Record Hill Wind, LLC // Natural Resources Protection Act
Construction of 50.6 megawatt wind energy development - Roxbury

Excerpts from the Department's License Record – Wildlife

- Excerpts from application
- Inland Fish and Wildlife comments (02/23/09); (06/06/09); (07/29/09)
- Methodologies for evaluating Bird Bat Interaction with Wind Turbines (draft 04/12/06)

Section 7
Wetlands, Wildlife, and Fisheries

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1.0 INTRODUCTION

Record Hill Wind LLC (RHW) has proposed the development of a wind energy project in the town of Roxbury, Maine. The project layout includes 22 2.5-megawatt (MW) Clipper C-96 wind turbines along with associated electrical interconnection infrastructure and permanent meteorological measurement (met) towers to be located along a north/south linear ridgeline that includes Record Hill, Flathead Mountain, and Partridge Peak (Figure 1). The proposed turbines will have a maximum tip-of-blade height of 128 meters (about 420 feet). The project will have a total nameplate capacity of 55 MW. During initial planning phases, RHW proposed a conceptual project area that contemplated up to 30 turbines and extended the project layout from Partridge Peak north to Old Turk Mountain in Byron, Maine. During project development, RHW decided to eliminate the portion of that conceptual layout north of Record Hill. The wildlife surveys described in this section were conducted over the breadth of the entire conceptual project area, including Byron.

Power generated by the turbine array will be collected by 34.5-kilovolt (kV) lines and carried approximately one mile east down the ridge to a collector substation located alongside an existing Central Maine Power Company (CMP) transmission line right-of-way. The voltage will be increased to 115 kV at the collector substation and then transferred to the adjacent CMP system and ultimately delivered to the New England grid.

In advance of permitting activities for the project, RHW initiated a series of ecological field surveys, including radar, raptor and breeding bird surveys, acoustic bat surveys, vernal pool surveys, wetland delineations, and rare, threatened, and endangered (RTE) species surveys. Surveys were targeted to provide data to help assess the project's potential to impact birds and bats, RTE plants and animals, breeding amphibians, and wetlands. The scope of the surveys was based on a combination of developing standard methods within the wind power industry for pre-construction surveys (i.e., guidelines outlined by U.S. Fish and Wildlife Service [USFWS] and Maine Department of Inland Fisheries and Wildlife [MDIFW]) and is consistent with other studies conducted recently in the state and the northeast. Additional agency consultations between Stantec staff, RHW, and MDIFW occurred at the Bangor regional headquarters in January 2008 to discuss work that has already been completed in 2007 at the project, as well as a proposed work scope for the project that would be followed during spring 2008. The additional surveys discussed at that meeting were conducted during spring 2008 and were in compliance with the final work plan submitted and approved by MDIFW on March 6, 2008.

Following is a brief review of the methods used to conduct scientific surveys and the results of those surveys; a discussion of those results; and the conclusions reached based on those results.

2.0 WETLANDS

Wetlands have the potential to provide numerous functions and values such as floodwater alteration, water quality protection, wildlife habitat, and recreational opportunities. Each individual wetland's capacity to provide these functions and values is dependent upon a variety of physical characteristics including, but not limited to, size, configuration, connectivity, topography, and landscape position. In addition, the proximity to development and level of anthropogenic disturbance within and surrounding a wetland affect this capacity. The project area includes numerous small, isolated wetlands, most of which have limited functional capacity because of their size and isolated nature. The few larger wetlands, particularly those associated with watercourses, have the capacity and the potential to provide more functions and values. However, many of the wetlands in the project area have been altered by anthropogenic activities, primarily timber harvesting operations. Such changes in the natural character of a wetland reduce its capacity to provide many functions. Several of the wetlands in the project area provide vernal pool habitat (see Section 3.2). Dominant palustrine (i.e., freshwater) communities in the project area are forested, scrub-shrub, and emergent (Cowardin *et. al* 1979). Also present are open water community components. Because these open water areas are such a small component of the wetlands present within the project area, they are not discussed in detail here. A detailed wetland and vernal pool report and associated resource maps are included in Appendix 7-1.

The proposed development, including the location of the collector line, has been sited to minimize wetland impacts where practicable. Approximately 10,689 square feet of permanent wetland fill will result as part of the proposed project. Of this permanent fill, approximately 12 percent is associated with upgrades to the existing access road. In addition to permanent fill impacts, 15,187 square feet of vegetation clearing within wetlands will occur, primarily in association with the new collector lines.

2.1 Forested Wetland

Forested wetland communities are one of the three most common wetland types present within the project area. Prior to timber harvesting activities, this would have been the most common wetland community, but many of these resources are now in some stage of regeneration and are either characterized as scrub-shrub or emergent wetlands. Tree species common to these wetlands include yellow birch (*Betula. alleghaniensis*), balsam fir (*Abies balsamea*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), northern white cedar (*Thuja occidentalis*) and eastern hemlock (*Tsuga canadensis*). The shrub layer consists primarily of these same tree species with a limited presence of shrub species such as hobblebush (*Viburnum lantanoides*), witherod (*Viburnum nudum*), and winterberry (*Ilex verticillata*). Commonly occurring herbaceous species include cinnamon fern (*Osmunda cinnamomea*), evergreen wood fern (*Dryopteris intermedia*), sensitive fern (*Onoclea sensibilis*), northeastern mannagrass (*Glyceria melicaria*), fowl mannagrass (*Glyceria striata*), and fringed sedge (*Carex crinita*). These wetlands are typically characterized by pit and mound micro-topography, are seasonally inundated, and have soils that remain saturated at or near the surface for much of the year. Representative examples of this community type can be found specifically in Wetland Resources A1, R8 and T1.

2.2 Scrub-Shrub Wetland

Scrub-shrub wetlands are present in scattered locations throughout the project area and often appear in conjunction with either forested or emergent wetland communities. These wetland communities are typically regenerating forested wetlands that have undergone timber harvesting. The shrub layer is dominated by tree species such as red maple, yellow birch, gray birch (*Betula populifolia*), and striped maple (*Acer pensylvanicum*). Red raspberry (*Rubus idaeus*), a common early successional species, also is present in many of these wetlands. The herbaceous layer includes species such as sensitive fern, cinnamon fern, rough-stemmed goldenrod (*Solidago rugosa*), fowl mannagrass, northeastern mannagrass, bluejoint (*Calamagrostis canadensis*), and swamp dewberry (*Rubus hispidus*). These wetlands have soils that remain saturated at or near the surface for much of the year and may experience at least periodic inundation. Representative examples of this community type are present in Wetland Resources A88, R40, and T20.

2.3 Emergent Wetland

Emergent wetlands are common throughout the project area, often in areas that have been disturbed by timber harvesting activities. These types of emergent wetlands are typically referred to as wet meadows. Wet meadows are dominated by herbaceous species that are adapted to saturated soil conditions but not adapted to long periods of inundations as would be common in marsh habitats. The emergent wetlands within the project area are typically dominated by herbaceous species such wool-grass, fowl mannagrass, bluejoint, sallow sedge (*Carex lurida*), fringed sedge, pointed broom sedge (*Carex scoparia*), sensitive fern, jewelweed (*Impatiens capensis*), and rough-stemmed goldenrod. These wetlands also support red raspberry, steeple-bush (*Spiraea tomentosa*) and seedlings of the tree species mentioned in the preceding sections. These wetlands have soils that remain saturated at or near the surface for much of the year and may experience at least periodic inundation. Representative examples of this community type are present in Wetland Resources A58, R24, and T4.

2.4 STREAMS

The project area includes numerous intermittent streams (R4SB) and several upper perennial streams (R3UB). Some of these stream resources occur in association with wetland communities, and others occur only as watercourses. Intermittent streams contain flowing water for part of the year. Otherwise, there may be no surface water present or water may occur only in isolated pools. The perennial streams present within the project area are typically high gradient, relatively fast moving streams where water flows throughout the year, except under unusual circumstances such as a severe drought. Both intermittent and perennial streams consist of a channel occurring between defined banks and created by the action of surface water. In addition, these channels may have a mineral substrate, are generally devoid of terrestrial vegetation, and may support aquatic flora and fauna. Representative examples of intermittent streams include Wetland Resources A125 and R29. Perennial stream examples include Wetland Resources T12 and A3.

3.0 WILDLIFE

Temporary and permanent changes in habitat conditions from the construction and installation of wind turbines, access roads, collector line poles, and collector lines for the proposed project have the potential to impact wildlife habitat. Impacts to habitats will consist of clearing land on the ridgelines of Partridge Peak, Flathead Mountain, and Record Hill for turbines and roads, and along the proposed collector line segment on the east side of the ridge. The project area is actively harvested for timber products and has been dissected by skidder roads and haul roads, but it is primarily undeveloped.

