Appendix 3:

Avian and Bat Assessment Report

Wind Energy Project Phase I Avian and Bat Risk Assessment

TOWN OF BREWSTER, MASSACHUSETTS

PREPARED FOR

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Project No. W279-000

July 31, 2010

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WIND ENERGY PROJECT PHASE I AVIAN AND BAT RISK ASSESSMENT
Town of Brewster, Massachusetts

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EXECUTIVE SUMMARY

This report presents a Phase I Avian and Bat Risk Assessment for two proposed turbines at the Cape & Vineyard Electric Cooperative/Brewster Wind Project Site in Brewster, Massachusetts. Research for this assessment included a literature review, consultation with regional experts including agency staff, environmental organizations, and a site visit on May 21, 2010. These sources provide an indication of the type and relative numbers of birds and bats that are known or suspected to use the project site and help determine the degree of risk to birds and bats from wind power development.

The Brewster Wind Project would have an estimated maximum capacity to generate 3.6 MW from two 1.8-MW turbines. Each turbine would be situated on a monopole tower structure with a hub height of approximately 80 meters (262 feet) and a rotor diameter of 90 meters (295 feet). Overall height of the turbine with the rotor in the 12 o'clock position would be approximately 125 meters (410 feet). The tower would be lit according to Federal Aviation Administration guidelines. Electrical collection lines on-site would be underground.

Based on a review of readily available literature, the site does not appear to be an important nesting or foraging area for federally or state endangered, threatened, or species of special concern. However, the Inner Cape Cod Bay and Pleasant Bay Areas of Critical Environmental Concern are both located within five miles of the project site. Brewster Ponds and Woodlands and Brewster-Eastham Flats Important Bird Areas are also located within five miles of the project site. Migrating birds, especially shorebirds and waterfowl are known to be attracted to these types of areas. The U.S. Fish and Wildlife Service and the Massachusetts Division of Fisheries and Wildlife's Natural Heritage & Endangered Species Program (NHESP) have been contacted for confirmation regarding the lack of presence of endangered or threatened species, or species of concern at the project site. The U.S. Fish and Wildlife Service has indicated that federally threatened Piping Plovers are known to breed on coastal beaches to the north, south, and east, but are not known to occur near the project location. Roseate Terns are not known to nest near the site, but could occur over the mainland of the Cape during the post-breeding period when the birds begin to congregate to feed in preparation for their southward migration. The NHESP has not indicated that there are any state-listed rare bird species occurring on the site.

As with most man-made structures, wind turbines present some level of potential risk to birds. Small but not biologically significant numbers of night-migrating songbirds may collide with the proposed turbines. No state-listed avian species are known to occur at or adjacent to the Brewster site. Therefore, the risk posed to these species is anticipated to be low. The project site is not documented to be an important nesting or foraging area for federally or state-listed endangered or threatened species or species of concern. Based on the particular conditions of the site, available literature, site reconnaissance and a substantial quantity of data documenting the minimal effects of wind turbines on avian species, the proposed project is likely to be of minimal risk to birds.

The collision risk to resident bats (i.e., little brown myotis, eastern pipestrelle, northern myotis, and big brown bat) on the project site is expected to be minimal and similar to the risk from collision with other vertical structures including communication towers. The potential impacts to migrating bats (i.e., hoary bat, silver-eared bat, and red bat) are largely unknown due to the lack of information on migration routes of these species.

1.0 INTRODUCTION

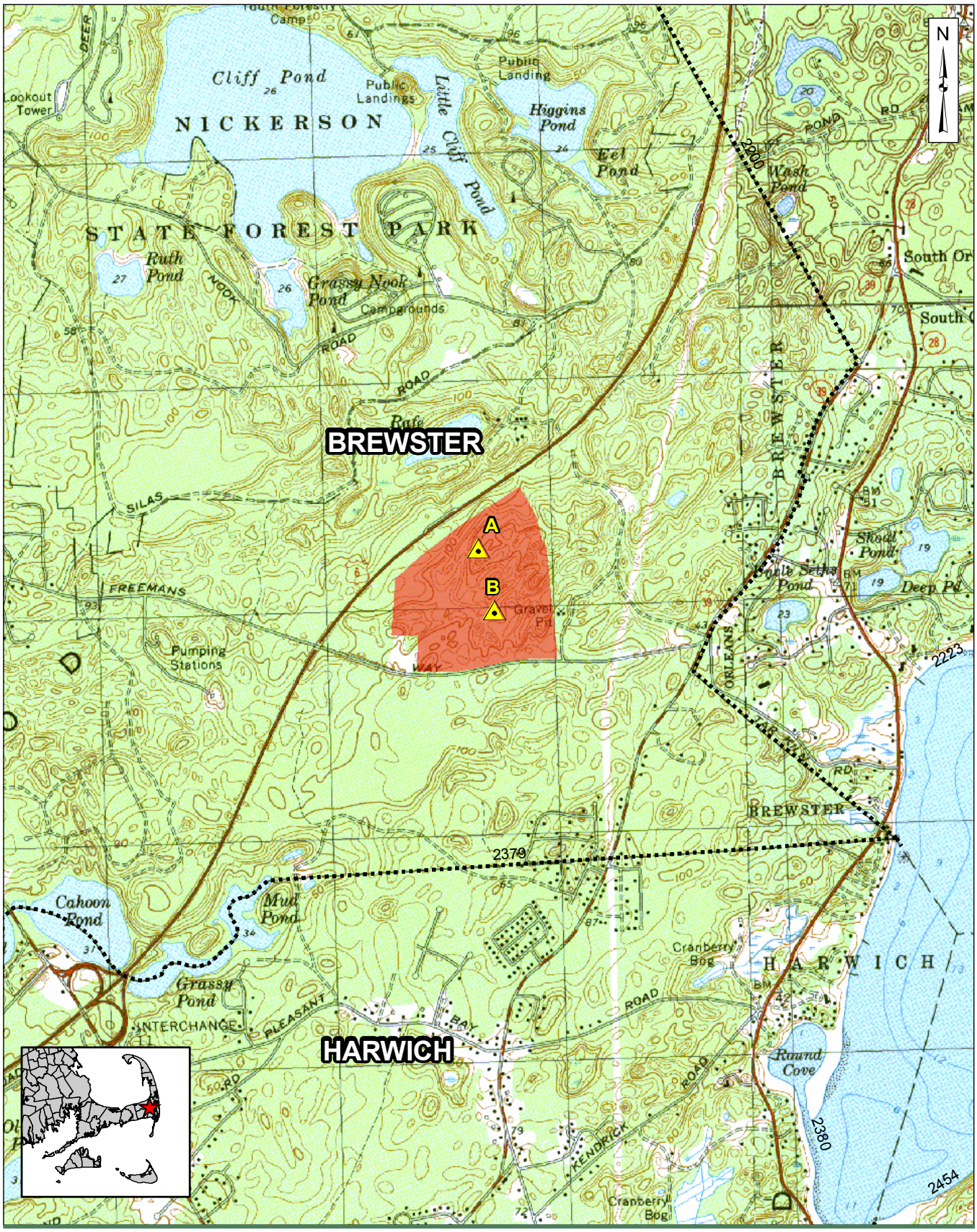
This report presents a Phase I Avian and Bat Risk Assessment for a proposed wind energy facility consisting of two 1.8-MW class wind turbines on municipal land, in the town of Brewster, Massachusetts (see Figure 1). The Phase I Assessment is used to determine potential risk to birds and bats at a proposed wind power site. The Phase I Assessment is designed to provide preliminary information to help guide developers, regulators, environmentalists, and other stakeholders through the process of determining risk at a particular site and how impacts or potential impacts may need further study.

Risk is defined as the likelihood that adverse impacts will occur to individuals or populations of species of concern as a result of wind energy development and operation. In this context, collision risk can be defined for individuals of a species or groups of species (such as songbirds) as the estimated number of collision fatalities (impact), based on the number of individuals in the zone of risk (exposure). Estimates of fatality risk can be used in a relative sense, allowing comparisons among different wind projects, alternative development designs, and in the evaluation of potential risk to populations. Because there are relatively few methods available for direct estimation of risk, a weight of evidence approach is often used (Anderson et al. 1999). Until such time that reliable risk predictive models are developed, estimates of risk are qualitative, but based upon-site information.

The assessment includes a literature review and information from local and regional experts, including agency staff and environmental organizations. Together, these sources of information provide an indication of the type and general abundance of birds and bats that are known or suspected to use the proposed site and the surrounding areas. This information is used to assess the degree of risk to birds and bats from wind power development at this particular site. In addition, the concerns of regulators and environmental organizations are determined and incorporated into the risk assessment. This Phase I Assessment also includes a field survey on May 21, 2010 that supplements the assessment.

The Brewster Wind Project proposes the installation of two 1.8 MW turbines. When fully operational, the project would have an estimated maximum capacity to generate 3.6 MW. Each turbine would be situated on an 80-meter (262-foot) tubular tower structure with a rotor diameter of 90 meters (295 feet), making the maximum height of the structure, at the tip of the blade 125 meters (410 feet). The tower would be lit according to Federal Aviation Administration (FAA) guidelines. FAA lighting would probably be red strobe lights or newer LED's (FAA type L-864). Access to the site location for construction would be by an existing roadway off of Freeman's Way and Commerce Park Road. New access road spurs approximately 20 feet wide would be extended to provide direct access to each turbine location. Electrical collection cables are proposed to run underground from each turbine along the access roads and tie into the existing local utility distribution system.

Location: G:/GIS-Projects/Brewster-Harwich/00-mxd/Avian/Locus.mxd



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CVEC WIND ENERGY FACILITY
Brewster, Massachusetts

Scale: 1" = 2,000'

0 2,000 Feet

Source: 1) MassGIS, USGS, 1972-79
2) Weston & Sampson, Turbines & Parcel Map, 2010

Legend

- Turbine Locations
- Town Boundaries
- Town-Owned Property of Interest

Site Locus Map

Figure 1

1.1 Methodology

ESS conducted a site visit on May 21, 2010 to assess the habitat, topography, and avifauna. The site visit was not meant to be a quantitative survey or inventory of birds. Instead, the purpose of the site visit was to gain an understanding of the habitat and topographic features so that potential species using the site could be better estimated.

To gather baseline information, a literature search was conducted that focused on pertinent materials (printed, published, unpublished, and electronic media) including the Audubon Christmas Bird Counts, *Bird Observer*, USGS Breeding Bird Surveys (BBSs), Massachusetts Division of Fisheries and Wildlife's Natural Heritage & Endangered Species Program (NHESP) database, and Massachusetts Breeding Bird Atlas (BBA). Other sources providing information on birds that might migrate through the site or stop over, nest, forage, winter or concentrate at the site were also considered. Information requests were submitted to the USFWS, NHESP, and Massachusetts Audubon Society (MassAudubon). Information from these sources is integrated into a report that summarizes the species that are present or likely to be present at a site, potential avian risk from wind turbine construction at the site, and a comparison of the site to risk at other sites where risk has been determined empirically. Finally, specific suggestions for further studies are made if indicated.

Although there is abundant literature available on bird migration, habitats, and avian impacts from wind turbines, comparatively little information of this sort is available for bats. Due to this discrepancy and the fact that birds and bats are biologically very different, this assessment considers the potential risks to bats separately. The literature search included bat natural history and habitat information and bat mortality studies at other wind turbine locations. From this information, the degree of risk to bats from wind development at this particular site has been assessed to the extent possible.

2.0 AVIAN HABITAT ANALYSIS AND LITERATURE SEARCH

2.1 Habitat

Information regarding topography and habitat of the site and surrounding area within a reasonable distance was first gathered using a 1:25,000 USGS topographic map (see Figure 1) and from a site visit on May 21, 2010. In addition, datalayers from MassGIS were overlaid on the project site to help identify any environmental constraints.

The project site is located within the a business park and bounded on the north by U.S. Route 6 and the south by Freeman's Way in Brewster, Massachusetts. Wind Turbine Generator A is located in the northern portion of the parcel and Wind Turbine Generator B is located in the southern portion of the parcel. Multiple commercial and town-owned buildings are on either side of Commerce Way. A driving range is located in the center of the site and the two proposed turbines would be on either side. There are two communications towers with guy wires on the southeastern portion of the site. The towers are 91.3 meters (300 feet) and 94.2 meters (309 feet) high.

Gravel mining operations occupy the adjacent parcels to the east and west of the project site. A Veteran's of Foreign Wars owned parcel abuts the southwestern periphery of the town-owned parcel.

Highway easements bound the site to the north (Route 6) and south (Freeman's Way). Nickerson State Park is on the northern side of Route 6 and primarily consists of forest and ponds. MassAudubon has designated Nickerson State Park as an Important Bird Area (IBA) (see Section 2.2.).

Captain's Golf Course is south of the project site with residential development beyond. To the east, residential land occupies much of the area between the project site and Pleasant Bay, especially along and east of Route 39. Forest cover is dominant along most of Freeman's Way just west of Route 6 before giving way to residential development approximately 4,000 feet west of the site.

Topography in the area varies from approximately 50 feet National Geodetic Vertical Datum 1929 at the lowest point on the property to more than 120 feet at the highest location. In general, elevations are highest near the northern and southern boundaries of the project site and lowest in the central portion.

Soils on the proposed site are mainly dry, sandy, nutrient-poor, and acidic. However, a small bog with hydric soils is located near the eastern boundary of the parcel. This area is mapped in the Massachusetts Department of Environmental Protection Wetland data layer. No certified or potential vernal pools are mapped on the project site (see Figure 2).

Upland portions of the site consist primarily of Pitch Pine-Oak Forest Woodland (Swain and Kearsley 2001) typical of interior portions of Cape Cod. The canopy is composed of pitch pine (*Pinus rigida*) and tree oaks, including black (*Quercus velutina*), scarlet (*Q. coccinea*), chestnut (*Q. prinus*), and white (*Q. alba*) oaks. The canopy trees reach approximately 50 to 60 feet. In the understory, blueberries (*Vaccinium angustifolium*), black huckleberry (*Gaylussacia baccata*) and other ericaceous shrubs are dominant. Catbriar (*Smilax rotundifolia*) is common. The herb layer is sparse with bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), pink lady's slipper *(Cypripedium acaule*), and star flower (*Trientalis borealis*). Old-man's Beard (*Usnea* spp.), a lichen that may be used by the Northern Parula (*Parula americana*) in nest building, commonly grows on branches and twigs of deciduous trees on site.

