

Fall 2011 Mist-Net Survey Report

for the Antrim Wind Energy Project
In Antrim, New Hampshire

Prepared for

Antrim Wind Energy, LLC
155 Fleet Street
Portsmouth, NH 03801

Prepared by

Stantec Consulting Services Inc.
30 Park Drive
Topsham, ME 04086



Stantec

December 2011

Table of Contents

1.0	Introduction.....	1
2.0	Methods.....	3
3.0	Results	7
4.0	Discussion	8
5.0	Literature Cited	9

Figures

Figure 1-1	Mist netting location map
Figure 2-1	The North Met survey site at Antrim
Figure 2-2	The Wetland survey site at Antrim
Figure 2-3	The Willard High survey site at Antrim
Figure 2-4	The Willard Low survey site at Antrim

Tables

Table 3-1	Summary of 2011 mist net survey effort and results
-----------	--

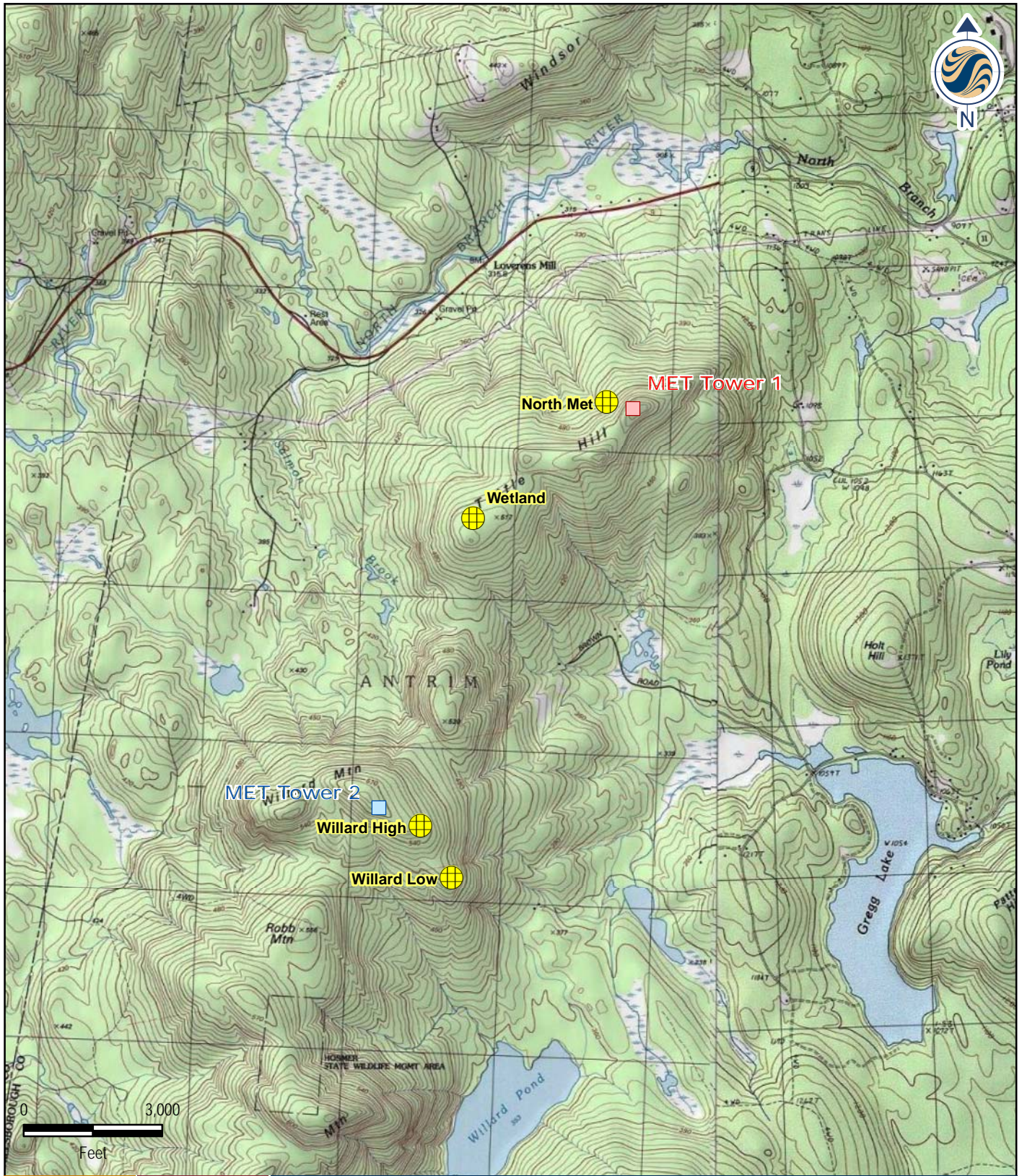
195600689¹

¹ This report was prepared by Stantec Consulting Services Inc. for TRC and Eolian Renewable Energy. The material in it reflects Stantec's judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. Stantec accepts no responsibility for damages, if any suffered by any third party as a result of decisions made or actions based on this report.

1.0 Introduction

Based upon their normal geographical range, eight species of bats occur in New Hampshire, including the little brown bat (*Myotis lucifugus*), northern long-eared bat, (*M. septentrionalis*), eastern small-footed bat (*M. leibii*), silver-haired bat (*Lasionycteris noctivagans*), tri-colored bat (*Perimyotis subflavus*), big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), and hoary bat (*L. cinereus*; BCI 2001). Although none of these species are currently federally-listed, many are of interest. In New Hampshire, the eastern small-footed bat is state-listed as endangered, and the eastern red bat, silver-haired bat, hoary bat, northern long-eared bat, and tri-colored bat are state species of special concern. New Hampshire may soon list the little brown bat and the northern long-eared bat as threatened or endangered due to significant population declines as a result of White-nose Syndrome (WNS).

Both acoustic sampling and mist net surveys can be used at proposed wind facilities to survey for bats. Pre-construction acoustic surveys at the proposed Antrim Wind project area (Project) occurred from April 7 to October 23, 2011. In spring of 2011, the New Hampshire Fish and Game Department (NHFGD) expressed an interest in adding mist netting to the study plan at the Project. While acoustic surveys provide baseline information