying early morning flights and concentrating observations at mid-day. Both wind direction and speed affected specific flight paths and directional trends on any given day were usually dependent on prevailing winds but still always oriented northward. Separating migrants from resident birds was fairly straightforward at this site, given that migratory individuals nearly always flew higher, more purposeful routes in a general northward direction and birds suspected as residents were repeatedly observed flying at lower elevations, hunting, courting, or perching.

The majority of raptors (61%) flew below the 150 m (492’) height of the proposed turbine blades. Birds flying below this height should be considered more at risk of possible collision with the turbines, than those flying above the turbine blade height. Generally, it’s still largely unknown what avoidance behavior migrating raptors possess when flying near wind turbines. Unpublished observations of hawk migration activity at an existing facility in New England (Woodlot, unpublished data) often included the passage of small raptors (such as sharp-shinned hawks) below the blade-swept area of turbines and the passage of larger raptors well above the turbines. Some observations have also included birds rising above one turbine and then decreasing altitude between turbines. It is unclear, however, if this type of presumed avoidance behavior would be observed at other wind turbine facilities in the East.

2.5 Conclusions

Spring raptor migration surveys indicated that large numbers of raptors utilize the airspace directly over and surrounding the project site. However, passage rates were low at the Clayton site compared to observations from the Derby Hill observatory and other regionally well-known hawk migration survey sites. Observation rates (birds observed per hour of observation) were three to five times lower than these other sites, indicating that the project area may not represent a concentration area for migrating raptors.

Resident birds comprised only a small fraction of the total raptors observed but always flew at relatively low elevations while traveling around the project area. As such, residents were observed flying almost exclusively below the maximum height of the proposed turbines and usually below the blade-swept area.

One of these more commonly observed resident species was the northern harrier, which is currently listed as Threatened in NY. Repeated observations of hunting and courtship activities indicate that this species is nesting in the project area. Another species listed by the State as a Species of Special Concern, the sharp-shinned hawk, is suspected to be nesting within the project area. Observations of this species included one to two individuals undertaking low flights while carrying food, indicative of nesting and chick-rearing activity. Other species listed as rare in the State or regionally were also observed. However, the individuals of those species were suspected to only be migrating through the project area and not nesting within it.

3.0 Nocturnal Radar Survey

3.1 Introduction

The vast majority of North American landbirds migrate at night. The strategy to migrate at night may be to take advantage of more stable atmospheric conditions for flapping flight (Kerlinger 1995). Conversely, species using soaring flight, such as raptors, migrate during the day to take advantage of warm rising air in thermals and laminar flow of air over the landscape, which can create updrafts along hillsides and ridgelines. Additionally, night migration may provide a more efficient medium to regulate body temperature during active, flapping flight and could reduce the potential for predation while in flight (Alerstam 1990, Kerlinger 1995).

Collision with unseen obstacles is a potential hazard to night-migrating birds. Additionally, some lighted structures may actually attract birds to them under certain weather conditions, which can be associated with collision or exhaustion of birds, both of which often result in mortality (Ogden 1996). For example, birds have been documented colliding with tall structures, such as buildings and communication towers, particularly when weather conditions are foggy (Crawford 1981; Avery *et al.* 1976, 1977). Wind turbines can also pose a potential threat to migrating birds as they are relatively tall structures, have moving parts, and may be lit, depending on their height and location (Erickson *et al.* 2000).

Factors that could affect potential collision risk of nocturnally-migrating birds by wind turbines can include weather, magnitude of migration, height of flight, and movement patterns in the vicinity of a wind project, along with the height of turbines and other site-specific characteristics of a wind project. Radar surveys were conducted at the Clayton project area to characterize spring nocturnal migration patterns in the area. The goal of the surveys was to document the overall passage rates for nocturnal migration in the vicinity of the project area, including the number of migrants, their flight direction, and their flight altitude.

3.2 Methods

Field Methods

A single marine surveillance radar similar to that described by Cooper *et al.* (1991) was used to document the night-time movement of migrating birds and bats over the study area. The radar was located in a small field largely surrounded by low trees near the met tower off of Lowe Road in Clayton (Figure 3-1). The radar had a peak power output of 25 kW and the ability to track small animals, including birds, bats, and even insects out to distances of up to 1.2 kilometer (km) (3,937’). The radar cannot, however, readily distinguish between different types of animals being detected. Consequently, all animals observed on the radar screen are called targets.

The radar was equipped with a 2-m (6.5’) waveguide antenna. The antenna has a vertical beam height of 20º (10º above and below horizontal) and the front end of it was inclined approximately 5º to increase the proportion of the beam directed into the sky. Objects on the ground detected by the radar cause returns on the radar screen (echoes) that appear as blotches called ground clutter. Large amounts of ground clutter reduce the ability of the radar to track birds and bats flying over those areas. By utilizing the tree lines around the radar location, ground clutter was reduced as much as possible.

The radar was operated in two modes during each survey hour. In the first (surveillance) mode, the antenna spins horizontally to survey the airspace around the radar and detects targets moving through the area. By analyzing the echo trail, the number, flight direction, and speed of targets can be determined. In the second (vertical) mode of operation, the antenna is rotated 90º to vertically survey the airspace above the radar (Harmata *et al.* 1999). In vertical mode, target echoes do not provide directional data but do provide information on the altitude of targets passing through the vertical, 20º radar beam.

The radar was operated at a range of 1.4 km (0.75 nautical miles). At this range, the echoes of small birds can be easily detected, observed, and tracked. At greater ranges, larger birds can be detected but the echoes of small birds are reduced in size and restricted to a smaller portion of the radar screen, reducing the ability to observe the movement pattern of individual targets. The geographical limits of the range setting used are depicted in Figure 3-1.

Radar surveys were conducted from sunset to sunrise. Forty-five nights of sampling were targeted between April 15 and May 30, 2005. Because the anti-rain function of the radar must be turned down to detect small songbirds and bats, surveys could not be conducted during periods of inclement weather. Therefore, surveys were targeted largely for nights without rain. However, in order to characterize migration patterns during nights without optimal conditions, some nights with weather forecasts including occasional showers were sampled. In total, 36 nights of sampling were conducted over the 45 targeted nights due to poor performance of the radar because of weather.

Data Collection

The radar display was connected to video recording software of a computer. During surveillance mode, 15 one-minute samples of the radar display were recorded for each survey hour. During vertical mode, a single 10-minute video sample was recorded for each survey hour. The video samples were recorded on the following schedule for each 1-hour period after sunset:

- Seven 1-minute samples during the first 15 minutes after sunset;
- One 10-minute vertical sample during the next 30 minutes; and
- Eight 1-minute samples during the last 15 minutes of the hour.

During the 30-minute period when vertical data were recorded, additional information was also recorded, including weather observations and ceilometer observations. Weather data that was recorded included wind speed and direction, cloud cover, temperature, and precipitation. Ceilometer observations involved directing a one million candlepower spotlight vertically into the sky in a manner similar to that described by Gauthreaux (1969). The ceilometer beam was observed by eye for 5 minutes to document and characterize low-flying (below 150 m) targets. The ceilometer was held in-hand so that any birds, bats, or insects passing through it could be tracked for several seconds, if needed. On nights with a full moon and clear skies, the ceilometer beam was too diffuse to readily detect birds and bats. On those nights, moonwatching (Lowery 1951) was used, which involved watching the face of the moon with binoculars for 5 minutes and recording any observations of birds or bats flying in front of the moon. Observations from each ceilometer or moonwatching period were recorded by hand, including the number of birds, bats and insects observed. This information was used during data analysis to help distinguish between insects from bird and bat targets.

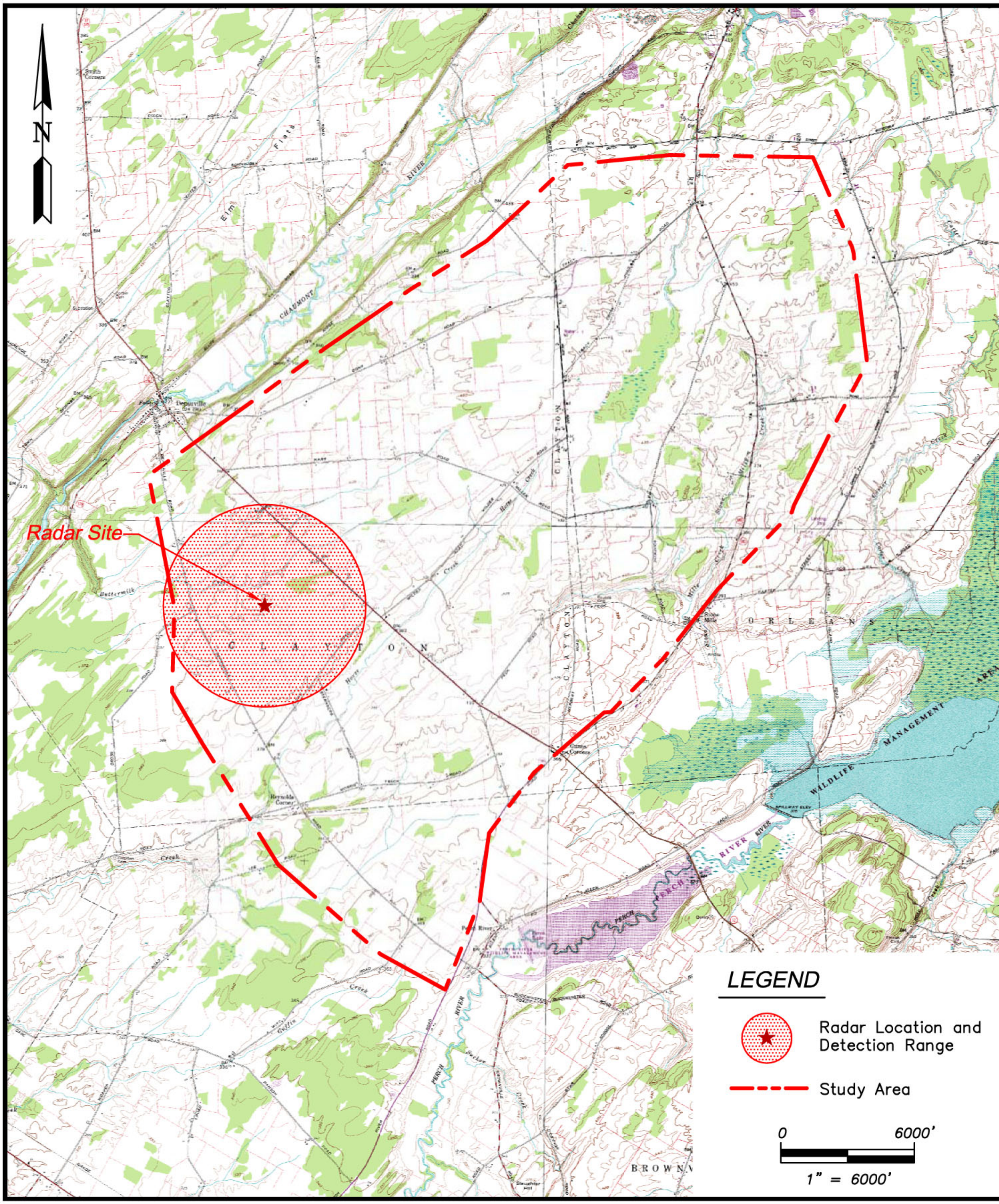

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Figure 3-1
Radar Location Map
Clayton Wind Project
Clayton, New York

REV.

Data Analysis

The video samples were analyzed using a digital video analysis software tool developed by Woodlot. For horizontal samples, targets were identified as birds and bats rather than insects based on their speed. The speed of targets was compared with wind speed and direction; targets traveling faster than approximately 7 m per second were identified as a bird or bat target. The software tool recorded the time, location, and flight vector for each target traveling fast enough to be a bird or bat. The results for each sample were output to a spreadsheet. For vertical samples, the software tools recorded the entry point of targets passing through the vertical radar beam, the time, and flight altitude above the radar location. The results for each sample were output to a spreadsheet. These datasets were then used to calculate passage rate, flight direction, and flight altitude of targets.

Hourly passage rates (in 1-hour increments post sunset) were calculated by tallying the total number of targets in the 1-minute samples for each hour and correcting for the number of samples collected in that hour. That estimate was then corrected for the radar range setting that was used in the field and was expressed as targets/km/hour (t/km/hr) ± 1 SE. The hourly rates were used to calculate passage rates for each night and the entire season.

Mean target flight directions (± 1 circular SD) were summarized in a similar manner: by hour, night, and for the entire season. Flight direction analysis and statistical analyses were conducted using software designed specifically to analyze directional data (Oriana2© Kovach Computing Services). The statistics used for this are based on Batschelet (1965), which take into account the circular nature of the data. Nightly wind direction was also calculated using similar methods and data collected from the central met tower, near the radar site. Mean wind speed was calculated using linear statistics (Zar 1999).

Flight altitude data were summarized using linear statistics. Mean flight altitudes (± 1 SE) were calculated by hour, night, and overall season. The percent of targets flying below 125 m (492'), the approximate maximum height of proposed wind turbines, was also calculated hourly, for each night, and for the entire survey period.

3.3 Results

Radar surveys were conducted during approximately 303 hours on 36 nights between April 15 and May 30, 2005 (Table 3-1). The radar site provided generally good visibility of the surrounding airspace and targets were observed in most areas of the radar display unit.

Passage Rates

A total of 2,778 one-minute radar video samples were analyzed during the passage rate and flight direction analysis and included a total of 53,134 targets. Nightly mean passage rates varied from 71 ± 14 t/km/hr (May 22) to 1,769 ± 87 t/km/hr (April 19), and the mean passage rate for the entire survey period was 460 ± 63 t/km/hr (Figure 3-2; Appendix B Table 1).

Table 3-1. Survey dates, level of effort, and weather – Clayton, Spring 2005

Night of	Sunset	Sunrise	Hours of Survey	Weather	Wind Direction (coming from)
Apr 15	7:48 PM	6:18 AM	3	calm and clear	
Apr 16	7:50 PM	6:16 AM	7	calm and clear	
Apr 17	7:51 PM	6:15 AM	11	calm, cloudy then clear	
Apr 18	7:52 PM	6:13 AM	11	calm and clear	
Apr 19	7:53 PM	6:12 AM	3	not available	
Apr 21	7:56 PM	6:08 AM	11	calm and clear	
Apr 24	7:59 PM	6:04 AM	11	light breeze, partly cloudy	SSE
Apr 26	8:01 PM	6:01 AM	6	light breeze, partly cloudy	SE
Apr 27	8:03 PM	5:59 AM	9	calm and mostly clear	SE
Apr 28	8:04 PM	5:58 AM	8	breezy, partly cloudy	SW
Apr 29	8:05 PM	5:56 AM	10	cloudy, mostly calm, light showers early	S
May 1	8:07 PM	5:53 AM	10	calm, partly cloudy, hazy with some rain	SSE
May 2	8:09 PM	5:52 AM	10	light breeze, partly cloudy	WSW
May 4	8:11 PM	5:49 AM	6	calm and clear	
May 5	8:12 PM	5:48 AM	10	calm and clear	E
May 6	8:13 PM	5:47 AM	10	calm and clear	SSE
May 7	8:14 PM	5:46 AM	7	calm and clear	NE
May 8	8:16 PM	5:44 AM	10	calm, partly cloudy then clear	ENE to NE
May 9	8:17 PM	5:43 AM	8	light breeze, partly cloudy then calm and clear	NNE
May 10	8:18 PM	5:42 AM	8	partly cloudy, light breeze, passing showers	NW
May 11	8:19 PM	5:41 AM	7	light breeze, cloudy	SW
May 12	8:20 PM	5:40 AM	10	calm and clear, cold	
May 15	8:24 PM	5:36 AM	6	light breeze, partly cloudy	SW
May 16	8:25 PM	5:35 AM	10	breezy, partly cloudy	SW
May 17	8:26 PM	5:34 AM	10	calm and cloudy	SW
May 18	8:27 PM	5:33 AM	10	calm and cloudy, cold	
May 19	8:28 PM	5:32 AM	10	light breeze, clear	N
May 20	8:29 PM	5:31 AM	8	calm and clear	NE
May 22	8:31 PM	5:30 AM	9	calm and cloudy, light rain	NE
May 23	8:32 PM	5:29 AM	9	light breeze, mostly cloudy, some rain showers	NE
May 24	8:33 PM	5:28 AM	7	light breeze, partly cloudy	NNE
May 25	8:34 PM	5:27 AM	9	light breeze, clear	NE
May 27	8:36 PM	5:26 AM	7	calm and partly cloudy, rain late	NE
May 28	8:37 PM	5:25 AM	9	light breeze, cloudy	NE
May 29	8:38 PM	5:25 AM	8	calm and clear	WSW
May 30	8:38 PM	5:24 AM	5	calm and cloudy	WSW

Note: Additional nights of survey were attempted but foul weather prevented the initiation of surveys.

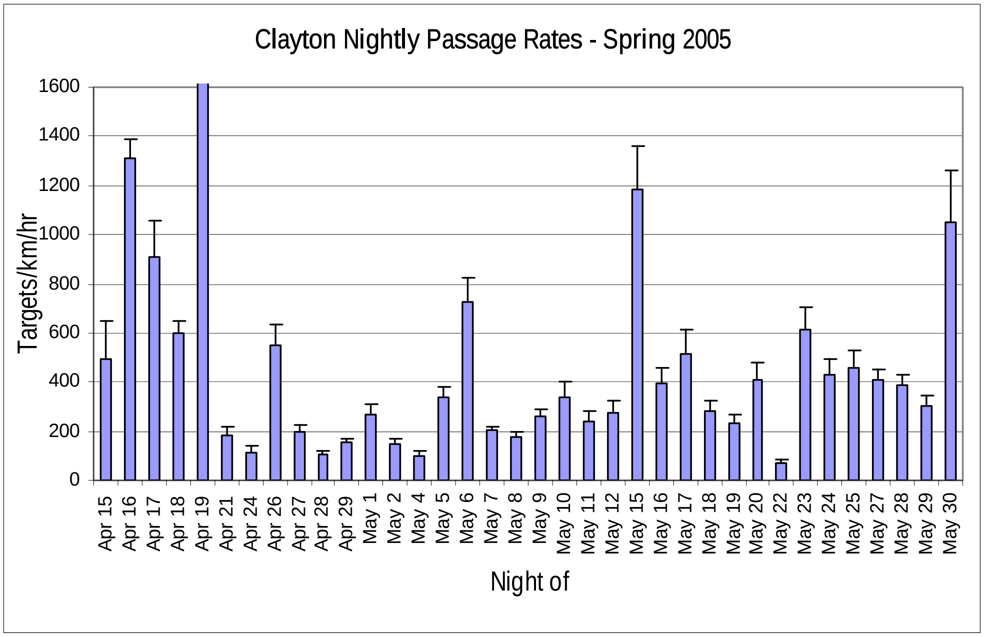

Figure 3-2. Nightly passage rates (error bars = 1 SE) observed.

Individual hourly passage rates throughout the entire season varied from 19 to 1,944 t/km/hr. Hourly passage rates varied throughout each night and for the season overall. In general, passage rates were highest during the third through sixth hours after sunset, followed by a relatively steady decline for the remainder of the night until a sudden rise in activity during the eleventh hour just before dawn (Figure 3-3).

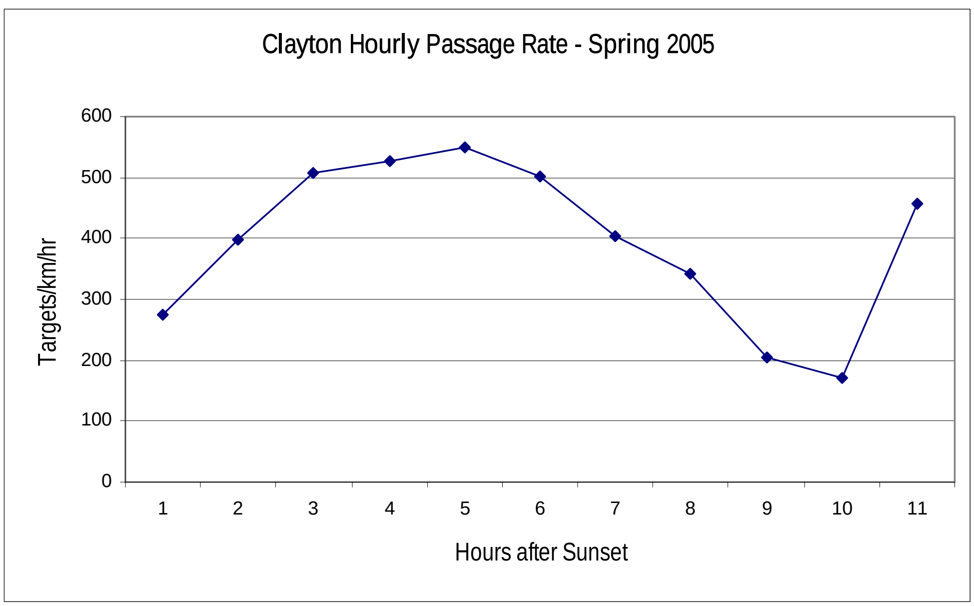

Figure 3-3. Hourly passage rates for entire season.

Flight Direction

Mean flight direction over the radar was 30º ± 53º (Figure 3-4; Appendix B Table 2). There was considerable night to night variation in mean direction, although within each night there was less variation (Figure 3-5). The average nightly flight direction was typically north to northeast on more than three quarters of the nights sampled.

Flight Altitude

The mean flight height of all targets was 443 m ± 38 m (1,453' ± 125') above the radar site. The average nightly flight height ranged from 199 m ± 8 m (653' ± 26') to 753 ± 36 (2,470' ± 118') (Figure 3-6, Appendix B Table 3). The percent of targets observed flying below 150 m (492') also varied by night, from 2 percent to 42 percent (Figure 3-7). The seasonal average percentage of targets flying below 150 m was 14 percent.

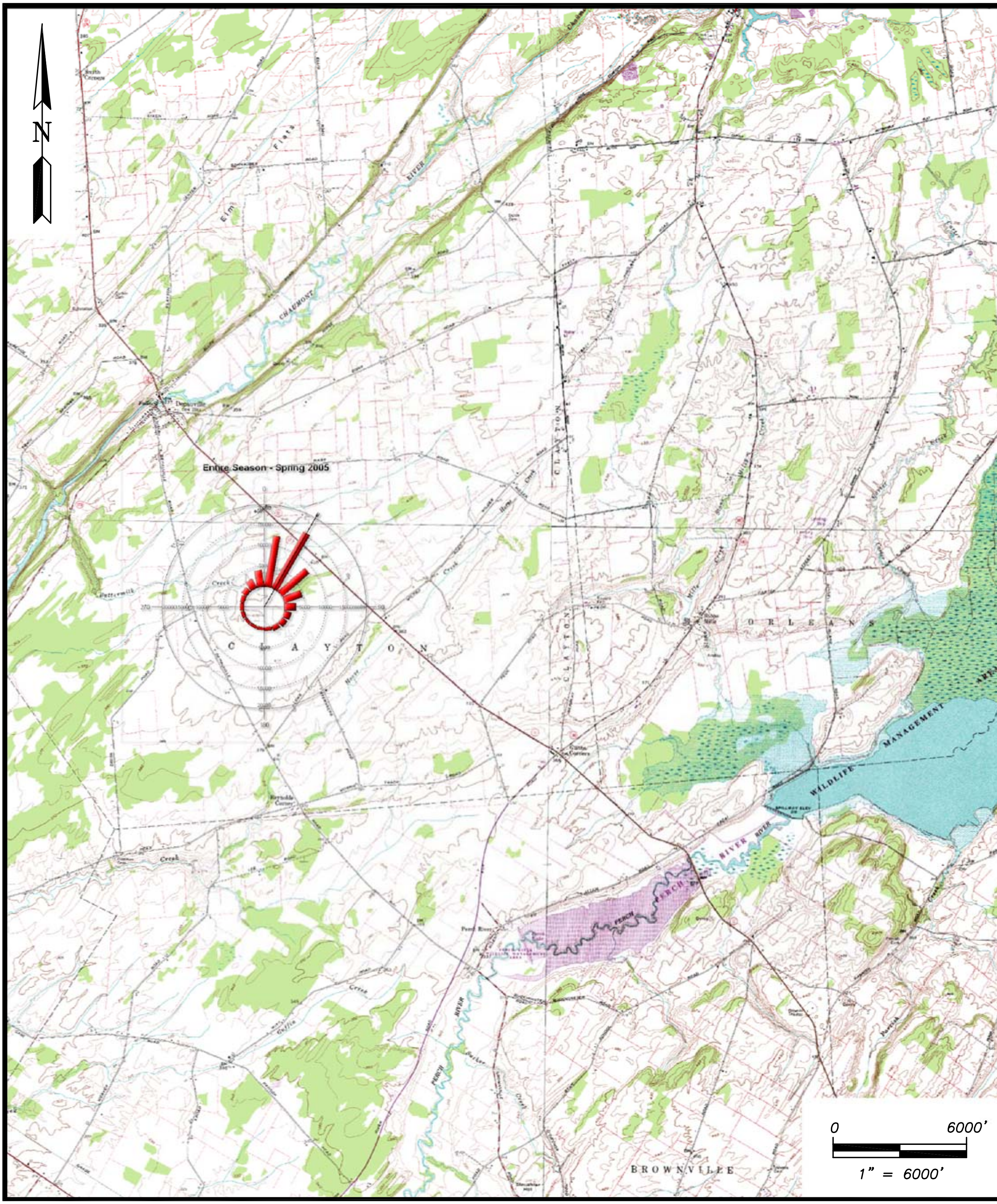

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Figure 3-4
Spring 2005 Target Flight Direction
Clayton Wind Project
Clayton, New York

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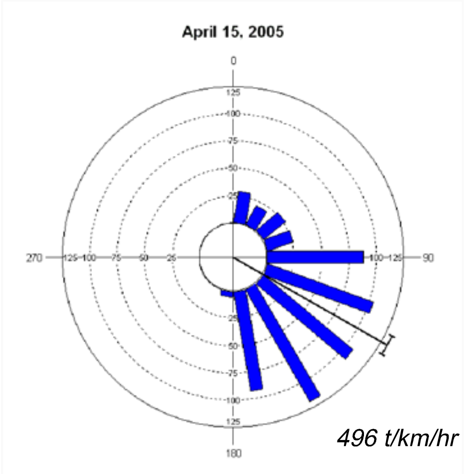
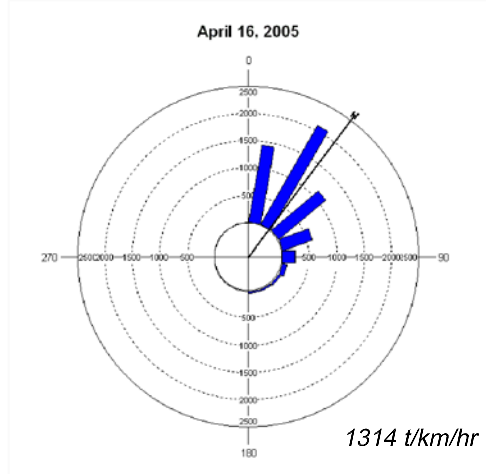
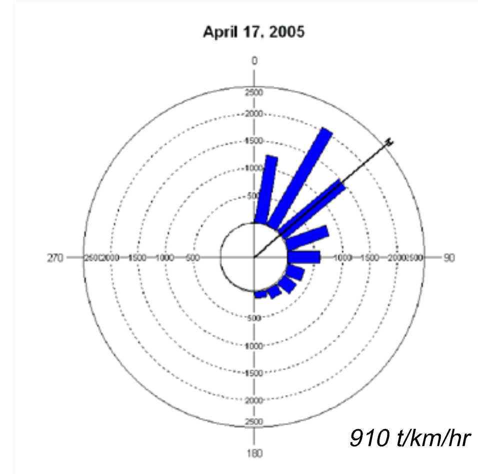
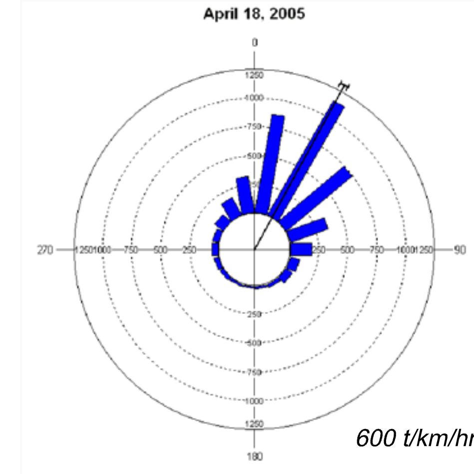
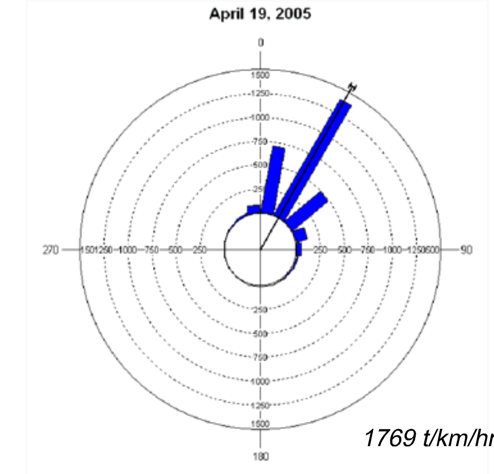
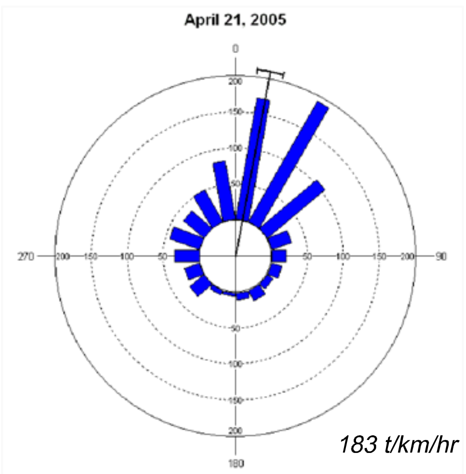


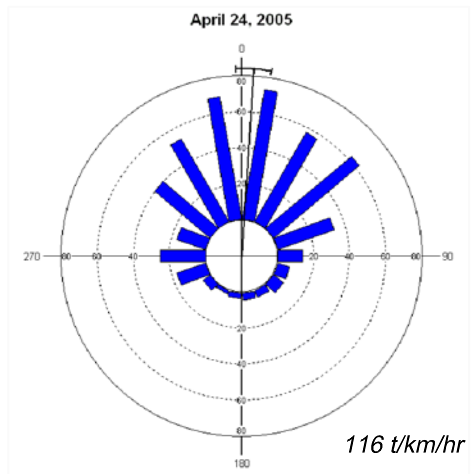


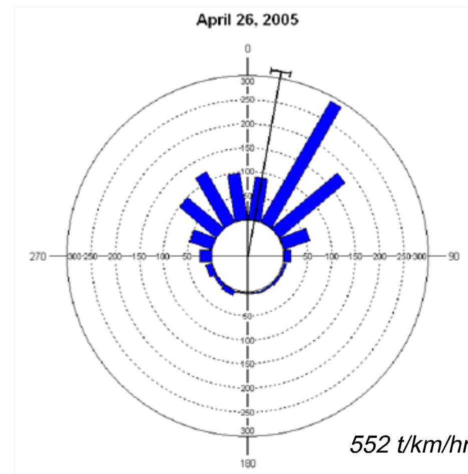


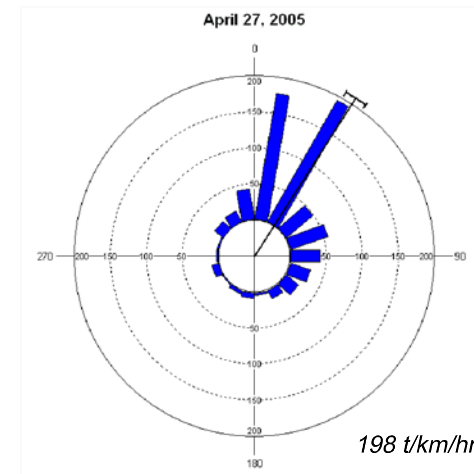


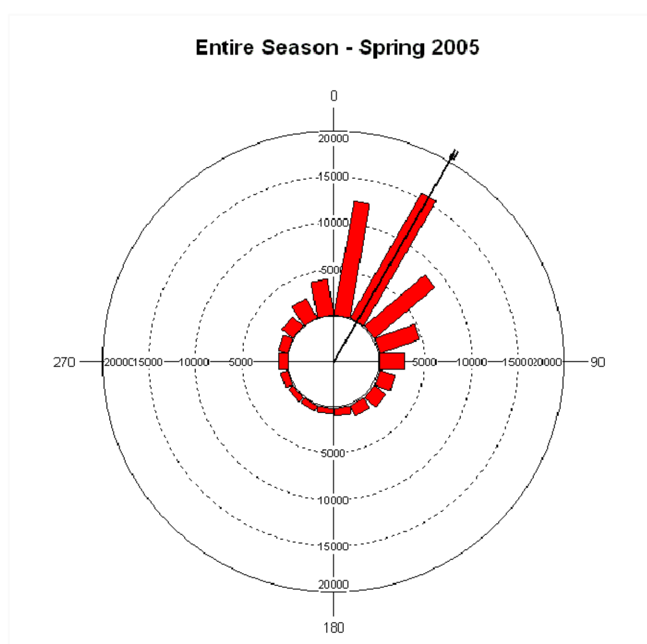












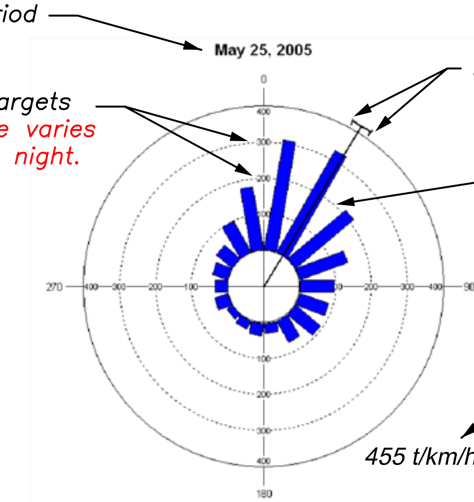
RADAR DATA ROSE LEGEND

Observation Period

Number of Targets
Histogram scale varies from night to night.

95% Confidence Interval

Mean Flight Direction



Mean Hourly Traffic Rate (Targets per Kilometer per Hour)

Data rose shows bird targets in directions of 20° increments.

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SCALE: n/a

DATE: September 2005

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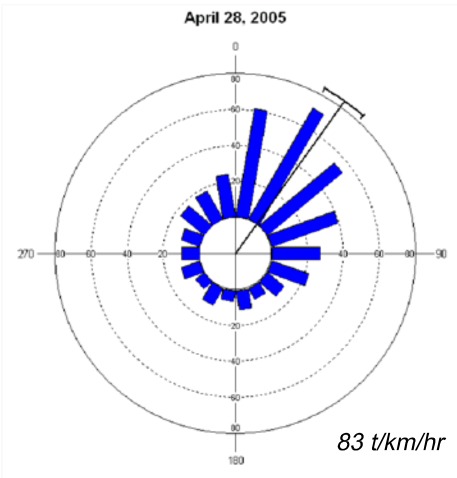
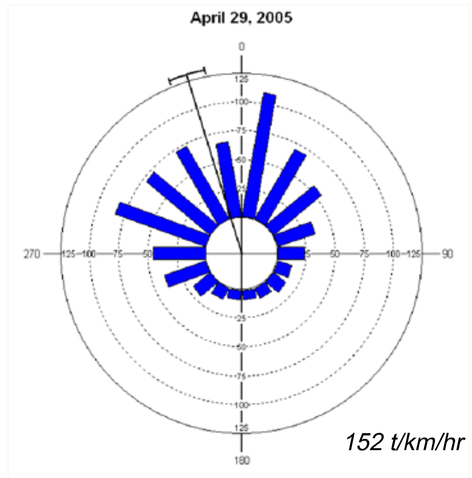
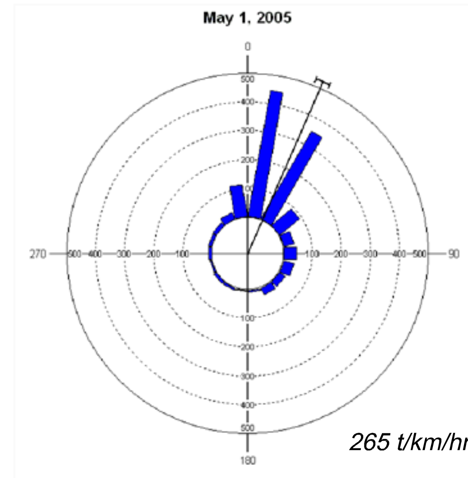
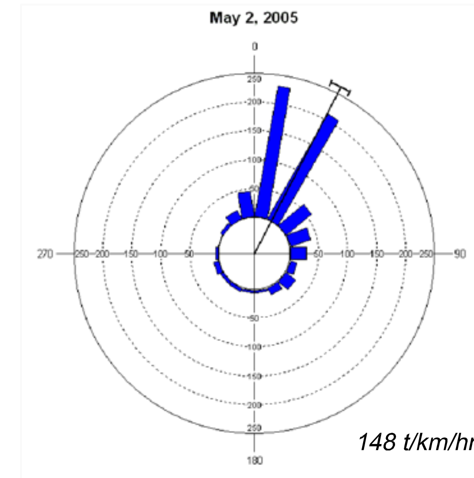
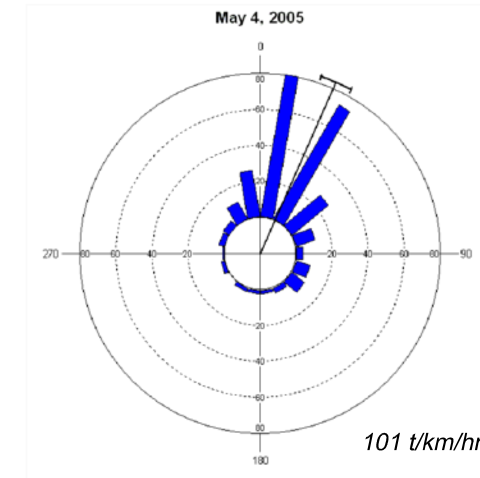
FIGURE NO. 3-5

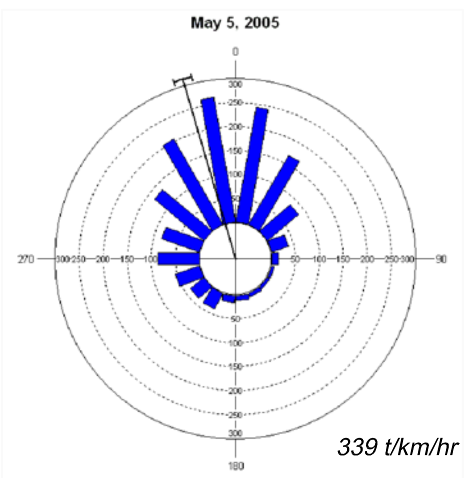


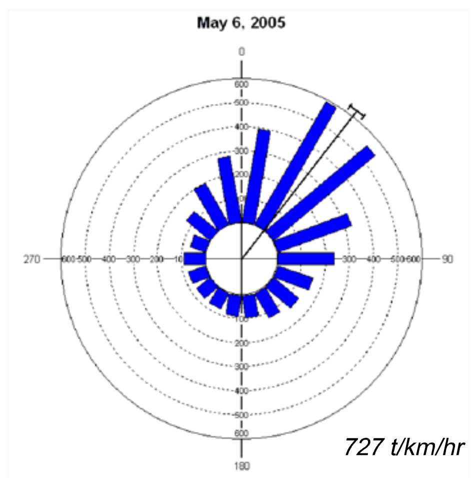


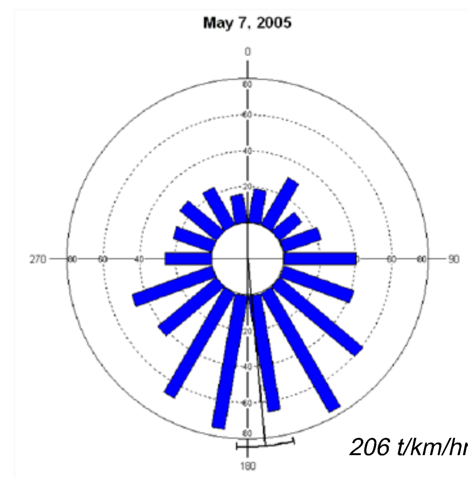


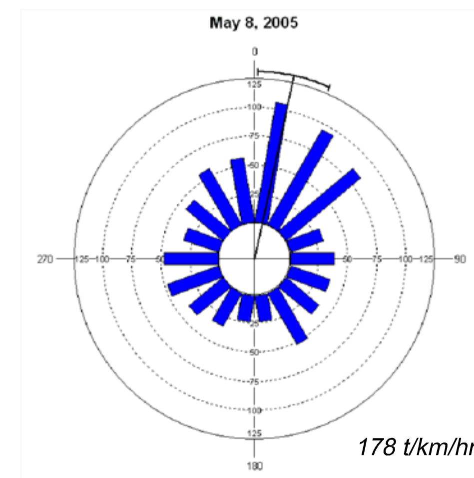


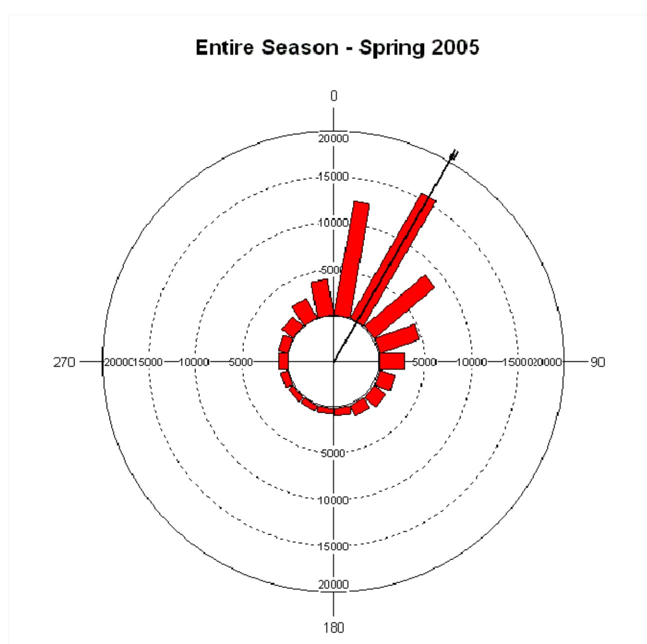












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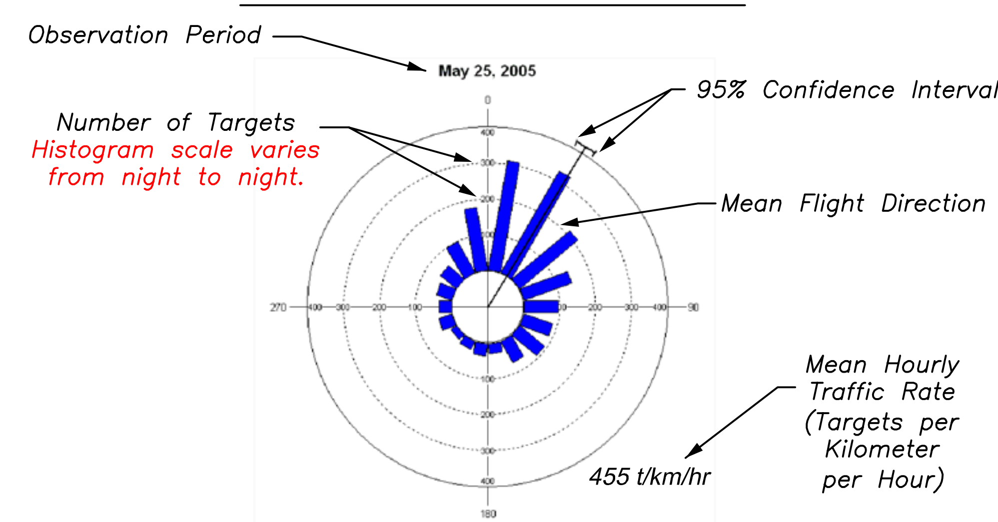

Data rose shows bird targets in directions of 20° increments.

Sheet 2 of 4

NO.	REVISIONS	DATE

SHEET TITLE: Nightly Mean Flight Direction

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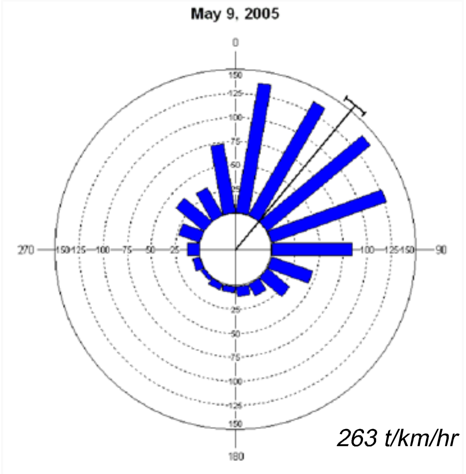
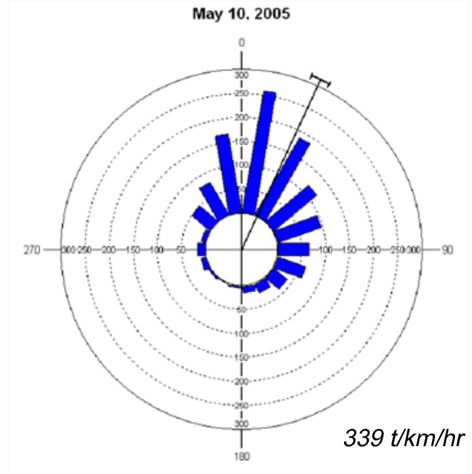
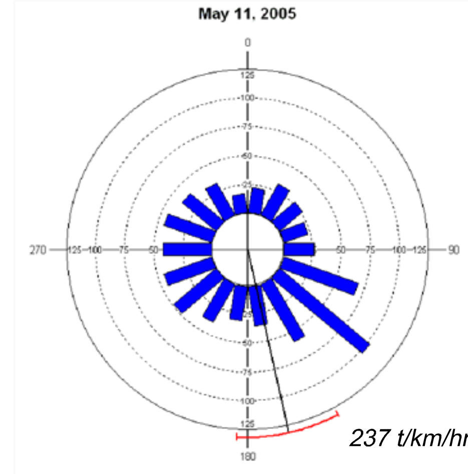
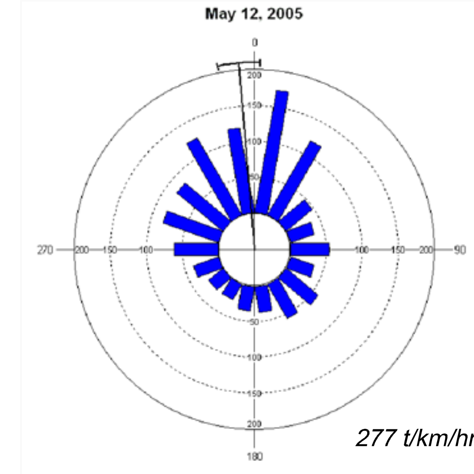
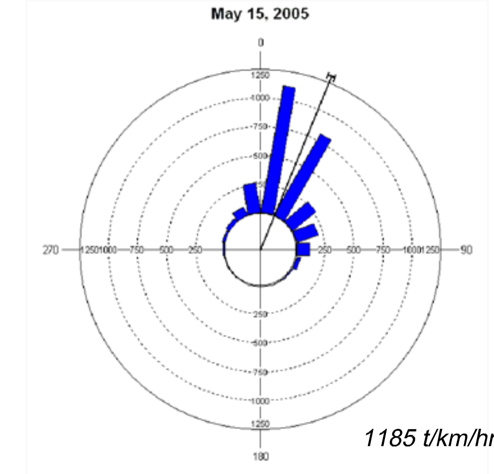
FIGURE NO. 3-5

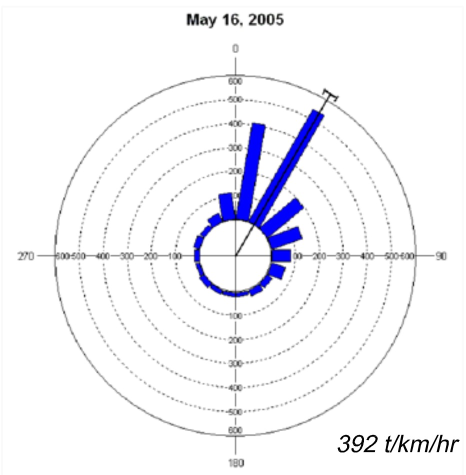


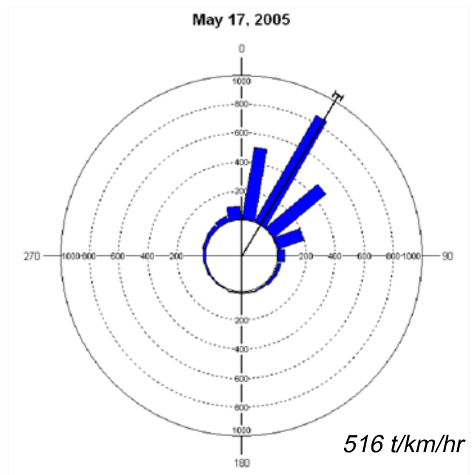


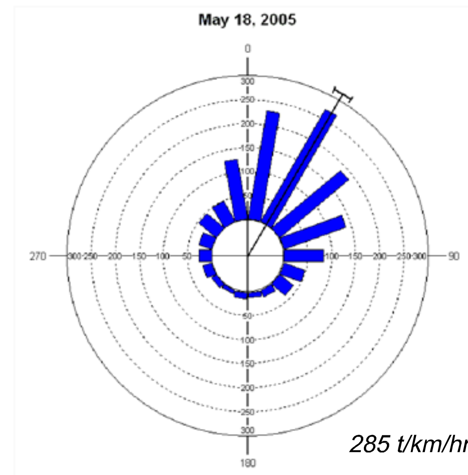


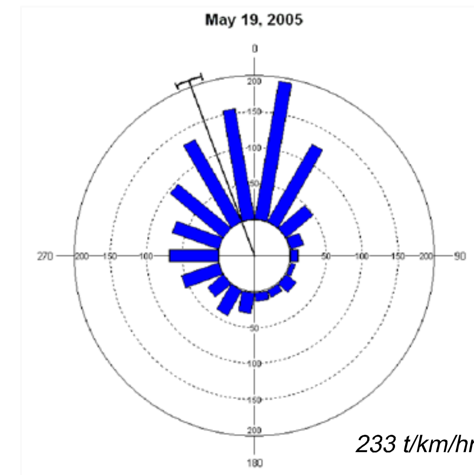


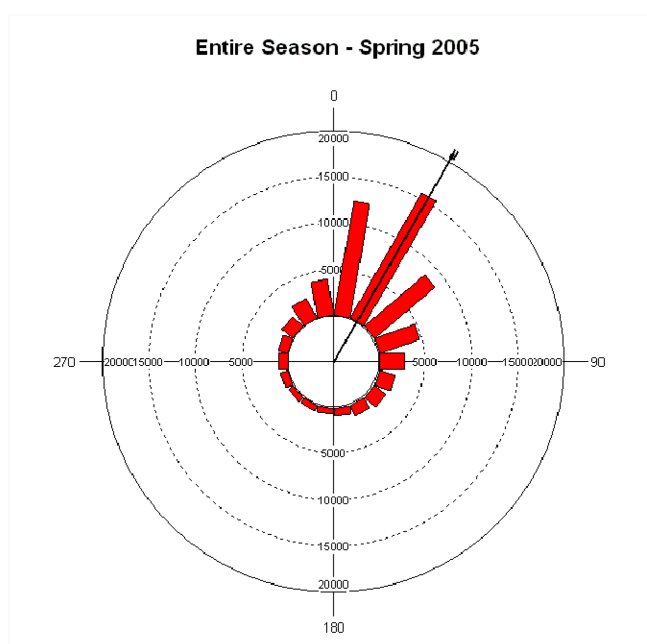












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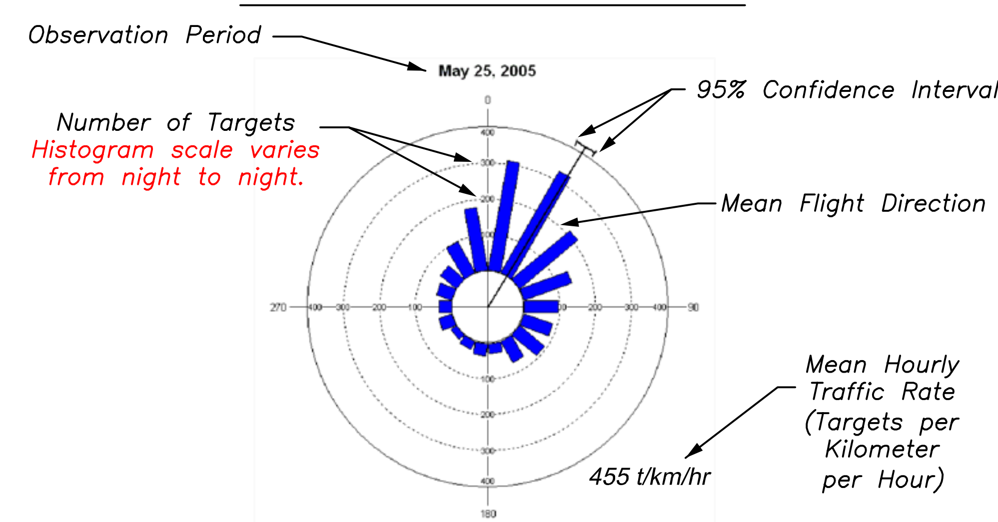

Data rose shows bird targets in directions of 20° increments.

Sheet 3 of 4

NO.	REVISIONS	DATE

SHEET TITLE: Nightly Mean Flight Direction

SCALE: n/a

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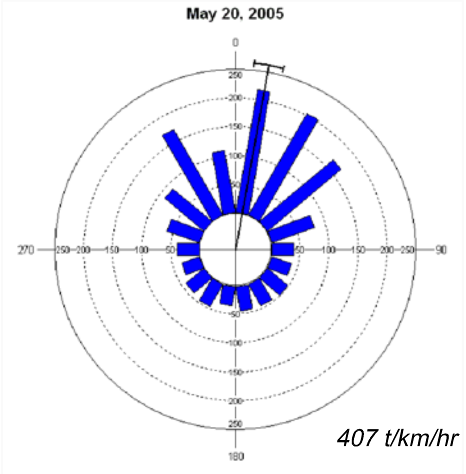
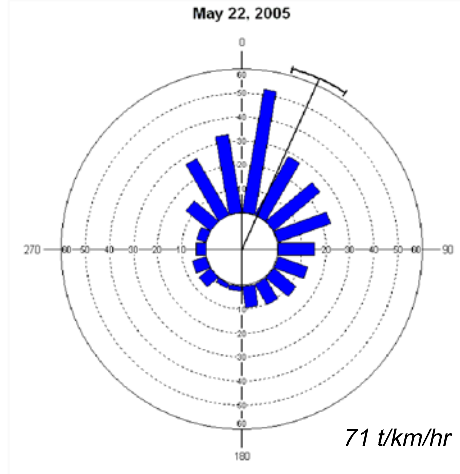
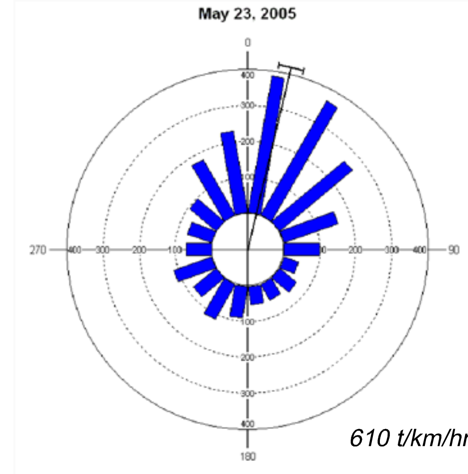
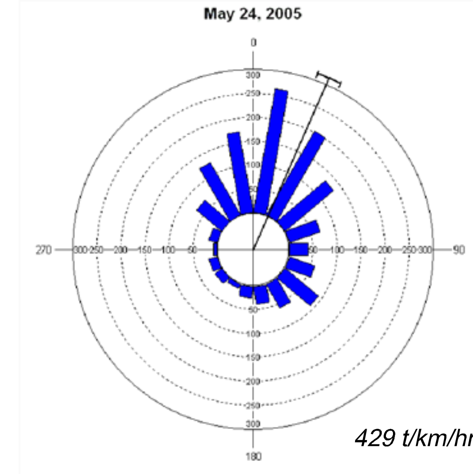
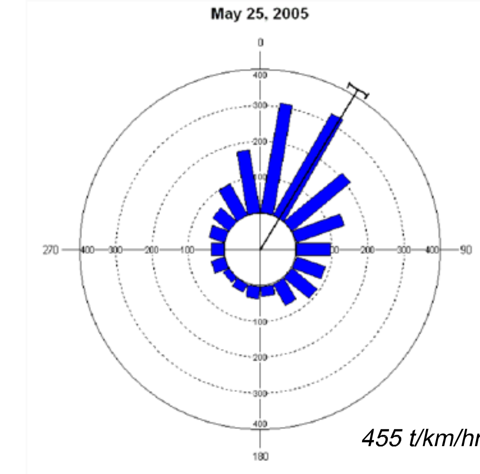
FIGURE NO. 3-5

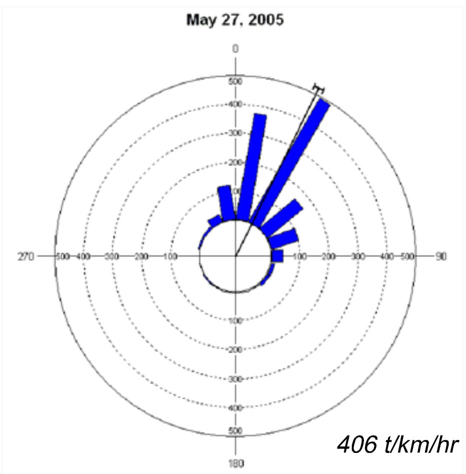


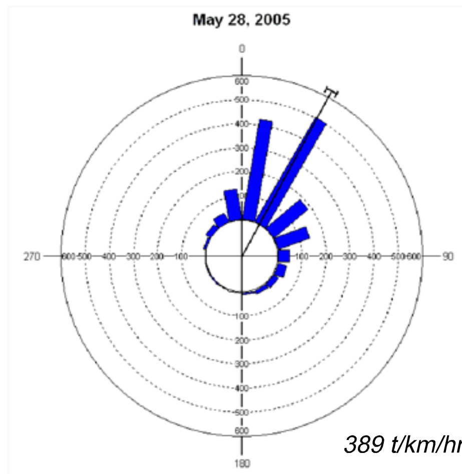


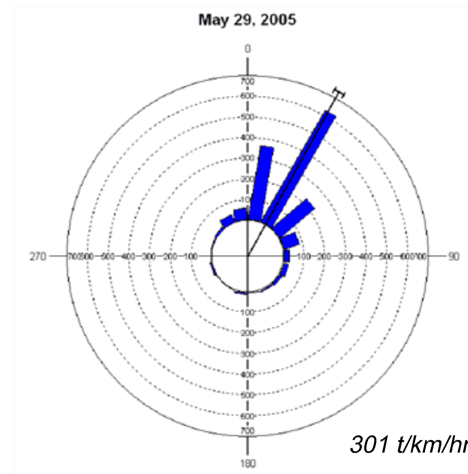


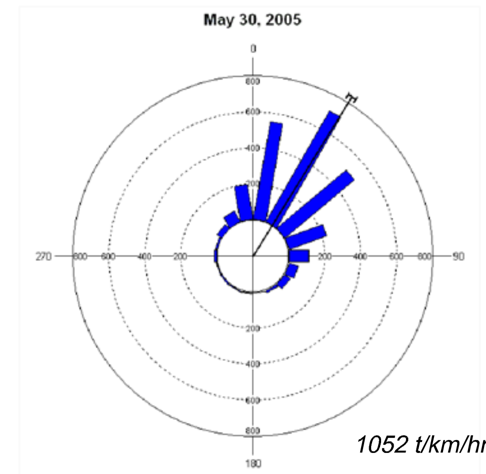


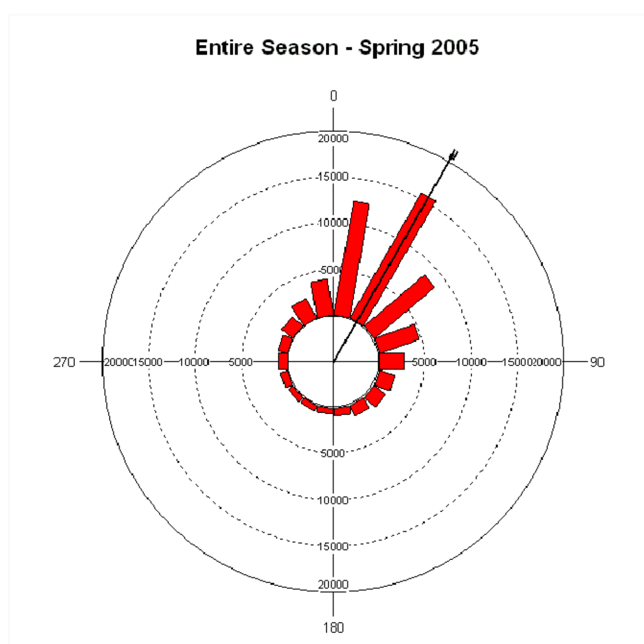












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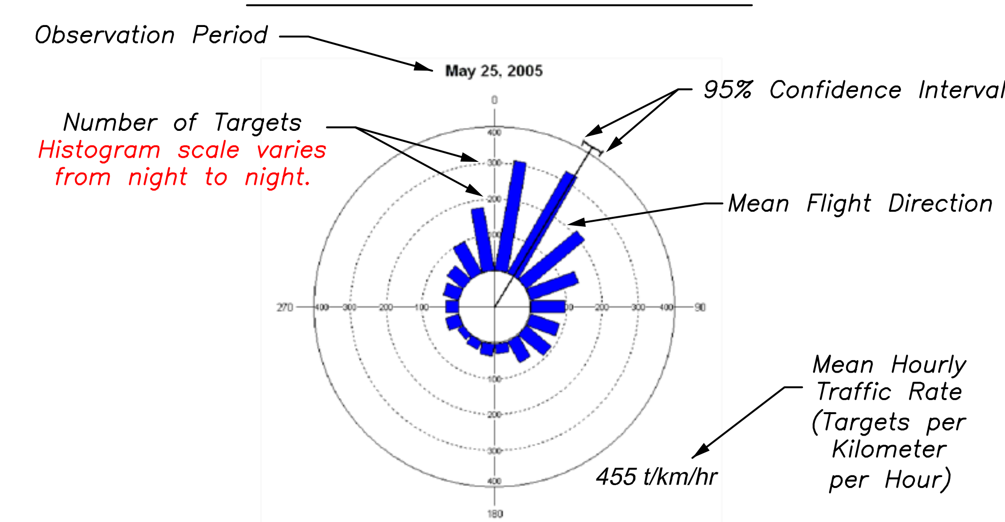

Data rose shows bird targets in directions of 20° increments.

Sheet 4 of 4

NO.	REVISIONS	DATE

SHEET TITLE: Nightly Mean Flight Direction
SCALE: n/a
DATE: September 2005
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ADDRESS: Clayton, New York
PREPARED BY: WOODLOT ALTERNATIVES, INC. ENVIRONMENTAL CONSULTANTS
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FIGURE NO. 3-5

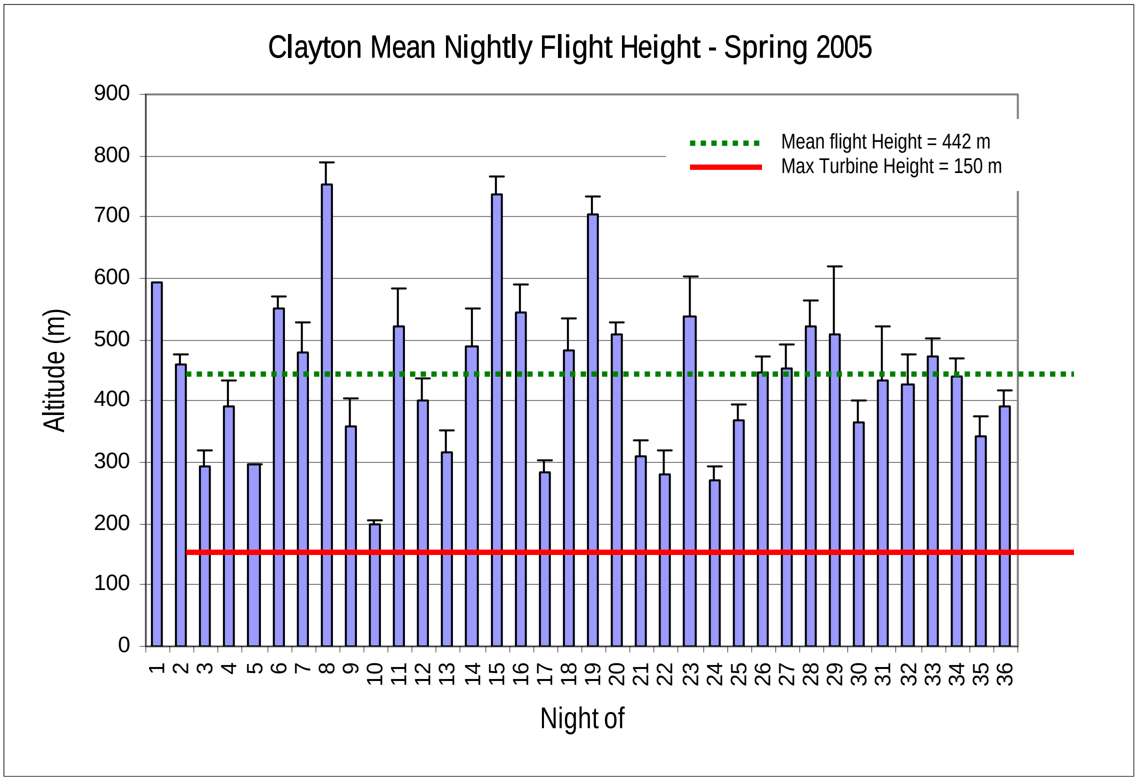


Figure 3-6. Mean nightly flight height of targets

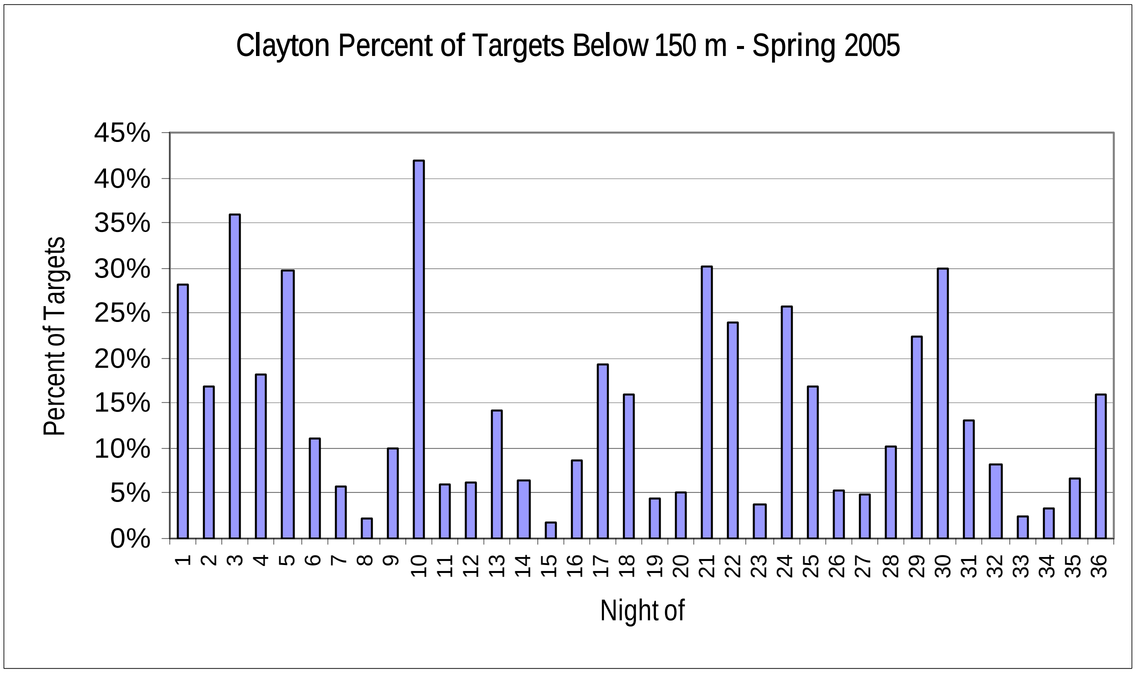


Figure 3-7. Percent of targets observed flying below a height of 150 m (492'')

Hourly flight height was generally consistent throughout the night, except during the first and eleventh hours after sunset when heights were lower (Figure 3-8). This is presumably the time during which migrants are ascending to or descending from their nightly flight height.