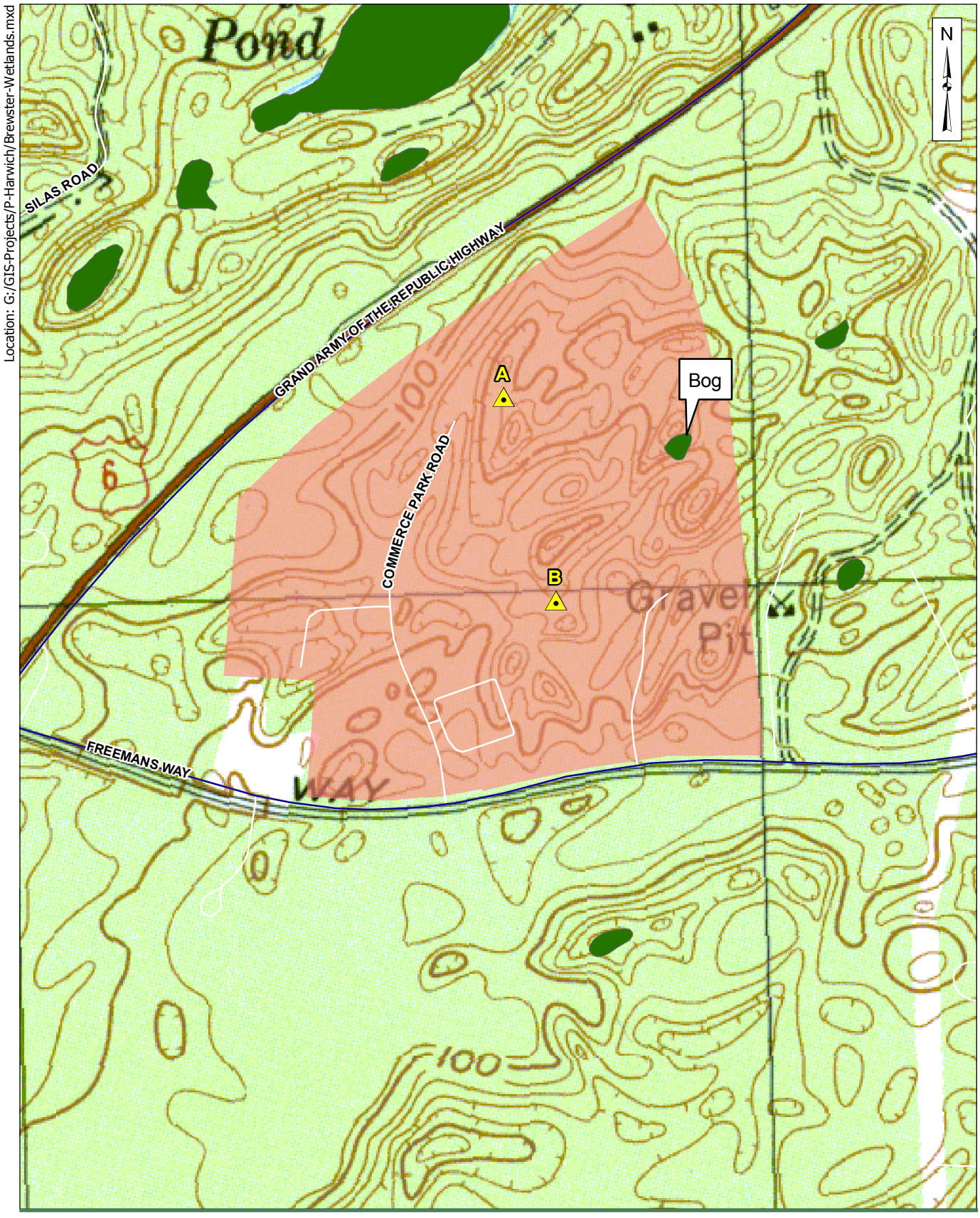
Bird fauna associated with this forest cover type are Ruffed Grouse, Pine Warbler, and Eastern Towhee (Swain and Kearsley 2001). The NHESP lists several rare plants and animals that are associated with the Pitch Pine-Oak Forest Woodland. Additionally, the town-owned property associated with the proposed project is located near NHESP BioMap Core Habitats and Priority Habitats of Rare Species. Potential rare species occurring on or near the project site are further discussed in Section 2.4.

2.1.1 Areas of Critical Environmental Concern

At its closest, the Pleasant Bay Area of Critical Environmental Concern (ACEC) is approximately 0.5 miles east of the project site (Figure 3). Spanning the towns of Brewster, Chatham, Orleans, and Harwich, the approximately 9,240-acre Pleasant Bay ACEC was designated in 1987. This ACEC includes salt marsh, tidal flats, islands, salt and freshwater ponds, rivers, bays, and barrier

beaches. Approximately 248 different avian species have been seen within the Pleasant Bay ACEC.

The nearest boundary of the Inner Cape Cod Bay ACEC is located approximately 2.3 miles northeast of the project site. Designated in 1985, this 2,600-acre ACEC spans the towns of Brewster, Eastham, and Orleans. Included within the ACEC boundary are hundreds of acres of salt marsh, highly productive shellfish beds, undisturbed wildlife habitat, barrier beaches, salt ponds, and tidal rivers and creeks.



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Scale: 1" = 600'

0 600 Feet

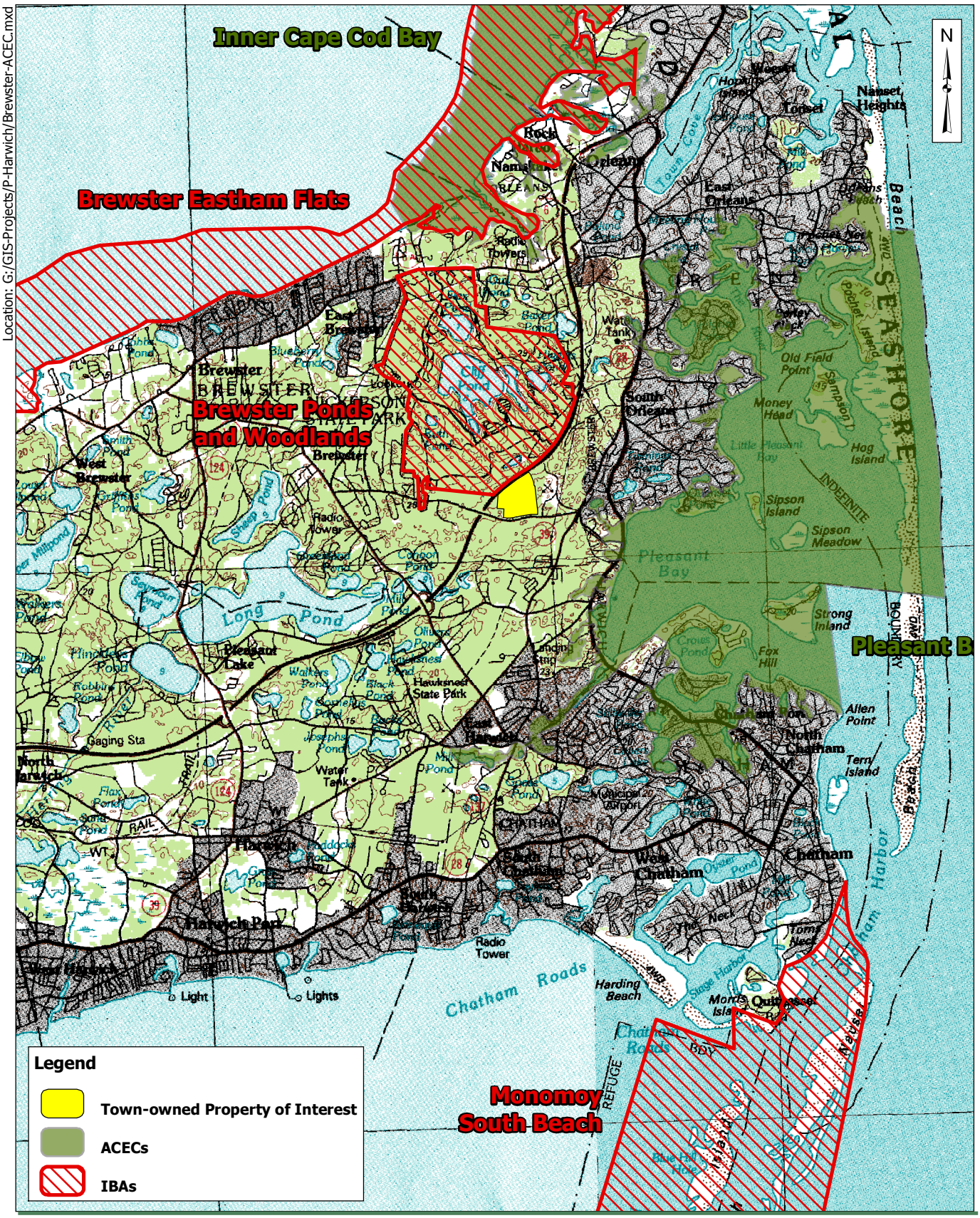
Source: 1) MassGIS, USGS Topo Map 1982-1990
2) Mass GIS, DEP Wetlands, 2007

Legend

- Turbine Location
- Town-owned Property of Interest
- DEP Wetland

MassDEP Wetland Datalayer Map

Figure 2



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Areas of Critical Environmental Concern and Important Bird Areas

Figure 3

2.2 Massachusetts Important Bird Areas

MassAudubon defines an IBA as "a site that provides essential habitat to one or more species of breeding, wintering, or migrating birds." The IBA concept was originally developed in 1985 by BirdLife International to assist with bird conservation efforts. The Massachusetts IBA Program is carried out cooperatively between MassAudubon, a volunteer technical committee, and other partner organizations. Through the Massachusetts IBA Program, key sites that contribute to the preservation of significant bird populations or communities are identified, nominated, and designated. Two IBAs, including Brewster Ponds and Woodlands and Brewster-Eastham Flats IBAs, are located near the project site.

Brewster Ponds and Woodlands IBA extend across the 2,900-acre Punkhorn Parklands Conservation Area and the 1,955-acre Nickerson State Park just to the north of the project site. Five large ponds and several smaller water bodies are contained within this IBA and support large numbers of waterfowl, including winter concentrations of Common Merganser and American Black Duck. Pitch pine and scrub oak (*Quercus ilicifolia*) are the dominant trees in the forest. At least one state-threatened Northern Parula breeding pair was confirmed in this IBA between 1993 and 2001. Habitats in these areas also sustain significant populations of species of regional high conservation priority, including Baltimore Oriole, Eastern Towhee, Scarlet Tanager, Great Crested Flycatcher, and Eastern Wood-Pewee (MassAudubon 2010).

According to MassAudubon, the area meets IBA criteria in Categories 2, 3c and 5. Category 2 includes sites that regularly hold significant numbers of species of high conservation priority in Massachusetts. Category 3c sites include areas supporting 500 or more waterfowl at any one time. Category 5 includes sites important for long-term research and/or monitoring projects that contribute substantially to ornithology, bird conservation, and/or education.

The Brewster-Eastham Flats IBA is also located approximately three miles north of the project site and consists of 4,200 acres of marine tidal areas, salt marsh, and coastal beach extending across 9.7 linear miles from approximately Quivett Creek in the west to First Encounter Beach in Eastham. It meets IBA Category 3a and 3c criteria, meaning that it supports concentrations of shorebirds of 1,000 or more individuals at one time (3a) and concentrations of waterfowl equaling or exceeding 500 individuals at one time (3c).

Brant and Dunlin are particularly common in fall and winter within the Brewster-Eastham Flats IBA, regularly exceeding 2,000 and 1,000 individuals, respectively (MassAudubon 2010). Other shorebirds, especially Black-bellied Plover and Sanderlings use the area during fall migration and early winter and their numbers are estimated to climb into the thousands at times.

2.3 Potential Avian Species

Several sources of information were reviewed to identify birds that potentially utilize the project site, including the Massachusetts BBA (Petersen and Meservey 2003), preliminary data from the online Massachusetts BBA II (2010), USGS BBS, Christmas Bird Counts (CBC), selected articles from the *Bird Observer*, and Birding Cape Cod (MassAudubon and Cape Cod Bird Club 2005).

NHESP maintains a list of Massachusetts Endangered, Threatened, and Species of Special Concern. Where potential birds are listed, they are noted in the following sections. Additionally, Audubon and the American Bird Conservancy developed the Watchlist for United States Birds. The list highlights priority birds for conservation in the United States. The Watchlist is divided into two categories: 1) the Red Watchlist, which consists of those with the highest national concern, and 2) the Yellow Watchlist, which is composed of declining or rare species. Where potential birds are Watchlist species, they are noted in the following sections.

2.3.1 Massachusetts Breeding Bird Atlas

The BBA was based on surveys of "blocks" of a USGS topographic map conducted between 1974 and 1979, with updates continuing through 2011. A topographic map covers an area slightly less than 60 square miles. Each USGS topographic map was divided into six blocks that were each approximately 10 square miles. A total of 989 blocks were surveyed in Massachusetts during the five-year Atlas period. The Atlas uses a species-by-species approach and provides a map of the distribution of species nesting in the state. A list of bird species documented in the project area block is listed in Table 1 below. The table includes results from the first BBA (1974-1979) and the current Atlas (2007-2011). The second BBA may not include all species observed within the survey block as results have not been finalized. The BBA revealed several federally and state-listed species nesting along this portion of the Cape. Listed species include Sharp-shinned Hawk, Northern Parula, Common Tern, and Piping Plover. Both Common Tern and Piping Plover nest in coastal areas whereas Sharp-shinned Hawk and Northern Parula nest in inland wooded areas.