Avian and bat mortality through direct collisions with the turbines is one of the primary wildlife impacts expected from this project. In addition, direct and indirect impacts to wildlife such as injury, mortality, or displacement are possible during clearing, construction, and operation of wind turbines, access roads, and electric lines and poles. The 34.5kV electrical collector system will be located on the eastern side of the ridge where currently there is no existing power line right-of-way. This line will run down slope (approximately 1.1 miles) to a collector substation. There, power will be converted to 115 kV and passed to the CMP system. Electrical collection lines will be buried along the ridgeline and will pass aboveground as the line travels down the mountain to the collector substation. Communication lines to the Operations and Maintenance Building will travel roadside and capitalize on the cleared area needed for the access roads. These communication lines are not expected to require more than 10 feet of additional clearing along the projects road system. Once constructed, the turbines and associated facilitates are anticipated to pose little threat to terrestrial wildlife.

The following section describes the dominate cover types found in the project area, the wildlife species that are likely to occur within the project area, the potential for adverse impacts to wildlife, and measures to minimize these impacts.

3.1 Existing Cover Types within the Record Hill Wind Project Area

The presence of wildlife species is correlated with the type of land cover in a given area. Cover type descriptions are based on observations recorded during field surveys conducted in fall 2007 and spring 2008. Cover types are classified according to the Maine Natural Areas Program (MNAP) natural communities classification system (Gawler S. and A. Cutko 2004) and the USFWS wetland classification system.

The project is located entirely within the town of Roxbury, Maine. The project area is primarily upland forested ridgelines that have been heavily harvested for timber products in past and recent years. Most of the project area is currently inaccessible by vehicle except for two haul roads on the west side of the project that were used for temporary access needed to transport met tower components. Natural community features present within the study area include forested uplands and palustrine forested wetlands, palustrine scrub-shrub wetlands, palustrine emergent wetlands, and streams. The various upland forest natural communities, as well as associated wildlife, are described below.

Upland Forest

Upland vegetation communities within the project area consist primarily of Beech-Birch-Maple Forest with small inclusions of red spruce on the summits of the ridgeline. The majority of the forest is in various stages of post-harvest regeneration, some of which is quite young from recent harvests.

A. Beech-Birch-Maple Forest

The primary upland forest type on the project ridgeline is described by the MNAP as Beech-Birch-Maple cover type (MNAP 2004). American beech is the dominant tree species over much of the site, with sugar maple, yellow birch, and paper birch (*Betula papyrifera*) present as canopy associates or co-dominants. Eastern hemlock, red spruce (*Picea rubens*), white ash (*Fraxinus americana*), and eastern white pine are present but sparse. Common shrubs in the dominant Beech-Birch-Maple Forest include striped maple, hobblebush, witch-hazel (*Hamamelis virginiana*), and beaked hazelnut (*Corylus cornuta*). The herbaceous layer contains common species such as evergreen wood fern, wild-sarsaparilla (*Aralia nudicaulis*), Christmas fern (*Polystichum acrostichoides*), starflower (*Trientalis borealis*), New York fern (*Parathelypteris novaboracensis*), shining fir-moss (*Huperzia lucidula*), and other typical herbaceous northern forest species.

B. White Pine-Mixed Conifer Forest

White Pine-Mixed Conifer Forest also occurs as small patch communities within the larger Beech-Birch-Maple Forest matrix in the project area. This community exists on dry-mesic to xeric hillsides and slopes with thin soil development over bedrock. Eastern white pine, red maple, red spruce, and big-toothed aspen (*Populus grandidentata*) typically co-dominates, with a shrub layer dominated by beaked hazelnut and large patches of red raspberry occupying canopy gaps and old timber harvesting roads. The herbaceous layer is dominated by lowbush blueberry (*Vaccinium angustifolium*), velvet-leaf blueberry (*Vaccinium myrtilloides*), and Canada mayflower (*Maianthemum canadense*).

C. Spruce-Northern Hardwoods Forest

Portions of some of the summits encompass areas that may be classified as Spruce-Northern Hardwoods Forest. Typical tree species present in this forest type include red spruce, balsam fir, sugar maple, red maple, and yellow birch. Shrub species present commonly include hobblebush and sheep laurel (*Kalmia angustifolia*). Herbaceous species present include evergreen wood fern, Canada mayflower, bracken fern (*Pteridium aquilinum*), partridgeberry (*Mitchella repens*), wintergreen (*Gaultheria procumbens*), and wild sarsaparilla.

3.2 Wildlife Use of Record Hill Project Area

Topography and Setting

The project area is located in the southern portion of Maine's Western Mountains Biophysical Region, in the western portion of the State of Maine. This region extends from Bald Mountain, near the Canada border, to the Mahoosuc Range in southwestern Maine (McMahon 1990). The Western Mountains Biophysical Region averages in elevation between approximately 1,000 feet to 2,000 feet; however, there are several mountains over 2,700 feet above sea level. The project ridgeline is punctuated by peaks at moderate elevations that do not exceed 2,400 feet. The climate is characterized by low annual precipitation and cool temperatures. Heavy snow fall prolongs winter in this region, resulting in a relatively short growing season (McMahon 1990).

General Wildlife Use

In general, early successional and mixed growth forests have become the dominant community types within the project area. Bird species that nest on the ground or in shrubs in this habitat include ovenbird (*Seiurus aurocapillus*), dark-eyed junco (*Junco hyemalis*), ruffed grouse (*Bonasa umbellus*), and chestnut-sided warbler (*Dendroica pensylvanica*). Cavity and canopy nesting birds include white-breasted nuthatch (*Sitta carolinensis*), golden-crowned kinglet (*Regulus satrapa*), rose-breasted grosbeak

(*Pheucticus ludovicianus*), American robin (*Turdus migratorius*), northern cardinal (*Cardinalis cardinalis*), blue jay (*Cyanocitta cristata*), black-capped chickadee (*Poecile atricapillus*), downy woodpecker (*Picoides pubescens*), hairy woodpecker (*Picoides villosus*), northern flicker (*Colaptes auratus*), pileated woodpecker, American redstart (*Setophaga ruticilla*), black-throated green warbler (*Dendroica virens*), and red-eyed vireo (*Vireo olivaceus*). Raptor and owl species include broad-winged hawk (*Buteo platypterus*), northern goshawk (*Accipiter gentilis*), sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), red-tailed hawk (*Buteo jamaicensis*), and barred owl (*Strix varia*).

Large mammals that may be present in these habitat types include white-tailed deer (*Odocoileus virginianus*), moose (*Alces alces*), black bear (*Ursus americanus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), and American marten (*Martes americana*). Bat species likely to occur in Oxford County, based upon their normal geographical range, are the little brown bat (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*), eastern small-footed bat (*myotis lebeiii*), silver-haired bat (*Lasionycteris noctivagans*), big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and eastern pipistrelle (*Pipistrellus subflavus*).

Other small mammal species that are likely present include red squirrel (*Tamiasciurus hudsonicus*), eastern chipmunk (*Tamias striatus*), snowshoe hare (*Lepus americanus*), southern red-backed vole (*Clethrionomys gapperi*), deer mouse (*Peromyscus maniculatus*), white-footed mouse (*Peromyscus leucopus*), porcupine (*Erethizon dorsatum*), meadow vole (*Microtus pennsylvanicus*), short-tailed shrew (*Blarina brevicauda*), and ermine (*Mustela erminea*).

Herptiles that may be present in these upland habitat types include spotted salamander (*Ambystoma maculatum*), red-back salamander (*Plethodon cinereus*), wood frog (*Rana sylvatica*), American toad (*Bufo americanus*), eastern garter snake (*Thamnophis sirtalis*), eastern milk snake (*Lampropeltis t. triangulum*), and northern ringneck snake (*Diadophis punctatus edwardsii*).

Breeding Birds

Stantec conducted breeding bird surveys at the project area during May and June 2008, which is typically the peak of the spring avian breeding season in Maine. Surveys were conducted at a total of 25 points across the project area ridgeline on three separate visits on May 28, June 10, and June 17 and 18, 2008. The survey was split within two days on the last visit due to passing thunderstorms on June 17 that cut surveys short for that day. Of the 25 points surveyed, 9 points were in Byron, Maine, which is no longer part of the project. Surveys were still conducted in Byron to sample habitat types present within the project area. In particular, Old Turk Mountain was surveyed because the habitat on the summit had the greatest potential for RTE bird species. Surveys began a half hour before sunrise on days when background noise caused by strong winds or rain did not affect the detection of birds. Overall, a total of 529 individual birds were detected representing 45 different species.