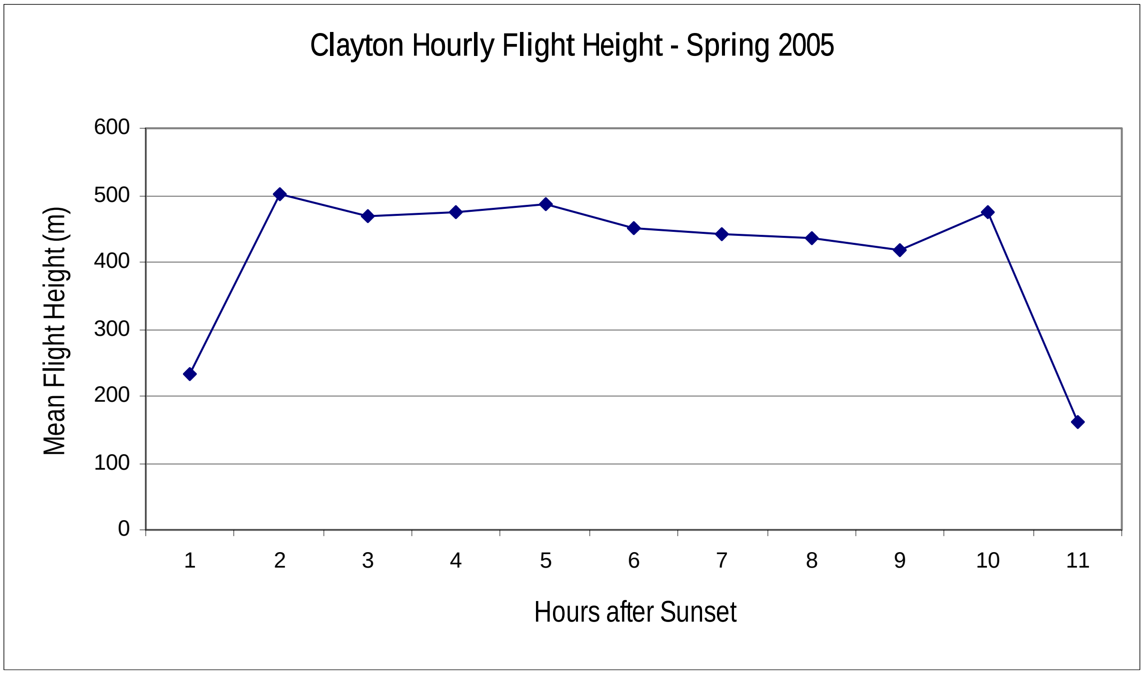


Figure 3-8. Hourly target flight height distribution

Ceilometer Observations

Ceilometer data collected during the radar survey yielded a total of 265 observations. Those observations, however, resulted in relatively few bird observations and relatively light insect activity. Eight birds were observed flying through the ceilometer beam.

3.4 Discussion

Spring 2005 radar surveys documented migration activity and patterns in the vicinity of the proposed Clayton wind project area. In general, migration activity and flight patterns varied between and within nights. Nightly variation in the magnitude and flight characteristics of nocturnally-migrating songbirds is not uncommon and is often attributed to weather patterns, such as cold fronts and winds aloft (Hassler *et al.* 1963, Gauthreaux and Able 1970, Gauthreaux 1971, Richardson 1972, Able 1973, Bingman *et al.* 1982, and Gauthreaux 1991).

Passage Rates

As indicated above, weather patterns are probably the largest factor affecting the magnitude of bird migration, particularly at inland sites. In the spring, an approaching low pressure system typically produces light southerly winds from the west or southwest. Bird migration is often more abundant during these periods because of favorable wind direction for spring migration until the system passes (Richardson 1972). Consequently, nightly migration traffic rates can be expected to be variable and to peak when the best migration weather occurs. The variable nightly passage rates documented at Clayton are consistent with this. Passage rates were variable on cloudy nights and generally low on nights with fog and passing showers, indicative of the role that weather can play in bird migration activity.

Nightly passage rates varied from 71 ± 14 to 1,769 ± 87 t/km/hr, with an overall mean of 450 ± 62 t/km/hr. Passage rates often peaked 3 to 6 hours after sunset, which is typical of nighttime migration activity (Able 1970; Gauthreaux 1971; Richardson 1971, 1972). However, average hourly flight heights for the entire season were consistent between 2 and 10 hours after sunset.

Few surveys using the same methods and equipment and conducted during the same time period are available for comparison (Table 3-2). In a similar study overlooking Lake Erie in western NY, Cooper *et al.* (2004a) documented spring 2003 passage rates between 15 and 1,702 t/km/hr with an overall passage rate of 395 t/km/hr. Previous studies by the same researchers found lower passage rates both in this general area of NY (Wethersfield) as well as in an upstate area (Carthage).

Table 3-2 Summary of regional spring migration studies using radar (Cooper *et al.* 2004a).

Location	Passage Rate
Chautauqua, NY	395
Carthage, NY	159
Wethersfield, NY	41

There are limitations in comparing that data with data from 2005, as year-to-year variation in continental bird populations invariably affects how many birds migrate through an area. However, nightly mean passage rates observed at Clayton were within the range of those studies.

Flight Direction

Some research suggests that bird migration may be affected by landscape features, such as coastlines, large river valleys, and mountain ranges. This has been documented for diurnally-migrating birds, such as raptors, but is not as well established for nocturnally migrating birds (Sielman *et al*. 1981; Bingman *et al*. 1982; Bruderer and Jenni 1990; Richardson 1998; Fortin *et al*. 1999; Williams *et al.* 2001; Diehl *et al*. 2003; Woodlot Alternatives, Inc. unpublished data).

Evidence suggesting topographic effects to night-migrating birds has typically included areas of varied topography, such as the Alps and most rugged areas of the northern Appalachians. The landscape around the Clayton project area is very flat, with low hills. This is considerably less than in those other areas where potential topographic effects on flight direction have been observed. The mean flight direction was 30º ± 53º and there are no indications that the topography is altering the movement of migrants through the area.

Flight Height

The altitude at which nocturnal migrants fly has been one of the least understood aspects of bird migration. Bellrose (1971) flew a small plane at night along altitudinal transects to visually document the occurrence and altitude of migrating songbirds. He found the majority of birds observed were between 150 m and 450 m (492' to 1,476') above the ground level, but on some nights the majority of birds observed were from 450 m to 762 m (1,476' to 2,500') above the ground. Radar studies have largely confirmed those visual observations, with the majority of nocturnal bird migration appearing to occur less than 500 m to 700 m (1,640' to 2,297') above the ground (Able 1970, Alerstam 1990, Gauthreaux 1991, Cooper and Ritchie 1995).

Recent studies at other proposed wind facilities in the Northeast and Mid-Atlantic states are consistent with this as well. Cooper *et al*. (2004a) documented a mean overall flight altitude of 528 m ± 3 m during a spring migration survey in Chautauqua, NY. The highest percentage (36%) of migrants was documented 300 m to 600 m above the ground and the smallest percentage (0.1%) above 1,401 m. In western NY, Cooper *et al*. (2004a) documented a mean flight altitude of 532 m with a small percentage (4%) of targets flying less 125 m above the ground. Results from Clayton are similar to those of Cooper *et al*. (2004a,b), with nightly flight altitudes varying from 199 m ± 8 m to 753 m ± 118 m and a mean of 443 m ± 38 m. The percentage of targets flying less than 150 m above the ground was low (14%), also similar to that found by Cooper *et al*. (2004a).

3.5 Conclusions

Radar surveys during the spring 2005 migration period have provided important information on nocturnal bird migration patterns in the vicinity of the Clayton project area. The results of the surveys indicate that bird migration patterns are generally similar to patterns observed at other sites in the region.

Migration activity varied throughout the season, which is probably largely attributable to weather patterns. The mean passage rate (460 ± 63 t/km/hr) is higher than that observed at similar studies, although the range in nightly passage rate (71 ± 14 to 1,769 ± 87 t/km/hr) is similar to those other studies during the previous fall. Migration activity throughout each night typically peaked 5 hours after sunset with a sudden rise in activity just before dawn. Flight direction for the entire season was 19° ± 83°. Flight direction data indicate that nocturnal migrants are not avoiding the project area for any topographic-related reasons.
The average flight altitude above the ground was 443 m ± 38 m. Only 14 percent of the targets observed during vertical radar operation were flying below an altitude of 150 m (492'), the height of the proposed turbines, indicating that risk of collision to night-migrating birds is limited to a very small subset of those birds.

Risk to nocturnally-migrating birds is known to occur, particularly during periods of inclement weather that can force birds to fly at lower heights and decrease night-time visibility. No consistent trend between flight height and weather patterns was observed. However, nights with inclement weather, which could be associated with increased risk, typically had low passage rates. While increased risk potential could develop due to inclement weather, the prediction of those events cannot be reliably made because night to night variation in flight characteristics occur, even on nights with similarly unsuitable migration weather.

4.0 Bat Survey

4.1 Introduction

Wind projects have been cited as a potential threat to migrating bats for a number of years, especially since a study at the Mountaineer Wind Energy Facility in Tucker County, West Virginia, documented 475 dead bats between April 20 and November 9, 2003 (Johnson and Strickland 2004). Subsequent fieldwork in 2004 at the Mountaineer site and nearby Meyersdale Wind Facility has revealed even higher rates of bat collision mortality with operating wind turbines (Arnett *et al.* 2005). These studies have raised numerous concerns regarding the potential for collision mortality associated with wind turbines to impact bat populations (Williams 2003). The concerns lie primarily with wind farms in the eastern United States, where documented bat fatality rates have been considerably higher (bats per turbine per year) than at western wind farms (Williams 2003, Arnett *et al.* 2005).

Researchers currently have limited understanding of the specific factors influencing rates of bat collision mortality, although evidence from the timing of fatalities documented at existing wind facilities and other structures suggests that migrating bats are at the highest risk (Johnson and Strickland 2004, Johnson *et al.* 2003, Whitaker and Hamilton 1998). A number of plausible hypotheses explaining the high rates of bat mortality have been presented by bat researchers, but none of these have been adequately tested. The most likely mechanisms explaining bat collision center on the possibility that ridges act as corridors for migrating or feeding bats, that bats are unable to detect turbines visually or by echolocation, or that bats may be attracted to wind turbines due to artificially high insect concentrations, light attraction, or acoustic attraction (Arnett *et al.* 2005).

Nine species of bats occur in NY, based upon their normal geographic range. These are the little brown myotis (*Myotis lucifugus*), northern myotis, (*Myotis septentrionalis*), Indiana myotis (*Myotis sodalis*), Eastern small-footed myotis (*Myotis leibii*), silver-haired bat (*Lasionycteris noctivagans*), Eastern pipistrelle (*Pipistrellus subflavus*), big brown bat (*Eptesicus fuscus*), Eastern red bat (*Lasiurus borealis*), and hoary bat (*Lasiurus cinereus*) (Whitaker and Hamilton 1998). Of these, the Indiana myotis is listed as federally endangered, and the small-footed bat is listed as a special concern species by the State. According to the NYDEC, eight Indiana myotis hibernacula are present in NY, located in Albany, Essex, Jefferson, Onondaga, Ulster, and Warren counties (NYDEC website, accessed 8/4/05). Clayton is located near the center of Jefferson County, in north central NY. Due to the proximity of the Clayton site to known Indiana myotis hibernacula, it is highly likely that the species is present in the study area. This was confirmed by the NYDEC in the spring of 2005 during a radio telemetry study (pers. comm. Al Hicks, NYDEC).

To document bat occurrence in the area of the proposed wind project, Woodlot conducted acoustic monitoring surveys from April 20 to May 30, 2005. Visual ceilometer observations were also made between April 15 and May 30, 2005, concurrent with a nocturnal radar study. Acoustic surveys were the primary survey type used in this study, and were designed to document bat passage rates in different habitat types and from ground level to heights of 20 m (66').

A primary goal of these surveys was to attempt to document the presence of bats migrating and foraging in and near the rotor zone of the proposed wind project. The majority of bats found in the eastern United States migrate, gather together near hibernacula, or enter hibernation between late July and early November (Whitaker and Hamilton 1998). Because recent research indicates that migrating bats appear to have a higher risk of collision with wind turbines than birds, most mortality at a wind farm would be expected to occur during the fall and spring bat migrations, the timing of which depends upon the bat species and the location.

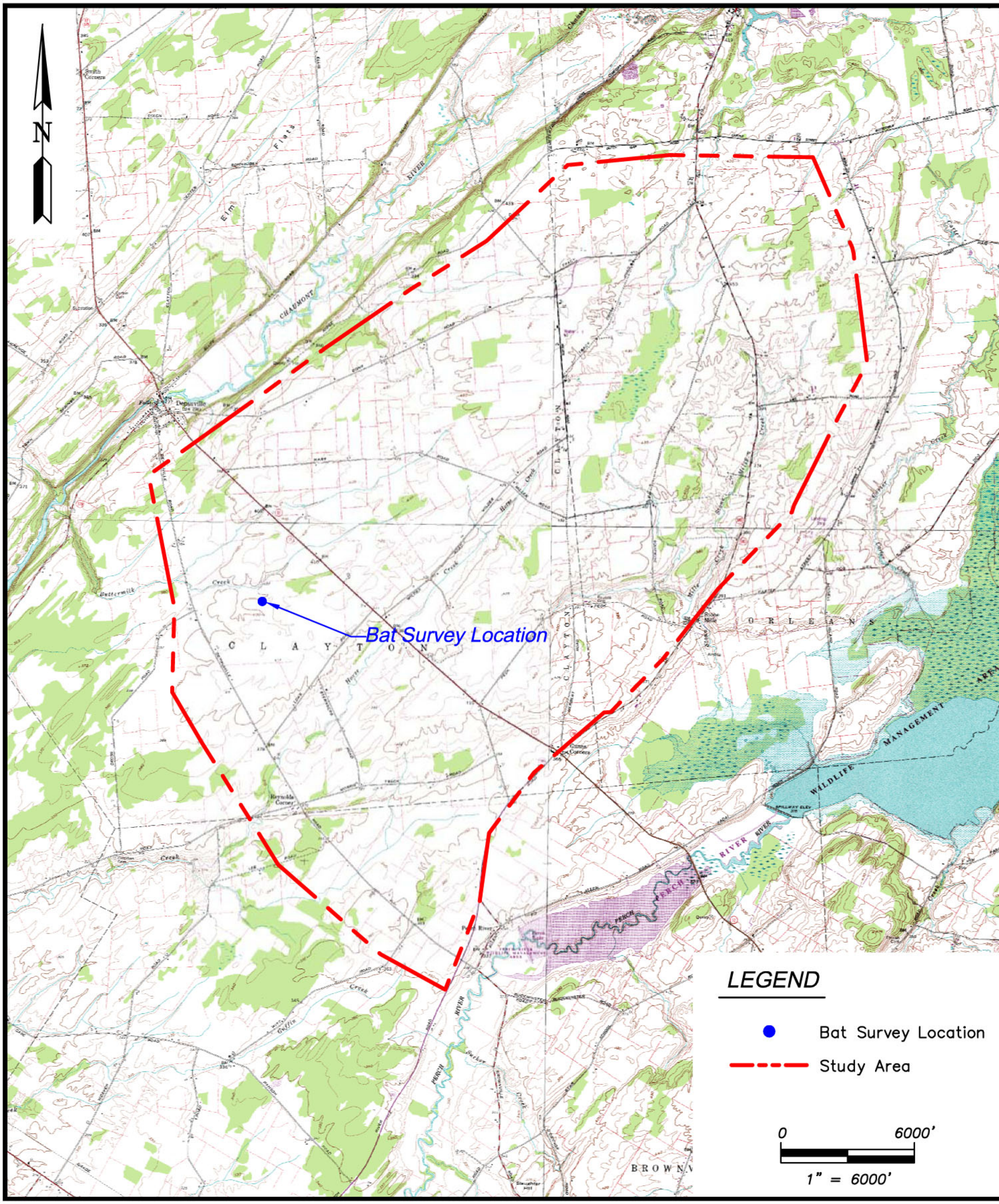
4.2 Methods

Field Surveys

Anabat II detectors were used for the duration of this study. Anabat detectors are frequency-division detectors, dividing the frequency of ultrasonic calls made by bats (a factor of 16 was used in this study[2]) so that they are audible to humans. These detectors are able to detect all bat species known to occur in New England using this setting. Data from the Anabat detectors were logged onto compact flash media using a CF ZCAIM (Titley Electronics Pty Ltd) and downloaded to a computer for analysis.

The acoustic surveys were designed primarily to document the occurrence and detection rates of bats near the ground and at heights near the low end of the blade-swept area of the proposed turbines. To do this, one to two detectors were suspended from the guy wires of the met tower near Lowe Road in Clayton (Figure 4-1). The two detectors were suspended at heights of 15 m and 20 m (49' and 66') from the met tower guy wires. Detectors were programmed to record data from 7:00 p.m. to 7:00 a.m. nightly, resulting in 12 hours of sampling per detector per night.

[2] The frequency division setting literally divides ultrasonic calls detected by the detector by the division setting in order to produce signals at frequencies audible to the human ear.



PREPARED BY:
WOODLOT ALTERNATIVES, INC.
ENVIRONMENTAL CONSULTANTS

DATE:	September 2005
SCALE:	1" = 6000'
JOB NO. 105030	
FILE: 105030-00-Location.dwg	

Figure 4-1
Bat Survey Location Map
Clayton Wind Project
Clayton, New York

REV.

Data Analysis

Call files were extracted from data files using CFCread© software, with default settings in place. Nightly tallies of detected calls were compiled for each detector. Mean detection rates (calls/hour and calls/night) were calculated for each night. These were summarized by time period within the migration season and detector location (15 m or 20 m high in the met tower). Detection rates indicate only the number of calls detected, and do not necessarily reflect the number of individual bats in an area.

Ultrasonic calls of bats are attenuated quickly by the atmosphere, and are only able to travel limited distances, depending upon their frequency (Griffin 1970, 1971). Also, Anabat detectors have a limited range of roughly 10 m to 15 m (33' to 49'). This was confirmed at the beginning of the survey period using an artificial "bat chirp" device and field tests with flying bats. Consequently, the height of bat calls recorded by the detectors deployed in the met tower was assumed to be roughly that of the detector that recorded the bat.

In addition to documenting passage rates, acoustic surveys with Anabat II detectors allow for limited species identification (O'Farrell and Gannon 1999). Because bat calls vary widely within species, and are influenced by habitat and region, definitive species identification based upon acoustic monitoring alone is not always possible. However, several of the species that are present in this area have calls that appear distinct when recorded with the Anabat system.

Qualitative visual comparison of recorded call sequences of sufficient length to reference libraries of bat calls allows for relatively accurate identification of bat species (O'Farrell *et al.* 1999a). Calls recorded during the survey were compared to reference calls compiled by Chris Corben, the designer of the Anabat II software used in this study, and data from the University of Maine Mammalogy Department. These reference calls were of western and northeastern origin and served as a basis for differentiating the calls that were recorded. Recorded calls were classified based upon the shape of the call sequence, the slope, and the maximum and minimum frequencies. Calls with insufficient material upon which to determine the species were classified as unknown. Because calls within the *Myotis* genus are so similar, they were not identified to the species level.

Ceilometer Surveys

As noted in Section 3.2, ceilometer surveys took place for 5 minutes during each hour of radar sampling. While species identification was not possible, targets were classified as either bats or birds and helped provide insight into the composition of the migrant animal population that occurred at low altitudes. The ceilometers were held in-hand so that animals passing through the light beam were followed for several seconds.

4.3 Results

Acoustic Monitoring

During the sampling period, a total of 67 bat call sequences were detected and recorded (Table 4-1). Of the total bat passages detected while high and low bat detectors were operating simultaneously, 55 (83%) were detected by the high bat detector, operating at a height of roughly 20 m (66'). This results in detection rates of 1.6 calls/night of survey and 0.9 calls/detector-night. Bats were detected between May 5 and May 28, with the peak passage rates occurring on May 6, when 15 call sequences were detected.

Table 4-1. Summary of bat calls detected at Clayton, NY, during spring 2005 surveys.

Species	High	Low	Total
Big brown Bat	21	6	27
Hoary Bat	0	1	1
Silver-haired Bat	18	0	18
Myotis sp.	8	4	12
Unknown	8	1	9
Entire Season	**22**	**12**	**34**

Recorded calls were classified by species based upon the shape of the call sequence, the slope, and the maximum and minimum frequencies. Visual comparisons were made to libraries of known reference calls. Of the 67 recorded calls, 27 were identified as big brown bats, 18 as silver-haired bats, 12 as *Myotis* sp., and one as a hoary bat. Nine calls were classified as "unknown," due to insufficient material on which to base an identification. Because calls within the genus *Myotis* are so similar, we did not attempt to differentiate between species.

Ceilometer Data

Ceilometer data collected during the radar survey yielded a total of 265 observations. Those observations, as is typical, resulted in no bat observations.

4.4 Discussion

Bat mortality at wind projects in the eastern United States has recently been identified as a potential risk to certain bat populations (Williams 2003). The study of this issue, however, poses difficulties, including insufficient scientific understanding of bat migration patterns and navigation systems, inadequate amounts of data on mortality rates and interactions between bats and turbines at existing wind farms in forested landscapes, a lack of accurate population estimates for many bat species, and limited monitoring methods available that provide credible, comprehensive, and reliable data on bat movements.

This study aimed to document passage rates of bats in and near the blade-swept zone of the proposed wind farm. Spring sampling at Clayton revealed very low levels of bat activity in late April, and moderate levels of bat activity during the month of May. Bats were recorded 21 of the 42 nights sampled. The majority (72%) of call sequences was detected during the first 4 hours of the night (between 8:00 p.m. and midnight). Detection rates were 1.6 calls/night for the 42 nights, but were 0.9 calls/detector-night when corrected for the number of detectors deployed and operating.

Of the 67 recorded calls, the majority were identified as big brown bat (27), silver-haired bat (18), and *Myotis* sp. (12). We did not attempt to differentiate between species within the genus *Myotis*, which includes the federally endangered Indiana myotis. However, most of the *Myotis* calls that were detected at Clayton were between 40 and 60 kHz, which is somewhat lower than the frequency of Indiana myotis calls, and most closely resembled the call shape of little brown bats. Clayton is located in Jefferson County, which is one of six counties in NY known to contain at least one Indiana myotis hibernacula. The nearest of which is located near Brownville, 16 to 32 km (10 to 20 miles) south of Clayton.

The ability to identify bats by acoustic methods requires significant amounts of practice and the accuracy of this method has been debated (O'Farrell *et al.* 1999b). The quality and length of recorded calls also influences the degree to which identification is possible (O'Farrell and Gannon 1999). The species identifications presented in this report are based on call analysis alone, and therefore are subject to error. The greatest potential for false identification would be in differentiating between big brown and silver-haired bats, due to the similarity of their call structure.

Data from spring bat surveys at Clayton revealed higher levels of bat activity at 20 m (66') than at 15 m (49'). Eighty-three percent of bat passages were detected by the high detector. The high and low detectors both functioned properly throughout the survey period, and were configured in exactly the same manner, although slight differences in sensitivity may have existed between the two detectors. Species detected by the high and low detectors were similar, although no silver-haired bats were detected by the low detector.

Emerging information on the potential susceptibility of bats to wind turbine-induced mortality indicates that some species may be particularly vulnerable to collisions with turbines. The tree roosting bats, (hoary and eastern red bats), along with the silver-haired bat, appear to have a higher risk of collision with wind turbines, based on mortality data collected at existing facilities. Although these species are all relatively common, they have constituted disproportionably large percentages of bat fatalities at existing facilities.

Ultrasonic calls of bats are attenuated quickly by the atmosphere and are only able to travel limited distances, depending upon their frequency (Griffin 1970, 1971). Anabat detectors have a limited range, roughly 10 m to 15 m (33' to 49'), based upon trials with an artificial "bat chirp" and field tests with flying bats. Due to these factors, a single Anabat II detector samples a cone of airspace approximately 45º wide and 9 m to 15 m (30' to 49') deep. Therefore, the detection distance of the upper detector, at 30 m (98'), would extend only 3 m to 5 m (10' to 16') into the bottom of a wind turbine's blade-swept area, representing only roughly 1 to 3 percent of that area.

Detectors were unable to sample bat passage rates in the central and upper regions of the rotor zone, which are at heights of approximately 80m (262') and 110 m (361'). It is not known whether or not certain bat species migrate at these higher altitudes. Because our detectors sampled only to roughly 20 m (66'), our methods would not have detected bats that may have been flying at higher altitudes. Additionally, our methods only allow the detection of bats that are producing ultrasonic signals. One possible explanation for why migrating bats may collide with turbines is that they do not use their echolocation system while migrating. This would either mean that bats do not monitor reflected echolocation signals, or that they do not produce ultrasonic signals when migrating, in which case they would be invisible to acoustic bat detectors. This possibility must be taken into account when interpreting data from acoustic monitoring surveys.

4.5 Conclusions

Acoustic bat surveys revealed very relatively low numbers of bats in the Clayton site during spring 2005. Bats were detected between April 24 and May 28, although the greatest number of bats detected in one night was two bats on the night of May 6. More bat passages were detected at the high detector than at the low detector at the Clayton site.

No definitive determination of the presence or absence of any rare bats from the project area can be made. Although 12 calls were identified as belonging to the genus *Myotis*, these calls could not be positively identified to species. The Clayton site is known to be used by Indiana bats and calls recorded during the spring survey could be those of this species.

The many factors that may influence bat collision rates with wind turbines are largely unknown, it is impossible to accurately predict whether or not a wind facility will cause significant bat mortality before it is operational. Many of the theories explaining bat collisions, such as acoustic attraction and insect concentration, suggest that the operation of the turbines may actually attract bats. Because acoustic monitoring surveys detect only those bats that are producing ultrasonic signals, and because this survey technique samples a very small air space relative to the rotor zone of a single wind turbine, let alone an entire wind facility, results from these surveys must be interpreted with caution. Acoustic sampling reveals activity patterns, species distributions, and can document bats' presence in the air space near the rotor zone of wind turbines, but cannot monitor the entire rotor zone of a turbine, and cannot predict how bats might interact with an operational turbine.

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Appendix A

Appendix A Table 1. Summary of Daily Raptor Migration Surveys

Species	3/30/2005	3/31/2005	4/11/2005	4/12/2005	4/20/2005	4/24/2005	4/28/2005	4/29/2005	5/6/2005	5/7/2005	Entire Season
American Kestrel		1	1	1			2				5
Bald Eagle							1		1		2
Broad-winged hawk					4	3	205	37	3		252
Coopers Hawk							1				1
Golden Eagle						1	1				2
Merlin	1			1						1	3
Northern Harrier	3	1	3			1			4	2	14
Osprey					1	2	1		4		8
Peregrine Falcon						1	2				3
Red Shouldered Hawk	1	1							1		3
Red Tailed Hawk	9	34	11		1	4	5	5	2	2	73
Rough Legged Hawk	1	3	1								5
Sharp-shinned Hawk			4	1	1		15	1	1	2	25
Turkey Vulture	8	42	88	50	9	11	19	11	11	11	260
Unid. Accipter							3		1		4
Unid. Buteo	8	3				2	7	2	2	2	26
Unid. Raptor	2	2				1	7	1	1		14
Entire Season	**33**	**87**	**108**	**53**	**16**	**26**	**269**	**57**	**31**	**20**	**700**

Appendix A Table 2. Summary of Hourly Raptor Observations

Species	9:00-10:00	10:00-11:00	11:00-12:00	12:00-1:00	1:00-2:00	2:00-3:00	7:00-8:00	8:00-9:00	3:00-4:00	Entire Season
American Kestrel	1		2		1	1				5
Bald Eagle				1	1					2
Broad-winged hawk	13	19	126	80	13	1				252
Coopers Hawk				1						1
Golden Eagle			1	1						2
Merlin	2	1								3
Northern Harrier	1	3	1	5	3		1			14
Osprey	1	2	2	2	1					8
Peregrine Falcon			2	1						3
Red Shouldered Hawk		1	2							3
Red Tailed Hawk	6	12	25	14	6	7	3			73
Rough Legged Hawk		3		2						5
Sharp-shinned Hawk	2	3	12	4	4					25
Turkey Vulture	26	37	67	43	35	45			7	260
Unid. Accipter	1			1	2					4
Unid. Buteo		2	13	6	2			3		26
Unid. Raptor	1		5	2	6					14
Entire Season	**54**	**83**	**258**	**163**	**74**	**54**	**4**	**3**	**7**	**700**

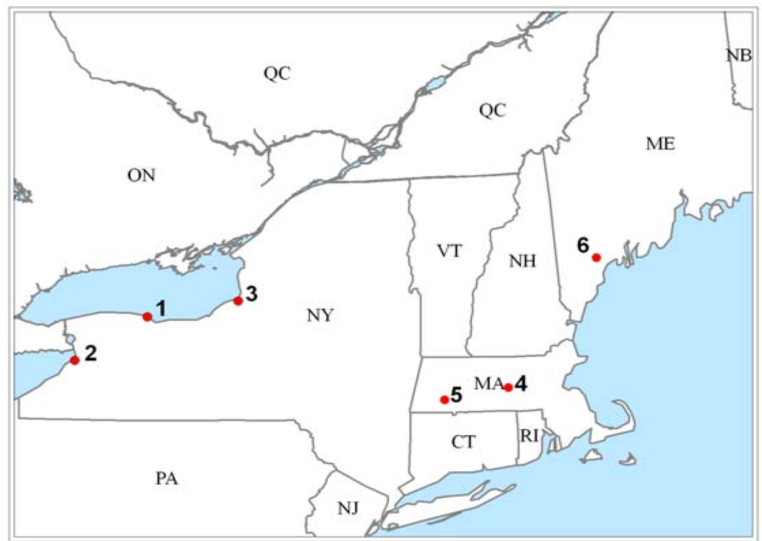
Appendix A Table 3. Species distribution below turbine height

Species	> 150 m	< 150 m	Entire Season
American Kestrel		5	5
Bald Eagle	1	1	2
Broad-winged hawk	105	147	252
Coopers Hawk		1	1
Golden Eagle		2	2
Merlin		3	3
Northern Harrier	6	8	14
Osprey	5	3	8
Peregrine Falcon		3	3
Red Shouldered Hawk	2	1	3
Red Tailed Hawk	43	30	73
Rough Legged Hawk	3	2	5
Sharp-shinned Hawk	3	22	25
Turkey Vulture	71	189	260
Unid. Buteo	23	3	26
Unid. Raptor	12	2	14
Unid. Accipter		4	4
Entire Season	**274**	**426**	**700**

Appendix A Table 4. Summary of Regional Spring (March - May) Migration Surveys*																											
Site Number**	**Year**	**Location**	**Observation Hours**	**BV**	**TV**	**OS**	**BE**	**NH**	**SS**	**CH**	**NG**	**RS**	**BW**	**RT**	**RL**	**GE**	**AK**	**ML**	**PG**	**SW**	**UR**	**UB**	**UA**	**UF**	**UE**	**TOTAL**	**BIRDS/ HOUR**
1	**2005**	**Braddock Bay, NY**	447.75	1	8993	100	113	700	1382	392	46	200	16294	1999	318	31	188	21	12	3	0	0	0	0	0	30,793	68.8
2	**2005**	**Hamburg, NY**	396.25	0	7838	109	42	76	525	124	2	299	2503	1368	42	3	95	3	6	0	106	0	0	0	0	13,141	33.2
3	**2005**	**Derby Hill, NY**	386.75	1	6834	278	137	423	1510	330	26	501	8928	4022	369	49	158	29	4	0	24	0	0	0	0	23,626	61.1
4	**2004**	**Barre Falls, MA**	169	1	92	203	13	23	234	19	0	18	536	132	0	1	132	12	1	0	21	0	0	0	0	1,438	8.5
5	**2004**	**Blueberry Hill, MA**	121	1	98	125	13	24	128	18	0	18	515	132	0	3	81	0	1	0	10	0	0	0	0	1,167	9.6
6	**2004**	**Bradbury Mountain, ME**	66	0	0	168	8	16	364	14	0	1	668	24	0	0	182	14	2	0	0	0	0	0	0	1,488	22.5
* Data obtained from HMANA website.																											
** See map to right for site location.																											

Abbreviation Key:

BV - Black Vulture
TV - Turkey Vulture
OS - Osprey
BE - Bald Eagle
NH - Northern Harrier
SS - Sharp-shinned Hawk
CH - Cooper's Hawk
NG - Northern Goshawk
RS - Red-shouldered Hawk
BW - Broad-winged Hawk
RT - Red-tailed Hawk
RL - Rough-legged Hawk
GE - Golden Eagle
AK - American Kestrel
ML - Merlin
PG - Peregrine Falcon
SW - Swainson's Hawk
UR - unidentified Raptor
UB - unidentified Buteo
UA - unidentified Accipiter
UF - unidentified Falcon
UE - unidentified Eagle



Appendix B

Appendix B Table 1. Summary of passage rates by hour, night, and for entire season.

Night of	Passage Rate (targets/km/hr) by hour after sunset											Entire Night	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Mean**	**SE**
Apr 15	788	405	295	--	--	--	--	--	--	--	--	496	149
Apr 16	1074	1152	1189	1231	1417	1631	1504	--	--	--	--	1314	78
Apr 17	881	1292	1396	1591	1531	1121	691	481	329	284	418	910	150
Apr 18	491	449	549	544	625	847	796	717	647	313	625	600	47
Apr 19	1944	1676	1687	--	--	--	--	--	--	--	--	1769	87
Apr 21	56	136	130	152	159	188	182	242	156	139	477	183	32
Apr 24	55	43	75	110	142	155	111	67	84	126	311	116	22
Apr 26	252	426	439	725	702	767	--	--	--	--	--	552	85
Apr 27	135	157	--	321	307	245	212	187	79	136	--	198	31
Apr 28	83	64	84	114	--	--	159	94	62	173	--	104	18
Apr 29	67	62	109	126	223	189	146	156	184	259	--	152	20
May 1	83	115	384	459	493	261	270	296	178	107	--	265	46
May 2	136	140	155	208	236	217	147	114	88	43	--	148	19
May 4	36	81	107	150	137	93	--	--	--	--	--	101	17
May 5	279	173	248	274	327	432	390	585	446	241	--	339	39
May 6	484	550	844	1093	1258	928	660	771	496	184	--	727	101
May 7	136	169	231	247	229	233	196	--	--	--	--	206	15
May 8	117	184	229	227	190	274	225	200	66	68	--	178	23
May 9	279	257	246	246	306	405	238	129	--	--	--	263	27
May 10	242	436	474	--	--	429	470	394	173	96	--	339	61
May 11	91	251	210	467	270	231	139	--	--	--	--	237	45
May 12	118	259	435	482	471	329	206	176	93	199	--	277	46
May 15	399	986	1380	1493	1465	1386	--	--	--	--	--	1185	174
May 16	121	330	576	703	587	572	349	290	120	270	--	392	65
May 17	104	439	754	536	596	791	816	853	94	171	--	516	95
May 18	141	259	304	354	343	431	424	332	122	136	--	285	37
May 19	94	160	199	231	287	333	384	386	129	129	--	233	34
May 20	75	300	238	368	441	555	617	661	--	--	--	407	71
May 22	19	24	41	54	62	76	109	120	136	--	--	71	14
May 23	247	529	981	800	995	765	568	335	271	--	--	610	97
May 24	63	396	471	634	526	446	465	--	--	--	--	429	67
May 25	129	467	765	705	636	465	437	259	232		--	455	73
May 27	139	379	519	497	446	407	454	--	--	--	--	406	48
May 28	158	321	339	527	420	444	441	529	318	--	--	389	39
May 29	98	271	413	376	404	388	287	171	--	--	--	301	41
May 30	256	982	1269	1370	1386	--	--	--	--	--	--	1052	212
Entire Season	274	398	508	528	551	501	403	342	205	171	458	**450**	**62**

-- indicates no data for that hour

Appendix B Table 2. Mean Nightly Flight Direction

Night of	Mean Flight Direction	Circular Stdev
Apr 15	119.769°	42.959°
Apr 16	36.788°	26.627°
Apr 17	49.537°	38.245°
Apr 18	28.603°	43.942°
Apr 19	29.329°	22.329°
Apr 21	10.655°	58.711°
Apr 24	3.587°	59.184°
Apr 26	10.134°	49.47°
Apr 27	32.71°	48°
Apr 28	35.431°	67.768°
Apr 29	342.944°	69.042°
May 1	23.468°	41.607°
May 2	27.274°	43.972°
May 4	23.903°	42.302°
May 5	343.596°	55.499°
May 6	37.862°	70.38°
May 7	174.739°	85.336°
May 8	12.204°	97.753°
May 9	39.669°	56.053°
May 10	24.736°	52.923°
May 11	167.464°	105.602°
May 12	355.07°	84.347°
May 15	22.177°	30.698°
May 16	30.364°	48.478°
May 17	30.942°	33.103°
May 18	30.269°	54.149°
May 19	339.448°	64.307°
May 20	10.176°	74.538°
May 22	24.384°	67.832°
May 23	13.3°	77.993°
May 24	23.825°	66.087°
May 25	31.404°	65.573°
May 27	26.325°	28.653°
May 28	28.389°	36.9°
May 29	28.984°	30.985°
May 30	31.88°	36.505°
Entire Season	**30°**	**53°**

Appendix B Table 3. Summary of mean flight heights by hour, night, and for entire season

Night of	Mean Flight Height (altitude in meters) by hour after sunset											Entire Night		% of targets below 150 meters
	1	2	3	4	5	6	7	8	9	10	11	Mean	SE	
Apr 15	--	595	--	--	--	--	--	--	--	--	--	595		28%
Apr 16	--	405	518	472	447	487	424	--	--	--	--	459	17	17%
Apr 17	183	253	304	309	357	331	314	341	394	348	90	293	26	36%
Apr 18	121	461	--	434	472	486	427	471	422	--	231	392	42	18%
Apr 19	--	--	--	--	297	297	--	--	--	--	--	297	0	30%
Apr 21	--	595	496	--	574	548	489	509	635	--	--	550	21	11%
Apr 24	114	632	623	546	517	522	548	515	455	328	--	480	49	6%
Apr 26	--	832	--	770	753	658	--	--	--	--	--	753	36	2%
Apr 27	183	428	296	--	503	354	--	397	--	--	--	360	45	10%
Apr 28	--	210	174	--	--	--	185	203	195	228	--	199	8	42%
Apr 29	66	330	548	561	683	628	629	682	549	555	--	523	60	6%
May 1	161	478	361	414	520	468	429	415	376	--	--	402	35	6%
May 2	108	397	264	266	314	387	460	386	277	--	--	317	35	14%
May 4	181	564	550	521	519	597	--	--	--	--	--	489	63	6%
May 5	--	837	869	737	719	--	758	716	634	620	--	736	31	2%
May 6	263	665	745	689	614	475	541	547	462	447	--	545	45	9%
May 7	210	316	357	--	288	257	277	--	--	--	--	284	20	19%
May 8	273	699	566	--	557	395	297	523	553		--	483	52	16%
May 9	--	--	--	603	618	813	739	742	641	764	--	703	31	5%
May 10	574	550	519	--	--	--	473	525	412	513	--	509	20	5%
May 11	--	233	308	358	398	272	299	--	--	--	--	311	24	30%
May 12	132	376	359	328	450	226	--	155	207	--	--	279	41	24%
May 15	298	540	683	596	574	--	--	--	--	--	--	538	65	4%
May 16	181	396	284	324	186	264	285	273	255	--	--	272	22	26%
May 17	239	426	463	404	434	378	326	300	353	--	--	369	24	17%
May 18	284	449	414	421	473	488	516	484	505	--	--	448	24	5%
May 19	255	618	--	384	555	448	425	507	425	--	--	452	39	5%
May 20	300	640	656	522	524	592	453	494	--	--	--	522	40	10%
May 22	--	227	236	--	--	910	731	462	488	--	--	509	111	23%
May 23	410	474	403	--	--	346	433	230	255	--	--	365	35	30%
May 24	20	690	669	518	489	333	306	--	--	--	--	432	88	13%
May 25	286	684	576	421	--	358	403	373	327	--	--	429	48	8%
May 27	369	627	497	436	449	460	479	--	--	--	--	474	30	3%
May 28	266	516	453	537	501	491	457	380	351	--	--	439	30	3%
May 29	241	491	--	357	337	296	293	274	462	--	--	344	32	7%
May 30	307	413	438	401	--	--	--	--	--	--	--	390	29	16%
Entire Season	232	501	470	474	487	452	443	436	419	475	161	*443*	*38*	*14%*

-- indicates no data for that hour

Appendix C

Appendix C Table 1. Bat calls detected at Clayton, NY, during spring 2005 surveys

Night of	Time	Detector	Species
24-Apr	22:07	High	MYSP
26-Apr	20:57	High	UNKN
5-May	21:13	High	LANO
5-May	21:13	High	LANO
5-May	21:41	High	LANO
6-May	19:42	Low	MYSP
6-May	21:15	High	LANO
6-May	21:22	High	LANO
6-May	21:52	High	EPFU
6-May	21:58	High	EPFU
6-May	22:14	High	LANO
6-May	22:18	High	LANO
6-May	22:21	High	LANO
6-May	22:24	High	LANO
6-May	22:31	High	LANO
6-May	22:36	High	LANO
6-May	22:36	High	EPFU
6-May	22:36	High	MYSP
6-May	22:41	High	LANO
6-May	1:07	High	EPFU
7-May	23:09	High	EPFU
8-May	21:32	High	EPFU
8-May	0:07	High	EPFU
8-May	0:22	High	EPFU
9-May	20:02	Low	MYSP
9-May	21:36	High	LANO
9-May	21:50	High	UNKN
9-May	22:00	High	EPFU
9-May	22:08	High	UNKN
9-May	22:16	High	LANO
9-May	22:18	High	LANO
9-May	22:57	High	EPFU
9-May	0:56	High	UNKN
9-May	1:11	High	EPFU
9-May	2:12	Low	LACI
10-May	2:54	Low	EPFU
10-May	3:06	High	EPFU
12-May	21:52	High	MYSP
12-May	22:42	High	MYSP
12-May	23:26	High	MYSP
13-May	23:16	Low	MYSP
15-May	0:49	High	LANO
15-May	1:16	High	LANO
17-May	1:50	Low	EPFU
17-May	2:48	High	UNKN
18-May	23:50	High	LANO
19-May	20:22	Low	MYSP
19-May	21:20	High	MYSP

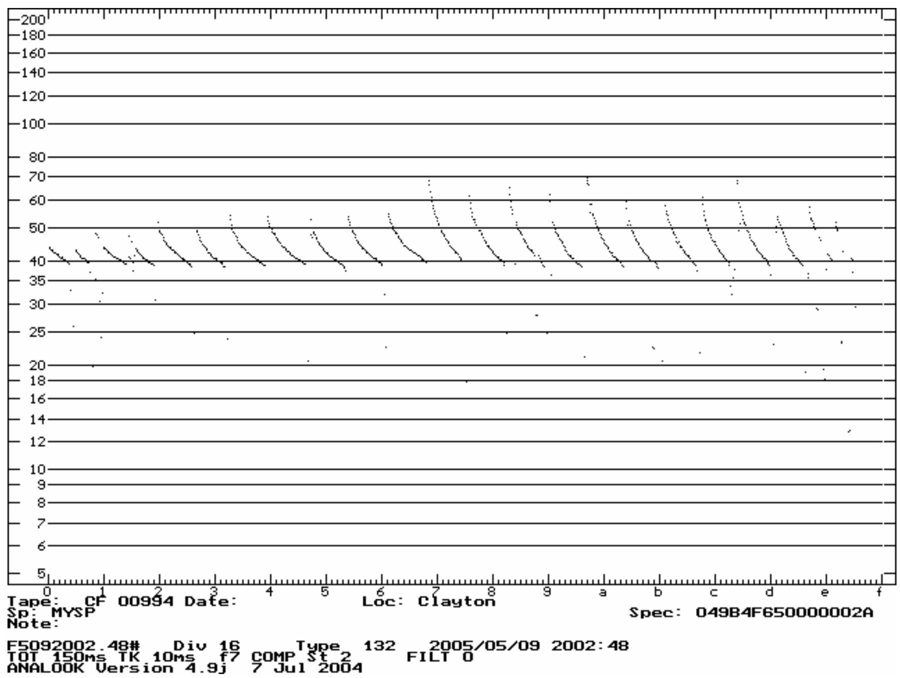
Appendix C Table 1. Bat calls detected at Clayton, NY, during spring 2005 surveys

Night of	Time	Detector	Species
19-May	21:28	High	EPFU
19-May	0:12	High	EPFU
19-May	2:01	High	EPFU
20-May	21:21	Low	UNKN
20-May	22:20	High	UNKN
20-May	2:55	High	MYSP
21-May	23:17	High	EPFU
23-May	20:52	Low	EPFU
24-May	21:40	High	UNKN
24-May	22:11	Low	EPFU
24-May	23:09	High	EPFU
25-May	23:27	High	MYSP
25-May	1:40	High	UNKN
26-May	23:57	Low	EPFU
26-May	0:31	High	EPFU
26-May	0:55	High	EPFU
28-May	22:51	Low	EPFU
28-May	23:49	High	EPFU
28-May	1:13	High	EPFU

EPFU = big brown bat, LACI = hoary bat, LANO = silver-haired bat, MYSP = *Myotis* sp., UNKN = unknown

Appendix C Figure 1. Representative samples of calls detected during Spring 2005. Figure 1a is identified as *Myotis* spp, and 1b is identified as big brown bat (*Eptesicus fuscus*).

1a



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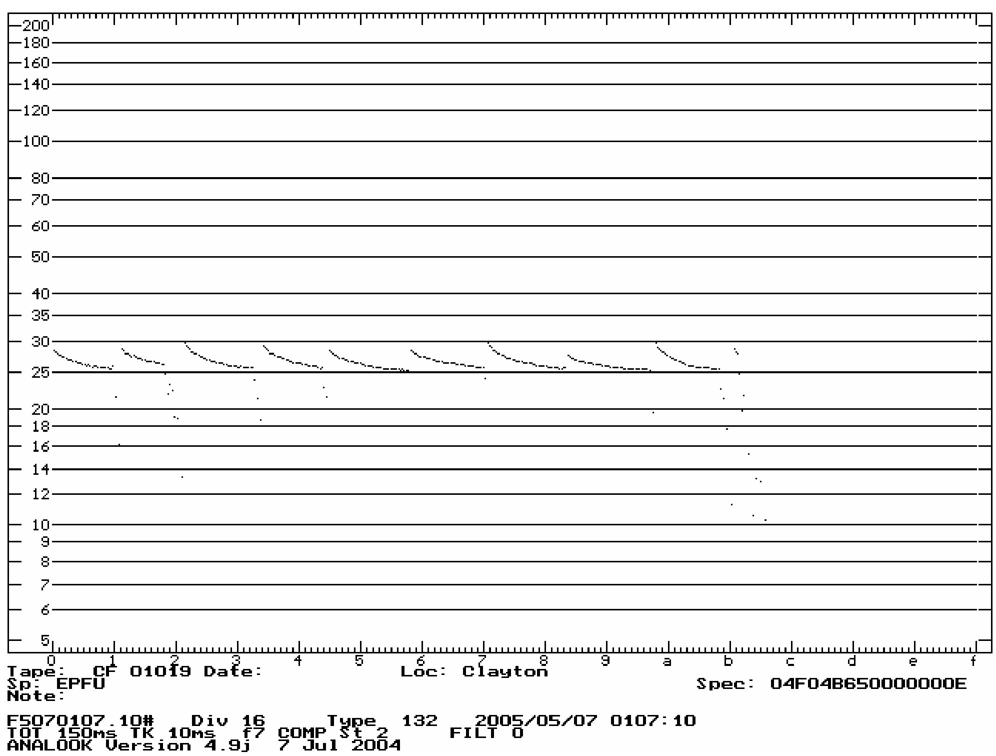

A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Clayton Wind Project

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November 2005

WOODLOT ALTERNATIVES, INC.
ENVIRONMENTAL CONSULTANTS

Executive Summary

During the fall of 2005, Woodlot Alternatives, Inc. (Woodlot) conducted field surveys of bird and bat migration activity at the Clayton wind project area in Clayton, Orleans, and Brownville, New York. The surveys are part of the planning process by PPM Atlantic Renewable (PPM) for a proposed wind project, which will include the erection of up to 54 wind turbines within the surrounding landscape of predominately dairy and pasture land. Surveys included daytime surveys migrating raptors and nighttime surveys of birds and bats using radar and bat echolocation detectors. These studies represent the second of two seasons of migration surveys undertaken by PPM at this site.

The results of the field surveys provide useful information about site-specific migration activity and patterns in the vicinity of the Clayton wind project area. The findings of this study provide valuable information about migration patterns within the proposed project area, especially when compared to results from the spring survey. This analysis is a valuable tool for the assessment of risk to birds and bats during migration through the area.

Raptor Migration

The fall field surveys included 11 days of visual observation between September 9 and October 16, 2005. A total of 575 raptors, representing 13 species, were observed during the surveys. Approximately 89 percent of the raptors observed were flying less than 150 meters (m) (492') above the ground. Two pairs of northern harriers (*Circus cyaneus*) in the vicinity of the project area were believed to have bred or at least spent the nesting season within the project area. The overall passage of raptors observed in the study area was considerably lower than that observed at other hawk watch locations in the eastern United States.

Radar Survey

The fall field survey included 37 nights of radar surveys to collect and record video samples of the radar during horizontal and vertical operation. Horizontal operation documents the abundance, flight path and speed of targets moving through the project area, and vertical operation documents the altitude of targets, operation. While 45 nights of sampling were targeted, a total of 37 were sampled due to inclement weather creating conditions in which the radar could not adequately document bird movements.

Nightly passage rates varied from 83 (September 10 and 11) to 877 (September 24) targets per kilometer per hour (t/km/hr), with the overall passage rate for the entire survey period at 418 ± 40 t/km/hr. Mean flight direction through the project area was 168º ± 111º. The mean flight height of targets was 475 m ± 14 m (1,558' ± 46') above the radar site. The average nightly flight height ranged from 305 m ± 15 m (1,001' ± 49') to 663 m ± 40 m (2,175' ± 131'). The percent of targets observed flying below 150 m (492') also varied by night, from 1 percent to 20 percent. The seasonal average percentage of targets flying below 150 m was 10 percent. Throughout the fall migration survey flight direction generally seemed to be influenced by wind direction.

The overall fall passage rate from the Clayton Wind Project area is similar to results from other migration studies in New York. The fall passage rate was slightly less than that found during the spring season and the flight height was slightly higher than that found in the spring study.

The mean flight direction, qualitative analysis of the surrounding topography and landscape, and mean flight altitude of targets passing over the project area indicates that avian migration in this area involves a broad front type of landscape movement. This type of broad front movement, particularly in conjunction with the high flight heights and flat topography of the site, demonstrates a lack of topographic influences on bird migration in the area and probably a limited avian mortality risk during fall migration.

Bat Migration

The fall field survey included deployment of bat detectors on 33 separate nights. Detectors were deployed in the guy wire array of a meteorological measurement tower (met tower) at heights of 2 m (6.6') and 30 m (100').

A total of 154 bat call sequences were recorded. The overall bat detection rate over the course of the entire study was only 4.7 bat calls/detector-night. Bat calls were recorded on all but two of the nights surveyed.

When possible, recorded bat calls were identified to species, genus (in the case of *Myotis*), or as "unknown," based upon the shape of the call sequence, the slope, and the maximum and minimum frequencies. Of the 154 calls recorded, 124 were identified to species or genus group. The *myotids* were the most abundant calls recorded, accounting for 97 (63%) of the calls. Following these were calls of the big brown bat (*Eptesicus fuscus*, 19 calls), eastern red bat (*Lasiurus cinereus*, 4 calls), silver-haired bats (*Lasionycteris noctivagans*, 3 calls), and eastern pipistrelle (*Pipistrellus subflavus*, 1 call). Thirty calls were too poor of quality or too short to identify.

The *myotid* calls were examined for the possibility of the Indiana bat (*Myotis sodalis*) being included within the call set. Considerable variation within this set of calls was observed but no definitive determination has yet been made. Considering the known occurrence of Indiana bats within the project area during summer 2005, it is possible that some of the *myotid* calls recorded during the fall survey were of this species.

Table of Contents

List of Appendices

List of Tables

List of Figures

1.0 Introduction

1.1 Project Context

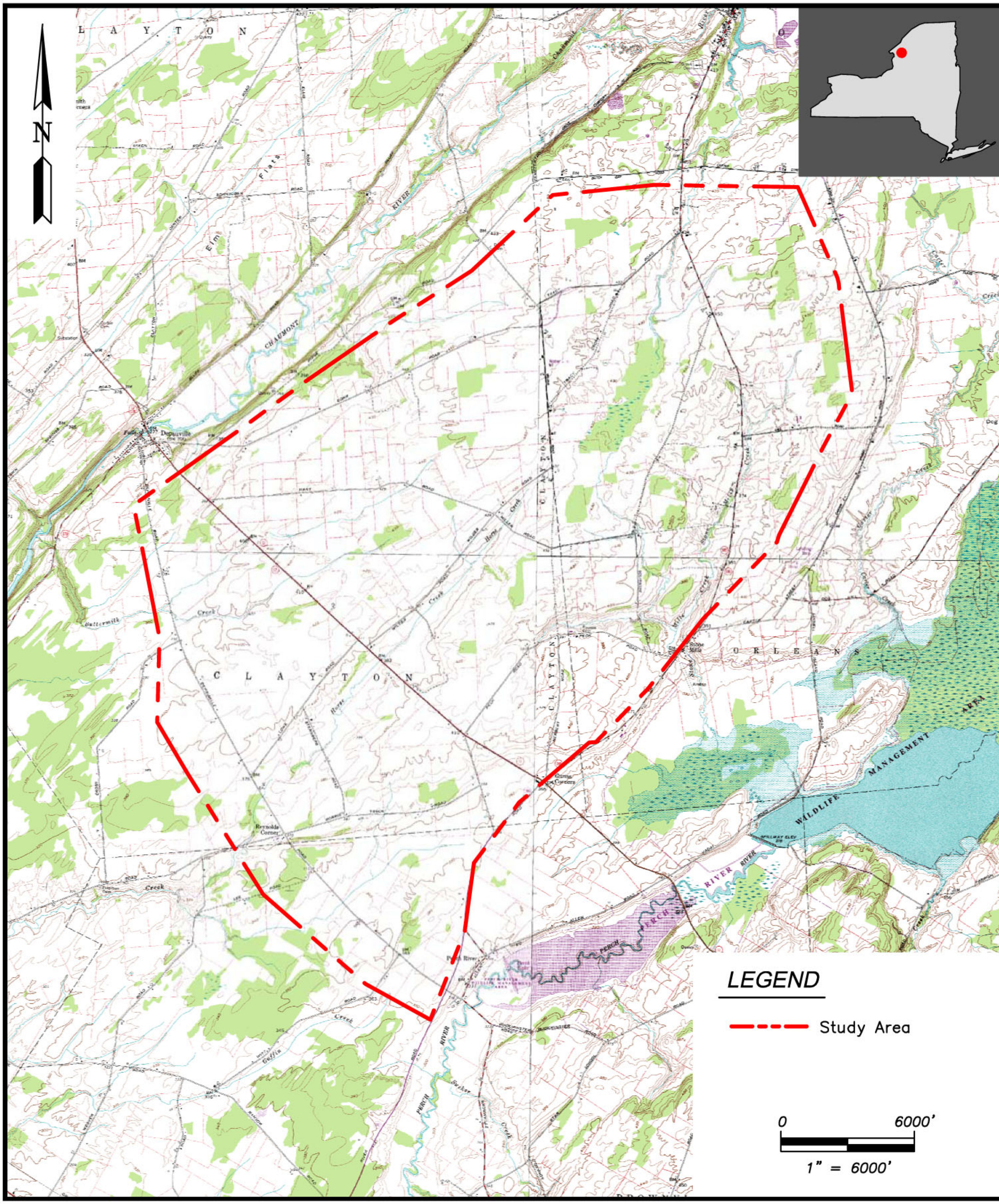
PPM Atlantic Renewable has proposed the construction of a wind project to be located in Clayton, Orleans, and Brownville, New York (Figure 1-1). The project would include up to approximately 54 2.75-megawatt (MW) wind turbines that could generate up to 150 MW of power annually. Turbines would have a maximum height of approximately 150 meters (m) (492') and would be located predominantly in active agricultural fields being used for hay and crop production, as well as for pasturing.

Birds are known to collide with tall lighted structures, such as buildings and communication towers, particularly when weather conditions reduce visibility (Crawford 1981; Avery *et al.* 1976, 1977). Depending on their height and location, wind turbines can also pose a potential threat to migrating birds because they are relatively tall structures, have moving parts, and may be lit. The mortality of migrating and resident birds and bats has been documented at wind farms as a result of collisions with turbines, meteorological measurement towers (met towers), and guy wires (Anderson *et al.* 2004; Erickson *et al.* 2000, 2003; Johnson *et al.* 2003; Thelander and Rugge 2000).

The surveys for this project were conducted to provide data that will be used to help assess the potential risk to birds and bats from this proposed project. The scope of the surveys was based on some standard methods that are developing within the wind power industry and consultation with the NY Department of Environmental Conservation (NYDEC).

1.2 Project Area Description

The project area is located within the Eastern Ontario Plain ecozone of New York (Andrle and Carroll 1988). This is a relatively flat region, with elevation ranging from approximately 76 m to 152 m (250' to 500'). Forest communities in the area are dominated by American elm (*Ulmus americana*), red maple (*Acer rubrum*), and northern hardwoods on soils of lake sediments that overlie limestone bedrock. The proximity of Lake Ontario helps moderate the local climate, which has resulted in the widespread development of agricultural land uses, predominantly dairying.



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WOODLOT ALTERNATIVES, INC.
ENVIRONMENTAL CONSULTANTS

DATE:	November 2005
SCALE:	1" = 6000'
JOB NO. 105030	
FILE: 105030-00-Location.dwg	

Figure 1-1
Study Area Location Map
Clayton Wind Project
Clayton, New York

REV.

1.3 Survey Overview

Woodlot Alternatives, Inc. (Woodlot) conducted field investigations for bird and bat migration during the fall of 2005. The overall goals of the investigations were to:

- document the occurrence and flight patterns of diurnally-migrating raptors (hawks, falcons, harriers, and eagles) in the project area, including number and species, general flight direction, and approximate flight height;
- document the overall passage rates for nocturnal migration in the vicinity of the project area, including the number of migrants, their flight direction, and their flight altitude; and
- document the presence of bats in the area, including the rate of occurrence and, when possible, species present during the summer and the fall migration period.

The field surveys included day-time raptor migration surveys, a radar study of bird and bat migration activity, and recordings of bat echolocation calls in several landscape settings and heights. Surveys were conducted from August 19 to October 16, 2005, although effort for the different aspects of the work varied within this time period. A total of 11 days of raptor surveys, 37 nights of radar surveys, and 33 nights of bat detector recordings were completed.

Raptor surveys were conducted near the met tower in a hay field on Lowe Road in Clayton. Methods employed were the same as those used by the Hawk Migration Association of North America (HMANA).

Radar surveys were conducted in the same vicinity as the fall raptor surveys. Radar data provide insight on the flight patterns of birds (and bats) migrating over the project area, including abundance, flight direction, and flight altitude. The nearby met tower provided a reliable source for wind data during the sampling period. Weather conditions for the survey location were also recorded by the radar technician to be used in conjunction with met tower data. The field observations of weather conditions provided information about temperature, cloud cover, wind direction and wind speed.

Bat surveys included the use of Anabat II (Titley Electronics Pty Ltd) bat detectors to record the location and timing of bat activity. Detectors were deployed in the guy wire array of the met tower off Lowe Road in Clayton at heights of approximately 20 m (66'), 10 (33'), and 2 m (6.6') above the ground.

Calls of the genus *Myotis* were examined to determine if those of the Indiana bat (*Myotis sodalis*), a federally listed Endangered species, had been recorded. These calls were reviewed using criteria developed by Eric Britzke, a national expert researching the ability to identify this species from recorded call sequences.

2.0 Diurnal Raptor Surveys

2.1 Introduction

The project area is located in the southeast central portion of the Central Continental Hawk Flyway. Geography and topography are major factors in shaping migration dynamics in this flyway. The northeast to southwest orientation of the northern North American coast and the inland mountain ranges influences hawks migrating in eastern Canada and New England to fly southwestward to their wintering grounds and northeastward in the spring (Kerlinger 1989, Kellogg 2004).

The Great Lakes, within the Central Continental Flyway, heavily influence the migration of raptors throughout the region. Migrating raptors typically avoid crossing large expanses of water by following shorelines until they resume their original migration direction. During fall migration, raptors of eastern-central Canada often travel west along the northern shores of Lakes Ontario and Erie to avoid those large water bodies. Once at the western ends of these lakes these birds then continue southward to their wintering areas. The reverse is true in the Given these observed trends, the eastern portion of the Central Flyway and specifically, the southern and eastern shores of Lake Ontario, could then be expected to concentrate large numbers of raptors during migration.

The project area is located within the Eastern Ontario Plain ecozone of New York (Andrle and Carroll 1988). This is a relatively flat region, with elevations ranging from approximately 76 m to 152 m (250’ to 500’). Forest communities in the area are dominated by American elm, red maple, and northern hardwoods on soils of lake sediments that overlie limestone bedrock. Lake Ontario moderates the local climate, which has resulted in the widespread development of agricultural land uses, predominantly dairying.

The project area lies just south of the St. Lawrence River and east of Lake Ontario. Perch River Wildlife Management Area, an 8,000-acre complex of wetlands including flooded valleys, wooded swamps, wet meadows, mixed woods, shrub swamp, and grassland lies just south of the project area. Because of the lack of large landscape features in the project area, migrating raptors move across the area in broad fronts, unlike migrating raptors in mountainous environments.

Woodlot conducted a raptor survey to determine if significant raptor migration occurred in the vicinity of the proposed project location. The survey was conducted on 11 days during the months of September and October. The goal of the survey was to document the occurrence of raptors in the vicinity of the project area, including the number and species, approximate flight height, general direction and flight path, as well as other notable flight behavior.

2.2 Methods

Field Surveys

Raptor surveys were conducted from a flat hayfield approximately 8 miles southeast of Clayton, New York; or 0.5 miles southwest of the intersection of State Route 12 and Lowe Road (Figure 2-1). This site, at an elevation of 120 m (400’), is surrounded by flat agricultural fields interspersed with small woodland fragments and marshland. It afforded unobstructed views in all directions, except for very low-flying birds beyond the tree line bordering the hayfield’s western edge.

Raptor surveys occurred on 11 days from September 9 to October 16, 2005, and were generally conducted from 9 am to 3 pm in order to include the time of day when the strongest thermal lift is produced and the majority of raptor migration activity typically occurs. Surveys were conducted throughout the entire raptor migration season to coincide with peak migration of all species. Surveys were targeted for days with favorable flight conditions produced by the passage of low-pressure systems bringing winds from the north, and days following the passage of a cold front were targeted as survey days. However, weather conditions during the survey period made this difficult and some days included less than optimal hawk migration weather.

Surveys were based on methods defined by the HMANA. Observers scanned the sky and surrounding landscape for raptors flying into the survey areas. Observations were recorded onto HMANA data sheets, which summarize the data by hour. Notes on each observation, including location and flight path, flight height, and activity of the animal, were recorded. Height of flight of each observation was estimated. Nearby objects with known heights, such as the met towers and surrounding trees, were used to gauge flight height. Information regarding the raptors' behavior and whether a raptor was observed in the same locations throughout the study period was noted to differentiate between migrant and resident birds. When possible, general flight paths of individuals observed were plotted on topographic maps of the project area.

Hourly weather observations, including wind speed, direction from which the wind was coming, temperature, percent cloud cover, and precipitation, were recorded on HMANA data sheets. Birds that flew too rapidly or were too far to accurately identify were recorded as unidentified to their Genus or, if the identification of Genus was not possible, unidentified raptor.

Data Analysis

Field observations were summarized by species for each survey day and for the whole survey period. This included a tally of the total number of individuals observed for each species, the observation rate (birds per hour, daily range, and an estimate of how many of those observations were suspected to be resident birds. The total number of birds, by species, and by hour, was also calculated as was the species composition of birds observed flying below and above 150 m (492'), the approximate height of the proposed turbines. Finally, the mapped flight locations of individuals were reviewed to identify if any concentrated migration corridors occurred in the project area.

Observations from the project area were compared to data obtained from local or regional HMANA hawk watch sites available from www.hmana.org. The HMANA watch sites with available data determined to be the most suitable for comparison with the project area counts were from New York, Pennsylvania, and Ontario.

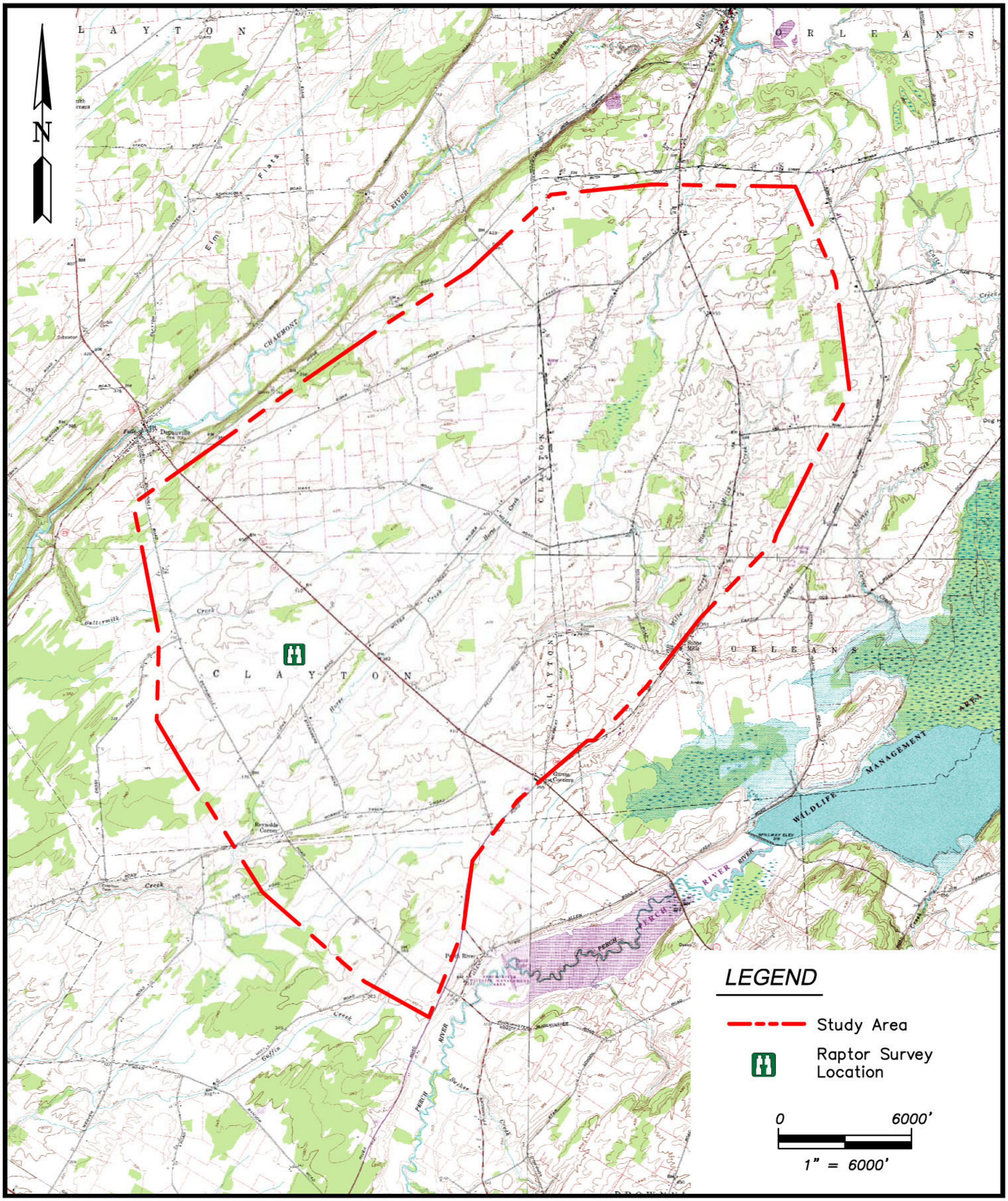

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Figure 2-1
Raptor Survey Location Map
Clayton Wind Project
Clayton, New York

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2.3 Results

Most surveys were conducted on clear days when the wind was light to moderate. During the earlier September surveys, the temperature ranged from 55 – 85º F while temperatures during the October surveys ranged from 40 – 65º F. Surveys on most days occurred after the passage of cold fronts. The development of thermals on these days was evident as temperatures increased and cumulus clouds were formed. On some of the survey days, visibility was inhibited by morning fog (accompanied by drizzle) that cleared as temperatures and wind speed increased. However, visibility was excellent for most surveys.