Table 1: Breeding Birds in Proximity of the Brewster Proposed Project Site based on the Massachusetts Breeding Bird Atlas

Species	BBA2*	BBA1*
Canada Goose	Possible	Confirmed
Wood Duck	Confirmed	Confirmed
American Black Duck	Possible	Confirmed
Mallard	Possible	Confirmed
Double-crested Cormorant	Observed	No
Ring-necked Pheasant	No	Probable
Wild Turkey	Possible	No
Northern Bobwhite	Confirmed	Probable
Green Heron	Possible	No
Black-crowned Night-Heron	Observed	No
Osprey	Confirmed	No
Cooper's Hawk	Confirmed	No
Sharp-shinned Hawk (SC)	Possible	No
Broad-winged Hawk	Probable	Possible
Red-tailed Hawk	Probable	Possible
Piping Plover (FT/T/WL-R)	Confirmed	No
Killdeer	Probable	Probable
Willet	Probable	No
American Woodcock	No	Probable
Laughing Gull	Observed	No

Species	BBA2*	BBA1*
Herring Gull	Observed	No
Common Tern (SC)	Observed	No
Rock Pigeon	Possible	Confirmed
Mourning Dove	Probable	Confirmed
Eastern Screech-Owl	Confirmed	Probable
Great Horned Owl	No	Confirmed
Northern Saw-whet Owl	No	Probable
Whip-poor-will	No	Probable
Chimney Swift	Probable	Confirmed
Ruby-throated Hummingbird	Possible	Possible
Belted Kingfisher	Confirmed	Possible
Red-bellied Woodpecker	Confirmed	No
Downy Woodpecker	Confirmed	Possible
Hairy Woodpecker	Confirmed	Confirmed
Northern Flicker (Yellow-shafted Flicker)	Confirmed	Probable
Eastern Wood-Pewee	Probable	Probable
Willow Flycatcher	Possible	No
Eastern Phoebe	Confirmed	Possible
Great Crested Flycatcher	Confirmed	Confirmed
Eastern Kingbird	Confirmed	Confirmed
Red-eyed Vireo	Possible	Confirmed
Blue Jay	Probable	Confirmed
American Crow	Confirmed	Confirmed
Purple Martin	No	Possible
Tree Swallow	Confirmed	Possible
Northern Rough-winged Swallow	Probable	No
Barn Swallow	Confirmed	Confirmed
Black-capped Chickadee	Confirmed	Confirmed
Tufted Titmouse	Confirmed	Confirmed
Red-breasted Nuthatch	Confirmed	Confirmed
White-breasted Nuthatch	Confirmed	Confirmed
Brown Creeper	Probable	Confirmed
Carolina Wren	Probable	No
House Wren	Possible	Probable
Eastern Bluebird	Confirmed	No
Veery	Possible	No
Hermit Thrush	Confirmed	No
American Robin	Confirmed	Confirmed
Gray Catbird	Confirmed	Confirmed
Northern Mockingbird	Confirmed	Probable
Brown Thrasher	No	Possible
European Starling	Confirmed	Confirmed
Cedar Waxwing	Probable	No
Northern Parula (T)	Possible	No
Yellow Warbler	Confirmed	Probable
Pine Warbler	Confirmed	Probable
Prairie Warbler (WL-Y)	Confirmed	No

Species	BBA2*	BBA1*
Black-and-white Warbler	No	Probable
American Redstart	No	Probable
Ovenbird	Confirmed	Probable
Common Yellowthroat	Confirmed	Probable
Scarlet Tanager	No	Probable
Eastern Towhee	Confirmed	Confirmed
Chipping Sparrow	Confirmed	Confirmed
Field Sparrow	Confirmed	No
Savannah Sparrow	Probable	No
Song Sparrow	Confirmed	Confirmed
Northern Cardinal	Confirmed	Confirmed
Indigo Bunting	Confirmed	No
Red-winged Blackbird	Confirmed	Confirmed
Common Grackle	Confirmed	Confirmed
Brown-headed Cowbird	Confirmed	Possible
Orchard Oriole	Confirmed	Probable
Baltimore Oriole	Confirmed	Confirmed
Purple Finch	No	Confirmed
House Finch	Confirmed	Confirmed
Pine Siskin	Probable	No
American Goldfinch	Probable	Confirmed
House Sparrow	Confirmed	Confirmed

*Based on Draft BBA2 (2007-2011) and BBA1 (1974-1979) for blocks 1674 and 1675
FT – Federally Threatened
T – State Threatened
SC–State Species of Special Concern
WL-Y – Audubon WatchList Yellow List (Rare or Declining Species)
WL-R – Audubon WatchList Red List (Species of Highest National Concern)

2.3.2 USGS Breeding Bird Survey

The USGS sponsors the annual BBS, which is a road survey of nesting birds. The East Dennis and Wellfleet USGS BBS Routes both approach within five miles of the project site. State-listed species include American Bittern, Common Tern, and Northern Parula.

Table 2: Results of USGS Breeding Bird Surveys, East Dennis and Wellfleet Survey Routes*

Species	East Dennis Birds/Route	Wellfleet Birds/Route
Double-crested Cormorant	0.09	0.89
American Bittern (E)	0.03	0.00
Great Blue Heron	0.03	0.00
Snowy Egret	0.03	0.11
Green Heron	0.33	1.22
Black-crowned Night-Heron	0.39	0.00
Canada Goose	0.97	0.11
Mute Swan	0.12	0.00
American Black Duck	1.15	0.28
Mallard	1.27	0.00
Osprey	0.09	0.00
Broad-winged Hawk	0.03	0.22
Red-tailed Hawk	0.06	0.06
American Kestrel	0.21	0.72
Ring-necked Pheasant	1.09	0.56
Ruffed Grouse	0.03	0.00
Northern Bobwhite	22.30	19.33
Killdeer	0.18	0.06
American Woodcock	0.09	0.00
Laughing Gull	0.00	1.17
Herring Gull	22.88	22.78
Great Black-backed Gull	1.09	3.72
Least Tern	0.12	0.17
Common Tern (SC)	0.45	1.61
Rock Pigeon	1.61	1.61
Mourning Dove	33.88	43.22
Yellow-billed Cuckoo	0.33	0.17
Black-billed Cuckoo	0.55	1.00
Eastern Screech-Owl	0.03	0.00
Great Horned Owl	0.06	0.11
Whip-poor-will	0.03	0.78
Chimney Swift	8.70	5.33
Ruby-throated Hummingbird	0.03	0.17
Belted Kingfisher	0.18	0.17
Red-bellied Woodpecker	0.21	0.00
Downy Woodpecker	4.58	4.22
Hairy Woodpecker	0.94	0.44
Northern Flicker	5.48	5.00
Eastern Wood-Pewee	3.00	4.78
Alder Flycatcher	0.00	0.60
Willow Flycatcher (WL-Y)	0.09	0.00
Willow (WL-Y)/Alder Flycatcher	0.09	0.06
Eastern Phoebe	0.82	0.17
Great Crested Flycatcher	3.58	5.89
Eastern Kingbird	2.09	5.39
White-eyed Vireo	0.03	0.00

Species	East Dennis Birds/Route	Wellfleet Birds/Route
Red-eyed Vireo	3.42	2.22
Blue Jay	28.79	33.72
American Crow	41.52	41.50
Fish Crow	0.00	0.11
Purple Martin	0.03	0.06
Tree Swallow	1.61	2.78
Northern Rough-winged Swallow	0.09	0.28
Bank Swallow	0.24	0.00
Barn Swallow	7.06	3.94
Black-capped Chickadee	34.58	55.33
Tufted Titmouse	11.88	10.44
Red-breasted Nuthatch	0.18	0.39
White-breasted Nuthatch	1.30	2.50
Brown Creeper	0.09	1.22
Carolina Wren	4.88	3.22
House Wren	2.76	0.67
Blue-gray Gnatcatcher	0.00	0.06
Veery	0.06	0.00
Hermit Thrush	0.24	0.89
Wood Thrush (WL-Y)	2.24	0.56
American Robin	56.97	56.72
Gray Catbird	34.27	35.67
Northern Mockingbird	6.88	11.61
Brown Thrasher	0.36	0.44
European Starling	45.97	46.94
Cedar Waxwing	5.79	6.61
Blue-winged Warbler (WL-Y)	0.15	0.00
Nashville Warbler	0.00	0.33
Northern Parula (T)	0.06	0.00
Yellow Warbler	8.24	7.67
Chestnut-sided Warbler	0.24	0.22
Pine Warbler	6.27	18.33
Prairie Warbler (WL-Y)	0.24	1.56
Black-and-white Warbler	0.94	2.89
American Redstart	1.18	0.50
Ovenbird	4.55	3.94
Common Yellowthroat	19.67	30.17
Scarlet Tanager	0.42	0.22
Eastern Towhee	16.70	21.28
Chipping Sparrow	12.18	31.94
Field Sparrow	0.85	1.39
Song Sparrow	28.73	26.72
Northern Cardinal	23.48	18.89
Indigo Bunting	0.03	0.06
Red-winged Blackbird	22.09	36.56
Eastern Meadowlark	0.27	0.06
Common Grackle	67.88	134.67

Species	East Dennis Birds/Route	Wellfleet Birds/Route
Brown-headed Cowbird	7.03	7.83
Orchard Oriole	0.09	0.33
Baltimore Oriole	13.00	15.17
Purple Finch	1.67	1.56
House Finch	31.61	47.00
Pine Siskin	0.03	0.00
American Goldfinch	23.73	36.94
House Sparrow	41.52	31.50

E – State Endangered
T – State Threatened
SC – State Species of Special Concern
WL-Y – Audubon WatchList Yellow List (Rare or Declining Species)
WL-R – Audubon WatchList Red List (Species of Highest National Concern)
*Source: Sauer et al. (2008)

2.3.3 Records from *Bird Observer,* the Cape Cod Bird Club, and MassAudubon

Although site specific and town specific articles were not found during a search of the *Bird Observer* index, an article detailing spring hawk migration on Cape Cod was reviewed (Lowe and Manchester 2001). Raptors tend to follow the coastline during migration and the highest concentrations of northbound raptors on Cape Cod are typically found near east-facing shorelines.

The Pilgrim Heights Hawk Watch program in Truro has a well-established dataset (MassAudubon 2009) indicating that Turkey Vulture and Sharp-shinned Hawk are generally the most abundant migrants on Cape Cod during spring, although Broad-winged Hawk, Osprey, and American Kestrel are also sometimes seen in higher numbers.

Additionally, the Cape Cod Bird Club published Birding Cape Cod (2005), which describes known bird hotspots by town. Paine's Creek Beach, Crosby Landing, Walkers Pond, Upper Mill Pond, the Punkhorn Conservation Area, and Nickerson State Park are each listed and described for the town of Brewster. Of these locations, Nickerson State Park is the closest and represents the most similar habitat (mixed pine-oak woodland) to that found on-site. Owls, including Great Horned Owl, Eastern Screech Owl, and Northern Saw-whet Owl are regularly observed in the park, especially in late winter to early spring. In addition to numerous songbird species, Cooper's Hawk and Red-tailed Hawk are known to breed in the park. Punkhorn Conservation Area, although more distant from the project site, also contains similar pine-oak woodland habitat and has been known to host state-threatened Northern Parula during the summer.

2.3.4 Christmas Bird Count

The CBC is an annual census of bird populations sponsored by the National Audubon Society. Volunteers follow specified routes through a designated 15-mile diameter circle, counting every bird seen or heard all day. Since December 25, 1900, the CBC has collected over 100 years of data on early-winter bird populations across the Americas. The resulting database is available online. ESS reviewed data of the Cape Cod CBC count circle (coded by Audubon as MACC), which

has its center point at the Eastward Ho Country Club in Eastham, Massachusetts. The project site is located well within the 15-mile diameter count circle. Given the lack of open water on the project site, fewer waterfowl species and lower densities of these species would be expected at the project site than for locations nearer the circle center. However, flyovers of these species are likely. Data for a recent 10 year period (1999-2009) are summarized in Table 3. Federal and state-listed species include Common Loon, Pied-billed Grebe, American Bittern, Northern Harrier, Sharp-shinned Hawk, Peregrine Falcon, Long-eared Owl, Blackpoll Warbler, and Vesper Sparrow.

Table 3: Cape Cod (MACC) Christmas Bird Count Data (Count Years 1999-2009)

Species - Common Name	Count	Number Per Hour
Snow Goose	0.1	0.001
Brant	1,045.5	10.869
Canada Goose	1,527.3	15.824
Mute Swan	31.4	0.326
Wood Duck	4.1	0.044
Gadwall	5.0	0.052
Eurasian Wigeon	0.7	0.007
American Wigeon	63.2	0.651
American Black Duck	3,140.7	31.966
Mallard	609.1	6.279
Blue-winged Teal	0.2	0.002
Northern Shoveler	2.2	0.023
Northern Pintail	2.6	0.028
Green-winged Teal	46.5	0.494
Canvasback	44.6	0.462
Redhead	0.9	0.009
Ring-necked Duck	101.1	1.024
Greater Scaup	214.0	2.174
Lesser Scaup	33.5	0.354
scaup sp.	9.5	0.096
King Eider	0.4	0.004
Common Eider	7,019.2	69.933
Harlequin Duck	6.4	0.068
Surf Scoter	192.8	1.808
White-winged Scoter	634.7	6.580
Black Scoter	290.2	2.905
scoter sp.	5.0	0.054
Long-tailed Duck	210.4	2.227
Bufflehead	1,639.7	17.183
Common Goldeneye	355.3	3.706
Barrow's Goldeneye	0.6	0.006
Hooded Merganser	306.1	3.173
Common Merganser	364.3	3.848
Red-breasted Merganser	1,681.7	17.624
Ruddy Duck	124.2	1.318
Ring-necked Pheasant	0.1	0.001
Wild Turkey	1.0	0.008

Northern Bobwhite	8.8	0.093
Red-throated Loon	102.6	1.042
Pacific Loon	0.1	0.001
Common Loon (SC)	77.1	0.781
Pied-billed Grebe (E)	20.3	0.218
Horned Grebe	18.0	0.190
Red-necked Grebe	6.6	0.066
Greater Shearwater (WL-Y)	0.1	0.001
Northern Gannet	1,492.5	15.248
Double-crested Cormorant	11.5	0.120
Great Cormorant	33.5	0.349
American Bittern (E)	1.6	0.016
Great Blue Heron	92.2	0.962
Great Egret	0.7	0.007
Snowy Egret	0.1	0.001
Little Blue Heron	0.1	0.001
Black-crowned Night-Heron	2.2	0.024
Turkey Vulture	0.4	0.004
Northern Harrier (T)	21.3	0.220
Sharp-shinned Hawk (SC)	11.6	0.119
Cooper's Hawk	10.4	0.107
Accipiter sp.	0.1	0.001
Red-shouldered Hawk	0.3	0.003
Red-tailed Hawk	36.9	0.378
Rough-legged Hawk	0.2	0.002
American Kestrel	0.2	0.002
Merlin	3.3	0.033
Peregrine Falcon (E)	2.1	0.021
Clapper Rail (WL-Y)	0.1	0.001
Clapper Rail/King Rail (WL-Y/T)	0.2	0.002
Virginia Rail	7.6	0.076
Sora	0.1	0.001
American Coot	32.4	0.336
Black-bellied Plover	53.9	0.558
Semipalmated Plover	0.2	0.002
Killdeer	0.4	0.004
Greater Yellowlegs	5.4	0.057
Willet	0.5	0.005
Lesser Yellowlegs	0.3	0.003
Marbled Godwit (WL-Y)	0.2	0.002
Ruddy Turnstone	0.4	0.004
Red Knot (WL-Y)	26.5	0.287
Sanderling (WL-Y)	1,070.3	11.451
Semipalmated Sandpiper (WL-Y)	0.3	0.003
Western Sandpiper (WL-Y)	1.0	0.011
Least Sandpiper	0.3	0.003
White-rumped Sandpiper (WL-Y)	0.1	0.001
Dunlin	3,963.7	40.454

peep sp.	0.1	0.001
Long-billed Dowitcher	1.3	0.013
Common (Wilson's) Snipe	3.4	0.037
American Woodcock	0.9	0.009
Laughing Gull	0.4	0.005
Little Gull	0.5	0.005
Black-headed Gull	0.3	0.003
Bonaparte's Gull	178.9	1.857
Ring-billed Gull	859.1	8.747
Herring Gull	5,003.9	50.785
Iceland Gull (WL-Y)	2.6	0.026
Lesser Black-backed Gull	2.3	0.024
Slaty-backed Gull	0.1	0.001
Glaucous Gull	0.3	0.003
Great Black-backed Gull	2,108.7	21.248
Black-legged Kittiwake	440.8	4.819
Forster's Tern	0.2	0.002
Pomarine Jaeger	0.8	0.008
jaeger sp.	1.4	0.015
Dovekie	13.2	0.137
Common Murre	4.5	0.047
Thick-billed Murre	3.4	0.036
Razorbill (WL-Y)	1,410.8	14.165
Black Guillemot	0.4	0.004
alcid sp.	537.9	5.649
Rock Pigeon	75.9	0.793
Mourning Dove	312.4	3.227
Eastern Screech-Owl	12.3	0.123
Great Horned Owl	14.8	0.151
Snowy Owl	1.7	0.016
Barred Owl	0.1	0.001
Long-eared Owl (SC)	0.1	0.001
Short-eared Owl (WL-Y/E)	0.2	0.002
Northern Saw-whet Owl	0.9	0.010
Calliope Hummingbird (WL-Y)	0.1	0.001
Rufous Hummingbird	0.1	0.001
Belted Kingfisher	21.6	0.225
Red-headed Woodpecker (WL-Y)	0.1	0.001
Red-bellied Woodpecker	16.5	0.168
Yellow-bellied Sapsucker	1.9	0.018
Downy Woodpecker	95.5	0.979
Hairy Woodpecker	15.9	0.165
Northern Flicker	93.5	0.961
Eastern Phoebe	0.4	0.004
Great Crested Flycatcher	0.1	0.001
Northern Shrike	0.6	0.006
Blue Jay	365.8	3.800
American Crow	806.7	8.265