on bat activity levels and general species composition, and also allow for simultaneous data collection at multiple locations, at varying heights above ground level, and across long time periods, species identification can be difficult for species whose echolocation call characteristics overlap. In particular, species belonging to the genus *Myotis* have very similar echolocation call characteristics, making visual species identification from acoustic data difficult. While a mist net survey does not have the ability to survey the same spatial or temporal extent as acoustic surveys, it does allow for the ability to collect precise species information on captured individuals.



195600689



Stantec

Stantec Consulting Services Inc.




30 Park Drive
Topsham, ME USA
04086

Phone (207) 729-1199

Fax: (207) 729-2715

www.stantec.com

Legend

-  Mist Netting Location
-  Met Tower 1
-  Met Tower 2

Client/Project
TRC Companies, Inc.
Antrim Wind Energy Project
Antrim, New Hampshire

Figure No.

1

Title

Mist Netting Location Map

December 1, 2011

2.0 Methods

The primary objective of summer mist netting was to document the bat species present along the ridges of the Project area. The Indiana bat (*Myotis sodalis*) is the only bat species for which a mist net survey protocol has been developed. Although Indiana bats are not known to occur in New Hampshire, other *Myotis* species in the Northeast share many behavioral and ecological traits with Indiana bats. In lieu of an accepted survey protocol for bats native to New Hampshire, the Indiana bat survey protocol developed by the United States Fish and Wildlife Services (USFWS; 2007) was followed. The acceptable Indiana bat survey period occurs between May 15 and August 15. Sites should be surveyed for a minimum of two nights, and a minimum of two net-sets per site are required, resulting in a minimum of four net-nights (2 net-sets per site x 2 survey nights per site). Net sets should be placed across presumptive travel corridors (e.g., streams or logging trails), and should fill the entire airspace side-to-side and from ground level to canopy height. A successful survey night occurs when temperatures are above 10° Celsius (C; 50° Fahrenheit [F]), wind speeds are low, and there is no precipitation. In addition to the methods derived from the Indiana bat protocol, it was decided that two additional nights of netting would occur at any site where a northern long-eared bat was captured.