Some survey effort did occur on days when the weather and wind were suboptimal for raptor migration due to inaccurate weather forecasting, relatively weak cold fronts, and extended periods of rain. Four surveys were conducted with N, ENE, or WNW winds. Six surveys were with SW or SSW winds, and one survey had variable wind direction.

Surveys were conducted for a total of 63.5 hours during the 11 survey days. A total of 575 raptors, representing 13[1] species, were observed during that time, yielding an overall observation rate of 9.1 birds/hour. The range in daily observation rates varied from 3.25 to 18.67 birds/hour (Figure 2-2; Appendix A Table 1). Daily count totals ranged from 13 to 115 birds. The largest count of 115 raptors was observed on October 15, a day of moderate (6–28km/hr) SW to WSW winds with temperatures of 52 – 60º F.

Turkey vultures (*Cathartes aura*)[2] (N = 391) were, by far, the most commonly observed species and accounted for 68 percent of the season's total birds. After turkey vultures the most common species observed, in decreasing order of abundance, were red-tailed hawks (*Buteo jamaicensis*) (N = 81), northern harriers (*Circus cyaneus)* (N = 31), sharp-shinned hawks (*Accipiter striatus)* (N = 17), and American kestrels (*Falco sparverius*) (N = 14).

The remainder of observed species comprised less than 1.5 percent of the total (each with ≤ 10 individuals). These species include broad-winged hawks (*Buteo platypterus),* osprey (*Pandion haliaetus*), merlin (*Falco columbarius*), peregrine falcon (*Falco peregrinus*), bald eagle (*Haliaeetus leucocephalus*), golden eagle (*Aquila chrysaetos*), northern goshawk (*Accipiter gentiles)* and Cooper's hawk (*Accipiter cooperii*). Five individuals were not identifiable due either to distance from the observation site or very brief views of the individual. The unidentified birds were mostly from the genus *Accipiter*, although several individuals could not even be identified to genus (and hence noted as "unidentified raptor") due to the brevity of their occurrence.

Of the aforementioned species, the golden eagle and peregrine falcon are listed as Endangered in New York, while the northern harrier and bald eagle are listed as Threatened. Species listed by the State as Species of Special Concern include osprey, sharp-shinned hawk, and Cooper's hawk. Only one federally listed species was observed: the bald eagle, which is listed as Threatened.

[1] Additional individuals that were not definitively identified were observed during the survey. While these were likely of the same species documented during the surveys, they have not been used in the calculation of the total number of species observed.
[2] While turkey vultures are not true raptors they are diurnal migrants that exhibit flight characteristics similar to hawks and other raptors and are typically included during hawk watch surveys.

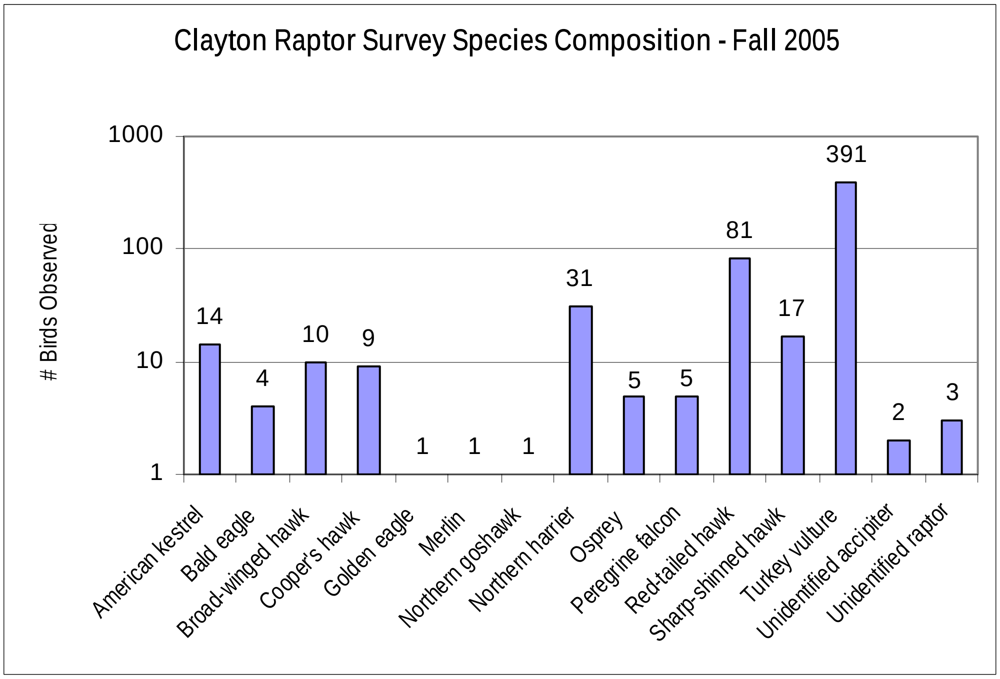

Figure 2-2. Species composition and number of individuals observed during raptor surveys.

Observations of some northern harriers, red-tailed hawks, American kestrels, sharp-shinned hawks, and osprey were noted to possibly be repeated sightings of the same individuals. In these cases, a particular individual may have been observed flying back and forth across a section of field or perching in an area repeated during the same day or on more than one survey day. However, for the most part, raptors that were observed were believed to be actively migrating and all observations are included in the count data reported. At least two pairs of northern harrier and red-tailed hawks observed were believed to be resident to the project area either year-round or at least during the summer 2005 nesting season. Both species were observed actively hunting, vocalizing, and interacting with juvenile birds. During surveys, ospreys were frequently seen to the southeast of observation area, over portions of the Perch River Wildlife Management Area.

In addition to some seasonal variation, the timing of raptor observations varied during each day. Typically, observations began slowly and reached a peak during the fourth hour of observation, after which observed decreased fairly quickly (Figure 2-3). This pattern was consistent for most of the species observed although on some days a later peak during the last 1 to 2 hours of the day was observed (Appendix A Table 2). It should be noted when winds shifted to more favorable migration direction (i.e., a north wind), raptors were more abundant.

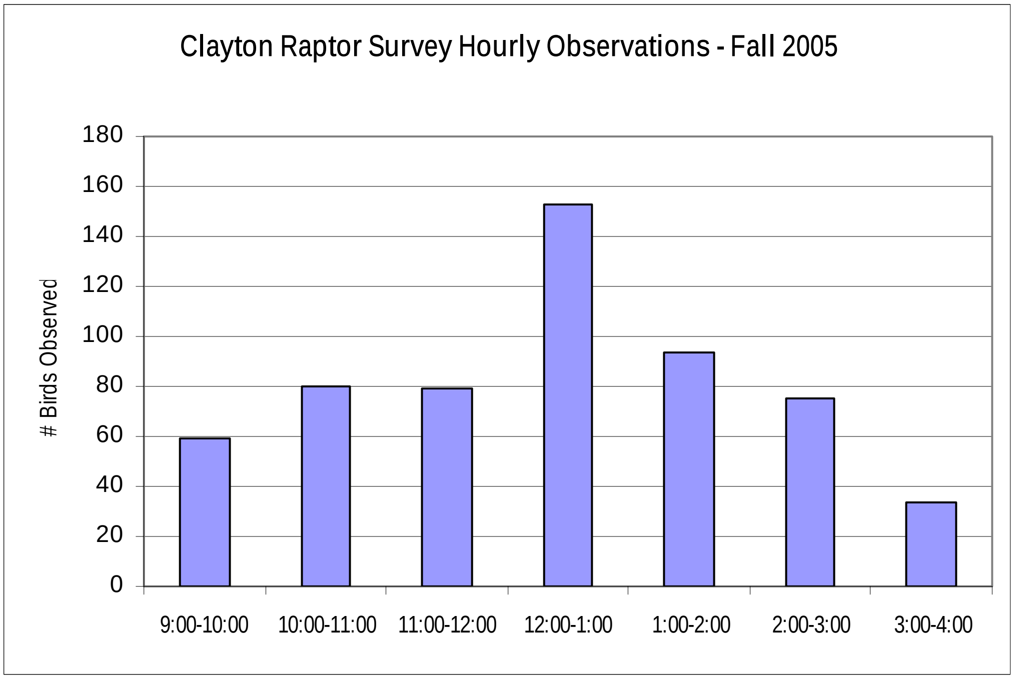

Figure 2-3. Hourly observation rates

Flight heights were categorized as below or above 150 m (492'), the approximate height of the proposed turbines. Overall, approximately 89 percent of the raptors observed were flying less than 150 m (492') above the ground. Differences in flight altitudes between species were observed (Figure 2-4; Appendix A Table 3). Small species, such as the accipiters and falcons were consistently observed flying low. In fact, all of the falcons observed were flying below this height. Sharp-shinned hawks and northern harriers were also consistently flying low. Exceptions to this included broad-winged hawks, of which 100 percent were flying greater than 150 m above the ground. Most *Buteo* flights were below 150 m.

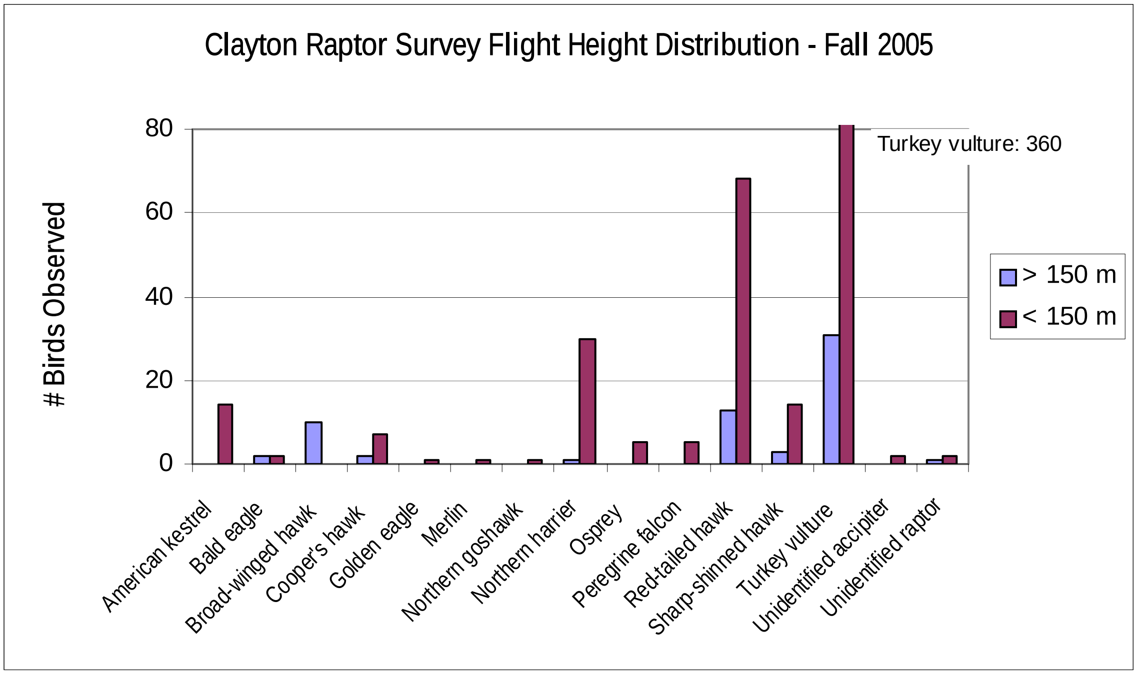

Figure 2-4. Raptor flight height distribution

The flight habits of raptors in the project area were variable, though their flight locations often occurred in similar locations. Many of the birds, particularly northern harriers, sharp-shinned hawks, red-tailed hawk, and American kestrels flew in different directions over the observation site and were typically observed kiting and hunting over the fields surrounding the observation site. Individuals believed to be undertaking long-distance migratory movements (particularly turkey vultures) had much more direct flight paths. On one occasion, a peregrine falcon was observed hunting after a flock of European starlings. Another peregrine falcon was observed following prey in the vicinity of the guy wires of the nearby met tower.

2.4 Discussion

A total of 575 migrating raptors were observed during 11 days (63.5 hrs) of field surveys during September and October 2005. Thirteen different species were recorded with an observation rate of 9.1 birds/hour. Turkey vultures were the most abundant species observed and comprised approximately 68 percent of all observations. Red-tailed hawks comprised 14 percent of observations.

At the Clayton project site, the absence of proximate landscape-scale features such as river corridors or mountain ridges played a significant role in the migratory patterns through the project area. This lack of major topography or other landscape features served to distribute migrants fairly evenly across the project area, rather than in a concentrated flight corridor. Also, because of the lack of features to concentrate migrating raptors, relatively few were observed at Clayton than at other sites surveyed during the fall 2005 migration season that have these landscape features. Observation rates at other regional sites ranged from 1.4 to 26.2 birds/hour (Appendix A Table 4).

There could be several reasons for the greater passage rates, including survey effort, geographical location, and visibility. The most active site was Hawk Mountain Sanctuary in Kempton, Pennsylvania, with a total of 15,394 raptors counted (20.7 birds/hour). At Cranberry Marsh in Whitby, Ontario, Canada, 6,505 birds (26.2 birds/hour) were observed. In Kestrel Haven, in Burdett, NY, 855 raptors (1.4 birds/hour) were observed. In comparison, the Clayton project area had a passage rate of 9.1 birds/hour a rate lower than the most active fall migration site but greater than other sites. The selected HMANA sites have a range of landscapes and elevations whose results offer comparative regional information on raptor migration in the northeast.

Survey effort varies from site to site and this could be a significant factor in comparing data from different sites. Hawkwatch locations are usually surveyed when the weather is optimal for raptor migration and typically during the peak of the migration season. This level of effort increases observation rates because relatively few hours of survey time are being targeted for the time periods when the majority of birds are migrating. However, there are various peak migration periods for different species. The rational for sampling across an extended sampling period, such as during this study, is to observe each individual species during their peak flight (September through October). Alternatively, sampling only during sub-optimal migration weather would decrease observation rates. During the surveys completed at the project site, several days with sub-optimal migration weather (south winds) were sampled and fewer hawks were typically observed on those days.

Geographical location can affect the magnitude of raptor migration at a particular site. Two well-known examples include Cape May, New Jersey, and Hawk Mountain, Pennsylvania. The location of these sites relative to large, regional landscape features result in large concentrations of migrating raptors. This likely happens at a smaller scale, as large river valleys and dominant ridgelines might result in more suitable migration conditions (i.e., strong thermal development, crosswinds, and updrafts). Organized hawk count locations typically target these areas of known, concentrated raptor migration activity. The nearby sites for which data is available (Appendix A Table 4) are demonstrative of this situation.

Visibility at a site can affect results of raptor surveys. The most ideal hawk migration sites often provide wide, open views of not only the surrounding airspace, but also the surrounding slopes and ridgelines. These sites include open mountaintops, cleared land on mountain peaks, very steep topography such as the top of a cliff, and sometimes observation towers. These views downward and over the surrounding hillsides are often needed to observe those species that hug hillsides and migrate at lower altitudes, such as sharp-shinned hawks, merlins, and American kestrels. The project area provided no survey locations with similar views of the surrounding landscape and forest canopies.

The flight heights of raptors observed in the project area indicate that birds migrated within the blade-swept area of the proposed turbines. Approximately 89 percent of raptors were observed flying below 150 m (492’). Most falcons and accipiters flew within the blade-swept area. The only golden eagle observed and 50% of bald eagles flew within the blade-swept area. While all broad-winged hawks passed over the site at > 150m. Overall, it may be easier to detect large species flying at low and high altitudes; therefore, smaller species may sometimes be underrepresented or represented disproportionately at lower flight heights (Kerlinger 1989). Generally, it’s still largely unknown what avoidance behavior migrating raptors possess when flying near wind turbines. Unpublished observations of hawk migration activity at an existing facility in New England (Woodlot, unpublished data) often included the passage of small raptors (such as sharp-shinned hawks) below the blade-swept area of turbines and the passage of larger raptors well above the turbines. Some observations have also included birds rising above one turbine and then decreasing altitude between turbines. It is unclear, however, if this type of presumed avoidance behavior would be observed at other wind turbine facilities in the East. The paucity of raptor fatalities documented during mortality surveys outside the state of Californian (scarcely more than 10 fatalities have been reported in the literature) indicates that avoidance at wind facilities that are more modern than some California wind farm (which have had high mortality rates).

Migration of raptors is a dynamic process due to various internal and external factors. Migrating raptors are well known to follow “leading lines” such as rivers, shorelines, and ridges that are orientated in the direction they are heading. Flight pathways and their movements along ridges, slide slopes, and across valleys may vary. In general, raptors tend to converge toward a small number of pathways as they migrate. Raptors may shift and use different ridge lines and cross different valleys from year to year or season to season. Because the project area lies in an area without significant ridges and slopes, raptors were observed moving across the area in a broad front and not in any concentrated pathways.

The project area has a mosaic of edge and grassland habitat which provide good nesting habitat (nesting structure and prey) for northern harriers, American kestrels, red-tailed hawks, short-eared owls, Cooper’s hawks, and sharp-shinned hawks. In close proximity is the Perch River Wildlife Management area, considered by New York Audubon as an Important Bird Area (IBA) due to a diverse wetland bird community with both wetland-associated and grassland birds (www.ny.audubon.org).

2.5 Conclusions

The results of the field surveys indicate that fall raptor migration in the Clayton project area is moderate relative to other sites in the region. This is likely due to a lack of large landscape features that could concentrate migration activity at the project area.

Most (89%) migrants were observed flying below the height of the proposed turbines. Differences between species were observed and could be due to typical flight height preferences or on limitations in the distance that different species are visible.

Migrants observed passing near or through the project area flew higher than birds believed to be resident to the project area. This is expected, as resident birds would be undertaking daily movements and activities, such as foraging, which would be concentrated at lower altitudes. Alternatively, birds focusing solely on migrating would be expected to utilize thermals and cross-current winds to gain altitudes more suitable for long distance migration.

One of these more commonly observed species believed to be resident to the project area was the northern harrier, which is currently listed as Threatened in New York. Repeated observations of hunting and brood-rearing activities indicate that this species is nesting in the project area. Another species listed by the State as a Species of Special Concern, the sharp-shinned hawk, is suspected to be nesting within the project area. Observations of this species included one to two individuals undertaking low flights and juvenile birds in project area. Other species listed as rare in the State or regionally were also observed. However, the individuals of those species were suspected to only be migrating through the project area and not nesting within it.

3.0 Nocturnal Radar Survey

3.1 Introduction

The vast majority of North American landbirds migrate at night. The strategy to migrate at night may be to take advantage of more stable atmospheric conditions for flapping flight (Kerlinger 1995). Conversely, species using soaring flight, such as raptors, migrate during the day to take advantage of warm rising air in thermals and laminar flow of air over the landscape, which can create updrafts along hillsides and ridgelines. Additionally, night migration may provide a more efficient medium to regulate body temperature during active, flapping flight and could reduce the potential for predation while in flight (Alerstam 1990, Kerlinger 1995).

Collision with unseen obstacles is a potential hazard to night-migrating birds. Additionally, some lighted structures may actually attract birds to them under certain weather conditions, which can be associated with collision or exhaustion of birds, both of which often result in mortality (Ogden 1996). For example, birds have been documented colliding with tall structures, such as buildings and communication towers, particularly when weather conditions are foggy (Crawford 1981; Avery *et al.* 1976, 1977). Wind turbines can also pose a potential threat to migrating birds as they are relatively tall structures, have moving parts, and may be lit, depending on their height and location.

Factors that could affect potential collision risk of nocturnally-migrating birds by wind turbines can include weather, magnitude of migration, height of flight, and movement patterns in the vicinity of a wind project, along with the height of turbines and other site-specific characteristics of a wind project. Radar surveys were conducted at the Clayton wind project area to characterize fall nocturnal migration patterns in the area. The goal of the surveys was to document the overall passage rates for nocturnal migration in the vicinity of the project area, including the number of migrants, their flight direction, and their flight altitude.

3.2 Methods

Field Methods

A marine surveillance radar similar to that described by Cooper *et al.* (1991) was used to document the night-time movement of migrating birds and bats over the study area. The radar was located in a small field largely surrounded by low trees near the met tower off of Lowe Road in Clayton (Figure 3-1). The radar had a peak power output of 25 kW and the ability to track small animals, including birds, bats, and even insects out to distances of up to 1,200 m (3,937’). The radar cannot, however, readily distinguish between different types of animals being detected. Consequently, all animals observed on the radar screen are called targets.

The radar was equipped with a 2-m (6.5’) waveguide antenna. The antenna has a vertical beam height of 20º (10º above and below horizontal) and the front end of it was inclined approximately 5º to increase the proportion of the beam directed into the sky.

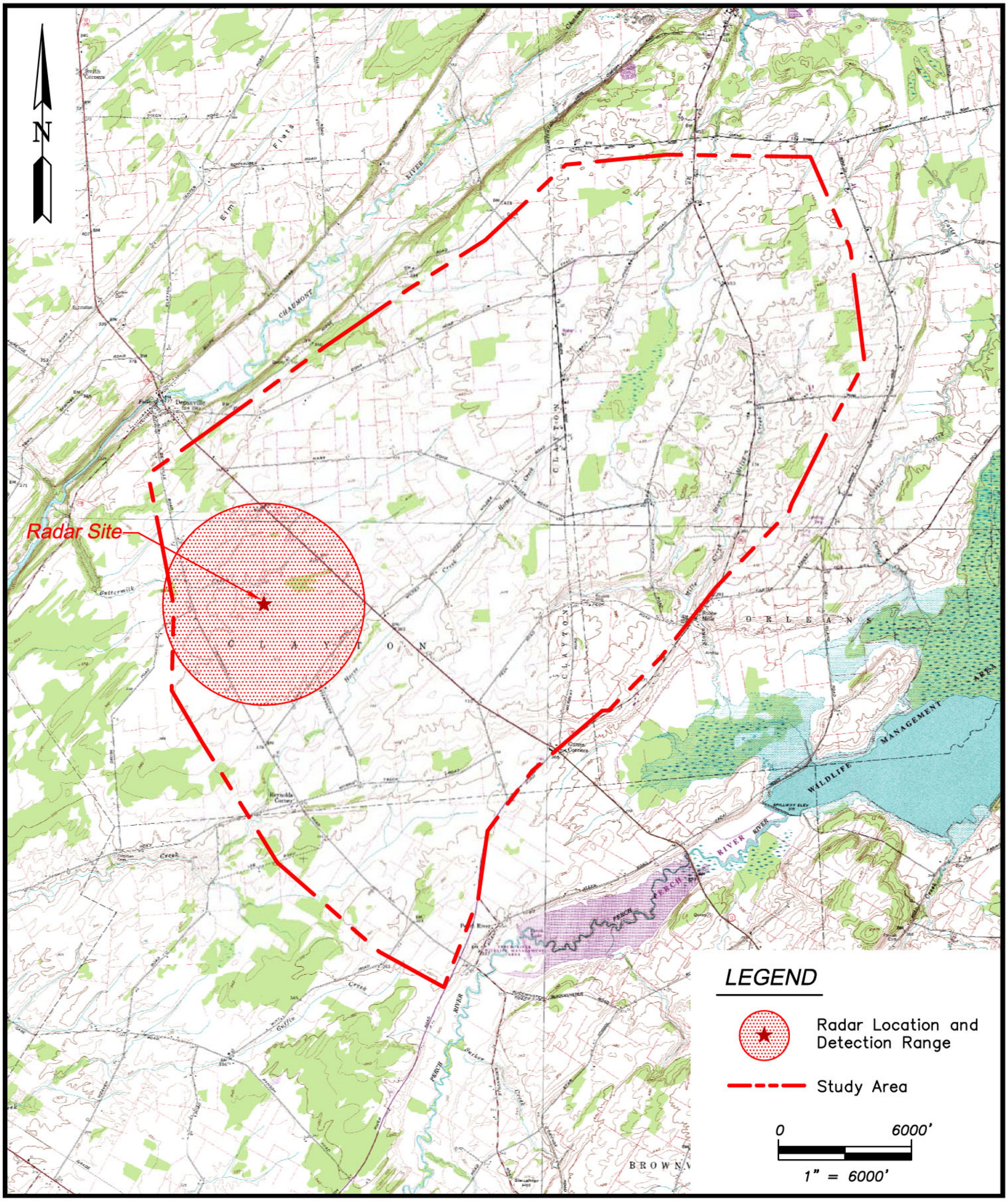

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Figure 3-1
Radar Location Map
Clayton Wind Project
Clayton, New York

REV.

Objects on the ground detected by the radar cause returns on the radar screen (echoes) that appear as blotches called ground clutter. Large amounts of ground clutter reduce the ability of the radar to track birds and bats flying over those areas. However, vegetation can be used to reduce or eliminate ground clutter by 'hiding' clutter-causing objects from the radar. These nearby features also cause ground clutter but their proximity to the radar antenna generally limits the ground clutter to the center of the radar screen. The presence of ground clutter (Figure 3-2) and other objects that could reduce clutter were important factors considered during the site selection process. The Clayton site was chosen for the low tree line bordering the radar which effectively masked a significant amount of surrounding ground clutter to the north. More extended views of fields by the radar to the west and east did occur but these were minimized by the presence of some nearby hedgerows.

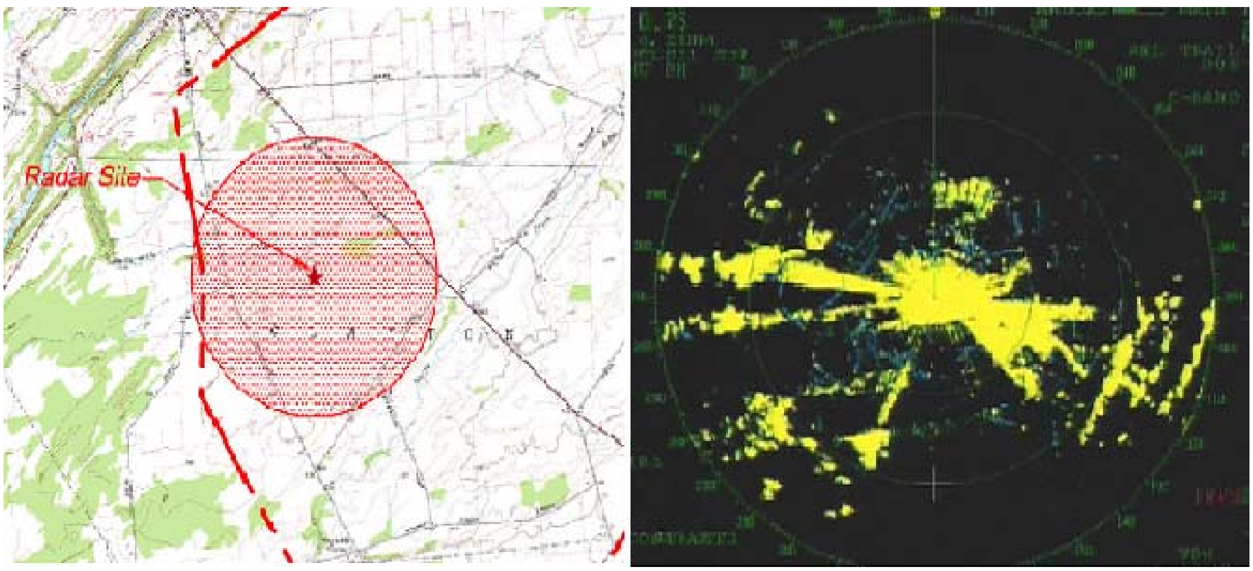


Figure 3-2. Ground clutter in project area

Radar surveys were conducted from sunset to sunrise. Forty-five nights of surveys were targeted from sampling between September 1 and October 15, 2005. Because the anti-rain function of the radar must be turned down to detect small songbirds and bats, surveys could not be conducted during periods of inclement weather. Therefore, surveys were targeted largely for nights without rain. However, in order to characterize migration patterns during nights without optimal conditions, some nights with weather forecasts including occasional showers were sampled. The operation of the radar for each survey night is presented in Table 3-1.

The radar was operated in two modes throughout the night. In the first mode, surveillance, the antenna spins horizontally to survey the airspace around the radar and detects targets moving through the area. By analyzing the echo trail, the flight direction of targets can be determined. In the second mode, vertical, the antenna is rotated 90º to vertically survey the airspace above the radar (Harmata *et al.* 1999). In vertical mode, target echoes do not provide directional data but do provide information on the altitude of targets passing through the vertical, 20º radar beam. Both modes of operation were used during each hour of sampling. The radar was operated at a range of 1.4 km (0.75 nautical miles). At this range, the echoes of small birds can be easily detected, observed, and tracked. At greater ranges, larger birds can be detected but the echoes of small birds are reduced in size and restricted to a smaller portion of the radar screen, reducing the ability to observe the movement pattern of individual targets. The geographical limits of the range setting used are depicted in Figures 3-1 and 3-2.

Table 3-1. Radar Survey dates, level of effort, and weather – Clayton, Fall 2005

Night of	Sunset	Sunrise	Hours of Survey	Weather	Wind Direction (from)
Sept 2	19:38	6:29	8	clear, moderate winds	W
Sept 3	19:36	6:30	9	mostly cloudy, rain, calm	N
Sept 4	19:34	6:31	11	clear and calm	NE
Sept 6	19:31	6:34	5	clear and calm	S
Sept 7	19:29	6:35	3	clear and calm	SSW
Sept 8	19:27	6:36	10	mostly cloudy, light winds late	SE
Sept 9	19:25	6:37	4	clear and calm	NE
Sept 10	19:23	6:38	7	clear and calm	SE
Sept 11	19:21	6:39	7	partly cloudy, light winds	SW
Sept 12	19:20	6:41	11	mostly cloudy, light winds	SW
Sept 13	19:18	6:42	11	partly cloudy, showers, calm	S
Sept 14	19:16	6:43	9	overcast, rain, light winds	NNW
Sept 15	19:14	6:44	10	mostly cloudy, light winds	SE
Sept 17	19:10	6:46	10	mostly cloudy, calm	N
Sept 18	19:08	6:47	12	partly cloudy, foggy, calm	SE
Sept 19	19:06	6:49	11	warm, mostly cloudy	S
Sept 20	19:05	6:50	11	clear and calm	W
Sept 21	19:03	6:51	12	clear and calm	SW
Sept 22	19:01	6:52	11	overcast, rain, moderate winds	W
Sept 23	18:59	6:53	10	clear and calm	NE
Sept 24	18:57	6:55	12	clear to overcast, light winds	S
Sept 27	18:51	6:58	12	clear and calm	SSW
Sept 28	18:50	6:59	12	overcast, strong winds	S
Sept 29	18:48	7:00	12	partly cloudy, light winds	WNW
Sept 30	18:46	7:02	11	partly cloudy, calm	S
Oct 1	18:44	7:03	13	clear and calm	SSE
Oct 2	18:42	7:04	13	clear and calm	SE
Oct 3	18:40	7:05	13	partly cloudy, light winds	S
Oct 4	18:39	7:06	13	clear and calm	S
Oct 5	18:37	7:08	12	clear and calm	S
Oct 6	18:35	7:09	11	partly cloudy, gusty winds, rain in AM	SSW
Oct 8	18:31	7:11	13	partly cloudy, strong winds	NE
Oct 9	18:30	7:13	9	overcast, showers, moderate gusty winds	NE
Oct 10	18:28	7:14	9	overcast, light winds	NE
Oct 11	18:26	7:15	11	overcast, light winds	NE
Oct 14	18:21	7:19	13	overcast, calm	SE
Oct 15	18:19	7:20	13	mostly cloudy, light gusty winds	W

Note: Additional nights of survey were attempted but foul weather prevented the initiation of surveys.

Data Collection

The radar display was connected to video recording software of a computer. Based on a random sequence for each night approximately 25 minutes of video samples were recorded during each hour of operation. These included 15 one-minute horizontal samples and 10 one-minute vertical samples.

Data Analysis

The video samples were analyzed using a digital video analysis software tool developed by Woodlot. For horizontal samples, targets were identified as birds and bats rather than insects based on their speed. The speed of targets was corrected for wind speed and direction; targets traveling faster than approximately 6 m per second were identified as a bird or bat target. The software tool recorded the time, location, and flight vector for each target traveling fast enough to be a bird or bat. The results for each sample were output to a spreadsheet. For vertical samples, the software tool recorded the entry point of targets passing through the vertical radar beam, the time, and flight altitude above the radar location. The results for each sample were output to a spreadsheet. These datasets were then used to calculate passage rate (reported as targets per kilometer of migratory front per hour or t/km/hr), flight direction, and flight altitude of targets.

Mean target flight directions (± 1 circular SD) were summarized using software designed specifically to analyze directional data (Oriana2© Kovach Computing Services). The statistics used for this are based on Batschelet (1965), which take into account the circular nature of the data. Nightly wind direction was also summarized using similar methods and data collected from the nearest met tower to the radar.

Flight altitude data were summarized using linear statistics. Mean flight altitudes (± 1 SE) were calculated by hour, night, and overall season. The percent of targets flying below 150 m (the approximate maximum height of proposed wind turbines) was also calculated hourly, for each night, and for the entire survey period.

3.3 Results

Radar surveys were conducted during 384 hours on 37 nights between September 1 and October 15, 2005 (Table 3-1). The radar site provided generally good visibility of the surrounding airspace and targets were observed throughout the radar display unit. A summary of nightly radar and weather data from the survey efforts is provided in Table 3-2. Appendix B contains data tables that provide nightly and hourly survey results.

Passage Rates

Nightly passage rates varied from 83 t/km/hr (September 10 and 11) to 877 t/km/hr (September 24), and the overall passage rate for the entire survey period was 418 ± 40 t/km/hr (Figure 3-3; Appendix B Table 1). A weak relationship between passage rate and wind direction was observed. On nights with the highest observed passage rates, the wind was typically from the northwest to northeast. An exception to this was September 24, on which winds were coming from the south but the highest passage rate was documented.

Table 3-2. Summary of radar and weather data, Clayton Wind Project - Fall 2005

Night of	Passage Rate (t/km/hr)	Flight Height (m)	Flight Direction (to)	Wind Speed (m/s)	Mean Temp (C)	Wind Direction (from)
Sep 2	578	498	125	5.75	17	294
Sep 3	260	574	205	4.90	17	8
Sep 4	216	547	171	2.73	12	40
Sep 6	305	382	318	3.23	15	202
Sep 7	447	417	39	6.17	16	209
Sep 8	186	595	195	2.77	12	115
Sep 9	243	663	190	6.20	12	51
Sep 10	83	523	271	3.23	9	155
Sep 11	83	584	22	7.82	17	218
Sep 12	95	569	30	6.91	20	215
Sep 13	780	464	324	5.95	19	189
Sep 14	613	483	131	3.91	20	341
Sep 15	857	490	161	2.66	16	128
Sep 17	560	633	100	3.00	16	355
Sep 18	726	476	31	5.88	15	221
Sep 19	412	441	322	7.69	20	181
Sep 20	415	458	114	5.82	15	274
Sep 21	446	429	31	7.40	18	217
Sep 22	359	413	70	7.41	20	272
Sep 23	769	539	198	7.01	9	45
Sep 24	877	390	267	6.02	15	167
Sep 27	262	523	40	5.98	11	210
Sep 28	249	387	339	13.10	19	181
Sep 29	292	451	152	4.47	6	297
Sep 30	634	348	299	6.58	10	186
Oct 1	404	506	334	4.29	11	202
Oct 2	625	465	222	4.21	15	145
Oct 3	146	384	304	5.38	17	195
Oct 4	415	506	258	4.84	17	181
Oct 5	411	444	249	5.71	17	191
Oct 6	163	406	36	7.43	21	207
Oct 8	778	506	175	9.14	9	42
Oct 9	93	321	221	6.40	10	49
Oct 10	200	305	189	4.44	11	40
Oct 11	816	428	184	6.85	11	49
Oct 14	300	444	127	2.08	14	239
Oct 15	361	580	124	7.10	11	288

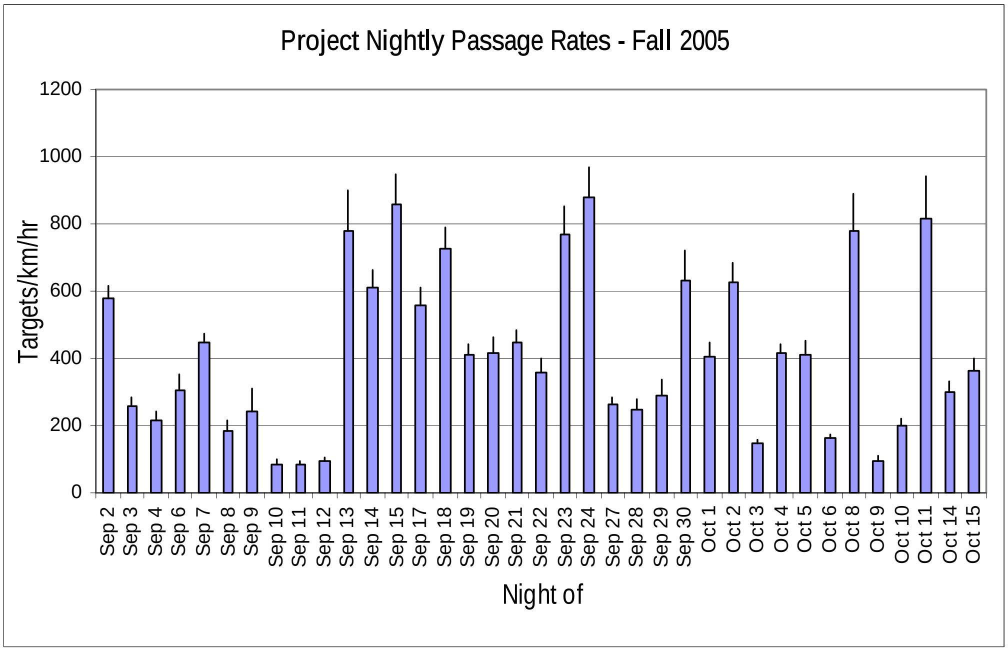


Figure 3-3. Nightly passage rates (error bars = 1 SE) observed

Individual hourly passage rates throughout the entire season varied from 21 to 1,425 t/km/hr. Hourly passage rates varied throughout each night and for the season overall. For the entire season, passage rates were highest during the second to fourth hour after sunset, followed by a relatively steady decline through the remainder of the nighttime period (Figure 3-4).

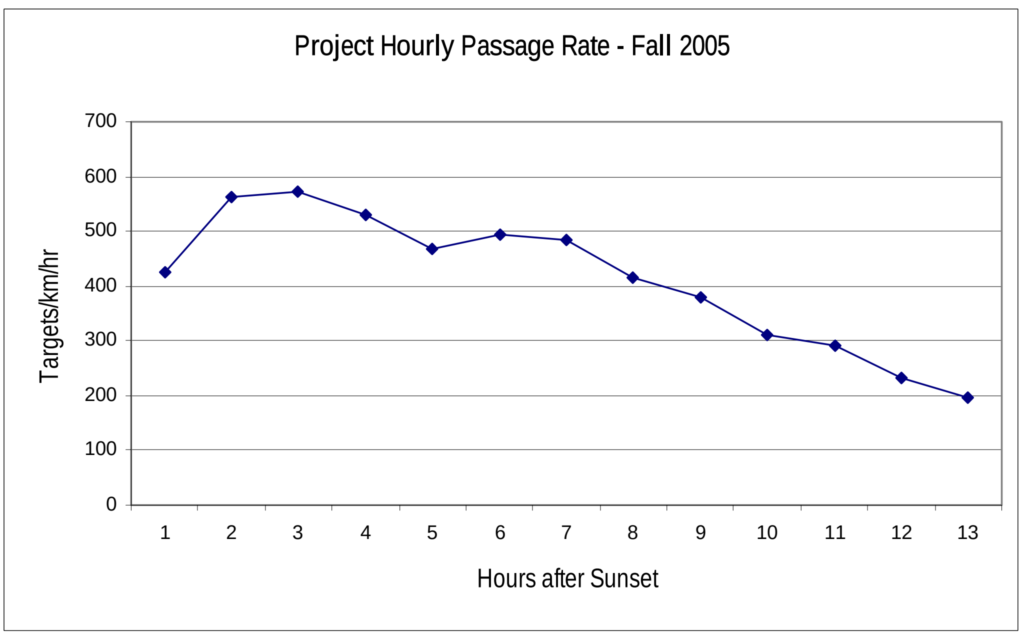


Figure 3-4. Hourly passage rates for entire season

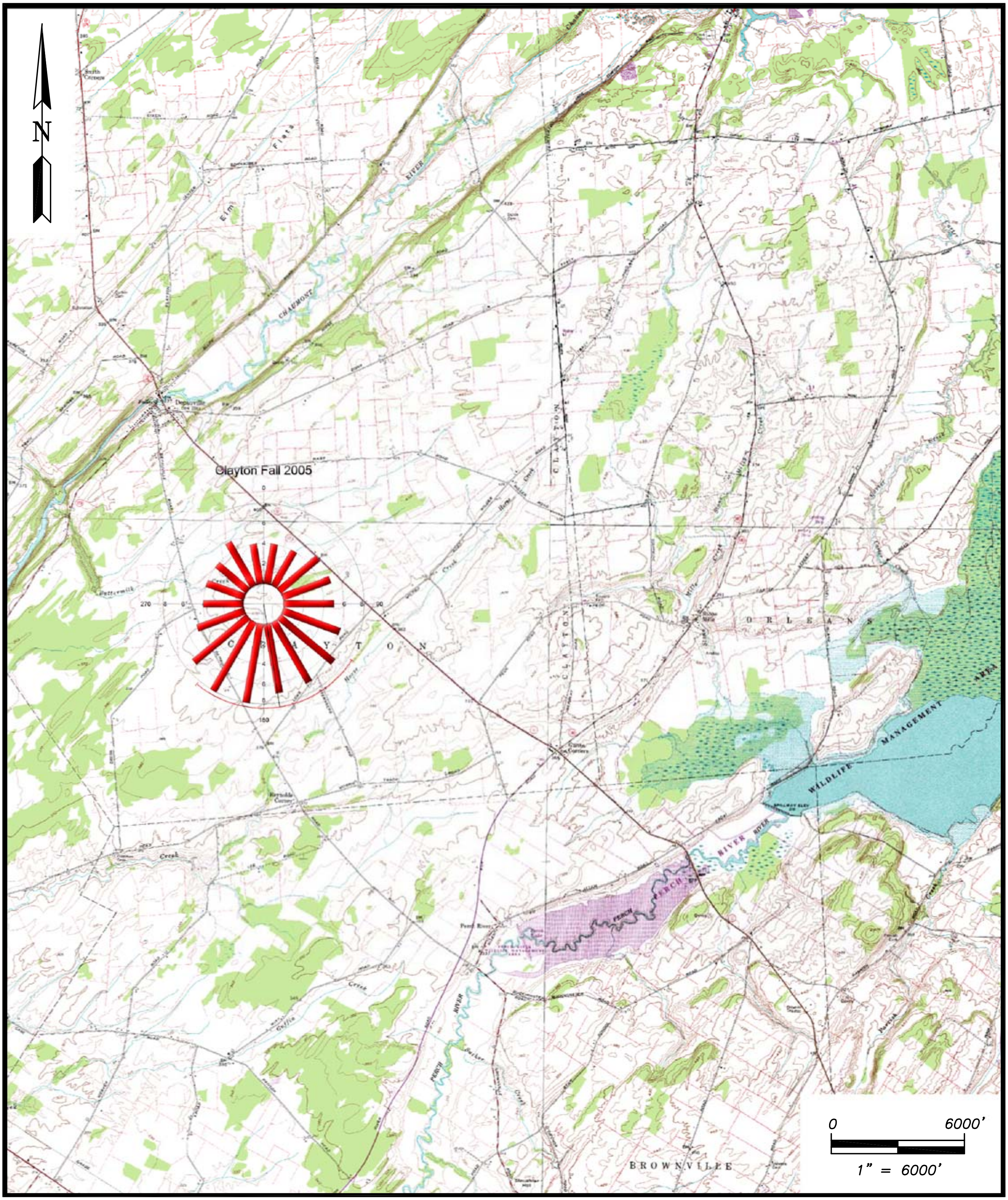
Flight Direction

Mean flight direction through the project area was 168º ± 111º (Figure 3-5; Appendix B Table 2). There was considerable night to night variation in mean direction, although within each night there was less variation (Figure 3-6). Flights were generally southward on most nights although nights with flights in more westerly or easterly directions were often associated with winds from the south (i.e., birds flew perpendicular to the wind and not downwind on nights with winds opposite the preferred migratory direction).

Flight Altitude

The mean flight height of all targets was 475 m ± 14 m (1,558' ± 46') above the radar site. The average nightly flight height ranged from 305 m ± 15 m (1,001' ± 49') to 663 m ± 40 m (2,175' ± 131') (Figure 3-7, Appendix B Table 3). The percent of targets observed flying below 150 m (492') also varied by night, from 1 percent to 20 percent (Figure 3-8). The seasonal average percentage of targets flying below 150 m was 10%. A weak relationship between flight height and wind speed was observed, migrants flying at lower heights when the wind speeds were greatest.

Hourly flight height was greatest from about five to seven hours after sunset although in general it flight height stayed relatively constant through the nighttime period (Figure 3-9). Within 100 m (328') height zones, the greatest percentage (14%) of targets occurred in both the 200 m to 300 m (656' to 984') and the 300 m to 400 m (984' to 1,312'). Sixty-one percent of all targets were observed from 200 m to 700 m (656' to 2,297'), and 80 percent were observed from 100 m to 800 m (328' to 2,625') above the radar site (Figure 3-10).



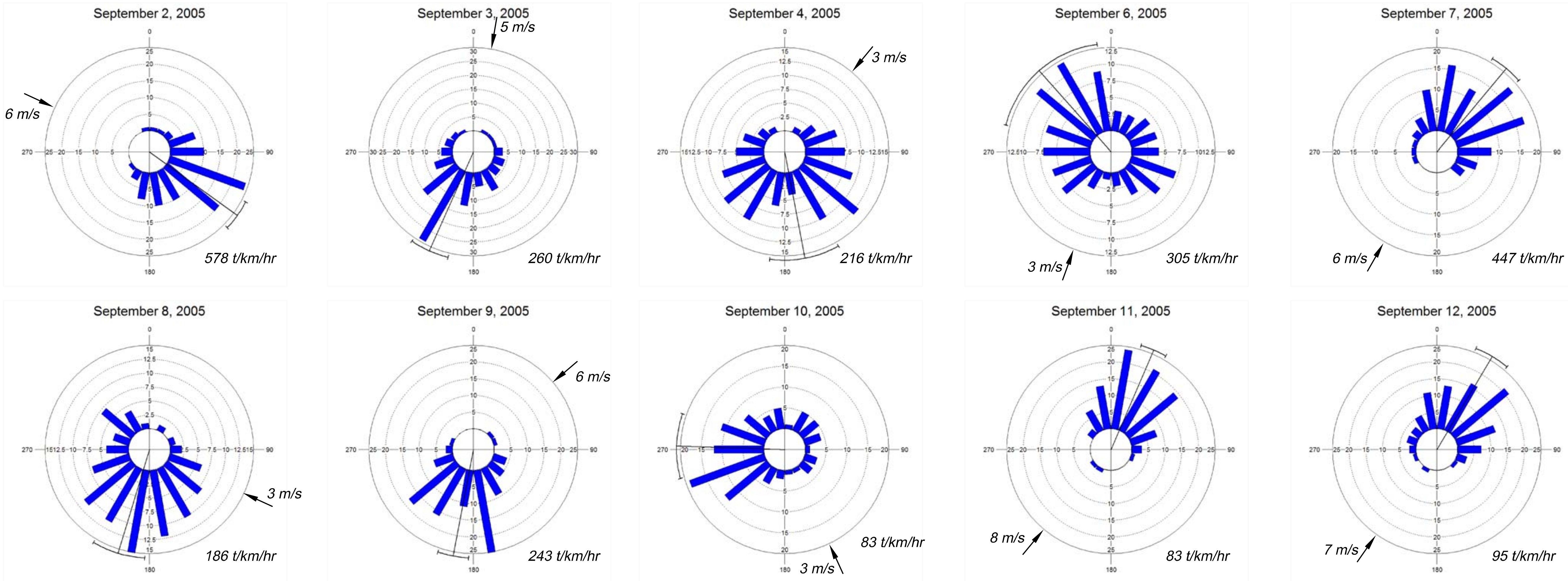
PREPARED BY:

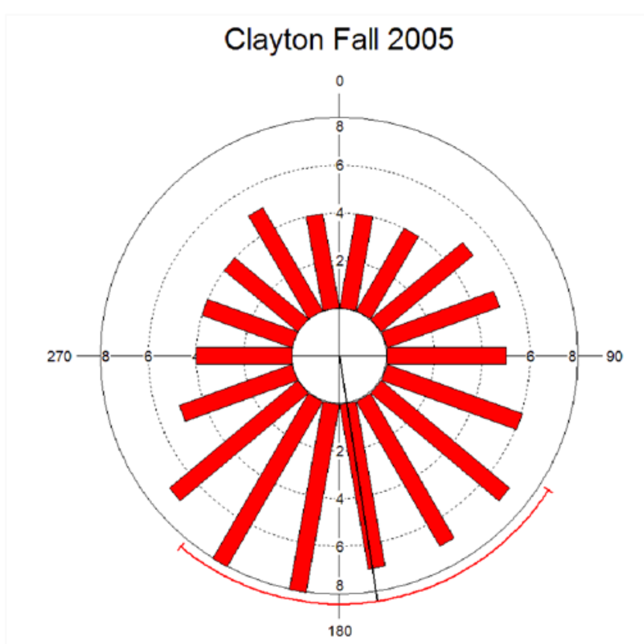
WOODLOT ALTERNATIVES, INC.
ENVIRONMENTAL CONSULTANTS

DATE:	November 2005
SCALE:	1" = 6000'
JOB NO. 105030	
FILE: 105030-00-Location.dwg	

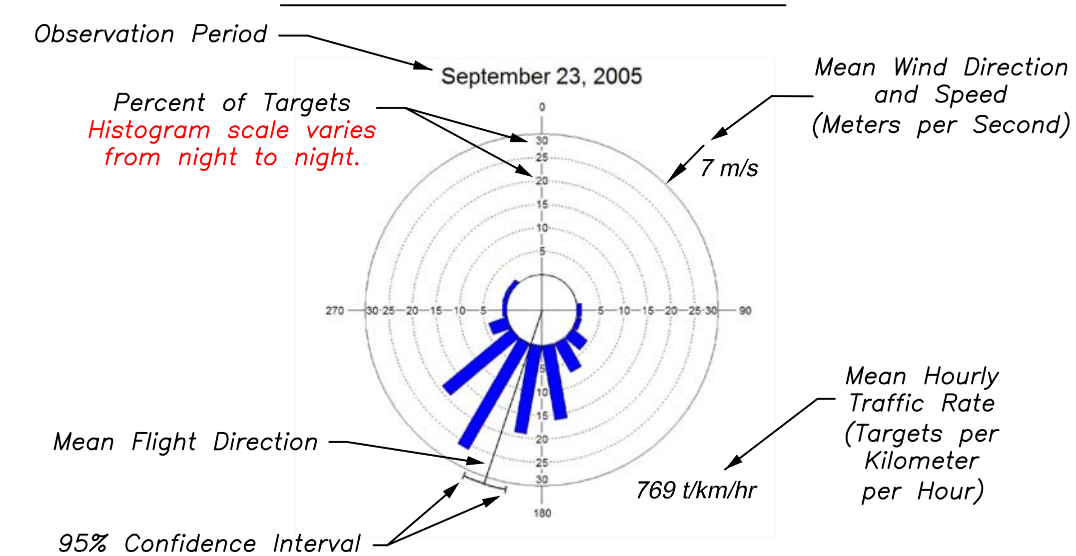
Figure 3-5
Fall 2005 Target Flight Direction
Clayton Wind Project
Clayton, New York

REV.





RADAR DATA ROSE LEGEND

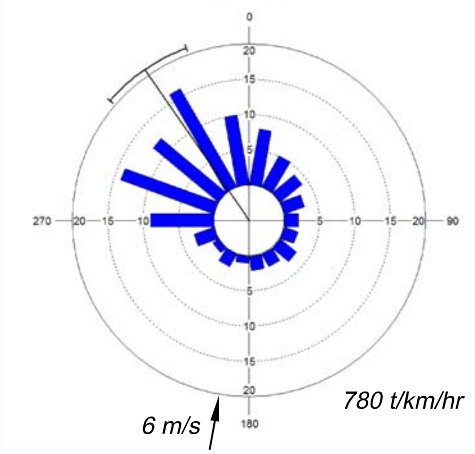


Data rose shows bird targets in directions of 20° increments.

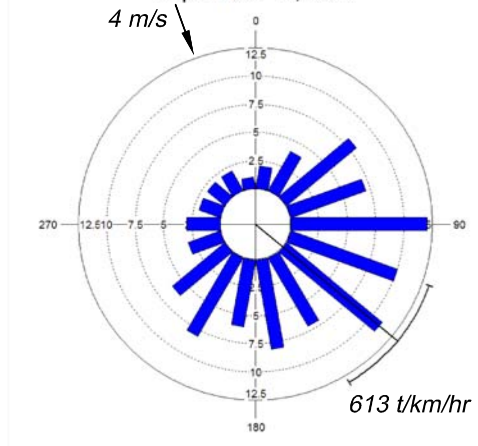
Sheet 1 of 4

SHEET TITLE:	Nightly Mean Flight Direction
SCALE:	n/a
DATE:	November 2005
PROJECT:	Clayton Wind Project
ADDRESS:	Clayton, New York
PREPARED BY:	WOODLOT ALTERNATIVES, INC. ENVIRONMENTAL CONSULTANTS
	105030-00-traffic.dwg
PROJ. NO.	105030
FIGURE NO.	3-6

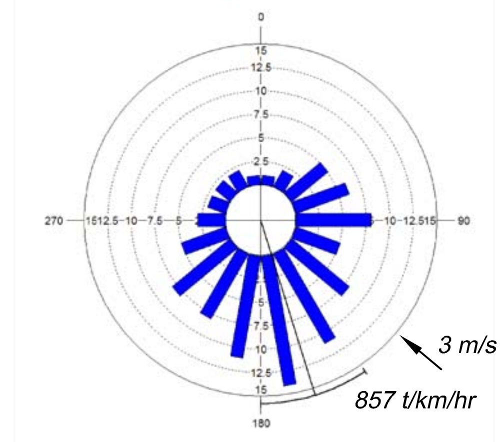
September 13, 2005



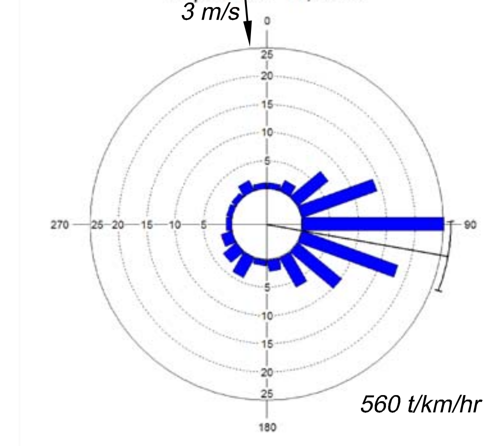
September 14, 2005



September 15, 2005



September 17, 2005



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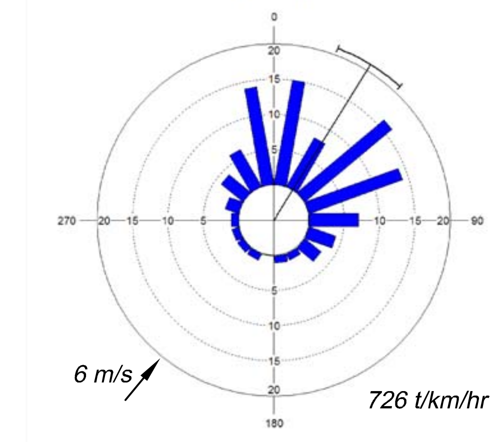

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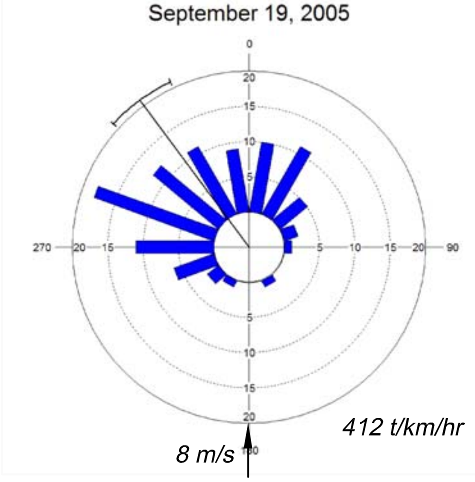

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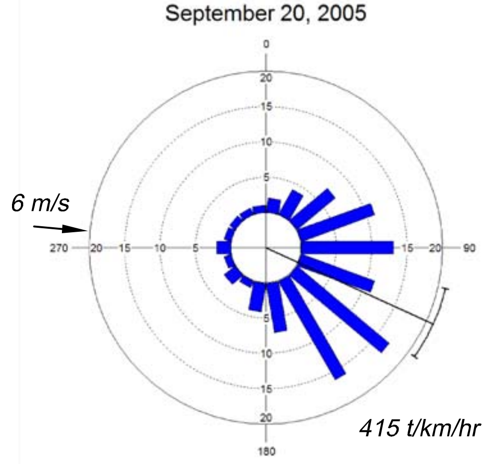

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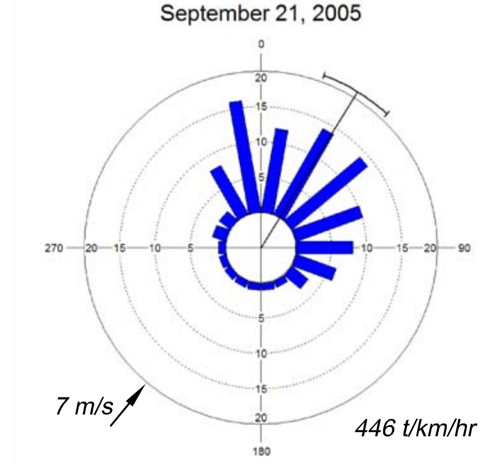
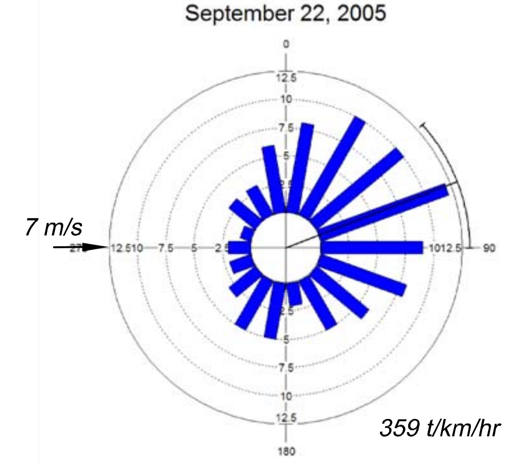
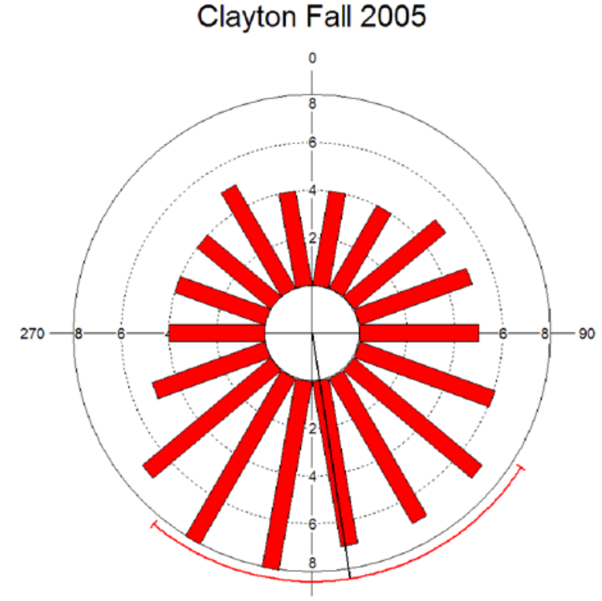


September 22, 2005



Clayton Fall 2005



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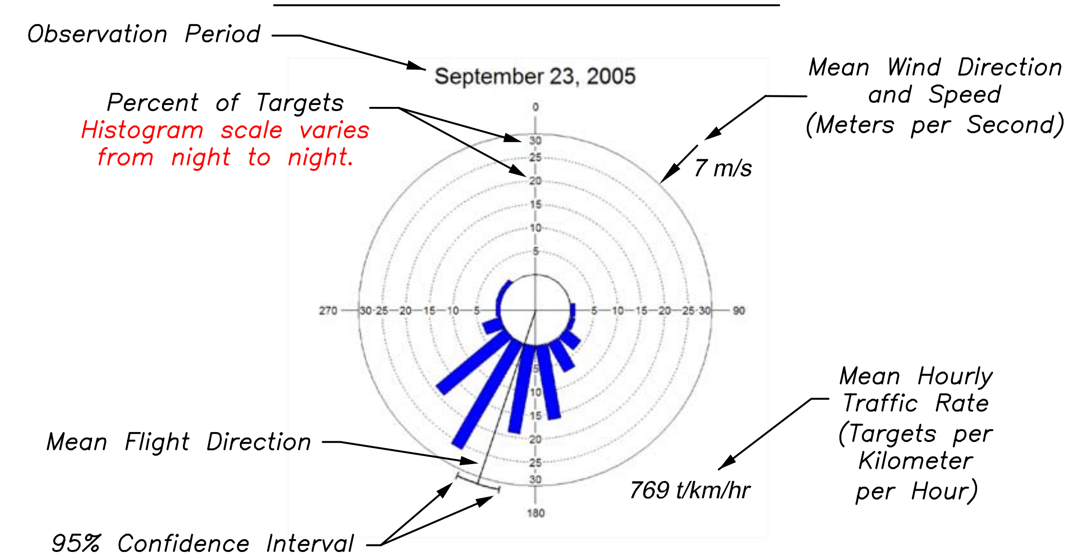
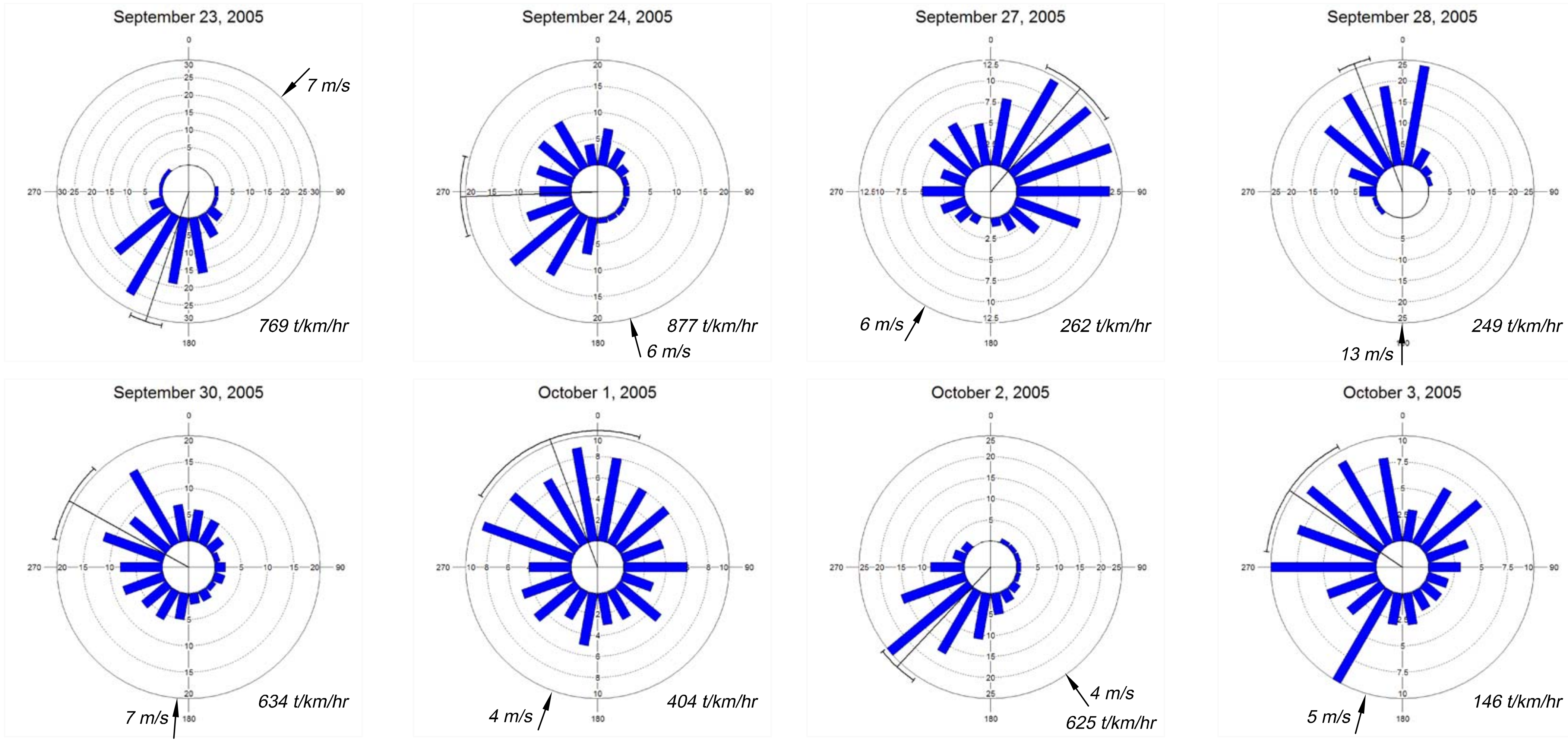


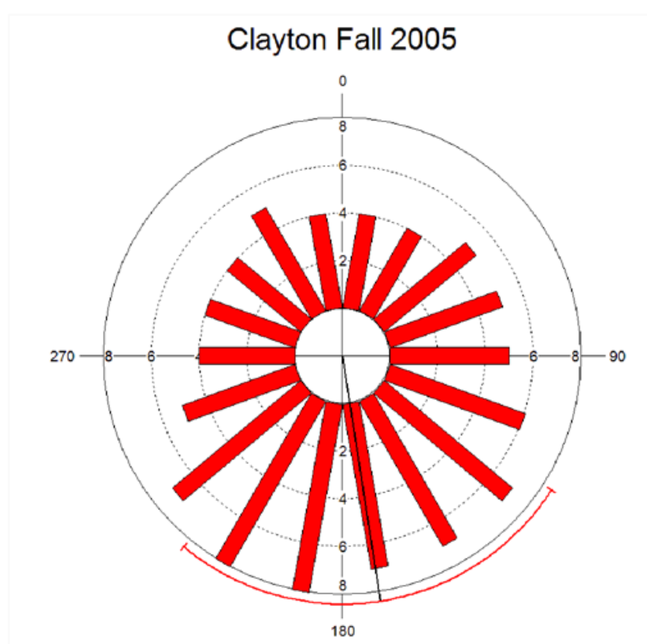
Data rose shows bird targets in directions of 20° increments.

