

PHASE I AVIAN RISK ASSESSMENT

Herkimer Wind Farm

Herkimer County, New York

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PPM Atlantic Renewable

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Phase I Avian Risk Assessment for Herkimer Wind Farm Herkimer County, New York

Executive Summary

This report details the results of a Phase I Avian Risk Assessment for the proposed Herkimer Wind Farm (hereafter the “Project”) in the towns of Fairfield and Norway in Herkimer County, New York. This assessment includes: 1) a site visit conducted on November 10, 2004, 2) a review of the literature and available databases, and 3) written consultations with the U.S. Fish and Wildlife Service (USFWS) and New York State Department of Environmental Conservation (NYSDEC). The site visit evaluated habitat in order to estimate 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 information relevant to potential impacts to birds at comparable 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 approximate numbers 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.

The Herkimer Wind Farm is proposed by the Atlantic Renewable Energy Corporation, a division of PPM. A conceptual layout for the Project shows 61 wind turbines distributed over an area 9 miles (14.4 km) long and 2 miles (3.2 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 about 91.5 and 110 MW. The towers of the wind turbines would be about 80 meters (262 feet) tall and have rotors of approximately 38.5 m (126 feet) long. With the rotor tip in the 12 o’clock position, the wind turbines would reach a maximum height of about 120 m (394 feet) above ground level (AGL) and the rotor tip in the 6 o’clock position, would be about 41.5 meters (136 feet) AGL.

The predominant habitats on the Project site are tilled farmland (corn, hay, cover crops), pasture, old field, and, dispersed, mainly deciduous forest patches and woodlots. Wetlands are not well represented, consisting of several small ponds and cattail marshes. According to the conceptual layout, the wind turbines would mainly be constructed in existing open areas, but some limited areas with trees would be affected by road and turbine construction. Land use in and around the proposed wind farm is mainly agricultural, with a significant number rural residences along a network of roads.

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. But, given these habitats, some state-listed species may breed at or near the site. Some of the potential state-listed species are classified as *threatened* and include Northern Harrier, Upland Sandpiper, and Henslow’s Sparrow. The extensive combination of fallow fields, pastures, and hay fields may support them. One of these birds – the harrier – was recently

confirmed as a breeder in one of the Breeding Bird Atlas (BBA) blocks that overlaps the Project site.

There is also the potential for several breeding birds classified as *of special concern*, including Sharp-shinned Hawk, Cooper's Hawk, Northern Goshawk, Red-shouldered Hawk, Red-headed Woodpecker, Horned Lark, Golden-winged Warbler, Vesper Sparrow, and Grasshopper Sparrow. One of these birds – the Cooper's Hawk – was recently confirmed as a breeder in one of the BBA blocks that overlaps the Project site. The habitats on site, and for more than five miles surrounding the site, however, are not suitable for any federally listed species, but the threatened Bald Eagle may fly over the site at times.

Letters from the USFWS and NYSDEC did not suggest the presence of federally endangered or threatened species at the Project site or nearby. However, the USFWS did mention the potential for impacts to birds protected by the Migratory Bird Treaty Act. The NYSDEC letter did suggest that New York State threatened Upland Sandpiper and endangered Loggerhead Shrike were known to nest at one time near the Project site, and state species of special concern, Common Loon, also was known to nest nearby.

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 is not known to be a significant wintering site for birds, so relatively few birds are likely to use the site between mid-November and mid-March. Wintering raptors – mostly Red-tailed Hawk, Rough-legged Hawk, Northern Harrier, and American Kestrel – will likely be present at the Project site in winter in small to moderate numbers. In addition, there was no evidence that the Project site or lands adjacent to the site would attract large or significant numbers of migrating or wintering waterfowl, shorebirds, songbirds, hawks, or other species.

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 or marginally suitable for species classified by the New York State Department of Environmental Conservation (NYSDEC) as threatened and of special concern, a nesting bird survey is advised to determine the extent to which the threatened Northern Harrier, Upland Sandpiper, and Henslow's Sparrow, and the special-concern Horned Lark, Vesper Sparrow, and Grasshopper Sparrow, use the site's grassland habitats. Additionally, two other special-special concern species that might breed in the site's woodland-type habitats should also be checked. They are the Red-headed Woodpecker and Golden-winged Warbler. The site-specific breeding bird survey should map the areas where these birds nest in relation to the proposed turbine and road locations. The results of this survey would be useful in preventing or mitigating the disturbance or displacement of these species. Should a site-specific breeding bird survey be conducted, its design should involve consultation with NYSDEC biologists prior to implementation.

With respect to grassland nesting songbirds and perhaps some raptors, some of these species will likely be displaced 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 Herkimer 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 fatalities at the nearby Madison and Fenner wind power facilities (30 and 45 miles distant respectively), there is no indication that the Herkimer Wind Farm will result in biologically significant collision impacts to birds. But, based on other wind power projects, 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.

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Figure 1. Location of the Proposed Herkimer Wind Farm, Herkimer County, New York State.

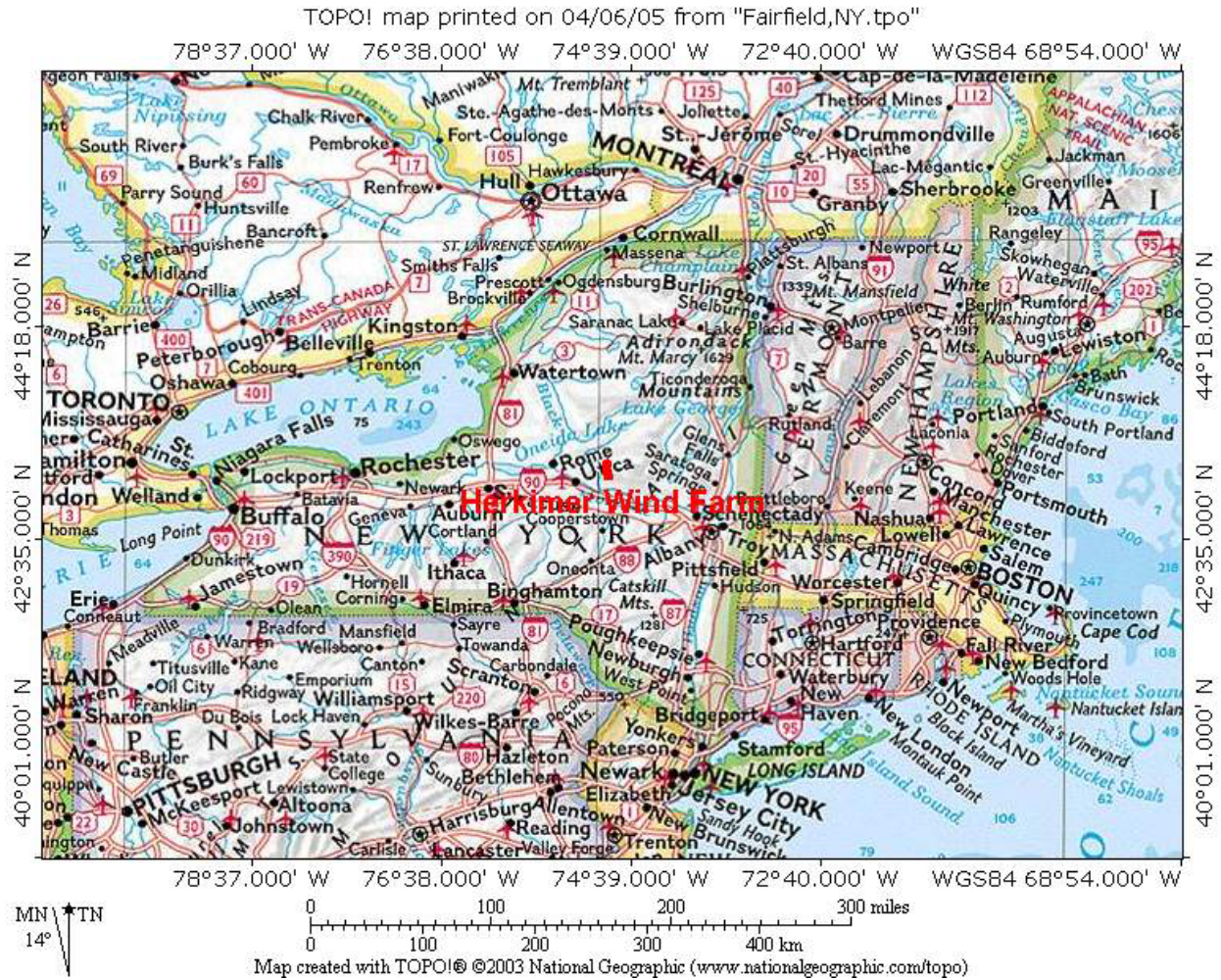
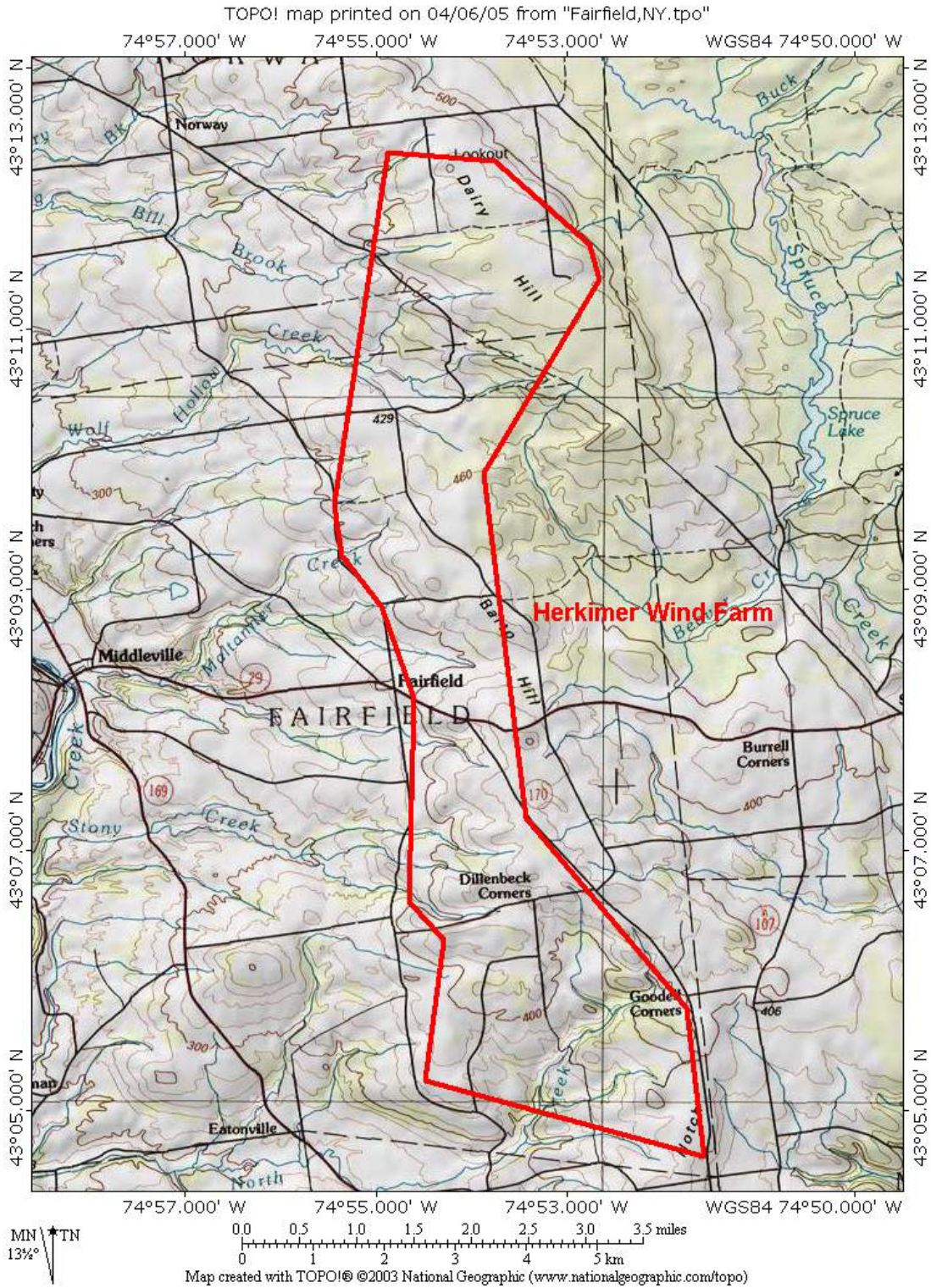