Capture effort consisted of erecting two mono-filament nylon mist-net sets (Avinet, Inc., Dryden, NY) spaced at least 30 meters (m; (98 feet [']) apart at each net site. Nets ranged from 6 to 12 m (19.7 to 39.4') in length, and were vertically stacked three nets (7.8 m [25.6']) high in order to completely fill the flight corridor. Net sets were placed perpendicular to potential travel corridors such as logging trails, breaks in a tree line, or over streams or wetlands.

The Project area is located on two distinct mountain peaks: Tuttle Hill and Willard Mountain. Four survey sites were identified based on proximity to probable bat habitat and on opportunities to place mist net sets across presumptive travel corridors along the ridgeline (Figure 1-1). There no suitable mist net sites on the immediate summit of Willard Mountain because timber harvesting activity created largely open areas lacking sufficient canopy coverage and forest gaps necessary to funnel bats into mist nets. Therefore, mist net survey sites on Willard Mountain were located downslope where more suitable locations were found. Similarly, on Tuttle Hill, the North Met site was located downslope of the meteorological (met) tower clearing where conditions were more suitable for mist net placement. However, the wetland survey site was located on the Tuttle Hill ridgeline.

North Met (elevation = 476 m [1,562']): The North Met survey site was located approximately 100 m downslope from the North Met tower. Two mist net sets were deployed across the access road leading to the tower; each set contained 3 mist nets and each mist net was 6 m long. The forest edge along the access road was composed of mixed hardwood/softwood tree species at one mist net set, and primarily softwood tree species at the second set. The surrounding softwood forest was dominated by even-aged stands of spruce (*Picea rubens*), white pine (*Pinus strobus*), and red oak (*Quercus rubra*), with beech (*Fagus grandifolia*), yellow birch (*Betula alleghaniensis*), and cherry (*Prunus* sp.) also present. Dominant tree species had a diameter-at-breast height (dbh) range of 8 to 15 inches and a canopy height of 20 to 25 m.

The forest understory was primarily open and the forest canopy was primarily closed, with canopy gaps over the access road.



Figure 2-1. The North Met survey site at Antrim.

Wetland (elevation = 519 m [1,702']): The Wetland survey site was located in the same opening as the Wetland acoustic detector. Two mist net sets were deployed across the opening on either end. Each set contained three mist nets; one set was 9 m long and the second was 12 m long. The surrounding mixed hardwood/softwood forest was dominated by uneven-aged stands of red maple (*Acer rubrum*), with white pine, spruce, and yellow birch also present. Dominant tree species had a dbh range of 5 to 10 inches and a canopy height of approximately 20 m. The forest understory was primarily cluttered, and the forest canopy was intermediate between open and closed, with canopy gaps scattered throughout the stand.



Figure 2-2. The Wetland survey site at Antrim.

Willard High (elevation = 553m [1,814']): The Willard High survey site was located approximately 300 m downslope from the summit of Willard Mountain. Two mist net sets were deployed across a foot path running within the forest stand located adjacent to the Met tower clearing at the summit of Willard Mountain. Each set contained 3 mist nets, and each mist net was 6 m long. The forest stand was composed of mixed hardwood/softwood tree species, dominated by even-aged stands of spruce and red maple with white birch (*Betula papyrifera*), red oak, and cherry also present. Dominant tree species had a dbh range of 10 to 20 inches and a canopy height of approximately 15 m. The forest understory was primarily open at one mist net set and primarily cluttered at the second set, and the forest canopy was primarily closed with canopy gaps over the trail.