Species most commonly observed were those typically found in various age classes of Beech-Birch-Maple Forests. These include ovenbird (n=55), chestnut-sided warbler (n=55), black-throated blue warbler (n=45), black-throated green warbler (n=35), and dark-eyed junco (n=33). The species that exhibited consistently higher relative abundances among the habitats sampled include black-throated blue warbler and chestnut-sided warbler throughout the survey; both species often have been associated with increased timber harvest levels in Maine (DeGraaf and Yamasaki 2001).

In general, the species observed within the project area are common to the region and are typical of habitats in which they were observed. The habitat type that demonstrated the greatest species richness was forest edge. Forest edge habitat in the project area consists of old skidder trails, recent clear-cuts, and access roads created by past and recent forest harvesting and met tower construction activities. The forest edges provide habitat for a range of edge-dwelling species, including black-throated blue warbler, mourning warbler, and chestnut-sided warbler. The mixed hardwood and spruce-fir forest cover types available on-site provide habitat for forest interior songbird species such as blackburnian warbler, ovenbird, and hermit thrush (*Catharus guttatus*).

No state endangered and no state threatened species were observed during the spring and summer 2008 surveys. There were a number of Maine Special Concern Species observed during the surveys within or near the Project area, including tree swallow (*Tachycineta bicolor*), veery (*Catharus fuscescens*), American redstart (*Setophaga ruticilla*), black-and-white warbler (*Mniotilta varia*), chestnut-sided warbler, and white-throated sparrow. These species are on conservation watch lists because of recent declines in their regional population trends, mainly due to loss of habitat. These species were found to be abundant in the project area and are known to do well in disturbed forests. Due to the historic disturbances at the site, clearing for the project is not anticipated to adversely affect these species. For further details and the complete breeding bird survey results, refer to the Spring 2008 Bird and Bat Migration Survey Report in Appendix 7-3.

Migrating Birds

The majority of North American landbirds migrate at night. The strategy to migrate at night may be to take advantage of more stable atmospheric conditions for flapping flight (Kerlinger 1995). Conversely, species using soaring flight, such as raptors, migrate during the day to take advantage of warm rising air in thermals and laminar flow of air over the landscape, which can create updrafts along hillsides and ridgelines.

Stantec conducted nocturnal radar surveys during the spring and fall 2007 migration periods to monitor nighttime migratory bird activity at the project site. Surveys were conducted using X-band marine radar, sampling from sunset to sunrise. Each hour of sampling included the recording of radar video files during horizontal and vertical operation. The radar site was located at the summit of Flathead Mountain and provided good visibility. Targets were observed in most areas of the radar viewshed. The spring radar survey included 20 nights of sampling from April 22 to June 8, 2007. The fall radar survey included 20 nights of sampling from September 5 to October 13, 2008.

In spring, the overall passage rate for the entire survey period was 539 targets per kilometer per hour (t/km/hr) with a seasonal average mean flight height of all targets of approximately 1,023 feet (312 meters) above the radar site. The radar site was constructed approximately 6 meters above ground to be even with the height of the surrounding trees and thus reduce the potential for ground clutter within the radar view. In fall, the overall passage rate for the entire survey period was 420 t/km/hr with a seasonal average mean flight height of all targets of 1,198 feet (365 meters) above the radar site. The overall mean flight heights by hour, night, and season suggests that a small portion of night migrants have the potential to encounter wind turbines along the ridgeline during spring and fall migration seasons. For further details and the complete Nocturnal Radar Survey results, refer to the spring and fall 2007 Migration Survey Reports in Appendix 7-2.

Stantec also performed diurnal raptor surveys to monitor raptor migration activity. In the fall of 2007, a total of 14 days of diurnal raptor surveys were conducted from the met tower location at the northern portion of Record Hill. In the spring of 2008, a total of 15 days of diurnal raptor surveys were conducted from the same location. In 2007, a total of 96 individual birds of 12 different species were observed, with an overall passage rate of 1.12 raptors/observation-hour. In 2008, 118 individual birds of 12 different species were observed, with an overall passage rate of 1.15 raptors/observation-hour. This observation rate was low for both years as compared to similar sites in the region (see Appendices 7-2 and 7-3).

Bats

There are eight species of bats known to occur in Oxford County, based upon their normal geographical range. These are the little brown bat, small-footed bat, northern myotis, silver-haired bat, eastern pipistrelle, big brown bat, eastern red bat, and hoary bat (Whitaker and Hamilton 1998). Of these species, eastern small-footed bat, red bat, hoary bat, and silver-haired bat are listed as Species of Special Concern in Maine due to a lack of information on population size and trends. All but the eastern small-footed bat are believed to be present in most of the state; the eastern small-footed bat is believed to be rare because population size and trends are not well known for this species. Within the region, forest openings, clear cuts, road corridors, and wetlands likely serve as important feeding habitats for bats.

Man-made structures and mature trees within forests likely comprise the majority of roost habitats. The study area itself contains a variety of natural and artificial edge habitats, such as wetlands, log landings, road edges, and forest openings.

Stantec conducted acoustic bat surveys with Anabat detectors within the project area in the fall of 2007 and the spring of 2008. Acoustic bat detectors allow for long-term monitoring of species composition and activity patterns of bats in a variety of habitats, including the air space approaching the rotor-swept zone of modern wind turbines. The acoustic bat survey was designed to document bat activity patterns near the rotor zone of the proposed turbines, at an intermediate height, and near the ground. Acoustic surveys were also intended to document bat activity patterns in relation to weather factors, including wind speed, temperature, and relative humidity. Four bat detectors were deployed across the ridgeline of the project site (including Byron) during the fall migration season from August 9 to October 21, 2007, for a total of 239 detector nights. The 2008 acoustic field survey included documentation of spring bat activity through passive surveys with six acoustic detectors, resulting in 215 detector-nights of recordings from May 1 to June 16. During each season, detectors were deployed in the two met towers at heights of 45 and 20 meters. One of the met towers was located north of Record Hill in the town of Byron and one on Flathead Mountain in Roxbury, Maine. Additional detectors were deployed in trees along the met tower opening to document bat activity at various different heights.

In the fall of 2007, a total of 370 bat call sequences were recorded from the two met towers (1.5 calls/detector night) and 2,249 calls were recorded in the trees (11.0 calls/detector night), most of which were during early August (outside the typical migration period). The detection rate for the met tower detectors in both met towers combined was at the low end of the range of recent fall studies in Maine and the region (1.5 calls/detector night). When combined, the detection rate for both the tree and met tower detectors is at the middle of the range of other comparable bat detector surveys. Habitat, landscape, location, and survey effort likely account for the observed differences site to site. However, the fact that the majority of calls were documented from the tree detectors (86%) during the non-migration period for most bat species in Maine indicates that greater bat activity occurs at heights well below the proposed wind turbines. Furthermore, the majority of bat species detected are those that forage at low heights and are not migratory tree-roosting bats which are those typically killed by wind turbines. For further details and the complete Acoustic Bat Survey results, refer to Appendices 7-2 and 7-3.

In the spring of 2008, a total of 103 bat call sequences were recorded in the met tower (0.6 calls/detector night) and 2258 calls were recorded from the tree detectors (55 calls/detector night). The calls recorded from the tree detectors occurred during June and made up approximately 96% of all calls recorded during the survey period. The detection rate for the met tower detectors was at the low end of the range to other recent spring studies conducted in met towers in Maine and the northeast region. As mentioned previously, the majority of calls were recorded by the tree detectors at low heights during the non-migration period, indicating limited risk for these species to collide with the proposed turbines. For further details and the complete Acoustic Bat Survey results, refer to Appendix 7-2.

Vernal Pools

The definition of a vernal pool varies among states and regulatory agencies; however, these definitions typically share several common points. Vernal pools are generally ephemeral, which means that the pools dry at some point during a typical year. In addition, vernal pools do not support established populations of fish. Finally, these habitats offer essential breeding habitat for several species of amphibians, as well as provide habitat for unique invertebrates such as fairy shrimp (*Eubranchipus* spp.) and some rare species of wildlife. In Maine, presence of a very specific subset of wildlife species is used to identify a vernal pool. This subset includes:

- Demonstrated breeding activity by wood frogs, spotted salamanders, or blue spotted salamanders (*Ambystoma laterale*);
- Presence of fairy shrimp (*Eubranchipus* spp.);

- Presence of state-listed threatened or endangered species such as Blanding's turtle (*Emydoidea blandingii*), spotted turtle (*Clemmys guttata*), or ringed boghaunter dragonfly (*Williamsonia lintneri*); or
- Presence of these state-listed species of special concern such as ribbon snake (*Thamnophis sauritus*), wood turtle (*Clemmys insculpta*), swamp darner dragonfly (*Epiaeschna heros*), or comet darner dragonfly (*Anax longipes*).

