

**A 2007 Breeding Bird and Area Search Surveys at
the Proposed Marble River Wind Farm in
Clinton County, New York**

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1.0 Introduction

1.1 Project Background

Marble River, LLC, is proposing to develop a 218 megawatt (mw) wind generation facility with up to 109 wind turbines arranged in several clusters and strings within the towns of Clinton and Ellenburg in Clinton County, New York. The project, referred to as the Marble River Wind Farm, has proposed approximately 89 turbines in the town of Clinton and 20 turbines in the town of Ellenburg on leased private land. As part of the project infrastructure, Marble River, LLC, will construct approximately 41 miles of access roads, 51 miles of underground electric cable, an operation and maintenance building, and a substation adjacent to an existing 230 kV transmission line.

Marble River LLC and Horizon Wind Energy initially undertook breeding bird surveys in the summer of 2005 (Woodlot 2006). Since the 2005 field season, Marble River, LLC, has expanded the project area to the north and south of the original project layout. As a result, systematic point counts and area searches to characterize the species diversity and abundance of birds breeding in the vicinity of the proposed project area were conducted in early summer of 2007. The 2007 breeding bird and area search survey was designed to expand upon and supplement the surveys conducted in 2005 and are reported here.

Observers gathered information on species identification, abundance, nest building, courtship displays, and any other notable behaviors. These survey efforts will establish a baseline of the area's breeding avifauna data for future post-construction habitat displacement surveys. This habitat displacement study will determine whether, and to what extent, the wind turbines may disturb/displace nesting birds.

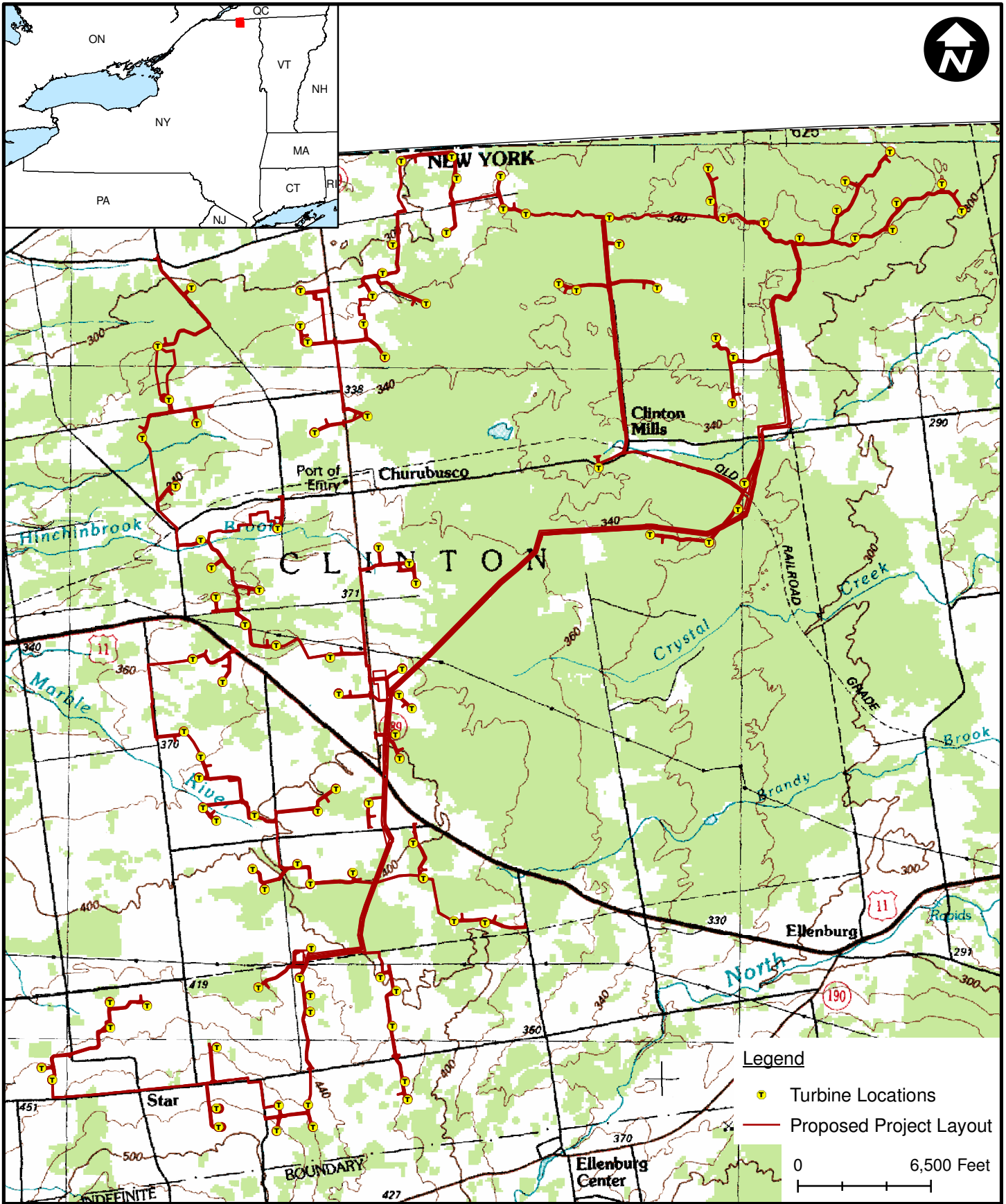
1.2 Project Area Description

The proposed Marble River Wind Farm is located north of the Adirondack Mountains and just south of the Canadian border in the towns of Clinton and Ellenburg in Clinton County, New York (Figure 1). It is also bounded by the Marble River on the west and a tract of State Forest Preserve on the east.

The topography of the proposed project area is relatively flat, with an average elevation of approximately 1,300 feet. The site is located near the intersection of three ecozones, specifically the Western Adirondack Foothills, Western Adirondack Transition, and Champlain Transition ecozones. Most of the project area was originally a forest-wetland complex, and although little of the forest remains today (American Bird Conservancy 2000), some of the wooded fragments are intermixed with wetlands and creeks.