Figure 2. Topography and forest cover at the Proposed Herkimer Wind Farm, Herkimer County, New York State (boundary approximate).



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 (61 turbines) has been proposed for a site in the towns of Fairfield and Norway in Herkimer County, New York (see Figures 1 and 2). The project has been named the Herkimer 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, Appendix A of 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).

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, New York Natural Heritage Program (NYSNHP), 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 (in this case, including the nearby Madison wind power facility, where a post-construction fatality study was conducted), and recommendations for further studies and mitigation, if indicated.

2.0 Project and Site Description

2.1 Project Description

Located in the foothills of the Adirondacks about 5 miles (8 km) southwest of the border of Adirondack Park, and about 25 miles east of the city of Rome (see Figure 1), the proposed Herkimer Wind Farm would consist of 61 wind turbine generators, each with a nameplate capacity of about 1.5 to 1.8 megawatts. Together, they would produce a total of between about 91.5 and 110 MW (megawatts) of generating capacity. The elevation of the wind farm would range approximately from 1,200 to 1,850 feet (365-565 m) above sea level. The area of the Project site is approximately 18 square miles (11,520 acres). The center of the Project is located slightly east of the town of Fairfield (see Figure 2).

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 12 o'clock position would be up to about 120 m (394 feet) above ground level (AGL) and the rotor tip in the 6 o'clock position, would be 41.5 m (136 feet) AGL. Turbines be 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 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 Herkimer Wind Farm and adjoining portions of Herkimer County are within the Appalachian Plateau ecological zone, a broad ecological zone of mixed hardwood forests

(Andrle and Carroll 1988, Levine 1998). In this part of New York State, this ecological zone ranges in elevation between about 1,000 and 2,000 feet (305 to 610 m) above sea level. There are no real mountains or ridges in the vicinity of the Project area, but there are a few deep valleys and steep hills. The hills or jumbles of hills sometimes lengthen into short, disjunct ridges oriented on a north-south axis. The Project site includes hills that reach elevations of about 1,850 feet (565 m) above sea level. There are no large bodies of water (lakes or rivers) on the site, but several creeks originate on the site and flow in several directions as they descend the higher elevations.

The Project site is mostly open agricultural land, the result of settlement more than 250 years ago. The Project site and areas where turbines would be located are largely open, with woodlots and fragmented forest covering about 20% of the landscape. The historical forests on the site were likely deciduous hardwood forests (mostly maple and beech) with small stands of coniferous trees (mostly eastern hemlock and lesser amounts of white pine). But, just beyond the Project boundary, there begins a large expanse of regenerating forest that connects with Adirondack Park, the boundary of which is 5 miles (8 km) to the northwest.

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 Herkimer Wind Farm site was visited on November 10, 2004. All areas accessible by road were toured by automobile and some areas were walked. The weather on that day was fair and did not impede the observation of habitats and birds. The areas where turbines would be located are relatively open, 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 found that the predominant land-use is agricultural, including corn, hay, cover crops, and pasture (see photographs in Appendix B). But, much fallow land was noted, ranging in habitat type from pure tall grasses to pure goldenrod and aster with little grass. There were also extensive areas of low, shrubby thickets. With regard to wetlands, they make up a very small percentage of the habitat on site, consisting mainly of small ponds and cattail marshes.

The remaining wooded areas in the Project area are highly fragmented and occur in small patches or woodlots (see photographs in Appendix B). The predominant trees noted were sugar maple, quaking aspen, black cherry, American ash, gray birch, American beech, American elm, and red maple. In some areas, the woods were mixed with spruce, white pine, and hemlock. Also noted were planted stands of red pine, white pine, Norway spruce, and red spruce. Northern white cedar was also recorded.

A total of 39 bird species were observed during the site visit (see Appendix C). These were mostly common, year-round resident, wintering, and late migratory species. Two NYSDEC-listed species were noted, however. These were Northern Harrier (threatened) and Horned Lark (special concern).

4.0 Avian Overview of the Herkimer Wind Farm Site

Based on the site visit, literature review, and agency consultations, the avifauna in and around the vicinity of the Herkimer 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.

Table 4.1-1. Listed Species and Habitat Suitability for Nesting

Species	NYS Status¹	Federal Status¹	Nearby BBA Record?²	Nearby BBS Record?³	Habitat Suitability for Nesting⁴
<i>Endangered/Threatened</i>					
Pied-billed Grebe	T				
Least Bittern	T				
Bald Eagle	T	T		Yes	NS
Northern Harrier	T		Yes	Yes	S
Golden Eagle	T				
Peregrine Falcon	E				
Spruce Grouse	E				
King Rail	T				
Black Rail	E				
Upland Sandpiper	T		Yes		S?
Piping Plover	E	T			
Common Tern	T				
Roseate Tern	E	E			
Black tern	E				
Least Tern	T				
Short-eared Owl	E				
Loggerhead Shrike	E				
Sedge Wren	T				
Henslow's Sparrow	T				MS?
<i>Of Special Concern</i>					
Common Loon	SC				
American Bittern	SC				

Species	NYS Status ¹	Federal Status ¹	Nearby BBA Record? ²	Nearby BBS Record? ³	Habitat Suitability for Nesting ⁴
Osprey	SC				
Sharp-shinned Hawk	SC			Yes	S?
Cooper's Hawk	SC		Yes		S
Northern Goshawk	SC			Yes	S?
Red-shouldered Hawk	SC		Yes	Yes	S?
Black Skimmer	SC				
Common Nighthawk	SC				
Whip-poor-will	SC				
Red-headed Woodpecker	SC		Yes		S?
Horned Lark	SC				S?
Bicknell's Thrush	SC				
Golden-winged Warbler	SC			Yes	S?
Cerulean Warbler	SC				
Yellow-breasted Chat	SC				
Vesper Sparrow	SC			Yes	S?
Grasshopper Sparrow	SC			Yes	S?
Seaside Sparrow	SC				

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.

Based on the visual evaluation of habitat on the Project site afforded by the site visit, available habitat appeared to be suitable or marginally suitable for three species listed by NYSDEC as threatened. These were Northern Harrier, Upland Sandpiper, and Henslow's Sparrow. In the case of the Upland Sandpiper, some fields could support nesting because they appear to be large enough and infrequently enough mowed. While on-site habitat could also be suitable for the Short-eared Owl and Loggerhead Shrike – listed as endangered – these birds have become so rare in this portion of New York State that nesting is highly unlikely.

The habitats in and around the Project site were also judged to be potentially suitable for nesting by a number of species of special concern. Sharp-shinned Hawk, Cooper's Hawk, Northern Goshawk, and Red-shouldered Hawk could conceivably nest in forested areas and forest edges. Horned Lark, Vesper Sparrow, and Grasshopper Sparrow could nest in the site's grassland habitats. And, Golden-winged Warbler could nest in the site's early successional wooded areas.

Letters from USFWS and the NYS Natural Heritage Program (a division of NYSDEC) did not indicate the presence of any federally listed species nesting on the site or nearby. However, the USFWS did mention the potential for impacts to birds protected by the Migratory Bird Treaty Act. The NYSDEC letter did suggest that New York State threatened Upland Sandpiper and endangered Loggerhead Shrike were known to nest at one time near the Project site, and state species of special concern, Common Loon, also was known to nest nearby.

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 Herkimer 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 5) and 5,335 blocks, each of which measured 5 x 5 km (3 x 3 miles). Each block was further subdivided into quadrants (A, B, C, and D), which were surveyed individually, with quadrant A given the most importance (in the event volunteers did not have enough time to survey all of the quadrants in a block). 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.).

All six blocks and eight quadrants that covered the Herkimer Wind Farm site were surveyed during the 2000-2004 Atlas Project (see Table 4.1.1-1). It is important to note, however, that these blocks and quadrants cover areas both inside and outside the proposed wind farm development. The species totals for the quadrants ranged from 80 to 58 species, with 113 species recorded cumulatively (see Appendix E for a complete list). Of this number, 65 species (58%) were confirmed as breeders, 24 (21%) were recorded as probable breeders, and 24 (21%) were listed as possible breeders.

Nearly all of the species recorded in the 2000-2004 BBA were common nesting species for this region of New York State. But, two threatened and three special-concern species were recorded (see Table 4.1-2 and discussion below).