Fish Crow	0.2	0.002
Horned Lark	111.6	1.154
Tree Swallow	0.5	0.005
Black-capped Chickadee	1,235.6	12.611
Tufted Titmouse	199.4	2.038
Red-breasted Nuthatch	46.2	0.496
White-breasted Nuthatch	78.0	0.817
Brown Creeper	5.1	0.054
Carolina Wren	124.6	1.287
House Wren	0.3	0.003
Winter Wren	6.2	0.064
Marsh Wren	3.8	0.040
Golden-crowned Kinglet	67.5	0.696
Ruby-crowned Kinglet	5.8	0.057
Blue-gray Gnatcatcher	0.3	0.003
Eastern Bluebird	25.8	0.257
Hermit Thrush	27.0	0.270
American Robin	2,014.1	20.423
Gray Catbird	22.6	0.234
Northern Mockingbird	72.0	0.768
Brown Thrasher	0.7	0.008
European Starling	1,636.5	16.271
American Pipit	0.6	0.006
Bohemian Waxwing	98.3	1.068
Cedar Waxwing	301.2	3.088
Orange-crowned Warbler	3.6	0.036
Yellow-rumped Warbler	495.9	5.131
Black-throated Green Warbler	0.1	0.001
Yellow-throated Warbler	0.1	0.001
Pine Warbler	1.1	0.011
Palm Warbler	3.9	0.039
Blackpoll Warbler (SC)	0.1	0.001
Black-and-white Warbler	0.2	0.002
Ovenbird	0.1	0.001
Northern Waterthrush	0.1	0.001
Common Yellowthroat	0.6	0.006
Yellow-breasted Chat	7.1	0.072
Eastern Towhee	4.9	0.053
American Tree Sparrow	35.5	0.374
Chipping Sparrow	5.1	0.054
Clay-colored Sparrow	0.1	0.001
Field Sparrow	16.7	0.179
Vesper Sparrow (T)	0.2	0.002
Lark Sparrow	0.1	0.001
Savannah Sparrow	27.2	0.280
Nelson's Sparrow (WL-Y)	0.3	0.003
Saltmarsh Sparrow (WL-R)	1.6	0.017
sharp-tailed sparrow sp. (WL-Y/R)	0.4	0.004

Seaside Sparrow (WL-R)	0.6	0.005
Fox Sparrow	5.7	0.058
Song Sparrow	378.5	3.901
Lincoln's Sparrow	0.1	0.001
Swamp Sparrow	50.9	0.532
White-throated Sparrow	304.8	3.160
White-crowned Sparrow	0.7	0.007
Dark-eyed Junco	91.6	0.962
Lapland Longspur	9.4	0.097
Snow Bunting	73.4	0.751
Northern Cardinal	458.7	4.751
Red-winged Blackbird	69.7	0.684
Eastern Meadowlark	8.7	0.089
Rusty Blackbird (WL-Y)	0.2	0.002
Common Grackle	1.7	0.017
Brown-headed Cowbird	3.8	0.042
Baltimore Oriole	1.8	0.018
Purple Finch	3.5	0.034
House Finch	632.8	6.574
White-winged Crossbill	0.3	0.003
Common Redpoll	17.1	0.186
Pine Siskin	2.4	0.023
American Goldfinch	600.0	6.156
House Sparrow	536.0	5.578

E – State Endangered
T – State Threatened
SC– State Species of Special Concern
WL-Y – Audubon WatchList Yellow List (Rare or Declining Species)
WL-R – Audubon WatchList Red List (Species of Highest National Concern)

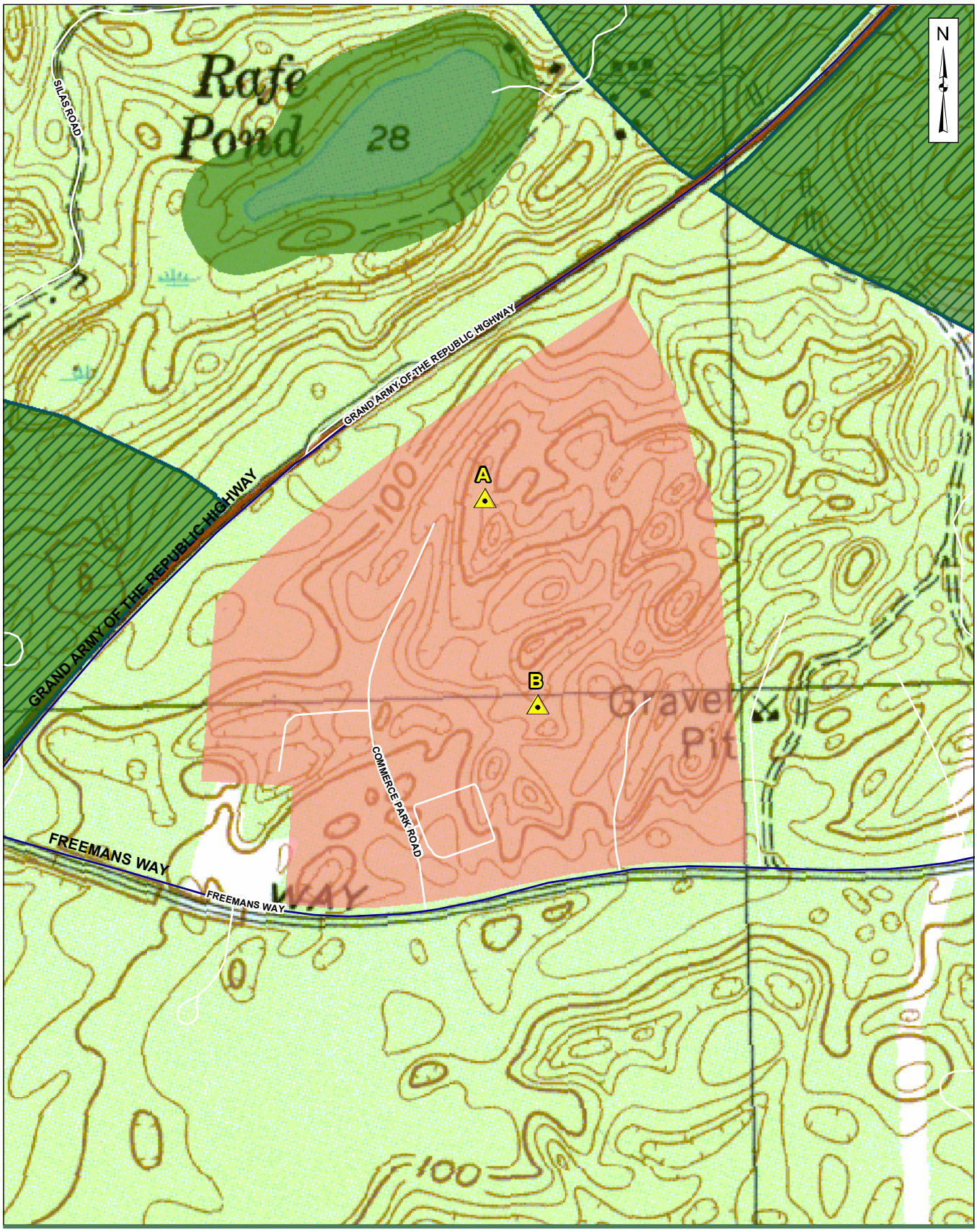
2.4 Potential Rare Species Occurring on the Project Site

Based on a review of the 2008 MassGIS Natural Heritage Datalayers, the project site is not located within priority habitat for rare species or estimated habitat for rare wildlife. Although priority habitat for rare species is located nearby to the northwest, north, and northeast of the site, it is associated with a reptile rather than avian or bat species (see Figure 4).

Information requests regarding federal or state protected species and significant habitats on and near the site were sent to the USFWS, NHESP, and MassAudubon. These letters introduce the organizations to the project and allow for governing agencies and local experts to comment on species that may be impacted by proposed turbines. MassAudubon did not reply to the information request.

The NHESP has confirmed that the site is not within Massachusetts Estimated or Priority Habitats for rare species. It advises that potential impacts to birds and bats be considered during design and permitting process for all wind turbines. NHESP recommend all turbines be monitored for birds and bat mortality and all observed mortalities be reported to NHESP.

The USFWS indicated that federally threatened Piping Plovers are known to breed on coastal beaches north, south, and east, but are not known to occur near the proposed project location. Additionally, federally endangered Roseate Terns are known to make use of areas on the outer Cape for staging during the fall migratory period. However, whether they cross over the project location during this time is unknown. Lastly, a candidate species for listing, the Red Knot, has been documented at coastal areas on Cape Cod. As with Piping Plover and Roseate Tern, the extent to which Red Knot may fly over the proposed project site is unknown.



ESS Group, Inc.
Engineers
Scientists
Consultants

CVEC WIND ENERGY FACILITY
Brewster, Massachusetts

Scale: 1" = 600'

0 600 Feet

Source: 1) MassGIS, USGS Topo Map 1982-1990
2) MassGIS, NHESP Data, 2008

Legend

- Turbine Location
- Town-Owned Property of Interest
- NHESP Priority Habitats of Rare Species
- NHESP Estimated Habitats of Rare Wildlife

Estimated and Priority Habitats of Rare Species

Figure 4

3.0 AVIAN RISK ANALYSIS

Wind turbines have the potential to impact birds both directly and indirectly. Direct impacts typically consist of collisions with turbine blades or other structures and affect avian populations through mortality. Indirect impacts are more varied and may impact rates of avian morbidity, mortality, and reproductive success. Examples of indirect impacts include disturbances associated with the loss or alteration of habitat, presence or activity of construction equipment, disturbances from routine and non-routine maintenance, avoidance behavior by resident or migratory birds in response to the presence or operation of turbines and other structures, changes in rates of nest predation and parasitism, or shifts in species composition in the project area.

A total of 34,368 MW of wind power were installed in the United States as of December 31, 2009 (U.S. Department of Energy 2010) and post construction avian mortality studies have been now been completed at numerous wind farms across the country. The growing database of impact studies at operational wind farms makes it possible to assess the general risk of direct and indirect impacts to birds at proposed wind energy project sites. The following is a summary of the latest research concerning general wind turbine effects on birds and an assessment of the likelihood of specific detrimental impacts to birds from the Brewster Wind Project.

3.1 Avian Impacts from Windfarms

3.1.1 Direct Mortality from Collision with Turbine Blades and Support Towers

There have been many studies conducted at various sites throughout the world, but no significant impacts have been found, except perhaps at the Altamont Pass Wind Resource Area in California. Altamont has little in common with modern wind projects including the Brewster Wind Project. Altamont is a large wind farm (5,000 turbines) with lattice structures, small and fast rotating blades, close spacing and a large raptor population with a prevalence of prey species. The two turbines at the Brewster site will have slower-rotating blades and tubular towers. The larger diameter of the rotor results in a reduction in the number of rotations the blades make per unit of time. This is likely to allow the blades to be more readily seen by birds and thus avoided. There is no documented concentration of birds or prey items at the Brewster site as with the Altamont Pass site.

Erickson et al. (2001) reviewed avian mortality data for eight wind energy facilities in the West (excluding California), upper Midwest, and eastern U.S. The estimated avian mortality was 2.11 birds/turbine/year, or 3.04 birds/MW/year. Using these mortality rates, US annual mortality outside of California was estimated at 9,200 birds and 195 raptors (Erickson et al. 2001).

The National Research Council (NRC) Committee on Environmental Impacts of Wind-Energy Projects compiled the most recent overview of avian mortality at wind power sites in 2007. This report compared mortality rates from the same sites as Erickson et al. (2001) plus three more (Combine Hills, Oregon; Top of Iowa; and Mountaineer, West Virginia). The 14 sites, each significantly larger than the Brewster Wind Project, included a total of 1,213 turbines with a total capacity of 908 MW. Data were collected over a minimum of one year and mortality methods

were standardized (i.e., scavenging and searcher efficiency biases are incorporated into estimates) (NRC 2007). Annual mortality rates for all bird species averaged 4.27 birds/turbine/year, or 2.96 birds/MW/year. For raptors, average mortality rates were 0.03 raptors/ turbine/ year, or 0.02 raptors/MW/year (NRC 2007).

A post-construction study for the Maple Ridge Wind Power Project near Lowville, New York provides bird mortality data from a regional wind farm (Curry and Kerlinger 2007). Though closer to the proposed Project than other studies reviewed in the NRC (2007) report, the Maple Ridge Wind Power Project is significantly larger than the Brewster Wind Project, consisting of 195 wind turbines, each 80 meters (262 feet) tall, constructed over 21,100 acres. Results from the first year of monitoring were obtained from a survey of 50 out of the 120 operational turbine sites. Mortality during the first year of operation year of the Maple Ridge Wind Power project ranged from 3.13 to 9.59 birds per turbine (Curry and Kerlinger 2007).

One of the most recent post-construction avian mortality studies in North America was conducted at the Wolfe Island Ecopower Centre in Ontario, Canada (Stantec 2010). This wind energy facility consists of 86 2.3 MW wind turbine generators arrayed on Wolfe Island, which is located on the northeastern shore of Lake Ontario. The waters surrounding Wolfe Island host large numbers of migratory waterfowl and have earned the area a designation as an IBA. Between July 1 and December 31, 2009, an average rate of 6.99 fatalities/turbine or 3.04 fatalities/MW per the six-month period occurred. The Wolfe Island Envirocentre reported the greatest number of documented fatalities among swallow species, especially Tree Swallow (Stantec 2010). The collision mortality rate for raptors (excluding vultures) during the same time period was 0.08 raptor fatalities/turbine or 0.04 raptor fatalities/MW. Although the overall avian collision mortality rate per turbine is the highest documented in North America, the mortality rate per MW of energy produced is comparable with other wind energy facilities. Additionally, no waterfowl mortalities were documented at this facility during the study period.