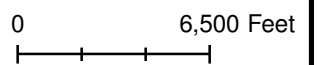
A variety of habitat types, including mature and regenerating stands of hardwood, coniferous, and mixed forests, abandoned fields, forested wetlands, emergent wetlands, swamps, ponds, hayfields, croplands, and low density residential areas, occur in the project area. The majority of forested areas within the project show signs of recent and past timber harvesting, and much of the forest appears to be relatively young. Wetland complexes consist primarily of scrub/shrub, emergent wetlands, and birch/alder swamp thickets. A relatively large wetland complex (open water and emergent wetlands) occurs in the northeastern portion of the site. The northeastern portion of the project area crosses several small streams, which drain into a relatively large forested ravine (The Gulf Unique Natural Area) just northeast of the project area. The eastern and southern portions of the project area are mostly grassland/field habitats intermixed with small patches of woodlands. Some of the grasslands have been abandoned and others are being maintained and actively cultivated. In some areas, the transition between cultivated fields and woodlands is buffered by early-successional or scrub habitat.

Avian species representative of grasslands, croplands, pastures, sharp transitional edges, emergent wetlands, open water wetlands, and fragmented woodlands would be expected to occur in this environment. Species known to prefer or require expansive tracts of intact forest would be unlikely to breed within the project area. Species listed as endangered, threatened, or of special concern by the New York State Department of Environmental Conservation (NYSDEC) that might be expected in the proposed project area include the northern harrier (*Circus cyaneus*), short-eared owl (*Asio flammeus*), upland sandpiper (*Bartramia longicauda*), pied-billed grebe (*Podilymbus podiceps*), horned lark (*Eremophila alpestris*), grasshopper sparrow (*Ammodramus savannarum*), vesper sparrow (*Pooecetes gramineus*), and American bittern (*Botaurus lentiginosus*).



Legend

- Turbine Locations
- Proposed Project Layout



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105038-F01-Project.mxd

Sheet Title: **Project Area Map**

Project: **Marble River Wind Farm
Clinton County, New York**

Date: July 2007

Scale: 1" = 6500'

Proj. No.: 105038

Figure: **1**

2.0 Methods

2.1 Point Count Field Surveys

Breeding bird surveys were conducted at the proposed Marble River Wind Farm during the months of May and June 2007 (Figure 2). The point count method, modeled on U.S. Fish and Wildlife Service Breeding Bird Survey (BBS) methodology (Sauer *et al.* 1997), was used to count individuals of each species located at a series of survey points. Thirty-two points were sampled: 13 points in field; 12 in forested habitats; and 7 in wetland habitats. Sixteen points were surveyed per day on two consecutive days, and the survey was repeated three times to coincide with breeding birds during peak nesting season, when the males are calling. Survey locations were chosen to provide coverage of the proposed locations of the wind turbines and transmission lines as well as proportional coverage of the project area habitat types. The survey points were spaced to ensure that double-counting of individuals did not occur and point locations were recorded using GPS.

All points were surveyed on days with suitable weather conditions, which included generally mild conditions or, at worst, light rain showers and light to moderate winds. Surveys were not conducted during periods of moderate to heavy rain or high winds. Surveys were timed to coincide with the hours of peak bird singing activity, approximately 4:30 to 10:30 AM. Each point was surveyed from the center of the plot for 10 minutes during which all visual or audible observations of birds were recorded onto a data sheet for that point. Each bird was identified as to species and distance from survey site (0-50 m, 50-100 m, or >100 m). This method is similar to the methodology of the BBS and provides the opportunity for comparison with BBS data in the future. The approximate location of each bird was also plotted on a point count data sheet to further ensure individual birds were not double-counted.

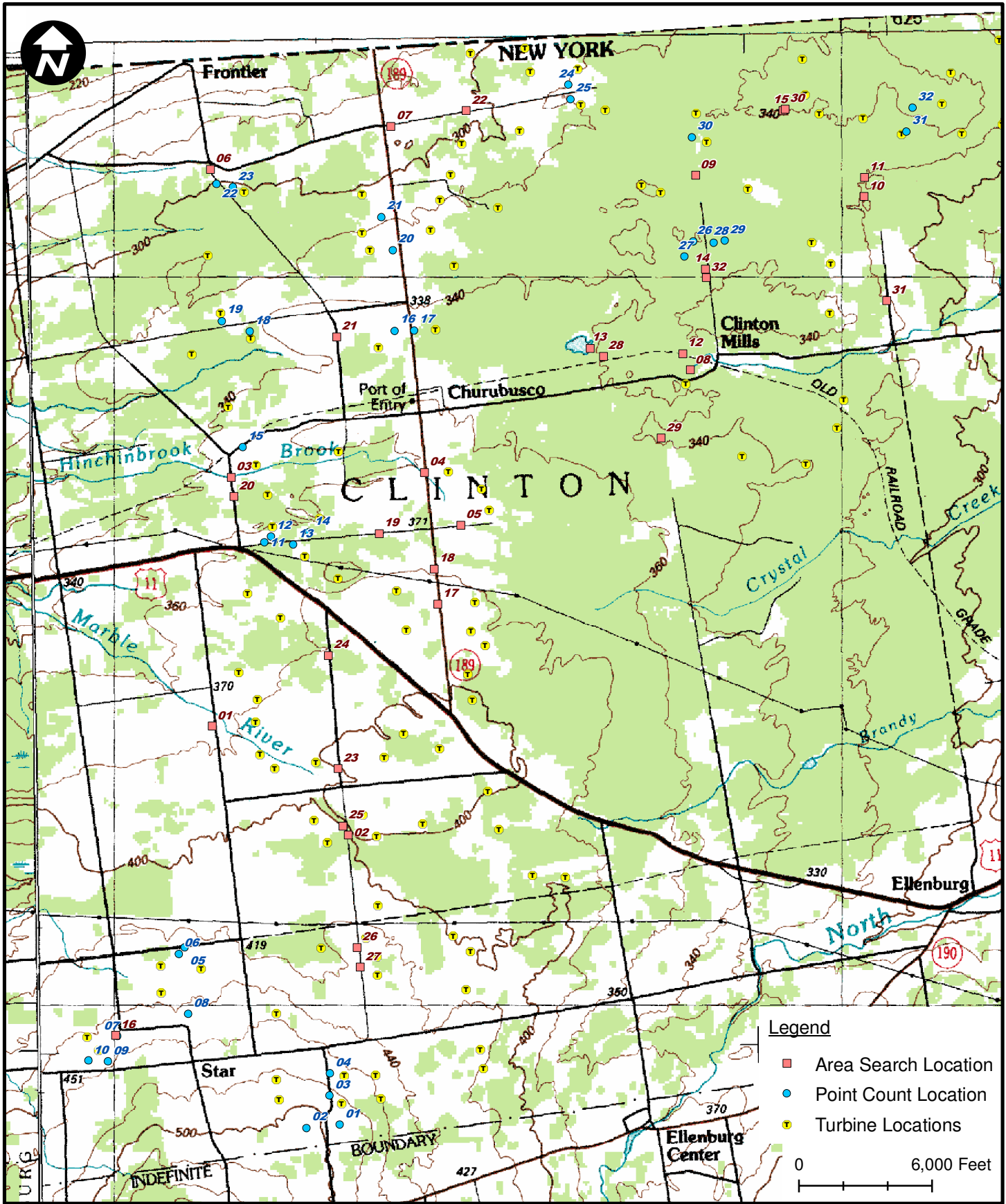
When possible, species identifications of birds flying overhead (flyovers) were documented, as were observations of notable activities (i.e., singing, courtship flights, territorial displays, nest flushes, food exchanges, or foraging). In addition, bird observations made incidental to the survey were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