Waterbirds were not particularly well represented in the BBA survey, which is not surprising, given the upland nature of the habitat. But, Great Blue Heron and Wood Duck were

confirmed as breeders, and Common Merganser and Wilson’s Snipe were recorded as probable breeders, all likely outside the Project site, given the lack of appropriate nesting habitat within.

Four raptors were confirmed as breeders, including the Northern Harrier (threatened), Cooper’s Hawk (special concern), Red-tailed Hawk, and American Kestrel. In addition, Red-shouldered Hawk was observed during the survey and listed as possibly breeding.

A wide variety of songbirds were recorded, including many of the species one would expect in forest, forest-interior, forest-edge, woodland, oldfield, grassland, and wetland habitats. Many were confirmed as breeders. Grassland nesting birds included possible nesting by Upland Sandpiper (threatened) and confirmed nesting by Savannah Sparrow, Bobolink, and Eastern Meadowlark.

Regarding listed species (see Table 4.1-2), Northern Harrier (threatened) was recorded in 5 of the 8 quadrants that cover the Project site. In one of these quadrants (5076A, overlapping the southeast section of the proposed wind farm), breeding was confirmed when adult harriers were observed entering or leaving a nest site. In two other quadrants (overlapping the southern and central sections of the Project site), harriers exhibited behaviors indicative of probable breeding. The harrier was also observed in or near the northern section of the proposed wind farm.

4.1.1-1. Breeding Bird Atlas (BBA) Records of Listed Species¹

Block Number	Wind Farm Section Covered	Total Species	Listed Species ²	Breeding Status	Notes
4978D	North-NW	58	Northern Harrier (T)	Possible	Seen in possible nesting habitat
5078C	North-NE	67	Cooper's Hawk (SC)	Confirmed	Recently fledged young observed
			Red-shouldered Hawk (SC)	Possible	Seen in possible nesting habitat
4977B	Center-NW	60	Upland Sandpiper (T)	Possible	Seen in possible nesting habitat
5077A	Center-NE	75	Northern Harrier (T)	Probable	Pair observed
4977D	Center-SW	74	Upland Sandpiper (T)	Possible	Seen in possible nesting habitat
			Red-headed Woodpecker (SC)	Possible	Seen in possible nesting habitat
5077C	Center-SE	65	Northern Harrier (T)	Possible	Seen in possible nesting habitat
4976B	South-SW	80	Northern Harrier (T)	Probable	Courtship, display, or agitated behavior noted
			Cooper's Hawk (SC)	Possible	Seen in possible nesting habitat
5076A	South-SE	65	Northern Harrier (T)	Confirmed	Adults seen entering or leaving nest site

¹ From the New York State Breeding Bird Survey, 2000-2004

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

Cooper's Hawk (special concern) was confirmed as a breeding species in or near the northeast section of the Project site, where recently fledged young were observed. In or near the southwest section of the Project site, a Cooper's Hawk was seen in possible nesting habitat. Additionally, a Red-shouldered Hawk (special concern) was observed in or near the middle of the Project site in possible nesting habitat. No Sharp-shinned Hawks or Northern Goshawks (other raptors of special concern) were recorded.

Upland Sandpiper (threatened) was observed in possible nesting habitat in two of the quadrants that overlap the center of the Project site. In addition, Red-headed Woodpecker (special concern) was seen in possible nesting habitat in or near the center section of the proposed wind farm.

In summary, the BBA data indicates that the Project site has a fairly diverse breeding bird community, with the species of open and wooded upland habitats well represented. Given the upland nature of the site, waterbirds are not well represented. Regarding listed species, the Project site or vicinity supports nesting Northern Harriers (threatened) and Cooper's Hawks (special concern). Possible nesting species include Upland Sandpiper (threatened), Red-shouldered Hawk (special concern), and Red-headed Woodpecker (special concern).

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.

Seven BBS routes, all within 35 miles of the Project site and covering similar habitat, were analyzed in order to evaluate the likelihood of the occurrence of listed species as breeders at the Herkimer Wind Farm site (see Table 4.1-3). The closest BBS routes to the Project site were Clinton (5 miles distant) and North Wilmurt (18 miles distant). Data analysis was limited to the last ten years, beginning in 1994.

Overall, the BBS data confirm the more Project site-specific BBA data. Waterbirds were not well represented in the BBS routes, a further indication of the mostly upland habitats in the Project region. Nine species of raptors were recorded in the BBS data, including the five recorded in the BBA. All were recorded in low numbers. Bald Eagle, a federally threatened species was recorded once – a single bird in 2003 on the McKeever route, some 35 miles north of the Project site. All other listed raptors were recorded extremely infrequently, and in low numbers, including Sharp-shinned Hawk and Northern Goshawk (see Table 4.1-3). The most

common raptors recorded during the BBS were Red-tailed Hawk and American Kestrel, but the numbers of birds recorded can be considered low.

4.1.2-1. Breeding Bird Survey (BBS) Records of Listed Species¹

Route Number	Route Name	County	Distance/ Bearing From Site	Years Analyzed	Species Max/Min	Species Listed Species ²	Frequency # Birds-Year
61080	Clinton	Oneida	5 mi SW	10	58 / 45	Grasshopper Sparrow (SC)	2-1995, 1-1996, 6-1997, 4-1998, 4-1999, 1-2001, 2-2002
61078	N. Wilmurt	Herkimer/Oneida	18 mi N	4	79 / 72	Red-shouldered Hawk (SC)	1-1997
						Golden-winged Warbler (SC)	1-1995
61123	Milford	Otsego	24 mi S	9	81 / 47		
61026	Duanesburg	Schenectady/Schoharie	26 mi SE	7	67 / 50	Northern Harrier (T)	1-1996, 1-1999
						Northern Goshawk (SC)	1-1997
						Vesper Sparrow (SC)	1-1998
						Grasshopper Sparrow (SC)	1-1997, 1-1998
61035	Oriskany Falls	Madison	31 mi WSW	5	58 / 47	Northern Harrier (T)	1-1995
61025	Cobleskill	Schoharie/Albany	34 mi SE	8	61 / 53		
61073	McKeever	Herkimer/Oneida	35 mi N	10	69 / 57	Sharp-shinned Hawk (SC)	1-1998, 1-2000, 1-2003
						Northern Goshawk (SC)	1-1999

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, one Golden-winged Warbler (special concern) was recorded in one year on the North Wilmurt BBS, 18 miles from the Project Site. Vesper Sparrow (special concern) and Grasshopper Sparrow (special concern) were also recorded along BBS routes. On the nearby Clinton BBS, Grasshopper Sparrow has been recorded in most years, with 6 birds in 1997. Upland Sandpiper (threatened) and Red-headed Woodpecker (special concern), species recorded in the BBA, were unrecorded in the sample of BBS routes. Horned Lark (special concern) and Sedge Wren (threatened) were also not recorded in the BBS data.

In summary, based on the site visit, BBA analysis, and BBS data, nesting habitat is certainly present on the site for two state-listed species confirmed as breeders in the recent BBA – the threatened Northern Harrier and special-concern Cooper’s Hawk. Given this evidence, habitat may also be suitable for nesting for other raptors, namely, Sharp-shinned Hawk (special concern), Northern Goshawk (special concern), and Red-shouldered Hawk (special concern). Although one threatened Bald Eagle was recorded in one year on a BBS route 35 miles distant, based on the site visit, habitat on the Project site does not appear to be suitable for this species.

Suitable nesting habitat may occur on site for the threatened Upland Sandpiper, which was recorded as a possible breeder in two of eight BBA quadrants that overlap the Project site. While no other listed grassland birds were recorded in the BBA, the site visit and BBS data raise the possibility that habitat may be suitable for the nesting of Horned Lark (special concern), Vesper Sparrow (special concern), Grasshopper Sparrow (special concern), and Henslow’s Sparrow (threatened). The Henslow’s Sparrow is a particularly difficult bird to find and identify and could easily have gone unrecorded in the BBA.

The BBA survey did record Red-headed Woodpecker (special concern) as a possible breeder. A BBS route 18 miles to the north of the Project site also recorded one Golden-winged Warbler (special concern) nearly ten years ago. Based on this evidence, habitat on the project site may be suitable for these species as well.

4.2 Migrating Birds

There are few major or significant migration stopover sites or migration “pathways” in central New York, including the area of Herkimer County near the Project site. The topography and habitat of the Project site, or anywhere nearby, does not indicate that it would be an ecological magnet for migrating birds (Berthold 2001, Alerstam 1990). Such topography and habitat is not similar to locations in New York State where large numbers of migrants are found.

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 central New York State, including Herkimer County. Thus, little information was found about the Project site or areas

nearby. Nonetheless, several sources that would apply to central New York and other locations were found regarding the night migration of songbirds.

It appears that the night migration of songbirds through central New York occurs over a broad front with no large concentrations of these birds. 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 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 ridges 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 along the lakeshores, especially in the hours before dawn. The evidence is overwhelming that most night migrating songbirds are spread across a broad front over most types of topography encountered by these birds.

There are two accounts of birds in 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.

The geographic location and topography of the Herkimer Wind Farm site are very similar to the conditions throughout much of central, western, and northern New York State, at least away from the Great Lakes and other larger lakes. There is no evidence to suggest that the Project site experiences anything but broad front migration and there are not likely to be migration concentrations at the site.

An acoustic study conducted by Evans and Rosenberg (1999) appeared to have demonstrated that night migrants in the central New York region follow topographic features. But this study had significant flaws.

Evans and Rosenberg attempted to quantify numbers of migrants and determine species composition of nocturnal migrants at seven sites across central New York State in the early 1990s. In general, Evans (pers. comm.) found that, during the fall migration, fewer birds migrated over the western portion of the state south of Lake Ontario than farther east (for example, over Oneonta in Otsego County, which is due west of the Project site). Evans also suspected that fewer birds fly over the hilltops than through the valleys, because as they come south they encounter the hills between the Finger Lakes and follow valleys so as not to utilize large amounts of energy to climb the steep hills. He stated that birds did fly over the hilltops and some were judged to fly at less than 300 feet (93 m) above the ground.