The nearest wind facility for which a post-construction avian mortality study was conducted is the single 660-kW Vestas V47 wind turbine at the Massachusetts Maritime Academy. Vlietstra (2008) evaluated effects of the construction and operation of the single turbine on Common and Roseate Terns, in addition to other avian species. Although the turbine is onshore, it is only 100 meters from the waters edge, located near a protected section of Buzzards Bay which is frequented by Roseate and Common Terns, gulls, diving ducks, and shorebirds. During the period of the study, which extended from April to November in both 2006 and 2007, a total of five bird fatalities were observed, three of which were suspected to have directly collided with the wind turbine. Roseate and Common Tern mortality has not been recorded. Once corrected for scavenging activity, the study estimated the wind turbine at the Massachusetts Maritime Academy was responsible for 2.1 to 4.0 avian fatalities per year, which is comparable to studies conducted at wind turbines elsewhere (Vlietstra 2008).

There have been numerous other studies and reviews of avian impacts from wind turbine generators of varying sizes in the United States, Canada, and Europe. The results from these

studies vary in the details but are consistent in supporting the observation that avian mortality rates at wind power sites, especially at modern facilities, are generally low.

The NRC (2007) suggests that predicted levels of avian mortality resulting from wind energy facilities are unlikely to result in measurable impacts to migratory populations of most species. Small impacts could prove significant, however, for unstable populations when combined with existing threats of mortality, such as predation and large weather-related bird kills (NRC 2007).

3.1.1.1 Factors Influencing Mortality

Turbine Height and Lighting

Chief concerns among governing agencies and biologists with regard to structures and avian collisions are height and lighting. Some types of lighting on human structures (buildings, bridges, towers, etc.) have been shown to attract birds, especially birds migrating at night in bad weather with poor visibility. The FAA requires that structures with heights over 61 meters (200 feet) above sea level be lit for aviation safety. Steady-burning lights are of particular concern.

The turbines proposed at the Brewster site will be 125 meters (410 feet) to the tip of the rotor. FAA guidance for lighting turbines allows for medium intensity red and white strobe lights with the minimum flash rate of 20 flashes per minute. The white strobe during the day and lower intensity red strobe at night minimizes the visual impact to human observers at night and reduces the probability of collision by night migrating songbirds, while ensuring visibility and pilot safety. Preliminary indications are that these lights do not appear to attract birds (American Bird Conservancy 2010). It is imperative that all other forms of lighting are extinguished at night at, or immediately adjacent to, the project site to avoid attracting night migrants to the vicinity of the turbines.

Based on studies at modern wind farms, it is clear that avian fatalities at wind turbine sites are uncommon or rare events. Studies of birds approaching wind turbines indicate that most birds change their flight behavior to avoid wind turbines (Desholm and Kahlert 2005, Chautaqua Windpower et al. 2004, Strickland et al. 2001, BirdLife 2002, and Sterner 2002). Studies comparing flight behavior over wind turbines to control areas without wind turbines show that migrating birds pass over wind farms at higher altitudes than over reference areas (BirdLife 2002).

In a study in Tarifa, Spain based on observation of 72,000 migrating birds, it was noted that birds flew at higher average altitudes (higher than 100 meters versus 60 meters) over wind turbines than over two other observation areas without wind turbines (Janss 2000). In Spain, low mortality has been observed at a large wind farm (more than 1,000 turbines) located in a major migratory pathway. Based on 1,000 hours of observation, Janss (2000) observed only two raptors killed during the passage of a minimum of 47,500 raptors.

Radar and visual observation studies were conducted at the 80-turbine Horns Rev Wind Park in Denmark in autumn 2003 and spring 2004. Nearly 2,000 radar tracks, representing individuals or groups of birds, were analyzed for signs of lateral avoidance of the wind farm. More than 70% of the tracks analyzed showed signs of lateral avoidance at distances of 300 to 1,000 meters. Of the tracks that entered the wind park, most showed a shift in direction to pass between rows of turbines. However, this correction in flight direction appeared to be more precise during the day than at night, implying that the risk of collision is higher under low visibility conditions. No waterfowl fatalities were observed during the period of study. (Christensen and Hounisen 2005).

Weather

Bird flight patterns near turbines may vary in response to weather conditions, which can affect the risk of mortality. Opposing winds aloft can force birds to fly at lower altitudes, as wind speeds are typically lower close to the ground. By flying at lower altitudes when faced with a head wind, birds can reduce their energy cost, but may increase the risk of collision with buildings, towers, turbines, and other structures. However, most species avoid flying into strong winds while migrating and wait until winds are favorable.

Inclement weather has been identified as an important factor contributing to bird collisions with obstacles, including power lines, buildings, and communication towers (Estep 1989). Low-lying clouds, rain, mist, and fog may also increase collision risk by reducing visibility (Percival 2001, Day et al. 2004, National Wind Coordinating Committee 2004). Although the risk of collision may to be higher during periods of low visibility, migrants generally avoid flying in clouds or fog banks, preferring to stay either above or below them (Percival 2001, Christensen and Hounisen 2005). The effect of weather, however, is confounded by the heights of structures, types of lighting, and whether towers are guyed or not (NRC 2007). Although inclement weather can increase the risk of collision with structures, this increased risk is anticipated to be minor, and is likely to be mitigated in some measure by reduced numbers of birds migrating in these conditions (Day et al. 2004, Pettersson 2005).

Topography and Geography

The effect of topography and geography on the risk of avian migration and fatality is not entirely clear due to the limited range of plant communities and landscapes that have been studied (NRC 2007). The literature suggests that the significance of topographic features such as mountain ridges or major waterways in determining migration patterns is species-specific. A more consistent observation with regard to migration patterns may be that species with limited breeding and winter ranges tend to have more restricted migration routes while species with widely dispersed breeding ranges typically display a broad-front migration pattern (NRC 2007). Given the lack of significant linear topography (i.e., mountain ridgelines or river valleys) at the Brewster Wind Project site, topographic concentration of avian migrants is unlikely at this location.

One popular migration pathway is the Atlantic Flyway, which is a series of migration routes that run north/south and is defined by the offshore waters of the Atlantic Coast to the east and the Appalachian Mountains to the west. Because many bird species use coastlines to aid in navigation during migration, the Atlantic coast is an integral route along the Atlantic Flyway. Although the geography of Cape Cod may concentrate some birds using the Atlantic Flyway near the proposed Brewster Wind Project, it is likely that most shorebirds, raptors, and coastal waterfowl will follow the dominant geographic feature (i.e., the coastline) rather than meandering over inland areas closer to the project site.

In general, current studies indicate that passerines are relatively unaffected by topographic variability and migrate in broad fronts, typically at elevations greater than the rotor-swept area of turbines (NRC 2007). However, it is important to note that weather conditions such as low ceiling, precipitation, poor visibility may compress migration elevation patterns and result in increased collision rates with structures.

3.1.1.2 Avian Mortality in Context

Human-related sources have been estimated to kill from 500 million to one billion or more birds annually in the United States (Erickson et al. 2001, USFWS 2002). Based on current estimates, avian mortality at wind energy facilities probably represents from 0.01% to 0.02% of annual avian mortality from collision with man-made structures in the United States (Sagrillo 2003). Even if wind energy facilities were more numerous (e.g., 1 million turbines), they would likely account for only a few percent of all avian mortality from collision (Erickson et al. 2001).

Table 4: Human-induced Direct Causes of Avian Mortality

Cause	Estimated Numbers
Buildings and windows	97 to 976 million[1]
Power lines	130 million[2]
Cats	100 million[2]
Automobiles	80 million[2]
Pesticides	72 million and likely greatly underestimated because of long-term effects[1]
Communication towers	4.5 million possibly up to 40 to 50 million[1,2]
Oil and wastewater pits	2 million[1]
Wind turbines	28.5 thousand[2]
Airplanes	25 thousand[2]

Sources:
[1] USFWS 2002
[2] Erickson et al. 2001

The large differences in total mortality from these sources are related to the differences in the total number (or miles) of structures in each category. By end of 2001 in the US, there were approximately 4 million miles of roads, 4.5 million commercial buildings, 93.5 million houses, 500,000 miles of bulk electrical transmission lines (and an unknown number of miles of distribution lines), 80,000 communication towers, and 15,000 commercial wind turbines.

3.1.2 Indirect Impacts

Avoidance of Windfarm Area

Avoidance is a potential impact from wind turbines. Some studies have shown that birds will avoid areas after turbines are erected. Studies have been published on the displacement and avoidance impacts of wind turbines and associated infrastructure and activities on grassland and shrub-steppe breeding songbirds and other open country birds (prairie and sage grouse, shorebirds, waterfowl, etc.). Some of these studies have documented decreased densities of and avoidance by grasslands songbirds and other birds as a function of distance to wind turbines and roads. The level of impact varies by species, and ongoing research is quantifying the distance of avoidance caused by the presence of infrastructure and human activity. Some birds seem to adapt (habituate) to areas previously avoided (National Wind Coordinating Committee 2004).

When birds demonstrate avoidance behavior in response to a wind power facility, it might be at some distance from a turbine string or upon approach to an individual turbine or an oncoming blade (Winkelman 1994). Most birds change their flight behavior to avoid wind turbines (Stantec 2010, Dong Energy 2006, Strickland et al. 2001, BirdLife 2002, Sterner 2002). Avoidance behavior appears to species-specific, but it is influenced by weather conditions and whether the facility is in operation (NRC 2007). Resident breeding birds appear to be able to adjust to some degree to wind towers by displacing their movements away from or otherwise avoiding turbines, whereas migrants are not exposed to individual sites long enough to learn about them, possibly increasing their risk (NRC 2007). Pre- and post-construction radar and visual surveys of migrating birds at the Searsburg Wind Facility in Vermont reported a decrease in the number of birds flying over the wind farm following construction, suggesting that migratory songbirds and raptors are able to avoid wind turbines post-construction (Kerlinger 2002, Woodlot 2005a and 2005b).

Habitat Loss and Fragmentation

Access and maintenance roads can also cause habitat loss and fragmentation. In some cases, fragmentation has a more deleterious effect on sensitive bird species than direct habitat loss. Fragmentation of forest habitat can lead to increased nest predation and brood parasitism of forest songbirds. Fragmentation opens up forests, allowing nest predators, such as crows, to more readily find and “rob” songbird nests (Haskell 1995, Wilcove 1985, Terborgh 1989 and 1992). Successful brood parasitism by Brown-headed Cowbird may also be facilitated by forest fragmentation. Brown-headed Cowbird is a brood parasite species that lays its eggs in other species’ nests and depends on these “foster parents” to raise its offspring. Although the rate of success varies by host species, most foster parents usually raise the cowbird young at the expense of their own offspring (Petit 2006). A single female Brown-headed Cowbird is capable of

laying nearly one egg per day at the peak of the breeding season. Although just one egg is laid in a host nest, female cowbirds may produce a total of 30 to 40 eggs over the two- to three-month breeding season (May to July), meaning they may parasitize equally as many nests, often of multiple species (Petit 2006). Brown-headed Cowbird is prevalent in open areas and, as land has been cleared in North America, its numbers and original range have increased, resulting in a widespread impact to breeding forest songbirds. Due to the limited clearing required for the project, size of the project area and minimal fragmentation, there would not be a major impact from nest predation or parasitism anticipated.

3.2 Risk for Vulnerable Species Groups

Data collected from post-construction avian mortality assessments indicate that different groupings of birds are disproportionately at risk from wind turbines. Biological factors such as abundance, migration, regional distribution, and behavioral patterns can influence mortality rates for particular avian species or suites of species (NRC 2007). Certain avian species groups need to be analyzed in more detail with regard to potential impacts of the proposed wind energy project. These include species that have been observed in the area or are likely to breed in or migrate through the area. In the following sections, the focus is placed on species groups that may be particularly vulnerable to impacts from wind turbines.

3.2.1 Migratory Birds

Some species of migrating birds, particularly shorebirds and waterfowl, concentrate in areas providing suitable habitat while resting and feeding between migratory flights. These may include marshes, coastal embayments, mudflats, or other areas that provide food and/or shelter (Richardson 1998).

The timing of migration varies among bird species. The majority of land birds travel at night, usually taking off within one-half to one hour after sunset and continuing to fly for several hours. Almost all hawks, eagles, and vultures migrate during the daytime. Takeoff is often delayed until mid-morning when thermal updrafts are stronger. Raptors, such as falcons that are less dependent on soaring, often take off earlier in the day than the soaring species. Waterfowl and shorebirds migrate both by day and night (Richardson 1998).

Birds migrate at diverse altitudes, although most stay within the following ranges (Deinlein 2010):

- Songbirds: 500 to 6,000 feet (150 to 2000 meters; seventy-five percent of songbirds migrate between 500 and 2,000 feet [150 to 600 meters])
- Shorebirds: 1,000 to 13,000 feet (300 to 4,000 meters)
- Waterfowl: 200 to 4,000 feet (60 to 1,200 meters)
- Raptors: 700 to 4,000 feet (200 to 1,200 meters)

These data are supported by various radar and other studies conducted in the United States and Europe. Most modern turbines extend to a maximum of 300 to 410 feet (90 to 125 meters). A small percentage of migrants passing over wind power sites are likely to fly within the altitude range of turbine swept areas. Migratory birds are also potentially at risk when taking off or descending near turbines, especially when some feature of the turbine, such as lighting or perching areas may be attractive to them.

Weather and wind patterns can affect migration altitudes. Opposing winds aloft can force birds to fly at lower altitudes. Wind speeds are typically lower close to the ground than at higher altitudes. By flying at lower altitudes when faced with a head wind, birds can reduce their energy cost. However, most species will avoid flying into strong winds while migrating and wait until winds are favorable. Sometimes birds take off under favorable conditions, but encounter poor conditions during their flight. This may force them to fly at lower altitudes and put them more at risk for collision with wind turbines.

When poor visibility occurs, nocturnal migrants are thought to be strongly attracted by lights, especially by bright steady burning lights that continuously illuminate the fog and precipitation in the airspace around the light. The greatest number of bird collisions with tall structures (typically tall communication towers with guy wires and steady burning lights) occurs on nights with poor visibility. This is likely due to birds flying at lower altitudes during inclement weather, and their attraction to light. For this reason, when obstruction lights are required, they should be flashing, not steady burning. Floodlighting of tall structures should be avoided, especially on nights with inclement weather (Richardson 1998). Neither guy wires nor steady lighting are anticipated for the two wind turbines at the Brewster site, which should minimize the collision risk of migrant birds during the night and periods of poor visibility.