Refer to Appendix 7-1 for further information on state and federal regulatory definitions of vernal pools and for specific details on vernal pool surveys conducted by Stantec. Stantec conducted seasonally appropriate vernal pool surveys in May 2008. In total, 27 vernal pools were identified. Of these pools, nine were man-made and occurred within either a roadside ditch or a rut created by heavy equipment. The remaining 18 pools were naturally occurring and supported breeding activity by wood frogs and/or spotted salamanders. Five pools met the criteria to be considered Significant Vernal Pools based upon the level of amphibian breeding activity.

3.3 Significant or Sensitive Wildlife Habitats

The Natural Resources Protection Act (NRPA) regulates activities that occur in, on, or over a Significant Wildlife Habitat or adjacent to Significant Wildlife Habitat. State and federal resource agencies were contacted and have had an opportunity to comment on the proposed project. These responses are attached in Appendix 7-1, Appendix G. Areas that would be regulated as Significant Wildlife Habitat include bald eagle (*Haliaeetus leucocephalus*) nest sites, Inland Waterfowl and Wading Bird Habitats (IWWH), and Deer Wintering Areas (DWA).

Bald Eagle Nest Sites

The bald eagle, found throughout Maine, was previously listed as a federally threatened species. However, due to achieving its recovery goals, the bald eagle was federally de-listed in 2007. It remains a state-listed threatened species. Bald eagles are protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, which prohibits the taking or possession of bald eagles or any feathers, eggs, or nests (Buehler 2000). Bald eagles typically nest in forested areas along shorelines of rivers, lakes, and bays. Bald eagles have high site fidelity, are generally monogamous, and mate for life. While bald eagles lay between one and three eggs annually, nests are most commonly observed with two eggs (Herrick 1932). One egg is laid per day, but not always on successive days, and the entire clutch is usually laid within three to six days (Stalmaster 1987). Eagles will start to incubate after the first egg is laid, and incubation will continue for approximately 35 days until hatching (Herrick 1932). The female does most of the incubation, but the male will also contribute (Gerrard *et al.* 1979). Bald eagles are opportunistic foragers that eat a variety of avian, mammalian, and herpetile prey, but fish are their primary food source. In Maine, some nests have been used repeatedly for 20 years or more (MDIFW 1990).

Bald eagles are present throughout the region surrounding the project area, but no nests are known to be present within the project area. There is one nest located approximately two miles west of the project area on French Island in Roxbury Pond. Agency consultation confirmed that the nest was successful in 2008. The distance of the nest was considered by MDIFW to be far enough away so that the proposed project would have minimal impact to this nest.

Two adult bald eagles were observed on September 4, 2007. Both were seen migrating at approximately 70 meters over Flathead Mountain. A juvenile bald eagle was observed on September 20, 2007, migrating west of the project ridgeline at an altitude of 200 to 300 meters. Only two bald eagles were observed during the spring 2008 raptor migration survey on May 1 and May 6, 2008. These individuals were observed flying parallel to the ridgeline over the valley to the west of the project. One eagle was observed flying low along the valley, while the other was estimated at 200 meters above the valley.

Inland Waterfowl and Wading Bird Habitats

The project area does not contain IWWH in areas proposed for wind turbines, access roads, and collector lines. Some habitat exists in proximity to the project to the east at Bunker Pond, and to the west at Roxbury and Garland Ponds (see Appendix 7-1, Appendix E). Adverse impacts are expected to be minimal because construction activities related to the project will not be within or close to this habitat.

Deer Wintering Areas

There are no mapped DWAs located along the turbine string, access roads, or collector lines system. The nearest DWAs are located on the west side of the ridge approximately two to three miles west of the project area. No adverse impacts to any of the mapped DWAs in proximity to the project will occur from this project.

Rare, Threatened, and Endangered Species

Stantec staff botanists and wildlife biologists conducted an RTE species survey for plant and animal species concurrently with the project area wetland delineation. In addition to these targeted surveys, bird and bat surveys conducted during fall 2007 and spring 2008 were also capable of documenting RTE species or Species of Special Concern if any were present. No RTE species or Species of Special Concern were observed during the fall 2007 or spring 2008 RTE surveys. However, as explained above, one peregrine falcon (State Endangered), bald eagle (State Threatened), red-shouldered hawk (State Special Concern species), Cooper's hawk (State Special Concern species), and Northern goshawk (State Special Concern species) were observed passing through the area during the raptor migration surveys. However, raptor mortality documented from developed projects across the country has shown that diurnally migrating species are at low risk of collision with wind turbines with only 0 to 0.07 fatalities/turbine/year recorded from other developed wind projects in the United States. Furthermore, no raptor mortalities were observed at the only post construction survey in the state of Maine (Mars Hill) in 2007. Additionally, breeding bird surveys documented a number of Maine special concern species within or in the vicinity of the project area, including tree swallow, veery, American redstart, black-and-white warbler, chestnut-sided warbler, and white-throated sparrow. These species are on conservation watch lists because of recent declines in their regional population trends, mainly due to loss of habitat. However, these species are known to occur in disturbed habitats as a result of industrial and commercial timber harvests and were found to be common in the project area. The project is not anticipated to have an adverse impact to RTE species. For more information on RTE species observed at the project see appendices 7-2 and 7-3.

3.4 Effects on Habitats and Associated Wildlife

Cover Type Changes

Small clearings along the ridgelines will be made to allow for the construction and operation of the wind turbines. The turbine clearings will be approximately 315 feet in diameter, much of which will be allowed to revegetate as either grassland or low shrubs. Access to the turbine areas will be accomplished by upgrading the existing Mine Notch Road with additional clearing for the construction of a new road corridor to the summit of the ridge from Mine Notch Road. New road segments were designed to avoid impacts to wetlands, vernal pools, and streams where possible.

For the most part, the clearing made for the collector connection line segment will re-vegetate to conditions that resemble the regenerating clearcuts and blow-downs that are already common throughout the region. Habitat fragmentation will be a primary impact to the landscape from the project. An important aspect of habitat fragmentation is the separation of individual forest fragments from each other and from much larger forest reserves. This separation of larger forest blocks can have a detrimental effect on wildlife that requires large, unbroken pieces of habitat. However, impact from the construction of the project will be similar to what is common in the area from timber harvesting practices and is not expected to be a significant impact to local wildlife in this area.

Impacts to Wetlands

In order to avoid wetland impacts, a large area was delineated so that the project could be designed around existing resources to the extent practicable. As a result, most of the wetlands delineated within the project area will be unaffected by construction activities. The total area of permanent wetland fill is approximately 10,689 square feet. These impacts include a few scattered fills associated with the access road and fills associated with five turbines. Impacts will occur as a result of upgrades to the existing access road, as well as construction of new access roads. The selected alternative for the road alignments utilized existing road where practicable. Where new roads were necessary, large, higher functioning wetlands were avoided. The unavoidable impacts generally affect small, isolated, and relatively low-functioning resources. Similarly, impacts associated with the turbines also affect small, low-functioning wetlands. The wetlands that are filled will have a reduced functional capacity, but on a landscape level there should not be a significant change in wetland functions or values.

Impacts to wetlands along the proposed collector lines corridor will consist primarily of a change in cover type. There will be approximately 15,187 square feet of vegetation clearing within wetlands. No permanent fill will occur within wetlands in association poles. The primary cover change will result from clearing forested wetlands. In time these forested wetlands will convert to an early successional stage scrub-shrub wetland. This cover type change will not significantly change the overall functions and values of the impacted wetlands, with the exception of a change in wildlife habitat. Other wetlands that will be crossed by the collector lines are either scrub-shrub or emergent, so there should be no change in cover type. In general, there should be only limited change in the functions provided by these wetlands.

Impacts to Streams

One perennial stream and three intermittent streams will be crossed by the new portion of the access road. Each of these new crossings will involve installation of a culvert. The other streams within the project area were avoided in an effort to minimize impacts.

Impacts to streams along the proposed collector line will be minimal. The new collector line will cross three intermittent streams and a small perennial streams, and as a result, there will be clearing of vegetation at these points. The clearing, however, should not impact the overall character of the streams. See Section 10 of this permit application for a discussion of vegetation management techniques at stream crossings intended to minimize impacts to wildlife and fisheries.