Figure 2-3. The Willard High survey site at Antrim.

Willard Low (elevation = 507m [1,663']): The Willard Low survey site was located approximately 400 m downslope from the Willard High survey site. Two mist net sets were deployed across the access road. Each set contained 3 mist nets; one set was 9 m long and the second was 12 m long. This area was logged heavily approximately one to two years ago, with scattered standing trees remaining in the large clearing. Red oak and red maple dominated the trees left standing in the clearing; white pine, spruce, and white birch could also be found in the surrounding forest stand. Dominant tree species had a dbh range of 10 to 20 inches and a canopy height of approximately 20 m.



Figure 2-4. The Willard Low survey site at Antrim.

Bats captured during surveys were identified to species by a biologist permitted by the NHFGD. The weight, age, sex, reproductive condition, and forearm length was recorded for all captured individuals. Individuals were outfitted with metal arm bands supplied by NHFGD. In order to assist with ongoing studies into effects of WNS, physical abnormalities were noted and a score was given based on the severity of those abnormalities following a system developed by John Reichard at Boston University: *Wing-Damage Index Used for Characterizing Wing Condition of Bats Affected by White-Nose Syndrome*. The scoring system ranks abnormalities from 0 (few to none) to 3 (high) based on the amount of depigmentation of the wing, the presence of scars on wing membranes, or the presence of flaking skin along the forearms. In order to minimize the spread of WNS, Stantec followed the most current decontamination procedures outlined by the USFWS. Prior to the start of field work, all nets and equipment that had previously come into contact with bats were sanitized in 10 percent bleach solution. Disposable paper bags were used for weighing bats and were discarded after one use. Calipers were sanitized after each use. Disposable latex gloves were worn over handling gloves and changed regularly throughout the night.

3.0 Results

Surveys began when minimum nightly temperatures were warm enough to initiate netting activity (above 50°F) to conform to Indiana bat survey protocol and to ensure surveys occurred during the known summer residency period. The first survey night was conducted on July 12, 2011, and the last survey night was conducted on July 28, 2011, during which time a total of 8 survey nights were conducted. One bat was captured during 41 survey hours at four survey sites (Table 3-1).

Table 3-1. Summary of 2011 mist net survey effort and results.				
Site	# Net-nights*	# Cumulative net hours	# Bats captured	Capture Rate**
North Met	4	10	1	0.25
Wetland	4	10.5	0	0.0
Willard High	4	10.25	0	0.0
Willard Low	4	10.25	0	0.0
Overall Results	16	41	1	--
* Net-nights is a sampling unit during which a single net set is deployed during a single survey night. When two net sets are used during a survey night, the sampling effort equals two net-nights, etc.				
** Number of bats captured per net-night				

The single bat capture was a juvenile male big brown bat, captured at the North Met survey site at 9:45 pm on July 27, 2011. It weighed 17.25 grams, had a forearm length of 45 millimeters, and was outfitted with NHFGD band # 43152. It had no evidence of WNS in the form of membrane depigmentation or scarring, and was therefore given a WNS score of 0.

4.0 Discussion

The primary objective of the summer mist-net survey was to document bat species present in the Project area. Mist net sites were placed along the higher elevation ridgelines within the Project area where turbines are being proposed so that individuals captured could be considered to be using the ridges, and therefore at risk of direct impacts from the wind facility. However, only one individual was captured. It is not surprising that a low capture rate was observed at high elevation survey locations. Mist net surveys can be biased toward those species that fly beneath the forest canopy such as North American *Myotis* species (Hayes and Gruber 2000, Kalcounis et al. 1999, Weller and Lee 2007). In New England, these same species are generally found in higher concentrations at lower elevations where temperatures can be warmer and more stable, leading to lower costs for reproductive females (Brack et al 2002).

