C Acoustical Monitoring Study, Fall 2007 (Woodlot Alternatives, Inc.)

Fall 2007 Bat Migration Survey Report

A Fall 2007 Acoustic Bat Survey of Bat Migration
at the Proposed Ball Hill Windpark, Villenova and Hanover, NY

Prepared for

Noble Environmental Power, LLC
&
Ecology and Environment, Inc

Prepared by

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Executive Summary

During fall 2007, Woodlot Alternatives, Inc. (Woodlot)[1], now Stantec Consulting (Stantec), conducted field surveys of bat migration activity at the Ball Hill Windpark in western New York (project). The surveys are part of the planning process by Noble Environmental Power, LLC (Noble), the developer of that site. These surveys represented the second season of investigation undertaken at this site. Surveys included passive nighttime surveys of bats using bat echolocation detectors. The results of the field surveys provide useful information about site-specific migration activity and patterns in the vicinity of the project.

Two acoustic detectors were deployed in a meteorological measurement tower located in an agricultural field and collected a total of 154 detector-nights from July 30 to October 14, 2007. A total of 541 bat call sequences were recorded by the detectors for a mean detection rate of 3.5 detections per detector-night for both detectors combined. The detection rate was generally slightly higher than other recent fall studies in New York and the region. Habitat, landscape, location, and survey effort probably account for the observed differences.

Bat calls were identified to the lowest possible taxonomic level. Calls were then grouped into four guilds based on call characteristics, because the frequency division detectors do not adequately differentiate among similar calls of some species. The majority of calls (54%) were identified as unknown, followed by species from the big brown guild (36%) and the *myotis* and red bat/eastern pipistrelle guilds (both 5%). This trend in species composition is similar to that of other studies in the region.

[1] Field work and subsequent report filings performed prior to October 1, 2007, were done so as Woodlot Alternatives, Inc. On October 1, 2007, Woodlot Alternatives, Inc. was acquired by Stantec Consulting Services, Inc.

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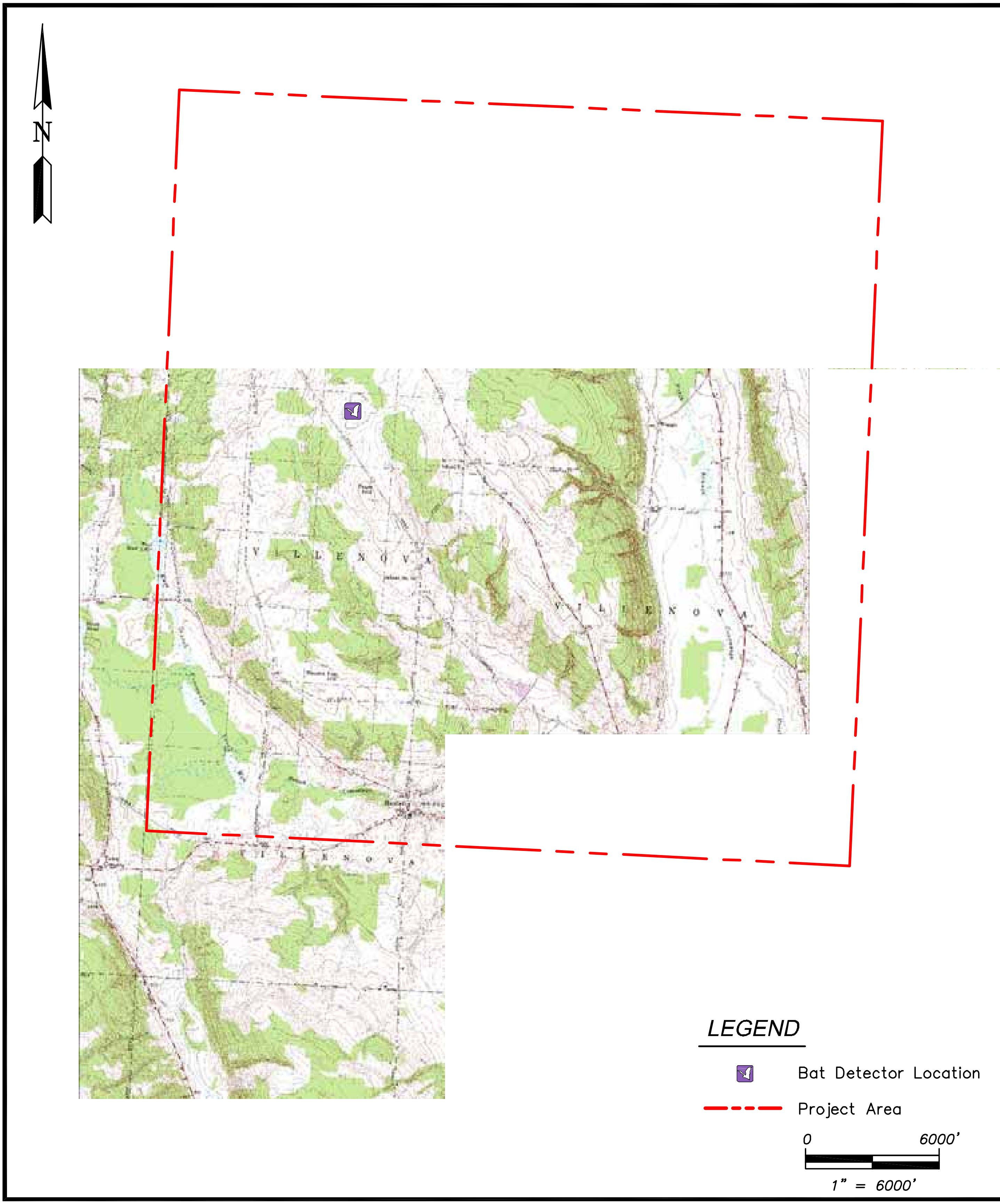
1.0 Introduction