Direct Impacts to Wildlife

Wildlife on the summits of the ridgelines will be impacted by the construction of the project. Also, the construction and operation of the project will result in a permanent change in habitat type where the turbine clearings and the access roads will be located. However, the majority of the surrounding forest area will remain as intact forest, and no further development is expected in the immediate vicinity of the turbines. Furthermore, land use is expected to remain similar to its current state. Terrestrial wildlife is not expected to be impacted by the operation of the turbines once construction is complete. Similar to the turbine areas, wildlife surrounding the collector line corridor will be impacted by a change in habitat type and small scale fragmentation. Short-term disturbances will likely occur during construction. It is anticipated that local wildlife populations will adapt and respond to this conversion of habitat types, much as they already do with the ongoing forest management activities in the area. Electric lines and poles can also pose a potential threat to birds as they are relatively tall structures and have long lines of cable that can be difficult to see. However, this line will be 34.5 kV, and poles will not exceed the height of tree canopy, which will help minimize the risk of collision.

Wind turbines also pose a threat to migratory birds and bats due to their height and the spinning turbine blades. Based on the results of the nocturnal radar surveys, diurnal raptor surveys, and acoustic bat surveys in 2007 and 2008, operation of wind turbines in the project area will not pose a significant threat to birds or bats. The radar surveys indicate that passage rates at the project are comparable to other

radar sites in the state. Flight height and flight direction data indicate that the majority of migratory birds are flying at a height sufficient to avoid the proposed turbines and blades. Diurnal raptor surveys indicate that passage rates of raptors is low compared to other sites in the area. This low rate is likely due to the lack of large landscape features that would concentrate raptor migration activity. Acoustic bat data suggest that the number of bats in the project area is similar to other sites in the vicinity of the project area, although the data for tree level bats activity from both seasons is moderate. Overall, the project is not located in an area of significant bird and bat migration, and the construction of the project will not significantly impact populations of these species. For a complete description of the bird and bat surveys performed at the project area, see Appendices 7-2 and 7-3.

Bald Eagles

There is one bald eagle nest on French Island in Roxbury Pond to the west of the project area. Bald eagles primarily fly along river corridors at varying heights in pursuit of prey, during aerial displays, and during daily movements. However, they also often expand their feeding grounds for many miles to lakes, ponds, and other waterbodies. Newly constructed wind turbines on Record Hill could also pose a threat to the mapped bald eagle nest on Roxbury Pond. However, because bald eagles tend to hunt on bodies of water, mortality from collisions with turbines is not expected due to their location on upland ridgelines.

Measures to Minimize Wildlife Impacts

During the initial planning stages of the project, RHW evaluated specific locations in order to minimize wetland and wildlife impacts. Multiple access road routes were initially investigated to determine their feasibility before any fieldwork began. This process was essential to find the most practical route to pursue. Once fieldwork began, access road routes and turbine locations were continuously shifted to avoid newly found resources. For additional information on the alternatives analysis, refer to Section 1A of this application.

On the project area ridgelines, roads and structures have been sited to avoid impacts to wetlands and other sensitive resources. The vast majority of the wetlands delineated on the ridgelines will not be impacted by the construction of the project. No vernal pools depressions identified within the project area will be directly impacted by the proposed project, and effects on vernal pool-dependent wildlife species should be limited. Additionally, access to the turbine locations will be accomplished by using a combination of existing roads and construction of new roads. New roads are only being constructed where wetland resources or topography limit the use of existing roads or where no usable roads currently exist. These roads have also been designed to avoid and minimize wetland impacts to the extent possible.

In order to reduce the amount of vegetation clearing required on the summits, only the minimum amount of vegetation will be cleared from each turbine location. Turbine clearings will generally be approximately 1.7 acres per turbine. Additionally, the power collector lines that run the length of the ridgeline project areas will be co-located with the constructed roads. This will eliminate the need to clear additional vegetation beyond what will already be cleared for the roads. Only 1.1 miles of new electric collector line corridor will be needed on the east side of the ridge to get power from the project to the grid.

Construction on both the ridgelines and the proposed collector lines will be performed according to Best Management Practices put forth by the MDEP to reduce erosion and sedimentation into sensitive resources. For additional information on this topic, refer to Section 14 of this application.

Post construction avian and bat casualty monitoring

In order to assess the bird and bat casualties from the project, RHW proposes a study protocol for post-construction monitoring during years 1, 3, and 5 following the construction and operation of the project (see Appendix 7-4). This protocol is based on the rapidly evolving methods associated with post construction assessment, including the most recent efforts at Mars Hill, and will continue to evolve in consultation with MDIFW.

4.0 FISHERIES

The project area encompasses limited fisheries resources. The majority of streams found within the project area are small tributary streams that are not mapped on U.S. Geological Survey (USGS) topographical maps.

4.1 Stream Crossings and Associated Fisheries

In total, there are seven delineated streams that are crossed by the project (see Appendix 7-1 for locations). The access roads will cross four of these resources. Three of these stream crossings will result from new road construction (see Exhibit 1, sheets C101, C102, and C103). The remaining four stream crossings in the project area will be associated with the collector lines corridor.

4.1.1 Impacts and Effects on Streams and Associated Fisheries

The streams that will be impacted on the ridgeline include a small perennial stream and three first order intermittent streams. While these streams meet the MDEP requirements to be classified as jurisdictional streams, the three intermittent streams would be unlikely to support fish, and the small perennial stream would most likely only support small non-game species such as longnose dace (*Rhinichthys cataractae*). No fish were observed during the field surveys in the project area. No adverse impacts to fisheries are expected on the ridgeline.

Two first order intermittent streams and two small perennial streams will be crossed by the collector lines corridor. No fish were observed in these streams during the course of the resource delineation, and it is unlikely that either intermittent stream is capable of supporting fish. The two perennial streams may support at least limited fisheries. The larger of the two perennial streams, located just west of the proposed collector substation, appears large enough to support species such as brook trout (*Salvelinus fontinalis*). Impacts to the streams will only occur through limited clearing of the vegetated buffer. A small amount of thermal gain is expected directly after clearing, but these areas will revegetate with a shrub buffer. The buffer clearing requirements that will be utilized to minimize impacts to fisheries are discussed in Section 10 of this application.

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Appendix 7-4
Avian and Bat Casualty Monitoring Protocol

Objective
The objective of this casualty monitoring protocol is to document injuries and fatalities of birds and bats as a result of collision with the wind turbines once the Record Hill Wind Project becomes operational.

Background
This post-construction monitoring protocol is based on the development of similar post-construction monitoring plans at existing or proposed projects in Maine, New Hampshire, Vermont, Pennsylvania, and New York. These plans were developed in consultation with natural resource agencies in each of the above mentioned states. The draft guidance of the Maine Wind Power Advisory Group was also considered. This draft guidance includes contributions by several recognized experts in the field of wind energy and wildlife interaction and other State-sponsored wind-wildlife survey protocols, such as the Pennsylvania Game Commission's post-construction monitoring protocols. Finally, other recent studies of bird and bat fatalities at wind power projects in the U.S. and Europe were reviewed with regard to methods and search techniques (e.g., Arnett *et al.* 2008, Arnett 2005, Kerns and Kerlinger 2004, Barrios and Rodriguez 2004, de Lucas *et al.* 2004, Krewitt and Nitchs 2003, and Osborn *et al.* 2000).

Proposed Casualty Monitoring Protocol

At a minimum, Record Hill Wind LLC (RHW) proposes to fund and conduct the following wildlife casualty monitoring protocols during Year 1 operations:

1) Standardized searches during peak activity periods for birds and bats (spring migration, summer nesting and pup-rearing, late-summer swarming, and fall migration);
2) Searcher efficiency trials to estimate the percentage of carcasses found by searchers in each habitat surrounding the turbines; and
3) Carcass removal trials to estimate the length of time that carcasses remain in the field for possible detection.

Other survey methods will also be employed in Year 1. These methods will include documentation of casualties outside the standard search plots and monitoring of weather conditions (see Additional Survey Methods, below). A more detailed work scope for these surveys will be developed in consultation with the Maine Department of Inland Fisheries and Wildlife (MDIFW) between the time that construction is initiated and the first season survey period that occurs after construction (currently planned as ending in fall 2010). Timing of the final work scope development in this way will allow for the incorporation of survey results from publicly-available post-construction monitoring studies.

In addition, RHW proposes to conduct follow-up monitoring in two subsequent years (e.g., Year 3 and Year 5). The scope and timing of the follow-up monitoring will be determined in cooperation with the MDIFW based on the Year 1 findings, with consideration of current research priorities within the industry and the region.

Standardized Searches
Monitoring will entail regular, systematic searches of the area beneath a subset of turbines and the two guyed meteorological measurement towers (met towers) by trained technicians. As requested by MDIFW, search preference will be given to those turbines with the largest clearings/openings, and the same locations will be maintained throughout the duration of the monitoring.