3.2.2 Raptors

On a population percentage basis, raptors are likely to be the most vulnerable avian species group to collision with wind turbines, primarily due to behavior (NRC 2007). This group may be especially prone to significant levels of mortality at land based wind energy sites where prey density, topography, or other habitat features tend to concentrate large numbers of raptors in the vicinity of wind turbine towers and the rotor-swept zone of operating turbines (e.g., Altamont Pass in California).

However, raptors have not been documented to frequent the Brewster area in large numbers, even during spring migration when the highest densities of raptors on Cape Cod tend to occur. Although it is possible that spring migrant raptors could pass through the project site, the best locations for spring raptor observation on Cape Cod are typically on east-facing shorelines (Lowe and Manchester 2001). Therefore, the project site is unlikely to be a primary corridor for spring raptor migration.

As shown in Table 3, five state-listed raptors have been identified within the Cape Cod (MACC) CBC 15-mile survey circle, including Northern Harrier, Sharp-shinned Hawk, Peregrine Falcon, Long-eared Owl and Short-eared Owl. Northern Harrier and Sharp-shinned Hawk were observed

during each count in the 1999-2009 period, typically ranging from 10 to 30 and 5 to 17 individuals, respectively. Peregrine Falcon, although observed in 91% of CBCs during this period, only occurred at lower abundances (one to four individuals). Short-eared and Long-eared owls were only observed once and twice, respectively, during the same period. Most other raptor species were observed at low abundances (fewer than five individuals) or in less than 50% of the CBC counts from this period. Exceptions include Cooper's Hawk, Red-tailed Hawk, Eastern Screech-Owl and Great Horned Owl, which were observed each year, as well as Snowy Owl, which was observed 64% of the time with as many as seven individuals in one year.

According to BBS data from the nearest survey transects (Wellfleet and East Dennis) Broad-winged Hawk, Red-tailed Hawk, Osprey, American Kestrel, Eastern Screech-owl, and Great Horned Owl may be present at low densities during the breeding period. BBA data also suggest that Sharp-shinned Hawk, Cooper's Hawk, Broad-winged Hawk, Red-tailed Hawk, Osprey, Eastern Screech-owl, Northern Saw-whet Owl, and Great Horned Owl may occupy appropriate habitats near the project site during the breeding period.

Although species composition and abundance vary on a seasonal basis, raptors are likely to be present in the area year-round. However, due to the locally low abundances of most species, it is not anticipated that the proposed turbines will have a significant effect on raptor populations, including state-listed raptor species.

3.2.3 Songbirds

Migratory songbirds likely fly over the Brewster site in relatively large numbers in the spring and the fall. Additionally, breeding populations of common woodland and garden songbird species (Eastern Kingbird, Black-capped Chickadee, Tufted Titmouse, Gray Catbird, American Robin, Baltimore Oriole, and several others) are likely to be present on-site from late spring through late summer.

Songbirds are the most often reported avian fatalities in land-based wind projects, making up 75% of observed fatalities in a recent review of 14 wind-energy facilities (NRC 2007). Despite this large proportion of total mortality, the absolute number of songbirds killed varied considerably between sites in the eastern United States. The reported rate of songbird mortality ranges from zero per year (five months of study) at the Searsburg Wind Facility (Kerlinger 1997) to 11.7 per megawatt per year from a site in Tennessee (Nicolson 2003). These data may be confounded by the fact that passerine mortality may be underrepresented in most studies because small birds are harder to detect and scavengers may remove small birds before they can be observed (Johnson et al. 2002).

The Wolfe Island Envirocentre reported the greatest number of documented fatalities among swallow species, especially Tree Swallow (Stantec 2010), although whether this was mainly a function of local abundance or flight behavior is unclear. There is appropriate foraging habitat for swallows at the Brewster site, particularly in the vicinity of the existing driving range. Whether this area is actively being used for foraging by swallows (and under what sort of weather conditions) is not known.

3.2.4 Shorebirds

Shorebird concerns may arise around coastal and offshore wind projects, where habitat exists for nesting and foraging. Although multiple shorebird species have been observed in the town of Brewster and along nearby BBS transects, these observations are likely to be almost entirely from coastal areas and shorebirds are unlikely to be present in significant numbers near the proposed project. While it is possible that migrant shorebirds and commuters could pass over the project site, appropriate habitat for nesting and foraging does not exist at the site.

3.2.5 Waterfowl

Permanent bodies of water are not found on-site and waterfowl would not be expected to make significant use of the parcel for foraging or nesting. However, based on correspondence with USFWS, waterfowl may use natural waterbodies near the Brewster Wind Project. Multiple species of goose, duck, loon, and grebe have been identified by recent CBC surveys in the MACC circle. Winter concentrations of Common Merganser and American Black Duck are known to inhabit ponds to the north of the Brewster site in Nickerson State Park.

Common Mergansers tend to stay low and follow waterways on short flights, but fly higher and more directly on longer flights. Female Common Mergansers are especially agile fliers and can navigate through forested areas below the canopy (Mallory and Metz 1999).

Populations of American Black Duck almost exclusively use tidal waters as a winter refuge in New England (Longcore et al. 2000). The collision risk for wintering American Black Duck populations from the proposed project could differ depending on whether they commute over the project site between fresh and tidal water bodies.

Few species (Canada Goose, Mute Swan, American Black Duck, Mallard, and Double-crested Cormorant) have been documented in the area during the breeding season by BBA or BBS surveys. Given the proximity to the ponds of Nickerson State Park, the wind turbines may pose some risk to resident or migratory waterfowl that use the airspace over the site. However, impacts to waterfowl from the two existing communication towers and guy wires have not been reported.

3.2.6 Rare Species

Based on correspondence with NHESP, no state listed avian species are known to occur at or adjacent to the Brewster site. Therefore, the risk posed to these species is anticipated to be low.

According to BBA and BBS data, as well as MassAudubon (2010), the state-threatened Northern Parula has been observed in relative proximity to the Brewster site during the breeding season. Although Old Man's Beard lichen appears to be available as a nesting material, it is unknown whether Northern Parula currently breeds on or near the Brewster site. Boggy woodlands and riparian forests appear to be the preferred nesting habitat for Northern Parula in Massachusetts (Petersen and Meservey 2003). Small areas of forested wetland do exist on site, but it is uncertain whether these would be able to support nesting of a Northern Parula pair.

State-endangered American Bittern may be present near the Brewster site during the breeding season and the winter, based on BBA and CBC data. This species prefers freshwater wetlands dominated by tall, emergent vegetation, and within these habitats frequents vegetation fringes and shorelines. However, little is known about its daily commuting and migratory movements (Lowther et al. 2010). Given the lack of appropriate habitat on site, active use of the Brewster site by American Bittern is unlikely.

Sharp-shinned Hawk is a state-listed species of concern and is known to be one of the most abundant migrants on Cape Cod during spring. Additionally, Sharp-shinned Hawks have been documented in Brewster during BBA surveys. If present on site, the risk of collision for this raptor may be elevated, given its opportunistic and secretive predatory behavior (MassAudubon 2009).

Common Tern has been documented in Brewster during recent BBA surveys. However, given the lack of appropriate habitat on site, active use of the Brewster site by Common Tern is unlikely. Additionally, in a study of the nearby Massachusetts Maritime Academy wind turbine, where Common Tern activity levels are high, this species was observed to avoid the rotor-swept zone, especially during operation (Vlietstra 2008). Therefore, although little is known about the use of airspace over the Brewster site by migrating or commuting terns, the risk of collision posed to Common Tern by the proposed project is likely to be low.

Based on correspondence with USFWS, no federally listed avian species are known to occur at the Brewster site. However, Piping Plover, Roseate Tern, and Red Knot have been documented to make use of nearby appropriate habitats at some point of the year and could potentially cross over the Brewster site if they were to follow overland trajectories.

Federally threatened Piping Plover is known to inhabit coastal areas to the north, south, and east of the Brewster site. However, this species are dependent on marine and coastal resources and nest in the narrow area of shore between the high tide line and the foot of coastal dunes. Plovers feed on organisms that live along the shoreline and are confined to the vicinity of their nests during the breeding season (Kerlinger and Curry 2002). The nearest shoreline (Pleasant Bay) is approximately 1.0 miles from the Brewster site.

Piping Plovers generally do not appear to move significant distances once they have established on their breeding grounds, except rarely in the case of nest failure (MacIvor 1990). Piping Plover banding studies suggest limited overland flights (Chapman 2010) and MacIvor (1990) reported few overland crossings of the Cape. Overland flights between beaches north and south of the Brewster Wind Project present a potential risk of collision for Piping Plovers. However, the data do not support overland flights as a significant flight path.

Little is known regarding the seasonal migratory pathways used by Piping Plovers as they travel toward their breeding habitat. It is unknown whether and to what extent they fly over land or follow the shoreline. Likewise, there is little known about their migratory flight paths during fall migration toward the southeast Atlantic Coast (Chapman 2010).

According to the USFWS, federally endangered Roseate Terns are not known to nest near the proposed turbine locations. However, they could traverse Cape Cod after breeding, when the entire North Atlantic breeding population forms staging flocks on the outer Cape (especially Monomoy Island) to feed prior to fall migration (Trull et al. 1999). However, it is unknown whether and to what extent these flocks cross mainland Cape Cod during their daily foraging and seasonal migratory movements.

Red Knot, which is a federal candidate species for listing, nests in the Arctic, but is known to use the Atlantic Flyway and stopover at coastal locations on Cape Cod during migration. However, documentation of Red Knot flight patterns over inland portions of the Cape during migration is lacking.

State or federally listed species are not expected to utilize the site. Overall, the potential impact of the Brewster Wind Project on rare avian species is expected to be low.

3.3 Summary and Conclusion

The wind turbines proposed at the Brewster site are not anticipated to have a biologically significant impact to avian species. Displacement of species due to habitat loss is unlikely to be significant given the small overall area of disturbance associated with the turbines, access roads, and underground transmission lines. However, some loss of forest habitat and small increases in forest fragmentation is expected, which could locally increase the chances of nest predation and cowbird brood parasitism, but because of the size of the project area this is not anticipated to be significant. Collisions with the turbines are possible but are expected to be minimal because the project is small in size (two turbines) and will use turbines with a tubular support structure, minimal lighting, and no associated guy wires. Additionally, although the turbines would be located within a migratory flyway, the height of the tower and turbine blades is well below the altitude of most migrating birds. The project site is not documented to be an important nesting or foraging area for federally or state-listed endangered or threatened species or species of concern. Based on the particular conditions of the site and a substantial quantity of data documenting the minimal effects of wind turbines on avian species, the proposed project is likely to be of minimal risk to birds.

Despite the minimal anticipated risks, the USFWS recommends conducting pre- and post-construction bird surveys at the site to avoid or minimize impacts to birds, especially migratory birds, gulls, and ducks. These surveys may include direct observation or make use of radar or other remote sensing techniques. Employing radar or remote sensing techniques is generally seen as cost-prohibitive and unrealistic for a project of this size and given the amount of potential risk. A post-construction mortality study similar to that conducted at the Massachusetts Maritime Academy project would provide sufficient data to understand effects from the project.

4.0 BAT ASSESSMENT

4.1 Bat Habitat Analysis and Literature Search

4.1.1 Habitat

As described in detail in Section 2.1 above, the proposed wind turbines are located within a business park with commercial and town-owned buildings. There are two large communications towers on the southeast portion of the site and a driving range in the center. The remainder of the site is wooded with Pitch Pine-Oak Forest Woodland.

4.1.2 Rare Species

Information regarding federally or state-protected species and significant habitats was requested from the USFWS and the NHESP. These letters introduced the agencies to the project and allowed for governing agencies and local experts to comment on species that they think may be impacted by the proposed turbines. The USFWS and NHESP indicated that no federally or state-listed bats occur near the project site.

4.1.3 Potential Bat Species

Eastern Massachusetts is included in the range of seven bat species (Cardoza et al. 2009; DeGraaf and Yamasaki 2001). These species are the big brown bat (*Eptesicus fuscus*), red bat (*Lasiurus borealis*), northern myotis (*Myotis septentrionalis*), eastern pipistrelle (*Pipistrellus subflavus*), little brown myotis (*M. lucifugus*), silver-haired bat (*Lasionycteris noctivagans*), and hoary bat (*Lasiurus cinereus*).

Due to their generally robust populations throughout their ranges, none of these bats is listed on the state or federal lists of rare, threatened, or endangered species. Most of the seven bat species that occur in eastern Massachusetts are classified as “uncommon to rare” in the southeastern Massachusetts portion of their ranges (DeGraaf and Yamasaki 2001). The characteristics of each species are summarized below.

Big Brown Bat

The big brown bat occurs statewide in Massachusetts, but has not been identified on Martha’s Vineyard or Nantucket Island (Cardoza et al. 2009). It inhabits cities, towns, and rural areas, and is less commonly found in heavily forested regions (Mulheisen and Berry 2000). This bat tends to be a habitat generalist, using a variety of hardwood and softwood forests and features, especially still water, roads, and trails, and regenerating shrub/sapling stands (DeGraaf and Yamasaki 2001). This bat has been found in human dwellings, barns, silos, and churches, and has also been found roosting in storm sewers, expansion joint spaces in concrete athletic stadiums, and mines. Big brown bats breed from September through March, and the young are usually born in June. Hibernation begins in November. They usually travel no more than 30 to 50 miles (48.3 to 80.5 kilometers) from maternity colonies to hibernation sites (Bat Conservation International, Inc. [BCI] 2001; DeGraaf and Yamasaki 2001; Kurta 1995). Big brown bats feed primarily on coleopteran (sheath-winged insects such as beetles, fireflies, and weevils) species, but may feed

on a variety of other insect prey. They forage at night, flying over a range of heights above ground from approximately 16 to 160 feet (5 to 50 meters) within approximately half a mile (0.8 kilometer) of day roosts (DeGraaf and Yamasaki 2001).

Red Bat

Red bats occur statewide in Massachusetts (Cardoza et al. 2009). They tend to choose habitats that are sparsely to moderately populated by humans, and are rare in heavily urbanized areas. Similar to the big brown bat, the red bat utilizes hardwood and softwood forests as well as features such as still water, roads, trails, and regenerating shrub/sapling stands. They begin foraging 1 to 2 hours after sunset, flying high at first and eventually coming within 6.5 to 30 feet (2 to 4 meters) of the ground as darkness approaches (BCI 2001). Red bats breed from August through September, and the young are born in late May to early June (DeGraaf and Yamasaki 2001). Red bats are migratory, arriving in the northern climates in mid-April and leaving in late October. They usually winter from Maryland to the Gulf States, typically hibernating in hollow trees and choose roosting sites in dense foliage. Red bats are strong fliers, and are capable of covering great distances over water (DeGraaf and Yamasaki 2001). Although they are fast flyers, their long narrow wings give them poor maneuverability (BCI 2001).