Still, bats are present and active at higher elevations, albeit in lower concentrations. Therefore, the capture of only a single individual seems best explained by the effects of WNS. As stated previously, mist net surveys can be biased toward species that fly beneath the forest canopy, and these same species are affected by WNS. WNS is causing unprecedented mortality among at least six species of hibernating bats in North America (Frick et al. 2010): eastern small-footed bat, little brown bat, northern long-eared bat, tricolored bat, big brown bat, and Indiana bat (USGS 2010). Three additional species have evidence of the fungus but no reports of mortality: cave myotis (*Myotis velifer*), southeastern bat (*M. austroriparius*) and gray bat (*M. grisescens*;

Turner et al. 2011). All 25 bat species in the United States that rely on hibernation have the potential to be affected by WNS (USGS 2010).

An estimated 1 million bats or more have died since mortalities were first recorded in 2007, and currently WNS has been identified in 16 states and 4 Canadian provinces, with 3 additional states having unconfirmed cases (Turner et al. 2011). Total mortality averaged 95 percent at closely monitored WNS hibernacula that had multiple years of infection in New York, Massachusetts, and Vermont in 2009 (Turner and Reeder 2009), and an analysis of 42 sites in five states (NY, PA, VT, VA, and WV) found an overall population decrease of 88 percent, ranging from a 12 percent decline for small-footed bats to a 98 percent decline for northern long-eared bats (Turner et al. 2011). These observed decreases in little brown bat populations follow predictions by Frick et al. (2010) that the little brown bat may become regionally extinct in the Northeast in 7 to 30 years (Turner et al. 2011).

As a result of decreasing populations, the USFWS is updating its Indiana bat survey methods to include a combination of mist netting and acoustic surveys in order to assess species presence. This new survey protocol will rely on the use of software to quantitatively identify acoustic data to species. It is likely that a combination of species identification via mist netting and acoustic methods will provide greater evidence of species composition in WNS-affected areas.

5.0 Literature Cited

- (BCI) Bat Conservation International. 2001. Bats in Eastern Woodlands.
<http://www.batcon.org/nabcp/newsite/forrep.pdf>. Accessed on November 2007.
- Brack, V., Jr., C. W. Stihler, R. J. Reynolds, C. M. Butchkoski, and C. S. Hobson. 2002. Effect of climate and elevation on distribution and abundance in the mideastern United States. Pages 21-28 in A. Kurta and J. Kennedy, editors. The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, USA.
- Frick, W. F., Pollock, J. F., Hicks, A. C., Langwig, K. E., Reynolds, D. S., Turner, G. G., Butchkoski, C. M., and T. H. Kunz. 2010. An emerging disease causes regional population collapse of a nommon North American bat species. *Science* 329:679-682.
- Hayes, J. P., and J. C. Gruver. 2000. Vertical stratification of activity of bats in an old-growth forest in western Washington. *Northwest Science* 74:102-108.
- Kalcounis, M. C., Hobson, K. A., Brigham, R. M., and K. R. Hecker. 1999. Bat activity in the boreal forest: importance of stand type and vertical strata. *Journal of Mammalogy* 80:673-682.
- Turner, G. G., and D. M. Reeder. 2009. Update of White Nose Syndrome, September 2009. *Bat Research News* 50:47-54.

- Turner, G. G., D. M. Reeder, and J.T.H. Coleman. 2011. A five-year assessment of mortality and geographic spread of White-nose Syndrome in North American bats and a look to the future. *Bat Research News* 52:13-27.
- U.S. Fish and Wildlife Service [USFWS]. 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision. Fort Snelling, Minnesota, USA.
- U.S. Geological Survey [USGS]. 2010. White-Nose Syndrome threatens the survival of Hibernating bats in North America. <<http://www.fort.usgs.gov/WNS/>>. Accessed 18 October 2010.
- Weller, T. J., and Lee, D. C. 2007. Mist net effort required to inventory a forest bat species assemblage. *Journal of Wildlife Management* 71:251-257.