Schedule and Search Effort
Monitoring will be conducted during the first full year following completion of the project to operational status. Subsequent survey efforts will be evaluated based upon the number of casualties documented during the initial year of survey, indications of correlations between casualties and weather, or indications of correlations between casualties and bird or bat activity.

Four distinct survey periods will occur. The timing of these periods will result in a total of 24 consecutive weeks of surveys. These survey periods are as follows.

- April 15 – May 31 for spring migration
- June 1 – July 14 for summer bird nesting and bat pup-rearing
- July 15 – August 15 for late-summer bat activity
- August 15 – October 15 for fall bird and bat migration

During each time period, a total of 20 turbines (50% of all turbines) will be searched weekly. Additionally, the cleared area under one of the met towers (which primarily lies directly underneath the guy wires) will be searched once per week. The turbines searched will be randomly selected, though the selection will be stratified to ensure that the proportion of lighted and unlighted turbines in the searched set will be proportional to the entire project.

Search Plot Sizes

Fatalities may be found at considerable distances from the base of the turbine (e.g., at distances equal to or greater than the total height of the turbine and rotor) commonly in the range of 300-400 feet (Erickson *et al.* 2004, 2003 and 2000, Johnson *et al.* 2000a and 2000b). The Clipper Liberty C96 2.5 megawatt (MW) turbines proposed for the Record Hill Wind Project have a maximum structural height of approximately 128 meters (420 feet) for the tower and rotor combined. Extending outward from the base this distance would yield a plot size significantly larger than the laydown area that will be cleared and leveled for each turbine (typical diameter of up to 75 meters or 250 feet). For example, a square plot based on the full tower height would measure approximately 238 meters (780 feet) on a side, and amount to approximately 14 acres. Plots of this size at the Record Hill Wind Project would include substantial areas of mature and mixed age forest cover and steep terrain for many turbines. In comparison, many of the published studies conducted at existing projects in the western U.S. are situated in relatively level agricultural landscapes, where searches are not hindered by terrain or tree cover.

As noted in the draft Maine guidelines, conducting searches at this level of intensity may simply be impractical in hilly and forested terrain. For similar reasons, Kerns *et al.* (2005) scaled down their search areas in consideration of existing site constraints. Offsetting this problem somewhat is the fact that most fatalities are being found much closer to the turbines. For example, working at the Meyersdale project in Pennsylvania, Kerns and Kerlinger (2004) reported that the majority of bird and bat fatalities were found within about 30 meters (100 feet) of the turbine bases, and Kerns *et al.* (2005) reported that greater than 80 percent of bat fatalities were found within 40 meters (131 feet) of turbines at Meyersdale, Pennsylvania and Mountaineer, West Virginia. The NEG Micon 1.5 MW wind turbines at Meyersdale and Mountaineer are similar in size to those proposed for the Record Hill Wind Project.

In light of the above, options for tailoring the monitoring methods at the Record Hill Wind Project have been considered. It is currently anticipated that the standardized searches will focus on monitoring the cleared and leveled lay-down areas around each selected turbine and applying a correction factor to account for fatalities that fall outside of the smaller search plots. The methods for calculating this correction factor will be determined through further discussions with MDIFW and will incorporate survey results targeting this issue at turbines located in field habitat at other operating wind projects with publicly-available post-construction monitoring data. In addition, the group of turbines selected can be weighted to include those turbines located in the direct center of the lay-down areas to maximize the chances of fatalities falling within these areas where carcasses are easier to find.[1]

[1] The effect of targeting 'centered' turbines on overall survey results is currently being investigated during the 2008, Year 2 monitoring at the Mars Hill Wind Farm.

Search Timing and Frequency

As noted above, systematic searches will be conducted weekly of 16 turbines (approximately 50% of all turbines) and one meteorological measurement (met) tower during four survey periods. These survey periods are essentially consecutive time periods ranging from four to eight weeks in length that represent different time periods of migration and breeding activity and habits of birds and bats known to occur in the area. The result will be approximately 24 weeks of consecutive casualty monitoring and a total of 480 individual turbine searches and 24 met tower searches.

Standardized Searches

Plots will be searched by walking along parallel transects located at regular intervals across the turbine laydown area. Initially, transects will be set at six to eight meters apart. A searcher will walk at a rate of approximately 45-60 meters a minute along each transect, searching on both sides out to 3-4 meters for casualties. Depending upon whether casualties are found, it should take an average of 60 minutes to search each plot and then travel to the next. The distance between transects will be modified, if needed, based on vegetation development within the plots.

Casualties found will be documented on standardized field forms, photographed, collected, and, if it is a state- or federally-listed species, reported within 24 hours of identification. The type of observation or condition of carcasses will be recorded, such as intact carcass, scavenged, or feather spot. The bearing to the center of the wind turbine being searched will be recorded and the distance to the turbine will be determined using a laser range finder and recorded.

Casualties found incidentally during normal on-site operations at the project will also be recorded and collected (only at turbines and along roads not included as search sites). Operations personnel will be instructed on the proper handling and notification requirements for these occurrences.

Searcher Efficiency Trials

Searcher efficiency trials will be conducted in the same area as the searches to estimate the percentage of avian and bat casualties that are found by searchers. The trials will consist of periodic placement of carcasses at the search turbines the night before searches occur (to reduce the likelihood of scavenging). Carcasses will be placed within all available 'search habitats' under the turbines, including the gravel access way immediately surrounding each turbine and the restored (loamed, seeded, and mulched) portions of the lay-down areas. Searchers will be unaware of the timing of these trials. Over the course of the full survey period, a target of 50 carcasses (targeting 25 birds and 25 bats) will be placed in the search plots. The number of carcasses placed for searcher efficiency trials will be modified, if necessary, based on the number of searchers used over the course of the surveys.

The carcasses used for these trials will be obtained during earlier searches at the project or other facilities and will be marked with a small piece of black electrical tape placed around a leg. If too few carcasses are available, then surrogate species of similar size as native species will be obtained. Estimates of searcher efficiency will be used to adjust for detection bias using methods similar to Kerns *et al.* (2005).

Carcass Removal Trials

Two carcass removal trials will be performed during the survey, one in spring and one in fall, independently of the searcher efficiency trials. The objective will be to estimate the percentage of bird and bat fatalities that disappear from study plots due to scavengers. Estimates of carcass removal will be used to adjust the number of carcasses found, thereby correcting for this removal bias.

For each trial, a minimum of 6 but preferably 25 carcasses (species composition as noted for searcher efficiency trials) will be placed near search plots (but not in plots to avoid contamination from blowing feathers). Birds will be checked on days 1, 2, 3, 4, 5, 7, 10, and 14, or until all evidence of the carcass is absent. On day 14, carcasses, feathers, or parts will be retrieved and properly discarded.

Additional Survey Methods

Some additional field efforts to monitor bird and bat activity and weather conditions will also be performed during the post-construction casualty monitoring surveys. These efforts are designed to evaluate the efficacy of pre-construction survey methods to predict actual numbers of fatalities resulting from a proposed wind development.

These efforts will be based on the pre-construction surveys conducted at the Record Hill Wind Project and trends observed during recent post-construction surveys conducted in other parts of the eastern United States, including West Virginia, Pennsylvania, and New York, but more importantly at the developed projects in Maine that have undergone post construction mortality searches. These surveys could incorporate bat detectors and radar operated at very specific times and for brief time periods, if deemed necessary, appropriate, and able to answer any small, targeted concerns.

Finally, weather conditions will be recorded throughout the duration of the survey effort to evaluate if correlations with casualty exist. Weather parameters used are those that will be recorded at the on-site met towers or at the wind turbines themselves. These include wind speed and wind direction as well as temperature at or near hub height and near the ground. Additional weather data that will be recorded will include barometric pressure, relative humidity, and precipitation.

Reporting

A report will be provided after each full year (spring-fall) of monitoring. The report will summarize the methods and results of monitoring. Estimates of the total number of wind turbine-related fatalities will be based on three components: 1) observed number of carcasses; 2) searcher efficiency expressed as the proportion of trial carcasses found by searchers; 3) removal rates expressed as the length of time a carcass remains in the study area and is available for detection by searchers; and possibly factors such as the 4) proportion of casualties likely to land or move outside the plot (such as forested portions beyond the cleared area surrounding turbines); and 5) an estimate of the number of carcasses found by observers where cause of death could not be attributed to wind energy development, and calculations of the number of bird and bat fatalities on a per turbine per year basis or other possible measurement methods (i.e., per MW per year). Calculation methods are presented in Kerns *et al.* (2005).

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1339 a.

