APPENDIX 12G:
GENERAL WILDLIFE IMPACTS

Wildlife Impact Assessment
for
Antrim Wind Energy Project
Town of Antrim
Hillsborough County, New Hampshire

Prepared for:

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Impacts to Wildlife

Impacts to wildlife in general can be separated into two categories: direct impacts from mortality and impacts from habitat alteration.

Direct Impacts (Mortality)

Direct impacts to wildlife from construction and operation of the project are not expected to be a significant concern. The results of mortality monitoring at other projects in similar settings in the northeast (relatively low forested ridges) suggest that wildlife mortality is low. See Attachment A for a summary of the results of mortality surveys at several projects in the northeast. Even with the likelihood that mortality to wildlife will be low at this site, AWE is incorporating a curtailment study into an Avian and Bat Protection Plan to assess reducing the potential for mortality to bats at the site. The Avian and Bat Protection Plan also incorporates monitoring and continued consultation with the agencies to provide additional protection to avian and bat species on the site.

Habitat Alteration

The project is located in an area that is largely undeveloped and has been recognized for habitat and ecological values in the Wildlife Action Plan. The project, however, will occupy a relatively small area within a much larger landscape, and the impacts associated with the Project are located largely at the edge of this block rather than in its center (e.g. nearby to NH Rte. 9 and the PSNH Transmission corridor). The unfragmented habitat block associated with the project area is approximately 12,994 acres (source: NH GRANIT, Wildlife Action Plan, Unfrag block layer, 2010). The area that will be initially disturbed during project construction will be approximately 63 acres; after construction of the ten turbines is complete, approximately 49.4 acres will be restored revegetated, including roadway shoulders and side slopes, and much of the construction pad area at the turbine locations. Ultimately the final project, including the maintained roads, electrical infrastructure and turbine pad footprint, will total 11.5 acres and will constitute a loss of forest habitat. While the project will create some degree of disruption in a forested landscape that is already frequently disturbed and bisected by forest management activities which can impact forest-interior species, the narrow footprint of the development represents a small incision into a large block of habitat. The narrow footprint does not separate and create a distinct habitat block or "island", so does not constitute a fragmentation of habitat especially given the scale of the habitat block. Disturbance caused by road use from vehicles will be restricted to operations personnel and will be low in volume. The gravel road footprints are narrow enough that the opportunity for wildlife to traverse the area unimpeded will remain. Finally, several large parcels of land will be conserved as part of the project, providing for protection of 685 acres of habitat that will not be developed. This habitat conservation effort, coming directly from the Project, will ensure that a significant portion of this habitat block will remain intact.

All other habitat alteration will be temporary, or will entail transformation from forested habitats to shrub and low forest habitats. It should be noted that some of these areas have been recently harvested and are currently in early successional stages.

For breeding birds, common species found in the vicinity include the red-eyed vireo (*Vireo olivaceus*) and black-throated blue warbler (*Dendroica caerulescens*), which favor a mixed forest stand of regenerating forests through large saw timber and the ovenbird (*Seiurus aurocapillus*), which favors saplings and saw timber. The blackburnian warbler *(Dendroica fusca*) is also common in the project area and favors primarily saw timber size forest (DeGraaf et al. 1992). The relatively minimal amount of clearing will likely have little effect on forest species due to the fact that there will remain abundant suitable habitat in area adjacent to the Project. Most mammal species observed on the ridges, similar to breeding birds found in the area are also typically found in forests that have a variety of size classes (DeGraaf et al. 1992). The most common mammal species found in the project area include moose (*Alces alces)*, eastern chipmunk (*Tamias striata*), red squirrel (*Tamiasciurus hudsonicus*), snowshoe hare (*Lepus americanus*), coyote (*Canis latrans*), and red fox (*Vulpes vulpes*). White-tailed deer (*Odocoileus virginianus*) and bobcat (*Lynx rufus*), while not abundant, are also found throughout the area, and both utilize all ages of forest from regenerating forest through large sawtimber. Both are also well adapted to living in close proximity to human disturbance and are often found in suburban areas. Species that require large blocks of habitat that are found in the region such as moose, black bear (*Ursus americanus*) and fisher (*Martes pennanti*) will still find abundant large blocks of habitat after construction of the Project. All of these species favor regenerating forest habitat for much of their life history, and use all ages of forest at one time or another. Gravel roads in general do not hamper their movements, and narrow roads that receive only limited use such as the Project roads will not be a barrier to the movement of any of these animals.

A description of each Project feature and the potential impacts from each is found in the following subsections.

Turbine Clearings

The turbine and laydown areas will be cleared of trees and grading will be required around the turbine foundations. Construction of the turbine foundations will result in a direct loss of habitat, though each of these areas is relatively small and contiguous with the turbine access road. Clearing for the remainder of the turbine opening will result in an indirect impact in the form of habitat conversion from a mature forest to a regenerating forest. These areas will be allowed to naturally re-vegetate.