Sheet 2 of 4

SHEET TITLE:	Nightly Mean Flight Direction
SCALE:	n/a
DATE:	November 2005
PROJECT:	Clayton Wind Project
ADDRESS:	Clayton, New York
PREPARED BY:	WOODLOT ALTERNATIVES, INC. ENVIRONMENTAL CONSULTANTS
	105030-00-traffic.dwg
PROJ. NO.	105030
FIGURE NO.	3-6

NO. | REVISIONS | DATE





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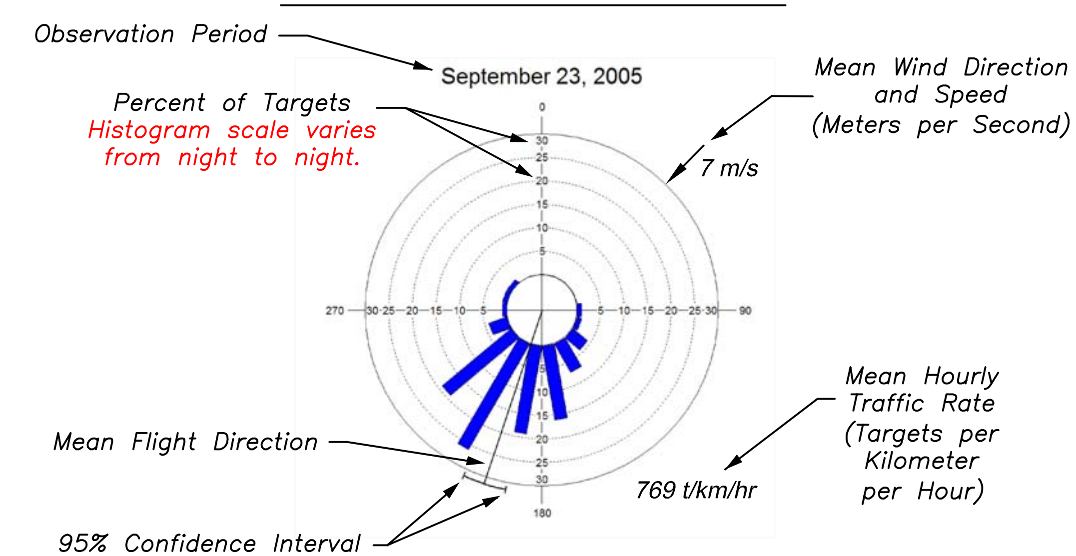
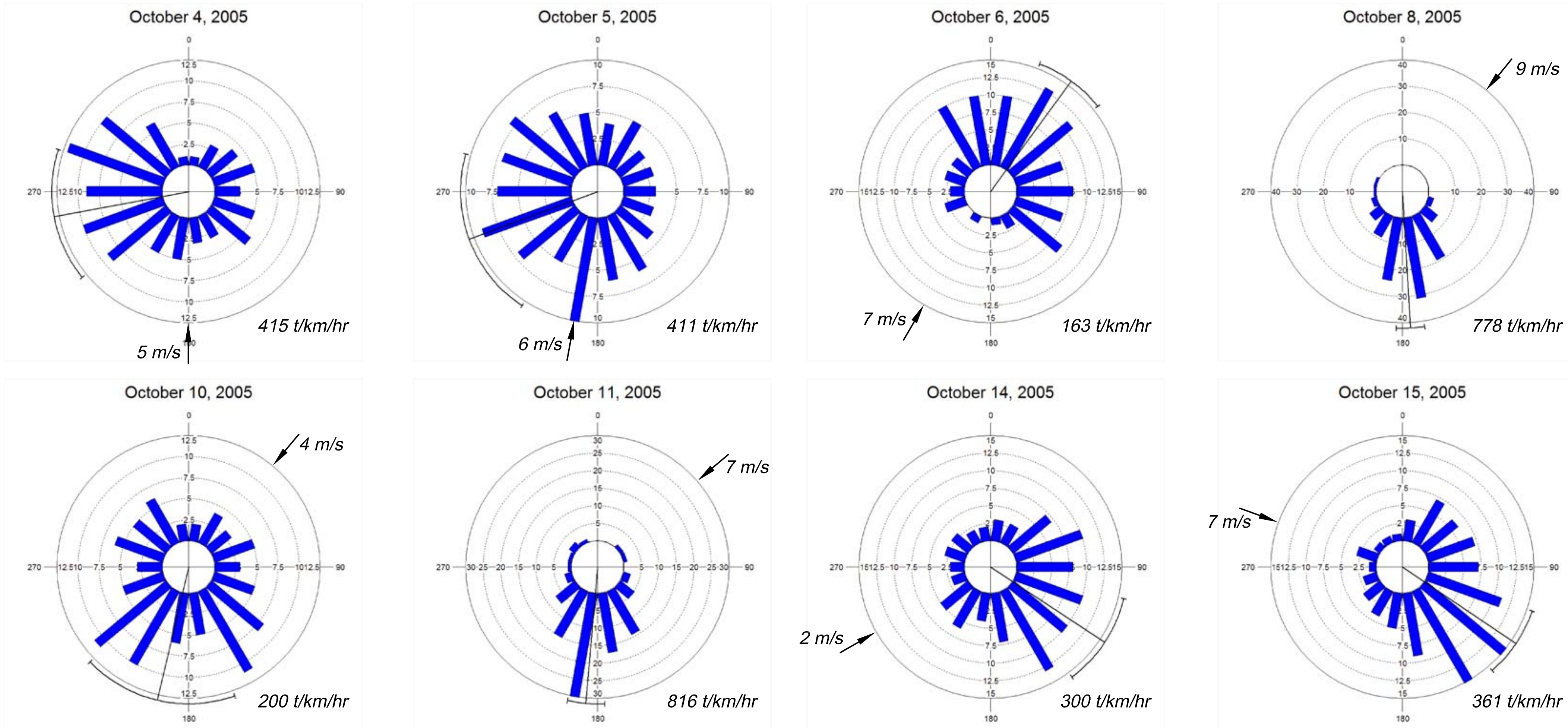


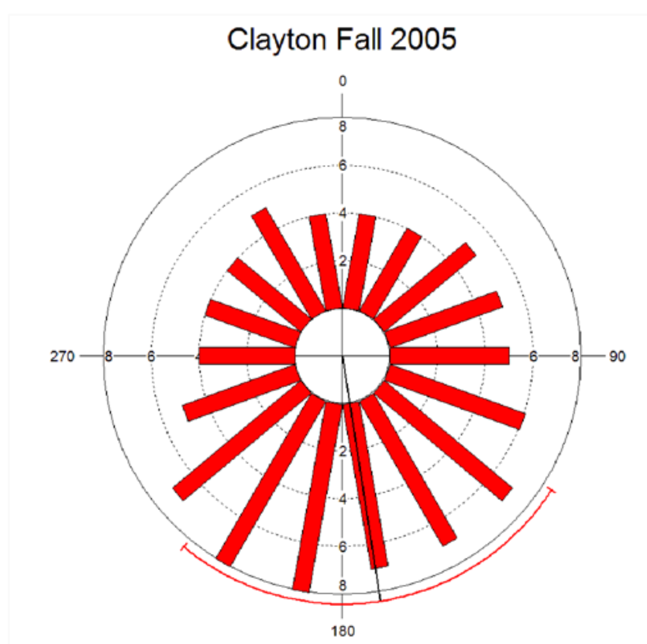
Data rose shows bird targets in directions of 20° increments.

Sheet 3 of 4

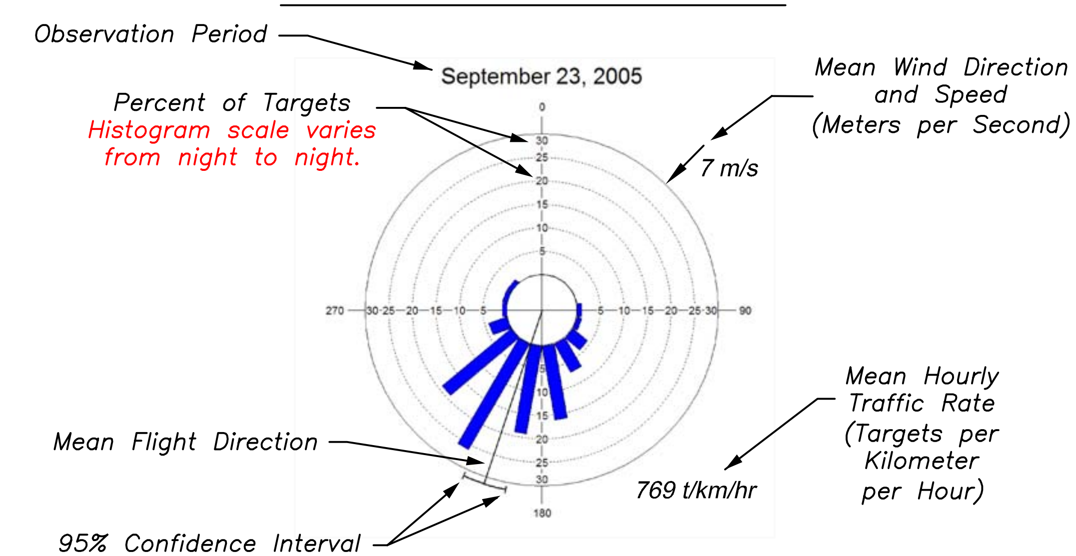
SHEET TITLE:	Nightly Mean Flight Direction
SCALE:	n/a
DATE:	November 2005
PROJECT:	Clayton Wind Project
ADDRESS:	Clayton, New York
PREPARED BY:	WOODLOT ALTERNATIVES, INC. ENVIRONMENTAL CONSULTANTS
	105030-00-traffic.dwg
PROJ. NO.	105030
FIGURE NO.	3-6

NO.	REVISIONS	DATE





RADAR DATA ROSE LEGEND



Data rose shows bird targets in directions of 20° increments.

Sheet 4 of 4

SHEET TITLE:	Nightly Mean Flight Direction
SCALE:	n/a
DATE:	November 2005
PROJECT:	Clayton Wind Project
ADDRESS:	Clayton, New York
PREPARED BY:	WOODLOT ALTERNATIVES, INC. ENVIRONMENTAL CONSULTANTS
	105030-00-traffic.dwg
PROJ. NO.	105030
FIGURE NO.	3-6

NO. | REVISIONS | DATE

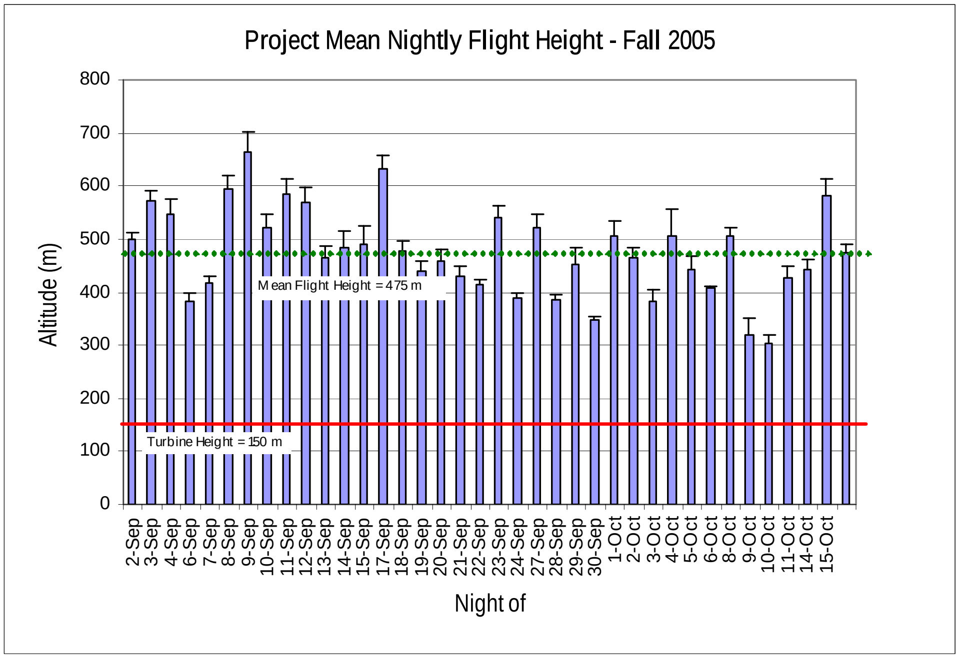


Figure 3-7. Mean nightly flight height of targets

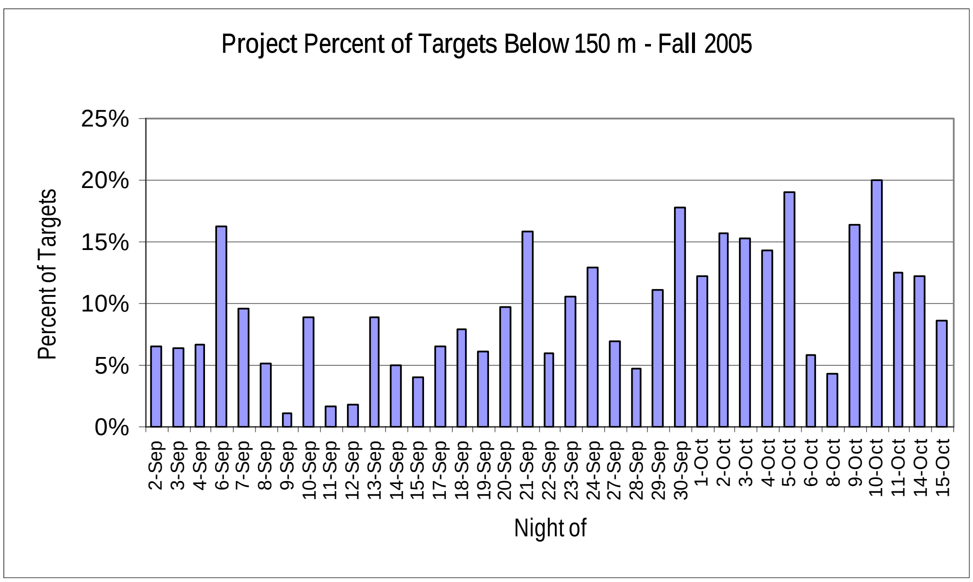


Figure 3-8. Percent of targets observed flying below a height of 150 m (492')

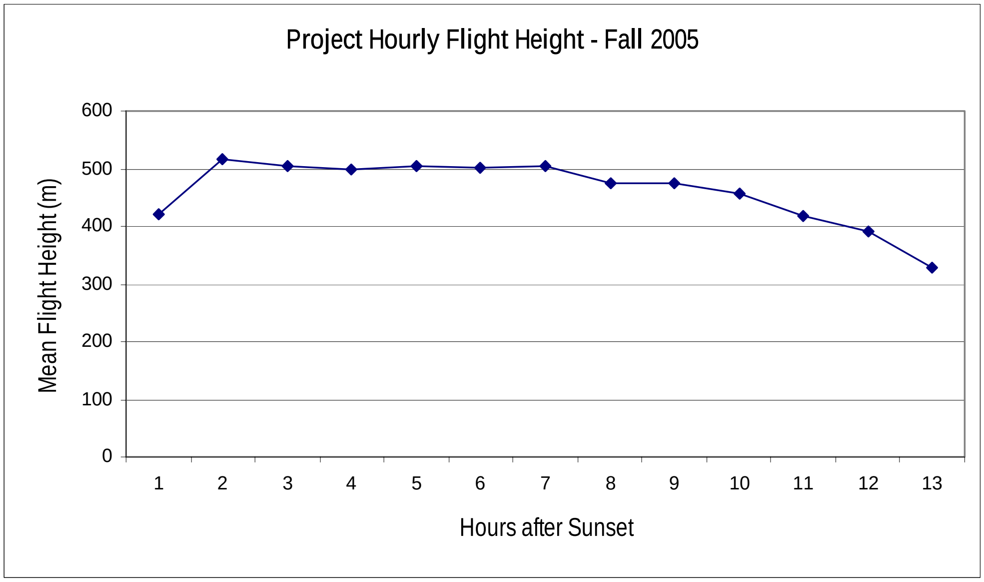


Figure 3-9. Hourly target flight height distribution

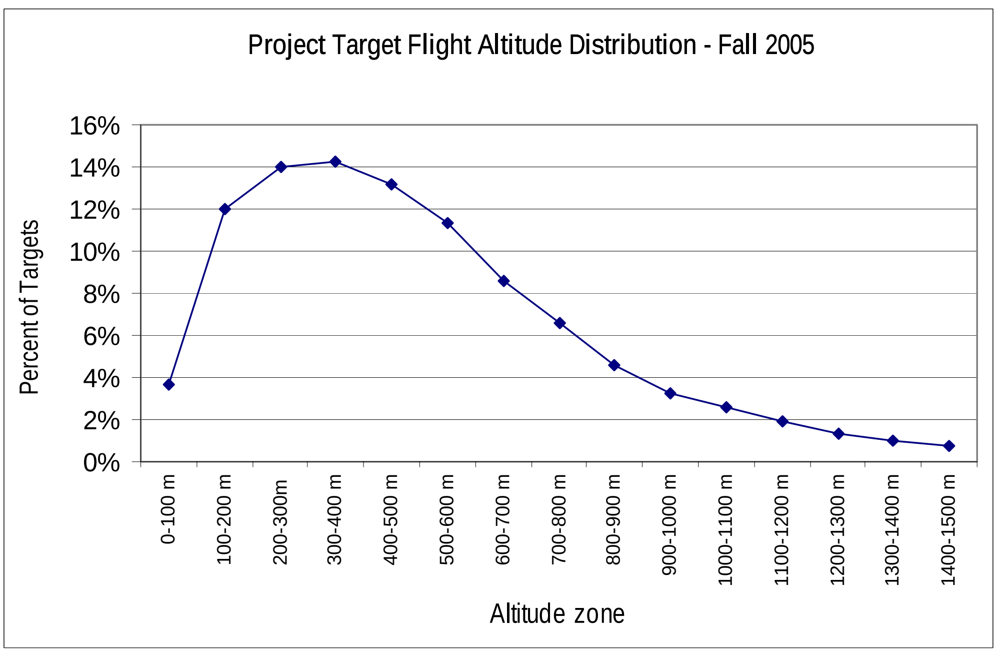


Figure 3-10. Target flight height distribution within 100 m (328') height zones

3.4 Discussion

Fall 2005 radar surveys documented migration activity and patterns in the vicinity of the proposed Clayton wind project area. In general, migration activity and flight patterns varied between and within nights. Nightly variation in the magnitude and flight characteristics of nocturnally-migrating songbirds is not uncommon and is often attributed to weather patterns, such as cold fronts and winds aloft (Hassler *et al.* 1963, Gauthreaux and Able 1970, Richardson 1972, Able 1973, Bingman *et al.* 1982, and Gauthreaux 1991).

Passage Rates

As indicated above, weather patterns are probably the largest factor affecting the magnitude of bird migration. In the fall, the passage of low pressure systems and cold fronts are typically followed by periods of southerly flowing winds that can last from one to three days. Bird migration is often more abundant during these periods, as birds are capitalizing on the generally suitable wind direction for fall migration (Richardson 1972). Consequently, nightly migration traffic rates can be expected to be variable and to peak when the best migration weather occurs. The variable nightly passage rates documented at the Clayton wind project are consistent with this.

Nightly passage rates varied from 83 ± 17 to 877 ± 93 t/km/hr, with an overall mean of 418 ± 40 t/km/hr. Passage rates often peaked 2 to 4 hours after sunset, which is typical of nighttime migration activity (Able 1970; Richardson 1972). Few surveys using the same methods and equipment and conducted during the same time period are available for comparison (Table 3-3). There are limitations in comparing that data with data from 2005, as year-to-year variation in continental bird populations invariably affects how many birds migrate through an area. However, nightly mean passage rates observed at the Clayton wind project were within the range of those studies, particularly those studies in relatively close proximity to Clayton (Copenhagen, Martinsburg, and Harrisburg, NY).

Table 3-3. Summary of passage rates from other fall radar studies

Year	Location	Passage Rate (t/km/hr)	Reference
1994	Western Maine	551	ND&T 1995
1994	Copenhagen, NY	341	Cooper *et al*. 1995
1994	Martinsburg, NY	661	Cooper *et al*. 1995
1998	Harrisburg, NY	336	Cooper and Mabee 1999
1998	Wethersfield, NY	466	Cooper and Mabee 1999
2003	Chautauqua, NY	235	Cooper *et al*. 2004a
2003	Mt. Storm, WV	241	Cooper *et al*. 2004b
2004	Prattsburgh, NY	200	Mabee *et al*. 2005

Differences in the overall passage rates could be due to several factors. First, surveys conducted during different years can yield different results, as the size of continental bird populations likely change year-to-year. Second, the timing of the surveys occurred during the second half of the migration season. Several nights of high migration activity could have occurred prior to the initiation of the surveys. Finally, year-to-year differences in regional weather patterns probably also affects where birds concentrate during the migration period.

Flight Direction

Some research suggests that bird migration may be affected by landscape features, such as coastlines, large river valleys, and mountain ranges. This has been documented for diurnally-migrating birds, such as raptors, but is not as well established for nocturnally migrating birds (Sielman *et al*. 1981; Bingman *et al*. 1982; Bruderer and Jenni 1990; Richardson 1998; Fortin *et al*. 1999; Williams *et al.* 2001; Diehl *et al*. 2003; Woodlot Alternatives, Inc. unpublished data).

Evidence suggesting topographic effects to night-migrating birds has typically included areas of varied topography, such as the most rugged areas of the northern Appalachians and the Alps. The landscape around the Clayton wind project consists of relatively flat terrain with low hills and an elevation differential of only 76 m to 152 m (250' to 500'), which is considerably less than in those other areas where potential topographic effects on flight direction have been observed. Consequently, topographic features are not believed to be affecting bird movements in this area.

Flight Altitude

The altitude at which nocturnal migrants fly has been one of the least understood aspects of bird migration. Bellrose (1971) flew a small plane at night along altitudinal transects to visually document the occurrence and altitude of migrating songbirds. He found the majority of birds observed were between 150 m and 450 m above the ground level but on some nights the majority of birds observed were from 450 m to 762 m above the ground. Radar studies have largely confirmed those visual observations, with the majority of nocturnal bird migration appearing to occur less than 500 m to 700 m above the ground (Able 1970, Alerstam 1990, Gauthreaux 1991, Cooper and Ritchie 1995).

Recent radar studies in the Northeast and Mid-Atlantic states are consistent with this as well. Cooper *et al.* (2004b) documented mean nightly flight altitudes at Mount Storm, West Virginia, between 214 m and 769 m, with a seasonal mean of 410 m and an average of 16% of targets flying below 125 m. In western New York, Cooper *et al.* (2004a) documented a mean flight altitude of 532 m with a small percentage (4%) of targets flying less 125 m above the ground.

Results from the Clayton wind project are similar to those of Cooper *et al*. (2004a, 2004b) with nightly flight altitudes varying from 305 m ±15 m (1,001' ± 49') to 663 m ± 40 m (2,175' ± 131') and a mean of 475 m ± 14 m (1,558' ± 46'). The percentage of targets flying less than 150 m above the ground was low, 10%, similar to that found by Cooper *et al*. (2004a).

The high mean flight altitude of targets documented during this study likely further supports the presumption that topographic features are not affecting migration patterns over the project area. The mean flight altitude being so high above the radar indicates that most birds are flying so high that their flight is unimpeded by topographic features, such as hillsides.

Comparison with the Spring 2005 Survey

The fall 2005 surveys represent the second season of radar surveys at the Clayton wind project area. The fall 2005 survey (Woodlot 2005) documented a slightly lower passage rate than the spring survey (Table 3-4). This is generally consistent with what would be expected, as bird populations in fall would typically be higher than in spring due to the recruitment of juvenile birds into the post-nesting season population. Flight direction in the fall was generally opposite that documented in the spring.

Flight altitude was approximately 32 m (105') higher in the fall than in the spring. There was slightly more variation in flight height observed in the spring and, consequently, the percentage of targets flying less than 150 m (492') above the radar was higher in the spring (14%) than in the fall (10%).

Table 3-4. Comparison of results from radar surveys in Spring and Fall 2005

	Spring 2005	**Fall 2005**
Overall Passage Rate	450 ± 62 t/km/hr	418 ± 40 t/km/hr
Flight Direction	30° ± 53°	168° ± 111°
Flight Height	443 ± 38	475 ± 14
Seasonal Average below 150 m	14%	10%

3.5 Conclusions

Radar surveys during the fall 2005 migration period have provided important information on nocturnal bird migration patterns in the vicinity of the Clayton wind project area. The results of the surveys indicate that bird migration patterns are generally similar to patterns observed at other sites in the region.

Migration activity varied throughout the season, which is probably largely attributable to weather patterns. The mean passage rate (418 ± 40 t/km/hr) is comparable to those observed at similar studies and generally similar to the spring study. Migration activity throughout each night typically peaked 2 to 4 hours after sunset and continued a steady decline fro the remainder of the night.

Flight direction for the entire season was 168º ± 111º. The average flight altitude above the ground was 475 m ± 14 m (1,558' ± 46'). Only 10 percent of the targets observed during vertical radar operation were flying below an altitude of 150 m (492'). Flight direction and height data indicate that nocturnal migrants are not avoiding the project area for any topographic-related reasons. Additionally, the flight height of targets so far above the height of the proposed turbines indicates that the risk of collision to night-migrating birds is limited to a very small subset of those birds

4.0 Bat Survey

Wind projects have emerged as a potentially significant source of mortality for migrating bats following results of post-construction mortality surveys conducted at several operational wind farms in the southeastern United States (Arnett *et al*. 2005). While concerns about the risk of bat collision mortality initially focused on forested ridgelines in the eastern United States, recent evidence from one facility on the prairies of Alberta indicates that bat mortality in those open habitats can be comparable to that observed along the central Appalachian Mountains (Robert Barclay, unpublished data).

Two consistent patterns have emerged from mortality studies of bats at operational wind farms: the timing of mortality and the species most commonly found. The majority of bat collisions appear to occur consistently during the month of August, which is thought to be linked to fall migration patterns, and the species most commonly found during mortality searches are the migratory tree bats: eastern red bat (*Lasiurus cinereus*), hoary bat (*Lasiurus cinereus*), eastern pipistrelle (*Pipistrellus subflavus*), and silver-haired bat (*Lasionycteris noctivagans*) (Arnett *et al.* 2005). Bat collision mortality during the breeding season has been virtually non-existent, despite the fact that relatively large populations of some bat species have been documented in close proximity to some wind facilities that have been investigated. These data suggest that wind plants do not currently impact resident breeding bat populations in the United States. All available evidence indicates that most of the bat mortality at wind plants in the United States involves migrant or dispersing bats in the late summer and fall.

A number of plausible hypotheses explaining the high rates of bat mortality, as well as these patterns in timing and species vulnerability, have been presented by bat researchers, but none have been adequately tested. The most likely mechanisms explaining bat collision center on the possibility that bats are unable to detect rotating turbine blades by echolocation, that bats are visually or acoustically attracted to wind turbines as potential roost habitat or due to curiosity, or that ridgelines act as corridors for migrating bats (Arnett *et al.* 2005). Additionally, bats may rely on navigational cues other than echolocation while migrating, making them less able to detect the rotating blades of a wind turbine. Although evidence is highly preliminary, the rotation of turbines appears to be linked to mortality estimates, as no dead bats were found beneath the single non-operational turbine at the West Virginia site surveyed for fatalities (Arnett *et al.* 2005).

Particular concern at this project has been expressed for the Indiana bat, a federally listed Endangered species that is known to occur in the vicinity of the project. Radio-tagging of Indiana bats from the nearest known hibernacula (approximately 14 km (8.7 mi) from the project area) during the pre-exodus period of 2005 documented several Indiana bats that traveled to the project area (pers. comm. Al Hicks, NYDEC).

To document bat activity in the area of the proposed Clayton Wind Project, Woodlot conducted acoustic monitoring surveys during fall 2005. Anabat II detectors were used to document bat passages near the rotor zone of the proposed turbines, at an intermediate height, and near the ground.

4.1 Methods

Field Surveys

Anabat II detectors were used for the duration of this study. Anabat detectors are frequency-division detectors, dividing the frequency of ultrasonic calls made by bats so that they are audible to humans. A factor of 16 was used in this study[3]. Frequency division detectors were selected based upon their widespread use for this type of survey, their ability to be deployed for long periods of time, and their ability to detect a broad frequency range, which allows detection of all species of bats that could occur in New York.

The survey included the deployment of 2 detectors on 33 nights from August 19 to September 20, 2005. Two detectors were deployed at heights of approximately 30 m (100') and 2 m (6.6') above the ground at an on-site met tower. This location was the same as that used for the raptor and radar surveys. The detectors were programmed to record data from 7:00 pm to 7:00 am every night. Data from the Anabat detectors were logged onto compact flash media using a CF ZCAIM (Titley Electronics Pty Ltd.) and downloaded to a computer for analysis.

Data Analysis

Call files were extracted from data files using CFCread© software, with default settings in place. Call files were visually screened to remove files caused by wind, insect noise, and other static so that only bat calls remained. Nightly tallies of detected calls were then compiled for each night. Detection rates indicate only the number of calls detected and do not necessarily reflect the number of individual bats in an area.

Call files were examined visually and assigned to species categories, based on comparison to libraries of known bat reference calls. Due to the similarity of calls between species in the genus *Myotis*, these calls were identified only to genus. However, calls of the genus *Myotis* were examined to determine if those of the Indiana bat, a federally listed Endangered species, may have been recorded. These calls were reviewed using characteristics identified by Eric Britzke, a national expert researching the ability to identify this species from recorded call sequences, as useful for separating this species from other *Myotis*. Calls lacking sufficient material upon which to base identification, or that could not be distinguished between species with similar call attributes, such as some silver-haired and big brown bat (*Eptesicus fuscus*) or eastern red bat and eastern pipistrelle calls, were labeled as "unknown." Nightly passage rates were calculated for each detector to document changes in species composition during the survey period.

4.2 Results

Of the 154 calls recorded, 124 were identified to species or genus group. The *myotids* were the most abundant calls recorded, accounting for 97 (63%) of the calls. Following these were calls of the big brown bat (19 calls), eastern red bat (4 calls), silver-haired bats (3 calls), and eastern pipistrelle (1 call). Thirty calls were of too poor of quality or too short to identify.

The *myotid* calls were examined for the possibility of the Indiana bat being included within the call set. Considerable variation within this set of calls was observed but no definitive determination has yet been

[3] The frequency division setting literally divides ultrasonic calls detected by the detector by the division setting to produce signals at frequencies audible to the human ear.

made. Considering the known occurrence of Indiana bats within the project area during summer 2005 it is possible that some of the *myotid* calls recorded during the fall survey are of this species.

The detectors were deployed continuously from August 19 to September 20, 2005. A malfunction in the high bat detector resulted in corrupt data files. Consequently, a total of 33 detector-nights of data were recorded. At total of 154 bat call sequences were recorded during the sampling, all from the lower detector. The total number of calls detected on any given night ranged from 0 (September 11 and 17) to 14 (August 28), with corresponding detection rates of 0 to 14 calls/detector-night. The overall average number of calls recorded per detector-night was 4.7. No overall trend in detection rate was observed.

Of the total number of recorded call sequences (154), 124 were identified to 5 different species categories and 30 were categorized as unknown (Figure 4-1). *Myotid* calls were the most abundant calls recorded (97), followed by big brown bat (19), eastern red bat (4), silver-haired bat (3), and eastern pipistrelle (1). No strong trends in the seasonal occurrence of any species were observed. However, several species (red bat, silver-haired bat, and eastern pipistrelle) were not observed after the August 28. Big brown bats and the myotids were generally documented throughout the survey period.

Table 4-1. Summary table for the results of fall bat surveys at Clayton.

Date (night of)	Big brown bat	Eastern red bat	Silver-haired bat	Myotis spp.	Eastern pipistrelle	Unknown	Total # Call Sequences
8/19/05		1		3		6	10
8/20/05				3			3
8/21/05		2		5		2	9
8/22/05			1	4			5
8/23/05		1		5		1	7
8/24/05	2		2	3			7
8/25/05	3			1			4
8/26/05				5		2	7
8/27/05	1			4		9	14
8/28/05				4	1	2	7
8/29/05	1			8			9
8/30/05	1			2		4	7
8/31/05	1			5			6
9/1/05	2			5			7
9/2/05	3			2			5
9/3/05				2		2	4
9/4/05				1			1
9/5/05				1			1
9/6/05				1		1	2
9/7/05				4			4
9/8/05				1			1
9/9/05	1			4			5
9/10/05				1			1
9/11/05							0
9/12/05				6			6
9/13/05	1			4		1	6
9/14/05				4			4
9/15/05	3						3
9/16/05				2			2
9/17/05							0
9/18/05				1			1
9/19/05				4			4
9/20/05				2			2
Total Calls	***19***	***4***	***3***	***97***	***1***	***30***	***154***
Detection Rate*	***0.6***	***0.1***	***0.1***	***2.9***	***0.03***	***0.9***	***4.7***

* Calls per detector-night

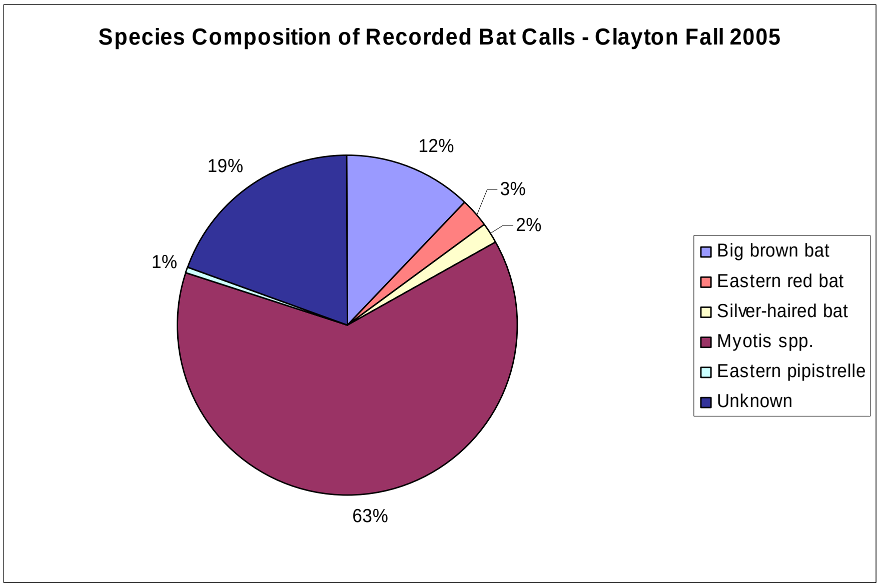


Figure 4-1. Species composition of bat calls recorded at the proposed Clayton Wind Project – Fall 2005

4.3 Discussion

The fall bat echolocation surveys provide some insight into activity patterns, species composition, and timing of movements of bats in the project area. Evaluation of the data collected does not document any obvious trend in the timing of activity during the time sampled.

Identification of recorded bat call sequences revealed that big brown bats and members of the genus *Myotis* were the most common species in the project area during fall. The detection rates documented during the fall survey were low. Very few of the tree-roosting species–species for which the greatest risk of collision has been demonstrated at some existing wind facilities–were documented during the fall survey.

Care must be taken in interpreting the results of echolocation surveys and using these data to predict the potential risk of a wind farm to bats. Although the relationship between bat activity levels, as measured by acoustic echolocation surveys, and bat collision mortality at wind farms has not been established and likely depends upon numerous factors, high bat passage rates could indicate increased likelihood of bat collision mortality while low detection rates could indicate lower risk of collisions.

Because so little is understood about the behavior of migrating bats, identifying the causes of collision mortality has been very difficult and any predictions based on pre-construction surveys should be conservative. The current understanding of bat mortality at wind farms is based on a small number of surveys, which may not be representative of more widespread patterns. Multiple survey types (acoustic echolocation surveys, mortality searches, thermal imaging, and radar) conducted concurrently at more wind farms once they become operational may be the only method of understanding this complicated issue.

4.4 Conclusions

Detector surveys during the fall 2005 migration period provided important information on bat activity in the vicinity of the Clayton project area. The survey documented the species that would be expected in the area based on the species' range and abundance, as well as the habitats in the project area. The generally low level of activity could be caused by many biological factors or simply by chance.

Of the bat calls recorded, 63 percent were classified as *Myotis* but were not further classified to species. Based on the relative abundance of these species, most of the *myotid* calls were likely from little brown bats (*Myotis lucifugus*) and northern long-eared bats (*Myotis septentrionalis*). However, considering the known occurrence of Indiana bats within the project area during summer 2005, it is possible that some of the *myotid* calls recorded during the fall survey were of this species.

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Appendix A

Appendix A Table 1. Summary of Daily Raptor Migration Surveys

Species	Sep 09	Sep 16	Sep 18	Sep 19	Sep 27	Sep 28	Oct 04	Oct 05	Oct 06	Oct 15	Oct 16	Total
American kestrel		3	1	2	1		2	2	1	1	1	14
Merlin					1							1
Northern harrier	2	3	2	3	2	2	2	3	2	7	3	31
Peregrine falcon	2				2			1				5
Red-tailed hawk	1		6	4	4	2	5	1	1	43	14	81
Sharp-shinned hawk		1	3	1	2		2		1	6	1	17
Turkey vulture	39	6	41	34	56	42	25	30	47	49	22	391
Cooper's hawk				1			2	1	1	2	2	9
Unidentified accipiter									1	1		2
Unidentified raptor			1							2		3
Broad-winged hawk			10									10
Bald eagle			1	1					2			4
Osprey	1			1		1		1			1	5
Golden eagle										1		1
Northern goshawk											1	1
Daily total	45	13	65	47	68	47	38	39	56	112	45	575

Appendix A Table 2. Summary of Hourly Raptor Observations

Species	9:00-10:00	10:00-11:00	11:00-12:00	12:00-1:00	1:00-2:00	2:00-3:00	3:00-4:00	Grand Total
American kestrel	3	2	2		4	2	1	**14**
Bald eagle					2	2		**4**
Broad-winged hawk			9			1		**10**
Cooper's hawk	3			2	3	1		**9**
Golden eagle						1		**1**
Merlin		1						**1**
Northern goshawk					1			**1**
Northern harrier	8	6	5	6	5	1		**31**
Osprey		1	1	1	1	1		**5**
Peregrine falcon	1	2	1	1				**5**
Red-tailed hawk	8	5	4	16	18	7	23	**81**
Sharp-shinned hawk		1	2	4	5	2	2	**16**
Turkey vulture	36	62	54	123	53	55	8	**391**
Unidentified accipiter					1	1		**2**
Unidentified raptor			1		1	1		**3**
Grand Total	**59**	**80**	**79**	**153**	**94**	**75**	**34**	**574**

Appendix A Table 3. Raptor species distribution below turbine height

Species	> 150 m	< 150 m	Total
American kestrel	0	14	14
Bald eagle	2	2	4
Broad-winged hawk	10	0	10
Cooper's hawk	2	7	9
Golden eagle	0	1	1
Merlin	0	1	1
Northern goshawk	0	1	1
Northern harrier	1	30	31
Osprey	0	5	5
Peregrine falcon	0	5	5
Red-tailed hawk	13	68	81
Sharp-shinned hawk	3	14	17
Turkey vulture	31	360	391
Unidentified accipiter	0	2	2
Unidentified raptor	1	2	3
Total	**63**	**512**	**575**

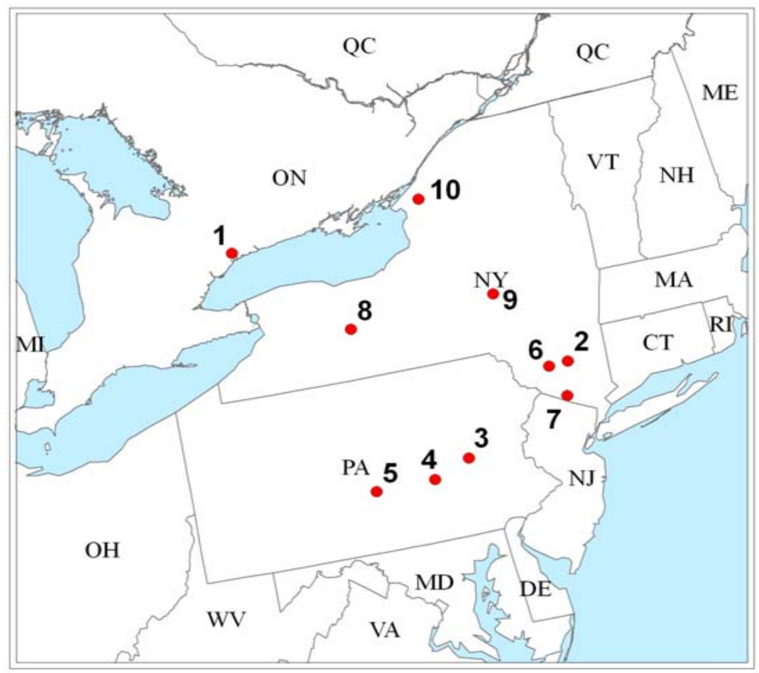
Appendix A Table 4. Summary of Fall 2005 Hawk Count Surveys at Clayton Wind Project and Other Regional Hawk Watch Sites*

Site Number**	Location	Observation Hours	BV	TV	OS	BE	NH	SS	CH	NG	RS	BW	RT	RL	GE	AK	ML	PG	SW	UR	UB	UA	UF	UE	TOTAL	BIRDS/ HOUR
1	**Cranberry Marsh, Ontario**	248.5	0	2920	122	40	89	1216	153	10	43	220	996	19	19	482	27	15	0	134	0	0	0	0	6505	26.2
2	**Mohonk Preserve, NY**	19.5	0	0	6	1	1	28	4	0	0	15	4	0	0	7	1	4	0	5	0	0	0	0	76	3.9
3	**Hawk Mountain, PA**	742.4	61	300	480	154	114	4324	1017	11	192	5273	2581	1	50	465	189	52	0	130	0	0	0	0	15394	20.7
4	**Second Mountain, PA**	669	76	172	189	69	82	1813	266	45	73	3082	773	0	34	105	39	25	0	56	0	0	0	0	6899	10.3
5	**Stone Mountain, PA**	187	0	43	65	22	36	765	262	6	55	425	934	1	31	92	33	9	1	29	0	0	0	0	2809	15.0
6	**Summitville, NY**	77.25	5	120	53	16	10	205	58	8	13	660	306	1	6	24	4	8	0	21	0	0	0	0	1518	19.7
7	**Mount Peter, NY**	314.67	65	102	129	28	51	1199	152	4	21	3826	418	0	5	149	40	18	0	65	0	0	0	0	6272	19.9
8	**Kestrel Haven, NY**	629.5	0	427	3	3	9	75	21	45	5	5	148	11	3	86	3	2	0	9	0	0	0	0	855	1.4
9	**Franklin Mountain, NY**	532.92	0	465	132	65	40	500	105	19	39	867	1769	5	46	149	35	10	0	51	0	0	0	0	4297	8.1
10	**Clayton Wind Project NY**	63.5	0	391	5	4	31	17	9	1	0	10	81	0	1	14	1	5	0	3	0	2	0	0	575	9.1

* Data current from HMANA website as of 11-1-05.
** See map to right for site location.

Abreviation Key:

BV - Black Vulture
TV - Turkey Vulture
OS - Osprey
BE - Bald Eagle
NH - Northern Harrier
SS - Sharp-shinned Hawk
CH - Cooper's Hawk
NG - Northern Goshawk
RS - Red-shouldered Hawk
BW - Broad-winged
RT - Red-tailed Hawk
RL - Rough-legged Hawk
GE - Golden Eagle
AK - American Kestrel
ML - Merlin
PG - Peregrine Falcon
SW - Swainson's Hawk
UR - unidentified Raptor
UB - unidentified Buteo
UA - unidentified Accipiter
UF - unidentified Falcon
UE - unidentified Eagle



Appendix B

Appendix B Table 1. Summary of passage rates by hour, night, and for entire season

Night of	Passage Rate (targets/km/hr) by hour after sunset													Entire Night	
	1	2	3	4	5	6	7	8	9	10	11	12	13	Mean	SE
Sep 2	660	705	672	580	520	561	529	399	--	--	--	--	--	578	35
Sep 3	430	327	230	289	260	220	183	196	207	--	--	--	--	260	26
Sep 4	56	247	318	289	294	262	213	236	201	168	91	--	--	216	25
Sep 6	--	--	--	136	280	374	392	343	--	--	--	--	--	305	46
Sep 7	--	407	496	438	--	--	--	--	--	--	--	--	--	447	26
Sep 8	--	401	285	222	179	163	178	171	144	63	55	--	--	186	32
Sep 9	66	200	364	343	--	--	--	--	--	--	--	--	--	243	69
Sep 10	75	176	--	--	101	78	73	37	43	--	--	--	--	83	17
Sep 11	--	--	109	121	80	94	55	--	75	48	--	--	--	83	10
Sep 12	--	77	53	67	81	70	86	93	129	132	147	107	--	95	9
Sep 13	336	1397	1357	1093	1050	--	836	654	589	504	564	204	--	780	120
Sep 14	843	845	698	607	579	579	--	464	439	461	--	--	--	613	52
Sep 15	1179	1277	971	819	--	918	986	600	807	713	300	--	--	857	89
Sep 17	--	--	618	686	690	707	647	605	632	339	420	257	--	560	51
Sep 18	793	893	954	868	786	648	724	889	771	680	552	157	--	726	61
Sep 19	257	589	441	568	418	393	375	354	378	413	343	--	--	412	29
Sep 20	514	611	546	--	514	471	461	468	361	300	227	86	--	415	47
Sep 21	557	525	643	493	541	493	407	416	380	339	457	100	--	446	40
Sep 22	686	391	364	364	396	--	471	171	198	284	346	279	--	359	42
Sep 23	879	948	913	964	1007	994	664	600	525	193	--	--	--	769	84
Sep 24	429	1209	1357	1187	868	1256	943	900	707	664	557	446	--	877	93
Sep 27	321	307	364	289	246	336	289	321	200	207	--	104	161	262	23
Sep 28	241	382	411	300	364	329	236	139	137	157	143	150	--	249	30
Sep 29	--	286	514	500	391	386	311	257	359	236	163	75	21	292	44
Sep 30	--	1350	893	734	582	475	586	536	356	407	386	671	--	634	86
Oct 1	246	546	729	493	339	519	530	436	279	279	193	197	471	404	45
Oct 2	364	707	657	750	1033	875	804	686	600	546	454	402	246	625	61
Oct 3	161	159	225	150	193	180	161	107	118	107	150	43	150	146	13
Oct 4	332	263	350	343	500	540	450	579	468	429	343	536	263	415	30
Oct 5	--	429	450	557	413	414	750	396	476	304	236	327	179	411	43
Oct 6	193	139	171	121	146	171	--	86	214	139	214	193	--	163	12
Oct 8	150	841	1079	1286	1286	1232	921	957	814	605	464	279	204	778	112
Oct 9	--	--	--	--	147	134	139	157	54	36	32	39	100	93	18
Oct 10	--	--	--	250	246	261	--	143	159	129	157	171	286	200	20
Oct 11	514	557	777	1200	--	1425	1404	870	1071	--	480	421	252	816	124
Oct 14	450	414	514	332	332	321	343	332	236	171	188	155	113	300	34
Oct 15	364	354	396	600	568	423	386	501	343	307	161	171	116	361	41
Entire Season	**427**	**561**	**573**	**531**	**468**	**494**	**485**	**415**	**378**	**312**	**290**	**232**	**197**	**418**	**40**

Appendix B Table 2. Mean Nightly Flight Direction

Night of	Mean Flight Direction	Circular Stdev
Sep 2	125	45
Sep 3	205	52
Sep 4	171	75
Sep 6	318	97
Sep 7	39	48
Sep 8	195	65
Sep 9	190	41
Sep 10	271	73
Sep 11	22	36
Sep 12	30	48
Sep 13	324	65
Sep 14	131	80
Sep 15	161	72
Sep 17	100	54
Sep 18	31	56
Sep 19	322	54
Sep 20	114	55
Sep 21	31	55
Sep 22	70	81
Sep 23	198	36
Sep 24	267	73
Sep 27	40	73
Sep 28	339	34
Sep 29	152	41
Sep 30	299	72
Oct 1	334	100
Oct 2	222	45
Oct 3	304	91
Oct 4	258	92
Oct 5	249	101
Oct 6	36	69
Oct 8	175	30
Oct 9	221	58
Oct 10	189	97
Oct 11	184	43
Oct 14	127	80
Oct 15	124	69
Entire Season	**168**	**111**

Appendix B Table 3. Summary of mean flight heights by hour, night, and for entire season

Night of	Mean Flight Height (altitude in meters) by hour after sunset													Entire Night		% of targets < 150 m
	1	2	3	4	5	6	7	8	9	10	11	12	13	Mean	SE	
2-Sep	473	566	519	515	485	496	484	449	--	--	--	--	--	498	12	7%
3-Sep	--	--	570	576	617	653	603	599	526	520	500	--	--	574	17	6%
4-Sep	610	658	640	676	621	556	510	485	494	473	365	473	--	547	27	7%
6-Sep	--	--	--	360	443	363	361	384	--	--	--	--	--	382	16	16%
7-Sep	--	406	404	442	--	--	--	--	--	--	--	--	--	417	12	10%
8-Sep	--	695	649	659	643	628	608	543	569	501	453	--	--	595	24	5%
9-Sep	697	708	583	--	--	--	--	--	--	--	--	--	--	663	40	1%
10-Sep	496	625	--	--	534	564	535	447	459	--	--	--	--	523	23	9%
11-Sep	--	--	423	612	555	597	630	--	594	674	--	--	--	584	30	2%
12-Sep	--	572	665	615	703	620	601	579	501	566	458	383	--	569	28	2%
13-Sep	511	554	548	386	387	454	449	491	--	431	343	549	--	464	22	9%
14-Sep	413	418	424	473	424	426	--	494	566	708	--	--	--	483	33	5%
15-Sep	--	664	626	596	507	453	472	458	416	411	--	301	--	490	35	4%
17-Sep	--	649	674	722	740	673	670	660	603	557	553	457	--	633	25	7%
18-Sep	435	566	490	544	534	573	522	462	378	393	388	429	--	476	21	8%
19-Sep	286	538	510	455	455	443	435	450	427	410	442	--	--	441	19	6%
20-Sep	420	518	491	507	528	584	476	429	419	407	438	283	--	458	22	10%
21-Sep	--	482	548	525	483	401	422	383	368	383	364	363	--	429	21	16%
22-Sep	--	410	349	409	405	416	411	385	423	452	475	--	--	413	11	6%
23-Sep	--	648	623	614	578	541	559	545	488	451	437	450	--	539	22	11%
24-Sep	355	378	375	379	411	442	431	395	396	389	--	343	--	390	9	13%
27-Sep	369	573	549	538	604	573	600	602	542	452	433	440	--	523	23	7%
28-Sep	335	373	357	412	407	381	394	394	396	390	405	402	--	387	6	5%
29-Sep	--	489	469	--	530	547	549	566	436	369	450	376	185	451	33	11%
30-Sep	329	354	338	348	324	337	353	346	389	306	377	381	337	348	7	18%
1-Oct	345	383	386	427	499	546	573	595	621	592	--	566	534	506	28	12%
2-Oct	427	534	441	410	396	385	482	498	549	547	576	436	366	465	19	16%
3-Oct	--	366	388	324	418	339	332	390	513	496	363	294	--	384	21	15%
4-Oct	333	650	566	622	680	702	729	596	510	371	355	335	127	506	51	14%
5-Oct	319	428	438	558	496	447	505	519	547	486	396	370	261	444	25	19%
6-Oct	--	391	420	408	393	422	411	416	416	--	391	396	--	406	4	6%
8-Oct	439	531	584	595	568	538	519	478	470	461	467	426	--	506	17	4%
9-Oct	--	--	--	282	415	449	357	314	373	347	323	216	131	321	30	16%
10-Oct	--	--	--	335	307	297	--	264	390	298	300	318	233	305	15	20%
11-Oct	338	349	360	482	509	570	485	470	471	385	388	391	364	428	20	12%
14-Oct	300	351	433	512	474	512	535	445	482	480	443	420	380	444	19	12%
15-Oct	594	711	757	586	639	627	643	572	495	460	424	345	694	580	33	9%
Entire Season	**420**	**517**	**503**	**497**	**506**	**502**	**504**	**474**	**476**	**457**	**419**	**390**	**328**	**475**	**14**	**10%**

-- indicates no data for that hour

Summer 2005 Breeding Birds Surveys at the Proposed Clayton Wind Project in Clayton and Orleans, New York

Draft Report

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November 2005

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Table of Contents

1.0 Introduction

Woodlot Alternatives, Inc. (Woodlot) conducted systematic point-counts to characterize the species diversity and abundance of birds breeding in the vicinity of the proposed Clayton Wind Project in New York.

The proposed project site is located between the Chaumont and Perch Rivers in the towns of Clayton and Orleans in Jefferson County, New York. It is in the Eastern Ontario Plains ecozone of New York and is approximately seven miles southeast of the St. Lawrence River and a half mile northwest of the Perch River Wildlife Management Area. The area is nearly level, rural, dominated by a mosaic of agricultural fields with fragments of northern hardwood and elm-red maple woodlands and scattered low density housing. In some areas, the transition between cultivated fields and woodlands is buffered by early successional or shrub habitat.

The project area is also surrounded by substantial inland marsh communities. Many species of waterfowl and other marsh community species occur within the project area. In other parts, avian species tolerant of disturbed areas, croplands, pastures, sharp transitional edges, and fragmented woodlands would be expected to occur. Species known to prefer or require extensive tracts of intact forest would be unlikely to breed within the project area. Species listed as endangered, threatened, or of special concern by the New York Department of Environmental Conservation that might be expected in the proposed project area include the short-eared owl (*Asio flammeus*), northern harrier (*Circus cyaneus*), upland sandpiper (*Bartramia longicauda*), horned lark (*Eremophila alpestris,*) cerulean warbler (*Dendroica cerulea*), Henslow's sparrow (*Ammodramus henslowii*), grasshopper sparrow (*Ammodramus savannarum*), vesper sparrow (*Pooecetes gramineus*), and black tern (*Chlidonias niger*).

2.0 Methods

2.1 Field Surveys

Breeding bird surveys were conducted along roads and farm fields, in Clayton and Orleans, New York, during June 2005 (Figure 2-1). The survey was modeled after the U.S. Fish and Wildlife Service Breeding Bird Survey (BBS) methodology (Sauer *et al.* 1997). Forty survey points were sampled: 37 points in field and 3 in forest edge habitats. All points were surveyed in early June (June 2) and the survey was repeated approximately 10 days later (June 13) to ensure good coverage of the breeding season. Survey locations were chosen to provide coverage of the proposed locations of the wind turbines and transmission lines as well as proportional coverage of the project area habitat types. The survey points were spaced to ensure that double-counting of individuals did not occur and point locations were recorded using GPS.

Surveys were conducted during the peak of nesting season. All points were surveyed on days with suitable weather conditions, which included generally mild conditions or, at worst, light rain showers and light to moderate winds. Surveys were not conducted during periods of moderate to heavy rain or high winds. Surveys were timed to coincide with the hours of peak bird singing activity, approximately 4:30 to 10:30 am. Each point was surveyed for three minutes during which all visual or audible observations of birds were recorded onto a data sheet for that point. Each bird was identified as to species and its distance from point (0 – 50 m, 50 – 100 m, or >100 m) was estimated. The approximate location of each bird was also plotted on a point count data sheet to ensure that individual birds were not double-counted.

When possible, observations of birds flying overhead (flyovers) and not exhibiting territorial behavior were documented, as were observations of specific activities (i.e., singing, courtship flights, territorial displays, nest flushes, food exchanges, or foraging). In addition, bird observations made while traveling between survey points were noted. Surveys were designed to document breeding birds during peak nesting season, when male birds are calling. Point counts help determine the abundance and species richness of the local bird community. Survey locations were chosen to provide coverage across the project area as well as proportional coverage of the project area habitat types. Point locations were recorded using GPS.

2.2 Data Analysis

Data collected from the field surveys were used to calculate the species richness, relative abundance, and frequency of occurrence over the entire survey area and by habitat type. Although all birds observed were recorded on the data sheets, only birds recorded within 100 meters (m) (328') of the survey site were used in the data analysis to avoid double-counting birds that occurred at adjacent points. Birds observed beyond 100 m, flyovers, and incidental observations were not included in the numerical analyses.

3.0 Results

Surveys were conducted on good weather days, generally with low winds and sunny skies. Temperatures ranged from 50 to 65 degrees during survey periods. During the 2 survey periods, 704 bird observations were made. Observations of flyover birds or birds beyond 100 m (328') from the survey point (131 observations) were excluded from the analyses, leaving 573 bird observations for numerical analyses. Similarly, 61species were observed, 52 of which were included in the numerical analyses (Table 1).

When the two survey results are combined for each point, the total number of bird observations at each survey point ranged from 8 to 20, with an overall relative abundance of 7.2. Species richness (number of observed species at survey points) ranged from 5 to 13 species per survey point (mean = 8.9). The most frequently observed species were the red-winged blackbird (*Agelaius phoeniceus*), yellow warbler (*Dendroica petechia*), and American robin (*Turdus migratorius*). Species with the highest relative abundance were the bobolink (*Dolichonyx oryzivorus*), red-winged blackbird, and yellow warbler.

Eight species of conservation concern in New York were observed during the surveys. These include the State Endangered short-eared owl and black tern; State Threatened upland sandpiper, northern harrier, and Henslow's sparrow; and State Special Concern cerulean warbler, grasshopper sparrow, and vesper sparrow.

The most commonly observed flyover species were the barn swallow (*Hirundo rustica*), Canada goose (*Branta canadensis*), American goldfinch (*Carduelis tristis*), and tree swallow (*Tachycineta bicolor*). Species that were observed exclusively as flyover species were the American black duck (*Anas rubripes*), Canada goose (*Branta canadensis*), common tern (*Sterna hirundo*), great blue heron (*Ardea herodias*), green heron (*Butorides virescens*), northern harrier (State Threatened), red-tailed hawk (*Buteo jamaicensis*), and an unidentified gull species. Species exclusively observed as flyovers were excluded from the numerical analyses as their breeding status in the project area were not determined.

3.1 Early Successional/Field

Ninety-three percent of the survey points were in early successional/field habitat. Ninety-one percent of the bird observations (522 observations) and 87 percent of the species (45 species) occurred at these points. Fifty-four percent of the species observed (28 species) were unique to field habitats (Table 2). Red-winged blackbirds, yellow warblers, American robins, and bobolinks were the most frequently observed birds at field points. Bobolinks, red-winged blackbirds, and yellow warblers were the most abundant species at these points. The relative abundance of all bird species in early successional areas and fields was 7.05 birds per point.

3.2 Forest Edge

Seven percent of the survey points were in forest edge habitat. Nine percent of the bird observations (51 observations) and 46 percent of the species (24 species) occurred at these points. Thirteen percent of all of the species observed (seven species) were unique to forest edge habitats (Table 2). Yellow warblers and common yellowthroats (*Geothylypis trichas*) were the most frequently observed species at forest edge points. Yellow warblers and bobolinks were the most abundant. The relative abundance of all bird species at forest edge point locations was 8.50 birds per point.

4.0 Discussion

The species encountered during the breeding bird surveys at the Clayton project area are consistent with those expected in the habitats present. The most abundant birds across all habitat types are well-documented as breeding species in agricultural habitats of the Clayton project area and throughout New York and include bobolink, red-winged blackbird, yellow warbler, and American robin (Andrle and Carroll 1988).

The most abundant birds within each habitat type were also consistent with historical records for the project area. Bobolink, red-winged blackbird, and yellow warbler were the most abundant at field points. Of these, the yellow warbler is the only species not strongly associated with open fields. However, yellow warblers commonly breed in thickets in open country and in brushy edge habitats (Andrle and Carroll 1988). These three species accounted for 41 percent of the total observations at survey points located in fields.

Yellow warblers and bobolinks were the most abundant birds at forest edge points. Yellow warblers commonly breed in the forest edge but bobolinks are more typically in open habitat. The abundance of bobolinks counted at forest edge points is likely due to the close location of bobolink territories to those areas (i.e., within 100 m) rather than from bobolinks using that habitat specifically.

Point count surveys produce an index of relative abundance rather than a complete count of breeding bird populations (Sauer *et al.* 1997). Relative abundance for early successional/field and forest edge habitats were similar: 7.05 and 8.50, respectively (Table 1). The total number of observations and species richness were lowest in the forest edge habitat. This may be because fewer points were sampled in this habitat, as it represented a small proportion of the habitat types in the proposed project area.

The number of unique species found in each habitat type was consistent with the number of survey points in that point, i.e., field habitat with 37 survey points had 28 unique species; forest edge habitat with 3 survey points had 7 unique species. The number of survey points in each habitat type was proportional to the amount of habitat in the proposed project area. Thus the relationship between number of survey sites and number of unique species may reflect the simple relationship between the amount of habitat and its suitability for species dependent upon that habitat. The number of unique species in the forest edge may be inflated because in addition to species that typically use edge habitat it also includes species that are characteristic of forest habitats (Table 2).

Observations of species of conservation concern in New York occurred at survey points in both early successional/field and forest edge habitats. A pair of short-eared owls observed at two survey points (30 and 37), in early successional/field habitats may be breeding in these areas. This pair was observed actively hunting during the morning hours. The northern harrier was observed as a flyover at one survey point (40) but the breeding status of this species was not determined. Henslow's sparrows were observed at two survey points (10 and 34) in early successional/field habitats. The upland sandpiper was observed at one early successional/field point (26). Grasshopper sparrows were observed at eight early successional/field points (2, 10, 11, 15, 24, 28, 30, and 37) and one forest edge point (36). A vesper sparrow was observed at one early successional/field point (31). Finally, cerulean warblers were observed at a successional/field point and a forest edge point (17 and 36).

Two species observed during the surveys—barn owl (*Tyto alba*) and cerulean warbler—are not reported in the Atlas of Breeding Birds in New York State (Andrle and Carroll 1988) as occurring in the vicinity of the proposed project area. The cerulean warbler is an unusual sighting given the limited number of tall deciduous forest trees in the proposed project area. The barn owl is likely using structures in the area for nesting purposes.

5.0 Conclusions

Bird species dependent upon or tolerant of open habitats were preponderant in the breeding bird surveys (bobolink, red-winged blackbird, yellow warbler, American robin, and common yellowthroat) at the Clayton project area. All but one (cerulean warbler) of the state-listed species observed are also associated with open habitats. Although black terns were not observed along breeding bird survey route, they were observed during crepuscular surveys in the vicinity of the Perch River Wildlife Management Area.

Field habitat points were dominated by 3 species (bobolink, red-winged blackbird, and yellow warbler) which represented 41 percent of the observations in this habitat. The yellow warbler, a typical inhabitant of forest edge habitats, and the bobolink, more typical of open country, were most abundant in forest edge habitats.

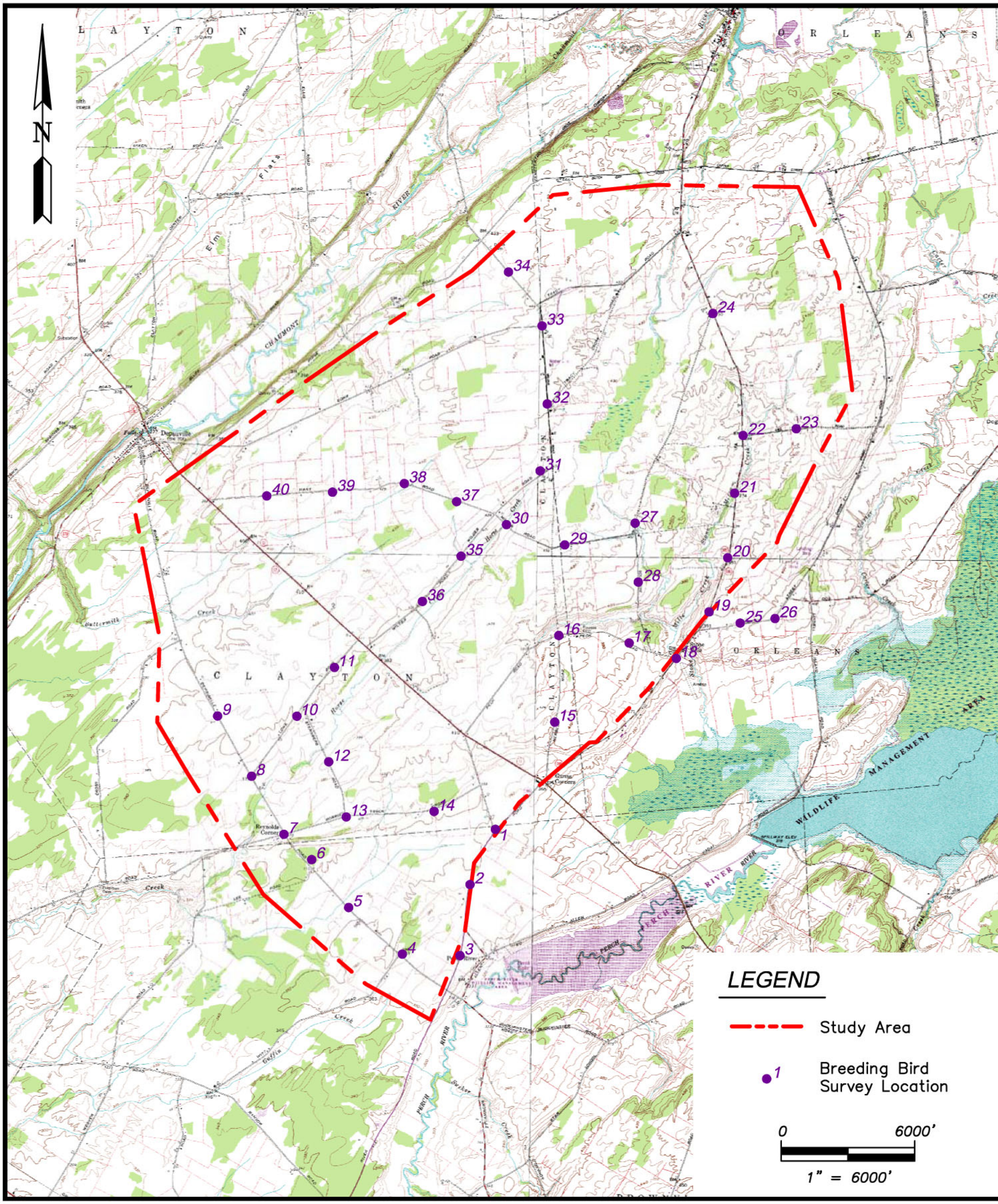
The project area consists of upland grasslands, croplands, forests, and forest edge. The field habitat had the greatest species richness and highest number of unique species. Forested parcels and grasslands within the study area contained good bird diversity.

6.0 Literature Cited

Andrle, R. F. and J. R. Carroll. 1988. The Atlas of Breeding Birds in New York State. Cornell University Press, Ithaca, NY and London.

Sauer, J. R., J. E. Hines, G. Gough, I. Thomas, and B. G. Peterjohn. 1997. The North American Breeding Bird Survey Results and Analysis. Version 96.4. Patuxent Wildlife Research Center, Laurel, MD.

Figures



PREPARED BY:

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DATE:	November 2005
SCALE:	1" = 6000'
JOB NO. 105030	
FILE: 105030-00-Location.dwg	

Figure 2-1
Breeding Bird Survey Map
Clayton Wind Project
Clayton, New York

REV.