From: Ryan, Jonathan [jonathan.ryan@stantec.com]
Sent: Monday, August 17, 2009 1:33 PM
To: Callahan, Beth
Cc: Rob Gardiner
ubject: Record Hill Wildlife Supplementary Information

Attachments: Public radar survey results 080109.pdf; Record Hill Bald Eagle Summary jtr.doc
Hi Beth --

I've attached two documents for your interest. Both deal with wildlife survey results at Record Hill. Neither presents new information that changes any of our conclusions. Instead, I think the attached tables put the survey results Stantec has collected at RHW into better perspective. The first document presents data collected at a number of different proposed wind projects across the region. All of the projects on the list are proposed for forested ridge settings like RHW. The second document is a single-page summary sheet of observed eagle activity at Record Hill. As I've previously mentioned to you, Record Hill Wind LLC has undertaken additional effort to survey and record summertime eagle activity in the project area. Those results are contained in this summary sheet. Please let me know if you have any questions about these data.

Jon

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1339 b.

Table 1. Summary of available avian radar survey results conducted at proposed (pre-construction) US wind power facilities in eastern US, using X-band mobile radar systems (2004-present)

Year	Season	Project Site	Number of Survey Nights	Number of Survey Hours	Landscape	Average Passage Rate (t/km/hr)	Range in Nightly Passage Rates	Average Flight Direction	Average Flight Height (m)	(Turbine Ht) % Targets Below Turbine Height	Citation
2004	Fall	Sheffield, Caledonia Cty, VT	18	176	Forested ridge	91	19-320	200	566	(125 m) 1%	Woodlot Alternatives, Inc. 2006. Avian and Bat Information Summary and Risk Assessment for the Proposed Sheffield Wind Power Project in Sheffield, Vermont. Prepared for UPC Wind Management, LLC.
2005	Fall	Swallow Farm, PA	58	n/a	Forested ridge	166	n/a	n/a	402	(125 m) 5%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http://www.dec.ny.gov/docs/wildlife_pdf/radarwindsum.pdf
2004	Fall	Casselman, PA	30	n/a	Forested ridge	174	n/a	n/a	436	(125 m) 7%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http://www.dec.ny.gov/docs/wildlife_pdf/radarwindsum.pdf
2004	Fall	Dans Mountain, MD	34	318	Forested ridge	188	2-633	193	542	(125 m) 11%	Woodlot Alternatives, Inc. 2004. A Fall 2004 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Dan's Mountain Wind Project in Frostburg, Maryland. Prepared for US Wind Force.
2005	Fall	Kibby, Franklin Cty, ME (Range 1)	12	101	Forested ridge	201	12-783	196	352	(125 m) 12%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
2004	Fall	Franklin, Pendleton Cty, WV	34	349	Forested ridge	229	7-926	175	583	(125 m) 8%	Woodlot Alternatives, Inc. 2005. A Fall 2005 Radar and Acoustic Survey of Bird and Bat Migration at the Proposed Liberty Gap Wind Project in Franklin, West Virginia. Prepared for US Wind Force, LLC.
2005	Fall	Fayette Cty, PA	26	n/a	Forested ridge	297	n/a	n/a	426	(125 m) 5%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http://www.dec.ny.gov/docs/wildlife_pdf/radarwindsum.pdf
2005	Fall	Stamford, Delaware Cty, NY	48	418	Forested ridge	315	22-784	251	494	(110 m) 3%	Woodlot Alternatives, Inc. 2007. A Spring and Fall 2005 Radar and Acoustic Survey of Bird Migration at the Proposed Moresville Energy Center in Stamford and Roxbury, New York. Prepared for Invenergy, LLC. Rockville, MD.
2006	Fall	Somerset Cty, PA	29	n/a	Forested ridge	316	n/a	n/a	374	(125 m) 8%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http://www.dec.ny.gov/docs/wildlife_pdf/radarwindsum.pdf
2007	Fall	Laurel Mountain, Barbour Cty, WV	20	212	Forested ridge	321	76-513	209	533	(130 m) 6%	Stantec Consulting Services Inc. 2007. A Fall 2007 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Laurel Mountain Wind Energy Project near Elkins, West Virginia. Prepared for AES Laurel Mountain, LLC.
2008	Fall	Georgia Mountain, VT	21	n/a	Forested ridge	326	56-700	230	371	(120 m) 7%	Stantec Consulting Services Inc. 2008. A Fall 2008 Survey of Bird Migration at the Georgia Mountain Wind Project, Vermont. Prepared for Georgia Mountain Community Wind .
2007	Fall	Errol, Coos County, NH	29	232	Forested ridge	366	54 to 1234	223	343	(125 m) 15%	Stantec Consulting Inc. 2007. Fall 2007 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Windpark in Coos County, New Hampshire by Granite Reliable Power, LLC. Prepared for Granite Reliable Power, LLC.
2007	Fall	Lincoln, Penobscot Cty, ME	22	231	Forested ridge	368	82-953	284	343	(120 m) 13%	Woodlot Alternatives, Inc. 2008. A Fall 2007 Survey of Bird and Bat Migration at the Rollins Wind Project, Washington County, Maine. Prepared for Evergreen Wind, LLC.
2005	Fall	Preston Cty, WV	26	n/a	Forested ridge	379	n/a	n/a	420	(125 m) 10%	Plissner, J.H., T.J. Mabee, and B.A. Cooper. 2006 A radar and visual study of nocturnal bird and bat migration at the proposed Preston Wind Development project, Virginia, Fall 2005. Report to Highland New Wind Development, LLC.
2005	Fall	Highland, VA	58	n/a	Forested ridge	385	n/a	n/a	442	(125 m) 12%	Plissner, J.H., T.J. Mabee, and B.A. Cooper. 2006 A radar and visual study of nocturnal bird and bat migration at the proposed Highland New Wind Development project, Virginia, Fall 2005. Report to Highland New Wind Development, LLC.
2007	Fall	Roxbury, Oxford Cty, ME	20	220	Forested ridge	420	88-1006	227	365	(130 m) 14%	Woodlot Alternatives, Inc. 2007. A Fall 2007 Survey of Bird and Bat Migration at the Record Hill Wind Project, Roxbury, Maine. Prepared for Roxbury Hill Wind LLC.
2006	Fall	Bedford Cty, PA	29	n/a	Forested ridge	438	n/a	n/a	379	(125 m) 10%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http://www.dec.ny.gov/docs/wildlife_pdf/radarwindsum.pdf
2007	Fall	Allegany, Cattaraugus Cty, NY	46	n/a	Forested ridge	451	n/a	230	382	(150 m) 14%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http://www.dec.ny.gov/docs/wildlife_pdf/radarwindsum.pdf
2005	Fall	Kibby, Franklin Cty, ME (Valley)	5	13	Forested ridge	452	52-995	193	391	(125 m) 16%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
2006	Fall	Stetson, Washington Cty, ME	12	77	Forested ridge	476	131-1192	227	378	(125 m) 13%	Woodlot Alternatives, Inc. 2007. A Fall 2006 Survey of Bird and Bat Migration at the Stetson Wind Project, Washington County, Maine. Prepared for Evergreen Wind V, LLC.
2008	Fall	Oakfield, Penobscot Cty, ME	20	n/a	Forested ridge	501	116-945	200	309	(125 m) 18%	Woodlot Alternatives, Inc. 2008. A Spring 2008 Survey of Bird and Bat Migration at the Oakfield Wind Project, Washington County, Maine. Prepared for Evergreen Wind, LLC.
2005	Fall	Mars Hill, Aroostook Cty, ME	18	117	Forested ridge	512	60-1092	228	424	(120 m) 8%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird Migration at the Mars Hill Wind Farm in Mars Hill, Maine. Prepared for Evergreen Windpower, LLC.
2005	Fall	Deerfield, Bennington Cty, VT	32	324	Forested ridge	559	3-1736	221	395	(100 m) 13%	Woodlot Alternatives, Inc. 2006. Fall 2005 Bird and Bat Migration Surveys at the Proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont. Prepared for PPM Energy, Inc.
2005	Fall	Kibby, Franklin Cty, ME (Mountain)	12	115	Forested ridge	565	109-1107	167	370	(125 m) 16%	Woodlot Alternatives, Inc. 2006. A Fall 2005 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
2006	Fall	Lempster, Sullivan Cty, NH	32	290	Forested ridge	620	133-1609	206	387	(125 m) 8%	Woodlot Alternatives, Inc. 2007. A Fall 2007 Survey of Nocturnal Bird Migration,Breeding Birds, and Bicknell's Thrush at the Proposed Lempster Mountain Wind Power Project Lempster, New Hampshire. Prepared for Lempster Wind, LLC.
2007	Fall	New Creek, Grant Cty, WV	20	n/a	Forested ridge	811	263-1683	231	360	(130 m) 17%	Stantec Consulting Services Inc. 2008. A Spring 2008 Survey of Bird Migration at the New Creek Wind Project,West Virginia. Prepared for AES New Creek, LLC.