Noble Environmental Power, LLC (Noble) has proposed the construction of a wind development located in Villenova and Hanover, New York (project; Figure 1). The project is located on an agricultural plateau surrounded by gently sloping flat-topped ridges, characteristic of the Cattaraugus Highlands. The project area is approximately 12.9 kilometers (km; 8 miles [mi]) southeast of Lake Erie. The area is largely agricultural and approximately 30 percent of the landscape forested with oak-dominated hardwoods. The elevation of the area ranges from 457 to 518 meters (m) (1,500 to 1,700 feet [']).

Woodlot Alternatives, Inc. (Woodlot), now Stantec Consulting (Stantec)[2], conducted an acoustic detector survey of nocturnal bat migration in the project area during fall 2007 migration period. This is the second of two seasons of bat detector surveys conducted at this site. Acoustic bat detectors allow for long-term monitoring of 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 at Ball Hill was designed to document bat activity patterns near the rotor zone of the proposed turbines and at an intermediate height. Acoustic surveys were also intended to document bat activity patterns in relation to weather factors including temperature and relative humidity.

[2] All field work and any reporting and permitting activities performed prior to October 1, 2007, were conducted as Woodlot Alternatives, Inc. and will be herein referenced as work done by Woodlot. On October 1, 2007, Woodlot Alternatives, Inc. was acquired by Stantec Consulting Services, Inc. Work conducted on or after October 1, 2007, is herein referenced as work done by Stantec.



PREPARED BY:

WOODLOT

Stantec

106193-F001-bat.dwg

SHEET TITLE:

Bat Detector Location Map

PROJECT:

Proposed Noble Ball Hill Windpark
Villenova and Hanover, New York

DATE:	January 30, 2008
SCALE:	1"=6000'
PROJ. NO.:	106193
FIGURE:	1

2.0 Acoustic Bat Survey

Nine species of bats occur in New York, based upon their normal geographical range. These are the little brown bat (*Myotis lucifugus*), northern long-eared bat, (*M. septentrionalis*), Indiana bat (*M. sodalis*), eastern small-footed bat (*M. leibii*), silver-haired bat (*Lasionycteris noctivagans*), eastern pipistrelle (*Pipistrellus subflavus*), big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), and hoary bat (*L. cinereus*) (Whitaker and Hamilton 1998). Of these, the Indiana bat is listed as federally endangered, and the small-footed bat is a state-listed species of special concern. According to the New York Department of Environmental Conservation (NYSDEC), ten Indiana bat hibernacula are present in New York, located in Albany (1), Essex (2), Jefferson (1), Onondaga (1), Ulster (4), and Warren (1) counties. Essex, Warren, Albany, and Ulster counties are located in a north-south band along the Hudson River, whereas Jefferson and Onondaga counties are located more than 250 km (156 mi) northeast of Ball Hill, near the center of the state.

2.1 METHODS

2.1.1 Field Surveys

Two Anabat II detectors (Titley Electronics Pty Ltd.) were deployed for the duration of the fall 2007 acoustic bat survey. Each Anabat detector was coupled with CF Storage ZCAIM (Titley Electronics Pty Ltd.), which programmed the on/off times and stored data on removable 1 GB compact flash cards. Anabat detectors, which record the bat calls for subsequent analysis, are frequency division detectors that divide the frequency of ultrasonic calls made by bats by a factor of 16 so that they are audible to humans. Anabat detectors were selected based upon their widespread use for this type of survey, their ability to be deployed for long periods of time, and their ability to detect a broad frequency range, which allows detection of all species of bats that could occur in the project area.