2.2 Area Searches

In addition to point count field survey, 32 area searches were conducted throughout the project area (Figure 2). Area searches were conducted to supplement point counts, focus on areas potentially containing rare species, and to document species not as effectively detected by point count survey methods (Ralph *et al.* 1993). Area searches were conducted in sections of the project area not sampled during point count surveys. Area searches were generally conducted for several hours following the point count surveys, but were also conducted occasionally in the early morning and the evening. During these surveys, all species detected, the habitat type, and additional behavioral notes were recorded. Birds observed in the project area while traveling between point count and area search locations were recorded as incidental observations. Data collected during the area searches will supplement the point count data.

Data Analysis

Observational data collected from the point count survey and area searches were used to determine species composition and distribution. Quantitative data collected during surveys were used to calculate species richness (total number of species observed), relative abundance (estimate of actual abundance), and frequency (percent occurrence) of breeding avian species over the entire survey area and by habitat type. The habitats that were surveyed and statistically analyzed were summarized into three habitat types: Field, forest, and wetland. Bird species recorded as flyovers or beyond 100 m, and birds detected during area surveys were not included in the statistical analysis.



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105038-F02-Survey.mxd

Sheet Title: *Point Count and Area Search Locations*

Project: *Marble River Wind Farm
Clinton County, New York*

Date: July 2007

Scale: 1" = 6000'

Proj. No.: 105038

Figure: **2**

3.0 Results

During the three survey periods, a total of 1,083 bird observations were made (Appendix A Table 2), with most observations occurring in field habitats (Appendix A Table 3). Of these observations, 257 were of flyover birds or birds beyond 100 m from the survey point. These were consequently excluded from the analyses, leaving 826 bird observations for numerical analyses. Similarly, 87 species were observed during point counts (including species detected at >100 m and flyovers); 72 species were included in the numerical analyses (Appendix A Table 1). Area search surveys documented 70 bird species (Appendix A Table 4). The overall relative abundance for the entire survey period was 8.60 birds per point. Species richness (number of observed species at survey points) ranged from 5 to 20 species per survey point with a species richness of 72 documented breeding birds. When point count surveys and area search surveys were pooled, 94 bird species were observed at Marble River Wind Farm (Appendix A Table 5).

The most frequently observed species were the white-throated sparrow (*Zonotrichia albicollis*), common yellowthroat (*Geothlypis trichas*), chestnut-sided warbler (*Dendroica pensylvanica*), and American robin (*Turdus migratorius*). Species with the highest relative abundance were the white-throated sparrow, ovenbird (*Seiurus aurocapillus*), common yellowthroat, and bobolinks (*Dolichonyx oryzivorus*).

Several species listed as threatened and special concern by NYSDEC were observed. Threatened species detected during point counts and area searches were the pied-billed grebe, northern harrier, and upland sandpiper. Species of special concern observed included the grasshopper sparrow and vesper sparrow. The locations of these species are depicted in Figure 3.

The most commonly observed flyover species were the European starling (*Sturnus vulgaris*), cedar waxwing (*Bombycilla cedrorum*), and American goldfinch (*Carduelis tristis*). Species that were observed exclusively as flyovers or beyond 100 m were the Baltimore oriole (*Icterus galbula*), barn swallow (*Hirundo rustica*), blackpoll warbler (*Dendroica striata*), broad-winged hawk (*Buteo platypterus*), brown thrasher (*Toxostoma rufum*), brown-headed cowbird (*Molothrus ater*), Canada goose (*Branta canadensis*), common raven (*Corvus corax*), European starling, herring gull (*Larus argentatus*), indigo bunting (*Passerina cyanea*), mallard (*Anas platyrhynchos*), red-shouldered hawk (*Buteo lineatus*), turkey vulture (*Cathartes aura*), and a unidentified duck species. Species exclusively observed as flyovers or beyond 100 m were excluded from the numerical analyses; their breeding status in the project area could not be determined.

Area searches documented an additional seven species that were not detected during point counts. Species detected during these surveys are provided in Appendix A Table 4.