The area to be impacted by construction of the turbines is relatively small, given the abundance of similar habitat in the project area. Most of the wildlife species that have been observed in ridgeline areas are not dependent on mature forest stands and will be minimally affected by clearing for turbines.

Access Roads

Impacts from the construction of access roads will include direct loss of habitat. Direct impacts from road construction have been minimized to the extent practicable. For example, necessary road width has been scrutinized thoroughly, and will be no wider than is necessary. It sum, the area lost to permanent infrastructure is relatively small in relation to the surrounding forest.

New roads have been designed based on detailed consideration of engineering and environmental information. Field surveys focused on identifying wetlands, streams and other features that are considered constraints to engineering design and must be accommodated in the standard procedures developed for road construction. Included in design and construction constraints are bedrock outcrops and very steep slopes.

Indirect effects of roads include roads acting as impediments to wildlife movement, increasing predation, and the introduction of exotic or competitive species. Some species are known to be hesitant to cross roadways. The gravel surface, narrow footprint, and limited use of the proposed roads, however, will lessen any barrier or filter effects of the proposed roads to wildlife. Much of the access road will be similar to the small existing gravel roads found throughout the region. Once the wind turbines are in place, minimal traffic will occur in the Project area, and will be limited to operation and maintenance staff. Increased predation can occur through the use of road corridors by predators. These include avian predators, such as hawks and owls, and mammalian predators, such as fox and coyote, which are known to use road sides as edges to hunt along. Within the Project area, observations of sign from these species on the ridges are common. The edges created by the Project are relatively small in relation to the remaining forest in the immediate area and any increase in predation will likely be negligible.

Construction of new roads could also lead to the introduction or spread of exotic plant species or competing wildlife. Non-native species found along the existing roads and in existing log landings and skidder trails where there is disturbed soil in the project area provides an insight into what the potential exotic plant species are: sheep sorrel (*Rumex acetosella*), white clover (*Trifolium repens*), and redtop (*Agrostis gigantea*) were among the most frequently observed non-native plant species. Most herbaceous vegetation found in disturbed areas are native species such as ferns, sedges, grasses, goldenrods, asters, and raspberries, and it is anticipated that any disturbed areas adjacent to new roads will become colonized with similar plant communities. To minimize the opportunity for undesirable plant species introductions on the new road sections, disturbed soil will not be seeded or mulched with hay, but will be covered with a layer of erosion control mix. The application of this locally chipped mulch will limit the opportunity for new non-native and invasive plant species to colonize disturbed areas and provide a suitable medium for indigenous shrub and tree regeneration.

Transmission Inter-ties

This Project requires no new transmission line construction to interconnect to the grid, and as such is able to avoid any impacts associated with this form of development. Collector line corridors, which occur along roadsides, will be allowed to revegetate to shrubs and low trees to a height of approximately 15 feet (4.6 m). These corridors will be trimmed or maintained every 4-6 years. In areas that have not been recently logged, impacts from clearing the collector system corridors will be similar to what is currently common in the area from harvesting practices, a conversion to early successional forest. These areas will become dominated by shrubs and a variety of broad- and narrow-leaved herbaceous vegetation as is typical of such corridors.

The response to the uses of transmission lines and transmission line corridors by wildlife have received much attention and study. As a direct impact, corridors act as potential barriers, stopping movement of some species across them and directing activity along the length of them. Corridors can also, depending on width and structure, form distinct species groups associated with the forest interior, corridor interior, or edge habitats (Anderson et al. 1977, Chasko and Gates 1982, Gates 1991). Most of the electric collector line is underground and only is above ground below the ridge on the home run to the substation. Where above ground the width of the electric collector line corridor is generally narrow, with a maximum width of 60 feet, and is primarily located adjacent and within the proposed access road clearing footprint. Careful construction practices will also be used to reduce the impact of the line. These include leaving vegetation, where possible, in all areas of the corridor in which it would otherwise be allowed to re-establish. Adverse avian interactions with transmission lines occur as well. These interactions include electrocution and collisions. Electrocution is not anticipated to be an issue due to use of design criteria that meets the APLIC standards for electric lines.

Indirect impacts to wildlife will also result from maintenance of the above ground collector line. The habitat in these areas will be kept in a shrub-dominated state, and will not be allowed to grow into forest. The area to be converted to young regenerating growth is proportionally small, however, to the surrounding undeveloped landscape. Additionally, the shrub habitats which will be maintained in the corridor are important to many species of wildlife, and being ephemeral in nature in a forested setting, maintenance of shrub habitats will provide a benefit. Many studies have been conducted to determine the effects and values of corridors and rights-of-way and have found that maintaining these areas with various vegetation types increase bird species richness and nesting success (Chasko and Gates 1982). Furthermore, these types of corridors help maintain an area's rich bird population and is beneficial to bird communities (Burke and Sherburne 1982).