There is no foundation in the scientific literature for the contention that night migrating birds follow ridges or valleys at topographic situations other than those similar to the Alps or other massive topographic structures. Because the acoustical devices used by Evans and Rosenberg (1999) are unlikely to detect higher flying migrants, studies based on acoustical devices are typically biased toward lower flying birds. In addition, a recent report by Farnsworth et al. (2004), in which results from acoustical studies were compared with those from radar studies, indicated that the acoustical methods proved a poor indicator of the numbers of birds aloft. The degree of correlation between the two methods was so low (mostly not significant) as to discount the use of acoustical studies for estimating traffic rates of night migrants at given sites. Furthermore, there has never been confirmation that the acoustical method is a valid means of determining the volume of migration at a particular site.

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 seen 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).

The Derby Hill hawk watch is the closest major migration site to the Herkimer Project and is considered a significant hawk watch (Zalles and Bildstein 2000). Tens of thousands of hawks pass this site on the spring migration as they concentrate along the shore of Lake Ontario (during the fall migration, relatively few hawks pass Derby Hill). Most of the migration noted at Derby Hill is concentrated within 1 to 5 miles (1.6 to 8 km) of the lakefront. Inland, migrating hawks are spread more evenly over large areas. Derby Hill is over 70 miles (112 km) west-

northwest of the proposed Herkimer Wind Farm. Most hawk migration in central New York occurs at relatively high altitudes (generally above 150 m (492 feet) and is spread over a broad front, as confirmed by radar studies (Kerlinger et al. 1985).

There are at least two noteworthy hawk watching sites of lesser significance than Derby Hill in the northern Catskills/Mohawk Valley area. The Franklin Mountain Hawkwatch, considered a significant site by Zalles and Bildstein (2000), is on a promontory along the Susquehanna River in northernmost Delaware County, about 40 miles (64 km) south of the Project site (Kerlinger and Bennett 1977). Spring counts total about 1,000 hawks. In the fall, about 3,000 to 5,000 hawks are counted, including significant numbers of Bald and Golden Eagles, as well as Red-tailed Hawks.

The Oneida Hawk Watch is not considered a significant hawk watch by some (Zalles and Bildstein 2000), but it does support a modest hawk migration of about 2,000 to 4,000 hawks in the fall (Drennan 1981, Heintzelman 1986). Most of those hawks are Broad-winged Hawks, which do not follow ridges to the extent of Sharp-shinned Hawks, Red-tailed Hawks, and other species (Kerlinger 1989, Heintzelman 1975). This site is about 30 miles (48 km) west-southwest of the Project site.

4.3 Waterbirds

In the Project vicinity, there are no large lakes, marshes, mudflats, or other types of ecological magnets that attract waterbirds, including ducks, rails, shorebirds, and the like. This suggests that these types of birds do not congregate on or over the Project site. Bellrose (1976) reports a modest migration of waterfowl spread over central New York State. This indicates that the region is not an important migratory corridor or stopover area for waterfowl.

The site visit found small ponds and cattail marshes within the project site. An examination of topographic maps shows the Mohawk River located 2 miles (3.2 km) south of the Project site and a small number of small lakes or large ponds dispersed over the landscape within 10 miles (16 km) of the Project site. The first larger body of water is the Hinckley Reservoir, located 11 miles (18 km) northwest. None of these nearby water bodies, however, are large enough to attract significant numbers of waterbirds during fall and, to a lesser extent, spring migration.

Regarding large lakes, Great Sacandaga Lake is located 29 miles (46 km) east of the Project site, Oneida Lake about 40 miles (64 km) west, and Lake Ontario about 70 miles (112 km) west-northwest. Oneida Lake and Lake Ontario are well documented as migration magnets where significant numbers of waterbirds gather. Most migrating waterbirds that might fly over the site at night (and to a lesser extent during daytime) would do so 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). It should be noted that migrating Canada Geese do make stopovers to feed in corn and other agricultural fields during fall and spring migration. This type of agricultural habitat occurs on the Project site.

4.4 Wintering Birds

Beginning in mid-November and extending into mid-March, winter in central New York is generally harsh, variable, and relatively inhospitable for many birds. The relatively high elevation of the Project site is subject to strong winds, low temperatures, and deep snow. Food for birds is likely to be scarce. Overall, a low diversity and density of birds would be expected in and around the Project site during winter.

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 (CBCs) Examined

Count Name (Code)	County	Distance/ Bearing from Site	Years Analyzed	Number Participants	Number Species Min/Max
Fort Plain (NYFP)	Montgomery	10 mi SE	10	16-24	53-65
Clinton (NYCL)	Oneida	18 mi WSW	10	20-50	52-64
Johnstown-Gloversville (NYJG)	Fulton	19 mi ESE	10	9-22	48-60
Rome (NYRM)	Oneida	21 mi WNW	10	9-18	44-46
Sherburne (NYSH)	Chenango	34 mi SW	6	13-22	45-58
Oneonta (NYOT)	Otsego	38 mi WSW	10	14-24	31-51

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 the six CBCs 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. All CBCs survey an area of about 177 square miles (453 square km). Thus, the six CBCs considered in this report covered a total area of 1,062 square miles (2,718 square km). Observer participation per count during the analysis period varied from a minimum of 9 observers to a maximum of 50.

The number of species recorded in these counts ranged from a maximum of between 51 and 65 species to a minimum of between 31 and 53 species. Inland sites with limited open water habitat, these CBCs had far fewer species and numbers of individual birds than sites along the Great Lakes or sites in southeastern New York along the Atlantic Ocean, which regularly record 100 species. This is because of the relative lack of waterbirds at inland sites. Inland sites also have harsher climates than sites bordering large bodies of water. Because the Project site is landlocked with little open water during winter, it is likely to have even fewer species than the totals from the six CBCs examined.

A majority of the birds recorded in the CBC data sets examined were common species of forest, forest edge, brushland, grassland, and to a lesser extent, water habitats. Many of the forest, brush, and grassland species are likely to be found on the Project site during winter, and some of those are likely to be 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.

Due to a lack of open water and feeding habitat, waterbirds will not be present at the Project site during winter, except possibly as flyovers. Raptor species that were present on the CBCs – Red-tailed Hawk, Northern Harrier, Rough-legged Hawk, and, to a lesser extent, American Kestrel – are likely to be present on the Project site on a regular basis. 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. All of these species use either open farmland or grassland, brushland, or forest edge habitats. Other birds on site during the winter include various sparrows, woodpeckers, open-country passerines, owls, grouse, and a few other species. Their abundances are likely to be relatively low, as compared to lower elevations in the region.

Table 4.4-2. Recent CBC Records for Listed Species

Species (Listing ¹)	CBC	Number Recorded per Year	Number Years Recorded
Common Loon (SC)	Clinton	1	1
	Sherburne	1	1
Pied-billed Grebe (T)	Fort Plain	1	1
	Oneida	2	1
Osprey (SC)	Clinton	1	1
	Oneonta	1	1
Bald Eagle (T, US-T))	Fort Plain	1	1
	Clinton	1	1
	Johnstown-Gloversville	1-2	5
	Oneida	1-2	2
	Sherburne	1-2	3
Northern Harrier (T)	Fort Plain	1-5	7
	Clinton	1	5
	Johnstown-Gloversville	2-27	9
	Oneida	1-9	5
	Sherburne	3	1
Sharp-shinned Hawk (SC)	Oneonta	1	3
	Fort Plain	2-5	9
	Clinton	1-4	6
	Johnstown-Gloversville	1-5	9
	Oneida	1-4	8
Cooper's Hawk (SC)	Sherburne	1-5	6
	Oneonta	1-2	3
	Fort Plain	3-7	10

Species (Listing ¹)	CBC	Number Recoded per Year	Number Years Recorded
	Clinton	1-2	7
	Johnstown-Gloversville	3-18	10
	Oneida	1-4	8
	Sherburne	1-3	5
	Oneonta	1-2	6
Northern Goshawk (SC)	Fort Plain	1-2	4
	Clinton	1	4
	Johnstown-Gloversville	1	2
	Oneida	1-2	2
	Sherburne	1	1
	Oneonta	1	4
Red-shouldered Hawk (SC)	Fort Plain	1	1
	Johnstown-Gloversville	1	1
	Oneonta	1	2
Golden Eagle (T)	Oneida	1	1
	Oneonta	1	1
Peregrine Falcon (E)	Fort Plain	1	2
Short-eared Owl (E)	Johnstown-Gloversville	1-10	6
Red-headed Woodpecker (SC)	Oneonta	1	1
Horned Lark (SC)	Fort Plain	15-234	10
	Clinton	4-60	4
	Johnstown-Gloversville	31-890	10
	Oneida	8-366	10
	Sherburne	6-8	2
	Oneonta	6	1

¹ E = Endangered, T = Threatened, and SC = Special Concern

No federally listed endangered species were present on any of the counts from the six CBCs examined over the ten-year period. Bald Eagle, now federally listed as threatened (and proposed for delisting in 2000), were seen in small numbers on five of the six CBCs (Table 4.4-2), with two individuals being the maximum number observed on any one count during any one year. The Bald Eagle most often inhabits areas near open water, where they eat fish, crippled and sick ducks, or carrion. These birds will not likely be present on hilltops in the winter because the habitat is not suitable and food is not likely to be present. Therefore, Bald Eagles will rarely, if ever, be found at the Project site.

There were two State-listed endangered species and three State-listed threatened species present on the CBCs (Table 4.4-2). Of these, Pied-billed Grebe (threatened) will not be found on the Project site because this species requires large aquatic habitats, which are not represented on the Project site or nearby. Golden Eagle (threatened) and Peregrine Falcon (endangered) are also unlikely to be found on the Project site, as they do not forage in upland farm fields during winter because there is little food for them. Short-eared Owls (endangered) and Northern Harriers (threatened) do forage in open farm fields during winter and may, at times, be present on the Project site. 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. Short-eared Owls do forage over large fields, especially where there is an abundance of rodent prey. Both

species are more likely to be found at lower elevations where there is less snow and more prey, however. It is also important to note that individuals of all these listed species may be migrants from farther north and from populations that are not listed.

Eight species of special concern in New York State were present on the CBCs. These were Common Loon, Osprey, Sharp-shinned Hawk, Cooper's Hawk, Northern Goshawk, Red-shouldered Hawk, Red-headed Woodpecker, and Horned Lark. Because the Project site lacks open water, Common Loon and Osprey will not be attracted to the Project site in winter, or at any other time of year; they may fly over on migration, however. Sharp-shinned and Cooper's Hawk might use the Project site in winter, but in very small numbers. These hawks usually frequent lower elevations and 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. Red-shouldered Hawk is most often found at lower elevations, particularly where there is a large prey base. They could be found in winter on the Project site, especially if there is an abundance of rodents on site. This is a rare bird in winter in upstate New York, as indicated by a total of four individuals sighted on the six counts over a ten-year period.