Field

Forty-one percent of the survey points were in field habitat. Field habitats ranged from abandoned farm fields to active agricultural lands. Thirty-seven percent of all bird observations (305 observations) and 60 percent of the species occurred at these points. Species richness at field habitats was 43 and ranged from 5 to 19 species per point. Ten percent of total species observed (7 species) were unique to field habitats. Chestnut-sided warbler, common yellowthroat, yellow warbler (*Dendroica petechia*), white-throated sparrow, savannah sparrow (*Passerculus sandwichensis*), bobolink, and song sparrow (*Melospiza melodia*) were the most frequently observed birds at field points. Bobolink, savannah sparrow, common yellowthroat, chestnut sided warbler, white-throated sparrow, and yellow warbler were the most abundant. The relative abundance of all bird species per field point was 7.82 (Appendix A Table 1). One threatened species (upland sandpiper) and two species of special concern (grasshopper sparrow and vesper sparrow) were detected in these field habitats.

Forest

Thirty-eight percent of the survey points were in forest habitat. Forty-one percent of the bird observations (338 observations) and 75 percent of the total species observed occurred at these points. Species richness at forest habitats was 54 and ranged from 10 to 22 species per point. Seventeen percent of total species observed (12 species) were unique to forest habitats. Ovenbird, white-throated sparrow, hermit thrush (*Catharus guttatus*), red-eyed vireo (*Vireo olivaceus*), American robin, and black-and-white warbler (*Mniotilta varia*) were the most frequently observed species and the most abundant at forest points. The relative abundance of all bird species per forest point was 9.39 (Appendix A Table 1).

Wetland

Twenty-two percent of survey points were in wetland habitats. Twenty-two percent of the bird observations (183 observations) and 60 percent of the total species observed occurred in these wetlands. Wetland habitats ranged from forested wetlands to open water emergent wetlands. Species richness at wetland habitats was 43 and ranged from 5 to 20 species per point. Ten percent of total species observed (7 species) were unique to wetland habitats. Eastern wood-peewee (*Contopus virens*), chestnut-sided warbler, common yellowthroat, white-throated sparrow, ovenbird, and alder flycatcher (*Empidonax alnorum*) were the most frequently observed species. White-throated sparrow, common yellowthroat, red-winged blackbird (*Agelaius phoeniceus*), black-capped chickadee (*Poecile atricapillus*), American redstart (*Setophaga ruticilla*), and American robin were the most abundant. The relative abundance of all bird species per wetland point was 8.71 (Appendix A Table 1).



4.0 Discussion

Spring BBS surveys documented a total of 87 species, and area searches and incidental observations accounted for an additional 7 species, resulting in a total of 94 species observed in the project area. Surveys were conducted during the peak of the nesting season, mainly in the morning when detection of birds is greatest, and during optimal weather conditions for detection. It is likely, therefore, that the species richness detected during surveys is a suitable reflection of the species composition of breeding birds in the area. However, certain species that make infrequent vocalizations, such as some species of woodpecker, can be underrepresented during bird surveys (Farnsworth *et al.* 2002).

The species encountered during the breeding bird surveys at the Marble River Wind Farm are consistent with those expected in field, forest, and wetland habitats. The most abundant birds across all habitat types are well-documented as breeding species in the Marble River Wind Farm project area: white-throated sparrow; ovenbird; common yellowthroat; and bobolink (Andrle and Carroll 1988).

The point count survey produces an index of relative abundance rather than a complete count of breeding bird populations (Sauer *et al.* 1997). The overall relative abundance was 8.60 birds/point with the greatest occurring in the forest points (9.39). Relative abundance for field and wetland habitats was similar at 7.82 and 8.60, respectively.

The most abundant birds within each habitat type were also consistent with historical records for the project area. The white-throated sparrow (0.79) and common yellowthroat (0.54) were the most abundant and most frequent species recorded, occurring at 81 percent and 75 percent of all points, respectively.

In general, the species observed in the field, forest, and wetland habitats of the project area are species that are common to the region and are typical of habitats in which they were observed, with the exception of a few species that were detected during the late-May survey period that were suspected to be migrants. The number of habitat-specific species found in each habitat type was consistent with the number of survey points in that habitat, i.e., field habitat with 13 survey points had 7 habitat-specific species, forest habitat with 12 survey points had 12 habitat-specific species, and wetland habitat with 7 surveys points had 7 habitat-specific species (Appendix A Table 1).

Species that were only detected during area searches were the northern harrier, rough-legged hawk (*Buteo lagopus*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), belted kingfisher (*Ceryle alcyon*), blue-headed vireo (*Vireo solitarius*), and rock dove (*Columba livia*). Area searches documented the presence of several threatened and species of concern.

Observations of New York state listed species occurred in both field and wetland habitats. Two threatened pied-billed grebes were detected during point counts and area searches (Point Count 29 and Area Search 7). Both locations are in the northern part of the project area and were in close proximity or in wetland habitats. Seven upland sandpipers were detected (Point Counts 15, 24, and 25 and Area Search 31) and these sites were associated with large open grasslands. One northern harrier was observed near Area Search 1 and another was observed incidentally flying low over a field near the met tower on the east side of Route 189. Three vesper sparrows were recorded at field points (Point Counts 7 and 9). One grasshopper sparrow was observed at Point Count 20. The relative abundance of these species was low and their distribution in the project area was localized. However, wind turbines are proposed in close proximity (± 200 m) to some areas where these rare species were observed.

5.0 Conclusions

No state or federally endangered species were observed during surveys within the project area. However, some state threatened and state species of concern were observed in grassland and wetland habitats. The proposed project area is in the St. Lawrence Plain Physiographic Area, considered by Partners in Flight to be the one of the largest and most important areas of “agricultural grasslands” in the northeast. This area supports some of largest number of grassland and early successional species in the Northeast (American Bird Conservancy 2000).

The fact that upland sandpipers, vesper sparrows, grasshopper sparrows, and northern harriers were observed during surveys suggests that grassland habitats in the proposed project do provide suitable habitat for these species. Turbines are proposed for both grassland and forested areas within the project area. Several proposed turbines locations are in close proximity (± 200 m) to these rare species locations. The large wetland complexes of open water, forested wetland, and emergent wetlands, especially in the northern part of the project area provide excellent habitat for the State Threatened pied-billed grebe and other waterfowl species. Wind turbines are proposed for these areas and should be sited carefully. The forested upland habitats have been logged and are already heavily fragmented. This habitat type did not support any threatened or special concern species.