As with the entire project, the collection system corridors were designed to avoid wetlands to the extent possible. Wetland avoidance has resulted in only clearing impacts to wetlands from clearing along the collector line routes. No filling of wetlands will be required for the collector lines.

Substation and Service Building

Direct impacts from the construction of the substation and service building will include 2 acres of habitat loss. Stormwater runoff will be treated at this site through utilizing undisturbed forested buffers. This area is currently a mixed age forest stand, from early successional to mature maple-beech-birch and hemlock-beech-oak-pine forest, due to recent forest management activities in the area. This area is also very close the NH Rte. 9 and directly adjacent to the existing PSNH transmission corridor, so it is at the very edges of the forested areas, helping reduce potential impacts.

Temporary Project Construction Elements

There will be a number of temporary project elements. These include equipment and component laydown areas and a construction control center and parking (2.9 acres). This feature will be located close to Route 9, and to the extent possible and practical, is sited in an area that have been previously disturbed. Impacts from the use of these areas will be temporary, and will coincide with the construction of the project. Upon completion of construction, this area will be restored.

Habitat Fragmentation

Habitat fragmentation is the division of habitat into smaller and smaller patches that become more and more isolated from each other and from larger forested areas. These smaller patches are believed to be of lower quality, consequently providing less suitable habitat for native wildlife populations.

Impacts associated with the Project include the conversion of narrow sections of forested, ridge habitats to roads. Associated with these narrow openings are approximately 1-acre clearings for each wind turbine. This conversion, however, would not be expected to pose a significant restriction to wildlife utilizing these habitats. First, only a very small percentage of the land within this habitat block will be altered for the Project. A total of approximately 63 acres of land within this habitat block of 12,994 acres will be cleared and disturbed for the construction of roads or turbine clearings.

Second, narrow clearings for the access roads represent the only major direct habitat loss associated with the project. The access roads will be maintained as drivable roads for the duration of Project operations. As such, they provide little or no wildlife value for most wildlife, although extensive use is expected by some species such as moose that will find it easier to move about the area. For the most part, however, clearings made for wind turbines and the transmission interconnection will re-vegetate to conditions that resemble the regenerating cuts that are already common in the region.

It is also fully anticipated that local wildlife populations will adapt and respond to the conversion of habitat types much as they already do to the natural occurrence of forest management

activities in the area. As an example, several of the most common breeding bird species that use the forests in the study area, including blackburnian warbler, red-eyed vireo, and myrtle warbler (*Dendroica coronata*) were all observed foraging and calling, along and near the edges of natural and man-made clearings on Tuttle Hill and Willard Mountain.

Finally, an important aspect of habitat fragmentation is the separation of individual forest fragments from each other and from much larger forest reserves. The basic biological concern related to forest fragmentation is based on the theory of island biogeography. This theory maintains that wildlife populations or assemblages on islands are smaller and less diverse than those on the mainland. Also, larger islands and islands closer to the mainland have larger and more diverse species assemblages than smaller islands and islands further away from the mainland. Forest fragments can also be considered to be islands, with the isolation factor being the distance of a small forest stand to a much larger stand (representing the "mainland").

Much research has been done to determine the responses of wildlife assemblages to the size and degree of isolation of forest fragments. Many researchers have found bird species richness declines in isolated forest fragments and that small fragments lost species faster and retained fewer species than larger fragments (Lynch and Whitcomb 1978; Whitcomb et al. 1981; Butcher et al. 1981). Others have found the more rapid decline in small fragments attributable to the lack of forest interior required for many bird species, most of which are neotropical migrants (Whitcomb et al. 1981). However, forest fragments have been found to be important to species which do not require forest interior and rely more on the interior of edges (Blake and Karr 1987; Freemark and Collins 1992).

Forest fragmentation must be looked at from a landscape scale. Most studies examine bird communities in fragments in agricultural areas, where forest stands are isolated and there has been a marked decrease in the regions' total forest area. The project area, however, is located in a region which is dominated by large expanses of forest. The impact of fragmentation in these areas has not been studied as intensively (Hunter 1990), however the project, being a thin, linear disturbed area, does not effectively separate a distinct fragment from the larger forest block, being more an incision into the block. Impacts of the project from fragmentation are expected to be minimal since the island effect will be minimal and due to its relatively close proximity to the edge of the forest block (again, close to the PSNH Corridor and NH Rte. 9).