Tables

Table 1. 2005 Breeding Bird Survey Results - Clayton Wind Project

Species	Early successional/Field (37 Points)			Forest Edge (3 Points)			All Habitats (40 Points)		
	Total #[a]	Relative Abundance[b]	Frequency[c]	Total #[a]	Relative Abundance[b]	Frequency[c]	Total #[a]	Relative Abundance[b]	Frequency[c]
American crow	10	0.14	21.6%	2	0.33	33.3%	12	0.15	22.5%
American goldfinch	10	0.14	18.9%	1	0.17	33.3%	11	0.14	20.0%
American kestrel	2	0.03	5.4%	0	0.00	0.0%	2	0.03	5.0%
American redstart	1	0.01	2.7%	0	0.00	0.0%	1	0.01	2.5%
American robin	45	0.61	75.7%	2	0.33	33.3%	47	0.59	72.5%
American woodcock	1	0.01	2.7%	0	0.00	0.0%	1	0.01	2.5%
Barn owl	1	0.01	2.7%	0	0.00	0.0%	1	0.01	2.5%
Baltimore oriole	3	0.04	8.1%	0	0.00	0.0%	3	0.04	7.5%
Barn swallow	1	0.01	2.7%	0	0.00	0.0%	1	0.01	2.5%
Black-and-white warbler	0	0.00	0.0%	1	0.17	33.3%	1	0.01	2.5%
Black-capped chickadee	3	0.04	8.1%	2	0.33	66.7%	5	0.06	12.5%
Belted kingfisher	1	0.01	2.7%	0	0.00	0.0%	1	0.01	2.5%
Brown-headed cowbird	1	0.01	2.7%	0	0.00	0.0%	1	0.01	2.5%
Blackburnian warbler	0	0.00	0.0%	1	0.17	33.3%	1	0.01	2.5%
Blue jay	3	0.04	5.4%	0	0.00	0.0%	3	0.04	5.0%
Bobolink	83	1.12	73.0%	4	0.67	33.3%	87	1.09	70.0%
Brown thrasher	5	0.07	10.8%	1	0.17	33.3%	6	0.08	12.5%
Black-throated green warbler	0	0.00	0.0%	1	0.17	33.3%	1	0.01	2.5%
Cerulean warbler	1	0.01	2.7%	1	0.17	33.3%	2	0.03	5.0%
Chipping sparrow	2	0.03	5.4%	0	0.00	0.0%	2	0.03	5.0%
Common grackle	1	0.01	2.7%	0	0.00	0.0%	1	0.01	2.5%
Common yellowthroat	23	0.31	54.1%	3	0.50	100.0%	26	0.33	57.5%
Eastern kingbird	8	0.11	21.6%	3	0.50	66.7%	11	0.14	25.0%
Eastern meadowlark	31	0.42	54.1%	0	0.00	0.0%	31	0.39	50.0%
Eastern phoebe	9	0.12	24.3%	2	0.33	66.7%	11	0.14	27.5%
Eastern towhee	7	0.09	16.2%	0	0.00	0.0%	7	0.09	15.0%
Eastern wood-pewee	0	0.00	0.0%	1	0.17	33.3%	1	0.01	2.5%
European starling	15	0.20	24.3%	0	0.00	0.0%	15	0.19	22.5%

(continued)

Table 1. 2005 Breeding Bird Survey Results - Clayton Wind Project (continued)

Species	Early successional/Field (37 Points)			Forest Edge (3 Points)			All Habitats (40 Points)		
	Total #[a]	Relative Abundance[b]	Frequency[c]	Total #[a]	Relative Abundance[b]	Frequency[c]	Total #[a]	Relative Abundance[b]	Frequency[c]
Field sparrow	20	0.27	32.4%	2	0.33	66.7%	22	0.28	35.0%
Gray catbird	13	0.18	27.0%	3	0.50	66.7%	16	0.20	30.0%
Grasshopper sparrow	10	0.14	21.6%	1	0.17	33.3%	11	0.14	22.5%
Hairy woodpecker	1	0.01	2.7%	0	0.00	0.0%	1	0.01	2.5%
Henslow's sparrow	2	0.03	5.4%	0	0.00	0.0%	2	0.03	5.0%
Indigo bunting	0	0.00	0.0%	2	0.33	33.3%	2	0.03	2.5%
Killdeer	4	0.05	10.8%	0	0.00	0.0%	4	0.05	10.0%
Mourning dove	3	0.04	5.4%	0	0.00	0.0%	3	0.04	5.0%
Northern cardinal	4	0.05	10.8%	0	0.00	0.0%	4	0.05	10.0%
Northern flicker	1	0.01	2.7%	0	0.00	0.0%	1	0.01	2.5%
Northern mockingbird	1	0.01	2.7%	0	0.00	0.0%	1	0.01	2.5%
Prairie warbler	3	0.04	8.1%	0	0.00	0.0%	3	0.04	7.5%
Red-eyed vireo	0	0.00	0.0%	1	0.17	33.3%	1	0.01	2.5%
Red-winged blackbird	80	1.08	86.5%	3	0.50	66.7%	83	1.04	85.0%
Savannah sparrow	26	0.35	56.8%	1	0.17	33.3%	27	0.34	55.0%
Short-eared owl	2	0.03	5.4%	0	0.00	0.0%	2	0.03	5.0%
Song sparrow	26	0.35	45.9%	3	0.50	66.7%	29	0.36	47.5%
Tree swallow	1	0.01	2.7%	0	0.00	0.0%	1	0.01	2.5%
Tufted titmouse	2	0.03	5.4%	0	0.00	0.0%	2	0.03	5.0%
Upland sandpiper	1	0.01	2.7%	0	0.00	0.0%	1	0.01	2.5%
Vesper sparrow	1	0.01	2.7%	0	0.00	0.0%	1	0.01	2.5%
White-breasted nuthatch	0	0.00	0.0%	2	0.33	33.3%	2	0.03	2.5%
White-throated sparrow	1	0.01	2.7%	0	0.00	0.0%	1	0.01	2.5%
Yellow-rumped warbler	53	0.72	78.4%	8	1.33	100.0%	61	0.76	80.0%
Total	522	7.05		51	8.50		573	7.16	
# Species		45			24			52	

a Total number of observations.
b Mean number of birds observed.
c Percent of survey points where species occurred.

Table 2. Breeding Bird Species Unique to Individual Habitat Types

Early Successional/Field	Forest Edge
American kestrel	Black and white warbler
American redstart	Black-throated blue warbler
American woodcock	Black-throated green warbler
Baltimore oriole	Eastern wood pewee
Barn owl	Indigo bunting
Barn swallow	Red-eyed vireo
Belted kingfisher	Wild turkey
Blue jay	
Brown-headed cowbird	
Chipping sparrow	
Common grackle	
Eastern meadowlark	
Eastern towhee	
European starling	
Hairy woodpecker	
Henslow's sparrow	
Killdeer	
Mourning dove	
Northern cardinal	
Northern flicker	
Northern mockingbird	
Prairie warbler	
Short-eared owl	
Tree swallow	
Tufted titmouse	
Upland sandpiper	
Vesper sparrow	
White-throated sparrow	

2006 Rare Bird Survey at the Proposed Clayton Wind Project in Clayton, New York

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Table of Contents

List of Figures

List of Appendices

1.0 Introduction

1.1 Project Context

PPM Atlantic Renewable (PPM) has proposed the construction of a wind project to be located in Clayton, Orleans, and Brownville, New York (Figure 1). The project would include up to approximately 54 2.75-megawatt (MW) wind turbines that could generate up to 150 MW of power annually. Turbines would have a maximum height of approximately 150 meters (m) (492') and would be located predominantly in active agricultural fields being used for hay and crop production, as well as for pasturing.

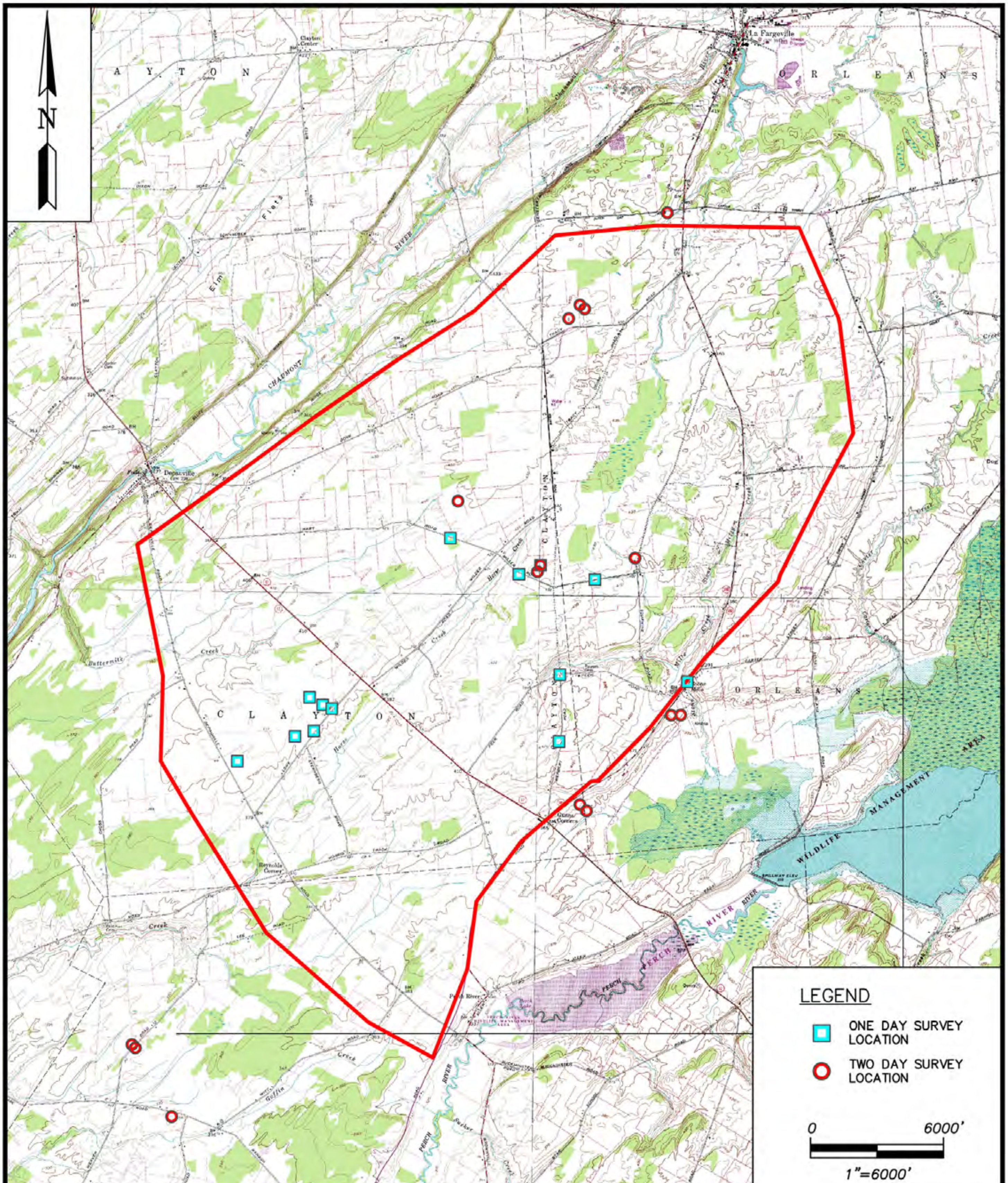
Birds are known to collide with tall lighted structures, such as buildings and communication towers, particularly when weather conditions reduce visibility (Crawford 1981; Avery *et al.* 1976, 1977). Depending on their height and location, wind turbines can also pose a potential threat to migrating birds because they are relatively tall structures, have moving parts, and may be lit. The mortality of migrating and resident birds and bats has been documented at wind farms as a result of collisions with turbines, meteorological measurement towers (met towers), and guy wires (Anderson *et al.* 2004; Erickson *et al.* 2000, 2003; Johnson *et al.* 2003; Thelander and Rugge 2000).

PPM undertook bird and bat migration studies in the spring and fall of 2005 as well as a breeding bird survey during the early summer of 2005. Fifteen rare bird species were observed in the Clayton project area during the original 2005 field surveys. This included five state Endangered species, three state Threatened species, and seven state Species of Special Concern. As a result, additional surveys were conducted during 2006 and are reported here. The surveys for this project were conducted to provide data that will be used to help assess the potential risk to birds from this proposed project.

1.2 Project Area Description

The project area is located within the Eastern Ontario Plain ecozone of New York (Andrle and Carroll 1988). This is a relatively flat region with open grasslands, patches of woodlands, and active agricultural fields, with elevation ranging from approximately 76 m to 152 m (250' to 500'). Forest communities in the area are dominated by American elm (*Ulmus americana*), red maple (*Acer rubrum*), and northern hardwoods on soils of lake sediments that overlie limestone bedrock. The proximity of Lake Ontario helps moderate the local climate, which has resulted in the widespread development of agricultural land uses, predominantly dairying.

The project area is located in a part of New York State that has been identified as important for a number of bird species. The National Audubon Society lists a number of established and proposed Important Bird Areas (IBAs) in the vicinity of the project. Included are the established Fort Drum, Perch River, and Point Penninsula IBAs and one under consideration, the Jefferson County Grasslands IBA (http://iba.audubon.org/iba/stateIndex.do?state=US-NY). Additionally, the project area is bounded on its western edge by the Chaumont Barrens, a unique alvar landscape of open grasslands, shrub savannas, and patches of woods, owned by The Nature Conservancy. The United States Fish and Wildlife Service (USFWS) has also prepared a Land Protection Plan for the St. Lawrence Wetland and Grassland Management District is recognition of the use of wetlands and grasslands of parts of Jefferson County for regionally rare bird species (http://www.fws.gov/r5mnwr/LandProtectionPlan.pdf#search=%22jefferson%20county%20iba%22).



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105030-F01-BBS_Surv.dwg

SHEET TITLE:

Breeding Bird Survey Location

PROJECT:

Clayton Wind Power Project
Clayton, New York

DATE: August 2006

SCALE: 1"=6000'

PROJ. NO.: 105030

FIGURE:

1

2.0 Methods

Survey effort targeted three species: short-eared owl (*Asio flammeus*); upland sandpiper (*Bartramia longicauda*); and Henslow's sparrow (*Ammodramus henslowii*). The short-eared owl is listed as Endangered in New York and the other two are listed as Threatened. All three species were determined to likely be nesting within the project area during the 2005 breeding bird surveys. The goal of the work will be to determine the overall number of nesting pairs of each of these species and collect site specific habitat use information and other incidental bird observations.

Targeted rare species and breeding bird surveys were conducted across three weeks of field surveys during April, May, and June of 2006. The goal of the project was to document habitat use, including confirmation of nesting, nest territory delineation, nest locations, and population size of targeted species in the project area by the three target species and incidental observations of other state-listed species. Approximately 60 percent of the fields of the project area were surveyed. Morning and early evening surveys were conducted to coincide with activity patterns of targeted species. Field surveys included a combination of breeding bird point counts and roving (walking) surveys, as well as nest searches. In addition, information on all breeding birds encountered during point count surveys was collected.

2.1 Targeted Species Field Surveys

Field surveys for the three target species consisted of systematic surveys to document the occurrence, location, and habitat use of the project area starting in early May and extending through late June. Upon confirmation of their presence, early morning site visits to each location were made to document nesting behavior and, when possible, nest locations. Habitat at each site was characterized. Periodic visits through the nesting season were made to nesting areas to document nesting success, when possible.

Roving surveys were conducted throughout the project area where landowner permission was granted to access the land. Observers walked along roads and fields of the project area specifically targeting areas of good habitat for short-eared owls, Henslow's sparrows, and upland sandpipers. Surveys started at 5:30 am and continued until 11:00 am and resume in the evening from about 5:00 pm to dusk. All observations were recorded, including behavioral notes, and all targeted species locations were recorded by GPS.

2.2 Breeding Bird Field Surveys

To collect species occurrence and use information across the entire project area, regardless of habitat quality, breeding bird surveys were conducted to supplement the targeted species surveys at various points in the project area. Point counts were stratified across the project area to cover transitional woodland-field edges, open grassland, and in active agricultural and hayfields (Figure 1). The point count methodology, modeled after the North American Breeding Bird Survey (BBS), was used to count individuals of each species located at a series of survey points (Sauer *et al.* 1997) and was the same method used during the 2005 breeding bird survey.

Twenty-eight points were sampled, including 18 points in fields and 10 points along field-woodland edges. Survey locations were chosen based on the proposed locations of the wind turbines and transmission lines and by identifying points that would provide representative coverage of the entire area's habitat types. The survey points were located far enough away from each other to ensure that double-counting of individuals did not occur (typically 0.3 miles apart). Survey locations were recorded using GPS for later identification.

For statistical purposes, the points were divided into two groups (1 day and 2 day) with one set of points (2 day) having two surveys per point and another set of points (1 day) being surveyed only once. Each point was unique and did not overlap with any other points. The 1 day surveys had 13 points and the 2 day surveys had 15 points. Each of the 15 points was surveyed twice during the breeding season, with the first survey of all points conducted on May 16 and 17 and the second round of surveys on May 18 and 19, 2006. The 13 points were surveyed once during the period of May 16 to 19, 2006.

The four days of surveys were conducted during suitable weather conditions, including generally clear conditions with, at most, drizzle and light to moderate winds. Surveys were not conducted during periods of moderate to heavy rain or high winds. Surveys were timed to coincide with the hours of peak bird singing activity, approximately 5:30 to 9:30 am. Each point was surveyed for five minutes and birds observed by sight or sound were recorded onto a data sheet for that point. Each bird was identified as to species, distance from survey site (0 – 50 m, 50 – 100 m, >100 m, or flyover), and time interval when it was first observed. This method is similar to the methodology of the BBS and in the future the data could be compared with BBS data. The approximate location of each bird was also plotted on a point count data sheet to ensure that individual birds were not double-counted.

When possible, species identifications of birds flying overhead (flyovers) were documented, as were observations of notable activities (i.e., singing, courtship flights, territorial displays, nest flushes, food exchanges, or foraging). In addition, bird observations made incidental to the survey were noted.

Data Analysis

Observational data from the targeted species surveys were used to determine species' distributions, potential nest sites, nesting behavior, and document habitat use. Data collected from the breeding bird field point counts were used to calculate the frequency, species richness, and relative abundance of breeding avian species over the entire survey area and by habitat type. The majority of the observations were singing males, each presumed to be defending a territory at this time of year. Bird species recorded as flyovers and incidental observations were not included in the numerical analyses but are described below.

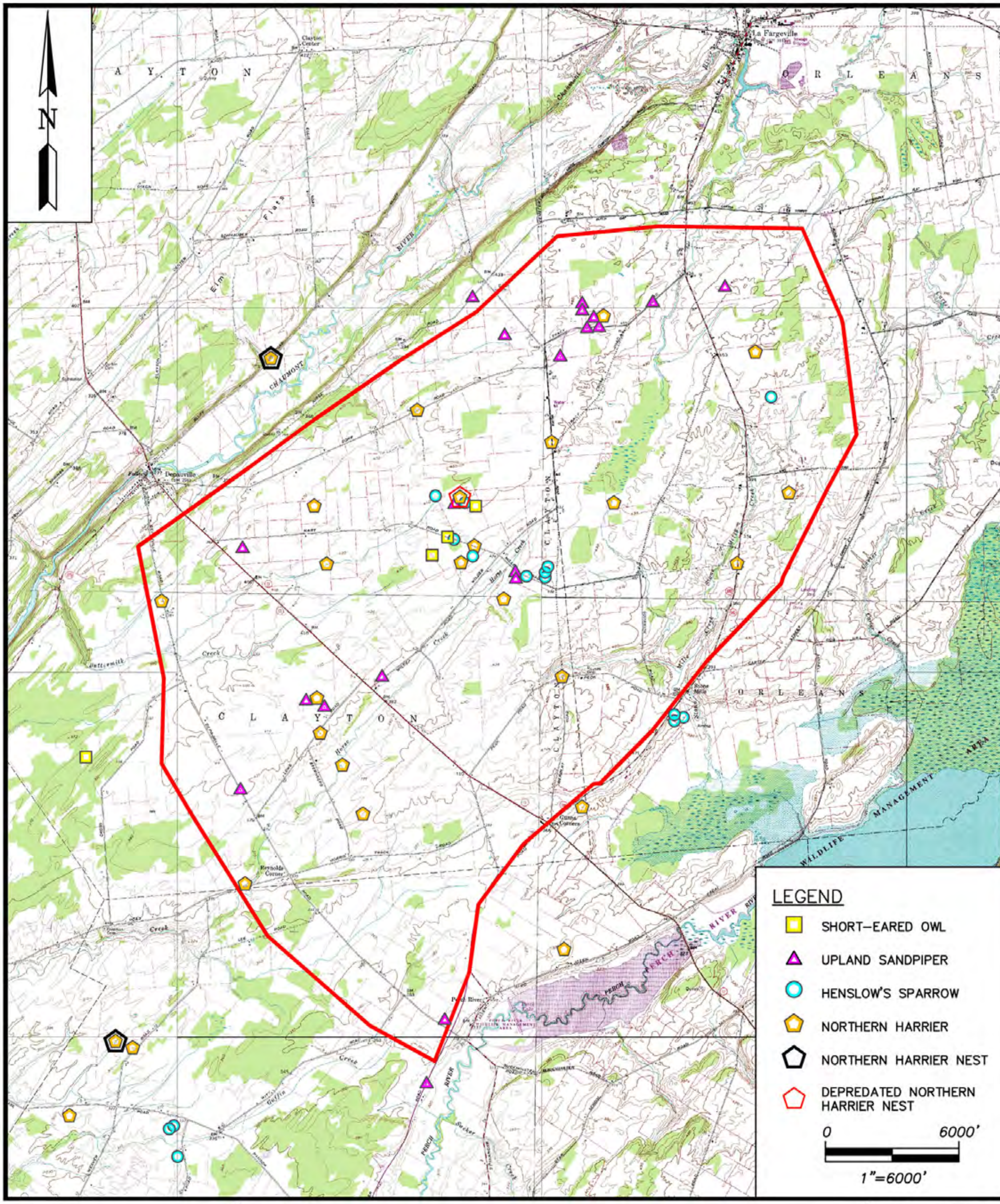
3.0 Results/Discussion

All three targeted species were detected and observed at the Clayton Wind Project in spring 2006. The locations of these species are depicted in Figure 2.

3.1 Targeted Species Field Surveys

3.1.1 Short-eared Owl

Short-eared owls are the most diurnal of all northeastern owl species. Short-eared owl preferred breeding habitats are grasslands, marshes, and tundra throughout North America. However, New York is considered the southern extent of their breeding range. These owls are active during the crepuscular hours of dawn and dusk and during the late afternoon. Their primary food sources are small mammals, but they will occasionally prey on small birds and insects. Short-eared owls tend to breed in areas where meadow voles (*Microtus pennsylvanicus*) are abundant. Nests are placed on the ground, with average clutch sizes between four and nine eggs.



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105030–F02–RareSp.dwg

SHEET TITLE: Rare Species Survey Results

PROJECT: Clayton Wind Power Project
Clayton, New York

DATE: August 2006
SCALE: 1"=6000'
PROJ. NO.: 105030
FIGURE: 2

Short-eared owls were observed in only one locality in the project area, which was the same area were a pair of owls was observed in 2005. The observations could constitute a pair that was nesting in the project area, though this was not definitive. The habitat where the observations were made was searched but no nest was found. The observed activity was limited to an undeveloped patch of open grassland and shrub-dominated old field.

One individual was observed on two occasions in this same area. The first sighting occurred at 5:45 pm on April 18, 2006, in which one owl was hunting over the project area along Hart Road (Figure 2). The bird circled over the north and south sides of the road. The owl spent approximately 15 minutes flying low (i.e., < 20 m above the ground), searching and diving after prey. The second sighting occurred on May 16, 2006, where one individual was perched in a small tree overlooking open grasslands about 300 m to the north of Hart Road. No short-eared owls were observed during four other visits in April, May, and June. The owl may have been in the area but were not detected or they may have moved elsewhere.

A short-eared owl was observed in the Chaumont Barrens, west of the project area, on June 5, 2006. The bird flew quickly across the grassland into the nearby woodland. It is unknown if this individual was distinct from the short-eared owl pair along Hart Road.

Short-eared owls were not observed at any of the 28 breeding bird point counts during the four morning visits. However, during the 2005 breeding bird surveys, a pair of owls was detected at the survey point located along Hart Road, where the 2006 observations were made. Based on the history and type of observations during the two years of surveys in the project area, one to two pairs of short-eared owls could be nesting within or in the vicinity of the project area.

The project area's fallow fields, open grasslands, and shrub dominated old-field habitat do provide abundant habitat for this species, as does the surrounding landscape of this part of New York State (Figure 3). Protection and management of this type of habitat could be considered as a potential mitigation strategy for the project.

Figure 3. Short-eared Owl habitat near Hart Rd at Clayton Wind Project in spring 2006.

3.1.2 Henslow's Sparrow

Henslow's sparrow is a species of agricultural grasslands, tallgrass prairies, and pine savannahs of the eastern United States. Populations have declined over the last 40 years due to reforestation of abandoned agricultural lands and development. Jefferson County grasslands have been listed by the Audubon Society as an important bird area for Henslow's sparrow.

Henslow's sparrows were documented during both the targeted species surveys and the breeding bird survey point counts. This species was widely distributed throughout, but localized within, the project area (Figure 2). Abundance of this species during the 1-day survey of 13 points was 0.23 individuals per point and birds were observed at only 2 (15.4%) of the 13 points. The 2-day survey of 15 other points had the same relative abundance as the 1-day survey (average of 0.23 individuals per point surveyed), but Henslow's sparrows were observed at 4 (26.7%) of the 15 points. Based on these results the population size in the project area was determined to be at least 15 to 20 pairs. They were often found in fields where other grassland sparrows, such as grasshopper sparrows (*Ammodramus savannarum*)and savannah sparrows (*Passerculus sandwichensis*), occurred.

Henslow's sparrows are very cryptic in their behavior. The sparrows typically perch atop tall weeds or grass and sing. Generally, the song could be detected only from within 50 m, though this varied with weather conditions. Limited nest searches documented no nests, but this was probably most likely due to their habits and our desire to disturb the birds as little as possible.

Henslow's sparrows were generally found in tall grasslands intermixed with tall weeds (Figure 4) and they were not detected in active agricultural or hayfield habitats. This is typical habitat for the species.

Figure 4. Henslow's sparrow habitat at Clayton Wind Project in spring 2006.

3.1.3 Upland Sandpiper

Unlike other sandpipers, upland sandpipers prefer dry, open grasslands. They prefer to nest in tall, herbaceous vegetation on open grasslands, meadows, and prairies. Similar to other grassland nesting birds, habitat for upland sandpiper is shrinking as rural development and forest regeneration on agricultural lands increases.

Upland sandpipers were documented during both the targeted and the breeding bird survey efforts. Observations of this species were located throughout the project area, although these were grouped in several areas (Figure 2). During April and May surveys, upland sandpipers were observed in courtship aerial displays over their territories. Displays involved male sandpipers circling up and producing their characteristic 'wolf-whistle' call as they circled over their territories. These courtship flights ranged from 20 m to 200 m above the ground and lasted up to 10 minutes. During June surveys, most of their activity was based on the ground where the pairs were observed foraging for food together. Based on the location and timing of the observations, it is estimated that at least 8 to 10 pairs breeding in the areas surveyed throughout the project area.

Most upland sandpiper observations occurred in open grasslands with little weeds or shrubs (Figure 5). Birds were occasionally observed perching on fence posts and on one occasion on a utility line. Active searches for nest sites for this species were not conducted, but it was obvious that nesting occurs in the project area.

Figure 5. Upland sandpiper habitat at Clayton Wind Project in spring 2006.

3.2 Breeding Bird Survey

When the 1-day and 2-day breeding bird survey point count results were pooled, 900 birds from 54 different species were detected from 28 points. Various state Endangered, state Threatened, and state Species of Special Concern were documented to be nesting in the project area during these surveys.

The 2-day survey points had an overall relative abundance of 16.60 individuals/survey point (15 points) and 39 different species observed. Species richness (number of observed breeding species at individual survey points) ranged from 9 to 20 birds. Field habitats had a relative abundance of 17.44 and species richness of 27. The field-edge habitat had a relative abundance of 15.64 and species richness of 33. The most abundant species across all survey points and habitat types were the red-winged blackbird (*Agelaius* *phoeniceus*) (2.67 individuals/survey point), bobolinks (*Dolichonyx oryzivorus*) (2.50), yellow-warbler (*Dendroica petechia*) (2.00), savannah sparrow (1.93), and eastern meadowlark (*Sturnella magna*) (0.90) (Appendix A Table 1).

The 1-day survey points had an overall relative abundance of 13.54 individuals/survey point (13 points) and 32 different species observed. Species richness per point ranged from 4 to 13. Field habitats had a relative abundance of 12.30 and species richness of 23. The field-edge habitat had a relative abundance of 17.67 and species richness of 23. The most abundant species after averaging across all survey points and habitat types were the bobolink, savannah sparrow, yellow warbler, red-winged blackbird, and eastern meadowlark (Appendix A Table 3).

Different groups of species were observed to be local to specific habitat types. Nine species were unique to field habitats and 10 species were unique to field-edge habitat. Appendix A Tables 2 and 4 provide specific information on the composition of the breeding birds during these two point counts. In general, there were similarities in the abundance and species composition between the two levels of survey effort (one-day point counts vs. two-day point counts) and both surveys generally documented the same species' use of the available habitats.

3.3 Additional Species

During the course of these field surveys, two other rare species were observed: northern harrier (*Circus cyaneus*) and grasshopper sparrow. The northern harrier is a State-listed Threatened species while the grasshopper sparrow is a State-listed Special Concern species.

A total of nine individual grasshopper sparrows were documented by the two point count surveys. The species was observed at only 4 of the 28 point count locations (3 of the 2-day points and 1 of the 1-day points). However, this species was somewhat commonly observed throughout the project area during the targeted species field surveys. During those latter surveys, grasshopper sparrows were more abundantly observed than the 3 target species and it is likely that more than 50 pairs nest in the project area.

Northern harriers were also observed during the point count and targeted species field surveys. Eight individuals were observed during the point count surveys. The species was observed at 8 of the 28 point count locations (5 of the 2-day points and 3 of the 1-day points). Similar to the grasshopper sparrow, this species was also commonly observed during the targeted species surveys. It is estimated that approximately 8 to 10 pairs nest within or very near the project area.

Three nest sites were found during the surveys (Figure 2). One nest site was located within the project area, while the other two were located just outside the project area boundary. The two pairs nesting outside the project area were believed to hunt within the boundaries of the project area. One nest had six eggs and the other was being incubated by the female when found, so an egg count was not made. A third nest (project area nest) was found, but the four eggs in it had puncture holes and were determined to be predated. However, this pair was frequently observed flying and hunting over the depredated nest area throughout the survey period. All nests were in typical nesting habitat for this species, namely old field and wetland habitat with tall herbaceous vegetation and sporadic shrubs (Figures 6 and 7).

Figure 6. Northern Harrier nest with six eggs near the project area in spring 2006.

Figure 7. Second Northern harrier nest site located on the border of the project area in spring 2006.

4.0 Summary and Conclusions

The three target species were observed in the project area. While their distribution was generally widespread across the project area, their occurrence tended to be concentrated in localized areas. The project area itself provides an abundance of grassland habitat. However, the composition of those habitats appears to be the most significant factor in determining the distribution of these rare birds in the project area. Specifically, these species were most common either in agricultural areas recently abandoned or in pasturelands.

Abandonment of agricultural fields stimulates the development of tall grasses, forbs, and scattered shrubs, which is preferred by short-eared owls and several other non-target rare species, such as the northern harrier. These areas of denser, taller grasses are also readily used by Henslow's sparrows and upland sandpipers, although both also use pasturelands. Active agricultural activities, such as row crop production or mowing of hayfields, tends to limit the occurrence of these species, however, despite the fact that other grassland species (i.e., bobolink and savannah sparrow) are very common in those habitats.

As with any rare species, the loss of a few individuals from a population should be considered more significant than for abundant species. The occurrence of these species in proximity to proposed wind turbines does pose a risk to the local populations of these species. However, while individuals of these species could be at risk of colliding with the proposed wind turbines the absolute risk is unknown due to a lack of information on bird and windpower interactions. More and more information on these interactions is becoming available, though the growth and distribution of this information is generally slow.

Important factors affecting risk for these species at this project could include the location of individual turbines, habitat distribution, size of the breeding populations, and species-specific habits. Project design and mitigation considerations should take into account the location of turbines relative to known areas of suitable habitat or potential habitat preservation sites.

Flight and activity habits of these grassland nesting birds are variable. Small species with cryptic habits, such as the Henslow's sparrow, probably have fairly limited risk due to their habits of remaining in tall herbaceous cover. Alternatively, upland sandpipers have occasionally long flights to heights of 100 to 200 m during their courtship period. This activity would probably place this species more at risk than those that consistently fly at lower heights. The occurrence of species with similar habits (such as American woodcock [*Scolopax minor*] or common snipe [*Gallinago gallinago*]) in mortality reports from existing wind developments that harbor populations of these species (such as the Maple Ridge or Top of Iowa projects) should be investigated to more accurately assess the potential for collision-related impact to this species and others with more elaborate courtship flights.

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Appendix A

Breeding Bird Survey Tables

Appendix A Table 1. Total number of observations, relative abundance, and frequency of occurrence of 2 days of breeding bird surveys at Clayton Wind Project in spring 2006.

Species	Field (8 Points)			Field/woodland edge (7 Points)			All Habitats (15 Points)		
	Total #[a]	Relative Abundance[b]	Frequency[c]	Total #[a]	Relative Abundance[b]	Frequency[c]	Total #[a]	Relative Abundance[b]	Frequency[c]
American crow	6	0.38	37.5%	5	0.36	71.4%	11	0.37	53.3%
American goldfinch	2	0.13	12.5%	10	0.71	71.4%	12	0.40	40.0%
American robin	7	0.44	37.5%	9	0.64	57.1%	16	0.53	46.7%
Baltimore oriole	1	0.06	12.5%	0	0.00	0.0%	1	0.03	6.7%
Black-capped chickadee	2	0.13	12.5%	4	0.29	42.9%	6	0.20	26.7%
Bluejay	1	0.06	12.5%	2	0.14	28.6%	3	0.10	20.0%
Bobolink	53	3.31	87.5%	22	1.57	85.7%	75	2.50	86.7%
Brown-headed cowbird	0	0.00	0.0%	1	0.07	14.3%	1	0.03	6.7%
Canada goose	19	1.19	25.0%	6	0.43	57.1%	25	0.83	40.0%
Chestnut-sided warbler	4	0.25	37.5%	7	0.50	42.9%	11	0.37	40.0%
Chipping sparrow	1	0.06	12.5%	2	0.14	14.3%	3	0.10	13.3%
Common yellowthroat	6	0.38	37.5%	7	0.50	42.9%	13	0.43	40.0%
Downy woodpecker	0	0.00	0.0%	1	0.07	14.3%	1	0.03	6.7%
Eastern kingbird	2	0.13	12.5%	3	0.21	42.9%	5	0.17	26.7%
Eastern meadowlark	19	1.19	87.5%	8	0.57	57.1%	27	0.90	73.3%
Eastern phoebe	0	0.00	0.0%	1	0.07	14.3%	1	0.03	6.7%
Eastern towhee	0	0.00	0.0%	2	0.14	28.6%	2	0.07	13.3%
European starling	0	0.00	0.0%	14	1.00	28.6%	14	0.47	13.3%
Field sparrow	0	0.00	0.0%	1	0.07	14.3%	1	0.03	6.7%
Grasshopper sparrow	5	0.31	37.5%	0	0.00	0.0%	5	0.17	20.0%
Gray catbird	0	0.00	0.0%	5	0.36	42.9%	5	0.17	20.0%
Henslow's sparrow	4	0.25	25.0%	3	0.21	28.6%	7	0.23	26.7%
Hermit thrush	0	0.00	0.0%	6	0.43	42.9%	6	0.20	20.0%
Herring gull	0	0.00	0.0%	2	0.14	14.3%	2	0.07	6.7%
Least flycatcher	1	0.06	12.5%	3	0.21	42.9%	4	0.13	26.7%
Unid. sparrow	1	0.06	12.5%	0	0.00	0.0%	1	0.03	6.7%
Mallard	1	0.06	12.5%	0	0.00	0.0%	1	0.03	6.7%
Mourning dove	2	0.13	25.0%	3	0.21	14.3%	5	0.17	20.0%
Northern cardinal	0	0.00	0.0%	3	0.21	28.6%	3	0.10	13.3%
Northern harrier	2	0.13	12.5%	4	0.29	28.6%	6	0.20	20.0%
Red-winged blackbird	40	2.50	87.5%	40	2.86	85.7%	80	2.67	86.7%
Rose-breasted grosbeak	1	0.06	12.5%	0	0.00	0.0%	1	0.03	6.7%
Ruffed grouse	0	0.00	0.0%	1	0.07	14.3%	1	0.03	6.7%
Savannah sparrow	52	3.25	100.0%	6	0.43	42.9%	58	1.93	73.3%
Song sparrow	14	0.88	75.0%	1	0.07	14.3%	15	0.50	46.7%
Upland sandpiper	4	0.25	25.0%	0	0.00	0.0%	4	0.13	13.3%
Wild turkey	2	0.13	25.0%	3	0.21	14.3%	5	0.17	20.0%
Winter wren	0	0.00	0.0%	1	0.07	14.3%	1	0.03	6.7%
Yellow warbler	27	1.69	100.0%	33	2.36	85.7%	60	2.00	93.3%
Grand total	**279**			**219**			**498**		
Relative abundance		**17.44**			**15.64**			**16.60**	
Species richness			**27**			**33**			**39**

[a] Total number of observations [b] Mean number of birds observed. [c] Percentage of survey points where species occurred..

Appendix A Table 2. Total number of species recorded and distance from point count center at Clayton Wind Project during 2 day breeding bird surveys in spring 2006.

Species	0-50 m	50-100 m	> 100 m	Flyovers[a]	Grand Total
American crow		4	7	2	**13**
American goldfinch	8	4		15	**27**
American kestrel				1	**1**
American robin	6	10		2	**18**
Baltimore oriole [b]		1			**1**
Barn swallow				14	**14**
Black-capped chickadee		6			**6**
Bluejay		3			**3**
Bobolink	12	60	3	96	**171**
Brown-headed cowbird [c]	1				**1**
Canada goose		17	8	7	**32**
Chestnut-sided warbler	1	10			**11**
Chipping sparrow	2	1			**3**
Common grackle				4	**4**
Common yellowthroat	2	11			**13**
Downy woodpecker [c]		1			**1**
Eastern kingbird	2	3			**5**
Eastern meadowlark	3	23	1	2	**29**
Eastern phoebe [c]		1			**1**
Eastern towhee [c]		2			**2**
European Starling [c]		14		9	**23**
Field sparrow [c]		1			**1**
Grasshopper sparrow [b]	3	2			**5**
Gray catbird [c]	4	1			**5**
Great Blue heron				3	**3**
Henslow's sparrow	6	1			**7**
Hermit thrush [c]		6			**6**
Herring gull [c]			2	1	**3**
Killdeer				1	**1**
Least flycatcher	2	2			**4**
Unidentified sparrow [b]		1			**1**
Mallard [b]		1		3	**4**
Mourning dove	1	4			**5**
Northern cardinal [c]		3			**3**
Northern flicker				1	**1**
Northern harrier		4	2	2	**8**
Red-tailed hawk				1	**1**
Red-winged blackbird	25	54	1	18	**98**
Rock pigeon				1	**1**

(*continued*)

Appendix A Table 2. Total number of species recorded and distance from point count center at Clayton Wind Project during 2 day breeding bird surveys in spring 2006. (*continued*)

Species	0-50 m	50-100 m	> 100 m	Flyovers[a]	Grand Total
Rose-breasted grosbeak [b]		1			**1**
Ruffed grouse [c]			1		**1**
Savannah sparrow	16	39	3	8	**66**
Song sparrow	13	2		2	**17**
Turkey vulture				1	**1**
Upland sandpiper [b]			4		**4**
Wild turkey		1	4		**5**
Winter wren [c]	1				**1**
Yellow warbler	16	42	2		**60**
Grand total	**124**	**336**	**38**	**194**	**692**

[a] Not included in numerical analysis

[b] Species unique to field habitat

[c] Species unique to field-woodland edge habitat

Appendix A Table 3. Total number of observations, relative abundance, and frequency of occurrence of one day of breeding bird surveys at Clayton Wind Project in spring 2006.

Species	Field (10 Points)			Field/woodland edge (3 Points)			All Habitats (13 Points)		
	Total #[a]	Relative Abundance[b]	Frequency[c]	Total #[a]	Relative Abundance[b]	Frequency[c]	Total #[a]	Relative Abundance[b]	Frequency[c]
American crow	0	0.00	0.0%	1	0.33	33.3%	1	0.08	7.7%
American robin	3	0.30	20.0%	5	1.67	100.0%	8	0.62	38.5%
American woodcock	2	0.20	80.0%	1	0.33	33.3%	3	0.23	23.1%
Black-capped chickadee	0	0.00	0.0%	2	0.67	33.3%	2	0.15	7.7%
Bobolink	29	2.90	50.0%	1	0.33	33.3%	30	2.31	69.2%
Brown thrasher	5	0.50	20.0%	1	0.33	33.3%	6	0.46	46.2%
Chestnut-sided warbler	0	0.00	0.0%	1	0.33	33.3%	1	0.08	7.7%
Chipping sparrow	0	0.00	0.0%	3	1.00	33.3%	3	0.23	7.7%
Common yellowthroat	2	0.20	10.0%	2	0.67	66.7%	4	0.31	30.8%
Eastern kingbird	1	0.10	50.0%	1	0.33	33.3%	2	0.15	15.4%
Eastern meadowlark	9	0.90	20.0%	0	0.00	0.0%	9	0.69	38.5%
Eastern towhee	2	0.20	10.0%	2	0.67	66.7%	4	0.31	30.8%
European starling	1	0.10	10.0%	3	1.00	33.3%	4	0.31	15.4%
Field sparrow	0	0.00	0.0%	2	0.67	33.3%	2	0.15	7.7%
Grasshopper sparrow	4	0.40	10.0%	0	0.00	0.0%	4	0.31	7.7%
Gray catbird	1	0.10	20.0%	1	0.33	33.3%	2	0.15	15.4%
Henslow's sparrow	3	0.30	10.0%	0	0.00	0.0%	3	0.23	15.4%
Hermit thrush	0	0.00	0.0%	3	1.00	33.3%	3	0.23	7.7%
Indigo bunting	1	0.10	10.0%	0	0.00	0.0%	1	0.08	7.7%
Unidentified sparrow	3	0.30	20.0%	0	0.00	0.0%	3	0.23	7.7%
Mourning dove	0	0.00	0.0%	2	0.67	66.7%	2	0.15	15.4%
Northern flicker	2	0.20	20.0%	3	1.00	100.0%	5	0.38	38.5%
Northern harrier	2	0.20	70.0%	0	0.00	0.0%	2	0.15	15.4%
Red-winged blackbird	9	0.90	90.0%	7	2.33	66.7%	16	1.23	69.2%
Savannah sparrow	17	1.70	20.0%	3	1.00	33.3%	20	1.54	76.9%
Song sparrow	4	0.40	20.0%	3	1.00	33.3%	7	0.54	23.1%
Tree swallow	4	0.40	30.0%	0	0.00	0.0%	4	0.31	15.4%
Tufted titmouse	0	0.00	0.0%	1	0.33	33.3%	1	0.08	7.7%
Upland sandpiper	4	0.40	20.0%	0	0.00	0.0%	4	0.31	23.1%
White-throated sparrow	0	0.00	0.0%	1	0.33	33.3%	1	0.08	7.7%
Wild turkey	2	0.20	80.0%	0	0.00	0.0%	2	0.15	15.4%
Yellow warbler	13	1.30	0.0%	4	1.33	66.7%	17	1.31	76.9%
Grand total	**123**			**53**			**176**		
Relative abundance		**12.30**			**17.67**			**13.54**	
Species richness			**23**			**23**			**32**

[a] Total number of observations. [b] Mean number of birds observed. [c] Percentage of survey points where species occurred.

Appendix A Table 4. Total number of species recorded and distance from point count center at Clayton Wind Project during one day of breeding bird surveys in spring 2006.

Species	0-50 m	50-100 m	> 100 m	Flyovers[a]	Grand Total
American crow [c]		1		2	**3**
American goldfinch				3	**3**
American robin		8			**8**
American woodcock	1	1	1		**3**
Barn swallow				2	**2**
Black-capped chickadee [c]			2		**2**
Bobolink	7	21	2	4	**34**
Brown thrasher	1	5			**6**
Canada goose				2	**2**
Chestnut-sided warbler [c]		1			**1**
Chipping sparrow [c]	1	2			**3**
Common yellowthroat		2	2		**4**
Eastern kingbird		2		1	**3**
Eastern meadowlark [b]		8	1		**9**
Eastern towhee	1	2	1		**4**
European Starling	3	1		5	**9**
Field sparrow [c]		2			**2**
Grasshopper sparrow [b]	1	3			**4**
Gray catbird	1		1		**2**
Great blue heron				2	**2**
Henslow's sparrow [b]		3			**3**
Hermit thrush [c]		1	2		**3**
Indigo bunting [b]		1			**1**
Unid. sparrow [b]		2	1		**3**
Mallard				2	**2**
Mourning dove [c]		2			**2**
Northern flicker	1	3	1		**5**
Northern harrier [b]			2	1	**3**
Red-winged blackbird	4	11	1	4	**20**
Savannah sparrow	12	8			**20**
Song sparrow	6	1			**7**
Tree swallow [b]			4	4	**8**
Tufted titmouse [c]		1			**1**
Upland sandpiper [b]		2	2		**4**
White-throated sparrow [c]		1			**1**
Wild turkey [b]		2			**2**
Yellow warbler [c]	4	10	3		**17**
Grand total	**43**	**107**	**26**	**32**	**208**

[a] Not included in numerical analysis
[b] Species unique to field habitat
[c] Species unique to field-woodland edge habitat

Summer 2006 Indiana Bat Surveys at the Proposed Clayton Wind Project in Clayton, New York

Draft Report

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November 2006

Table of Contents

List of Appendices

List of Tables

List of Figures

1.0 Introduction

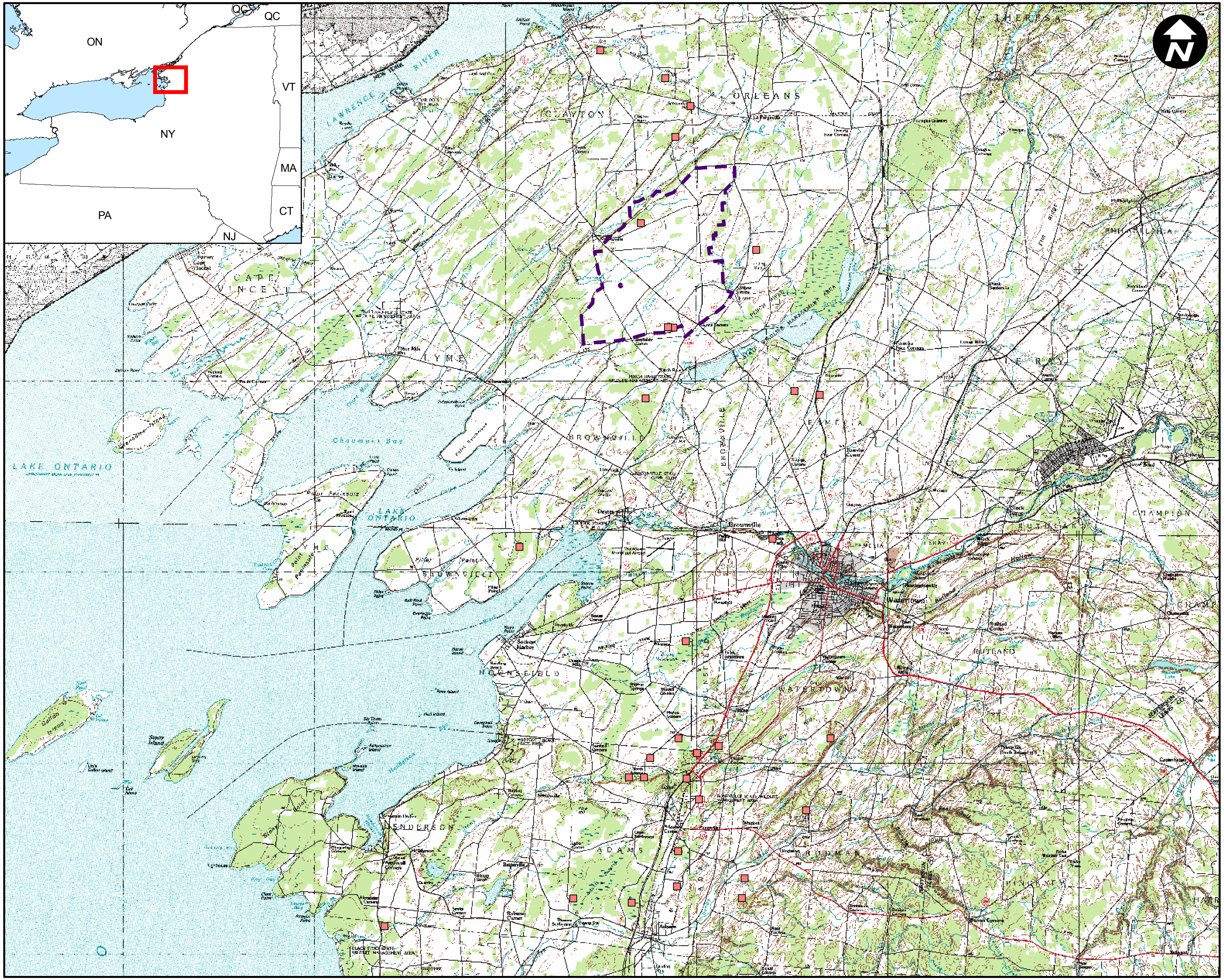
PPM Atlantic Renewable (PPM) has proposed the construction of a wind project to be located in Clayton, Orleans, and Brownville, in Jefferson County, New York. The project would include approximately 54 2.75-megawatt (MW) wind turbines that could generate up to 150 MW of power annually. Turbines would have a maximum height of approximately 150 meters (m) (492') and would be located predominantly in active agricultural fields being used for hay and crop production, as well as for pasturing.

The project area is located within the Eastern Ontario Plain ecozone of New York (Andrle and Carroll 1988). This is a relatively flat region with open grasslands, patches of woodlands, and active agricultural fields, with elevation ranging from approximately 76 m to 152 m (250' to 500'). Forest communities in the area are dominated by American elm (*Ulmus americana*), red maple (*Acer rubrum*), and northern hardwoods on soils of lake sediments that overlie limestone bedrock. The proximity of Lake Ontario helps moderate the local climate, which has resulted in the widespread development of agricultural land uses, predominantly dairying.

The Indiana bat (*Myotis sodalis*) is a state-listed and federally listed Endangered species. The population in New York State is among the largest in the Northeast, probably the fourth largest in the nation (Hicks 2005). There are 10 known hibernacula in the state, located in Albany (1), Essex (2), Jefferson (1), Onondaga (1), Ulster (4), and Warren (1) Counties (NYNHP 2006).

In 2005, the New York Department of Environmental Conservation (NYDEC) conducted a radio telemetry study of Indiana bats in the Jefferson County hibernaculum (Glens Falls Park Cave), which is located in Watertown. That work documented that most of the 28 radio-tagged Indiana bats flew south from Watertown following their exodus in mid-April until mid-May, when the battery life of their radio transmitters ended. However, that work documented that a number of bats flew north, including several individuals that traveled to and resided in and near the Clayton Wind Project area (Figure 1).

Based on these results, PPM undertook field investigations to further investigate Indiana bats within the Clayton Wind Project area. The goal of the investigations was to collect additional data on the habitat use, distribution, and duration of residency of Indiana bats within the project area for use in the assessment of the potential risk of the project to this species. The survey focused field effort on the forest stand within the project area that the most number of bats were found to be using in 2005. The survey consisted of mist-netting near and around 2005 and new 2006 roost trees and radio-tagging Indiana bats to document their daily roost trees, follow their movement to other portions of the project area, and examine patterns in their habitat use at night.



Clayton Windpower Project
Indiana Bat Survey

FIGURE 1 - 2005 Radio Telemetry Locations of Indiana Bats by NYDEC

Legend

- 2005 NYDEC Indiana Bat Roost Locations
- Clayton Wind Power Project Area

Data Sources

2005 Indiana Bat Roost Locations provided by the New York Department of Environmental Conservation.

0 3 6 Miles

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2.0 Methods

2.1 Study Site

The study site was a forest stand located along Morris Track Road near the southeast corner of Clayton, New York (Figure 2). This stand was approximately 15.6 hectares in size and comprised of mixed-age hardwood trees with a significant component of large, mature and over-mature sugar maple (*Acer saccharum*), American elm, and black cherry (*Prunus serotina*).

The site was surrounded by large agricultural fields used predominantly for corn and hay production. Occasional hedgerows of trees and shrubs separated these fields. To the west, several parcels of old field habitat dominated by shrubs and low trees occurred. Species composition of these areas was variable and largely dependant on drainage. A similar old field parcel was located south of the site, which graded into a forested wetland associated with Horse Creek. Further south, mixed agriculture and wet forest patches extend to the Perch River Wildlife Management Area, located approximately 2.25 kilometers (km) away.

This site was found to be used by several female Indiana bats that were radio-tagged and tracked from the Glen Falls Park Cave in Watertown by the NYDEC in 2005. At least nine different roost trees were used by those bats by the time they left their hibernacula in late-April to mid-May. These roost tree locations were provided by the NYDEC to target early spring and summer 2006 mist-netting surveys.

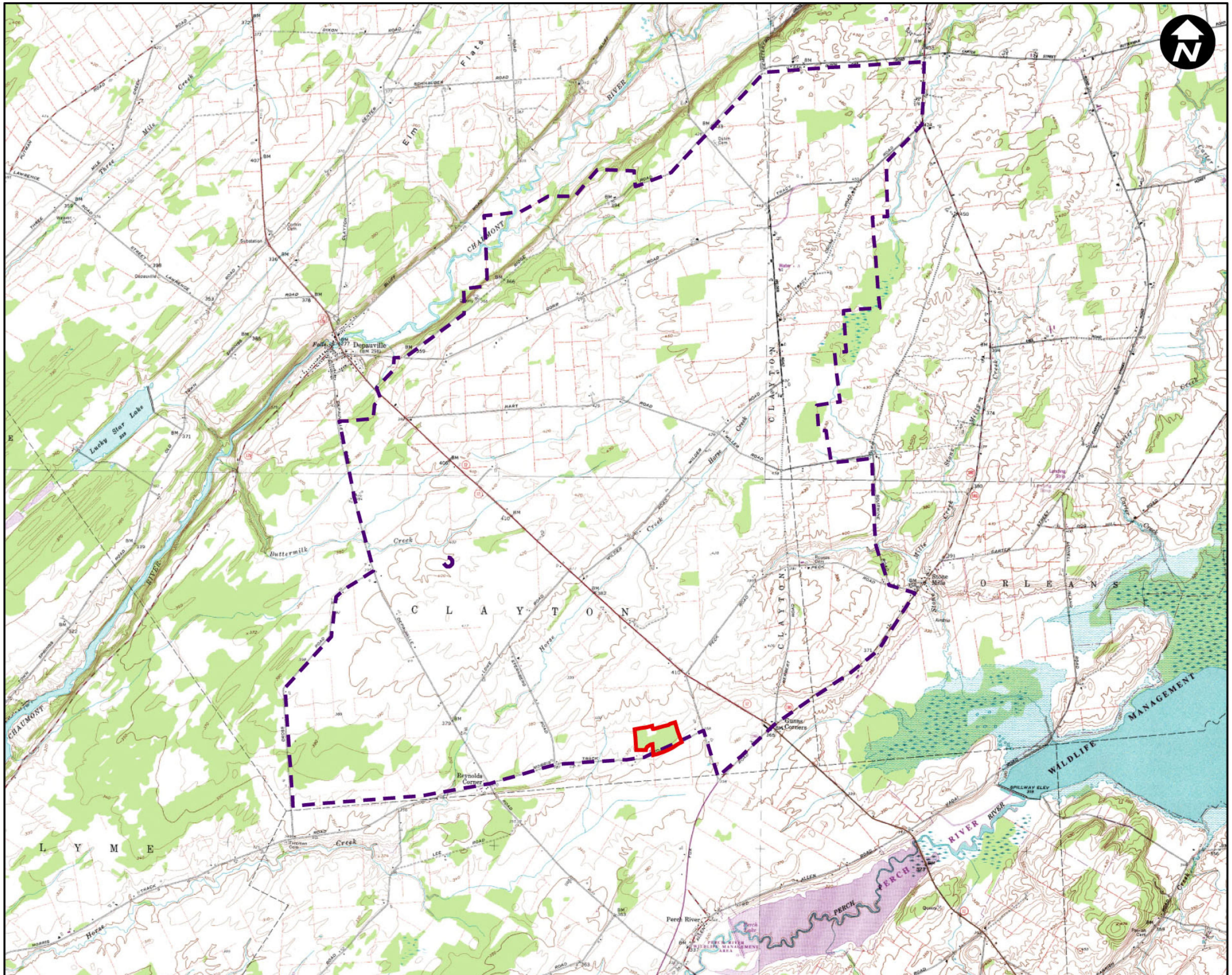
2.2 Mist-netting

Mist-netting was conducted during four 1- to 3-week periods from late April to August 2006. Netting periods were April 21 to May 15, June 1 to June 15, July 6 to July 12, and July 22 to August 11. These periods were based on the known or suspected exodus of bats from the hibernacula, activity periods of the bats, and on-site observations of habituation of the bats to the mist nets.

Mist nets were 3 m by 6, 9, 12, and 16 m. The location of net sites varied but included areas of mixed trees and shrubs around the periphery of the forest stand, over ATV trails within the stand, and around roost trees documented and flagged during the 2005 NYDEC telemetry work and during the present study. The number of nets deployed each night was typically 6 to 8, though as many as 12 nets were deployed on some nights. Nets were deployed in a variety of configurations, including single, double-stacked, and triple-stacked nets.

Nets were set on nights of suitable weather, such as no precipitation, relatively calm ground wind conditions, and relatively mild temperatures (during the early part of the season). Nets were set prior to sunset and typically run until midnight (3 to 4 hours). Night vision goggles were used each night to investigate the overall level of bat activity in the area, which helped to determine when to curtail netting.

Nets were checked every 15 to 20 minutes. All bats caught were removed from the nets and identified. Information recorded for each bat included species, sex, age, reproductive status, forearm length, ear length, tragus length, thumb length, and weight. All Indiana bats were fitted with a lipped aluminum wind band supplied by the NYDEC. Each bat that was large enough (≥ 6 g) was also fitted with a 0.35-gram radio-transmitter (ATS- Model A2415). Each transmitter had its own unique frequency ranging from 151.000 to 151.999 MHZ. Transmitters were attached by trimming a small patch of fur in the midscapular area and gluing the transmitter in place using Torbot bonding cement. Following the attachment of the transmitter, each bat was retained in a fleece bag for approximately 30 minutes to allow the glue to dry adequately. All bats were released successfully and in good condition.



Clayton Windpower Project
Indiana Bat Survey

FIGURE 2 - Study Area and Trapping Area Location Map

Legend

- Indiana Bat Trapping Area
- Clayton Wind Power Project Area

0 4,000 8,000 Feet

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2.3 Radio Telemetry

Tagged bats were located each morning using a Communication Specialists model R1000 receiver. A standard Yagi antenna and a Telonics three-element antenna were used to find and record the roost tree location and foraging range location. Additionally, during mist-netting, bearings to tagged bats were occasionally made to determine the general direction from the roost trees that bats were flying. Lotek auto data loggers with omni-directional whip antennas were placed in fields north of the netting area, the direction in which the majority of the Clayton Wind Project area lies. The auto loggers were placed near the middle of fields and were programmed to scan for the active transmitter frequencies for the nights they were deployed. The sensitivity was adjusted so that they would detect transmitters only within approximately 400 m in order to determine if tagged bats were readily crossing open fields.

Near the end of the season, radio-tagged bats with live transmitters were actively tracked by multiple hand-held receivers to document more specific movements of individual bats. Tracking was conducted largely from roadways and other accessible areas (some farm field roads). Bats were located three to four times an hour, when possible, and both the bearing to the bat and the trackers location were recorded. The actual locations of bats were estimated using multiazimuth triangulations of the recorded tracker locations and bearings to bats. These telemetry azimuths were then converted into point data. Triangulation error was calculated and estimated to be 286 m.

Estimated locations of Indiana bats were used to develop 95 and 50 percent fixed kernel foraging range estimates with the least squares cross validation smoothing factor (h) of 40, as well as a 95 percent minimum convex polygon (MCP). The 95 percent fixed kernel contour uses the majority of telemetry locations and a smoothing parameter to obtain an area estimate around each point location. The 50 percent estimate uses concentrations of telemetry locations to identify the core areas used by individual bats. These estimates offer a more in-depth look at how bats spatially use foraging areas. A 95 percent MCP was also created to show the area bounded by the furthest telemetry locations. The MCP connects a line from the bounding radio telemetry locations to form a foraging range estimate of the enclosed area. The animal movement extension (Hooge *et al.* 1999, Worton 1989) in ArcGIS 9.1 was used for analysis for all radio-marked Indiana bats with sufficient telemetry locations. All bats used in the foraging analysis had greater than 63 locations.

A coarse scale habitat analysis was conducted to evaluate habitat use and area used for each foraging bat. Foraging range estimates (ha) of the bats locations were overlaid and digitally clipped to a landcover map. A digital landcover map was created using color aerial photos and field observations to classify habitats into six categories: active agriculture; early successional; forested; open water; other-low density development; and roads. The amount of each habitat type within a bat's foraging range was estimated using clipping tools in ArcGIS 9.1. Further, each roost tree was surrounded by a 3-km buffer (the farthest distance flown by any one bat). The habitat type within this buffer area was treated as available habitat and individual bats were considered independent sampling units.

3.0 Results

Mist-netting was conducted on a total of 46 nights. This included a total of approximately 1,018 net-hours of effort during which a total of 56 captures were made with a capture rate of 0.06 captures per net per hour (Appendix A, Table 1). Indiana bats were the most commonly captured species (17 captures), followed by big brown bats (*Eptesicus fuscus*, 15 captures), northern long-eared bats (*Myotis septentrionalis*, 12 captures), and little brown bats (*Myotis lucifugus*, 9 captures). Two eastern red bats (*Lasiurus borealis*) were captured and one bat escaped prior to identification.

The first bat capture occurred at the end of April, though no Indiana bats were captured until the night of June 2, when four individuals were netted. Captures of all species decreased near the end of July and ceased altogether at the beginning of August despite increased effort in mist-netting. Visual observations during this time noted less bat activity at roost trees and around the periphery of the study site.

A total of 17 Indiana bat captures occurred during mist-netting. Three of these captures were animals that were previously captured and tagged, resulting in a total of 14 unique individuals, including 4 males and 10 females. Seven of the females were pregnant, two were non-lactating, and one was lactating. Thirteen of the 14 individual Indiana bats captured were fitted with radio transmitters (Appendix A, Table 2). All Indiana bats (females and males) caught through mid-June were adult bats, while three of the four caught in July were sub-adult.

From the 14 Indiana bats tagged, the number of days the bats were relocated ranged from 1 to 15 days and averaged 7.5 days. Once a bat could no longer be tracked to the study site, searchers drove roads throughout the project area to search for the transmitter pulse and determine if animals were using roost sites in new forest stands.

3.1 Diurnal Roosts

All tagged bats were tracked to their respective roost trees using homing telemetry techniques (Figure 3). Seventeen roost trees were found within the study site. Some trends were noted for roost tree selection. Males and females generally had separate roost trees (i.e., maternity roosts); however, on two occasions a male was found roosting in a tree with one to several females. Females tended to cluster at two roost locations, one on the eastern and one on the western ends of the hardwood stand, with individual trees used for more consecutive days. Two trees were used as maternity roost sites.

Male roosts sites were spaced throughout the forested stand and males showed less tendency or fidelity to a particular roost. One individual male (5304) spent five days at one roost tree and six days at five different roost trees. However, in general males spent fewer days in individual trees and moved their diurnal roost location from day to day more frequently than females. Some of the diurnal roosts used in 2006 were the same as in the 2005 NYDEC telemetry study, though some of those 2005 sites that were netted did not result in any bat captures.

As indicated above, bats were relocated for periods of 1 to 15 days. Searches for bats that could no longer be found in the study site yielded no re-locations of animals in other forest stands. This is despite searches from roads and farm fields throughout the project area. These lost bats dispersed from the project area, roosted in forest stands too far from roads and fields to be detected by the telemetry receiver, or had transmitter batteries that died.

3.2 Nocturnal activity

Active radio-tracking (near the end of the survey period) was conducted on three bats (5309, 5311, and 5312) captured and radio-tagged at the end of July. These bats were radio-tracked nightly for 7 to 12 days until the end of transmitter life or dispersal from the project (Table 1). Nightly activity patterns have been summarized using only active radio-telemetry data collected through homing and multiazimuth triangulations for the analysis. The auto data loggers used within the project area did not provide results at the scale necessary for identifying bat locations within specific habitats and were not used in the analysis. Specifically the sensitivity of these units, combined with regular radio interference (perhaps from Fort Drum) could not be turned down far enough to limit detections to suitably close ranges.

Clayton Windpower Project
Indiana Bat Survey

FIGURE 3 - Roost Site Locations for Tagged Indiana Bats in 2006

Legend

Male Roost Location
- 5304
- 5312
- 5399

Female Roost Location
- 5303
- 5305
- 5307
- 5309
- 5311
- 5398
- 5400

Maternity Roost

Indiana Bat Study Site

0 300 600 Feet

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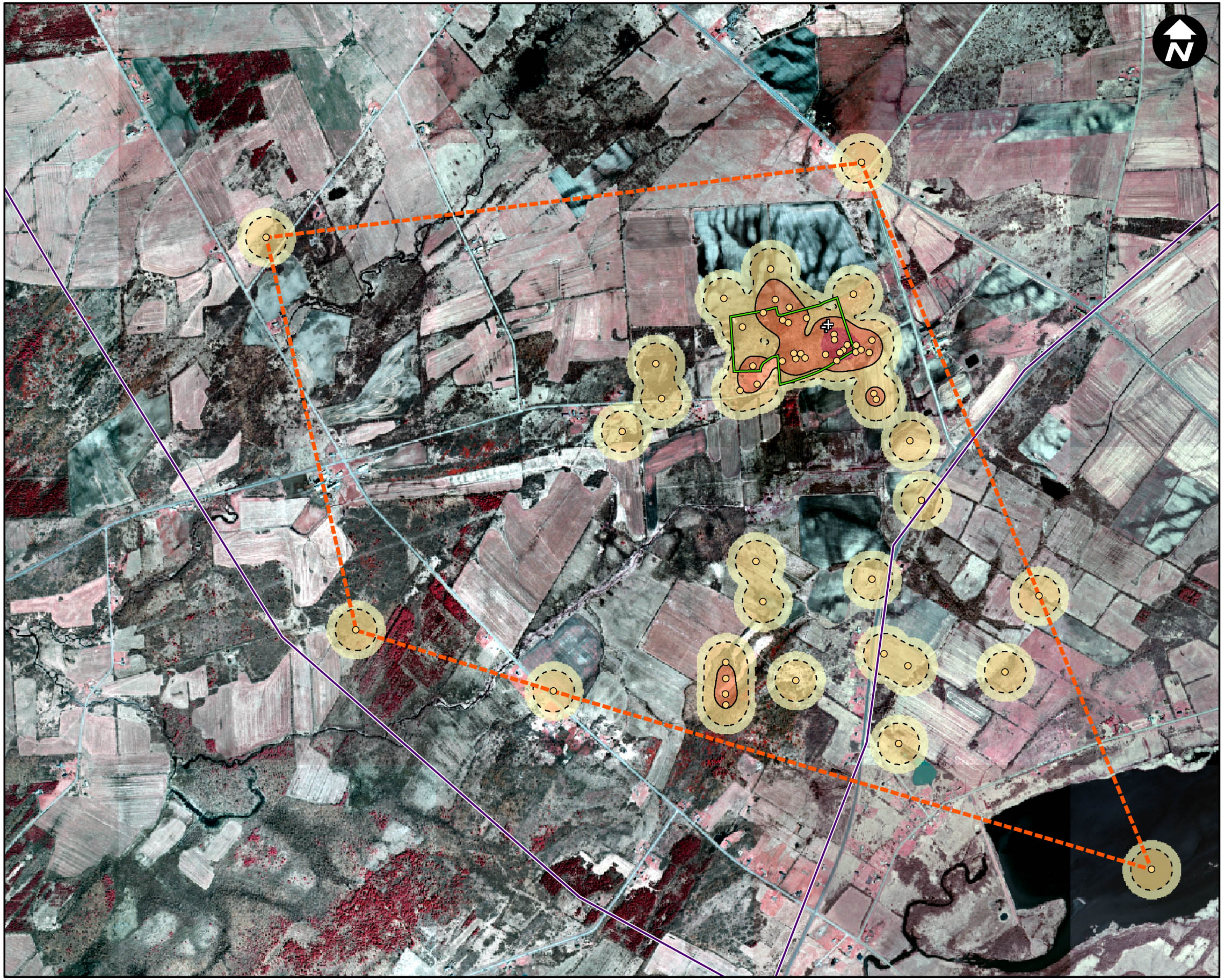
Table 1. Summary of radio telemetry information for three Indiana bats (*Myotis sodalis*) actively radio tracked at the Clayton Wind Project, including foraging range fixed kernel estimate, MCP range estimate, maximum linear distance from roost, number of nights tracked, and number of telemetry locations.