As with any rare species, the loss of a few individuals from a population should be considered more significant than for more abundant species. The occurrence of these grassland associated species in close proximity to proposed wind turbines may pose a risk to the local populations of these species. Two of the five listed species may be a greater risk due to their breeding behavior. For example, northern harriers (NYS Threatened), a grassland-associated species, fly low over the ground searching for food. Most of their foraging behavior is below turbine height. However, during the breeding season, male northern harriers take part in aerial courtship displays, referred to as “sky dancing”, with undulating flights of steep climbs and descents (Simmons 1988, Christiansen and Reinert 1990). This sky dancing behavior may briefly put northern harriers at a greater collision risk than other species because the display behavior takes place in the turbine zone.

Similar to northern harriers, upland sandpipers (NYS Threatened) are a grassland species and typically engage in low elevation flights over their breeding territory (Roberts 1936). These flights include a flutter stroke and vocalizations that generally occur within the turbine zone. As with the male northern harrier, these flights are limited in duration and occur only during a brief, annual breeding period. Conversely, unlike the northern harrier and upland sandpiper, both the vesper sparrow (NY Species of Concern) and grasshopper sparrow (NY Species of Concern) breeding and foraging movements are generally close to the ground and therefore limit the potential risk or exposure of individuals to collisions with wind turbines. Impacts to these species, if any, would likely be in the form of displacement or loss of habitat.

While individuals of these species could be at risk of colliding with the proposed wind turbines the absolute risk is unknown due to a lack of information on bird and wind turbine interactions. More and more information on these interactions is becoming available, though the growth and distribution of this information is generally slow.

6.0 References

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Appendix A

Breeding Bird Survey Tables

Appendix A Table 1. Total number of observations within 100m of point count center, relative abundance, and frequency of occurrence during 3 days of point count surveys at Marble River Wind Farm in spring 2007.

Species	Field (13 Points)			Forest (12 Points)			Wetland (7 Points)			All Habitats (32 Points)		
	Total # ^a	Relative Abundance ^b	Frequency ^c	Total # ^a	Relative Abundance ^b	Frequency ^c	Total # ^a	Relative Abundance ^b	Frequency ^c	Total # ^a	Relative Abundance ^b	Frequency ^c
Alder flycatcher	9	0.23	46.2%	6	0.17	33.3%	7	0.33	71.4%	22	0.23	46.9%
American crow	2	0.05	15.4%	4	0.11	33.3%				6	0.06	18.8%
American goldfinch	13	0.33	46.2%	3	0.08	16.7%				16	0.17	28.1%
American redstart	1	0.03	7.7%	9	0.25	58.3%	3	0.14	42.9%	13	0.14	34.4%
American robin	7	0.18	53.8%	14	0.39	83.3%	9	0.43	71.4%	30	0.31	68.8%
American woodcock ^f				1	0.03	8.3%	1	0.05	14.3%	2	0.02	6.3%
Black-and-white warbler	2	0.05	15.4%	15	0.42	66.7%	5	0.24	42.9%	22	0.23	40.6%
Blackburnian warbler	1	0.03	7.7%	7	0.19	41.7%	2	0.10	28.6%	10	0.10	25.0%
Black-capped chickadee	4	0.10	23.1%	9	0.25	50.0%	10	0.48	57.1%	23	0.24	40.6%
Black-throated blue warbler				6	0.17	33.3%	3	0.14	42.9%	9	0.09	21.9%
Black-throated green warbler	1	0.03	7.7%	6	0.17	33.3%				7	0.07	15.6%
Blue jay	1	0.03	7.7%	9	0.25	41.7%	5	0.24	42.9%	15	0.16	28.1%
Bobolink	50	1.28	69.2%							50	0.52	31.3%
Brown creeper ^c				2	0.06	16.7%				2	0.02	6.3%
Canada warbler ^c				2	0.06	8.3%				2	0.02	3.1%
Cedar waxwing	7	0.18	23.1%	3	0.08	25.0%	4	0.19	57.1%	14	0.15	31.3%
Chestnut-sided warbler	21	0.54	92.3%	9	0.25	33.3%	6	0.29	85.7%	36	0.38	71.9%
Chipping sparrow	6	0.15	30.8%				1	0.05	14.3%	7	0.07	18.8%
Common grackle	1	0.03	7.7%	7	0.19	16.7%	6	0.29	28.6%	14	0.15	15.6%
Common yellowthroat	27	0.69	76.9%	12	0.33	58.3%	13	0.62	85.7%	52	0.54	75.0%
Dark-eyed junco ^f							1	0.05	14.3%	1	0.01	3.1%
Downy woodpecker				1	0.03	8.3%	2	0.10	28.6%	3	0.03	9.4%
Eastern kingbird	5	0.13	23.1%				5	0.24	42.9%	10	0.10	18.8%
Eastern meadowlark	1	0.03	7.7%							1	0.01	3.1%
Eastern phoebe	2	0.05	15.4%	2	0.06	16.7%	1	0.05	14.3%	5	0.05	15.6%
Eastern towhee	5	0.13	38.5%	2	0.06	8.3%	1	0.05	14.3%	8	0.08	21.9%
Eastern wood-pewee	3	0.08	15.4%	2	0.06	16.7%	9	0.43	85.7%	14	0.15	31.3%
Field sparrow	4	0.10	15.4%	1	0.03	8.3%				5	0.05	9.4%
Golden-crowned kinglet ^c				1	0.03	8.3%				1	0.01	3.1%
Grasshopper sparrow ^d	1	0.03	7.7%							1	0.01	3.1%
Gray catbird	2	0.05	15.4%	1	0.03	8.3%	3	0.14	28.6%	6	0.06	15.6%
Great-crested flycatcher ^d	1	0.03	7.7%							1	0.01	3.1%
Hairy woodpecker				5	0.14	33.3%	2	0.10	28.6%	7	0.07	18.8%
Hermit thrush	2	0.05	15.4%	21	0.58	83.3%	5	0.24	57.1%	28	0.29	50.0%
Hooded warbler ^f							1	0.05	14.3%	1	0.01	3.1%
House sparrow ^d	2	0.05	7.7%							2	0.02	3.1%
House wren ^d	1	0.03	7.7%							1	0.01	3.1%
Killdeer ^d	2	0.05	7.7%							2	0.02	6.3%
Magnolia warbler				3	0.08	25.0%				3	0.03	9.4%
Mourning dove	1	0.03	7.7%	6	0.17	41.7%	1	0.05	14.3%	8	0.08	21.9%
Mourning warbler				7	0.19	41.7%	2	0.10	28.6%	9	0.09	21.9%
Nashville warbler				3	0.08	16.7%	1	0.05	14.3%	4	0.04	9.4%
Northern cardinal ^c				1	0.03	8.3%				1	0.01	3.1%
Northern flicker				5	0.14	33.3%	4	0.19	42.9%	9	0.09	21.9%
Northern parula ^c				2	0.06	16.7%				2	0.02	6.3%
Ovenbird	2	0.05	15.4%	54	1.5	91.7%	7	0.33	71.4%	63	0.66	56.3%
Philadelphia vireo ^c				1	0.03	8.3%				1	0.01	3.1%
Pied-billed grebe ^f							1	0.05	14.3%	1	0.01	3.1%
Pine warbler ^c				1	0.03	8.3%				1	0.01	3.1%
Red-eyed vireo	7	0.18	46.2%	22	0.61	83.3%	3	0.14	28.6%	32	0.33	59.4%
Red-winged blackbird	10	0.26	46.2%	1	0.03	8.3%	10	0.48	57.1%	21	0.22	34.4%
Rose-breasted grosbeak	1	0.03	7.7%	7	0.19	41.7%				8	0.08	18.8%
Ruby-throated hummingbird ^c				1	0.03	8.3%				1	0.01	3.1%
Savannah sparrow ^d	36	0.92	69.2%							36	0.38	31.3%
Scarlet tanager	1	0.03	7.7%	4	0.11	25.0%	1	0.05	14.3%	6	0.06	15.6%
Song sparrow	16	0.41	61.5%	3	0.08	25.0%	5	0.24	57.1%	24	0.25	50.0%
Swamp sparrow				2	0.06	8.3%	3	0.14	42.9%	5	0.05	12.5%
Tree swallow ^f							1	0.05	14.3%	1	0.01	3.1%
Tufted titmouse ^c				1	0.03	8.3%				1	0.01	3.1%
Upland sandpiper ^d	2	0.05	15.4%							2	0.02	6.3%
Veery	3	0.08	15.4%	4	0.11	25.0%	3	0.14	28.6%	10	0.1	21.9%
Vesper sparrow ^d	3	0.08	7.7%							3	0.03	6.3%
Warbling vireo ^c				2	0.06	16.7%				2	0.02	6.3%
White-breasted nuthatch ^c				6	0.17	33.3%				6	0.06	12.5%
White-throated sparrow	21	0.54	69.2%	34	0.94	91.7%	21	1.00	85.7%	76	0.79	81.3%
Wild Turkey	2	0.05	7.7%	1	0.03	8.3%				3	0.03	6.3%
Wilson's snipe				1	0.03	8.3%	1	0.05	14.3%	2	0.02	6.3%
Winter wren				1	0.03	8.3%	2	0.10	14.3%	3	0.03	6.3%
Wood duck ^f							4	0.19	28.6%	4	0.04	6.3%
Wood thrush ^c				1	0.03	8.3%				1	0.01	3.1%
Yellow warbler	16	0.41	76.9%	4	0.11	25.0%	7	0.33	57.1%	27	0.28	53.1%
Yellow-bellied sapsucker ^f							1	0.05	14.3%	1	0.01	3.1%
Grand Total	305			338			183			826		
Relative abundance		7.82			9.39			8.71			8.60	
Species richness	43			54			43			72		
Species richness range	5 to 19			10 to 22			15 to 20			5 to 20		