Some bird species observed in the project area that may be sensitive to forest fragmentation are the long-distance, neotropical migrants including the black-throated blue warbler and ovenbird. The dynamic environment in this area and the thin, linear configuration of all AWE Project features limits the impacts associated with the potential for forest fragmentation. The AWE Project roads along the ridges between turbines will have a 34 foot wide travel corridor during construction, although only 20 feet will be maintained following construction. These roads will represent narrow breaks in the forest canopy to wildlife species. Openings are currently a common feature in the project area due to forest management activities. Clearings for wind turbines will be approximately 1 acre in size, and will be located along the road and, except for the turbine foundation and a crane pad, allowed to naturally revegetate to native low

shrubs and herbaceous cover. The short length of above ground collector line will be maintained as shrub-dominated habitats within a landscape that already contains a high occurrence of perpetually young, regenerating forest and cuts. Edge species and interior edge species are expected to inhabit portions of the collector line and wind turbine clearings. The construction or operation of the project is not expected to significantly alter any wildlife populations in the region, in light of the current land uses and the associated impacts.

Attachment A
Stantec Consulting
Summary of NE Avian and Bat Fatalities

Summary of documented avian fatalities by bird group in the northeast as of 2011, summarized by Stantec Consulting	
game	**26**
rock pigeon	4
ruffed grouse	14
wild turkey	8
owl	**1**
barred owl	1
passerine	**384**
alder flycatcher	1
American crow	2
American goldfinch	4
American redstart	4
American robin	4
bay-breasted warbler	5
belted kingfisher	1
black-and-white warbler	5
black-billed cuckoo	2
blackburnian warbler	4
black-capped chickadee	1
blackpoll warbler	4
black-throated blue warbler	10
black-throated green warbler	4
blue jay	1
blue-headed vireo	5
bobolink	4
brown creeper	7
cedar waxwing	10
chesnut-sided warbler	3
chimney swift	1
cliff swallow	2
common grackle	2
common yellowthroat	3
dark-eyed junco	2
downy woodpecker	1
eastern kingbird	3
eastern phoebe	2
eastern towhee	2

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eastern wood peewee	2
European starling	14
golden-crowned kinglet	72
gray catbird	1
hairy woodpecker	1
hermit thrush	4
indigo bunting	2
kinglet species	1
least flycatcher	1
magnolia warbler	28
mourning dove	1
Nashville warbler	1
northern flicker	1
northern mockingbird	1
northern parula	3
northern waterthrush	1
nuthatch species	1
ovenbird	7
palm warbler	1
Philadelphia vireo	2
pine siskin	1
pine warbler	2
prairie warbler	1
purple finch	3
red crossbill	1
red-breasted nuthatch	2
red-eyed vireo	51
red-winged blackbird	1
rose-breasted grosbeak	3
ruby-crowned kinglet	9
ruby-throated hummingbird	2
Savannah sparrow	2
scarlet tanager	2
song sparrow	3
Swainson's thrush	4
swamp sparrow	1
tennessee warbler	1
tree swallow	9

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unidentified bird	3
unidentified crow or raven	1
unidentified flycatcher	2
unidentified passerine	1
unidentified songbird	1
unidentified vireo	1
unidentified warbler	2
veery	2
warbler species	6
white-breasted nuthatch	1
white-throated sparrow	1
white-winged crossbill	1
winter wren	1
wood thrush	2
woodpecker species	1
wren species	1
yellow warbler	1
yellow-bellied flycatcher	3
yellow-bellied sapsucker	7
yellow-rumped warbler	3
yellow-throated vireo	1
raptor	**21**
American kestrel	2
broad-winged hawk	2
Cooper's hawk	1
osprey	1
red-tailed hawk	11
sharp-shinned hawk	4
seabird	**3**
great black-backed gull	1
gull species	1
laughing gull	1
shorebird	**10**
American woodcock	5
killdeer	4
semipalmated sandpiper	1
unknown	**77**

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unidentified bird	75
unidentified large bird	1
unidentified non-passerine	1
waterfowl	**9**
Canada goose	4
common merganser	1
mallard	4
References: Jain et al. 2007; Jain et al. 2008; Jain et al. 2009a, 2009b, 2009c, 2009d; Normandeau 2010; Stantec 2008; Stantec 2009a, 2009b; Stantec 2010a, 20010b; Tidhar and Sonnenberg 2009; and Vlietstra 2008.	

Stantec Consulting
Summary of NE and Midwest avian and bat fatalities

Summary of documented bat fatalities by species in the northeast as of 2011, summarized by Stantec Consulting	
big brown bat	59
eastern pipistrelle	5
eastern red bat	121
hoary bat	462
little brown bat	245
northern long-eared bat	2
silver-haired bat	223
tri-colored bat	2
unidentified bat	20
unidentified myotis	13
References: Jain et al. 2007; Jain et al. 2008; Jain et al. 2009a, 2009b, 2009c, 2009d; Normandeau 2010; Stantec 2008; Stantec 2009a, 2009b; Stantec 2010a, 20010b; Tidhar and Sonnenberg 2009; and Vlietstra 2008.	

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