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

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 deep snow, Horned Larks are unlikely to be present. As evidenced by the significant fluctuation in numbers on the counts analyzed, 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 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 or threatened will be found on the Project site in winter. This is also true of the State-listed endangered Peregrine Falcon. But, the State-listed endangered Short-eared Owl and the State-listed threatened Northern Harrier may be present at times. 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, Northern Goshawk, and Red-shouldered Hawk, although they are unlikely to be regular inhabitants and, when present, they will occur in small numbers. Virtually no waterbirds will be present on site during winter because there is no open water available in the area. 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 (IBAs)

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 IBAs have been designated in New York State (see <http://www.audubon.org/chapter/ny/ny/iba/>). Among the closest sites are two located in Herkimer County. About 40 miles north of the Project site, Moose River Plains has some of the best lowland boreal forest and wetlands in the western Adirondacks. Its bird fauna is decidedly boreal in composition and significantly different than that of the Project site. About 70 miles north of the Project site, the Stillwater Reservoir is noteworthy for having the state's densest breeding population of Common Loons.

The closest IBA is located about 35 miles east of the Project site in the town of Broadalbin in Fulton County. The Broadalbin Tree Swallow Colony has been designated as an IBA for scientific reasons because it has been the subject of a 10-year Tree Swallow banding project. About 40 miles south of the Project site, the Franklin Mountain Hawk Watch overlooks the Susquehanna River and the city of Oneonta. It has been active since 1976 and records an impressive variety and number of raptors, including one of the highest fall tallies for Golden Eagles in the eastern U.S. The Pharsalia Woods IBA is located about 55 miles southwest of the Project site in Chenango County. This IBA covers the fifth highest spot in New York State, has some of the largest unfragmented blocks of hardwood and mixed forest in the region, and host an impressive list of breeding forest birds.

As can be seen from this discussion, no IBA overlaps with the Project site, nor is one located in its proximity. Moreover, the habitats and bird communities protected or designated for protection in the mentioned IBAs are different than those of the Project site. This confirms that the Project site's habitat types and bird communities are common and widespread in the central New York region. In comparison with IBAs, the project site does not contain what might be considered essential bird habitat, nor is it distinguishable in character, habitat, or ornithological importance from the surrounding area.

5.2 Federal, State, and Private Protected Areas

The closest protected area to the Project site is Adirondack Park, located about 5 miles (8 km) northeast. Encompassing 6 million acres, the Adirondack Park was created in 1892 by the State of New York in order to conserve the region's water and timber resources. Today, it is the largest publicly protected area in the contiguous U.S. – larger than Yellowstone, Everglades, Glacier, and Grand Canyon National Parks combined. Half of the park is still in private ownership. The other half is owned by New York State and is constitutionally protected to remain a “forever wild” forest preserve.

Despite the proximity of Adirondack Park to the Project site, the park does not indicate any increased avian risk at the Project site. Adirondack Park is huge, and its purpose is water and forest protection. In the vicinity of the Project site, the forested habitats and associated bird communities it contains are widespread.

About 25 miles west of the Project site, The Rome Sand Plains is a private protected area owned by The Nature Conservancy. This area is one of only a few inland pine barrens left in the U.S. Its premier habitat is not represented at the Project site.

Located 5.5 miles (8.8 km) southwest of the Project site, the Plantation Island Wildlife Management Area (WMA) is located adjacent to the City of Herkimer at the confluence of West Canada Creek and the Mohawk River/Erie Canal. Unlike major WMA's in New York State, no information is available at the NYSDEC website on Plantation Island. Therefore, it is assumed that Plantation Island is not of particular significance with regard to waterfowl migration.

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

6.0 Risk to Birds at the Proposed Herkimer 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 Herkimer 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) 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 (262 feet) to nearly 200 m (650 feet) of turbines. 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). Anecdotal information from the Fenner Wind Power facility in New York State (Paul Kerlinger), located approximately 45 miles (72 km) west-southwest 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.

In contrast to the European studies, two years of post-construction studies at the Top of Iowa wind plant (Koford et al. 2005) revealed that Canada Geese were not displaced significantly by the construction of 89 turbines. That study, designed by Iowa State University and the Iowa Department of Natural Resources, was the first disturbance/displacement study of waterfowl in the United States.

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 F), 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 of 7 or 8 birds per turbine per year at some eastern U.S. sites. 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 120 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 than 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 F). With the exception of the APWRA, reported fatality numbers have been small. At San Geronio 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 Geronio 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 alien 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 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 are most relevant to the Herkimer 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 Herkimer 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).

A two year study completed by Iowa State University and the Iowa Department of Natural Resources at the Top of Iowa wind power project site revealed no fatalities to Canada Geese or other waterfowl (Koford et al. 2005). This study is important because the 89 turbines were located within one to two miles of three waterfowl management areas. Despite intense use of the turbine fields by waterfowl (>1.5 million duck and goose-use-days per year), none were

killed. In addition, no raptors or shorebirds were killed. Fewer than 1.5 birds per turbine per year were found to be killed at this site.

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 Herkimer 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, 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 30 miles (48 km) west-southwest of the Herkimer site. The Madison site has seven modern turbines that reach a maximum height of about 120 m (390 feet) tall 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 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 45 miles west-southwest of the Herkimer 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.

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.

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 Herkimer Wind Farm

6.2.1 Disturbance and Displacement Risk at the Herkimer Wind Farm

Because much of the habitat within the Project site is grassland-like, there is the potential for disturbance and displacement of some grassland nesting birds, including some 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. It is likely that some Savannah Sparrows, Bobolinks, and Eastern Meadowlarks, which undoubtedly nest on the site, will be displaced. Regarding other grassland species, such as Upland Sandpiper and Henslow's Sparrow (both threatened), or Horned Lark, Vesper Sparrow, and Grasshopper Sparrow (all species of special concern), their nesting status on the site is uncertain. If they do nest, they too may be displaced from areas where turbines are erected. If they are displaced, it is not known how far this displacement would extend from the turbines. Northern Harrier (threatened) has been confirmed as a breeding species in one of the BBA quadrants that includes the Project site. Assuming that harriers nest in grassland near turbine locations, these birds will likely be displaced once the Project is constructed. But, how far they will be displaced is uncertain.

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. Therefore, 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.

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, American Kestrels, and Cooper's Hawks (a species of special concern confirmed as a breeder in one of the BBA blocks that overlaps the Project site). 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 there are virtually no waterbirds or shorebirds that frequent the site, there will likely be no impact to those species. Waterfowl are also very scarce on the site, with the exception of some migrating and summering Canada Geese, which may forage in the farm fields at times. These birds often habituate quickly to human structures. Observations by author Paul Kerlinger at the nearby Fenner Wind Power Project included Canada Geese foraging in farm fields with operating turbines. Also, Koford et al. (2005) have reported that Canada Geese forage in corn and soybean fields without being disturbed by the presence of turbines.

6.2.2 Collision Risk at the Herkimer Wind Farm

6.2.2.1 Listed Species

Data demonstrates 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 during migration or dispersal. But, they are not likely to use the site for nesting or foraging. In either case, they are unlikely to collide with the turbines. Bald Eagles 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-species that are not raptors (for a discussion of listed raptors, please see below), assessments cannot be made because it is not known if any of these species nest on site. As was stated above, the habitat appears suitable for more than one threatened species and a few species of special concern. Listed species that have aerial courtship displays, such as Upland Sandpiper (threatened), could be at risk during those activities. If these birds

regularly fly in circles at 100-200 feet (30-60 m) above the ground, they could be a risk of colliding with turbine rotors.

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 likely nests on site, as was evident from the site visit and BBA data. 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 may put them at rotor height and at increased risk of collision.

Cooper’s Hawk (special concern) was confirmed as a breeding species in a BBA quadrant that overlaps the Project site. During the breeding season, it can be expected to forage within forested areas, not open country. As a consequence, it 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 minimal at the Herkimer Wind Farm site. That the Herkimer 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 Herkimer 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 Herkimer Wind Power Project
Large concentration of turbines (about 5,400 in 2002)	61 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 41.5 m (136 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 Herkimer site, as there are no noteworthy hawk migration sites in the project’s vicinity. The closest site is the Oneida Hawk Watch, located 30 miles (48 km) to the west-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 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 F) 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 Herkimer site are likely to fly within the height range of turbine rotors. The turbines proposed for use at Herkimer would be slightly taller than those situated on Appalachian ridges in West Virginia (Kerns and Kerlinger 2004) and Tennessee (Nicholson 2002). But, the turbine placements in West Virginia and Tennessee have not been demonstrated to present significant risk to night migrants. In

addition, the Herkimer turbines would be hundreds of miles farther north, where migrants are fewer in number and where fatalities at the nearby Madison wind power facility have not been reported to impact large numbers of migrants.

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 Herkimer 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 Herkimer Wind Farm.

6.2.2.4 Waterbirds

Collision risk to shorebirds is not likely because few shorebirds occur in the Project area. Some shorebirds likely 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 Herkimer site.

Risk to nesting waterbirds (waterfowl, long-legged waders, shorebirds, rails, etc.) at the Project appears to be minimal, because there is little appropriate nesting or foraging habitat for these species. Risk of collision 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). Canada Geese that may forage on site during migration and at other times may experience a slightly higher level of risk. But Canada Geese have never demonstrated susceptibility to colliding with wind turbines or with communication towers; therefore, they are unlikely to be at significant risk.