Northern Myotis

The northern myotis, also known as the northern long-eared bat, occurs statewide in Massachusetts but has not been observed on Nantucket Island (Cardoza et al. 2009). This bat is largely associated with boreal forests (Ollendorff 2002) but also occurs in mature forests of oak, hickory, maple, hemlock, red cedar, or birch (BCI 2001). In areas of North America and Canada, the northern myotis roosts in buildings, under exfoliating bark, and in the cavities of dead trees. Caves and underground mines are its choice sites for hibernating. The northern myotis forages over ponds and clearings within forests, below tree canopy but above the shrub layer. This species is a slow flier but has high maneuverability, allowing individuals to forage in thick forest habitats (DeGraaf and Yamasaki 2001). These bats appear to feed exclusively beneath the canopy level, often 3.3 to 9.8 feet (1 to 3 meters) above ground along forested hillsides and ridges (BCI 2001). The northern myotis is not a migratory species and appears to make only local seasonal movements (BCI 2001).

Eastern Pipistrelle

The eastern pipistrelle occurs statewide in Massachusetts but has not been positively identified on Martha's Vineyard or Nantucket Island (Cardoza et al. 2009). Summer roosts are usually caves or mines, except in colder northern areas, where pipistrelles may be found in houses or hollow trees during summer months. The eastern pipistrelle performs short annual migrations between winter hibernation and summer nursery sites. Such travel is not known to exceed 50 miles (80 kilometers), and averages 31 miles (50 kilometers) or less (BCI 2001). The eastern pipistrelle forages over water and along forest-field edges and typically avoids dense forests (DeGraaf and Yamasaki 2001). It prefers to feed over rivers, pastures, and high in bordering trees and feeds on flies, beetles, ants, bugs, moths, and wasps.

Little Brown Myotis

The little brown myotis occurs statewide in Massachusetts (Cardoza et al. 2009). This bat forages over streams and ponds, where its diet consists of aquatic insects (mainly midges, mosquitoes, mayflies, and caddisflies) (DeGraaf and Yamasaki 2001). It also feeds over forest trails and lakes in a forest-dominated landscape where it consumes beetles, moths, stoneflies, true bugs, and termites. Breeding occurs from September to October, and the young are born from mid-June to early July. The little brown myotis seeks cavities for shelter, roosting, and brooding. In summer, females brood their young in dark, warm sites such as barns, attics, caves, hollow tree cavities, and other protected areas. Roost sites are highly variable and not well known. Little brown myotis hibernate in clusters during the winter months. Caves or mines are preferred, but large tree cavities with favorable microclimates may be used (Snyder, undated). Although not known as a migratory species, little brown myotis may travel up to 31 to 310 miles (50 to 500 kilometers) between summer and winter roosts (BCI 2001).

Silver-haired Bat

The silver-haired bat occurs statewide in Massachusetts (Cardoza et al. 2009). Foraging typically occurs around sunset in mixed, coniferous, and hardwood forest areas near lakes, streams, and ponds (DeGraaf and Yamasaki 2001). This bat forages for emerging aquatic insects, flies, beetles, and moths often less than 20 feet (6.1 meters) above the surface. Individuals have their own hunting territories, often approximately 328 feet (100 meters) in diameter, and may travel up to 1.2 to 31 miles (2 to 50 kilometers) to reach these sites (BCI 2001). The silver-haired bat breeds in late September, and the young are born between June and July. This is a migratory species that travels along coastal flyways in the northeast to the southern parts of its range in late October before returning in April (DeGraaf and Yamasaki 2001).

Hoary Bat

The hoary bat appears to occur statewide in Massachusetts (Cardoza et al. 2009). This species is found in forests, open cultivated areas, and small towns. It prefers coniferous forests but also utilizes woodland edges, deciduous woods, hedgerows, and trees in parks (DeGraaf and Yamasaki 2001). Breeding occurs from September to November, and the young are born in late May to early June. The hoary bat begins foraging in the fifth hour after sunset, and tends to forage in uncluttered areas at heights 23 to 49 feet (7 to 15 meters) above the ground. This species is generally solitary, except during migration. Migration to the southern United States and Central America occurs from August through October (BCI 2001).

4.2 Bat Risk Analysis

This section discusses potential impacts of the proposed wind turbines on local bat populations as a result of both habitat loss from construction and bat collision mortality during operation.

4.2.1 Habitat Loss

Habitat loss and avoidance is a potential impact to bats from the construction and operation of wind turbines. Although it is unknown which species of bats are currently using the project site, inferences have been made based on the habitat preferences of each species described in Section 4.1.3 above and the habitat features provided by the site, as described in Section 4.1.1 above. The following summarizes the potential habitat provided by the site for each of the seven bat species.

- **Big brown bat:** is a habitat generalist, but prefers deciduous forests and is rare in heavily urbanized areas (BCI 2001). The project site may provide habitat for this species.

- **Red bat:** a migratory species that roosts in the foliage of deciduous trees. Their roosting preferences include: 1) dense vegetation above, 2) unobstructed space below, 3) no potential perches beneath, 4) dark-colored ground cover, 5) sufficient surrounding vegetation to protect from wind and enhance heat and humidity retention, and 6) southern exposure (BCI 2001). They forage in a variety of habitats, mostly along the edges of clearings (BCI 2001). Based on these habitat requirements, the project site may provide roosting and feeding habitat for the red bat.

- **Northern myotis:** prefers boreal forests, but may also occur in mature forests of oak, hickory, maple, hemlock, red cedar, birch, or ponderosa pine (BCI 2001). They forage in these forests along hillsides and ridges (BCI 2001). The project site provides secondary habitat for this species. Due to the absence of caves or abandoned mines, the project site does not contain hibernacula for this species during the winter.

- **Eastern pipistrelle:** shows a preference for hibernating and roosting in caves, mines, and buildings (DeGraaf and Yamasaki 2001). There are buildings on site that may provide hibernating or roosting habitat. Nearby ponds at Nickerson State Park may provide foraging habitat for this species, which prefers to forage over waterways.

- **Little brown myotis:** lives in a variety of forested habitats during the summer and over-winters in caves and mines (BCI 2001). Females may form maternity colonies in buildings (DeGraaf and Yamasaki 2001). They primarily feed over water, but non-reproductive individuals may forage in a variety of habitats. The project site may provide summer roosting habitat for this species. The site does not provide hibernacula for little brown myotis, due to the absence of caves and mines; however, the site's buildings may provide habitat for maternity colonies.

- **Silver-haired bat:** occurs in forested habitats and roosts in tree cavities (BCI 2001). They feed in areas sheltered by vegetation over streams, ponds, or roadsides (BCI 2001). The site provides potential roosting habitat and may provide limited feeding habitat.

- **Hoary bat:** occupies a variety of habitats, including both coniferous and deciduous forests (DeGraaf and Yamasaki 2001). During the summer, they prefer tree roosts in edge habitats

close to feeding grounds. Feeding grounds are typically mixed forest and vegetation types with small open areas and edges. The project site may provide adequate foraging and roosting habitat for this species.

4.2.2 Bat Collision Mortality

In studies of inland wind farms and bats, resident bat populations seemed to be at substantially less risk of collision with wind turbines than were migrants (West 2002). Most bat mortality documented at wind farms in the United States occurred during the migration season, in late summer and early fall, and involved migratory tree and foliage roosting bats, of which the hoary and eastern red bat were the most prominent species in the eastern United States and the Midwest (West 2002). Several hypotheses have been developed to explain bat collisions with wind turbines. Several researchers believe that although bats rely on echolocation when foraging, migrating bats may navigate without echolocation (Kunz, undated; Johnson 2004).

Migration behavior varies among the bats with range in southeastern Massachusetts. The eastern pipistrelle migrates less than 30 miles (48.3 kilometers), generally over land, between its maternity colonies and hibernation sites (Kurta 1995). Other species migrate from New England to their southern ranges, from the mid-Atlantic states to Central America. Many species of bats make extensive use of linear features in the landscape such as ridges or rivers while commuting (Limpens and Kapteyn 1991) and migrating (Humphrey and Cope 1976; Timm 1989), which may indicate a preference for overland migration routes. However, the migration routes of these bats are not well documented. There is also little information available about the heights at which bats migrate, although Altringham (1996) reported that at least some groups of bats are known to migrate at altitudes higher than the upper rotor swept zone (i.e., above 125 meters [410 feet]).

Behavioral studies have shown that of the bats that could appear in the project area all generally forage below the height of the rotor swept zone. Based on the bat behavioral studies reviewed by West, Inc. (2002), hoary and eastern red bats typically forage from treetop level to within a meter of the ground, silver-haired bats spend most of their time foraging at heights less than 19.7 feet (6 meters), and big brown bats forage from 23 to 33 feet (7 to 10 meters) above ground (Barclay 1984; Fitzgerald et al. 1994). Little brown bats forage almost exclusively less than 16.5 feet (5 meters) above the ground (Fenton and Bell 1979). These foraging altitudes are well below the proposed lower rotor swept zone (35 meters [115 feet]).

The use of echolocation may explain why bat collision mortality is low during the breeding season. Although bats have relatively good eyesight, most depend on a highly developed echolocation system to navigate, avoid obstacles, and capture insects in the dark (Harvey et al. 1999). Bats emit pulses of very high-frequency sound (inaudible to human ears) at a rate of a few to 200 per second, depending on the species. By using echolocation, bats can discern objects in their path by listening to the echoes reflected back to them (Witt 1999). Bat echolocation and collision mortality studies suggest that only a small fraction of detected bat passes near turbines results in collisions (Johnson et al. 2002). In addition, studies of captive hoary bats have shown that they are able to avoid colliding with moving objects more successfully than stationary ones

(Jen and McCarty 1978). Despite their use of echolocation, bat collision mortality at wind turbines does occur and may exceed avian collision mortality at some sites (Johnson 2004). Foraging and migration are the two primary behaviors requiring flight time that may put bats at risk of collision.

Recent studies have shown one potential source of mortality to bats lies not in strikes with the structures or spinning blades themselves, but in a flying bat's proximity to the low pressure area created by the spinning blades. Emerging research is showing that where bats are being found dead near wind turbines, they show little sign of external trauma, but upon further investigation, it has been observed that their lungs have ruptured in a phenomenon known as barotrauma. The pressure gradient created by the rotating blades of the turbines does not appear to affect birds' lungs, but is too great for bats to fly through. Studies now are being conducted investigating whether turning off the turbines at night, especially during periods of light wind when bats may be more likely to forage, helps alleviate the mortality rates seen at land-based turbines (Johnson 2009).

As described above, the proposed turbine would be lit according to FAA guidelines, which specifies dual-medium intensity lighting. Lighting of turbines and towers does not appear to affect bat collision rates. FAA lighting on turbines was not found to increase the probability of bat collisions at the Buffalo Ridge, Minnesota Phase III site (West 2002).

Overall, bat collisions with wind turbines result in an average bat fatality rate in the United States of 3.4 fatalities per turbine per year, or 4.6 fatalities per MW per year (Johnson 2004). The highest mortality rates have been observed in the eastern United States at mountain top projects, which averages 46.3 fatalities per turbine per year, or 32 per MW per year. This is an average from only two bat mortality studies conducted in Mountaineer, West Virginia and Buffalo Mountain, Tennessee. Based on this limited sample size, it appears that the likelihood of bat fatalities at ridge top wind farms in middle Appalachia is far greater than at wind farms in other parts of the country. In general, studies of inland wind farms and bats indicate that relatively few bat mortalities occur compared to the overall size of local bat populations (e.g., Howe et al. 2002).

4.2.3 White-nose Syndrome

White-nose Syndrome (WNS) was first documented in bats hibernating in Howes Cave near Albany, New York in 2007. Since then, it has been documented at numerous other locations across the eastern United States, with the highest rates of incidence in the Appalachian Mountains. Likely cases of WNS have been recently reported in Massachusetts as far east as Norfolk and Middlesex Counties, although it has not yet been documented on Cape Cod (USGS 2010).

WNS is most easily recognized by the whitish fungal growth on the nose, which appears to be caused by a recently described fungus called *Geomyces destructans*. However, WNS is also characterized by emaciation and overall poor body condition, resulting in mortality of the affected

bat. It is unclear whether the fungus itself plays a primary role in the observed decline in affected bats.

Losses to date from WNS since 2007 may be as high as one million bats (USGS 2009), which would be the most severe disease-related decline of North American wildlife ever documented. It is likely that WNS has caused a significant reduction in regional populations of affected bat species in the northeastern U.S. Affected species include little brown, big brown, northern long-eared, and eastern pipistrelle bats, each of which is known to range into eastern Massachusetts. However, as data is not available, it is uncertain whether and to what degree populations of bats migrating through or residing on Cape Cod have been affected by WNS. Additionally, research is lacking on whether WNS influences the impacts of wind energy projects on affected bat populations.

4.2.4 Bat Impact Conclusions

Because of their nature, wind turbines pose a potential risk to bats. It appears that barotrauma may be a leading cause of mortality at some wind farms. Major bat fatalities have been observed at large wind farms in certain parts of the United States, but these have been typically ridge top locations. Data from one year of post-construction studies at the Massachusetts Maritime Academy wind turbine in nearby Bourne, Massachusetts, has recorded no bat fatalities (Vlietstra 2008). Bat fatalities are not anticipated to occur in large numbers at the Brewster Wind turbines.

The collision risk to resident bats (i.e., little brown myotis, eastern pipestrelle, northern myotis, and big brown bat) on the project site is expected to be minimal and similar to the risk from collision with other vertical structures including on-site communication towers. The potential impacts to migrating bats (i.e., hoary bat, silver-eared bat, and red bat) are unknown due to the lack of information on the migration routes of these species.

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Appendix A

Correspondence

ESS Group, Inc.

Engineers
Scientists
Consultants

888 Worcester Street
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Wellesley
Massachusetts
02482
p 781.431.0500
f 781.431.7434

June 18, 2010

Massachusetts Audubon Society
Advocacy Headquarters
208 South Great Road
Lincoln, Massachusetts 01773

Re: Cape & Vineyard Electric Cooperative/Brewster Wind Project Site
Brewster, Massachusetts
ESS Project Number W279-000.02

To whom it may concern:

ESS Group, Inc. (ESS) is developing a Phase I Avian and Bat Risk Assessment for a proposed wind energy project in the town of Brewster, Massachusetts. The site is being evaluated as a potential location for the placement of two 1.8 megawatt wind turbines. The proposed location is identified on the attached USGS site locus figure.

We have submitted data requests with the U.S. Fish and Wildlife Service as well as the Massachusetts Natural Heritage and Endangered Species Program. However, in light of the valuable comments that Mass Audubon has provided regarding other wind energy projects in the Commonwealth of Massachusetts, we would like to invite your organization to share any comments or data concerning avian or bat populations near the proposed project site at this time.

Please feel free to contact me at (781) 489-1143 if you have any questions or require any additional information. We look forward to your reply and thank you in advance for your time.

Sincerely,

ESS GROUP, INC.