^a Total number of observations. ^d Species specific to field habitats
^b Mean number of birds observed. ^e Species specific to forested habitats
^c Percentage of survey points where species occurred. ^f Species specific to wetland habitats

Appendix A Table 2. Total number of species recorded and distance from point count center at Marble River Wind Farm during 3 day point count surveys in spring 2007.

Species	0-50 m	50-100 m	> 100 m ^a	Flyovers ^a	Grand Total
Alder flycatcher	3	19	2		24
American crow	1	5	4	9	19
American goldfinch	2	14		16	32
American redstart	4	9			13
American robin	6	24	3	6	39
American woodcock		2	5	4	11
Baltimore oriole			1		1
Barn swallow				1	1
Black-and-white warbler	2	20			22
Blackburnian warbler	1	9			10
Black-capped chickadee	10	13	4		27
Blackpoll warbler				2	2
Black-throated blue warbler	1	8			9
Black-throated green warbler	1	6	2		9
Blue jay	1	14		2	17
Bobolink	16	34	4	2	56
Broad-winged hawk				2	2
Brown creeper		2			2
Brown thrasher			1		1
Brown-headed cowbird				1	1
Canada goose				2	2
Canada warbler		2			2
Cedar waxwing	6	8	1	17	32
Chestnut-sided warbler	8	28			36
Chipping sparrow		7			7
Common grackle	1	13	1	2	17
Common raven			1	3	4
Common yellowthroat	9	43	2		54
Dark-eyed junco		1	1		2
Downy woodpecker		3			3
Duck species			1		1
Eastern kingbird	3	7	1	1	12
Eastern meadowlark		1			1
Eastern phoebe	1	4			5
Eastern towhee	1	7	2		10
Eastern wood-pewee	4	10	1		15
European starling				56	56
Field sparrow	1	4			5
Golden-crowned kinglet		1			1
Grasshopper sparrow		1			1
Gray catbird		6			6
Great-crested flycatcher		1			1
Hairy woodpecker	1	6	1		8
Hermit thrush		28	5		33
Herring gull				1	1
Hooded warbler		1			1
House sparrow		2			2
House wren		1			1
Indigo bunting				3	3
Killdeer		2			2
Magnolia warbler	2	1			3
Mallard				2	2
Mourning dove	2	6	2	1	11
Mourning warbler	2	7			9
Nashville warbler		4			4
Northern cardinal		1			1
Northern flicker	1	8	1	2	12
Northern parula		2			2
Ovenbird	11	52	2		65
Philadelphia vireo		1			1
Pied-billed grebe		1			1
Pine warbler		1			1
Red-eyed vireo	4	28	6		38
Red-shouldered hawk			1	2	3
Red-winged blackbird	4	17	5	5	31
Rose-breasted grosbeak		8			8
Ruby-throated hummingbird	1			1	2
Savannah sparrow	12	24	1		37
Scarlet tanager		6			6
Song sparrow	3	21	2		26
Swamp sparrow	1	4	1		6
Tree swallow		1		10	11
Tufted titmouse		1			1
Turkey vulture				1	1
Upland sandpiper		2	1	2	5
Veery		10			10
Vesper sparrow	1	2			3
Warbling vireo		2	1		3
White-breasted nuthatch	1	5	1		7
White-throated sparrow	8	68	21	1	98
Wild Turkey		3			3
Wilson's snipe		2	3		5
Winter wren		3	2		5
Wood duck		4	2		6
Wood thrush		1	1		2
Yellow warbler	3	24	1		28
Yellow-bellied sapsucker		1	2	1	4
Grand Total	139	687	99	158	1083