7.0 Findings

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

1. Land ownership on the Project site is private and land use (primarily agriculture with some residential housing and perhaps some forestry) should continue relatively unchanged following construction of the wind farm. Nonetheless, there is the possibility that grassland areas released from agriculture may, if not managed, succeed into woodland and be lost as habitat for nesting grassland birds, including some state-listed species.
2. The Herkimer Project site consists mainly of agricultural lands with some forest patches adjacent to and intersecting the areas where turbines would be located. The Project is located on rolling hills oriented roughly north-south.
3. All sections of the Herkimer site have grassland habitat consisting of hay fields, cover crops, pasture, and old fields. Forest-type habitat throughout the site is highly fragmented and accounts for about 20% of habitat coverage, but within a mile east-northeast of the Project site begins an extensive area of forest that connects with the huge Adirondack Park.
4. The wind farm's predominant agricultural and grassland habitats appear to be quality nesting habitat for various grassland breeders. Typical such species in central New York include Savannah Sparrow, Bobolink, and Eastern Meadowlark, all of which were confirmed as breeders in the recent Breeding Bird Atlas (BBA) Project, which surveyed the Project area and vicinity. But, the site probably also supports a number of state-listed grassland nesting species. Based on BBA data, the Northern Harrier (threatened) likely nests within the Project site. BBA data also indicates that the Upland Sandpiper could nest within the Project site. While not recorded in the BBA, the following other species may also nest in the site's grassland habitat: Henslow's Sparrow's (threatened), Horned Lark (special concern), Grasshopper Sparrow (special concern), and Vesper Sparrow (special concern). Both the harrier and Horned Lark were observed during the November site visit. Birds that inhabit forest edges and forest interiors would be farther from turbine placements than grassland birds. But, the following state-listed species of special concern could conceivably use the site's wooded habitats: Sharp-shinned Hawk, Cooper's Hawk, Northern Goshawk, Red-shouldered Hawk, Red-headed Woodpecker, and Golden-winged Warbler.
5. Several New York State-listed species and species of concern may nest on site, based on habitat present, BBA data, and other literature sources. These species include the threatened Northern Harrier, Upland Sandpiper, and Henslow's Sparrow and the special-concern, Sharp-shinned Hawk, Cooper's Hawk, Northern Goshawk, Red-shouldered Hawk, Red-headed Woodpecker, Horned Lark, Golden-winged Warbler, Vesper Sparrow, and Grasshopper Sparrow. As discussed above, half of these species would use grassland-like habitats, the other half would use wooded habitats. There is no suitable habitat on site for federally listed endangered or threatened species. On occasion, Bald Eagles (federally threatened) may migrate over the site.

6. Significant migration of hawks, songbirds, waterfowl, shorebirds, or other species is not known or likely to occur over the Project site. The site does not have ecological magnets that attract large numbers of migrants. Nevertheless, it is likely to host modest numbers of migrant songbirds on occasion.
7. The habitat on site does not suggest the large concentrations of wintering birds or the presence of state or federally listed species during that season.
8. The site is not near a designated Important Bird Area (IBA), nor does it have habitat or bird communities closely resembling the closest IBAs. Except for the expansive Adirondack Park about 5 miles (8 km) from the site, there are no federal, state, or private protected areas near the site. The vicinity of Adirondack Park does not indicate increased avian risk, because the nearby forested habitats and associated birds are abundantly represented.
9. The Project may displace grassland nesting species, possibly including New York State listed species or species of concern, if any can be confirmed nesting within the Project site. Such impacts are not likely to be regionally or globally significant, but could affect locally nesting populations. It is not known if these species would habituate to the presence of turbines. Recommendations are made below to prevent and mitigate potential impacts.
10. Fatality numbers and species impacted at the Herkimer Project are likely to be similar to those found at the nearby Madison Wind Power Project, as well as other existing wind power projects in the Midwestern and eastern United States. As various studies demonstrate, these fatalities are not likely to be biologically significant.

8.0 Recommendations

The following recommendations for the proposed Herkimer Wind Farm Project are based on a site examination of the habitat and 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 considered to determine whether Northern Harrier, Upland Sandpiper, Henslow's Sparrow, Horned Lark, Vesper Sparrow, and Grasshopper Sparrow are present in the grassland habitats that will be occupied by wind turbines and related infrastructure. 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.

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Appendix A. 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 the public or avian experts outside of 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 Herkimer 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

Teaming With Agencies. 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. Responses were received in April and May 2005. 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 Herkimer 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.

Reference Sites. The Herkimer 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. This included a study of avian fatality at the Madison Wind Power Project, approximately 30 miles (48 km) south-southwest of the Herkimer site, as well as sites studied on Appalachian Ridges farther to the south. 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 Herkimer site is no greater than at other wind power facilities in the United States.

While it is not possible to compare the Herkimer 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 Herkimer 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 Herkimer 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 are not likely to 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 Herkimer Project site, further research has been recommended to prevent or mitigate such impacts.

Alternate Sites. In the case of the Herkimer 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 Herkimer 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.
- The Herkimer site is not on a known migration pathway for hawks, songbirds, shorebirds, waterfowl or other migrants. 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 Herkimer 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 Herkimer 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 Herkimer 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 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. This discussion provides strong evidence that concentrated migration does not occur at the Project site. Thus, there is no scientific reason to suspect that there will be any concentration of migrants at the Project site. Therefore, radar or other remote sensing is not recommended.
- 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.

Appendix B. Photographs of representative habitat at locations where turbines would be located at the Proposed Herkimer Wind Farm Site, Herkimer County, New York.



Appendix B. Photographs of representative habitat at locations where turbines would be located at the Proposed Herkimer Wind Farm Site, Herkimer County, New York.



Appendix C. Birds Observed at the Herkimer Wind Farm site on November 10, 2004
 (NYSDEC-listed species are highlighted; T = Threatened; SC = Special Concern)

Canada Goose	Golden-crowned Kinglet
Mallard	Eastern Bluebird
Northern Harrier (T)	American Robin
Red-tailed Hawk	European Starling
Rough-legged Hawk	Cedar Waxwing
Ruffed Grouse	American Tree Sparrow
Wild Turkey	Fox Sparrow
Rock Dove	Song Sparrow
Morning Dove	White-throated Sparrow
Great-horned Owl	Dark-eyed Junco
Downy Woodpecker	Northern Cardinal
Hairy Woodpecker	Red-winged Blackbird
Blue Jay	Brown-headed Cowbird
Common Raven	Purple Finch
American Crow	House Finch
Horned Lark (SC)	Common Redpoll
Black-capped Chickadee	Pine Siskin
Red-breasted Nuthatch	American Goldfinch
White-breasted Nuthatch	House Sparrow
Brown Creeper	

Appendix D. Letters from the USFWS and NYSDEC regarding potential presence of endangered and threatened species at the Herkimer Wind Power Project site, New York.



United States Department of the Interior

FISH AND WILDLIFE SERVICE

3817 Luker Road
Cortland, NY 13045



May 17, 2005

Mr. Michael Curry
Curry & Kerlinger, L.L.C
P.O. Box 453
Cape May Point, NJ 08212

Dear Mr. Curry:

This responds to your letter dated March 28, 2005, requesting information on the presence of Federally-listed or proposed, endangered or threatened species in the vicinity of a potential PPM Atlantic Renewable wind energy project in the vicinity of the Hamlet of Fairfield in Herkimer County, New York. We will address listed species, but will also provide information regarding the potential for other wildlife-related concerns.

It appears that the proposed project may affect species under U.S. Fish and Wildlife Service (Service) jurisdiction, however, further information is necessary to adequately make any determinations. This additional information includes a more detailed project description (*e.g.*, estimate of the operational lifespan of the project, the length of roads to be constructed, whether transmissions lines will be buried or overhead), as well as information on habitat and bird and bat use within the project area. We are providing the following comments pursuant to the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712), the Endangered Species Act of 1973 (ESA) (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*), and the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d). In addition to these comments, we may provide additional future comments under other legislation such as the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 *et seq.*).

The Service supports use of renewable energy resources when developed in an environmentally responsible manner. Renewable energy sources, such as solar and wind, can reduce environmental impacts of extraction and emissions associated with burning fossil fuels. To ensure that environmental benefits of renewable energy development outweigh potential impacts, we will work with the project sponsor in identifying ways that protect wildlife.

One purpose of this letter is to advise the project sponsor of the prohibitions and permitting aspects of the applicable Federal wildlife laws. We do this so the project sponsor can make an informed decision regarding site selection, project design, the risk of violating these acts, and whether applying for a permit to cover the anticipated take of the species is appropriate, where such a mechanism is available.

Migratory Species

Background

Migratory birds, such as waterfowl, passerines, and raptors are Federal trust resources and are protected by provisions of the MBTA; the Service is the primary Federal agency responsible for administering and enforcing the MBTA. This act prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests except when specifically authorized by the Service. The word "take" is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect." The unauthorized taking of even one bird is legally considered a "take" under the MBTA and is a violation of the law. Neither the MBTA nor its implementing regulations, 50 CFR Part 21, provide for permitting of "incidental take" of migratory birds that may be killed or injured by wind projects. However, we recognize that some birds may be killed at structures such as wind turbines even if all reasonable measures to avoid it are implemented. Depending on the circumstances, the Service's Office of Law Enforcement may exercise enforcement discretion. The Service focuses on those individuals, companies, or agencies that take migratory birds with disregard for their actions and the law, especially when conservation measures have been developed but are not properly implemented.

Operational wind turbines can adversely affect wildlife in a variety of ways. Foremost, the potential exists for bird and bat collision within the rotor-swept area of each turbine. It has been documented that wind turbines cause bat and bird mortality in a variety of species (Erickson et al. 2001). Research to date indicates that raptors are prone to wind turbine collisions. Songbirds, particularly those individuals migrating at night under poor visibility conditions, are even more susceptible. Recently, it has been reported that large numbers of bats have also been killed by these structures located on ridges. Habitat loss, fragmentation, and degradation are also potential impacts from wind energy development projects. Turbines can affect breeding and feeding behavior in some species, as well.

Recognizing the potential impacts to wildlife due to development of wind power projects, the Service developed *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines* (Guidelines) (Service 2003). A copy of this document may be obtained from our office or found on the Internet at www.fws.gov/r9dhebf/wind.pdf. These Guidelines include recommendations for: 1) proper evaluation of wind resource areas; 2) proper siting and design of turbines within development areas; and 3) pre- and post-construction research and monitoring to identify and/or assess impacts to wildlife. We suggest the project sponsor review this information during the development of the project design.

The potential for bat and bird mortality from this type of project appears to be dependent on factors such as wildlife abundance, presence of a migration corridor, geographic location, and particular landscape features. As specified in the Guidelines, the project site should be evaluated for habitat features such as the presence of breeding, feeding, and roosting areas. Unique habitats, such as wetlands, should also be considered.

Recommendations

The Service agrees that a bat and bird risk assessment should be conducted by the project sponsor as indicated in your species list request letter. This assessment should include a review of all available data and literature relevant to bat and bird use of this site. In addition, the assessment

should identify potential impacts as a result of collisions with turbines including the potential effects on, but not limited to, raptors, passerines, and bats, as well as cumulative effects of collision mortality from the proposed turbines. The physical disturbance, direct loss, and fragmentation of grassland and forest habitat should also be included in the evaluation. This information should be incorporated into the project's environmental documents for review.