Two detectors were deployed in a met tower in the project area, the same location used for the spring surveys. The detectors were placed at heights of approximately 20 m (66’) and 40 m (132’) above the ground using the on-site met tower. Deployment in this fashion allowed for data collection at two different heights. The met tower was in an agricultural field in a west-central location in the project area (Figure 1). Detectors were deployed from July 30 through October 14, 2007. Detectors were programmed to record data continuously between 7:00 pm and 7:00 am each night and powered by 12-volt batteries charged by solar panels.

Each solar-powered Anabat system was deployed in a waterproof housing enabling the detector to record while unattended for the duration of the survey. The housing suspends the Anabat microphone downward to give maximum protection from precipitation. To compensate for the downward position, a reflector shield of smooth plastic is placed at a 45-degree angle directly below the microphone. The angled reflector allows the microphone to record the airspace horizontally surrounding the detector and is only slightly less sensitive than an unmodified Anabat unit.

Maintenance visits were conducted approximately every two weeks to check on the condition of the detectors and download data to a computer for analysis. The sensitivity of each Anabat system was set at between six and seven to maximize sensitivity while limiting ambient background noise and interference. The sensitivity of individual detectors was tested using an ultrasonic Bat Chirp (Reno, Nevada) to ensure that the detectors would be able to detect bats up to a distance of at least 10 m (33').

2.1.2 Data Analysis

Potential call files were extracted from data files using CFCread© software. The default settings for CFCread© were used during this file extraction process, as these settings are recommended for the calls or call sequences that are characteristic of northeastern bats. A call is a single pulse of sound produced by a bat. A call sequence is a combination of two or more pulses recorded in a call file. Analook software screens and filters all data recorded by the bat detector and extracts only those files with potential bat calls. Using the default settings for this initial screen also ensures comparability among data sets. Settings used by the filter include a max TBC (time between calls) of 5 seconds, a minimum line length of 5 milliseconds, and a smoothing factor of 50. The smoothing factor refers to whether or not adjacent pixels can be connected with a smooth line. The higher the smoothing factor, the less restrictive the filter is and the more noise files and poor quality call sequences are retained within the data set. Understanding these parameters of these settings is important in terms of determining when individual calls are classified as "unknown".

Following extraction of call files, each retained file was visually inspected to ensure that files created by static or some other form of interference that were still within the frequency range of bats were not included in the data set. Bat calls typically include a series of pulses characteristic of normal flight or prey location ("search phase" calls) and capture periods (feeding "buzzes") and visually look very different than static, which typically forms a diffuse band of dots at either a constant frequency or widely varying frequency, caused by wind, vibration, or other interference. Using these pulse characteristics, bat call files are easily distinguished from non-bat files.

Bat call sequences were individually marked and categorized by species group, or "guild" based on visual comparison to reference calls. Qualitative visual comparison of recorded call sequences of sufficient length to reference libraries of bat calls allows for relatively accurate identification of bat species (O'Farrell *et al*. 1999, O'Farrell and Gannon 1999). A call sequence was considered of suitable quality and duration if the individual call pulses were "clean" (i.e., consisting of sharp, distinct lines) and at least five pulses were included within the sequence. Call sequences were classified to species whenever possible, based on criteria developed from review of reference calls collected by Chris Corben, the developer of the Anabat system, and other bat researchers. However, due to similarity of call signatures among several species, all classified calls have been categorized into four guilds for presentation in this report. This classification scheme follows that of Gannon *et al.* (2003) and is as follows:

- **Myotid (MYSP)** – All bats of the genus *Myotis*. While there are some general characteristics believed to be distinctive for several of the species in this genus, these characteristics do not occur consistently enough for any one species to be relied upon at all times when using Anabat recordings;

- **Red bat/pipistrelle (RBEP)** – Eastern red bats and eastern pipistrelles. Like many of the other northeastern bats, these two species can produce calls distinctive only to each species. However, significant overlap in the call pulse shape, frequency range, and slope can also occur.

- **Big brown/silver-haired/hoary bat (BBSHHB)** – This guild will be referred to as the big brown guild. These species' call signatures commonly overlap and have therefore been included as one guild in this report, and;

- **Unknown (UNKN) –** All call sequences with too few pulses (less than five) or of poor quality (such as indistinct pulse characteristics or background static). These calls were further identified as either "high frequency unknown" (HFUN) for calls above 35 kHz or "low frequency unknown" (LFUN) for calls below 35 kHz.