Bat ID and sex	95% Kernel (ha)	50% Core (ha)	MCP foraging range (ha)	Maximum distance (km)	Number of nights tracked	Number of locations
5309- F	107.9	19.4	821.5	2.99	7	64
5311- F	51.1	9.7	64.7	0.92	10	63
5312- M	163.7	33.9	534.0	2.75	12	92
Average	107.6	21.0	473.4	2.22	9.7	73

Bat 5309, a sub-adult female Indiana bat, was captured on July 24 and radio-tracked for 7 days until its last location on July 31. Bat 5309 had a fixed kernel foraging range size of 107.9 ha and a core area range of 19.4 ha (Table 1). Using an MCP estimate, foraging size was 821.5 ha (Figure 4). The average nightly distance traveled from roost tree to radio-telemetry locations was 801 m and ranged from 186 to 1,373 m. The maximum distance traveled from roost tree was 2,989 m. This bat used forested habitat 50 percent of the time, even though active agriculture landscapes were proportionally more available (Table 2).

Bat 5311, an adult female Indiana bat, was captured on July 26 and radio-tracked for 10 days until its last location on August 5. Bat 5311 had a fixed kernel 95 percent foraging range of 51.1 ha and a 50 percent core area of 9.7 ha. Using an MCP estimate, foraging size was 64.7 ha (Figure 5). The average nightly distance traveled from roost to radio-telemetry locations was 326 m and ranged from 223 to 1,373 m. The maximum distance traveled from roost tree was 917 m. Bat 5311 used forested habitat (58.7%) in a much greater proportion than other habitats available (Table 2) and used the study site and immediate vicinity much more frequently than the other bats tracked.

Bat 5312, a sub-adult male Indiana bat, was captured on July 27 and radio-tracked for 12 days until its last location on August 9. Bat 5312 had a fixed kernel 95 percent foraging range of 163.7 ha and a 50 percent core area of 33.9 ha. Using an MCP estimate, foraging range size was 534 ha (Figure 6). The average nightly distance traveled from roost to radio-telemetry locations was 1,077 m and ranged from 355 to 1,899 m. The maximum distance traveled from roost tree was 2,747 m. Bat 5312 did use active agricultural landscapes (41.3%) slightly more than forested areas (40.2%; Table 2), though use of agricultural areas was slightly less than the availability of that habitat and use of forested habitat was approximately twice its availability.



Clayton Windpower Project
Indiana Bat Survey

FIGURE 4 - Foraging Range Estimates for Bat 5309 during 2006

Legend

- Bat 5309
- Roost Location

Bat 5309 Density

- Low Density
- High Density
- 50% Volume Contour (19.4 Ha.)
- 95% Volume Contour (107.9 Ha.)
- MCP 5309 (821.5 Ha.)
- Indiana Bat Study Site
- Clayton Wind Power Project Area

0 1,500 3,000 Feet

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Clayton Windpower Project
Indiana Bat Survey

FIGURE 5 - Foraging Range Estimates for Bat 5311 during 2006

Legend

- Bat 5311
- Roost Location
- Bat 5311 Density
  - Low Density
  - High Density
- 50% Volume Contour (9.7 Ha.)
- 95% Volume Contour (51.1 Ha.)
- MCP 5311 (64.7 Ha.)
- Indiana Bat Study Site
- Clayton Wind Power Project Area

0 1,000 2,000 Feet

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Clayton Windpower Project
Indiana Bat Survey

FIGURE 6 - Foraging Range Estimates for Bat 5312 during 2006

Legend

- Bat 5312
- Roost Location

Bat 5312 Density

- Low Density
- High Density
- 50% Volume Contour (33.9 Ha.)
- 95% Volume Contour (163.7 Ha.)
- MCP 5312 (534.0 Ha.)
- Indiana Bat Study Site
- Clayton Wind Power Project Area

0 1,500 3,000 Feet

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105030-F06-5312KDE.mxd November 2006

Table 2. Habitats used by three *M. Sodalis* trapped and actively radio tracked during summer 2006 in Clayton, New York using fixed kerneling and 95% minimum convex polygons.

	Kernel		MCP		Number of locations	% of time
	Ha	%	Ha	%		
Bat ID- 5309						
Active Agriculture	57.9	53.7%	482.2	58.8%	26	40.6%
Early Successional	7.7	7.1%	146.7	17.9%	3	4.7%
Forested	31.4	29.1%	135.6	16.5%	32	50.0%
Open Water	3.0	2.8%	17.7	2.2%	1	1.6%
Other- Low Density Development	5.0	4.7%	25.4	3.1%	2	3.1%
Road	2.8	2.6%	12.6	1.5%	0	0.0%
Total	**107.8**		**820.2**		**64**	
Bat ID-5311						
Active Agriculture	19.8	38.8%	31.2	48.3%	12	19.0%
Early Successional	7.9	15.4%	5.5	8.6%	12	19.0%
Forested	18.0	35.3%	21.9	33.9%	37	58.7%
Open Water	0.0	0.0%	0.0	0.0%	0	0.0%
Other- Low Density Development	4.2	8.2%	4.7	7.3%	2	3.2%
Road	1.2	2.3%	1.2	1.9%	0	0.0%
Total	**51.0**		**64.6**		**63**	
Bat ID- 5312						
Active Agriculture	75.4	46.1%	256.5	48.1%	38	41.3%
Early Successional	36.8	22.5%	150.8	28.3%	14	15.2%
Forested	42.6	26.1%	103.7	19.5%	37	40.2%
Open Water	0.0	0.0%	0.0	0.0%	0	0.0%
Other- Low Density Development	5.8	3.5%	14.8	2.8%	3	3.3%
Road	0.0	1.8%	7.3	1.4%	0	0.0%
Total	**160.6**		**533.1**		**92**	

When telemetry locations for all three tagged bats were pooled together, a foraging kernel estimate of 220.0 ha and MCP estimate of 976.2 ha was generated. As a whole, Indiana bats used forested landscapes more frequently than any other habitat type (Table 3). Forested landscapes only comprised between 10 and 18 percent of the total foraging range, but Indiana bats were located there 48.4 percent of the time. Active agriculture landscapes were used 35 percent of the time, but consisted of 20 to 55 percent of the foraging area. Early successional, open water, roads, and other-low density development landscapes were used substantially less.

Table 3. Habitats used by pooling foraging range estimates of three *M. Sodalis* trapped and actively radio tracked during summer 2006 in Clayton, New York using fixed kerneling and 95% minimum convex polygons.

	Ha	% of habitat	Number of locations	% of time
Kernel (*n* = 3)				
Active Agriculture	111.2	20.3%	76	34.7%
Early Successional	40.7	7.4%	29	13.2%
Forested	54.0	9.9%	106	48.4%
Open Water	2.4	0.4%	1	0.5%
Other - Low Density Development	8.3	1.5%	7	3.2%
Road	4.4	0.8%	0	0.0%
Total	**220.9**		**219**	
MCP (*n* = 3)				
Active Agriculture	532.4	54.5%	76	34.7%
Early Successional	200.7	20.6%	29	13.2%
Forested	173.4	17.8%	106	48.4%
Open Water	20.4	2.1%	1	0.5%
Other - Low Density Development	33.7	3.5%	7	3.2%
Road	15.6	1.6%	0	0.0%
Total	**976.2**		**219**	

4.0 Discussion

A total of approximately 1,018 net-hours were spent to capture 56 bats from 5 different species. Trapping began on April 21 and the first bat was trapped on April 30. Indiana bats and big brown bats were the most common species trapped. Fewer bats were captured than expected, based on the fact that 3 of 28 Indiana bats out of a wintering population in the hundreds were tracked from their hibernacula (in 2005 by NYDEC) not only to the project area but to the forest stand studied in 2006. The survey results indicate that forested stands intermixed in this landscape mosaic of agriculture, old field, and grassland are of high importance to these bats, which is a generally accepted characteristic of their natural history (Rommé *et al*. 1995, USFWS 1999).

4.1 Diurnal roosts

During the summer months, Indiana bats roost in trees and forage for flying insects in primarily riparian and upland forests. Tracking of these individuals did not yield new roost areas, although 17 roost trees were used by tagged bats over the course of the survey periods. All roost sites were located in a forested stand of hardwoods. This data is consistent with other studies (Carter *et al*. 2002).

This study documented Indiana bats using the same roosting area from year to year, a sign of roost fidelity (Gumbert *et al*. 2002). This does not mean they didn't move, but that they moved far enough away (out of our search area) or too deep into forest stands (i.e., too far from roads, deep into tree cavities) to detect them (greater than 1 to 1.5 km) with the radio receivers. Daily locations did not yield movements to other forest stands to roost; however, it is likely that other stands are probably used. Bats likely find new roost sites during foraging activities or when moving from roost areas to foraging areas (Kurta *et al.* 2002).

Telemetry documented that females formed maternity colonies under the exfoliating bark of live, dead, or dying trees. Reproductive and pregnant females were captured through mid-June and bats captured near the end of July were either lactating or non-reproductive. Some bats, mostly males, used multiple diurnal roosts. Two maternity roosts were documented and some bats switched roosts, which coincides with other research on Indiana bat colonies documenting multiple roost sites per colony and switching behavior (Brack 2006, Kurta *et al.* 2002). On July 28, four tagged bats (three females and one male) roosted in the same tree. Some bats did roost there for more consecutive days than others.

Exodus counts at roost trees were made periodically through the season with night vision equipment and typically documented one to only several individual bats. In no instance were more than 10 individuals observed exiting a roost tree. Visual observations at roost trees surrounded by mist nets documented several times that Indiana bats and northern long-eared bats used the same roost trees.

4.2 Nocturnal activity

In general, radio-tracked bats used foraging areas near their respective roost sites. Each bats' core area was in the general vicinity of their respective roost trees. Average distance from diurnal roost to foraging grounds ranged from 186 m to 1899 m, with a maximum distance of almost 3 km. The average foraging range size was approximately 107 ha (MCP = 473 ha). This is generally consistent with other published ranges and flight distances for this species. For example, Menzel *et al.* (2005) documented a mean home range size (95% kernel) of 145 ha for both sexes in Illinois, with female home ranges being slightly larger (161 ha) than male home ranges (115 ha). In Missouri, Rommé *et al.* (1995) documented a mean spring home range of 208 ha, with male home ranges (255 ha) more than twice the size of female home ranges (113 ha), though their method of determining home range was slightly different than most reported ranges.

Butchkoski and Hassinger (2002) documented foraging ranges of 39 to 112 ha in west-central Pennsylvania. Sparks *et al.* (2005) documented an average nightly flight distance from roosts of 3.02 km, with a range of 0.51 to 7.4 km. In general the foraging ranges and nightly dispersal distances at Clayton were comparable to other similar studies in the region and across its range.

Re-located bats were typically south, west, and in the immediate vicinity of their respective roost sites. The area to the south where most bats were tracked was predominantly wetland and consisted of forested and shrub wetlands and reverting old fields associated with Horse Creek and the Perch River Wildlife Management Area. The area to the north of the study site was mostly grasslands and active agricultural fields, which are generally less suitable habitat for Indiana bats. However, some telemetry locations fell within active fields.

Habitat use was generally consistent with other published habitat use studies (Rommé *et al.* 1995, USFWS 1999, Menzel *et al*. 2005, Brack 2006). Indiana bats foraged more frequently in forested environments (106 of 219 telemetry locations) than in active agricultural landscapes, although open landscapes such as grasslands, agricultural, and old fields dominate the project study area. One bat (5312) foraged in agricultural landscapes slightly more than forested areas. Woodlands with open canopies, which are present in the project area, provide a greater foliage area for foraging Indiana bats (Brack 2006). Canopy openings may also provide a greater number of insects (Tibbels and Kurta 2003).

The total residency period for bats in the study site was shorter than expected. The first Indiana bat was trapped on June 2 (although a gap in netting activities indicates that bats could have been present in late-

May) and the last radio telemetry location occurred on August 9. After July 31, capture rates significantly decreased. The decrease in capture rates indicates possible movement to the vicinity of hibernacula (off-site) for swarming and pre-hibernation activities. If the observed activity at the study site is consistent across the Clayton Wind Project area, then this could indicate that the duration of the presence of this species in the project area is relatively short, though that activity time (summer pup-rearing) is a critical time period. A shorter than expected residency in the project area may help to reduce the potential risk of the proposed project on the species, as a shorter residency results in overall less exposure to proposed wind turbines then a longer residency period.

5.0 Conclusions and Recommendations

Indiana bats used forest field edges, forested wetlands, and agricultural mosaics of old fields to grasslands during foraging and roosting events during the summer 2006 reproductive season. Despite movements between daytime roost trees, tagged bats were not tracked to roost trees within any other forest stands within the Clayton Wind Project area. Indiana bats showed roost site fidelity and returned to the same roosting area during summers of 2005 and 2006.

The home range size and apparent habitat use documented during the study was generally very consistent with patterns documented by other researchers. In general, Indiana bat habitat use was most commonly associated with presumed high productive foraging habitat, which included upland forest, wet forests, and open-canopied old fields. Nightly foraging areas used typically included a water body, most commonly Horse Creek. While bats were tracked up to 7 km away from their roost tree on any given night, nightly dispersal was typically much less than that and nightly use was much more common in the immediate vicinity of the study site.

The results of this field survey provide important information on the potential use of the project area by Indiana bats and some insight into the potential risk of the project to these bats. Additionally, this information can be used during the ongoing design phase of the project. Because the patterns in habitat use observed in the project area are consistent with other published surveys, that other survey data can be used to strengthen any conclusions or assessments of use of the project area by this species. Based on this, it is likely that upland forest stands with large-diameter mature trees within the project area provide potential summer roosting habitat, including maternity roosts, for this species.

Dispersal and habitat use around potential roost sites is likely to be limited to the closest areas of suitable foraging habitat. This includes upland and wetland forests along low-gradient streams and creeks. Old field habitat near these areas is likely to be used as well, depending upon the vegetation structure and open agricultural fields will likely be used much less than their availability (percent occurrence in home range) to these bats.

The results of the survey are encouraging, as it appears that patterns in habitat use and distribution of this species documented here, and in other parts of its range, may help define a potential level of risk of the proposed project to this colony of bats. A range of additional investigations could be conducted at the site and these options should be discussed with the NYDEC. Possible investigations or assessments include, but are not limited to, a project-wide habitat assessment of the project area to identify and quantify high quality habitat for this species, investigations of apparently high quality roost sites throughout the project area for the presence of this species, further investigations of habitat use or flight characteristics (flight heights) in the project area, and integration of any applicable or useful information from post-construction studies at the nearby Maple Ridge wind farm into an assessment of collision risks within the Clayton Wind Project area.

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Appendix A

Bat Trapping and Radio Telemetry Data Tables

Appendix A Table 1. Summary of mist netting results of bats at Clayton Wind Farm, New York during the spring and summer of 2006.

Date	Number of Nets	Number of Hours	Net-hours	Big brown bat	Indiana bat	Little brown bat	N. long-eared bat	Eastern red bat	Unknown	Total	Captures/ net-hour
21-Apr	3	2.5	7.5							0	0.00
23-Apr	3	3.25	9.75							0	0.00
27-Apr	4	3	12							0	0.00
28-Apr	4	3	12							0	0.00
29-Apr	4	3	12							0	0.00
30-Apr	6	2	12	1						1	0.08
1-May	6	2.5	15							0	0.00
2-May	6	3.25	19.5							0	0.00
4-May	6	4	24							0	0.00
5-May	6	1.5	9				1			1	0.11
8-May	6	4.5	27				1			1	0.04
10-May	6	3.5	21	1						1	0.05
13-May	6	4	24				1		1	2	0.08
15-May	6	1.5	9			2	3			5	0.56
1-Jun	6	3.3	19.8				1			1	0.05
2-Jun	6	3.75	22.5		4		1			5	0.22
4-Jun	6	4	24			1	1			2	0.08
6-Jun	6	3.5	21			1	1			2	0.10
7-Jun	6	3.5	21		2					2	0.10
8-Jun	6	3.5	21		1					1	0.05
12-Jun	6	3.5	21		2					2	0.10
13-Jun	6	3.5	21		1	1				2	0.10
14-Jun	6	4	24		1					1	0.04
15-Jun	6	3.3	19.8		1					1	0.05
6-Jul	4	3.25	13							0	0.00
7-Jul	4	3	12							0	0.00
8-Jul	4	3.25	13							0	0.00
10-Jul	6	3.25	19.5				1			1	0.05
11-Jul	6	3.25	19.5							0	0.00
12-Jul	6	3.5	21							0	0.00
22-Jul	6	3.3	19.8	1						1	0.05
23-Jul	6	3.3	19.8	1						1	0.05
24-Jul	7	3.3	23.1	4	1					5	0.22
25-Jul	7	3.3	23.1	1	1			1		3	0.13
26-Jul	8	4	32		1					1	0.03
27-Jul	10	4	40		1		1			2	0.05
28-Jul	12	4	48	3		1				4	0.08
29-Jul	11	3.3	36.3			1				1	0.03
30-Jul	12	3.3	39.6	2	1	2		1		6	0.15
31-Jul	12	3.3	39.6	1						1	0.03
1-Aug	8	3.3	26.4							0	0.00
7-Aug	8	4	32							0	0.00
8-Aug	8	3.3	26.4							0	0.00
9-Aug	8	3.3	26.4							0	0.00
10-Aug	8	3.3	26.4							0	0.00
11-Aug	8	4	32							0	0.00
Total	**301**	**153.15**	**1017.75**	**15**	**17**	**9**	**12**	**2**	**1**	**56**	**0.06**

Appendix A Table 2. Morphometrics of Indiana bats trapped at Clayton Wind Farm in New York during spring and summer 2006.

Species	Sex	Reproductive Status	Age	FA (mm)	Thumb (mm)	Ear (mm)	Tragus (mm)	Weight (g)	Time Captured	Date Captured	Wingband number	Transmitter frequency	Number of days radiotracked
Myotis sodalis	F	Pregnant	Adult	37	5	11	6	7.5	2050	6/2/2006	5305	150.271	12
Myotis sodalis	M	Non-reproductive	Adult	35	5	10	5	6	2050	6/2/2006	5304	150.543	12
Myotis sodalis	F	Pregnant	Adult	37	5	10	4	8	2050	6/2/2006	5303	150.421	12
Myotis sodalis	M	Non-reproductive	Adult	39	5	11	5	7	2050	6/2/2006	5306	150.754	1
Myotis sodalis	F	Pregnant	Adult	38	5	11	5	8.5	2130	6/7/2006	5400	150.361	15
Myotis sodalis	M	Non-reproductive	Adult	39	5	11	4	7.5	2330	6/7/2006	5399	150.573	7
Myotis sodalis	F	Pregnant	Adult	38	5	11	5	8.5	2115	6/8/2006	5398	150.691	6
Myotis sodalis	F	Pregnant	Adult	38	5	11	5	9	2050	6/12/2006	5397	150.122	1
Myotis sodalis	F	Pregnant	Adult	Recap	Recap	Recap	Recap	Recap	2050	6/12/2006	5398 *	150.691	6
Myotis sodalis	F	Pregnant	Adult	39	5	11	6	8.5	2050	6/13/2006	5307	150.092	1
Myotis sodalis	F	Pregnant	Adult	Recap	Recap	Recap	Recap	Recap	2100	6/14/2006	5305 *	150.243	12
Myotis sodalis	F	Pregnant	Adult	37	5	11	5	9	2110	6/15/2006	5308	150.334	1
Myotis sodalis	F	Non-lactating	Sub-adult	35.3	5.4	10.3	5	6	2135	7/24/2006	5309	150.153	7
Myotis sodalis	F	Non-lactating	Sub-adult	35	5	10	4	5	2110	7/25/2006	5310	Not tagged	Not tagged
Myotis sodalis	F	Lactating	Adult	39	6	10	4	7	2145	7/26/2006	5311	150.302	10
Myotis sodalis	M	Non-reproductive	Sub-adult	35.3	5.4	10.1	5	6	2105	7/27/2006	5312	150.454	12
Myotis sodalis	F	Lactating	Adult	Recap	Recap	Recap	Recap	Recap	2145	7/30/2006	5311 **	150.302	10

* Bats were recaptured and a new radio-transmitter attached.
** Bat recaptured on July 30th but was not outfitted with a new transmitter.

2007 Breeding Bird and Rare Bird Survey at the Proposed Horse Creek Wind Project near Clayton, New York

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Table of Contents

List of Figures

List of Tables

List of Appendices

WAI PN 107125

1.0 Introduction

1.1 Project Context

PPM Atlantic Renewable (PPM) has proposed the construction of a wind project to be located in the Townships of Clayton, Orleans, and Brownville in Jefferson County, New York (Figure 1). The proposed Horse Creek Wind project would include approximately 54 2.75-megawatt (MW) wind turbines that could generate up to 150 MW of power annually. Turbines would have a maximum height of approximately 150 meters (m) (492') and would be located predominantly in active agricultural fields being used for hay and crop production, as well as for pasturing.

Birds are known to collide with tall lighted structures, such as buildings and communication towers, particularly when weather conditions reduce visibility (Crawford 1981; Avery *et al.* 1976, 1977). Depending on their height and location, wind turbines can also pose a potential threat to migrating birds because they are tall structures, have moving parts, and may be lit. The mortality of migrating and resident birds and bats has been documented at wind farms as a result of collisions with turbines, meteorological measurement towers (met towers), and guy wires (Anderson *et al.* 2004; Erickson *et al.* 2000, 2003; Johnson *et al.* 2003; Thelander and Rugge 2000).

PPM undertook bird and bat migration studies in the spring and fall of 2005 as well as a breeding bird survey during the early summer of 2005. Fifteen rare bird species were observed in the Horse Creek project area during the initial 2005 field surveys. These included five state endangered species, three state threatened species, and seven state Species of Special Concern. As a result, additional breeding birds and rare bird surveys were conducted during the spring and summer of 2006 and 2007. These surveys were conducted to provide information to help assess the potential impacts to birds from the proposed wind power project. The results of the 2007 breeding bird and rare bird surveys are included in this report.

1.2 Project Area Description

The project area is located within the Eastern Ontario Plain ecozone of New York (Andrle and Carroll 1988). This is a relatively flat region with open grasslands, patches of woodlands, and active agricultural fields, with elevation ranging from approximately 76 m to 152 m (250' to 500'). Forest communities in the area are dominated by American elm (*Ulmus americana*), red maple (*Acer rubrum*), and northern hardwoods on soils of lake sediments that overlie limestone bedrock. Lake Ontario, located 21 kilometers (km) (13 miles [mi]) west of the project area, helps moderate the local climate, resulting in the widespread development of agriculture, predominantly dairying.

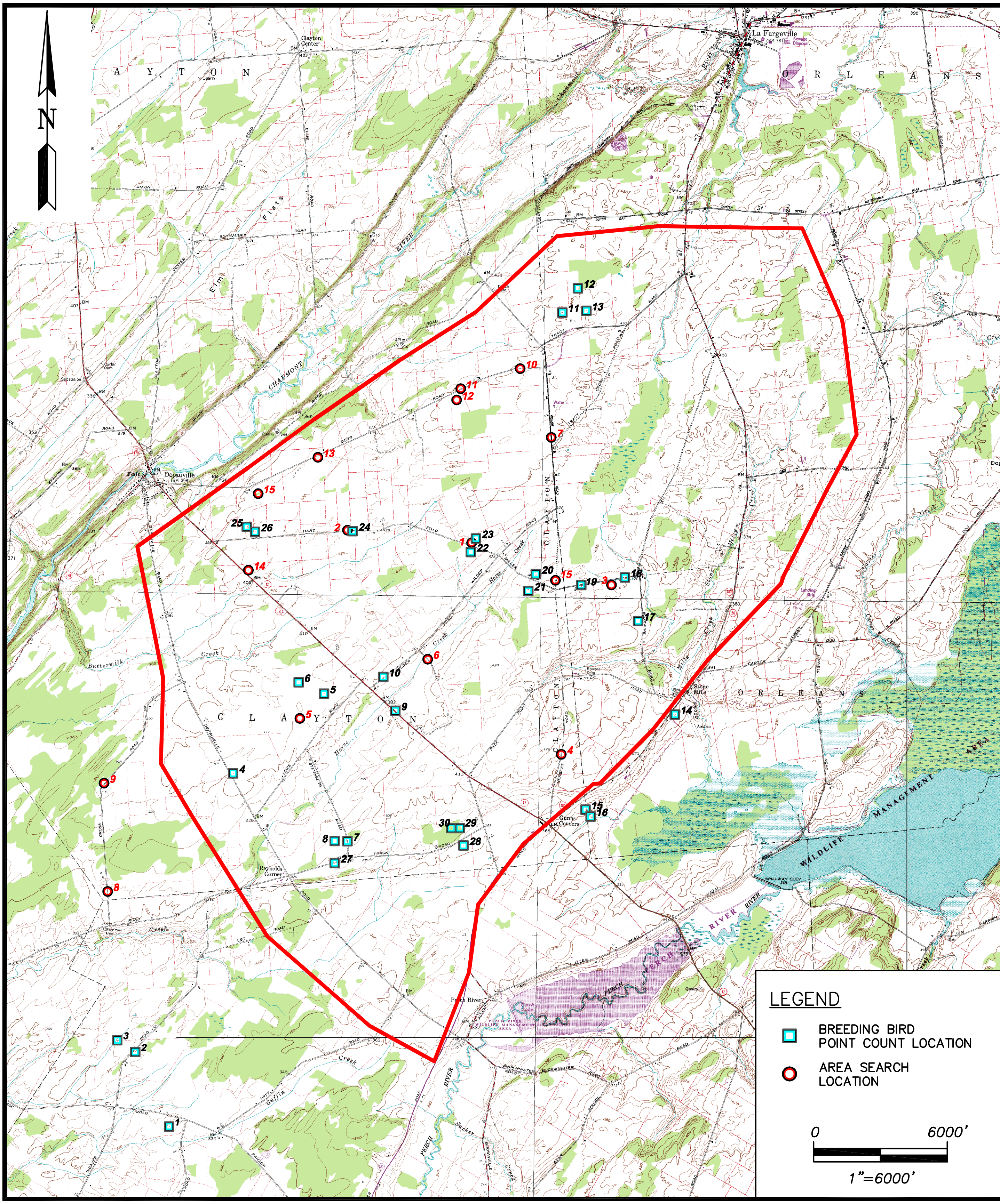
The project area is characterized mainly by agricultural areas, including managed and overgrown grasslands, as well as residential areas, fragmented woodlands, and emergent wetlands and streams that are associated with the Chaumont River system, Horse Creek, and the Perch River. The project area is bordered on its western edge by the Chaumont Barrens owned by The Nature Conservancy, a unique alvar landscape characterized by grasslands, shrub savannas, woodlands dominated by oak and hickory, and areas of limestone calcareous barrens with white spruce and white cedar. The southeastern boundary of the project is bordered by the Perch River Wildlife Management Area. The area is characterized by high quality wetlands, including open water, marsh, and forested wetlands.[1]

[1] http://www.dec.ny.gov/animals/27077.html

The project area is located in a part of New York State that has been identified as important for a number of bird species. The National Audubon Society has designated Important Bird Areas (IBAs) in the vicinity of the project. Included are the Fort Drum, Perch River, and Point Penninsula IBAs. The project area is within the Perch River IBA. An additional location under IBA consideration is the Jefferson County Grasslands.[2] The United States Fish and Wildlife Service (USFWS) has prepared a Land Protection Plan for the St. Lawrence Wetland and Grassland Management District in sections of Jefferson County due to the use of wetlands and grasslands by regionally rare bird species.[3]

Grassland habitats consisting of active and fallow agricultural fields are the most dominant habitat within and surrounding the project area. Despite their abundance in the area, these habitats are generally limited in the northeast. Many bird species that depend on grassland habitats are therefore relatively common in the Horse Creek project area, but rare in the northeast as a whole. Grassland habitats are not confined to the project area, and the species and habitat assemblages within the project area are very similar to those in the surrounding region.

[2] http://iba.audubon.org/iba/stateIndex.do?state=US-NY
[3] http://www.fws.gov/r5mnwr/LandProtectionPlan.pdf#search=%22jefferson%20county%20iba%22



PREPARED BY:

WOODLOT ALTERNATIVES, INC.
ENVIRONMENTAL CONSULTANTS

107125-F001-BBS_Surv.dwg

SHEET TITLE:

2007 Breeding Bird Survey
Point Count and Area Search Locations

PROJECT:

Proposed Horse Creek Wind Project
Clayton, New York

DATE: August 24,2007

SCALE: 1"=6000'

PROJ. NO.: 107125

FIGURE: 1

2.0 Methods

Breeding bird surveys and area searches for rare birds were conducted in the spring and summer of 2007. Survey effort targeted five species: short-eared owl (*Asio flammeus*) (Endangered); upland sandpiper (*Bartramia longicauda*) (Threatened); Henslow's sparrow (*Ammodramus henslowii*) (Threatened), northern harrier (*Circus cyaneus*) (Threatened), and grasshopper sparrow (*Ammodramus savannarum*) (Species of Conservation Concern). Of these species, the short-eared owl, upland sandpiper, and Henslow's sparrow were determined to be likely nesting within the project area during the 2005 breeding bird surveys. The 2006 bird surveys confirmed breeding pairs of Henslow's sparrow, upland sandpiper, grasshopper sparrow, and northern harrier within the project area. The goal of the 2007 bird surveys was to provide additional information for the assessment of habitat use and the overall number of nesting pairs of each of the target species, and to determine the species composition and relative abundance of all species that breed within the project area.

Targeted rare species and breeding bird surveys were conducted during four site visits in 2007: May 30 to June 1; June 13; June 19 to June 20; and July 12. Breeding bird point count locations and rare bird area search locations were similar to survey points in 2006, although area search points targeted additional locations not surveyed in 2006. Point count and area search locations were positioned throughout the project area so that the majority of fields, as well as all other habitat types available within the project area, were sampled. Point count locations targeted suitable habitat for each of the listed species. Morning and early evening surveys were conducted to coincide with activity patterns of most avian species, particularly the targeted species. Field surveys included a combination of breeding bird point counts and roving (walking) surveys, as well as nest searches.

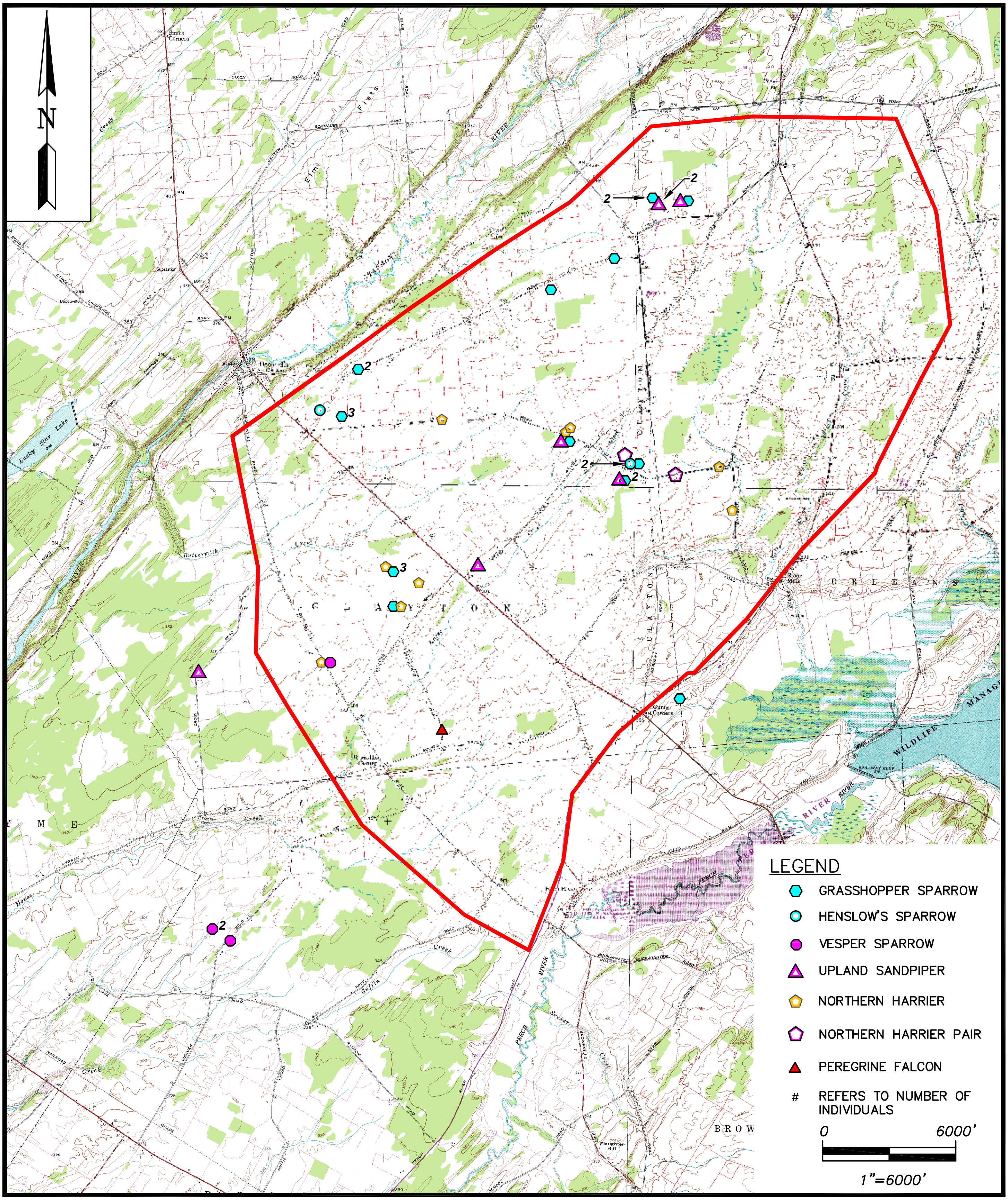
2.1 Rare Bird Area Searches

Rare bird surveys consisted of area searches to document the occurrence, location, and habitat use of the project area by the five target rare bird species. Observers drove throughout the project area searched for suitable habitat, surveying these areas on foot using binoculars and spotting scopes. A total of 16 locations with suitable habitat for the listed species were surveyed within the project area (Figure 1).

Surveys generally began at 5:30 am and continued until 11:00 am and resumed in the evening from approximately 5:00 pm to dusk. Visits were made to suitable habitat locations in order to document nesting behaviors, including vocalizing males, breeding pairs, or nests. Site visits were made to 2006 confirmed nesting locations to determine the presence of last year's breeding pairs. The number of individuals of all species observed and behavioral observations were recorded at each area search location.

2.2 Breeding Bird Point Count Surveys

Breeding bird point counts were stratified across the project area to cover transitional woodland-field edges, grasslands and agricultural fields, and deciduous forest (Figure 2). The 30 total survey locations sampled in 2007 were similar to those surveyed in 2006, but included additional locations. Points were chosen based on the proposed locations of the wind turbines and transmission lines, and were chosen so that all habitat types available in the project area were sampled. The survey points were located approximately 0.3 mi apart to avoid double-counting of individuals.



PREPARED BY:

WOODLOT ALTERNATIVES, INC.
ENVIRONMENTAL CONSULTANTS

107125-0000-RareBird.dwg

SHEET TITLE:

2007 Rare Species Survey Results

PROJECT:

Proposed Horse Creek Wind Project
Clayton, New York

DATE: August 29, 2007

SCALE: 1"=6000'

PROJ. NO.: 107125

FIGURE:

2

The North American Breeding Bird Survey (BBS) protocol, as described by Sauer *et al.* (1997), was used to determine the species richness, relative abundance, and frequency of occurrence of all species detected within the project area. Surveys were conducted from 5:30 am to 10:30 am and were targeted for periods of calm to light winds with little to no precipitation to allow for optimal detection of vocalizing males. During surveys, observers approached point locations quietly and oriented themselves toward the North in order to record the general location of birds onto circle sketches with direction quadrants. Point count sample periods were broken into two periods: the first three minutes and the following two minutes. For the duration of the 5-minute count surveys, the species and the number of individuals occurring 50 m, 50 to 100 m, or greater than 100 m from the observer, or flying over head, were recorded in the interval during which they were first heard or observed. During each consecutive time period, observers would determine the location of previously recorded birds and track any movements within the count circle sketch in order to avoid recounting birds. Observational notes related to breeding behavior, weather conditions, and habitat descriptions were recorded. Observations of birds made outside of the point count timeframe were recorded separately as incidental.

Data Analysis

Observational data collected during the point count survey and rare bird area searches were used to determine the occurrence and habitat use of rare birds within the project area, as well as the species composition and distribution of all species detected in the area.

Quantitative data collected during point counts were used to calculate the species richness, relative abundance, and frequency of breeding birds within the available habitats of the project area. The points that were surveyed and statistically analyzed were summarized into three habitats: grassland; grassland/field edge; and deciduous forest. Bird species recorded as flyovers and birds detected during area surveys were not included in the statistical analysis or calculation of species richness.

2.3 Regional Surveys Rare Bird Observations and Other Information

In addition to on-site field surveys, regional rare bird data collected in the vicinity of the project is available. This information includes Notable Species observations from 2000 to 2005 (specifically grasshopper sparrow, northern harrier, upland sandpiper, Henslow’s sparrow, and short-eared owl) within the six Breeding Bird Atlas (BBA) blocks that occur in the project area (Figure 4). These observations were provided by the New York State Department of Environmental Conservation (NYDEC).

The USGS Breeding Bird Survey (BBS) database was accessed for reports of the five targeted species from the 1966 to 2006 analysis of the Watertown and Philadelphia routes, which are approximately 4 mi (6.4 km) south and 12 mi (19.3 km) east of the project, respectively (Figure 4). These routes have been included in this report because they are the closest route locations to the project area. BBS are annual roadside surveys that extend approximately 24.5 mi (39.4 km) along fixed routes. During a BBS survey, an observer records all birds heard within a 0.25 mi (0.4 km) radius at a stop made every 0.5 mi (0.8 km) along each route.

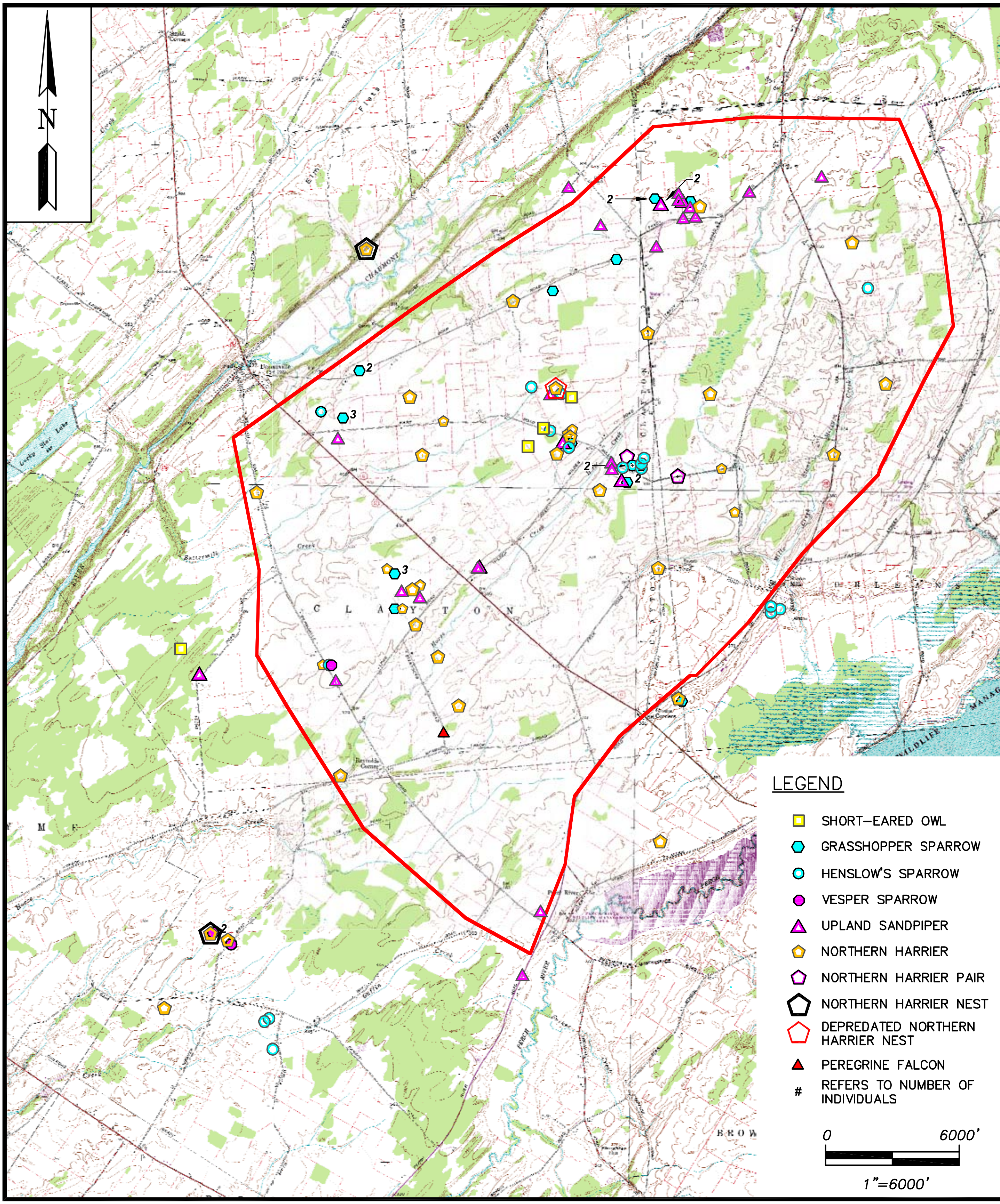
The Audubon Christmas Bird Count (CBC) 2000 to 2007 database was accessed for observations of the five targeted species from the closest count location to the project area. The Watertown 15-mi (24 km) diameter count circle is located approximately 3 mi [4.8 km] south southeast of the project (Figure 4). CBC surveys are conducted by multiple observers per count circle to document the occurrence of wintering birds at a site.

Reported observations are also available of Henslow's sparrow, grasshopper sparrow, northern harrier, and upland sandpiper documented in Jefferson County in 2004 and 2005 by Lazazzero and Norment (2006). The researchers conducted a multi-scale population analysis of grassland birds, with a particular focus on the Henslow's sparrow. During the 2-year study, roadside surveys at 159 sites in Jefferson County, in fields ranging from 5 to 200 hectares (ha), were surveyed.

3.0 Results

3.1 Targeted Rare Species Field Surveys

Four of the five targeted rare bird species were observed during 2007 rare bird area searches, breeding bird surveys, and incidental observations. Grasshopper sparrows were the most frequently observed targeted rare species, with at least 19 individuals observed at 12 sites. Northern harriers were also frequently observed within the project area, and 11 individuals and 2 pairs were observed. Upland sandpipers were detected in six locations, and nine individuals were observed. Three Henslow's sparrows were observed at two sites (Figure 3). The 2007 surveys also documented that vesper sparrows (*Pooecetes gramineus*), a species of conservation concern, breed within the project area. There was also an observation of a state endangered peregrine falcon (*Falco peregrinus*) within the project area; however, due to the lack of its preferred habitat in the area, it was not expected to be breeding within the project area. The 2007 surveys did not indicate the presence of short-eared owl in the project area during the breeding season. Targeted rare species field surveys documented 51 bird species within the project area. Of these, seven species were detected only during area searches and not during the breeding bird survey point counts (Table 1).



PREPARED BY:

WOODLOT ALTERNATIVES, INC.
ENVIRONMENTAL CONSULTANTS

107125-f003-RareBird_06-07.dwg

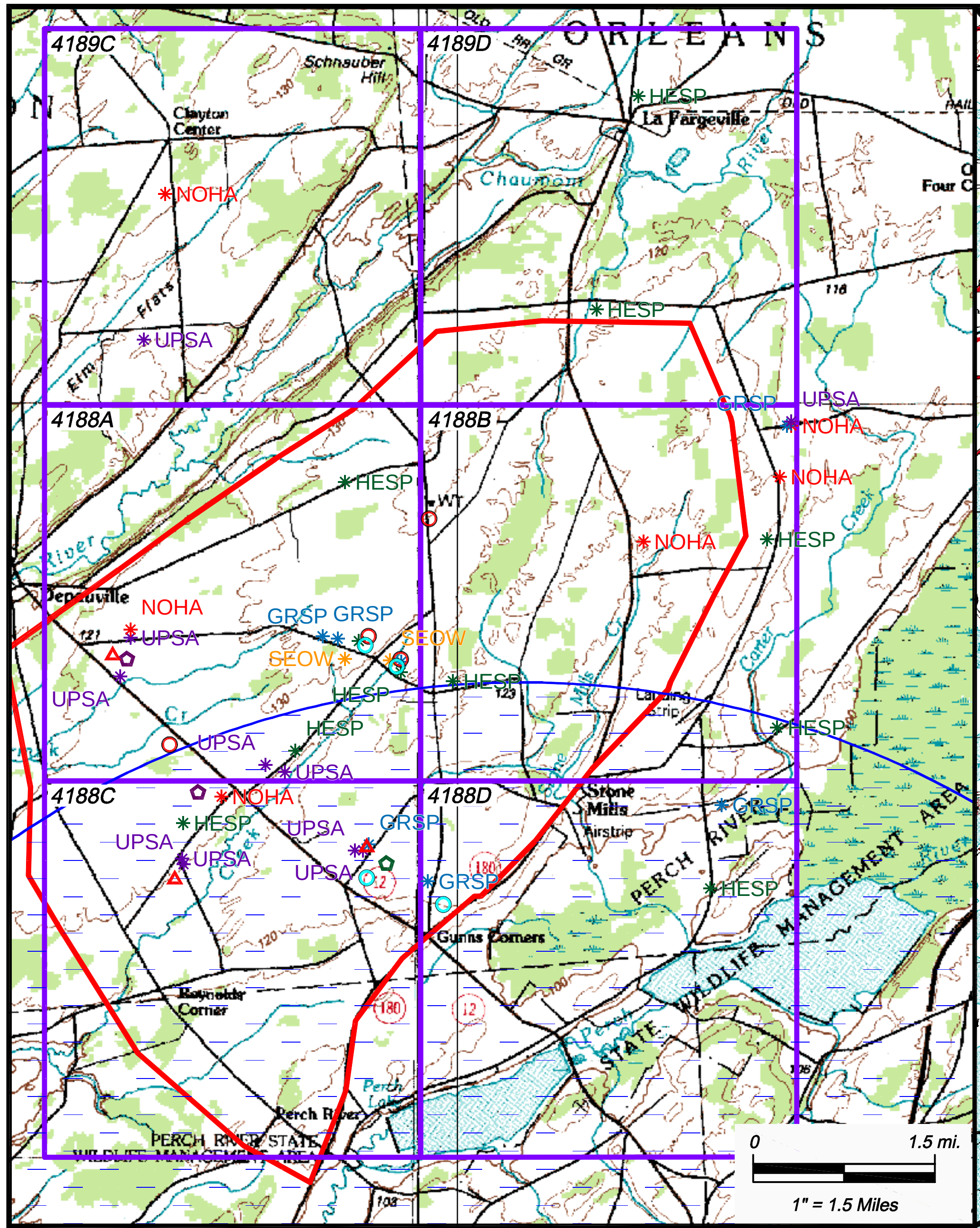
SHEET TITLE:

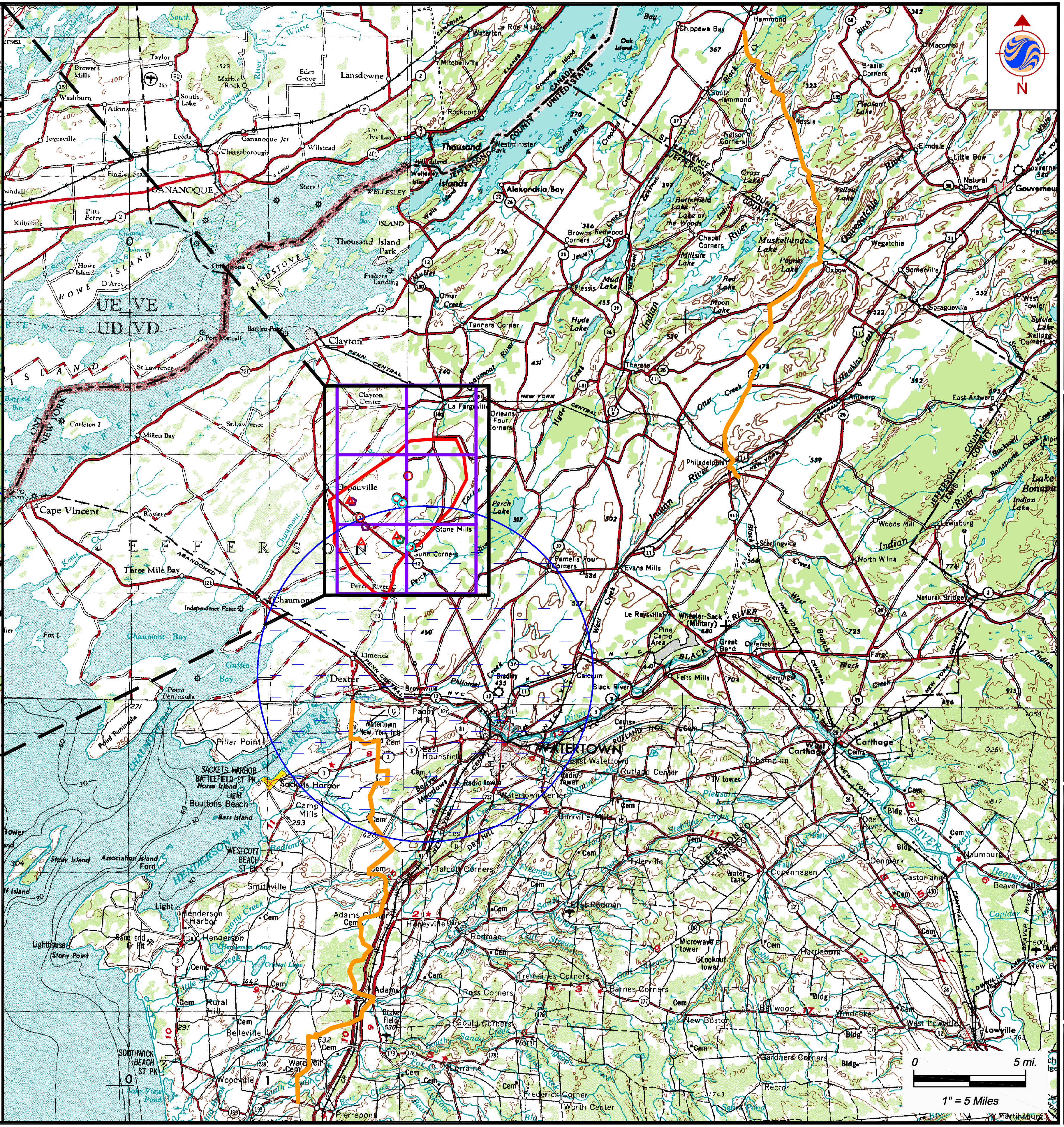
2006 and 2007 Rare Species Survey Results

PROJECT:

Proposed Horse Creek Wind Project
Clayton, New York

DATE: August 29, 2007
SCALE: 1"=6000'
PROJ. NO.: 107125
FIGURE: 3





LEGEND

LAZAZZERO & NORMENT (2006) RARE BIRD OBSERVATION WITHIN THE PROJECT AREA

- GRASSHOPPER SPARROW 2004
- GRASSHOPPER SPARROW 2005
- NORTHERN HARRIER 2004
- NORTHERN HARRIER 2005
- UPLAND SANDPIPER 2005

NYDEC BBA NOTABLE SPECIES OBSERVATIONS (2000 – 2005)

- GRSP – GRASSHOPPER SPARROW
- HESP – HENSLOW'S SPARROW
- NOHA – NORTHERN HARRIER
- SEOW – SHORT-EARED OWL
- UPSA – UPLAND SANDPIPER

- PROJECT AREA
- BREEDING BIRD ATLAS BLOCK
- WATERTOWN CHRISTMAS BIRD COUNT
- BREEDING BIRD SURVEY ROUTE

SHEET TITLE: Regional Surveys Rare Bird Observations

PROJECT: Proposed Horse Creek Wind Project Clayton, New York

PREPARED BY: WOODLOT Stantec

107125-F04-RegionalSurveys2.dwg

DATE: 2/5/2008

SCALE: 1" = 5 Miles

PROJ. NO. 107125

FIGURE: 4

Table 1. Bird species observed during spring 2007 area searches at the proposed Horse Creek Wind Project

Common name	Scientific name	Common name	Scientific name
American crow	*Corvus brachyrhynchos*	Green heron*	*Butorides virescens*
American goldfinch	*Carduelis tristis*	House sparrow*	*Passer domesticus*
American kestrel	*Falco sparverius*	Indigo bunting	*Passerina cyanea*
American robin	*Turdus migratorius*	Killdeer	*Charadrius vociferus*
Baltimore oriole	*Icterus galbula*	Least flycatcher	*Empidonax minimus*
Barn swallow	*Hirundo rustica*	Mourning dove	*Zenaida macroura*
Black-billed cuckoo*	*Coccyzus erythropthalmus*	Northern cardinal	*Cardinalis cardinalis*
Black-capped chickadee	*Poecile atricapilla*	Northern flicker	*Colaptes auratus*
Blue jay	*Cyanocitta cristata*	Northern harrier	*Circus cyaneus*
Bobolink	*Dolichonyx oryzivorus*	Prairie warbler*	*Dendroica discolor*
Brown thrasher	*Toxostoma rufum*	Red-bellied woodpecker*	*Melanerpes carolinus*
Brown-headed cowbird	*Molothrus ater*	Red-tailed hawk	*Buteo jamaicensis*
Carolina wren*	*Thryothorus ludovicianus*	Red-winged blackbird	*Agelaius phoeniceus*
Cedar waxwing	*Bombycilla cedrorum*	Savannah sparrow	*Passerculus sandwichensis*
Chipping sparrow	*Spizella passerina*	Scarlet tanager	*Piranga olivacea*
Common grackle	*Quiscalus quiscula*	Song sparrow	*Pooecetes gramineus*
Common yellowthroat	*Geothlypis trichas*	Tree swallow	*Tachycineta bicolor*
Eastern kingbird	*Tyrannus tyrannus*	Turkey vulture	*Cathartes aura*
Eastern meadowlark	*Sturnella magna*	Upland sandpiper	*Bartramia longicauda*
Eastern towhee	*Pipilo erythrophthalmus*	Vesper sparrow	*Pooecetes gramineus*
Eastern wood-peewee	*Contopus virens*	Warbling vireo*	*Vireo gilvus*
European starling	*Sturnus vulgaris*	White-throated sparrow	*Zonotrichia albicollis*
Field sparrow	*Spizella pusilla*	Wild turkey	*Meleagris gallopavo*
Grasshopper sparrow	*Ammodramus savannarum*	Wood thrush	*Hylocichla mustelina*
Gray catbird	*Dumetella carolinensis*	Yellow warbler	*Dendroica petechia*
Great-crested flycatcher	*Myiarchus crinitus*	*Species observed only during area searches	

3.2 Breeding Bird Point Count Surveys

Three rounds of breeding bird surveys were conducted in spring 2007. Survey points established in 2005 and re-sampled in 2006 were once again sampled in 2007. A total of 929 individuals representing 67 species were observed within the 28 point counts (Appendix A, Table 1). Species richness varied from 6 to 21 across the survey points. Grassland habitats (18 survey points) had an overall species richness of 51 and relative abundance of 10.98 individuals per point. Field edge habitats (11 survey points) had an overall species richness of 52 and relative abundance of 9.61 individuals per point. Only one point was sampled within deciduous forest habitat, and this point had a species richness of 14 and a relative abundance of 6.33 individuals per point.

The most abundant species observed during 2007 breeding bird surveys were the bobolinks (*Dolichonyx oryzivorus*) (1.56 individuals/survey point), red-winged blackbird (*Agelaius phoeniceus*) (1.28 individuals/survey point), savannah sparrow (*Passerculus sandwichensis*) (1.09 individuals/survey point), and common yellowthroat (*Geothlypis trichas*) (0.70 individuals/survey point). These species also had the highest frequency of occurrence across the survey points. Of the 67 species observed during breeding bird surveys, 43 (64%) were detected in 2 or more habitat types, 12 (18%) were detected only in the grassland habitats, 9 (13%) were detected only in the field edge habitats, and 3 (4%) were detected only in the forested habitat (Appendix A, Table 1).

In addition to the species listed in Appendix A, Table 1, five species were observed only as flyovers during point counts. These included the common raven (*Corvus corax*), great-blue heron (*Ardea herodias*), herring gull (*Larus argentatus*), peregrine falcon (*Falco peregrinus*), rock dove (*Columbia livia*), and turkey vulture (*Cathartes aura*). Including flyovers, a total of 1480 birds representing 74 species were observed during point counts (Appendix A, Table 2).[4] Of the total number of birds detected, the majority (47%) were detected in the 50 to 100 m distance category, 19 percent were detected greater than 100 m from the plot center, 16 percent were detected within 50 m of the plot center, and 18 percent were flyovers (Appendix A, Table 3).

3.3 Regional Surveys Rare Bird Observations and Other Information

NYDEC Notable Species reports within BBA blocks that occur within the project area documented the locations of northern harrier, upland sandpiper, grasshopper sparrow, Henslow's sparrow, and short-eared owl (Table 2). Henslow's sparrow were observed in BBA blocks 4188A, 4188B, 4188C, 4188D, and 4189D (Figure 4). Upland sandpipers were observed in BBA blocks 4188A, 4188B, 4188C, and 4189C (Figure 4). Northern harriers were observed in BBA blocks 4188A, 4188B, 4188C, and 4189C (Figure 4). Grasshopper sparrows were documented in BBA blocks 4188A, 4188B, 4188C, and 4188D (Figure 4). Short-eared owls were observed in two locations within BBA block 4188A (these are the same owl observations made during on-site surveys as described in Section 4.1.5.) (Figure 4).

Table 2. Occurrence of Rare Birds documented by Regional Surveys within 12 miles of the Horse Creek Wind Project

	Notable species in BBA blocks (4188A, 4188B, 4188C, 4188D, 4189C, and/or 4189D)	USGS BBS (Watertown and Philadelphia)	CBC (Watertown)	Lazazzero and Norment 2006
Northern harrier	x	x	x	x
Upland sandpiper	x	x		x
Grasshopper sparrow	x	x		x
Henslow's sparrow	x	x		x
Short-eared owl	x*		x	

*The short-eared owl locations reported as Notable Species observations in the BBA blocks by NYDEC are the same short-eared owl observations documented during 2005 and 2006 on-site field surveys.

During the Watertown USGS BBS survey, northern harrier, upland sandpiper, grasshopper sparrow, and Henslow's sparrow were documented approximately 4 mi (6.4 km) from the project area during the 1966 to 2006 analysis (Table 2, Figure 4). The Philadelphia route documented northern harrier and Henslow's sparrow within 12 mi (19.3 km) of the project area during the 1966 to 2006 analysis (Table 2, Figure 4).

[4] Flyovers are not included in the calculation of species richness, as they could not be confirmed as breeding within the project area.

The CBC Watertown survey documented the occurrence of short-eared owl in December 2000, and northern harrier in December 2000, 2001, 2003, 2004 and 2006 approximately 3 mi [4.8 km] from the project area.

Between 2004 and 2005, Lazazzero and Norment (2006) documented 7 different observation points of grasshopper sparrow, 3 different observation points of northern harrier, 4 different observation points of upland sandpiper, and no observation points of either Henslow's sparrow or short-eared owl within the project area (Figure 4). Lazazzero and Norment (2006) provide observation locations of the targeted grassland nesting species throughout Jefferson County (with the exception of short-eared owl).

Some of the observation locations of the targeted species detected by the regional surveys are similar to those observation locations detected during on-site surveys though others are different and may reflect varying habitat conditions across multiple years (Figure 2, 3, and 4).

4.0 Discussion

4.1 Targeted Rare Species Field Surveys

4.1.1 Grasshopper Sparrow

Grasshopper sparrows were observed at 8 out of 30 (27%) point counts during 2007 breeding bird surveys. Area searches and point counts documented at least 12 locations of suspected nesting activity within the project area. Grasshopper sparrows were detected at additional locations within the BBA blocks which occur in the project area, at additional sites surveyed by Lazazzero and Norment in 2004 and 2005, as well as along the USGS BBS survey route within 4 miles of the project area (Figure 3). Grasshopper sparrows appear to be quite common throughout the project area and surrounding region. This species was observed at 11 (28%) point counts in 2005 and 7 (25%) point counts in 2006. Of the targeted rare species, grasshopper sparrows appear to be the most abundant in the project area. A total of approximately 19 different individuals were observed during 2007 area searches (Figure 2). Based on the location and timing of observations, it is estimated that a minimum of 40 to 50 pairs of grasshopper sparrows breed within the project area.

Grasshopper sparrows inhabit tall grasslands in the east, and generally select fields with occasional bare spots, but with few shrubs (Vickery 1996). Within the project area, this habitat type is generally associated with hayfields or tall grass meadows. As is the case for Henslow's sparrows, suitability of habitat and distribution of the species within the project area is likely influenced by mowing regimes. Grasshopper sparrows are often found in habitats similar to those used by savannah sparrows and Henslow's sparrows.

Grasshopper sparrows are a state-listed species of special concern in New York. Although grasshopper sparrows breed throughout the eastern U.S., their population is estimated to have declined by roughly 70 percent since the late 1960s, primarily due to loss of agricultural grasslands and conversion of pastureland to row crops (Vickery 1996). According to data from the New York Breeding Bird Atlas (BBA), the population of grasshopper sparrows within New York has declined by about 9 percent annually during the same period (NYDEC 2007). The range of grasshopper sparrows within New York has become less widespread between the 1980-1985 and 2000-2005 BBA (New York BBA 2007a,b). In northern New York, the distribution of grasshopper sparrows is concentrated in the region surrounding the Horse Creek project (Appendix B). Partners in Flight estimates a global population of approximately 15 million for the species (Rich *et al.* 2004).

4.1.2 Northern Harrier

Northern harriers were observed at 11 different locations within the project area during 2007 surveys. A pair of harriers was observed on two occasions, and the remaining harriers were observed singly. Harriers were observed within 2 out of 30 point counts (6.7%) in 2007 and were observed as flyovers in an additional 6 point counts. Overall, a total of 11 individuals were observed (Figure 2) during field surveys. No nest sites were documented within the project area during 2007 surveys, although three nests were located in 2006. Based on the results of 2006 and 2007 surveys, it is estimated that approximately 8 to 10 pairs nest within or very near the project area (two of the three nests located in 2006 were just outside the project area) (Figure 3). Northern harriers were also detected in proximity of the project area during regional surveys: there are Notable Species reports of northern harrier within the BBA blocks that occur in the project area, northern harrier were detected along both the USGS BBS routes which occur within 12 miles of the project area, they were detected within the CBC count circle within three miles of the project area in recent years, and additional observation locations of northern harrier were documented by Lazazzero and Norment in 2004 and 2005 (Figure 4).

Harriers feed primarily on small mammals during the breeding season and are often observed flying low over meadows and tall grasslands (MacWhirter and Bildstein 1996). Within the project area, they were typically observed over hayfields and other grasslands. Harriers nest on the ground, in a variety of open habitats. Although no nests were observed in 2007, a pair of harriers was observed near the center of the project area on two occasions, and likely nest nearby. Harriers are expected to forage in a variety of open grasslands and were observed throughout the project area during 2006 and 2007 surveys (Figure 4).

Northern harriers breed throughout much of New York, although their population has declined throughout their range due to habitat loss and degradation associated with agriculture and loss of marshes and grasslands (Wheeler 2003). Since the late 1960s, the species is estimated to have declined by approximately 2.5 percent annually within New York (NYDEC 2007). Partners in Flight estimate a global population of 1.3 million for the species, 35 percent of which is in the U.S. and Canada (Rich *et al.* 2004). According to BBA data for New York, northern harriers are distributed along most of the northern border of the state along the St. Lawrence River, although the largest number of confirmed observations within survey blocks during the 2000-2005 survey was in Jefferson County, in the vicinity of the Horse Creek project area (Appendix B) (New York BBA 2007a,b).

4.1.3 Upland Sandpiper

Upland sandpipers were documented at 3 out of 30 point counts (10%), and at a total of 5 locations within the project area, including results of 2007 area searches (Figure 2). Whereas the distribution of upland sandpipers was similar between 2006 and 2007 surveys, the species was documented in two additional locations in 2007. Upland sandpipers were documented at a total of eight point counts during 2006 surveys, and one point count during 2005 surveys. Upland sandpipers were observed in similar habitats during the 2005, 2006, and 2007 on-site surveys and were often observed perched on fence posts along roadsides. In addition, Notable Species observations were made of upland sandpiper within the BBA blocks that occur within the project area, upland sandpiper were documented along the Watertown USGS BBS route, as well as at additional locations within the project area as reported by Lazazzero and Norment (2006) (Figure 4).

Although abundance and distribution of upland sandpipers shifts between years, upland sandpipers have consistently been observed in a few locations such as the northwestern corner of the project area, in fields to the north and south of Tracy Road. Upland sandpipers have been observed in courtship aerial displays in the study area, and while nests have not been observed during 2005, 2006, and 2007 field surveys, they are certainly nesting in the project area based on the types of behaviors observed. Based on the location and timing of the observations, it is estimated that at least 8 to 10 pairs breeding in the areas surveyed throughout the project area.

Unlike other sandpipers, upland sandpipers prefer dry, open grasslands, and were typically found in open grasslands with weeds and shrubs within the project area. This species nests on the ground, in shrubby grasslands with clumps of grasses. Foraging habitat is similar, and often includes grazed pastures. Upland sandpipers generally fly near low to the ground, and use a relatively slow fluttering flight during the breeding season (Houston and Bowen 2001).

Upland sandpipers are distributed irregularly throughout the northeast, and depend upon large grasslands for breeding. Within New York, their range has become more limited in the past 20 years, according to BBA data, and the population has declined approximately 6 percent per year, largely due to loss of suitable grassland habitats (NYDEC 2007). The species is currently listed as state threatened in New York. During the 2000-2005 BBA survey, the range for upland sandpipers was most concentrated in the area surrounding the Horse Creek project in Jefferson County (Appendix B) (New York BBA 2007a,b). This is likely due to the abundance of large grasslands with suitable nesting habitat in the area. The global population for upland sandpipers is estimated to be 350,000 individuals (Houston and Bowen 2001).