If the results of the risk assessment indicate there may be the potential for adverse effects, we may recommend pre-construction studies of bird use of the proposed project site. Pre-construction studies of bats for this location are recommended. These studies should be of sufficient rigor to determine the temporal and spatial distribution of resident and migrating bat and bird species in and adjacent to the project area during various weather conditions (*e.g.*, fog, rain, low cloud ceilings, clear skies, etc.). One source of information on monitoring the project site for wildlife species can be obtained from "Studying Wind Energy/Bird Interactions: A Guidance Document. Metrics and Methods for Determining or Monitoring Potential Impacts on Birds at Existing and Proposed Wind Energy Sites" (National Wind Coordinating Committee 1999).

In order to determine the potential collision-hazard for a particular site, and to account for annual variability, the spatial and temporal uses of the project airspace by birds and bats need to be defined during a multi-year period. This can best be accomplished by using remote sensing technology (radar, acoustic, and infrared) to collect data in various spatial and temporal scales (day and night, season to season, and year to year). Traditional sampling protocols (*e.g.*, visual observation and/or mist netting) may be appropriate to supplement the remote sensing work and would likely be necessary to ground truth the data for individual species. Survey techniques are currently evolving and the project sponsor should work closely with this office and the New York State Department of Environmental Conservation (NYSDEC) to develop a draft study design prior to conducting any studies. Survey results should also be submitted to us for review and comment, along with proposed project-specific avoidance and minimization methods to reduce the risk of bat and bird mortality.

Finally, the Service recommends that all wind power projects that proceed to construction be monitored for impacts to wildlife following construction and during turbine operation. Therefore, we recommend mortality monitoring be completed on a systematic basis around the turbines. Post-construction bat and bird mortality monitoring should occur for a minimum of three years. Methods should be coordinated with both the Service and the NYSDEC. Information gained from post-construction monitoring will continue to aid the Service and project sponsors about the potential impacts, or lack thereof, to wildlife (including listed species - see below) in the project area.

Federally-listed Threatened or Endangered Species

Except for occasional transient individuals, no Federally-listed or proposed endangered or threatened species under our jurisdiction are known to exist in the project impact area. In addition, no habitat in the project impact area is currently designated or proposed "critical habitat" in accordance with provisions of the ESA. Should project plans change, or if additional information on listed or proposed species or critical habitat becomes available, this determination may be reconsidered. The most recent compilation of Federally-listed and proposed endangered and threatened species in New York* is available for your information. If the proposed project is not completed within one year from the date of this determination, we recommend that you

contact us to ensure that the listed species presence/absence information for the proposed project is current.

The above comments pertaining to endangered species under our jurisdiction are provided pursuant to the ESA. This response does not preclude additional Service comments under other legislation.

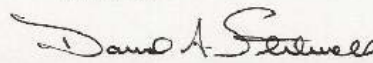
For additional information on fish and wildlife resources or State-listed species, we suggest you contact the appropriate State regional office(s),* and:

New York State Department of Environmental Conservation
New York Natural Heritage Program Information Services
625 Broadway
Albany, NY 12233-4757
(518) 402-8935

Work in certain waters of the United States, including wetlands, and streams may require a permit from the U.S. Army Corps of Engineers (Corps). If a permit is required, in reviewing the application pursuant to the Fish and Wildlife Coordination Act, the Service may concur, with or without recommending additional permit conditions, or recommend denial of the permit depending upon potential adverse impacts on fish and wildlife resources associated with project construction or implementation. The need for a Corps permit may be determined by contacting the appropriate Corps office(s).* In addition, should any part of the proposed project be authorized, funded, or carried out, in whole or in part, by a Federal agency, such as the Corps, further consultation between the Service and that Federal agency pursuant to the ESA may be necessary.

If you require additional information or assistance please contact Timothy Sullivan at (607) 753-9334. Future correspondence with us on this project should reference project file name 51237.e

Sincerely,



David A. Stilwell
Field Supervisor

*Additional information referred to above may be found on our website at:
<http://nyfo.fws.gov/es/esdesc.htm>.

References:

Erickson, W.P., G.D. Johnson, M.D. Strickland, D.P. Young, Jr., K.J. Semka, and R.E. Good.
2001. Avian collisions with wind turbines: A summary of existing studies and comparisons to other sources of avian collision mortality in the United States. National Wind Coordinating Committee publication.

National Wind Coordinating Committee. 1999. Studying Wind Energy/Bird Interactions: A Guidance Document. Metrics and Methods for Determining or Monitoring Potential Impacts on Birds at Existing and Proposed Wind Energy Sites.

U.S. Fish and Wildlife Service. 2003. Interim guidelines to avoid and minimize wildlife impacts from wind turbines. Web site address: <http://www.fws.gov/r9dhcbfa/wind.pdf>

cc: NYSDEC, Watertown, NY (Environmental Permits)
NYSDEC, Albany, NY (Natural Heritage)
NYSDEC, Albany, NY (Endangered Species Unit, Attn: P. Nye/A. Hicks)
EPA, Div. of Environmental Planning & Protection, New York, NY

New York State Department of Environmental Conservation**Division of Fish, Wildlife & Marine Resources****New York Natural Heritage Program**625 Broadway, 5th floor, Albany, New York 12233-4757

Phone: (518) 402-8935 • FAX: (518) 402-8925

Website: www.dec.state.nyErin M. Crotty
Commissioner

April 28, 2005

Michael Curry
Curry & Kerlinger
P O Box 453
Cape May Point, NJ 08212

Dear Mr. Curry:

In response to your recent request, we have reviewed the New York Natural Heritage Program database with respect to an Environmental Assessment for the proposed Wind Farm Project - Atlantic Renewable - possibly 60 wind turbines, area as indicated on the map you provided, located Herkimer County.

Enclosed is a report of rare or state-listed animals and plants, significant natural communities, and other significant habitats, which our databases indicate occur, or may occur, on your site or in the immediate vicinity of your site. The information contained in this report is considered sensitive and may not be released to the public without permission from the New York Natural Heritage Program.

PLEASE NOTE : For Windpower Projects, we report all records found within the project boundary and any avian and bat records that may be located within a 10-mile buffer of the project boundary.

The presence of rare species may result in this project requiring additional permits, permit conditions, or review. For further guidance, and for information regarding other permits that may be required under state law for regulated areas or activities (e.g., regulated wetlands), please contact the appropriate NYS DEC Regional Office, Division of Environmental Permits, at the enclosed address.

For most sites, comprehensive field surveys have not been conducted; the enclosed report only includes records from our databases. We cannot provide a definitive statement on the presence or absence of all rare or state-listed species or significant natural communities. This information should not be substituted for on-site surveys that may be required for environment impact assessment.

Our databases are continually growing as records are added and updated. If this proposed project is still under development one year from now, we recommend that you contact us again so that we may update this response with the most current information.

Sincerely,

Betty Ketcham
Betty A. Ketcham, Information Services
NY Natural Heritage Program

Encs.

cc: Reg. 6, Wildlife Mgr.
Mark Wothal, Bureau of Habitat, Albany
Peter Nye, Endangered Species Unit, Albany
Rudyard G. Edick, Environmental Permits, Albany

Natural Heritage Report on Rare Species and Ecological Communities

NY Natural Heritage Program, NYS DEC, 625 Broadway, 5th Floor,
Albany, NY 12233-4757
(518) 402-8935



Avian records found near a 10 mile radius of project site

-This report contains SENSITIVE information that may not be released to the public without permission from the NY Natural Heritage Program.
-Refer to the User's Guide for explanations of codes, ranks and fields.
-Location maps for certain species and communities may not be provided if 1) the species is vulnerable to disturbance, 2) the location and/or extent is not precisely known, and/or 3) the location and/or extent is too large to display.

County: Hamilton
Town: Morehouse

BIRDS			
<i>Gavia immer</i>			Office Use
Common Loon	NY Legal Status: Protected, Special Concern	NYS Rank: Vulnerable	1245
	Federal Listing:	Global Rank: Demonstrably secure	SL
	Last Report: **	EO Rank: **	ESU
	Hamilton		
	Morehouse		
Location:	Diamond Lake		
General Quality and Habitat:	**For information on the population at this location and management considerations, please contact the NYS DEC Regional Wildlife Manager or NYS DEC Endangered Species Unit at 518-402-8859.		

<i>Gavia immer</i>			Office Use
Common Loon	NY Legal Status: Protected, Special Concern	NYS Rank: Vulnerable	10239
	Federal Listing:	Global Rank: Demonstrably secure	SL
	Last Report: **	EO Rank: **	ESU
	Hamilton		
	Morehouse		
Location:	Long Lake Morehouse		
General Quality and Habitat:	**For information on the population at this location and management considerations, please contact the NYS DEC Regional Wildlife Manager or NYS DEC Endangered Species Unit at 518-402-8859.		

County: Herkimer
Town: Warren

BIRDS			
<i>Bartramia longicauda</i>			Office Use
Upland Sandpiper	NY Legal Status: Threatened	NYS Rank: Vulnerable	10938
	Federal Listing:	Global Rank: Demonstrably secure	
	Last Report: **	EO Rank: **	ESU
	Herkimer		
	Warren		
Location:	Route 18 Fields Warren		
General Quality and Habitat:	**For information on the population at this location and management considerations, please contact the NYS DEC Regional Wildlife Manager or NYS DEC Endangered Species Unit at 518-402-8859.		

County: Oneida
Town: Deerfield
BIRDS

Natural Heritage Report on Rare Species and Ecological Communities



ian records found near a 10 mile radius of project site

ounty: Oneida
 wn: Deerfield

BIRDS

Bartramia longicauda

Wetland Sandpiper

NY Legal Status: Threatened

NYS Rank: Vulnerable

Office Use
10953

Federal Listing:

Global Rank: Demonstrably secure

Last Report: **

EO Rank: **

ESU

Oneida
 Deerfield

Location: Dewey Corners Fields

General Quality and Habitat: **For information on the population at this location and management considerations, please contact the NYS DEC Regional Wildlife Manager or NYS DEC Endangered Species Unit at 518-402-8859.

wn: Trenton

BIRDS

Lanius ludovicianus

Loggerhead Shrike

NY Legal Status: Endangered

NYS Rank: Critically imperiled

Office Use
3032

Federal Listing:

Global Rank: Apparently secure

Last Report: **

EO Rank: **

M

ESU

Oneida
 Trenton

Location: Holland Patent

General Quality and Habitat: **For information on the population at this location and management considerations, please contact the NYS DEC Regional Wildlife Manager or NYS DEC Endangered Species Unit at 518-402-8859.