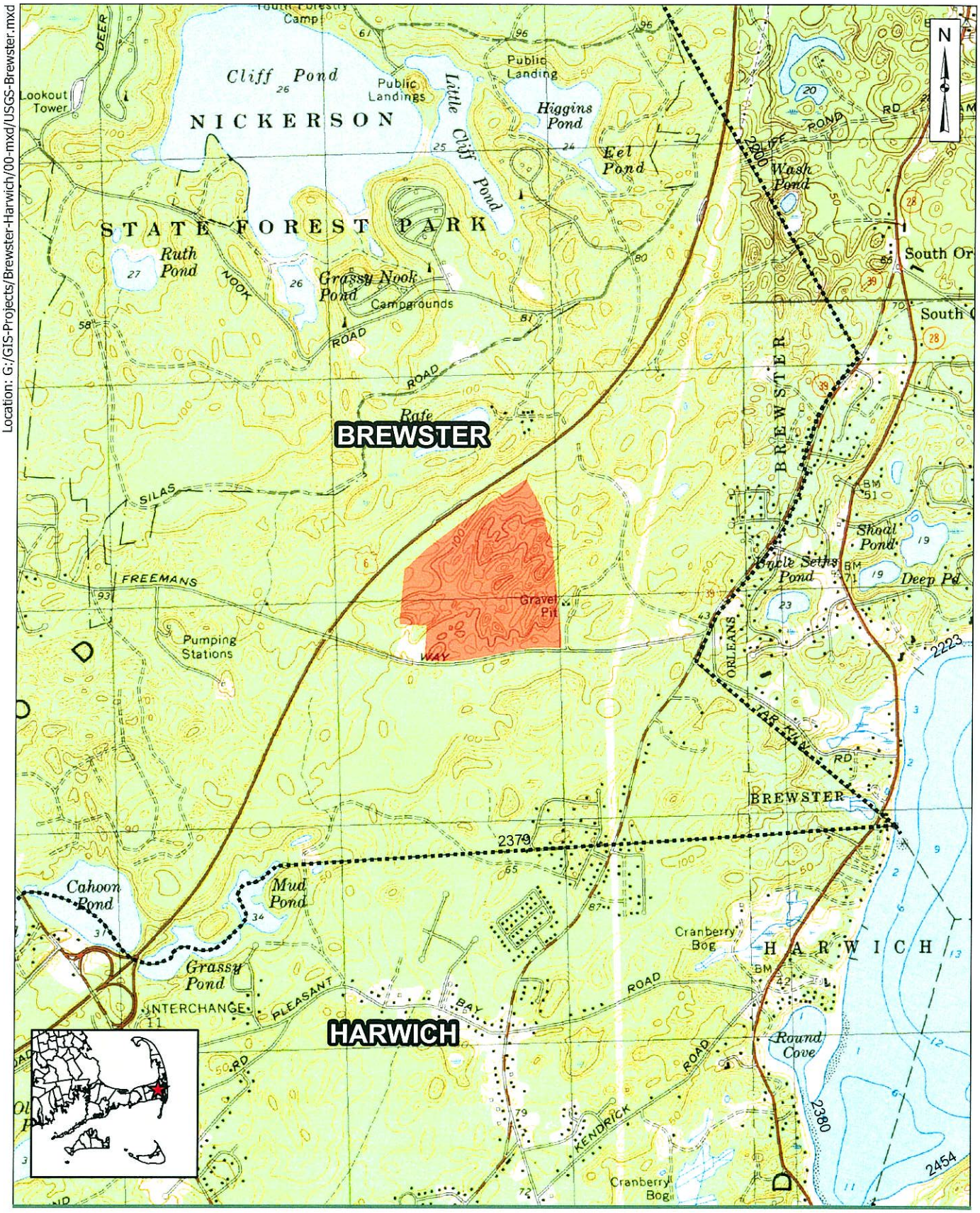
FOR

Darrell Oakley
Senior Ecologist

Enclosures: Site Locus Figure

C: File

Location: G:/GIS-Projects/Brewster-Harwich/00-mxd/USGS-Brewster.mxd



ESS Group, Inc.
Engineers
Scientists
Consultants

CVEC WIND ENERGY FACILITY
Brewster, Massachusetts

Scale: 1" = 2,000'

0 2,000 Feet

Source: 1) MassGIS, USGS, 1972-79
2) Weston & Sampson, Turbines & Parcel Map, 2010

Legend

- Town Boundaries
- Town-Owned Property of Interest

Project Locus Map

United States Department of the Interior

FISH AND WILDLIFE SERVICE

New England Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5087
http://www.fws.gov/newengland

May 25, 2010

Mark D. Driscoll
ESS Group, Inc.
888 Worcester Street, Suite 240
Wellesley, Massachusetts 02482

Dear Mr. Driscoll:

This responds to your April 23, 2010 letter requesting our review of the proposed installation of two 1.65-megawatt (MW) wind turbines in Brewster and two 1.5-MW wind turbines in Harwich, Massachusetts. Your request asks for information on significant wildlife resources that might be associated with the project location. Accordingly, we have reviewed the project with respect to the potential presence of federally-listed endangered or threatened species, candidate species, and other significant wildlife resources. Our comments relative to endangered and threatened species are provided in accordance with the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531, *et seq.*) and the Migratory Bird Treaty Act (16 U.S.C. 703-712).

Federally-listed and Candidate Species

The proposed Brewster project is located between Routes 6 and 28, approximately 3.5 miles south of Cape Cod Bay and 1.5 miles west of Pleasant Bay. Freshwater ponds occur within one mile of the site. The proposed Harwich project is located north of Route 6, adjacent to Robbins Pond, approximately 4 miles south of Cape Cod Bay and 3.5 miles north of Nantucket Sound. Based on information currently available to us, federally-threatened piping plovers (*Charadrius melodus*) are known to breed on coastal beaches to the north, south and east, but are not known to occur near the proposed projects' locations. Currently, there is little information regarding the seasonal migratory pathways used by piping plovers as they move along the coast to their breeding habitat, specifically whether they fly over land or follow the shoreline. Similarly, the flight paths used by plovers in late summer/fall, when they move southward out of the Northeast to winter along the southeast Atlantic Coast, are also poorly known.

Research indicates that there is little movement by piping plovers once they are on their breeding beaches, either to new sites after a nest failure or between breeding and feeding habitat. Piping plovers rarely move great distances from one nest site to another after a nest failure (MacIvor 1990).[1] With respect to movements between breeding and feeding habitats, MacIvor *et al.* (1985)[2] observed a single plover breeding at one beach and feeding at another site 23 miles (37 kilometers) away. Moreover, studies of banded piping plovers indicate limited occasional overland flights. MacIvor (1990) reported a few piping plovers making overland crossings of the Cape. Overland flights between beaches north and south of the proposed wind turbine locations could make plovers vulnerable to collision mortality if the turbines are constructed in their flight paths. However, the likelihood of overland flights is difficult to assess based on the information currently available.

Endangered roseate terns (*Sterna dougallii*) are not known to nest near the proposed turbine locations in Brewster or Harwich. However, roseate terns could occur over the mainland of the Cape during the post-breeding period, when the entire North Atlantic breeding population converges on outer Cape Cod to feed in preparation for their southward migration to coastal Brazil (Trull *et al.* 1999).[3] These fall staging flocks of terns move frequently throughout the Cape Cod-Nantucket Sound area, seeking areas of preferred foraging and resting. To what extent these flocks that sometimes number in the thousands of birds fly over the mainland of the Cape in the vicinity of Barnstable is unknown. No other federally-listed threatened or endangered species are known to occur in the vicinity of the project area.

The New England cottontail (*Sylvilagus transitionalis*) and the red knot (*Calidris canutus rufa*) are candidates for federal listing as a threatened or endangered species (FR vol. 71, no. 176: 53757-53758). The cottontail is a thicket- or shrubland-dependent species and is known to occur east of the proposed project location near the Barnstable Airport. We have no information on the occurrence of this species in the project location, but it may be present if shrublands or dense understory vegetation occur at the site. The red knot is an arctic nesting species that seasonally migrates along the Atlantic Coast. It is documented as occurring at many coastal locations on Cape Cod, but we are unaware of any studies examining the potential for overland movements across the Cape.

Other Migratory Birds and Bats

The presence of natural waterbodies in the area may attract gulls and waterfowl to the locations. Whether gulls or ducks will be at risk from colliding with the turbines can be evaluated by a better understanding of the use of the airspace at the projects' locations before and after construction.

---

1 MacIvor, L.H. 1990. Population dynamics, breeding ecology, and management of Piping Plovers on Outer Cape Cod, Massachusetts. M.S. Thesis. University of Massachusetts, Amherst, Massachusetts. 100 pp.

2 MacIvor, L.H., C.R. Griffin and S. Melvin. 1985. Management, habitat selection and population dynamics of piping plovers on Outer Cape, Massachusetts. Progress Report. University of Massachusetts, Amherst, Massachusetts. 15 pp.

3 Trull, P., S. Hecker, M.J. Watson and I. C. T. Nisbet. 1999. Staging of Roseate Terns Sterna dougallii in the post-breeding period around Cape Cod, Massachusetts, USA. Atlantic Seabirds 1(4):145-158.

In some locations, operation of wind turbines can adversely affect a variety of wildlife species, including migratory birds and bats. In order to assess the level of risk and the scope of species potentially present in a wind turbine project area, the U.S. Fish and Wildlife Service (Service) recommends that the spatial and temporal uses of the rotor-swept zone by wildlife be identified and evaluated, e.g., by a qualified observer, or perhaps through the use of radar and other remote-sensing techniques.

Pre-construction surveys will inform the project proponent, as well as the Service, of potential wildlife conflicts during the site selection and planning stages. With this information, risks can be assessed, and methods to avoid, minimize and mitigate impacts to wildlife may be accommodated. Without pre-construction surveys, unexpected mortality of birds or bats may warrant operational adjustments to reduce or avoid further impacts to wildlife. Absent adequate pre-construction surveys and careful analysis of subsequent data, the siting, construction and operation of a wind project may result in the mortality of wildlife in violation of federal laws, such as the Migratory Bird Treaty Act or the Endangered Species Act. We are available for technical assistance in the development of pre- and post-construction surveys in order to ensure that impacts to birds and bats will be avoided and/or minimized.

For further information regarding endangered species, please contact Susi von Oettingen, and for further assistance relative to migratory birds, contact Maria Tur at the contact information provided above. You may also visit the Wind Energy page on the New England Field Office's website for useful links, including guidance documents for avoiding and minimizing impacts to wildlife: (http://www.fws.gov/newengland).

Sincerely yours,

Eric L. Davis
Acting For

Thomas R. Chapman
Supervisor
New England Field Office

Commonwealth of Massachusetts

Division of Fisheries & Wildlife

MassWildlife

Wayne F. MacCallum, *Director*

May 07, 2010

Mark Driscoll
ESS Group, Inc
888 Worcester Street, Suite 240
Wellesley MA 02482

RE: Project Location: Freemans Way, Brewster & North Westgate Road, Harwich
Town: BREWSTER, HARWICH
NHESP Tracking No.: 10-28122

To Whom It May Concern:

Thank you for contacting the Natural Heritage and Endangered Species Program ("NHESP") of the MA Division of Fisheries & Wildlife for information regarding state-listed rare species in the vicinity of the above referenced site. Based on the information provided, this project site, or a portion thereof, is located near or **within** *Priority Habitat* (PH) and *Estimated Habitat* (EH) as indicated in the *Massachusetts Natural Heritage Atlas* (13th Edition). Our database indicates that the following state-listed rare species have been found in the vicinity of the site:

Freemans Way, Brewster
Near Priority Habitats 15, 278 (PH 15, 278) and *Estimated Habitats 79, 174* (EH 79, 174)

Scientific name	Common Name	Taxonomic Group	State Status
Terrapene carolina	Eastern Box Turtle	Reptile	Special Concern

North Westgate Road, Harwich
***Within** Priority Habitat 15* (PH 15) and *Estimated Habitat 624* (EH 624)

Scientific name	Common Name	Taxonomic Group	State Status
Enallagma laterale	New England Bluet	Damselfly	Special Concern
Enallagma recurvatum	Pine Barrens Bluet	Damselfly	Threatened
Terrapene carolina	Eastern Box Turtle	Reptile	Special Concern

The species listed above are protected under the Massachusetts Endangered Species Act (MESA) (M.G.L. c. 131A) and its implementing regulations (321 CMR 10.00). State-listed wildlife are also protected under the state's Wetlands Protection Act (WPA) (M.G.L. c. 131, s. 40) and its implementing regulations (310 CMR 10.00). Fact sheets for most state-listed rare species can be found on our website (www.nhesp.org).

We advise that potential impacts to birds and bats be considered during the design and permitting process for all wind turbines. Our recommendation is that all wind turbines be monitored for bird and bat mortality and all observed mortalities be saved and reported to Natural.Heritage@state.ma.us.

Please note that projects and activities located within Priority and/or Estimated Habitat **must** be reviewed by the NHESP for compliance with the state-listed rare species protection provisions of MESA (321 CMR 10.00) and/or the WPA (310 CMR 10.00).

Wetlands Protection Act (WPA)

If the project site is within Estimated Habitat and a Notice of Intent (NOI) is required, then a copy of the NOI must be submitted to the NHESP so that it is received at the same time as the local conservation commission. If the NHESP determines that the proposed project will adversely affect the actual Resource Area habitat of state-protected wildlife, then the proposed project may not be permitted (310 CMR 10.37, 10.58(4)(b) & 10.59). In such a case, the project proponent may request a consultation with the NHESP to discuss potential project design modifications that would avoid adverse effects to rare wildlife habitat.

A streamlined joint MESA/WPA review process is available. When filing a Notice of Intent (NOI), the applicant may file concurrently under the MESA on the same NOI form and qualify for a 30-day streamlined joint review. For a copy of the revised NOI form, please visit the MA Department of Environmental Protection's website: http://www.mass.gov/dep/water/approvals/wpaform3.doc.

MA Endangered Species Act (MESA)

If the proposed project is located within Priority Habitat and is not exempt from review (see 321 CMR 10.14), then project plans, a fee, and other required materials must be sent to NHESP Regulatory Review to determine whether a probable "take" under the MA Endangered Species Act would occur (321 CMR 10.18). Please note that all proposed and anticipated development must be disclosed, as MESA does not allow project segmentation (321 CMR 10.16). For a MESA filing checklist and additional information please see our website: www.nhesp.org ("Regulatory Review" tab).

We recommend that rare species habitat concerns be addressed during the project design phase prior to submission of a formal MESA filing, as avoidance and minimization of impacts to rare species and their habitats is likely to expedite endangered species regulatory review.

This evaluation is based on the most recent information available in the Natural Heritage database, which is constantly being expanded and updated through ongoing research and inventory. If you have any questions regarding this letter please contact Amy Coman, Endangered Species Review Assistant, at (508) 389-6364.

Sincerely,

Thomas W. French

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Assistant Director