4.1.4 Henslow's Sparrow

Henslow's sparrows were documented at 1 out of 28 (3.3%) points surveyed in 2007 and were observed at one additional location during area searches (Figure 2). Between 2006 and 2007 surveys, this species has been documented at six general locations in and just outside the project area (Figure 3). Henslow's sparrows were observed at 10 point counts in 2006 and 2 point counts in 2005. In 2006, it was estimated that between 15 and 20 pairs of Henslow's sparrows are likely nesting within the project area. Although fewer numbers were observed in 2007 than in 2006, this species can be very difficult to detect, and patterns of distribution are likely to have been similar between the two years. Also, Notable Species observations were reported of Henslow's sparrows within the BBA blocks that occur within the project area, Henlsow's sparrows were documented along both the Watertown and Philadelphia USGS BBS routes, as well as at additional locations within the project area as reported by Lazazzero and Norment (2006) (Figure 4).

Henslow's sparrow is a species of agricultural grasslands, tallgrass prairies, and pine savannahs of the eastern United States. Populations have declined over the last 40 years due to reforestation of abandoned agricultural lands and development. Jefferson County grasslands have been listed by the Audubon Society as an important bird area for Henslow's sparrow. Within the project area, Henslow's sparrows have generally been observed in tall grasslands and were often observed in fields where other grassland sparrows, such as grasshopper sparrows and savannah sparrows occurred. This habitat type is quite common throughout the study area, although most of the tall grasslands are hayfields and are mowed at somewhat regular intervals. Rare bird surveys in 2006 and 2007 suggest that, while the distribution and abundance of Henslow's sparrows likely shifts between years due to population shifts and mowing regimes within the project area, the species is somewhat common in the study area and surrounding region.

Among grassland species in the eastern U.S., the Henslow's sparrow appears to be declining most rapidly. Henslow's sparrows are a state-listed threatened species in New York, and the population within the state has declined an estimated 15 percent per year within the past 30 years (NYDEC 2007). The global population, which is found entirely within the U.S. and Canada, is estimated to be approximately 79,000 individuals. Partners in Flight has identified the Henslow's sparrow as one of 21 species on a watch list for "multiple causes for concern across [their] entire range" (Rich *et al.* 2004). Reasons for decline of this species are similar to those affecting other grassland species and are focused on loss and conversion of suitable grassland habitats. Within New York, the documented range of the species has changed between 1980-1985 and 2000-2005 (Appendix B), and the greatest concentration of confirmed, probable, and possible locations was in the region surrounding the proposed Horse Creek project (New York BBA 2007a,b).

4.1.5 Short-eared Owl

Short-eared owls were not observed in the project area during the spring and summer 2007 surveys. A landowner reported seeing an owl at dusk in March 2007 off Hart Road in the vicinity of where a pair and a single bird were observed in 2005 and 2006, respectively. It is unconfirmed, however, if this was a short-eared owl. The presence of the pair in 2005 could indicate that the pair was breeding within the project area that season, although no nest site was found. An additional sighting of a short-eared owl occurred at the Chaumont Barrens, west of the project area, on June 5, 2006. The short-eared owl NYDEC Notable Species observation locations within BBS block 4188A are the same reports of short-eared owl sightings during on-site surveys as described above. Two short-eared owls were detected within the Watertown CBC circle in December 2000. Stantec Consulting, formerly Woodlot Alternatives, Inc.,[5] is scheduled to conduct a winter survey for short-eared owls within the project area in January and February, 2008.

Short-eared owls forage during crepuscular periods, at dawn and dusk, and at night for small mammals, and occasionally birds and insects (Wiggins 2006). The birds hunt while flying at heights of 0.3 to 3 m above the ground, and will also hunt by hovering 2 to 30 m above the ground (Wiggins 2006). Short-eared owls nest on the ground in grassland and marsh habitats (Wiggins 2006). When pair bonds are formed in the late-winter and early spring, males perform elaborate courtship flight displays at height elevations ranging from 30 to 150 m. During the winter, short-eared owls are communal and typically occur in open, shrubby areas adjacent to woodlots. In the winter, the owls occasionally roost in trees. Their wintering grounds may overlap with their breeding grounds depending on food abundance. Winter foraging may take place mainly during crepuscular periods.

The short-eared owl is a state listed endangered species in New York. The distribution of short-eared owls in the Northeast is patchy and breeding locations are mainly restricted to the Great Lakes plains and the St. Lawrence and Champlain valleys (Wiggins 2006). New York is at the southern extent of the breeding range of the short-eared owl. In New York, the owls are rare and local during the breeding season. However, relatively large numbers of short-eared owls occur in certain regions within New York, one of which is the area of Jefferson County surrounding the Horse Creek project (Appendix B). The species has been declining throughout its range, primarily due to loss and conversion of suitable grassland habitat, and the population within the U.S. and Canada is estimated to be approximately 710,000 individuals (Rich *et al.* 2004).

4.1.6 Additional Species

In addition to the five species targeted for surveys in 2007, vesper sparrows and a single peregrine falcon were observed during field surveys. The vesper sparrow is a species of special concern in New York, and the peregrine falcon is a state-listed endangered species. Vesper sparrows were observed at three breeding bird survey locations (10%) during 2007 surveys, and a total of four individuals were observed. Although two of the observations were made outside the boundaries of the project area, this species inhabits a variety of field types including old fields and tall grasslands, which are widespread within the

[5] Field work and subsequent report filings performed prior to October 1, 2007, were done so as Woodlot Alternatives, Inc. On October 1, 2007, Woodlot Alternatives, Inc. was acquired by Stantec Consulting Services, Inc.

project area. As with other grassland species, vesper sparrows are vulnerable to impacts from field mowing, and annual nest success is likely tied in part to when and where mowing takes place. Vesper sparrows are distributed throughout much of New York, although their range has declined in recent decades (Appendix B), and the population has declined an estimated 8.5 percent per year in the state during the past 30 years (NYDEC 2007, New York BBA 2007a,b). Partners in Flight estimates the worldwide population of this species to be approximately 30 million (Rich *et al.* 2004).

A single peregrine falcon was observed as a flyover at one breeding bird survey point in 2007. Peregrine falcons were not observed during breeding bird surveys in 2005 and 2006. Given the flight pattern of the bird, and the fact that no other peregrine falcons were observed during spring surveys or previous breeding bird surveys, it is unlikely that this individual was breeding in the region. Peregrine falcons are not thought to breed within Jefferson County (New York BBA 2007a,b).

4.1.7 Breeding Bird Survey

Including results of targeted rare species surveys and point counts, a total of 80 species of birds were identified in or near the project area. The majority of these species were likely breeding in the area, although only 67 species were documented during point count surveys. Certain species, such as the peregrine falcon, were only observed as a flyover on one occasion, and were likely passing through the area on an intermittent basis when observed. Breeding bird surveys documented an assemblage of species to be expected in a grassland-dominated habitat, with species such as the bobolink, eastern meadowlark (*Sturnella magna*), red-winged blackbird, and savannah sparrow being among the most frequently observed and abundant during point counts. This pattern was similar to results of 2005 and 2006 surveys. Although distribution and frequency of observation of particular species differed between 2005, 2006, and 2007 surveys, dominant species remained similar between years. Because much of the land within the project area consists of mixed agricultural land, with numerous hayfields and pastures, changes in mowing regimes likely affect the distribution and abundance of breeding grassland birds considerably between years.

5.0 Summary and Conclusions

Breeding bird surveys and targeted rare bird surveys identified a total of 80 species, including species observed only as flyovers and incidentally between surveys. Included in this total are six rare species: the upland sandpiper; Henslow’s sparrow; grasshopper sparrow; northern harrier; peregrine falcon; and vesper sparrow. Short-eared owls were not observed during spring 2007 surveys, although a winter habitat survey will take place in the project area during January and February, 2008. The most commonly observed species during spring 2007 surveys were those common to the grassland habitats and small woodlots that characterize the project area.

Breeding bird surveys have been conducted in the project area of the proposed Horse Creek Wind Farm in 2005, 2006, and 2007. Although distribution of survey points and effort differed slightly between years, similar patterns of abundance and distribution of species were documented during the three years. Pre-construction data on the species assemblage, abundance, and distribution of breeding birds within the project area will provide a useful set of data to evaluate potential effects of a wind project. Additional observation locations of the five targeted rare bird species in proximity to the project area are available from NYDEC Notable Species reports within BBA blocks, the USGS BBS 1966 to 2006 analysis, the 2000 to 2007 Watertown CBC data, and 2004 and 2005 records provided by Lazazzero and Norment (2006). These data also demonstrate natural fluctuation in abundance and distribution of breeding birds between years in the absence of a wind project.

According to the on-site and the regional bird surveys, the distribution of rare species was widespread across the project area; however, the occurrence of the targeted species appeared to be concentrated and localized in three areas. Upland sandpiper and grasshopper sparrow observation points were concentrated near Tracy Road at the northern end of the project area (Figure 4); observations of all five of the targeted species were concentrated at the center of the project area, in the area where Horse Creek crosses Hart Road (Figure 3 and 4); and grasshopper sparrow, northern harrier, and upland sandpiper observations were concentrated at a southwest location within the project boundary, off of Lowe Road (Figure 3 and 4). This distribution pattern has been relatively consistent among survey years. Areas where observations of the targeted species have been concentrated are associated with habitat that is suitable for grassland nesting species. Certain species, such as the northern harrier, cover large distances while foraging and likely travel within the project area and beyond on a regular basis, whereas grassland species such as the Henslow's sparrow, grasshopper sparrow, and vesper sparrow, have much more limited ranges and concentrated distributions. Of the rare species observed, the grasshopper sparrow is the most abundant throughout the project area.

Many of the rare bird species documented in the proposed Horse Creek project area, although rare on a larger scale, are quite abundant within Jefferson County due to the prevalence of suitable grassland habitat. This can be observed in the maps of data from the New York BBA, which identifies northern Jefferson County as containing a large number of confirmed, probable, and possible occurrences of these species relative to the surrounding region of New York (Appendix B). Whereas the project area does not contain exceptional grassland habitats relative to the surrounding region, breeding bird surveys and targeted rare bird surveys documented substantial numbers of a variety of rare bird species in the project area.

Current understanding of the potential effects of wind turbines on the behavior and distribution of breeding birds, including rare grassland species, is limited. Likewise, the risk of avian collision mortality at wind farms is not adequately characterized for breeding birds in general or rare grassland species. However, the potential risks of displacement and collision mortality associated with a wind farm on this site will likely receive considerable scrutiny during the permitting process due to the apparent concentration of rare bird species in the project area and surrounding region. Should the project proceed, studies focusing on documentation of collision mortality and displacement of breeding birds will likely be required.

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Appendix A

Breeding Bird Survey Tables

Appendix A Table 1. Total number of observations within 100m of point count center, relative abundance, and frequency of occurrence during 3 days of point count surveys at Horse Creek Wind Farm in spring 2007

Species	Grassland (18 Points)			Grassland/Field Edge (11 Points)			Deciduous Forest (1 Point)			All Habitats (30 Points)		
	Total #[a]	Relative Abundance[b]	Frequency[c]	Total #[a]	Relative Abundance[b]	Frequency[c]	Total #[a]	Relative Abundance[b]	Frequency[c]	Total #[a]	Relative Abundance[b]	Frequency[c]
Alder flycatcher	5	0.09	16.7%	1	0.03	9.1%				6	0.07	13.3%
American crow	10	0.19	38.9%	5	0.15	36.4%				15	0.17	36.7%
American goldfinch	10	0.19	33.3%	4	0.12	36.4%				14	0.16	33.3%
American kestrel [d]	3	0.06	16.7%							3	0.03	10.0%
American redstart				2	0.06	9.1%	1	0.33	--	3	0.03	6.7%
American robin	15	0.28	66.7%	21	0.64	72.7%	3	1.00	--	39	0.43	70.0%
Baltimore oriole	1	0.02	5.6%	2	0.06	9.1%	1	0.33	--	4	0.04	10.0%
Barn swallow	4	0.07	22.2%	1	0.03	9.1%				5	0.06	16.7%
Black-and-white warbler				2	0.06	9.1%	1	0.33	--	3	0.03	6.7%
Black-capped chickadee	1	0.02	5.6%	2	0.06	18.2%				3	0.03	10.0%
Blue jay	4	0.07	16.7%	3	0.09	18.2%	1	0.33	--	8	0.09	20.0%
Blue-winged warbler	2	0.04	11.1%	1	0.03	9.1%				3	0.03	10.0%
Bobolink	105	1.94	88.9%	35	1.06	72.7%				140	1.56	80.0%
Brown thrasher	2	0.04	5.6%	2	0.06	18.2%				4	0.04	10.0%
Brown-headed cowbird	3	0.06	11.1%	7	0.21	36.4%				10	0.11	20.0%
Canada goose [d]	33	0.61	11.1%							33	0.37	6.7%
Cedar waxwing	2	0.04	11.1%	2	0.06	18.2%				4	0.04	13.3%
Chestnut-sided warbler [d]	1	0.02	5.6%							1	0.01	3.3%
Chipping sparrow	1	0.02	5.6%	3	0.09	18.2%				4	0.04	10.0%
Clay-colored sparrow [e]				3	0.09	9.1%				3	0.03	3.3%
Common grackle [d]	2	0.04	11.1%							2	0.02	6.7%
Common yellowthroat	35	0.65	72.2%	28	0.85	90.9%				63	0.70	76.7%
Dark-eyed junco [e]				3	0.09	9.1%				3	0.03	3.3%
Eastern kingbird	10	0.19	33.3%	4	0.12	27.3%				14	0.16	30.0%
Eastern meadowlark	39	0.72	83.3%	16	0.48	63.6%				55	0.61	73.3%
Eastern phoebe	1	0.02	5.6%	1	0.03	9.1%				2	0.02	6.7%
Eastern towhee	9	0.17	38.9%	11	0.33	63.6%				20	0.22	46.7%
Eastern wood-peewee	3	0.06	16.7%	2	0.06	18.2%	2	0.67	--	7	0.08	20.0%
European starling	21	0.39	11.1%	3	0.09	18.2%				24	0.27	13.3%
Field sparrow	5	0.09	16.7%	14	0.42	63.6%				19	0.21	33.3%
Grasshopper sparrow	13	0.24	33.3%	7	0.21	18.2%				20	0.22	26.7%
Gray catbird	3	0.06	16.7%	2	0.06	18.2%	1	0.33	--	6	0.07	20.0%
Great-crested flycatcher				1	0.03	9.1%	1	0.33	--	2	0.02	6.7%
Hairy woodpecker [f]							1	0.33	--	1	0.01	3.3%
Henslow's sparrow [d]	2	0.04	5.6%							2	0.02	3.3%
Hooded warbler [d]	3	0.06	16.7%							3	0.03	10.0%
Indigo bunting [e]				4	0.12	18.2%				4	0.04	6.7%
Killdeer [d]	6	0.11	16.7%							6	0.07	10.0%
Least flycatcher [e]				2	0.06	18.2%				2	0.02	6.7%
Mourning dove	4	0.07	11.1%	5	0.15	27.3%				9	0.10	16.7%
Mourning warbler [f]							1	0.33	--	1	0.01	3.3%
Nashville warbler [e]				1	0.03	9.1%				1	0.01	3.3%
Northern cardinal [e]				1	0.03	9.1%				1	0.01	3.3%
Northern flicker	1	0.02	5.6%	5	0.15	36.4%	1	0.33	--	7	0.08	20.0%
Northern harrier	1	0.02	5.6%	1	0.03	9.1%				2	0.02	6.7%
Northern mockingbird	1	0.02	5.6%	1	0.03	9.1%				2	0.02	6.7%
Olive-sided flycatcher [d]	1	0.02	5.6%							1	0.01	3.3%
Ovenbird	3	0.06	16.7%	1	0.03	9.1%	1	0.33	--	5	0.06	16.7%
Philadelphia vireo [e]				2	0.06	9.1%				2	0.02	3.3%
Red-eyed vireo				2	0.06	9.1%	3	1.00	--	5	0.06	6.7%
Red-tailed hawk [e]				1	0.03	9.1%				1	0.01	3.3%
Red-winged blackbird	85	1.57	94.4%	30	0.91	72.7%				115	1.28	83.3%
Ring-necked pheasant	1	0.02	5.6%	1	0.03	9.1%				2	0.02	6.7%
Rose-breasted grosbeak	1	0.02	5.6%	5	0.15	36.4%				6	0.07	16.7%
Savannah sparrow	77	1.43	77.8%	21	0.64	63.6%				98	1.09	70.0%
Scarlet tanager [f]							1	0.33	--	1	0.01	3.3%
Song sparrow	12	0.22	44.4%	8	0.24	27.3%				20	0.22	36.7%
Swamp sparrow [d]	2	0.04	5.6%							2	0.02	3.3%
Tree swallow [d]	1	0.02	5.6%							1	0.01	3.3%
Upland sandpiper [d]	3	0.06	16.7%							3	0.03	10.0%
Vesper sparrow	3	0.06	11.1%	1	0.03	9.1%				4	0.04	10.0%
White-throated sparrow [e]				1	0.03	9.1%				1	0.01	3.3%
Wild turkey	10	0.19	5.6%	1	0.03	9.1%				11	0.12	6.7%
Willow flycatcher	1	0.02	5.6%	1	0.03	9.1%				2	0.02	6.7%
Wilson's snipe [d]	5	0.09	5.6%							5	0.06	3.3%
Wood thrush	4	0.07	16.7%	4	0.12	18.2%				8	0.09	16.7%
Yellow warbler	23	0.43	55.6%	30	0.91	100.0%				53	0.59	70.0%
Grand Total	593			317			19			929		
Relative abundance		10.98			9.61			6.33			10.32	
Species richness	51			52			14			67		
Species richness range	6 to 21			6 to 19			n/a			6 to 21		

[a] Total number of observations.
[b] Mean number of birds observed.
[c] Percentage of survey points where species occurred.
[d] Species specific to grassland habitats
[e] Species specific to grassland edge habitats
[f] Species specific to deciduous forest habitats

Appendix A Table 2. Total number of species recorded from each habitat type at Horse Creek Wind Farm during 3-day point count surveys in spring 2007

Species	Grassland (18 points)	Grassland/ Field Edge (11 points)	Deciduous Forest (1 point)	Grand Total
Alder flycatcher	5	1		6
American crow	19	10	1	30
American goldfinch	30	9		39
American kestrel	4	1		5
American redstart		2	1	3
American robin	21	23	3	47
Baltimore oriole	1	2	1	4
Barn swallow	23	8		31
Black-and-white warbler		2	1	3
Black-capped chickadee	1	2		3
Blue jay	4	3	1	8
Blue-winged warbler	2	1		3
Bobolink	147	53		200
Brown thrasher	2	3		5
Brown-headed cowbird	3	7		10
Canada goose	61	1		62
Cedar waxwing	5	3		8
Chestnut-sided warbler	1			1
Chipping sparrow	1	3		4
Clay-colored sparrow		3		3
Common grackle	7	1		8
Common raven*		1		1
Common yellowthroat	35	28		63
Dark-eyed junco		3		3
Duck (unidentified)	2			2
Eastern kingbird	11	4		15
Eastern meadowlark	49	22		71
Eastern phoebe	1	1		2
Eastern towhee	9	12		21
Eastern wood-peewee	4	2	3	9
European starling	80	207	1	288
Field sparrow	5	14		19
Grasshopper sparrow	13	7		20
Gray catbird	3	2	1	6
Great-blue heron*	2	3		5
Great-crested flycatcher		1	1	2
Hairy woodpecker			1	1
Henslow's sparrow	2			2
Herring gull*	5	2		7

(*continued*)

Appendix A Table 2. Total number of species recorded from each habitat type at Horse Creek Wind Farm during 3-day point count surveys in spring 2007 *(continued)*

Species	Grassland (18 points)	Grassland/ Field Edge (11 points)	Deciduous Forest (1 point)	Grand Total
Hooded warbler	3			3
Indigo bunting		4		4
Killdeer	6			6
Least flycatcher	1	2		3
Mourning dove	8	7		15
Mourning warbler			1	1
Nashville warbler		1		1
Northern cardinal	1	1		2
Northern flicker	1	5	1	7
Northern harrier	8	2		10
Northern mockingbird	1	1		2
Olive-sided flycatcher	1			1
Ovenbird	4	1	1	6
Peregrine falcon*		1		1
Philadelphia vireo		2		2
Red-eyed vireo		2	3	5
Red-tailed hawk	1	2		3
Red-winged blackbird	103	46		149
Ring-necked pheasant	2	1		3
Rock dove*	2			2
Rose-breasted grosbeak	1	5		6
Savannah sparrow	80	21		101
Scarlet tanager			1	1
Song sparrow	12	9		21
Swamp sparrow	2			2
Tree swallow	3	2		5
Turkey vulture*	5	1		6
Upland sandpiper	7			7
Vesper sparrow	3	1		4
White-throated sparrow		1		1
Wild turkey	10	1		11
Willow flycatcher	1	1		2
Wilson's snipe	5			5
Wood thrush	4	4		8
Yellow warbler	24	30		54
Grand Total	**857**	**601**	**22**	**1480**
Species per habitat	**59**	**61**	**16**	**74**

*Species observed only as flyovers

Appendix A Table 3. Total number of species recorded and distance from point count center at Horse Creek Wind Farm during 3-day point count surveys in spring 2007

Species	0-50 m	50-100 m	> 100 m[a]	Flyovers[a]	Grand Total
Alder flycatcher	2	4			6
American crow		15	8	7	30
American goldfinch	2	12		25	39
American kestrel		3	2		5
American redstart	2	1			3
American robin	16	23	3	5	47
Baltimore oriole	1	3			4
Barn swallow	3	2	1	25	31
Black-and-white warbler		3			3
Black-capped chickadee	1	2			3
Blue jay		8			8
Blue-winged warbler	1	2			3
Bobolink	33	107	1	59	200
Brown thrasher	2	2		1	5
Brown-headed cowbird	6	4			10
Canada goose		33		29	62
Cedar waxwing	1	3		4	8
Chestnut-sided warbler		1			1
Chipping sparrow	2	2			4
Clay-colored sparrow	3				3
Common grackle		2	2	4	8
Common raven				1	1
Common yellowthroat	11	52			63
Dark-eyed junco		3			3
Duck species				2	2
Eastern kingbird	4	10	1		15
Eastern meadowlark	5	50	2	14	71
Eastern phoebe		2			2
Eastern towhee	4	16	1		21
Eastern wood-peewee	1	6	2		9
European starling	21	3	251	13	288
Field sparrow	2	17			19
Grasshopper sparrow	4	16			20
Gray catbird	1	5			6
Great-blue heron				5	5
Great-crested flycatcher		2			2
Hairy woodpecker		1			1
Henslow's sparrow	1	1			2
Herring gull				7	7
Hooded warbler	2	1			3
Indigo bunting	1	3			4
Killdeer		6			6
Least flycatcher	1	1		1	3

(*continued*)

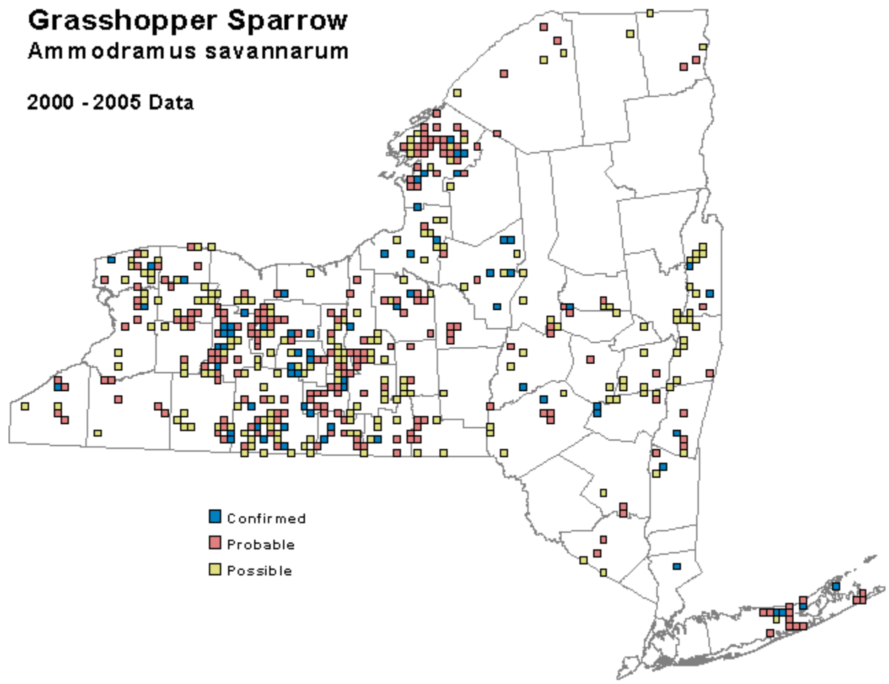
Appendix A Table 3. Total number of species recorded and distance from point count center at Horse Creek Wind Farm during 3-day point count surveys in spring 2007 *(continued)*

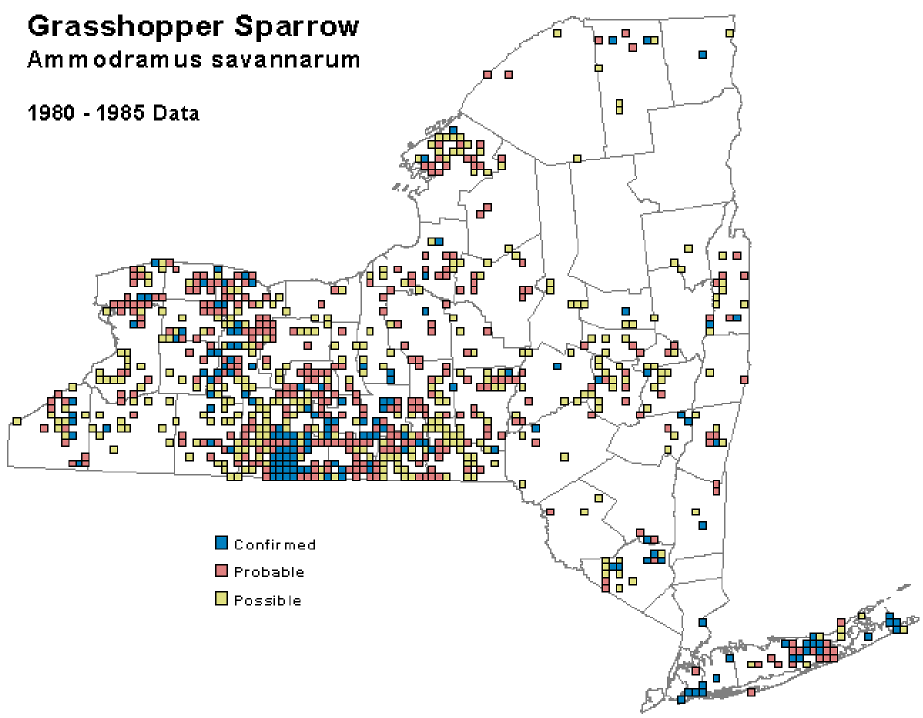
Species	**0-50 m**	**50-100 m**	**> 100 m[a]**	**Flyovers[a]**	**Grand Total**
Mourning dove	2	7	1	5	15
Mourning warbler		1			1
Nashville warbler		1			1
Northern cardinal		1		1	2
Northern flicker	1	6			7
Northern harrier		2	1	7	10
Northern mockingbird		2			2
Olive-sided flycatcher	1				1
Ovenbird		5	1		6
Peregrine falcon				1	1
Philadelphia vireo		2			2
Red-eyed vireo	2	3			5
Red-tailed hawk		1	1	1	3
Red-winged blackbird	38	77	1	33	149
Ring-necked pheasant		2	1		3
Rock pigeon				2	2
Rose-breasted grosbeak	1	5			6
Savannah sparrow	19	79		3	101
Scarlet tanager		1			1
Song sparrow	12	8	1		21
Swamp sparrow	2				2
Tree swallow	1			4	5
Turkey vulture			1	5	6
Upland sandpiper		3	4		7
Vesper sparrow	1	3			4
White-throated sparrow	1				1
Wild turkey		11			11
Willow flycatcher	1	1			2
Wilson's snipe	2	3			5
Wood thrush		8			8
Yellow warbler	15	38		1	54
Grand Total	232	697	286	265	1480
Yellow warbler	15	38		1	54
Grand Total	**232**	**697**	**286**	**265**	**1480**

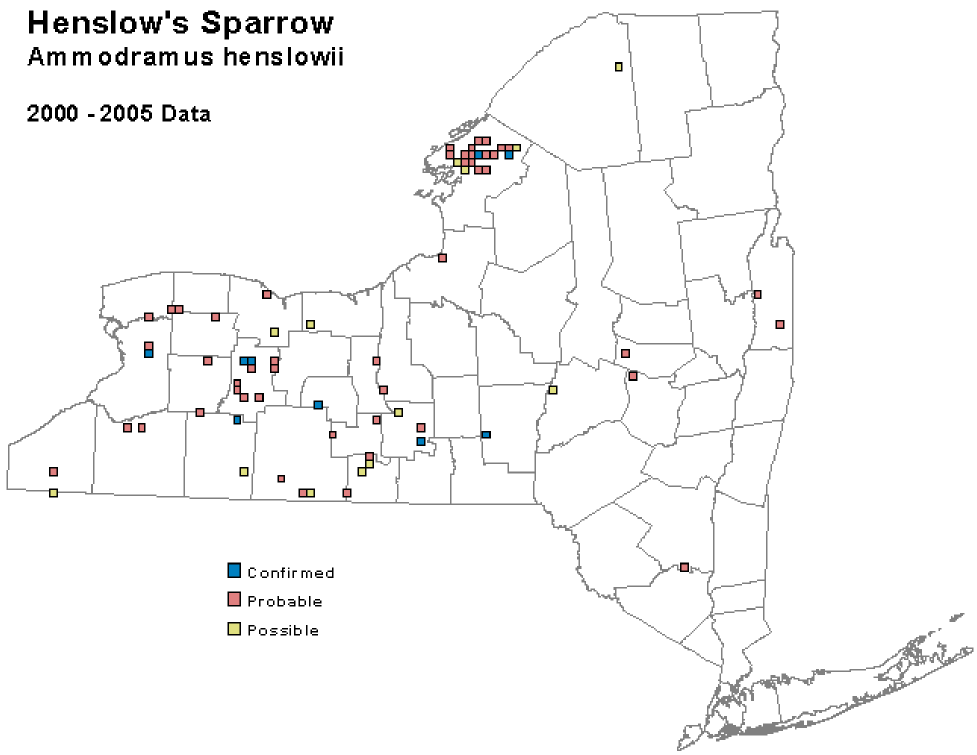
Appendix B

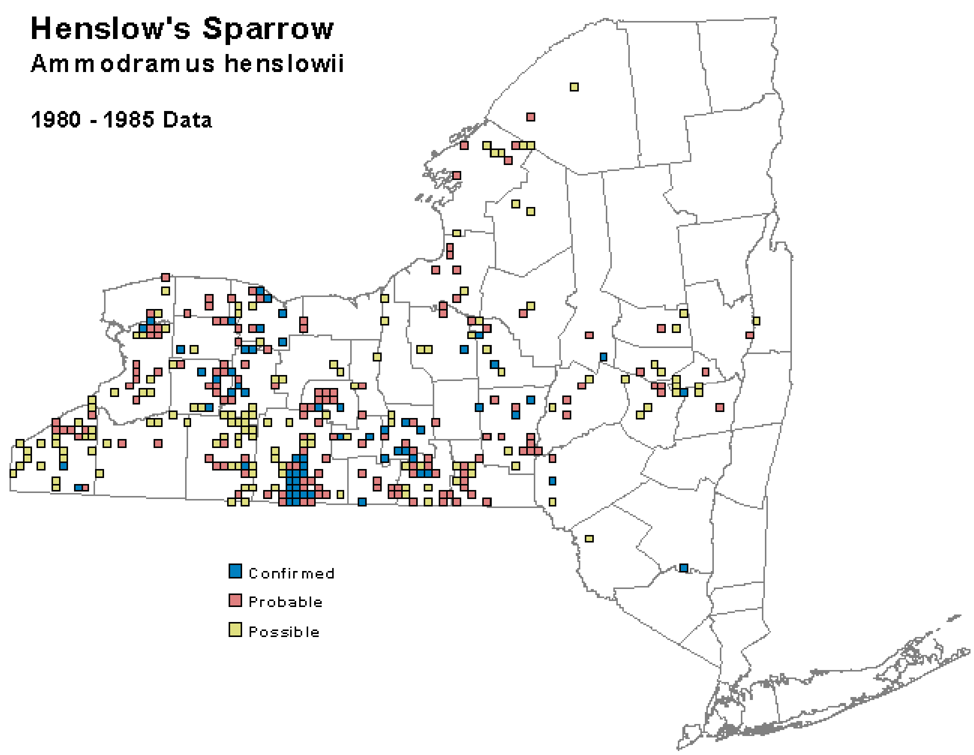
New York State Breeding Bird Atlas Maps

Maps of New York Breeding Bird Atlas data for targeted rare species documented within the Horse Creek project area (New York BBA 2007a,b).






Henslow's Sparrow
Ammodramus henslowii
2000 - 2005 Data
Confirmed
Probable
Possible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1980 - 1985 Data
Confirmed
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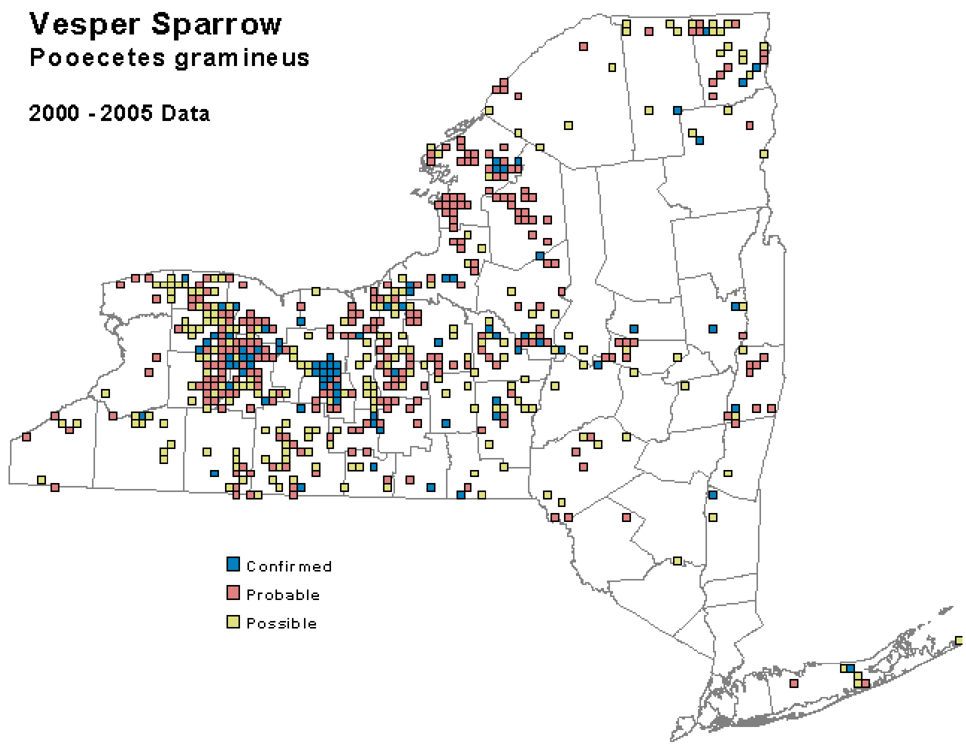
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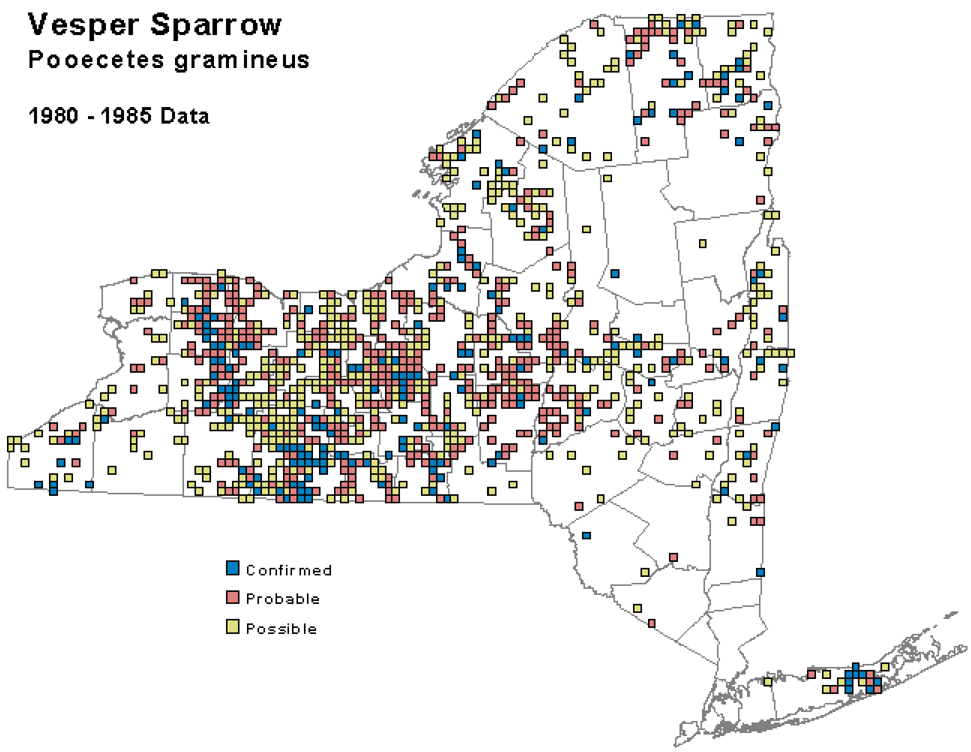
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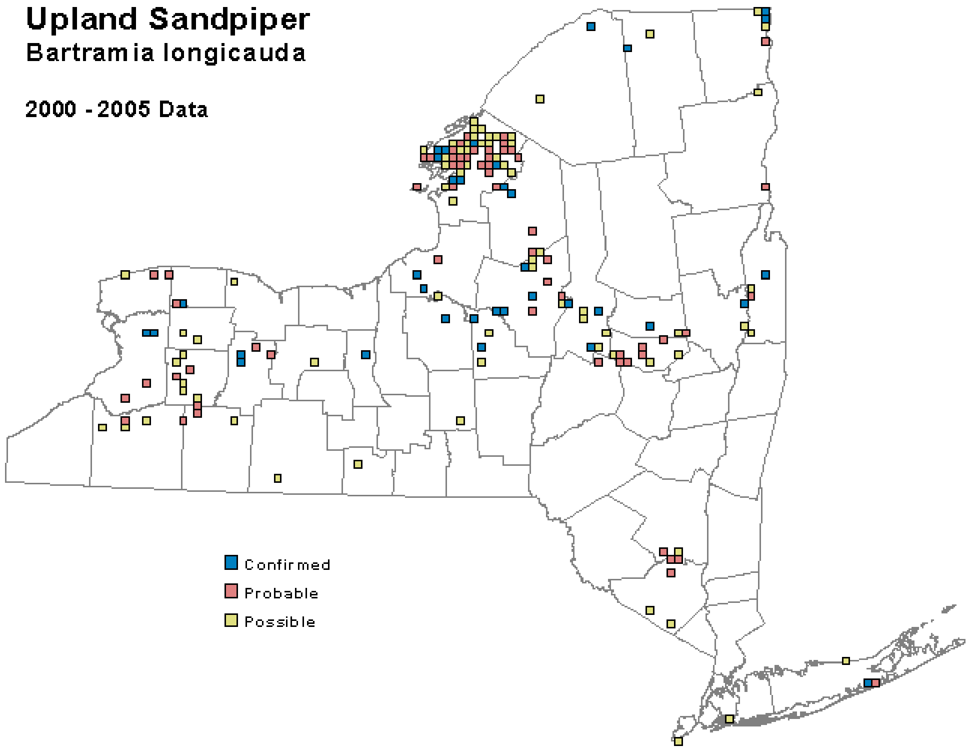
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Confirmed
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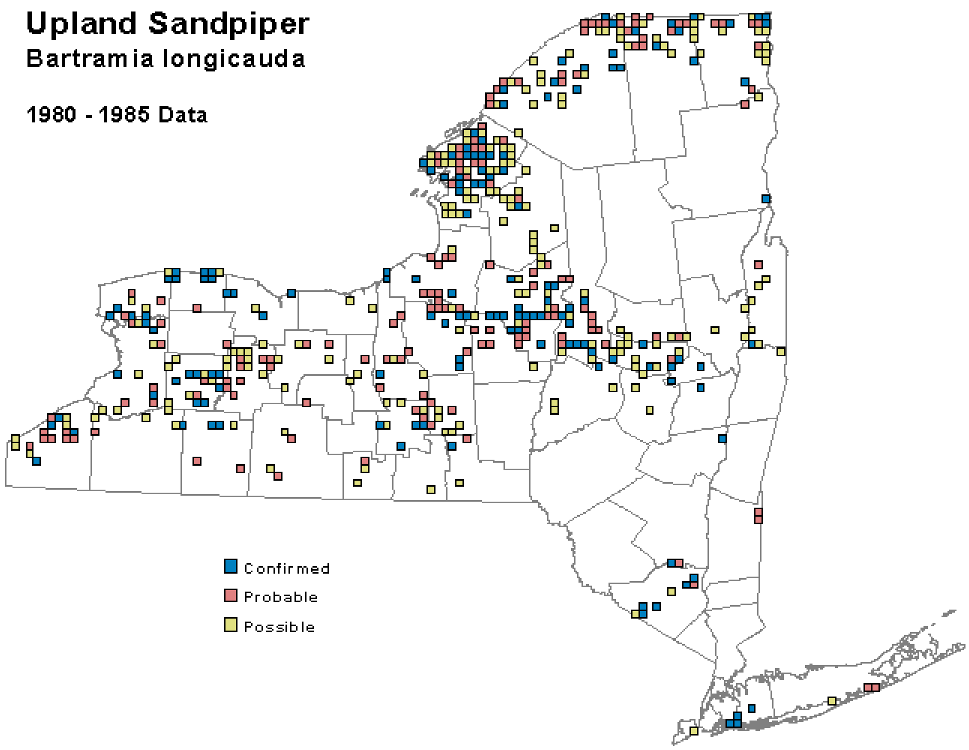
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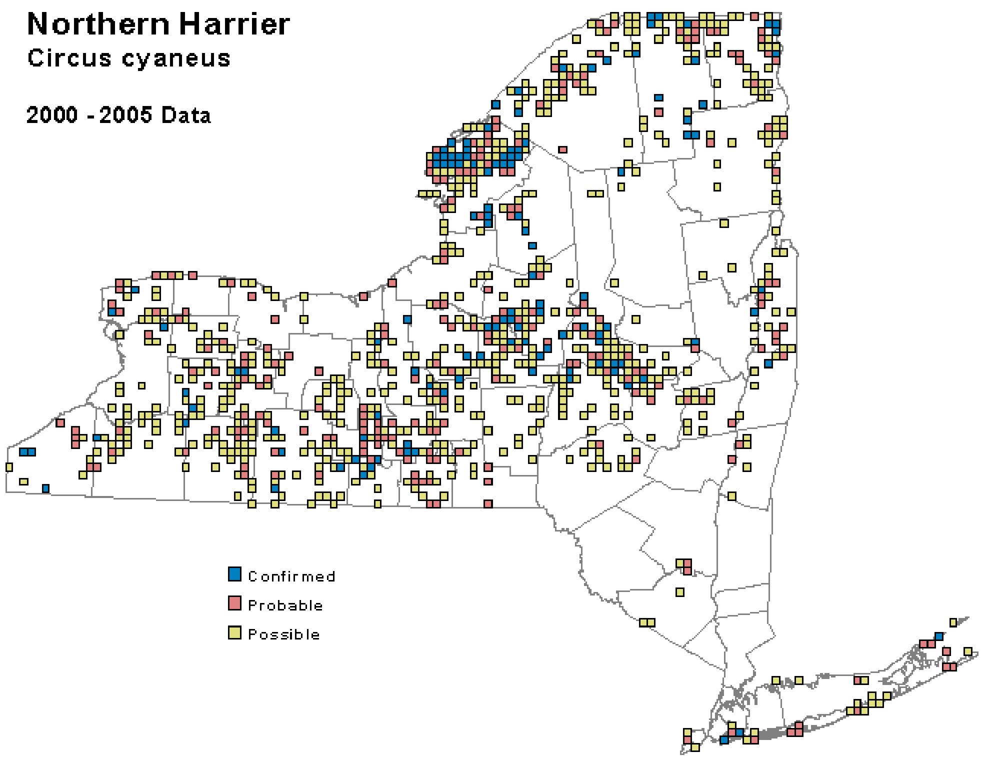
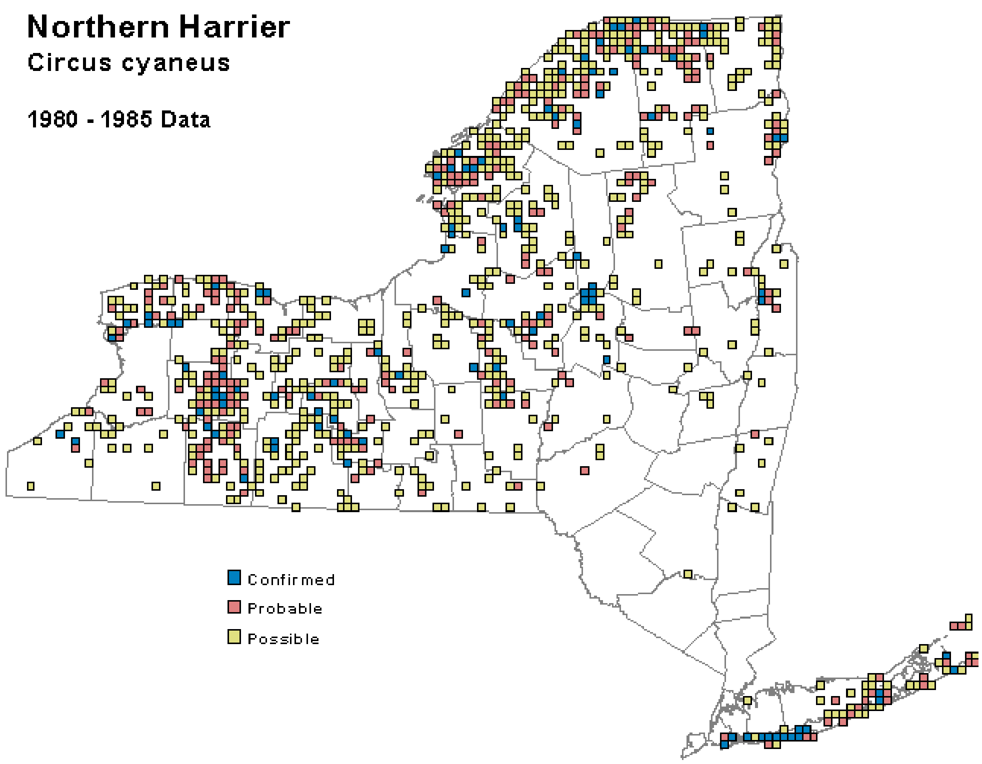

Northern Harrier
Circus cyaneus
2000 - 2005 Data
Confirmed
Probable
Possible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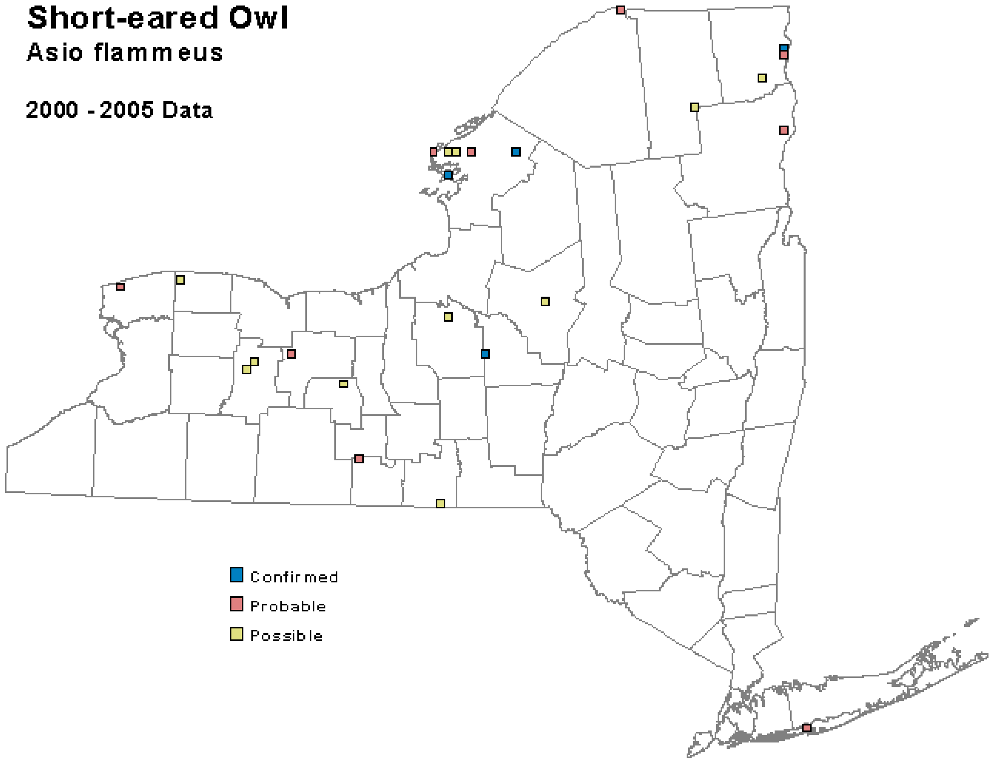
1980 - 1985 Data
Confirmed
Probable
Possible

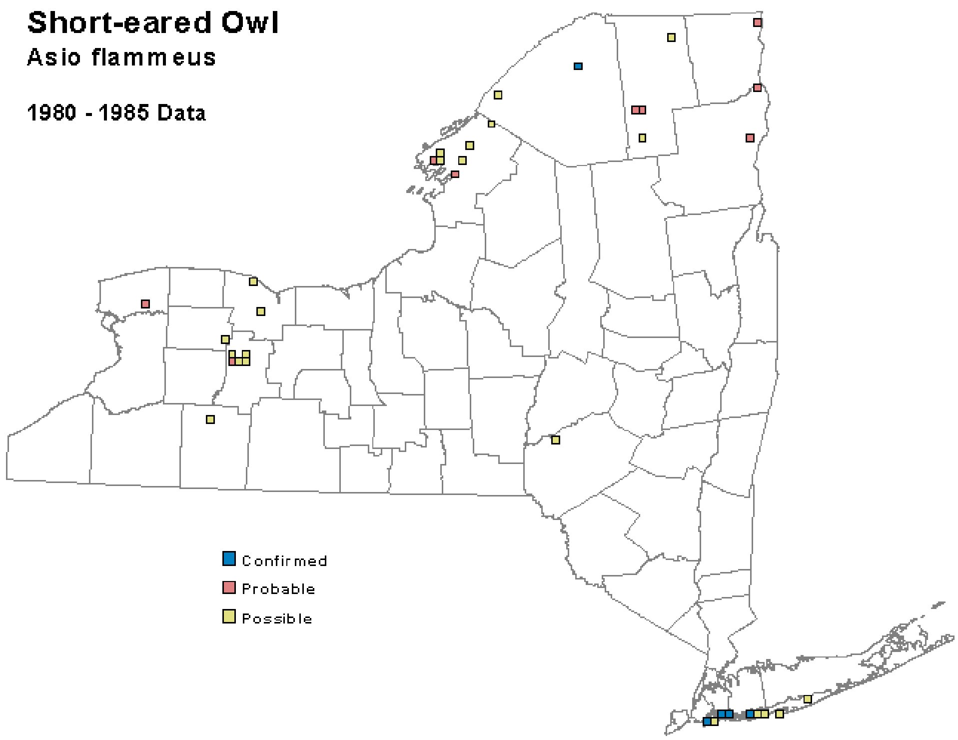
Short-eared Owl
Asio flammeus

2000 - 2005 Data



Short-eared Owl
Asio flammeus

1980 - 1985 Data



Raptor Survey Report

Visual Surveys from October 2007 to May 2008
for the Horse Creek Wind Project
near Clayton, New York

Prepared for

Iberdrola Renewables S.A.
330 Province Line Road
Skillman, NJ 08558

Prepared by

Stantec Consulting
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Topsham, ME 04086

Stantec

December 2008

Table of Contents

PN195600123

1.0 Introduction

This report has been prepared to provide information to help assess the potential impact to migrating and wintering raptors and owls in the vicinity of the Horse Creek Wind Project.

Following is a brief description of the project; a review of the methods used to conduct scientific surveys and the results of those surveys; a discussion of those results; and the conclusions reached based on those results.

1.1 PROJECT CONTEXT

Iberdrola Renewables S.A. (Iberdrola) has proposed the construction of a wind project to be located in the Townships of Clayton, Orleans, and Brownville in Jefferson County, New York (Figure 1). The proposed Horse Creek Wind project would include approximately 54 2.75-megawatt (MW) wind turbines that could generate up to 150 MW of power annually. Turbines would have a maximum height of approximately 150 meters (m) (492') and would be located predominantly in active agricultural fields being used for hay and crop production, as well as for pasturing.

Initial raptor surveys were conducted in the Project area during 2005 and documented fifteen rare bird species. These included five state endangered species, three state threatened species, and seven state Species of Special Concern. As a result, additional breeding bird and rare bird surveys were conducted during the spring and summer of 2006.

Based on further guidance provided by the New York State Department of Environmental Conservation (NYSDEC), Iberdrola contracted Stantec Consulting (Stantec) to conduct three additional seasons of raptor surveys, including surveys during the fall 2007 and spring 2008 migration seasons and during the winter period from January to March 2008.

The overall goals of the surveys were to document:

- passage rates and species composition of raptors migrating through the project area in the fall and in the spring; special efforts were made to document migration of golden eagle (*Aquila chrysaetos*) (State Endangered) in the vicinity of the project; and

- passage rate and species composition for all raptor and owl species observed in the winter, as well as other avian species incidentally observed; special efforts were made to document wintering owls, including short-eared owl (*Asio flammeus*) (State Endangered) and snowy owl (*Bubo scandiacus*); and raptor species, including northern harrier (*Circus cyaneus*) (State Threatened), rough-legged hawk (*Buteo lagopus*), and bald eagle (*Haliaeetus leucocephalus*) (State Threatened).

The following sections outline the survey methodology and results contributing toward the achievement of survey goals. Discussion of survey results and subsequent conclusions follow each section.

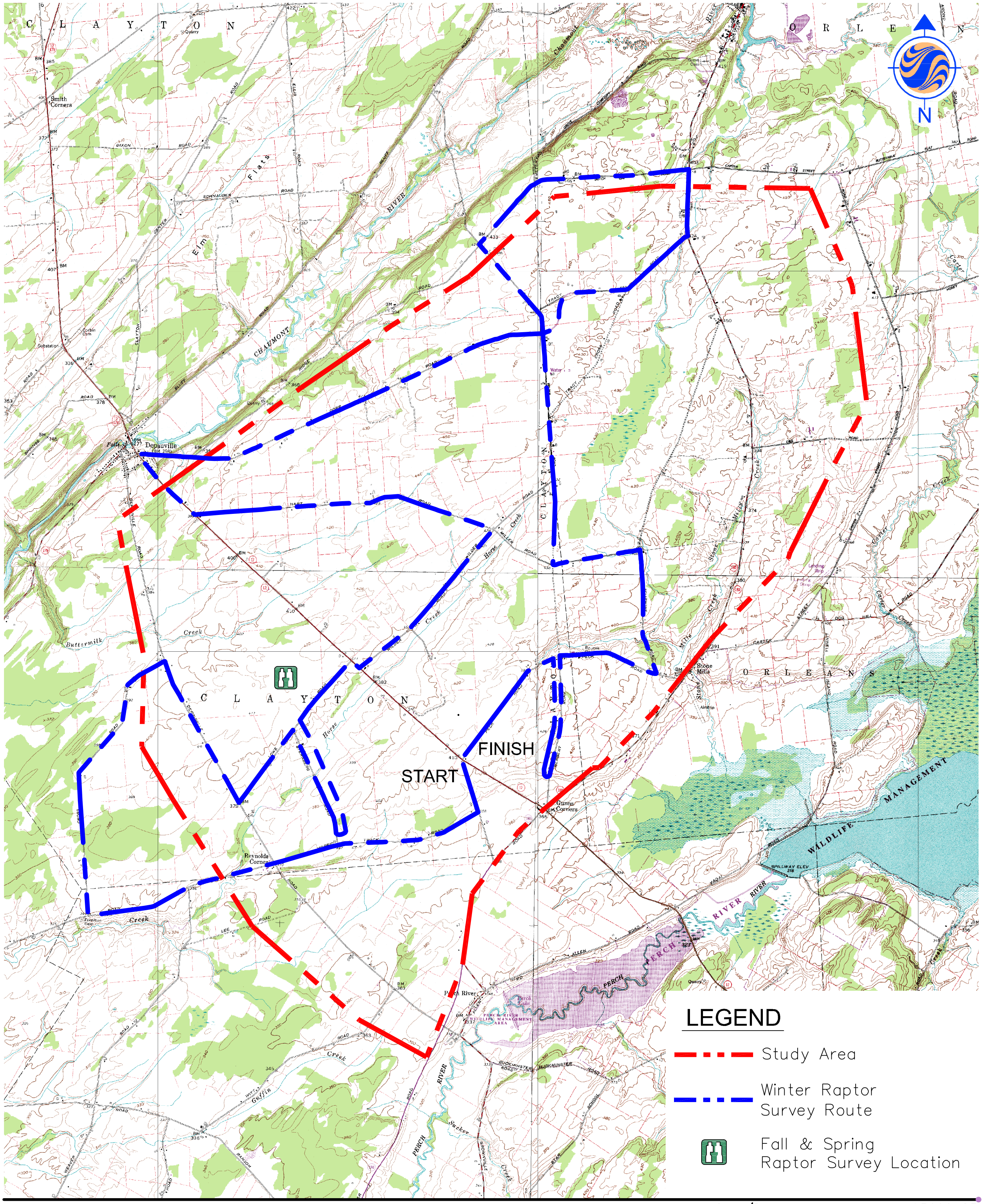
1.2 PROJECT AREA DESCRIPTION

The Project area is located within the Eastern Ontario Plain ecozone of New York (Andrle and Carroll 1988). This is a relatively flat region with open grasslands, patches of woodlands, and active agricultural fields, with elevation ranging from approximately 76 m to 152 m (250' to 500'). Forest communities in the area are dominated by American elm (*Ulmus americana*), red maple (*Acer rubrum*), and northern hardwoods on soils of lake sediments that overlie limestone bedrock. Lake Ontario, located 21 kilometers (km) (13 miles [mi]) west of the project area, helps moderate the local climate, resulting in the widespread development of agriculture.

The Project area is characterized mainly by agricultural areas but also includes managed and overgrown grasslands, residential areas, and fragmented woodlands, as well as emergent wetlands and streams associated with the Chaumont River, Horse Creek, and the Perch River. The Project area is bordered on its western edge by the Chaumont Barrens owned by The Nature Conservancy, a unique alvar landscape characterized by grasslands, shrub savannas, woodlands dominated by oak and hickory, and areas of limestone calcareous barrens with white spruce and white cedar. The southeastern boundary of the project is bordered by the Perch River Wildlife Management Area. The area is characterized by high quality wetlands, including open water, marsh, and forested wetlands (NYSDEC 2001).

The Project is located in an area that has been identified as important for a number of bird species. The National Audubon Society has designated three Important Bird Areas (IBAs) in the vicinity of the project, including Fort Drum, Perch River, and Point Penninsula IBAs. The Project area is within the Perch River IBA. An additional location under IBA consideration is the Jefferson County Grasslands (National Audubon Society 2008). The United States Fish and Wildlife Service (USFWS) has prepared a Land Protection Plan for the St. Lawrence Wetland and Grassland Management District in sections of Jefferson County due to the use of wetlands and grasslands by regionally rare bird species (USFWS 2006). Grassland habitats consisting of active and fallow agricultural fields are the most dominant habitat within the Project area, and the species and habitat assemblages are very similar to those in the surrounding region. Despite their abundance in the area, these habitats are generally limited in the Northeast. Many bird species that depend on grassland habitats are therefore relatively common in the Project area, but rare in the Northeast.

Raptor movement in the vicinity of the Project area tends to be most concentrated in the spring, as raptors move northeast along the southern shoreline of the Great Lakes. During the fall, the raptor migration flight corridor tends to be located further east, and fewer raptors are expected to migrate near the eastern shoreline of Lake Ontario. Golden eagle migration follows the same geographic pattern as general raptor migration, but tends to occur near the end of the fall raptor migration period (late October through early December) and near the beginning of the spring raptor migration period (March and April).



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Client/Project 195600123

Horse Creek Wind Project
Clayton, New York

Figure No.
Figure 1

Title
Raptor Survey
Location Map
November 20, 2008

2.0 Methods

2.1 FALL AND SPRING RAPTOR SURVEYS

Fall raptor surveys were conducted for 10 days from mid October to mid December 2007 and spring raptor surveys were conducted for 10 days from mid March to mid May 2008. Days following the passage of weather fronts or low-pressure systems were targeted. In both seasons, surveys were conducted from a flat hayfield in the eastern third of the Project area, the same site at which raptor migration surveys were conducted in 2005 (Figure 1). This site provided unobstructed views in all directions, except for very low-flying birds beyond the treeline bordering the hayfield's western edge.

Surveys were based on Hawk Migration Association of North America (HMANA) methods (HMANA 2007). Surveys were conducted from 9 am to 4 pm, during the peak hours of thermal development and raptor movement. During surveys, observers scanned the sky and surrounding landscape for raptors with binoculars and a spotting scope. Observations were recorded onto HMANA data sheets, which summarize the raptor count data by hour. Hourly weather observations, including wind speed and direction, temperature, percent cloud cover, and precipitation were recorded.

Detailed notes for each observation were recorded on separate datasheets and project area maps, including:

- The general flight path of each bird was drawn on topographic maps of the Project area,
- The minimum and maximum flight height for birds observed,
- An estimate of flight height for birds observed,
- The flight azimuth (in relation to true North), and
- Notes describing the general activity of the bird.

Flight height was categorized as less than or greater than 150 m (492') above ground (*directly below the bird*), the maximum height of the proposed turbines. Nearby objects with known heights, such as the met towers and nearby trees, were used to gauge flight height.

Information regarding each bird's flight behavior (indirect verses direct flight path) and tendency to remain within the same location throughout the study period was noted in order to attempt to differentiate between migrant and resident birds.

Birds that flew too rapidly or were too far to accurately identify were recorded as unidentified to their genus or, if the identification of genus was not possible, unidentified raptor. Priority was given to raptor observations; however observers collected incidental data for other avian species observed including passerines and water birds.

The raptor observation data was summarized by survey day and for the entire survey period. Analysis included a summary of:

- The total number of individuals per species observed for each survey day and for the entire survey period,
- The daily passage rate (birds per hour) was calculated for each survey day as well as for the entire spring survey period,
- The hourly observation totals per species, and
- The total number of individuals observed flying above or below 150 m (494').

2.2 WINTER RAPTOR SURVEYS

Winter raptor surveys were conducted from January to March 2008. Daytime surveys were modeled after the HMANA winter raptor protocol and the NYSDEC's *Draft Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects*. The project area was surveyed three days in January and six days in February 2008. Surveys were conducted during periods from mid-morning to mid-afternoon. Generally, two survey periods were conducted during each survey day. Additionally, roadside diurnal raptor surveys targeted periods of fair weather and good visibility.

During roadside surveys, the surveyor drove slowly (10 to 25 miles per hour) on roads within and adjacent to the project area. Figure 1 highlights the roads that were driven during the three different site visits. All roads of the project area were driven during each survey period and all roads were searched at least twice during each monthly visit. In general, 65 km (40 mi) were targeted per each diurnal raptor survey period. The surveyor would stop along the route to scan fields and woodlot borders with binoculars. When a raptor was observed, a Global Positioning System (GPS) reading was taken; the time, species, number of individuals, the morph (when applicable), and behavioral notes were then documented[1]. Incidental observations of other avian species, including songbirds and waterfowl, seen within the project area were documented and particular attention was given to State-listed species or large flocks of any species.

In order to better assess the potential of wintering bald eagle in the area, observers also visited the Perch River State Game Management Area during varying times of day to scan over the water and surrounding trees for the presence of eagles and evidence of breeding and foraging habitat.

Raptor observations made during each survey period were totaled and the number of raptors observed per miles surveyed was calculated. The locations of each raptor observation were mapped and categorized according to vegetative cover type and frequency of occurrence. Relative abundance and species richness in various habitat types was also calculated.

[1] Due to the non-stationary location of the observer, flight height estimates would have been inaccurate and, therefore, were not made when raptors were observed in flight.

The locations of each raptor observation were mapped and categorized according to the day during which they were observed.

2.3 TARGETED SHORT-EARED OWL SURVEYS

Crepuscular surveys were conducted during the same period as winter raptor surveys and were modeled after the HMANA winter raptor protocol and the NYSDEC's *Draft Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects*. The project area was surveyed on the same days as winter raptor surveys, including three days in January and six days in February 2008. Surveys were conducted during periods at dusk. Short-eared owl surveys targeted periods of fair weather with good audibility (and visibility for the remaining daylight). Incidental observations of other species of owls were recorded.

All short-eared owl surveys involved call playback techniques to aid detections. Short-eared owl surveys were conducted in areas that had prior observations of short-eared owls and in preselected potential short-eared owl habitat. Transects were established in these areas and GPS points were selected in 200-meter intervals throughout the potential habitat. The short-eared owl calls were broadcast at each point for three repetitions over a five-minute period before moving 200 meters to the next point and repeating the playback method. Any owl pellets found on the ground during or between points were noted in field datasheets.

2.4 AVAILABLE REGIONAL RAPTOR AND OWL DATA

For fall and spring migration surveys, observations from the Project were compared to seasonal data from local or regional HMANA hawk watch sites available at http://hawkcount.org. The regional sites included for comparison in the fall are Franklin Mountain, New York; Hawk Mountain, Pennsylvania; Waggoner's Gap, Pennsylvania; Metro Park, Michigan; Hawk Cliff, Ontario; and Holiday Beach, Ontario. The regional hawk watch sites included for comparison in the spring are Braddock Bay, New York; Derby Hill, New York; Hamburg, New York; and Barre Falls, Massachusetts. Also provided for comparison, are the results of available regional surveys conducted at other proposed wind facilities located in New England.

For winter raptor surveys, information from the Audubon Society's Christmas Bird Count (CBC) from 2008 was referenced for locations near the Horse Creek project area to provide information on species occurrence and habitat use for wintering raptors in the surrounding region. The Audubon's CBC is conducted annually in late-December and early January. Recent surveys have included three locations in the area surrounding the project area. Watertown (11.5 mil southwest from the center of the project area), Thousand Islands (12.4 m north), Massena (80.1 m) (National Audubon Society 2008). During the CBC, multiple observers survey a 24 km (15 mi) diameter circle around a location center. All avian species seen or heard within the count circle are documented.