5 Records Processed

Natural Heritage Report on Rare Species and Ecological Communities



ian records found near a 10 mile radius of project site

ounty: Oneida
 wn: Deerfield

BIRDS

Bartramia longicauda

Wetland Sandpiper

NY Legal Status: Threatened

NYS Rank: Vulnerable

Office Use
10953

Federal Listing:

Global Rank: Demonstrably secure

Last Report: **

EO Rank: **

ESU

Oneida
 Deerfield

Location: Dewey Corners Fields

General Quality and Habitat: **For information on the population at this location and management considerations, please contact the NYS DEC Regional Wildlife Manager or NYS DEC Endangered Species Unit at 518-402-8859.

wn: Trenton

BIRDS

Lanius ludovicianus

Loggerhead Shrike

NY Legal Status: Endangered

NYS Rank: Critically imperiled

Office Use
3032

Federal Listing:

Global Rank: Apparently secure

Last Report: **

EO Rank: **

M

ESU

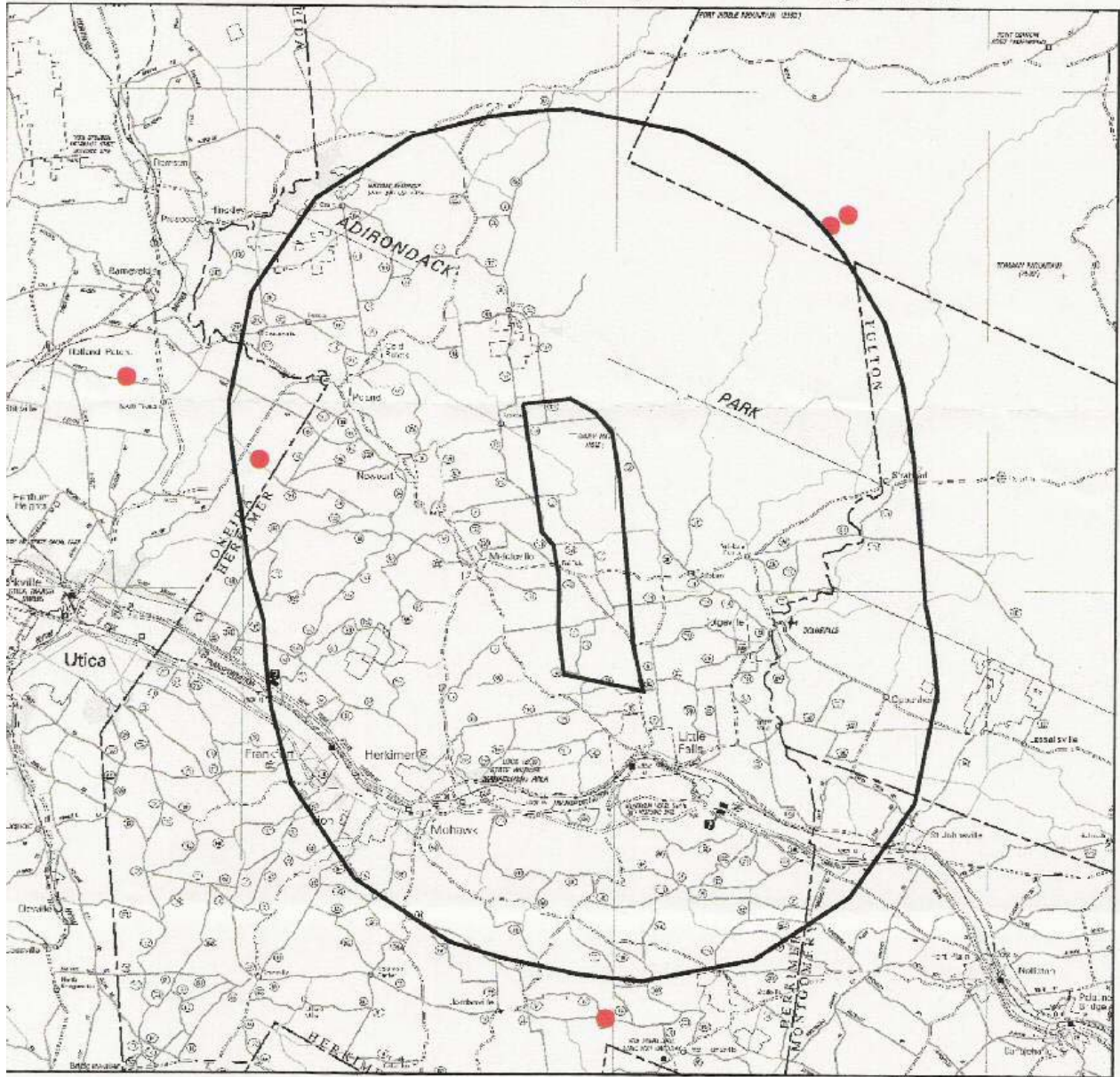
Oneida
 Trenton


Location: Holland Patent

General Quality and Habitat: **For information on the population at this location and management considerations, please contact the NYS DEC Regional Wildlife Manager or NYS DEC Endangered Species Unit at 518-402-8859.

5 Records Processed

Natural Heritage Map of Rare Species and Ecological Communities
Prepared April 25, 2005 by NY Natural Heritage Program, NYS DEC, Albany, New York



 **Project Site and 10 Mile Buffer**

NY Natural Heritage Program Database Records*

Scale: 1:300000

 **Animal**



* The locations that are displayed are considered sensitive and cannot be released to the public without permission.

Appendix E. Birds Recorded in the Vicinity of the Project Site during the 2000-2004 Breeding Bird Atlas Project (NYSDEC-listed species are highlighted; T = Threatened, SC = Special Concern).

Great Blue Heron – Confirmed	Red-eyed Vireo – Confirmed
Green Heron – Probable	Blue Jay – Confirmed
Black-crowned Night-heron – Possible	American Crow – Confirmed
Turkey Vulture – Probable	Common Raven – Confirmed
Canada Goose – Confirmed	Tree Swallow – Confirmed
Wood Duck – Confirmed	N. Rough-winged Swallow – Confirmed
Mallard – Confirmed	Bank Swallow – Confirmed
Common Merganser – Probable	Cliff Swallow – Probable
Northern Harrier (T) – Confirmed	Barn Swallow – Confirmed
Cooper’s Hawk (SC) – Confirmed	Black-capped Chickadee – Confirmed
Red-shouldered Hawk (SC) – Possible	Tufted Titmouse – Probable
Red-Tailed Hawk – Confirmed	Red-breasted Nuthatch – Probable
American Kestrel – Confirmed	White-breasted Nuthatch – Probable
Ring-necked Pheasant – Possible	Brown Creeper – Possible
Ruffed Grouse – Probable	House Wren – Confirmed
Wild Turkey – Confirmed	Winter Wren – Possible
Killdeer – Confirmed	Golden-crowned Kinglet – Possible
Spotted Sandpiper – Possible	Eastern Bluebird – Confirmed
Upland Sandpiper (T) – Possible	Veery – Probable
Wilson’s Snipe – Probable	Hermit Thrush – Probable
Rock Pigeon – Confirmed	Wood Thrush – Confirmed
Mourning Dove – Confirmed	American Robin – Confirmed
Black-billed Cuckoo – Probable	Gray Catbird – Confirmed
Eastern Screech-Owl – Possible	Brown Thrasher – Confirmed
Great Horned Owl – Confirmed	European Starling – Confirmed
Barred Owl – Possible	Cedar Waxwing – Confirmed
Chimney Swift – Confirmed	Blue-winged Warbler – Probable
Ruby-throated Hummingbird – Confirmed	Nashville Warbler – Possible
Belted Kingfisher – Possible	Yellow-Warbler – Confirmed
Red-headed Woodpecker (SC) – Possible	Chestnut-sided Warbler – Confirmed
Red-bellied Woodpecker – Confirmed	Magnolia Warbler – Probable
Yellow-bellied Sapsucker – Confirmed	Black-throated Blue Warbler – Probable.
Downy Woodpecker – Confirmed	Yellow-rumped Warbler – Confirmed
Hairy Woodpecker – Confirmed	Black-throated Green Warbler – Possible.
Northern Flicker – Confirmed	Blackburnian Warbler – Probable
Pileated Woodpecker – Probable	Black-and-white Warbler – Probable
Eastern Wood-Pewee – Confirmed	American Redstart – Confirmed
Alder Flycatcher – Possible	Ovenbird – Probable
Willow Flycatcher – Confirmed	Mourning Warbler – Confirmed
Least Flycatcher – Possible	Common Yellowthroat – Confirmed
Eastern Phoebe – Confirmed	Canada Warbler – Probable
Great Crested Flycatcher – Probable	Scarlet Tanager – Probable
Eastern Kingbird – Confirmed	Eastern Towhee – Possible
Yellow-throated Vireo – Possible	Chipping Sparrow – Confirmed
Blue-headed Vireo – Possible	Field Sparrow - Possible
Warbling Vireo – Probable	Savannah Sparrow – Confirmed

Song Sparrow – Confirmed
 Swamp Sparrow – Confirmed
 White-throated Sparrow – Possible
 Dark-eyed Junco – Possible
 Northern Cardinal – Confirmed
 Rose-breasted Grosbeak – Confirmed
 Indigo Bunting – Confirmed
 Bobolink – Confirmed
 Red-winged Blackbird – Confirmed
 Eastern Meadowlark – Confirmed
 Common Grackle – Confirmed

Brown-headed Cowbird – Confirmed
 Orchard Oriole – Possible
 Baltimore Oriole – Confirmed
 Purple Finch – Confirmed
 House Finch – Confirmed
 White-winged Crossbill – Possible
 Pine Siskin – Probable
 American Goldfinch – Confirmed
 Evening Grosbeak – Confirmed
 House Sparrow – Confirmed

Total Species:	113	
Confirmed Breeders:	65	(58%)
Probable Breeders:	24	(21%)
Possible Breeders:	24	(21%)

Appendix F. 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

- **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 Ruge 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 Geronio 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 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)