Table 1. Summary of available avian radar survey results conducted at proposed (pre-construction) US wind power facilities in eastern US, using X-band mobile radar systems (2004-present)

Year	Season	Project Site	Number of Survey Nights	Number of Survey Hours	Landscape	Average Passage Rate (t/km/hr)	Range in Nightly Passage Rates	Average Flight Direction	Average Flight Height (m)	(Turbine Ht) % Targets Below Turbine Height	Citation
2007	Spring	Stetson, Washington Cty, ME	21	138	Forested ridge	147	3-434	55	210	(120 m) 22%	Woodlot Alternatives, Inc. 2007. A Spring 2007 Survey of Bird and Bat Migration at the Stetson Wind Project, Washington County, Maine. Prepared for Evergreen Wind V, LLC.
2005	Spring	Sheffield, Caledonia Cty, VT	20	180	Forested ridge	166	12-440	40	552	(125 m) 6%	Woodlot Alternatives, Inc. 2006. Avian and Bat Information Summary and Risk Assessment for the Proposed Sheffield Wind Power Project in Sheffield, Vermont. Prepared for UPC Wind Management, LLC.
2006	Spring	Kibby, Franklin Cty, ME (Range 1)	10	80	Forested ridge	197	6-471	50	412	(120 m) 22%	Woodlot Alternatives, Inc. 2006. A Spring 2006 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
2005	Spring	Stamford, Delaware Cty, NY	35	301	Forested ridge	210	10-785	46	431	(110 m) 8%	Woodlot Alternatives, Inc. 2007. A Spring and Fall 2005 Radar and Acoustic Survey of Bird Migration at the Proposed Moresville Energy Center in Stamford and Roxbury, New York. Prepared for Invenergy, LLC. Rockville, MD.
2008	Spring	Lincoln, Penobscot Cty, ME	20	189	Forested ridge	247	40-766	75	316	(120 m) 13%	Stantec Consulting Services Inc. 2008.A Spring 2008 Survey of Bird and Bat Migration at the Rollins Wind Project, Washington County, Maine. Prepared for Evergreen Wind, LLC.
2006	Spring	Deerfield, Bennington Cty, VT	26	236	Forested ridge	263	5-934	58	435	(100 m) 11%	Woodlot Alternatives, Inc. 2006. Spring 2006 Bird and Bat Migration Surveys at the Proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont. Prepared for PPM Energy, Inc.
2008	Spring	Allegany, Cattaraugus Cty, NY	30	275	Forested ridge	268	53-755	18	316	(150 m) 19%	New York Department of Conservation [Internet]. c2008. Publicly Available Radar Results for Proposed Wind Sites in New York. Albany, NY: NYDEC; [updated May 2008; cited June 2009]. Available at http://www.dec.ny.gov/docs/wildlife_pdf/radarwindsum.pdf
2007	Spring	Laurel Mountain, Barbour Cty, WV	20	197	Forested ridge	277	13-646	27	533	(130 m) 3%	Stantec Consulting Services Inc. 2007. A Spring 2007 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Laurel Mountain Wind Energy Project near Elkins, West Virginia. Prepared for AES Laurel Mountain, LLC.
2006	Spring	Mars Hill, Aroostook Cty, ME	15	85	Forested ridge	338	76-674	58	384	(120 m) 14%	Woodlot Alternatives, Inc. 2006. A Spring 2006 Radar, Visual, and Acoustic Survey of Bird Migration at the Mars Hill Wind Farm in Mars Hill, Maine. Prepared for Evergreen Windpower, LLC.
2007	Spring	Errol, Coos County, NH	30	212	Forested ridge	342	2 to 870	76	332	(125 m) 14%	Stantec Consulting Inc. 2007. Spring 2007 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Windpark in Coos County, New Hampshire by Granite Reliable Power, LLC. Prepared for Granite Reliable Power, LLC.
2005	Spring	Deerfield, Bennington Cty, VT	20	183	Forested ridge	404	74-973	69	523	(100 m) 4%	Woodlot Alternatives, Inc. 2005. Spring 2005 Bird and Bat Migration Surveys at the Proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont. Prepared for PPM Energy, Inc.
2006	Spring	Kibby, Franklin Cty, ME (Valley)	2	14	Forested ridge	443	45-1242	61	334	(120 m) n/a	Woodlot Alternatives, Inc. 2006. A Spring 2006 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
2006	Spring	Kibby, Franklin Cty, ME (Mountain)	6	33	Forested ridge	456	88-1500	67	368	(120 m) 14%	Woodlot Alternatives, Inc. 2006. A Spring 2006 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
2005	Spring	Franklin, Pendleton Cty, NY	21	204	Forested ridge	457	34-1240	53	492	(125 m) 11%	Woodlot Alternatives, Inc. 2005. A Spring 2005 Radar and Acoustic Survey of Bird and Bat Migration at the Proposed Liberty Gap Wind Project in Franklin, West Virginia. Prepared for US Wind Force, LLC.
2005	Spring	Dans Mountain, MD	23	189	Forested ridge	493	63-1388	38	541	(125 m) 15%	Woodlot Alternatives, Inc. 2005. A Spring 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Dan's Mountain Wind Project in Frostburg, Maryland. Prepared for US Wind Force.
2008	Spring	Oakfield, Penobscot Cty, ME	20	194	Forested ridge	498	132-899	33	276	(120 m) 21%	Stantec Consulting Services Inc. 2008.A Spring 2008 Survey of Bird and Bat Migration at the Oakfield Wind Project, Washington County, Maine. Prepared for Evergreen Wind, LLC.
2006	Spring	Kibby, Franklin Cty, ME (Range 2)	7	57	Forested ridge	512	18-757	86	378	(120 m) 25%	Woodlot Alternatives, Inc. 2006. A Spring 2006 Survey of Bird and Bat Migration at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine.
2007	Spring	Roxbury, Oxford Cty, ME	20	n/a	Forested ridge	539	137-1256	52	312	(130) 18%	Woodlot Alternatives, Inc. 2007. A Spring 2007 Survey of Bird and Bat Migration at the Record Hill Wind Project, Roxbury, Maine. Prepared for Roxbury Hill Wind LLC.
2007	Spring	Lempster, Sullivan Cty, NH	30	277	Forested ridge	542	49-1094	49	358	(125 m) 18%	Woodlot Alternatives, Inc. 2007.A Spring 2007 Survey of Nocturnal Bird Migration,Breeding Birds, and Bicknell's Thrush at the Proposed Lempster Mountain Wind Power Project Lempster, New Hampshire. Prepared for Lempster Wind, LLC.
2008	Spring	New Creek, Grant Cty, WV	20	n/a	Forested ridge	1020	289-2610	30	354	(130 m) 13%	Stantec Consulting Services Inc. 2008. A Spring 2008 Survey of Bird Migration at the New Creek Wind Project,West Virginia. Prepared for AES New Creek, LLC.

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Record Hill Bald Eagle Summary

Three survey periods:

- Fall 2007: September 3 – October 15 (total 14 days)
- Spring 2008: March 11 – May 27 (total 15 days)
- Summer 2009: July 13 – August 16 (total 6 days)

Date	Number Individuals	Relative Age	Circumstances	Total Number by Season
2007				
September 4	1	Adult	Migrating at approximately 70 m over Flathead Mountain	
September 4	1	Adult	Migrating at approximately 70 m over Flathead Mountain	
September 20	1	Sub-adult	Migrating west of the Project ridgeline at an altitude of 200 to 300 m	3
2008				
May 1	1	Sub-adult	May 1 flew between 50 to 200 m as it traveled parallel to the ridge along the ridge top	
May 6	1	Sub-adult	Flying low in the valley west of the Project	2
2009*				
July 23	1	Adult	Nest occupant seen on two occasions flying at the pond near the nest island	
August 1	1	Adult	Nest occupant attempting to fish, but flushed by boater	
August 1	1	Sub-adult/Juvenile	Flying over pond, circle-soar before flying out of view	
August 7	1	Adult	Flying over pond and appeared to be successfully fishing	
August 16	2	Adult	Flying at the pond near the nest island	
August 16	1	Sub-adult/Juvenile	Flying at the pond near the nest island	7**
			Total	**10****

*No bald eagles were observed on July 13, 2009 or August 13, 2009. Distance prevented making the distinction between juvenile and sub-adult bird.

**Seven separate sightings were made in the summer of 2009; however, these likely represent observations of only 5 birds with multiple sights of the nesting adults.