^a Not included in numerical analysis

Appendix A Table 3. Total number of species recorded from each habitat type at Marble River Wind Farm during 3 day point count surveys in spring 2007.

Species	Field	Forest	Wetland	Grand Total
Alder flycatcher	10	6	8	24
American crow	7	8	4	19
American goldfinch	27	5		32
American redstart	1	9	3	13
American robin	12	18	9	39
American woodcock		4	7	11
Baltimore oriole	1			1
Barn swallow	1			1
Black-and-white warbler	2	15	5	22
Blackburnian warbler	1	7	2	10
Black-capped chickadee	8	9	10	27
Blackpoll warbler			2	2
Black-throated blue warbler		6	3	9
Black-throated green warbler	3	6		9
Blue jay	1	11	5	17
Bobolink	56			56
Broad-winged hawk		2		2
Brown creeper		2		2
Brown thrasher	1			1
Brown-headed cowbird	1			1
Canada goose		2		2
Canada warbler		2		2
Cedar waxwing	16	8	8	32
Chestnut-sided warbler	21	9	6	36
Chipping sparrow	6		1	7
Common grackle	3	7	7	17
Common raven		1	3	4
Common yellowthroat	28	12	14	54
Dark-eyed junco	1		1	2
Downy woodpecker		1	2	3
Duck species	1			1
Eastern kingbird	6	1	5	12
Eastern meadowlark	1			1
Eastern phoebe	2	2	1	5
Eastern towhee	6	3	1	10
Eastern wood-pewee	3	3	9	15
European starling	56			56
Field sparrow	4	1		5
Golden-crowned kinglet		1		1
Grasshopper sparrow	1			1
Gray catbird	2	1	3	6
Great-crested flycatcher	1			1
Hairy woodpecker		6	2	8
Hermit thrush	4	24	5	33
Herring gull	1			1
Hooded warbler			1	1
House sparrow	2			2
House wren	1			1
Indigo bunting	3			3
Killdeer	2			2
Magnolia warbler		3		3
Mallard	2			2
Mourning dove	2	8	1	11
Mourning warbler		7	2	9
Nashville warbler		3	1	4
Northern cardinal		1		1
Northern flicker	2	6	4	12
Northern parula		2		2
Ovenbird	3	54	8	65
Philadelphia vireo		1		1
Pied-billed grebe			1	1
Pine warbler		1		1
Red-eyed vireo	13	22	3	38
Red-shouldered hawk		3		3
Red-winged blackbird	17	2	12	31
Rose-breasted grosbeak	1	7		8
Ruby-throated hummingbird	1	1		2
Savannah sparrow	37			37
Scarlet tanager	1	4	1	6
Song sparrow	16	5	5	26
Swamp sparrow		3	3	6
Tree swallow	4	2	5	11
Tufted titmouse		1		1
Turkey vulture		1		1
Upland sandpiper	5			5
Veery	3	4	3	10
Vesper sparrow	3			3
Warbling vireo		2	1	3
White-breasted nuthatch		7		7
White-throated sparrow	29	43	26	98
Wild Turkey	2	1		3
Wilson's snipe		2	3	5
Winter wren		3	2	5
Wood duck		2	4	6
Wood thrush		2		2
Yellow warbler	17	4	7	28
Yellow-bellied sapsucker	2		2	4
Grand Total ^a	463	399	221	1083

^a Grand total includes all species at all distances

Appendix A Table 4. Bird species observed during area searches at Marble River Wind Farm in spring 2007.	
Alder flycatcher	Grasshopper sparrow
American crow	Gray catbird
American goldfinch	Great-crested flycatcher
American kestrel ^a	Hairy woodpecker
American redstart	Hermit thrush
American robin	Herring gull
American woodcock	Killdeer
Baltimore oriole	Mallard
Belted kingfisher ^a	Mourning dove
Black-and-white warbler	Northern flicker
Blackburnian warbler	Northern harrier ^a
Black-capped chickadee	Ovenbird
Blackpoll warbler	Pied-billed grebe
Black-throated green warbler	Pine warbler
Blue-headed vireo ^a	Red-eyed vireo
Bobolink	Red-tailed hawk ^a
Broad-winged hawk	Red-winged blackbird
Brown thrasher	Rock dove ^a
Brown-headed cowbird	Rose-breasted grosbeak
Canada goose	Rough-legged hawk ^a
Canada warbler	Ruby-throated hummingbird
Cedar waxwing	Savannah sparrow
Chestnut-sided warbler	Scarlet tanager
Chipping sparrow	Song sparrow
Common grackle	Swamp sparrow
Common raven	Tree swallow
Common yellowthroat	Unidentified duck
Dark-eyed junco	Unidentified warbler
Eastern kingbird	Upland sandpiper
Eastern meadowlark	Veery
Eastern phoebe	Warbling vireo
Eastern towhee	White-throated sparrow
Eastern wood-pewee	Wilson's snipe
European starling	Yellow warbler
Field sparrow	Yellow-bellied sapsucker
^a Not detected during point counts	

Appendix A Table 5. Bird species list pooled from point counts and area searches
at Marble River Wind Farm during spring 2007 surveys.