3.0 RESULTS

3.1 FALL 2007 RAPTOR MIGRATION SURVEYS

Surveys were conducted on ten days from October 21 and December 19, 2007 with a total of 66 survey hours. Most surveys were conducted on clear days allowing for optimal visibility. Temperatures ranged from -15 °C to 17 °C across the season. Wind speeds ranged from calm to 6 mph. Wind direction and visibility was variable throughout the season

Daily count totals ranged from 2 raptors on December 10 to 15 raptors on October 22 (Figure 2). A total of 65 raptors representing nine species[2] was observed during the survey period (Figure 3), yielding an overall observation rate of 0.98 birds/ hour (Appendix A, Table 1). Turkey vultures (*Cathartes aura)* were the most abundant species observed (n=31) and composed approximately 50 percent of all observations, followed by red-tailed hawk (*buteo jamaicensis)* (n=21). The number of observations peaked between 12 pm and 2 pm (Figure 4, Appendix A, Table 2). As raptors were observed, flight heights were categorized as below or above 150 m (492'), the approximate maximum height of the proposed turbines. Eighty-three percent (n=54) of all raptors were observed at heights less than 150 m (492') for at least some portion of their flight path (Figure 5; Appendix A, Table 3)

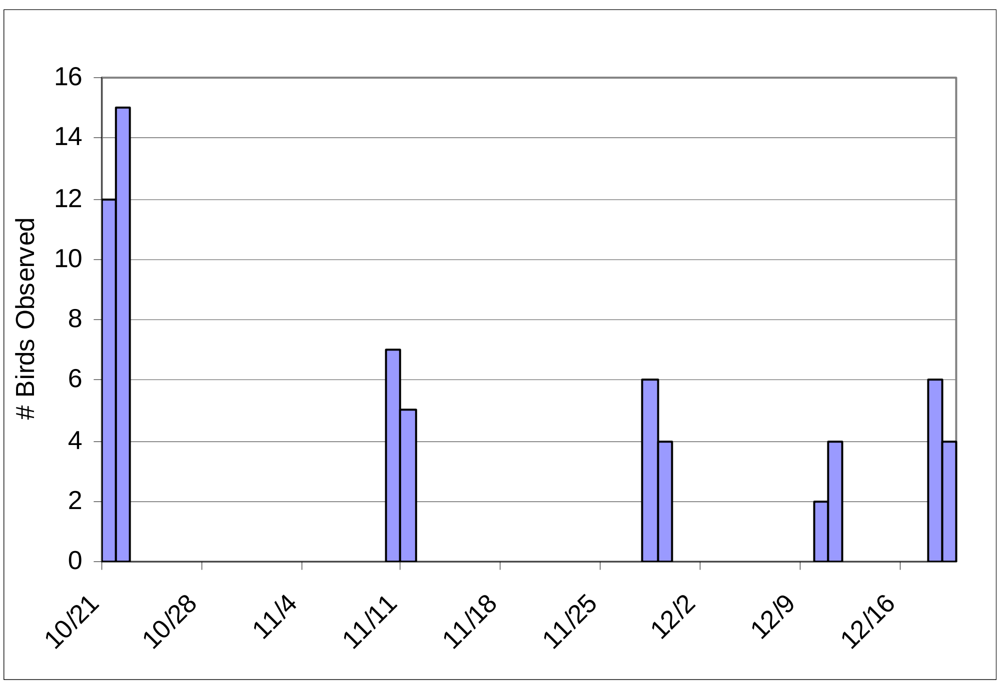

Figure 2. Total number of raptors observed per survey day – fall 2007

[2] While turkey vultures are not phylogenetically considered true raptors, they are diurnal migrants that exhibit flight characteristics similar to *Buteos, Accipiters* and other *Falconiformes* species, therefore vultures are typically included during hawk watch surveys.

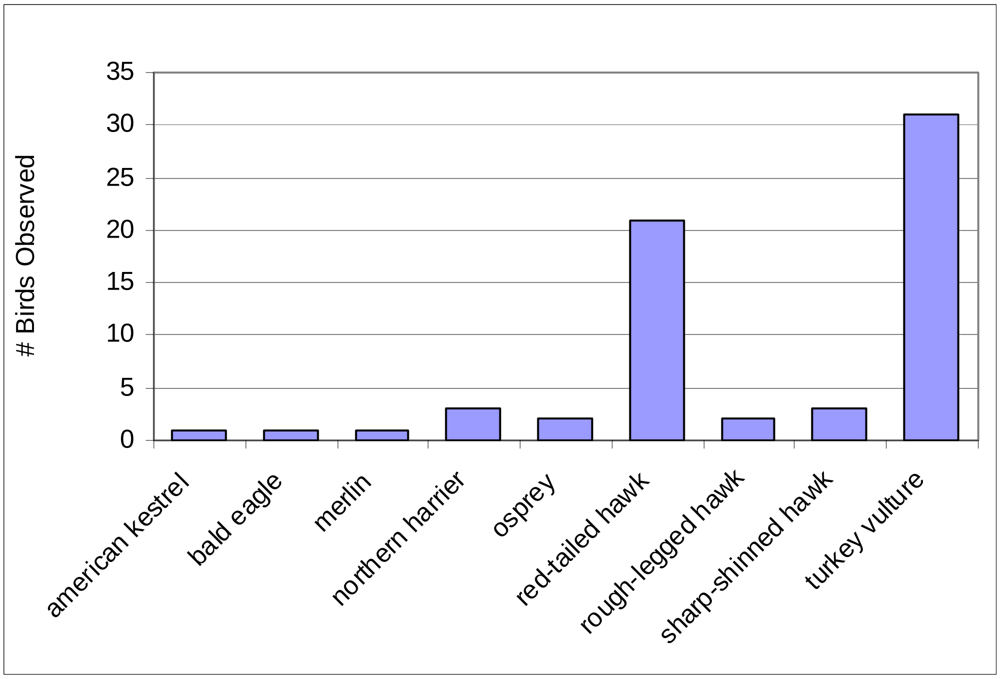

Figure 3. Number of raptors observed, by species – fall 2007

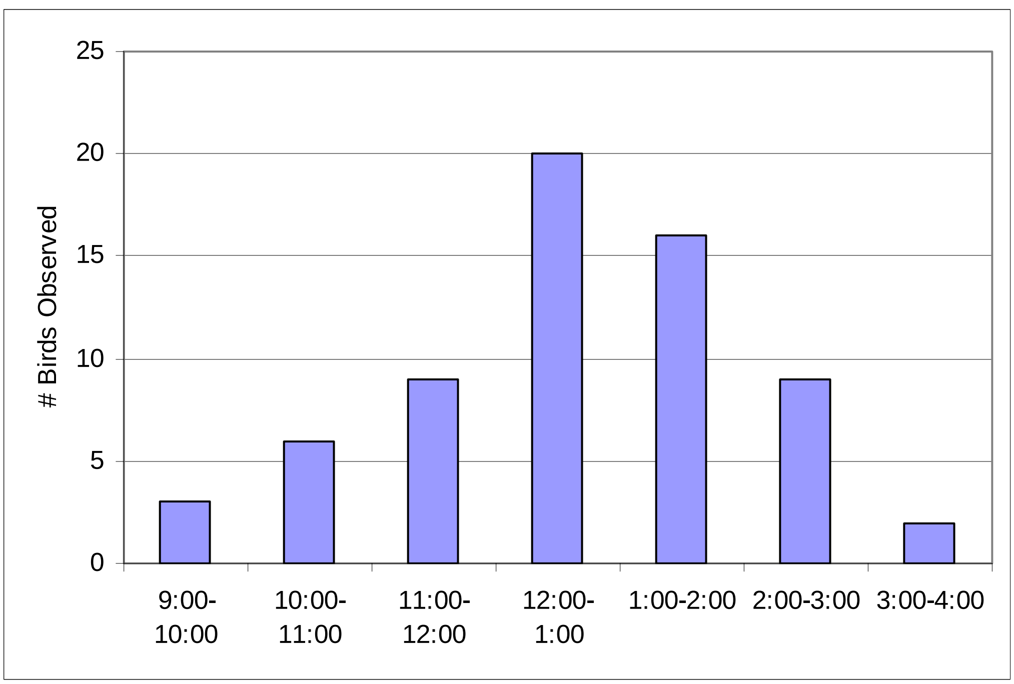

Figure 4. Number of raptors observed per survey hour – fall 2007

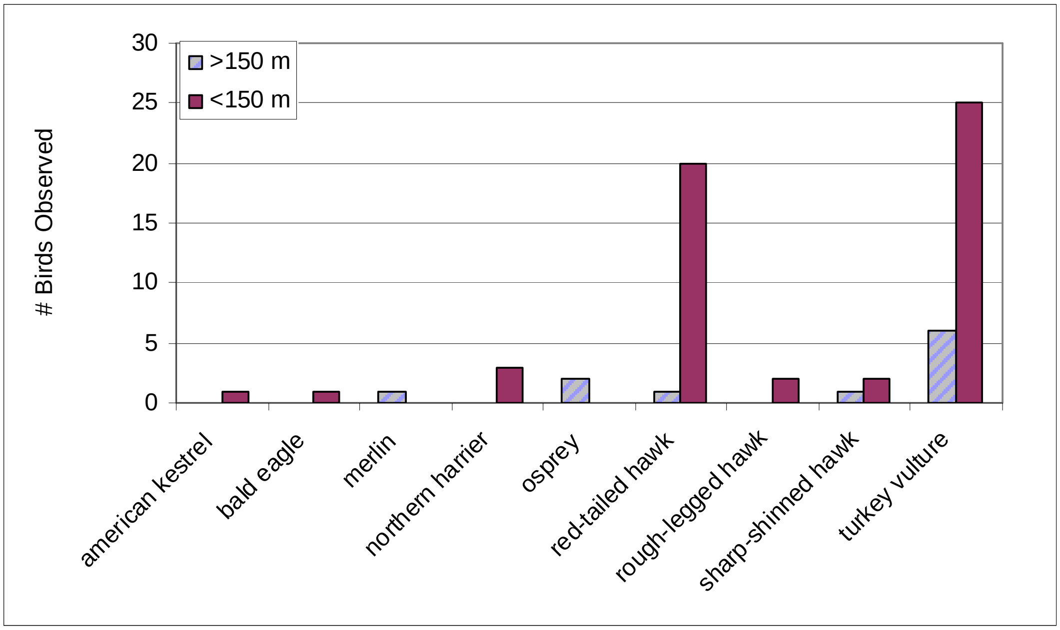

Figure 5. Raptor flight height distribution through the Project area – fall 2007

Three state-listed species were observed, including one observation of bald eagle and three observations of northern harrier, both listed as Threatened in New York. There were also three observations of sharp-shinned hawk, a State Species of Special Concern. No golden eagles were observed during the survey period.

A total of 14 additional species of birds were observed incidentally during the raptor surveys. Appendix A, Table 4 lists the specific species observed.

3.2 WINTER 2008 RAPTOR SURVEYS

Surveys were conducted on nine days from January 16 and February 27, 2008 with a total of 49.5 survey hours during survey periods from mid-morning to mid-afternoon. A total of 618 km (364 mi) were surveyed. Survey effort and weather conditions are summarized in Appendix B Table 1. Cloud cover during the surveys ranged from 30 to 100 percent. During five survey days, there was no precipitation; during four survey days there were flurries or snow. Visibility during the surveys was generally 10 to 39 km (6 to 24 miles). However, during the four days with snow, visibility was reduced to between 3 and 10 km (2 and 6 mi). Snow cover was generally 3 to 5 inches during the January surveys and 5 to 12 inches during the February surveys. Temperatures ranged from -17 to 2°C during the surveys. Winds speeds during the surveys ranged from 0 to 20 mph. Wind direction was primarily from the south to west, although there were two days during late January when winds were from the north.

Daily count totals ranged from 5 raptors to 16 raptors (Figure 6) A total of 68 diurnal raptors were observed (some observations represent individuals seen previously), yielding an overall observation rate of 1.37 birds/hour (Appendix B Table 2). An additional purpose of winter surveys was to characterize raptor frequency, abundance, and overall density. The raptor density was 0.19 raptors per mile, with the greatest number of raptors per miles surveyed observed on February 14 (0.40 raptors per mile). Five species of raptors were observed in the project area, including red-tailed hawk, rough-legged hawk, Cooper's hawk (*accipter cooperii)*, northern harrier, and American kestrel (*falco sparverius)* (Figure 7)*.* Of these species, northern harrier is listed as Threatened in New York and Cooper's hawk is listed as a Species of Special Concern. The majority of raptors were observed on days with south or southwest winds; the peak day (n=16) occurred on February 14 when winds were from the south (Figure 6, Appendix B Table 1).

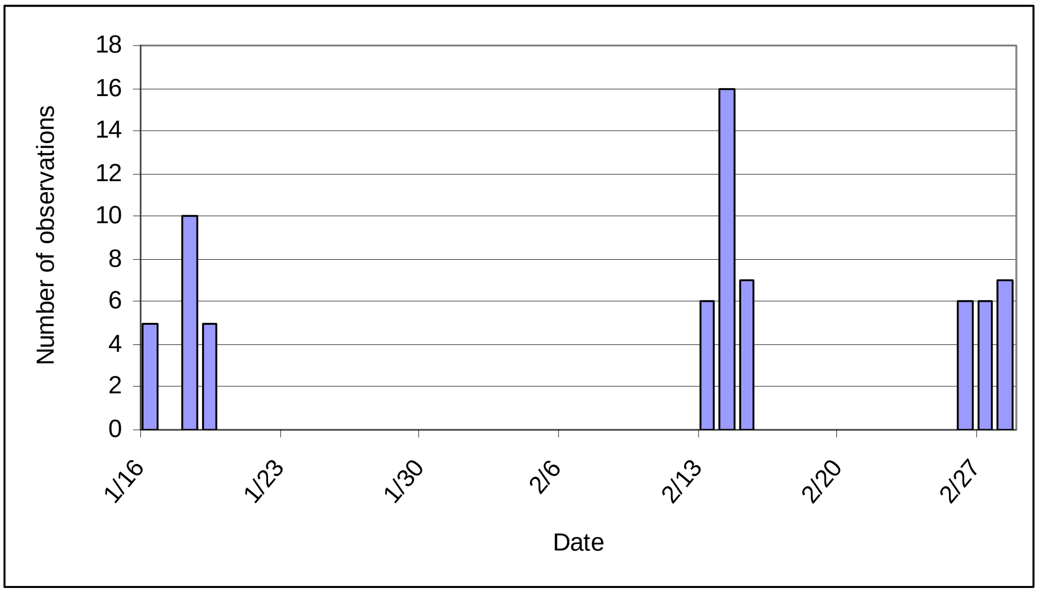

Figure 6. Total number of raptors observed per survey day – winter 2008

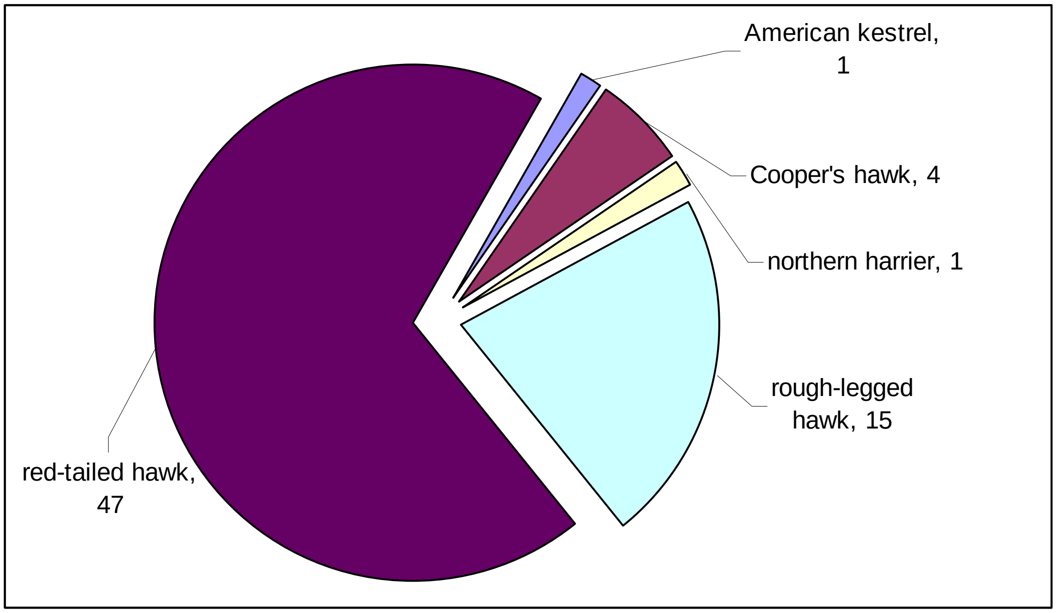

Figure 7. Species composition of raptors observed – winter 2008

Raptor observations occurred throughout the project area in various habitats during the January and February survey periods. Species richness was greatest in old field habitat, where four of the species were observed (Figure 8, Appendix B Table 3).

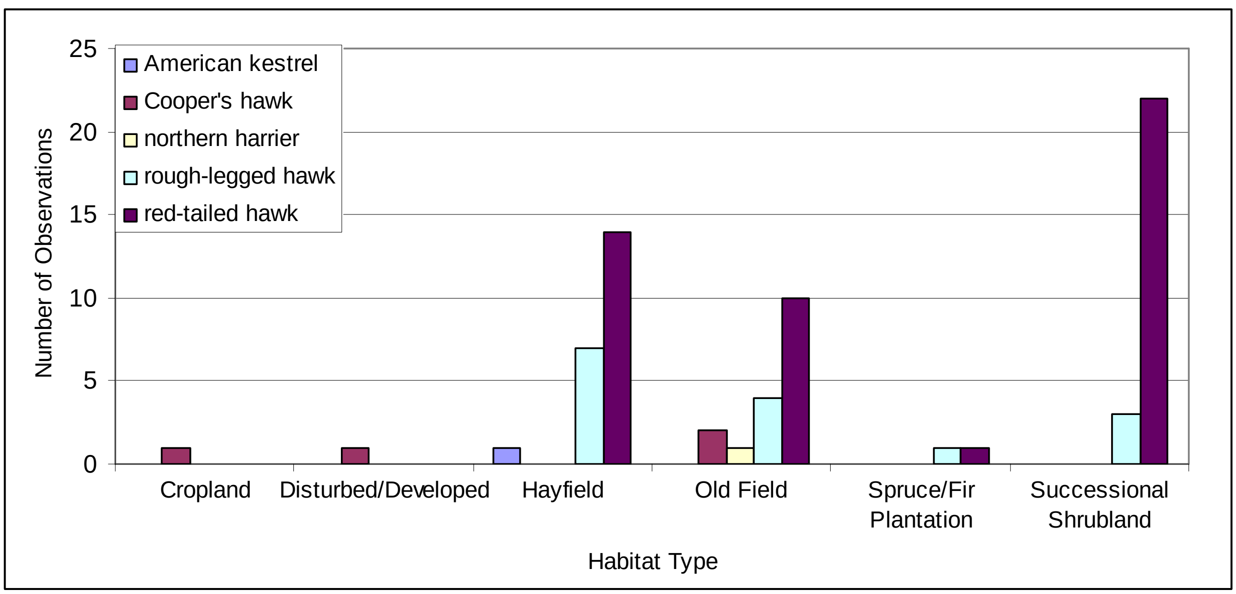

Figure 8. Raptor frequency in various habitats within the Project area – winter 2008

Frequency of Red-tailed hawks was 67% and relative abundance was 0.87 (raptors per habitat type per visit). Forty-six percent (n=22) of red-tailed hawk observations occurred in successional scrubland, thirty percent (n=14) occurred in hayfields and twenty-one percent (n=10) occurred in old fields. Only one red-tailed hawk was observed in a spruce-fir plantation. Frequency of rough-legged hawk was sixty-seven percent and relative abundance was 0.27.

Forty-seven percent (n=7) rough-legged hawks were observed in hayfields, twenty-seven percent (n=4) occurred in old fields, and twenty percent (n=3) were observed in successional shrublands. Only one rough-legged hawk was observed in a spruce-fir plantation. Two of the four observations of Cooper's hawks occurred in old field habitat, one occurred in cropland and the other was found diving at a mourning dove at a backyard feeder. The only American kestrel was observed perched adjacent to a hayfield. The Northern harrier was observed in old field habitat.

3.3 TARGETED SHORT-EARED OWL SURVEYS

Portions of the project area are characterized by suitable owl habitat, including the short-eared owl's preferred habitat which consists of open, shrubby areas adjacent to woodlots. However, no owl species were detected in the project area during the winter 2008 surveys. Most species of owl in the region are generally active at night and are difficult to detect during crepuscular and daytime surveys. The owl species that are known to be active at crepuscular periods, snowy owl and short-eared owl, were not detected during the surveys. An increased effort was made to detect short-eared owl. A short-eared owl call playback survey was conducted off the Hart Road and Chaumont Barrens (Figure 1), and in areas representing suitable habitat, at dawn. Although conditions were windy during two surveys, broadcasted recordings of calls elicited no response from any short-eared owls.

3.4 SPRING 2008 RAPTOR MIGRATION SURVEYS

Surveys were conducted on ten days from March 15 through May 13, 2008 with a total of 77 survey hours. Most surveys were conducted on clear days allowing for optimal visibility. Temperatures ranged from -3 °C to 34 °C across the season. Wind speeds ranged from calm to 28 mph.

Daily count totals ranged from 3 raptors on March 15 to 88 raptors on April 3 (Figure 9). A total of 225 raptors representing ten species was observed during the survey period (Figure 10), yielding an overall observation rate of 2.9 birds/hour (Appendix C, Table 1). Turkey vultures were the most abundant species observed (n=79), followed by northern harrier (n=43) and red-tailed hawk (n=39). The number of observations was relatively consistent throughout the day (Figure 11, Appendix C, Table 2). As raptors were observed, flight heights were categorized as below or above 150 m (492'), the approximate maximum height of the proposed turbines. Eighty-two percent (n=184) of all raptors were observed at heights less than 150 (492') for at least some portion of their flight path (Figure 12, Appendix C, Table 3).

Four state-listed species were observed, including one observation of golden eagle, listed as Endangered in New York, as well as five observations of bald eagle and 43 observations of northern harrier, both listed as Threatened in New York. There were also four observations of sharp-shinned hawk, a State Species of Special Concern.

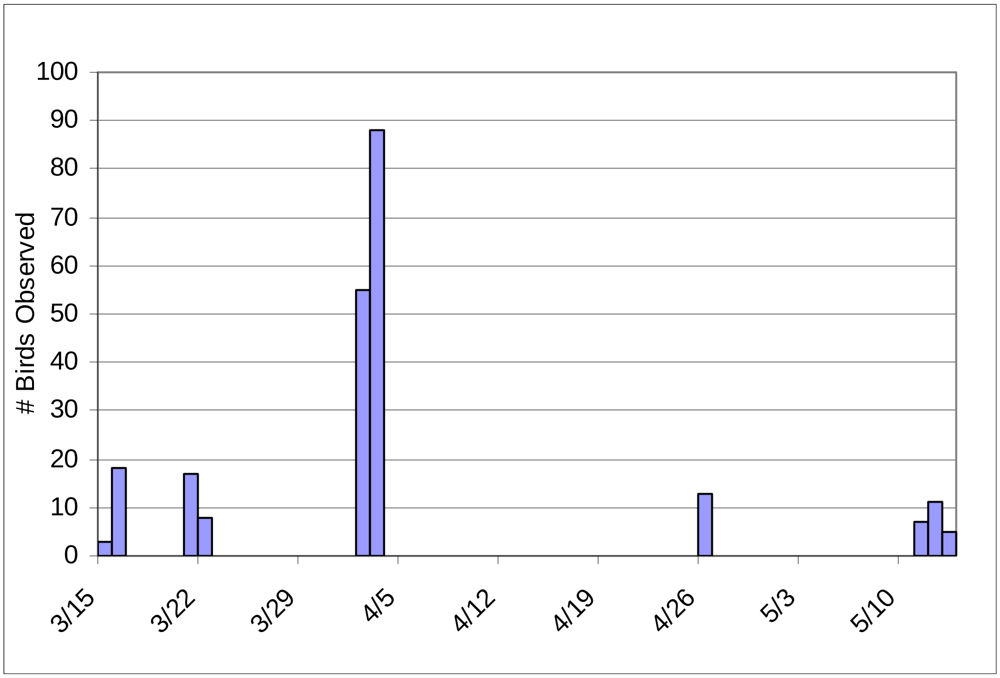

Figure 9. Total number of raptors observed per survey day – spring 2008

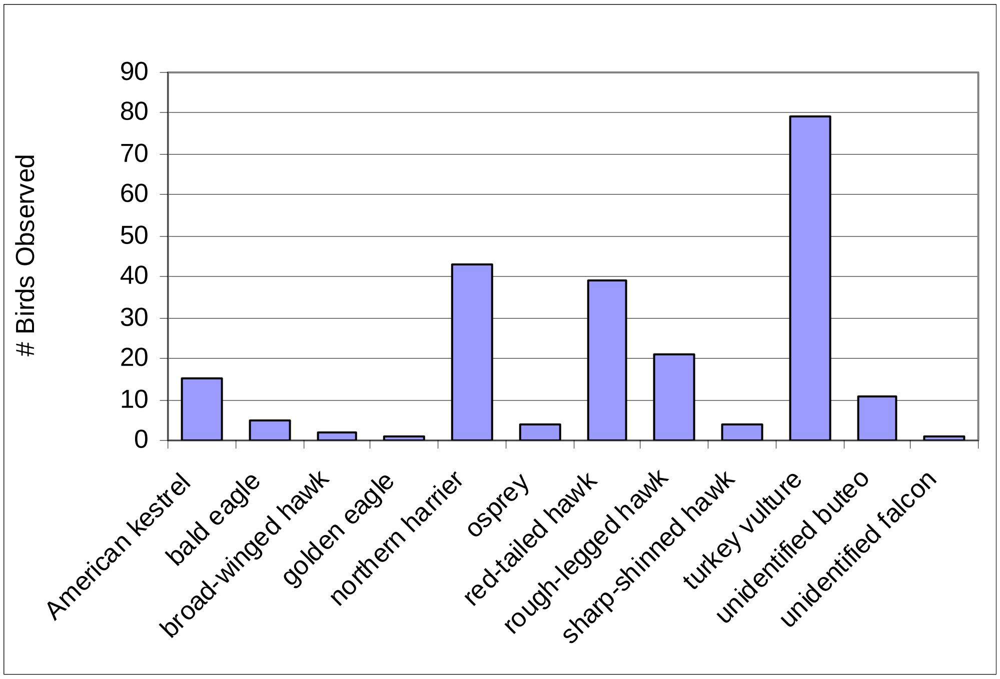

Figure 10. Number of raptors observed, by species – spring 2008

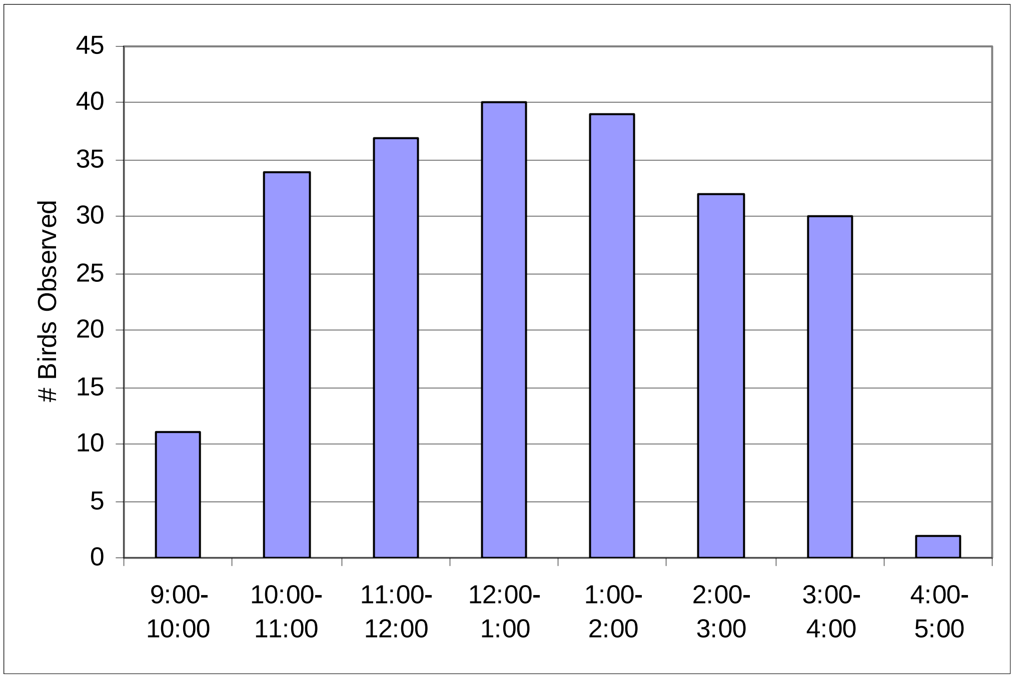

Figure 11. Number of raptors observed per survey hour – spring 2008

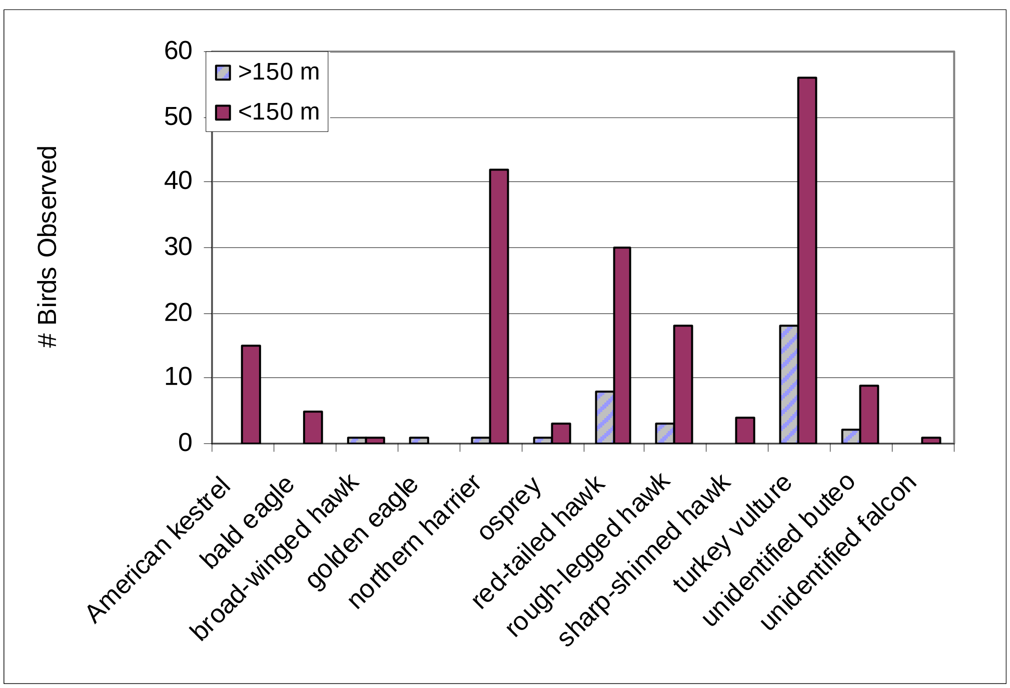

Figure 12. Raptor flight height distribution through the Project area – spring 2008

A total of 19 additional species of birds were observed incidentally during the raptor surveys. Appendix C, Table 4 lists the specific species observed.

4.0 DISCUSSION

Surveys were conducted from October 2007 to May 2008 to document raptor presence in the Project area, including passage rate and species composition, with a particular focus on State-listed species observed during previous surveys. Across the three seasons of surveys, a total of 358 raptors, representing 12 species were observed.

During the winter, the severity of the winter and availability of food dictates the annual distribution and densities of raptors in the region. Five species of raptor were observed in the Project area from January to March 2008. Red-tailed hawks were the most commonly observed species, and were typically found in successional scrubland habitats. No observations of golden eagle, bald eagle, or short-eared owl were documented during the winter surveys. Results from the winter survey can be compared with recent Audubon Christmas Bird Count surveys, which documented 18 different species of raptors and owls wintering in the region surrounding the project area (Appendix B, Table C), including State-listed species such as bald eagle, northern harrier, sharp-shinned hawk, Cooper’s hawk, and short-eared owl.

During raptor migration, flight pathways and flight heights along ridges, side slopes, and across valleys may vary seasonally, daily, or hourly. Raptors may shift and use different ridgelines and cross different valleys from year to year or season to season. Weather and wind are major factors that influence migration paths as well as flight heights. Wind strongly affects the propensity of raptors to congregate along ‘leading lines’ or topographic features (Richardson 1998). Wind, air temperature, and cloud cover influence the development of updrafts and thermals used by raptors while making long-distance flights.

Results from the fall 2007 and spring 2008 migration surveys can be compared to past surveys at the same location, surveys at HMANA hawk watch sites conducted during the same season, and publicly-available results of surveys conducted at other proposed wind projects in the region.

Compared to surveys conducted during 2005, the passage rates documented in fall 2007 and spring 2008 were significantly lower, although trends in species composition and flight height were similar (Table 1).

Table 1. Summary of survey results during four migration seasons

	Spring 2005	**Spring 2008**	**Fall 2005**	**Fall 2007**
Timeframe	Mar 30-May 7	Mar 15-May 13	Sep 9-Oct 16	Oct 21-Dec 19
Passage rate (birds/hour	12.1	2.9	9.1	0.98
# of Observations	700	225	575	65
# of Species	14	10	13	9
Most common species	turkey vulture (37%), broad-winged hawk (36%)	turkey vulture (35%), northern harrier (19%)	turkey vulture (68%), red-tailed hawk (14%)	turkey vulture (50%), red-tailed hawk (32%)
% Flight height below 150 m	61%	82%	89%	83%

Passage rates in the Project area are generally lower than those documented at HMANA hawk watch sites during the same timeframes. In the fall 2007 survey period, the passage rate was 0.98 birds/hour, which is low compared to passage rates recorded at fall 2007 HMANA hawk watch sites in the region, which ranged from 6.4 (Barre Falls, Massachusetts) to 261.4 (SMRR Lake Erie, Michigan) birds/hour (Appendix A Table 5). In the spring 2008 survey period, the passage rate was 2.9 birds/hour, which was also low compared to passage rates recorded at spring 2008 HMANA hawk watch sites in the region, which varied between 5.5 birds/hr (Blueberry Hill, Granville, Massachusetts) and 149.1 birds/hr (Braddock Bay, Hilton, New York), with an average passage rate of 46.7 birds/hr (Appendix C, Table 5).

It should be noted that visibility and topographic features in the Project area generally vary from those at HMANA sites; these factors can influence the results of observed passage rates at hawk watch sites. The HMANA survey methods differ to some extent from survey methods conducted at proposed wind sites in that 1) flight heights are not gauged during HMANA surveys, and 2) HMANA surveyors often do not count birds believed to be resident. These factors should be considered when interpreting the results of the spring and fall surveys.

Also available for comparison are results from publicly available spring and fall raptor surveys conducted from 1999 to 2006 with similar levels of effort for other proposed wind projects in the region. Passage rates observed in the project area are generally similar, although raptor activity in the Project area during spring 2008 was among the higher passage rates observed in the region in recent years. Seasonal fall passage rates among these sites range from 3.0 (Clinton County, New York; open agriculture) to 12.72 (Deerfield, Vermont; forested landscape) birds/hour (Appendix A Table 6). Seasonal spring passage rates among these sites ranged from 0.9 (Deerfield Vermont; forested ridge) to 25.6 (Westfield, New York; Great Lakes Shore) birds/hr (Appendix C Table 6).

During previous raptor migration surveys conducted in spring and fall 2005, nine State-listed species were observed. Five of these same species were observed during surveys in fall 2007 and/or spring 2008 (Table 2), and two additional species were only observed during the winter survey period.

Table 2. Observations of State-listed species during four migration seasons

Species	State Status	Spring 2005	Spring 2008	Fall 2005	Fall 2007
golden eagle	Endangered	2	1	1	--
peregrine falcon	Endangered	3	--	5	--
bald eagle	Threatened	2	5	4	1
northern harrier	Threatened	14	43	31	3
Cooper's hawk	Special Concern	1	--	9	--
osprey	Special Concern	8	4	5	2
red-shouldered hawk	Special Concern	3	--	--	--
sharp-shinned hawk	Special Concern	25	4	17	3

-- indicates species not observed during this season

The five State-listed species were observed during multiple timeframes from October 2007 to May 2008:

One golden eagle (State Endangered) was observed in mid March. There were no other Endangered species observed during the three survey timeframes.

Bald eagles (State Threatened) were observed during the fall and spring seasons. One individual was observed in mid December and four were observed in mid March.

Short-eared owls (State Endangered) were not observed.

Northern harriers (State Threatened) were observed during all three survey timeframes. During the winter survey, northern harriers were observed only during the February surveys. During the spring survey, northern harriers were the second most commonly observed species.

Cooper's hawks (State Special Concern) were observed during the winter season only.

Ospreys (State Special Concern) were observed during both the fall and spring seasons. In the fall, two observations occurred in early November and in the spring, all four observations occurred on the same day in early April.

Sharp-shinned hawks (State Special Concern) were observed during the fall and spring seasons. In the fall, three observations occurred across two days in mid November, and in the spring, all four observations on the same day in early April.

During fall 2007 and spring 2008, flight heights of raptors observed in the Project area suggest that migrating raptors occur within the zone of the blade-swept area of the proposed turbines. During both fall and spring surveys, approximately 80 percent of raptors were observed below 150 m (492') for at least a portion of their flight through the Project area. This trend was also observed during earlier surveys in 2005. Among the data available from proposed wind sites in the east, it has generally been the trend that the majority of raptors observed have been below the height of the proposed turbines (Appendix A Table 6; Appendix C, Table 6); the range of birds below the towers has been between 18 to 83 percent. Variations in flight heights are due to the particular flight behaviors of different raptor species, as well as daily weather conditions. Typically, *accipiters* and falcons use up-drafts from side slopes to gain lift and, therefore, usually fly low over ridgelines. *Buteos* tend to use lift from thermals that develop over side slopes and valleys and tend to fly high during hours of peak thermal development. Raptors (*accipiters* in particular) typically fly lower than usual during windy or inclement conditions. Resident birds may fly at lower altitudes while making small scale movements between foraging locations (Barrios & Rodriguez, 2004).

Although the greater occurrence of migrants within the zone of the proposed rotor blades increases the potential for migrating raptors to come into the vicinity of the proposed turbines, raptor mortality in the United States, outside of California, has been documented to be relatively low. For example, mortality rates found at onshore wind developments, outside of Altamont Pass in California, have documented 0 to 0.07 fatalities/turbine/year from 2000-2004 (GAO 2005). A more recent study at the Maple Ridge Wind Power facility in New York also documented low raptor mortality. A single American kestrel was found during the 2006 study which surveyed 50 of 120 operational turbine sites (Jain *et al* 2007). The second year of monitoring at 64 of 195 turbines at Maple Ridge documented at total of 6 raptors (including those found incidentally and not during standard surveys), 1 sharp-shinned hawk and 5 red-tailed hawks (Jain *et al.* 2008). Of the 96 total birds found during Year 2 monitoring at Maple Ridge (including birds found during and not during standard searches), raptors represented 6 percent (Jain *et al*. 2008). Several other studies that have been conducted in the U.S. recently have documented few raptor fatalities and few more than 20 fatalities have been reported at more than a dozen sites surveyed in recent years (Osborn *et al*. 2000, Johnson *et al*. 2002, Kerlinger 2002, Young *et al*. 2003, Erickson *et al*. 2000, Kerlinger 2006, Erickson *et al*. 2002, Johnson *et al*. 2003, Kerns and Kerlinger 2004, Arnett *et al*. 2005, Koford *et al*. 2005, Fiedler *et al*. 2007, Jain *et al*. 2007, Jain *et al.* 2008).

Studies have documented high raptor collision avoidance behaviors at modern wind facilities (Whitfield and Madders 2006; Chamberlain *et al.* 2006). As most raptors are diurnal, raptors may be able to visually, as well as acoustically detect turbines during periods of fair weather. Foraging raptors that may become distracted by prey or migrant raptors flying during periods of reduced visibility may be at increased risk of collision with wind turbines.

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Appendix A

Fall 2007 raptor survey results

Appendix A Table 1. Summary of daily observations by species – Fall 2007											
Species	10/21/07	10/22/07	11/10/07	11/11/07	11/28/07	11/29/07	12/10/07	12/11/07	12/18/07	12/19/07	Grand Total
american kestrel					1						1
bald eagle							1				1
merlin									1		1
northern harrier	3										3
osprey			1	1							2
red-tailed hawk	2	4	1	2	2	1	1	1	4	3	21
rough-legged hawk				2							2
sharp-shinned hawk	1	1				1					3
turkey vulture	6	10	5		3	2		3	1	1	31
Daily Totals	12	15	7	5	6	4	2	4	6	4	65

Appendix A Table 2. Summary of hourly observations by species – Fall 2007								
Species	9:00-10:00	10:00-11:00	11:00-12:00	12:00-1:00	1:00-2:00	2:00-3:00	3:00-4:00	Grand Total
american kestrel				1				1
bald eagle					1			1
merlin			1					1
northern harrier			1	2				3
osprey					1	1		2
red-tailed hawk		4	5	3	6	3		21
rough-legged hawk						2		2
sharp-shinned hawk	2				1			3
turkey vulture	1	2	2	14	7	3	2	31
Hourly Totals	3	6	9	20	16	9	2	65

Appendix A Table 3. Raptor flight altitudes by species – Fall 2007

Species	Greater than 150 m	Less than or equal to 150 m	Grand Total
american kestrel		1	1
bald eagle		1	1
merlin	1		1
northern harrier		3	3
osprey	2		2
red-tailed hawk	1	20	21
rough-legged hawk		2	2
sharp-shinned hawk	1	2	3
turkey vulture	6	25	31
Grand Total	11	54	65

Appendix A Table 4. Incidental Observations – Fall 2007
american crow
american robin
black-capped chickadee
blue jay
canadian goose
common raven
European starling
great blue heron
golden-crowned kinglet
house finch
pine grosbeak
rock pigeon
snow bunting
snow goose

Appendix C Table 5. Summary of Regional Fall 2007 (September to October) Migration Surveys*																								
Site Number	Location	Observation Hours	BV	TV	OS	BE	NH	SS	CH	NG	RS	BW	RT	RL	GE	AK	ML	PG	UA	UR	UB	UF	UE	TOTAL	BIRDS/ HOUR
1	Franklin Mountain, NY	181	0	16	84	31	23	225	43	2	7	1535	94	0	0	46	8	10	0	22	0	0	0	2,146	11.86
2	Hawk Mountain, PA	437	33	171	593	102	149	3660	481	1	29	7671	343	0	9	458	139	34	0	177	0	0	0	14,050	32.17
3	Waggoner's Gap, PA	395	0	487	516	173	184	6999	595	1	31	6087	396	0	13	289	99	60	0	98	0	0	0	16,028	40.55
4	SMRR Lake Erie, Metro Park, MI	434	0	59406	191	195	748	9739	507	2	424	69574	2704	4	34	1272	38	61	0	0	0	0	0	145,333	334.87
5	Hawk Cliff, ON	505.5	0	20393	207	365	2000	16412	499	23	641	41017	3344	10	64	4379	258	148	3	5	7	2	0	89,777	177.60
6	Holiday Beach, ON	453	0	29159	186	152	1073	12227	596	12	300	18400	1853	4	29	1608	104	86	2	6	25	4	0	65,826	145.31
* Data obtained from HMANA website.																									

Abbreviation Key:

BV - Black Vulture
TV - Turkey Vulture
OS - Osprey
BE - Bald Eagle
NH - Northern Harrier
SS - Sharp-shinned Hawk
CH - Cooper's Hawk
NG - Northern Goshawk
RS - Red-shouldered Hawk
BW - Broad-winged Hawk
RT - Red-tailed Hawk
RL - Rough-legged Hawk
GE - Golden Eagle
AK - American Kestrel
ML - Merlin
PG - Peregrine Falcon
SW - Swainson's Hawk
UR - unidentified Raptor
UB - unidentified Buteo
UA - unidentified Accipiter
UF - unidentified Falcon
UE - unidentified Eagle

Appendix A Table 6. Summary of publicly available fall raptor survey results conducted at proposed wind projects									
Project Site	**Survey Period**	**# of Survey Days**	**# of Survey Hours**	**Landscape**	**Total # Observed**	**# of Species Observed***	**Ave. Passage Rate (Raptors/Hr)**	**(Turbine Ht) % Raptors Below Turbine Height**	**Citation**
Fall 1996									
Searsburg, Bennington County, VT	9/11 - 11/3	20	80	Forested ridge	430	12	5.4	n/a	Kerlinger 1996
Fall 1998									
Harrisburg, Lewis County, NY	9/2 -10/1	13	68	Great Lakes plain/ADK foothills	554	12	8.1	n/a (47 m mean flight height)	Cooper & Mabee 2000
Wethersfield, Wyoming Cty, NY	9/2 - 10/1	24	107	Agricultural plateau	256	12	2.4	n/a (48 m mean flight height)	Cooper & Mabee 2000
Fall 2004									
Prattsburgh, Steuben Cty, NY	9/2- 10/28	13	73	Agricultural plateau	220	10	3.0	(125 m) 62%	Woodlot 2005b
Cohocton, Stueben, Cty, NY	9/2 - 10/28	8	41	Agricultural plateau	128	8	3.1	(125 m) 80%	Woodlot 2005u
Deerfield, Bennington Cty, VT (Existing Facility)	9/2 - 10/31	10	60	Forested ridge	147	11 for sites combined	2.5	(100 m) 9% for sites combined	Woodlot 2005c
Deerfield, Bennington Cty, VT (Western Expansion)	9/2 - 10/31	10	57	Forested ridge	725	11 for sites combined	12.7	(100 m) 9% for sites combined	Woodlot 2005c
Sheffield, Caledonia Cty, VT	9/11 - 10/14	10	60	Forested ridge	193	10	3.2	(125 m) 31%	Woodlot 2006a
Fall 2005									
Cohocton, Stueben, Cty, NY	9/7 - 10/1	7	40	Agricultural plateau	131	10	3.3	(125) 63%	Woodlot 2005u
Churubusco, Clinton Cty, NY	10/6- 10/22	10	60	Great Lakes plain/ADK foothills	217	15	3.6	(120 m) 69%	Woodlot 2005l
Dairy Hills, Clinton Cty, NY	9/11 - 10/10	4	16	Agricultural plateau	48	7	3.0	n/a	Young *et al.* 2006
Howard, Steuben Cty, NY	9/1 - 10/28	10	57	Agricultural plateau	206	12	3.6	(91 m) 65%	Woodlot 2005o
Fall 2005									
Munnsville, Madison Cty, NY	9/6 - 10/31	11	65	Agricultural plateau	369	14	5.7	(118 m) 51%	Woodlot 2005r
Mars Hill, Aroostook Cty, ME	9/9 - 10/13	8	43	Forested ridge	115	13	1.5	(120 m) 42%	Woodlot 2005t
Lempster, Sullivan County, NH	Fall 2005	10	80	Forested ridge	264	10	3.3	(125 m) 40%	Woodlot 2007c
Clayton, Jefferson Cty, NY	9/9 - 10/16	11	64	Agricultural plateau	575	13	9.1	(150 m) 89%	Woodlot 2005m
Fall 2006									
Stetson, Penobscot Cty, ME	9/14 - 10/26	7	42	Forested ridge	86	11	2.1	(125 m) 63%	Woodlot 2007b
Fall 2007									
Cattaraugus County, NY	*9/8 - 10/11*	*11*	*64*	*Forested ridge*	*125*	*10*	*1.96*	*(125) 71%; (150) 78%*	*n/a*

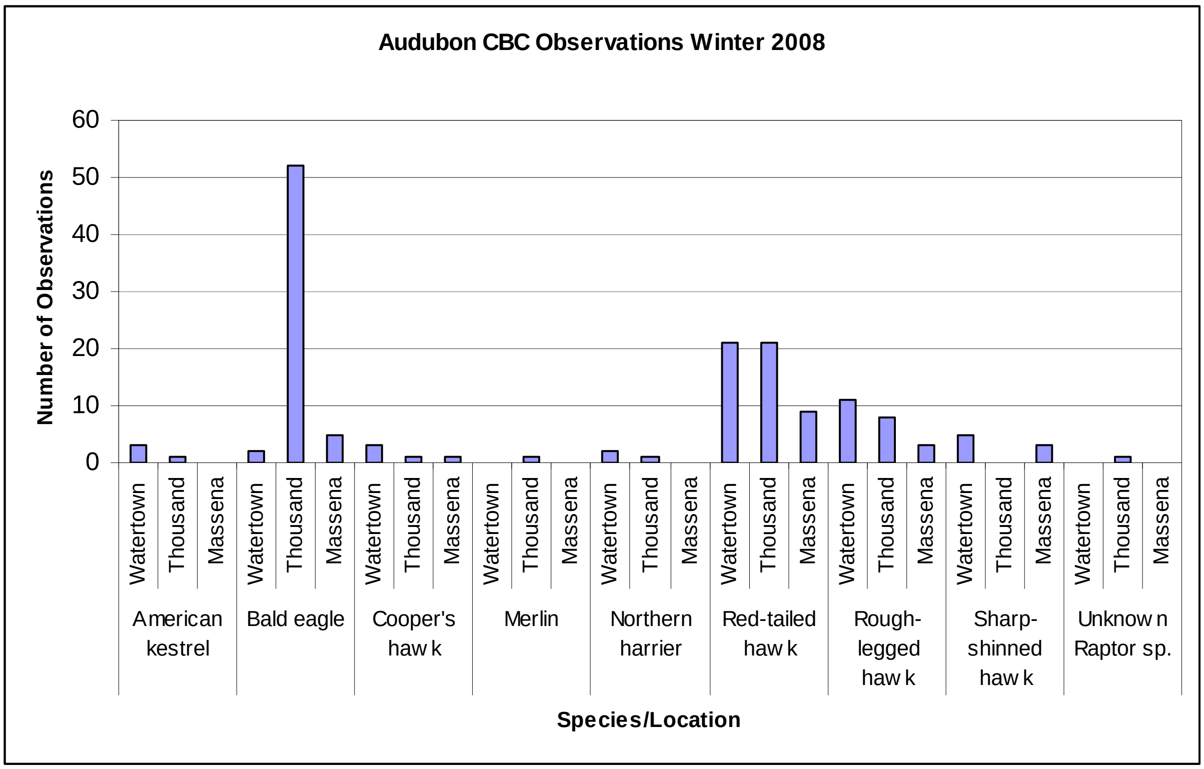
Appendix B

Winter 2008 raptor survey results

Appendix B. Table 1. Raptor species observed – Winter 2008*		
Species	**Number of observations**	**Percent of total observations**
American kestrel	1	1.5%
Cooper's hawk	4	5.9%
Northern harrier	1	1.5%
Rough-legged hawk	15	22.1%
Red-tailed hawk	47	69.1%
Total observations	**68**	**--**
*Total observations include sightings of birds that were seen previously in similar locations.		

Appendix B Table 2. Frequency of occurrence in various vegetative types within the project area						
Habitat Type	American kestrel	Cooper's hawk	northern harrier	rough-legged hawk	red-tailed hawk	Grand Total
Cropland		1				1
Disturbed/Developed		1				1
Hayfield	1			7	14	22
Old Field		2	1	4	10	17
Spruce/Fir Plantation				1	1	2
Successional Shrubland				3	22	25
Grand Total	1	4	1	15	47	68

Appendix B Table 3. Christmas Bird Count (CBC) Observations within vicinity of Project area - Winter 2008			
Species	**Watertown**	**Thousand Islands**	**Massena**
bald eagle	2	52	5
red-tailed hawk	21	21	9
northern harrier	2	1	0
rough-legged hawk	11	8	3
sharp-shinned hawk	5	0	3
Cooper's hawk	3	1	1
American kestrel	3	1	0
merlin	0	1	0
unknown raptor sp.	0	1	0
Totals	**53**	**90**	**21**



Appendix B Figure 1. CBC observations near the project area -Winter 2008

Appendix C

Spring 2008 raptor survey results

Appendix C Table 1. Summary of daily observations by species – Spring 2008

Species	3/15/08	3/16/08	3/21/08	3/22/08	4/2/08	4/3/08	4/26/08	5/11/08	5/12/08	5/13/08	Grand Total
American kestrel	1		1			7	3		2	1	15
bald eagle		3		1		1					5
broad-winged hawk						2					2
golden eagle		1									1
northern harrier	1	2	1	2	14	7	5	5	3	3	43
osprey						4					4
red-tailed hawk	1	3	4		3	25	2		1		39
rough-legged hawk		3	3	3	9	3					21
sharp-shinned hawk						4					4
turkey vulture		1	7	1	28	31	3	2	5	1	79
unidentified buteo		4	1	1	1	4					11
unidentified falcon		1									1
Daily Totals	3	18	17	8	55	88	13	7	11	5	225

Appendix C Table 2. Summary of hourly observations by species – Spring 2008									
Species	9:00-10:00	10:00-11:00	11:00-12:00	12:00-1:00	1:00-2:00	2:00-3:00	3:00-4:00	4:00-5:00	Grand Total
American Kestrel	3	4	1	1	2	2	1	1	15
bald eagle			1	1	3				5
broad-winged hawk			1		1				2
golden eagle							1		1
northern harrier	7	10	10	9	3	1	3		43
osprey			1		3				4
red-tailed hawk		4	5	11	6	7	5	1	39
rough-legged hawk		2	3	3	3	5	5		21
sharp-shinned hawk					1	3			4
turkey vulture	1	13	14	13	14	13	11		79
unidentified buteo		1	1	2	3	1	3		11
unidentified falcon							1		1
Hourly Totals	11	34	37	40	39	32	30	2	225

Appendix C Table 3. Raptor flight altitudes by species – Spring 2008				
Species	Greater than 150 m	Less than or equal to 150 m	Outside 1 km of observer	Grand Totals
American kestrel		15		15
bald eagle		5		5
broad-winged hawk	1	1		2
golden eagle	1			1
northern harrier	1	42		43
osprey	1	3		4
red-tailed hawk	8	30	1	39
rough-legged hawk	3	18		21
sharp-shinned hawk		4		4
turkey vulture	18	56	5	79
unidentified buteo	2	9		11
unidentified falcon		1		1
Grand Total	35	184	6	225

Appendix A Table 4. Incidental Observations – Fall 2007
American crow
american gold finch
american robin
bobolink
canadian goose
Eastern meadowlark
European starling
great blue heron
killdeer
red-winged blackbird
ring-billed gull
savannah sparrow
snow bunting
snow goose
song sparrow
swallow
tree swallow
vesper sparrow
wild turkey

Site Number	Year	Location	Observation Hours	BV	TV	OS	BE	NH	SS	CH	NG	RS	BW	RT	RL	GE	AK	ML	PG	SW	UR	UB	UA	UF	UE	MK	SK	TOTAL	BIRDS/ HOUR
Appendix C Table 5. Summary of Regional Spring (March - June) Migration Surveys*																													
1	2008	Braddock Bay, NY	422.5	2	18656	295	268	1207	5751	564	20	588	29093	5601	366	35	480	39	26	1	0	0	0	0	0	0	0	62,992	149.1
2	2008	Hamburg, NY	398.58	0	9812	92	24	48	423	116	2	118	2407	1052	16	3	67	10	3	0	17	58	11	3	1	0	0	14,283	35.8
3	2008	Derby Hill, NY	615.5	3	12894	712	339	792	4214	333	19	533	19825	5558	287	80	395	52	21	0	0	1	4	0	0	1	0	46,063	74.8
4	2008	Barre Falls, MA	134.25	0	115	51	13	6	123	7	3	23	313	115	2	0	34	2	0	0	16	0	0	0	0	0	0	823	6.1
* Data obtained from HMANA website.																													

Abbreviation Key:

BV - Black Vulture	GE - Golden Eagle
TV - Turkey Vulture	AK - American Kestrel
OS - Osprey	ML - Merlin
BE - Bald Eagle	PG - Peregrine Falcon
NH - Northern Harrier	SW - Swainson's Hawk
SS - Sharp-shinned Hawk	UR - unidentified Raptor
CH - Cooper's Hawk	UB - unidentified Buteo
NG - Northern Goshawk	UA - unidentified Accipiter
RS - Red-shouldered Hawk	UF - unidentified Falcon
BW - Broad-winged Hawk	UE - unidentified Eagle
RT - Red-tailed Hawk	MK - Mississippi Kite
RL - Rough-legged Hawk	SK - Swallow-tailed Kite

Appendix C Table 6. Summary of publicly available fall raptor survey results conducted at proposed wind projects

Project Site	Survey Period	# of Survey Days	# of Survey Hours	Landscape	Total # Observed	# of Species Observed*	Average Passage Rate (raptors/hr)	Range in Daily Passage Rates	(Turbine Ht) % Raptors Below Turbine Height	Citation
Spring 1999										
Wethersfield, Wyoming Cty, NY	April 20 - May 24	24	97	Agricultural plateau	348	12	3.6	n/a	n/a (23 m mean flight height)	Cooper and Mabee 2000
Spring 2003										
Westfield Chautauqua Cty, NY	April 16 - May 15	50	100.7	Great Lakes Shore	2,578	17	25.6	n/a	n/a (278 m mean flight height)	Cooper *et al.*2004
Spring 2005										
Churubusco, Clinton Cty, NY	Spring 2005	10	60	Great Lakes plain/ADK foothills	170	11	2.83	n/a	(120 m) 69%	Woodlot 2005a
Dairy Hills, Clinton Cty, NY	April 15 - April 26	5	20	Great Lakes shore	50	7	3	n/a	n/a	ED&R 2006b
Clayton, Jefferson Cty, NY	March 30 - May 7	10	58	Agricultural plateau	700	14	12.1	n/a	(150 m) 61%	Woodlot 2005b
Prattsburgh, Steuben Cty, NY	Spring 2005	10	60	Agricultural plateau	314	15	5.23	n/a	(125 m) 83%	Woodlot 2005u
Cohocton, Steuben Cty, NY	Spring 2005	10	60	Agricultural plateau	164	11	2.73	n/a	(125 m) 77%	Woodlot 2005u
Munnsville, Madison Cty, NY	April 5 - May 16	10	60	Agricultural plateau	375	12	6.25	n/a	(118 m) 78%	Woodlot 2005d
Sheffield, Caledonia Cty, VT	April - May	10	60	Forested ridge	98	10	1.63	n/a	(125 m) 69%	Woodlot 2006b
Deerfield, Bennington Cty, VT (Existing facility)	April 9 - April 29	7	42	Forested ridge	44	11 (for both sites combined)	1.05	n/a	(125 m) 83% (at both sites combined)	Woodlot 2005g
Deerfield, Bennington Cty, VT (Western expansion)	April 9 - April 29	7	42	Forested ridge	38	11 (for both sites combined)	0.9	n/a	(125 m) 83% (at both sites combined)	Woodlot 2005g
Spring 2006										
Lempster, Sullivan County, NH	Spring 2006	10	78	Forested ridge	102	n/a	1.3	n/a	125 m (18%)	Woodlot 2007c
Howard, Steuben Cty, NY	April 3 - May 19	9	52.5	Agricultural plateau	260	11	4.95	2.5-9.17	(125 m) 64%	Woodlot 2006d
Mars Hill, Aroostook Cty, ME	April 12 - May 18	10	60.25	Forested ridge	64	9	1.06	0-5.04	(120 m) 48%	Woodlot 2006g

Pre-Construction Over-winter
Diurnal Raptor and Short-eared Owl Surveys Study Plan
Horse Creek Wind Power Project
Jefferson County, New York

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November 15, 2010

WEST Inc.
Environmental & Statistical Consultants

NATURAL RESOURCES ◆ SCIENTIFIC SOLUTIONS

TABLE OF CONTENTS

INTRODUCTION AND BACKGROUND

Atlantic Wind, LLC a subsidiary for profit of Iberdrola Renewables, Inc. (Atlantic Wind) requested Western EcoSystems Technology, Inc. (WEST) prepare a study plan for over-winter diurnal raptor and short-eared owl surveys for the Horse Creek Wind Power Project, Jefferson County, New York. The study plan is designed to be consistent with New York State Department of Environmental Conservation (NYSDEC) information requests made as part of the Article 11 application process as well as NYSDEC Region 6 Grassland Bird Survey Protocol (Mazzocchi and Ross 2009).

The objectives of the surveys are to:

1. Determine winter presence, absence, and site use by rare, threatened or endangered (RTE) bird species such as northern harrier and short-eared owl within the Project.

2. Determine the use of other diurnal raptors and large birds observed during surveys within the Project.

3. Provide pre-construction use estimates and location information for comparison with post-construction surveys.

METHODS

Diurnal raptor surveys and short-eared owl surveys will be conducted weekly between November 15 – March 15. A total of 16 weekly rounds will be completed during the study period (no surveys will take place Christmas week or New Years week). Two survey methods will be used to determine presence and use of diurnal raptors and short-eared owl: 1) fixed-point bird use stations, and 2) driving surveys. In addition, any observations of raptors, owls or sensitive species made incidentally while field technicians are on-site will be recorded and mapped.

Fixed-point Surveys

A total of 18 survey points will arrayed at the Project: 11 survey points will be centered at proposed turbine locations and 7 survey points will be centered within the Project at locations where diurnal raptor observations were made during previous surveys conducted at the Project (Woodlot Alternatives 2005; Figure 1).

A survey plot is an 800-m (0.5 mile) radius circle centered on the point. Points will be micro-sited to provide good coverage of appropriate over-winter habitat and good 360^{o} visibility around the point. Visibility will be maximized over long distances to facilitate spotting owls and diurnal raptors. Surveys will be conducted for 20 min at each point, and all bird species observed during the survey period were recorded. Each point will be once per weekly round. Each point will be alternated weekly such that points are surveyed approximately equally between 0900-1400, to optimize detections of diurnal raptors, and between 1400 and one half hour after sunset, to optimize detections of short eared owls, during the study period.

One qualified observer will survey each point. All owls, large birds, raptors, or sensitive species observed perched or flying over the plot will be recorded and mapped. All small birds within 100 m (~328 ft) of the point will be recorded, but not mapped. Observations of birds beyond the 800-m radius plot will be recorded, but will not be included in the statistical analyses. All raptors and short-eared owl locations will be mapped at first sighting at all distances.

The following information will be recorded for each observation: the date, start and end time of the survey period, and weather information such as temperature, wind speed, wind direction, and cloud cover. A unique observation number will be assigned to each observation. 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 the ground, behavior, and habitat(s) in which or over which the bird occurred will be recorded for each observation. The behavior and habitat type will be recorded based on the point of first observation. Approximate flight height and flight direction at first observation will be recorded to the nearest 5-m (~16 ft) interval. In addition, whether the observation was auditory only, and the 10-min interval of the 20-minute survey in which it was first observed, as well as any other comments or unusual observations will be recorded.

Estimates of bird use will be calculated as the number of individuals observed per 20-min survey from the standardized fixed-point surveys. For the large bird use estimates, only observations of birds detected within 800 m of the survey point will be used. Percent composition will be calculated as the mean use of a particular species divided by the total use for all species. The frequency of occurrence for each species will be calculated as the percent of surveys in which a particular species was observed. Frequency of occurrence and percent composition provide relative estimates of risk to species observed within the study area. To quantify potential risk to raptors and short-eared owls and other large birds, the flight height at first observation will be used to estimate the percentage of birds flying within the likely “zone of risk” (ZOR) for wind turbines. Flight height at first observation will be used for this analysis because observation lengths vary, and use of heights during variable length observation periods would create bias. For example, species y is observed for 30 seconds, while species z is observed for 3 minutes. Flight heights for species z are more variable, but this variation may be a result of length of the observation.

In order to provide additional qualification on whether individuals/groups were observed flying within the ZOR during observations, observers will collect information on the lowest and highest flight heights observed, and indicate on the data form whether the individuals/groups were observed within the ZOR.

The differences between short-eared owl and raptor use during the pre- and post-construction periods will be calculated for each point, by habitat type, and for the Project.

Driving Transect Surveys

Driving transects will be arrayed within the Project on the majority of public roads and determined based on observations of raptors made during previous field surveys (Woodlot Alternatives 2005) and habitat. (Figure 1). Transects will be driven at slow speeds (up to 25 mph) once per weekly survey round. Transects will be surveyed between 1400 and one half hour after sunset to optimize detections of short eared owls.

Two qualified observers will search for owls and record detections using a map and gps such that observations may be plotted for each 250-m segment of the survey route. Perpendicular distance of each observation from the transect will be plotted. Detections of short-eared owls that were either seen or heard will be recorded on standard data forms by each 250 meter segment in which the observation occurred. The approximate distance to each bird will be recorded for each observation. The following information will be recorded for each observation: the date, start and end time of the survey period, and weather information such as temperature, wind speed, wind direction, and cloud cover. A unique observation number will be assigned to each observation. 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 the ground, behavior, and habitat(s) in which or over which the bird occurred will be recorded for each observation. The behavior and habitat type will be recorded based on the point of first observation. Approximate flight height and flight direction at first observation will be recorded to the nearest 5-m (~16 ft) interval.

The differences between short-eared owl and raptor use during the pre- and post-construction periods will be calculated for each 250-m segment of survey transects, for each survey route and for the Project.

In addition, the observers will conduct 23 x 3-minute point counts at stations arrayed approximately every 800-m along the transect. Shorter interval distances between points will be used when risk of double counting may be minimized. Methods for point counts will be consistent with Fixed Point Surveys (see above).

DISPOSITION OF DATA AND REPORTING

A study report will be completed no later than 30 days after completion of field surveys. The report will be provided to the NYSDEC for review.

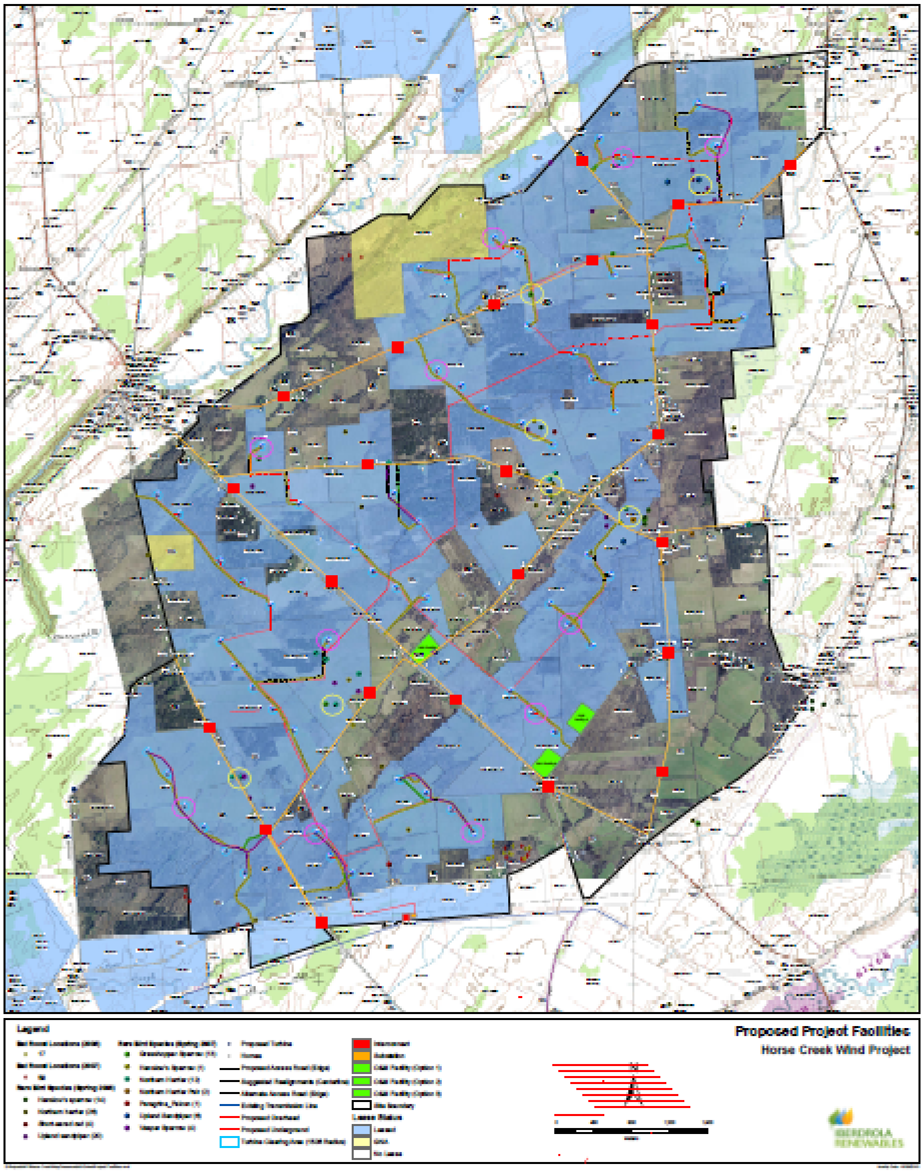

Figure 1. Map of the Horse Creek Project and Overwinter Diurnal Raptor and Short-eared Owl Survey Points. Pink circles indicate fixed points arrayed at proposed turbines (11); yellow circles indicate fixed points arrayed at use areas (7); orange lines indicate driving transects and red squares indicate 3-minute point count stations along driving transects (23).