Common name	Scientific name	Common name	Scientific name
Alder flycatcher	<i>Empidonax virescens</i>	Herring gull	<i>Larus argentatus</i>
American crow	<i>Corvus brachyrhynchos</i>	Hooded warbler	<i>Wilsonia citrina</i>
American goldfinch	<i>Carduelis tristis</i>	House sparrow	<i>Passer domesticus</i>
American kestrel	<i>Falco sparverius</i>	House wren	<i>Troglodytes aedon</i>
American redstart	<i>Setophaga ruticilla</i>	Indigo bunting	<i>Passerina cyanea</i>
American robin	<i>Turdus migratorius</i>	Killdeer	<i>Charadrius vociferus</i>
American woodcock	<i>Scolopax minor</i>	Magnolia warbler	<i>Dendroica magnolia</i>
Baltimore oriole	<i>Icterus galbula</i>	Mallard	<i>Anas platyrhynchos</i>
Barn swallow	<i>Hirundo rustica</i>	Mourning dove	<i>Zenaida macroura</i>
Belted kingfisher	<i>Ceryle alcyon</i>	Mourning warbler	<i>Oporornis philadelphia</i>
Black-and-white warbler	<i>Mniotilta varia</i>	Nashville warbler	<i>Vermivora ruficapilla</i>
Blackburnian warbler	<i>Dendroica fusca</i>	Northern cardinal	<i>Cardinalis cardinalis</i>
Black-capped chickadee	<i>Poecile atricapilla</i>	Northern flicker	<i>Colaptes auratus</i>
Blackpoll warbler	<i>Dendroica striata</i>	Northern harrier	<i>Circus cyaneus</i>
Black-throated blue warbler	<i>Dendroica caerulescens</i>	Northern parula	<i>Parula americana</i>
Black-throated green warbler	<i>Dendroica virens</i>	Ovenbird	<i>Seiurus aurocapillus</i>
Blue-headed vireo	<i>Vireo solitarius</i>	Philadelphia vireo	<i>Vireo philadelphicus</i>
Blue jay	<i>Cyanocitta cristata</i>	Pied-billed grebe	<i>Podilymbus podiceps</i>
Bobolink	<i>Dolichonyx oryzivorus</i>	Pine warbler	<i>Dendroica pinus</i>
Broad-winged hawk	<i>Buteo platyterus</i>	Red-eyed vireo	<i>Vireo olivaceus</i>
Brown creeper	<i>Certhia americana</i>	Red-shouldered hawk	<i>Buteo lineatus</i>
Brown thrasher	<i>Toxostoma rufum</i>	Red-tailed hawk	<i>Buteo jamaicensis</i>
Brown-headed cowbird	<i>Molothrus ater</i>	Red-winged blackbird	<i>Agelaius phoeniceus</i>
Canada goose	<i>Branta canadensis</i>	Rock dove	<i>Columbia livia</i>
Canada warbler	<i>Wilsonia canadensis</i>	Rough-legged hawk	<i>Buteo lagopus</i>
Cedar waxwing	<i>Bombycilla cedrorum</i>	Rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>
Chestnut-sided warbler	<i>Dendroica pensylvanica</i>	Ruby-throated hummingbird	<i>Archilochus colubris</i>
Chipping sparrow	<i>Spizella passerina</i>	Savannah sparrow	<i>Passerculus sandwichensis</i>
Common grackle	<i>Quiscalus quiscula</i>	Scarlet tanager	<i>Piranga olivacea</i>
Common raven	<i>Corvus corax</i>	Song sparrow	<i>Pooecetes gramineus</i>
Common yellowthroat	<i>Geothlypis trichas</i>	Swamp sparrow	<i>Melospiza georgiana</i>
Dark-eyed junco	<i>Junco hyemalis</i>	Tree swallow	<i>Tachycineta bicolor</i>
Downy woodpecker	<i>Picoides pubescens</i>	Tufted titmouse	<i>Baeolophus bicolor</i>
Duck species		Turkey vulture	<i>Cathartes aura</i>
Eastern kingbird	<i>Tyrannus tyrannus</i>	Upland sandpiper	<i>Bartramia longicauda</i>
Eastern meadowlark	<i>Sturnella magna</i>	Veery	<i>Catharus fuscescens</i>
Eastern phoebe	<i>Sayornis phoebe</i>	Vesper sparrow	<i>Pooecetes gramineus</i>
Eastern towhee	<i>Pipilo erythrophthalmus</i>	Warbling vireo	<i>Vireo gilvus</i>
Eastern wood-pewee	<i>Contopus virens</i>	White-breasted nuthatch	<i>Sitta carolinensis</i>
European starling	<i>Sturnus vulgaris</i>	White-throated sparrow	<i>Zonotrichia albicollis</i>
Field sparrow	<i>Spizella pusilla</i>	Wild Turkey	<i>Meleagris gallopavo</i>
Golden-crowned kinglet	<i>Regulus satrapa</i>	Wilson snipe	<i>Gallinago delicata</i>
Grasshopper sparrow	<i>Ammodramus savannarum</i>	Winter wren	<i>Troglodytes troglodytes</i>
Gray catbird	<i>Dumetella carolinensis</i>	Wood duck	<i>Aix sponsa</i>
Great-crested flycatcher	<i>Myiarchus crinitus</i>	Wood thrush	<i>Hylocichla mustelina</i>
Hairy woodpecker	<i>Picoides villosus</i>	Yellow warbler	<i>Dendroica petechia</i>
Hermit thrush	<i>Catharus guttatus</i>	Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>