This guild grouping represents the most conservative approach to bat call identification (Hayes 2000). Since some species do sometimes produce calls unique only to that species, all calls were identified to the lowest possible taxonomic level before being grouped into the listed guilds. Tables and figures in the body of this report will reflect those guilds. However, since species-specific identification did occur in some cases, each guild will also be briefly discussed with respect to potential species composition of recorded call sequences.

Once all of the call files were identified and categorized in appropriate guilds, nightly tallies of detected calls were compiled. Mean detection rates (number of calls/detector-night) for the entire sampling period were calculated for each detector and for all detectors combined. It is important to note that detection rates indicate only the number of calls detected and do not necessarily reflect the number of individual bats in an area. For example, a single individual can produce one or many call files recorded by the bat detector, but the bat detector cannot differentiate among individuals of the same species or similar sounding species producing those calls. Consequently, detections recorded by the bat detector system could over-represent the actual number of animals that produced the recorded calls.

2.1.3 Weather Data

Temperature, relative humidity, and dew point were recorded for the duration of the survey period at 10-minute intervals by data loggers (HOBO Pro v2 U23-001, Onset Computer Corporation) placed on at least one of the bat detector systems. The mean, maximum, and minimum temperature, relative humidity, and dew point were calculated for each night. The data collected by the HOBO datalogger were collected from August 1 to October 14, 2007.

2.2 RESULTS

2.2.1 Detector Call Analysis

Detectors were deployed from July 30 through October 14, 2007 for a total survey period of 154 detector nights. Occasional data gaps occurred when the detectors powered down. A total of 541 bat call sequences were recorded during the sampling period (Table 2-1). The overall mean detection rate for both detectors was 3.5 calls/detector night. Detection rates at both detectors ranged from 3.2 calls/detector-night by the high detector to 3.8 calls/detector-night by the low detector.

Table 2-1. Summary of bat detector field survey effort and results

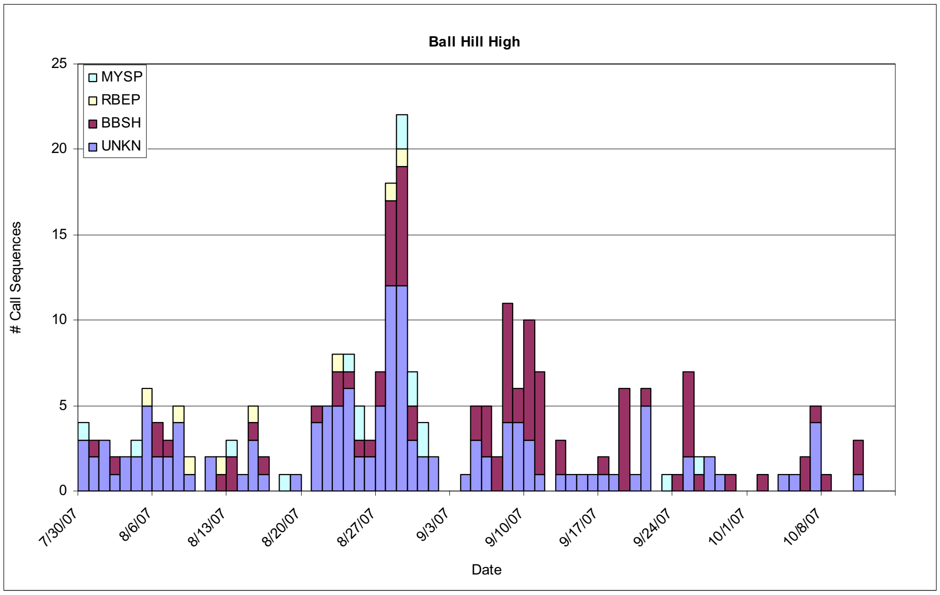
Location	Dates	# Detector-Nights*	# Recorded Sequences	Detection Rate **	Maximum # Calls Recorded ***
High Detector	7/30-10/14	77	246	3.2	22
Low Detector	7/30-10/14	77	295	3.8	20
Overall Results		***154***	***541***	***3.5***	--

* Detector-night is a sampling unit during which a single detector is deployed overnight. On nights when two detectors are deployed, the sampling effort equals two detector-nights, etc.

** Number of bat passes recorded per detector-night.

*** Maximum number of bat passes recorded from any **single** detector for a 12-hour sampling period.

The number of call sequences recorded by each detector ranged from 246 (by the high detector) to 295 (by the low detector). The maximum number of call sequences recorded in one night at the high detector was 22 and at the low detector was 20 (Figure 2). Nights with peak activity occurred in on August 28 and 29 at the high detector, and on September 21 at the low detector, with smaller peaks on September 10 and August 28.



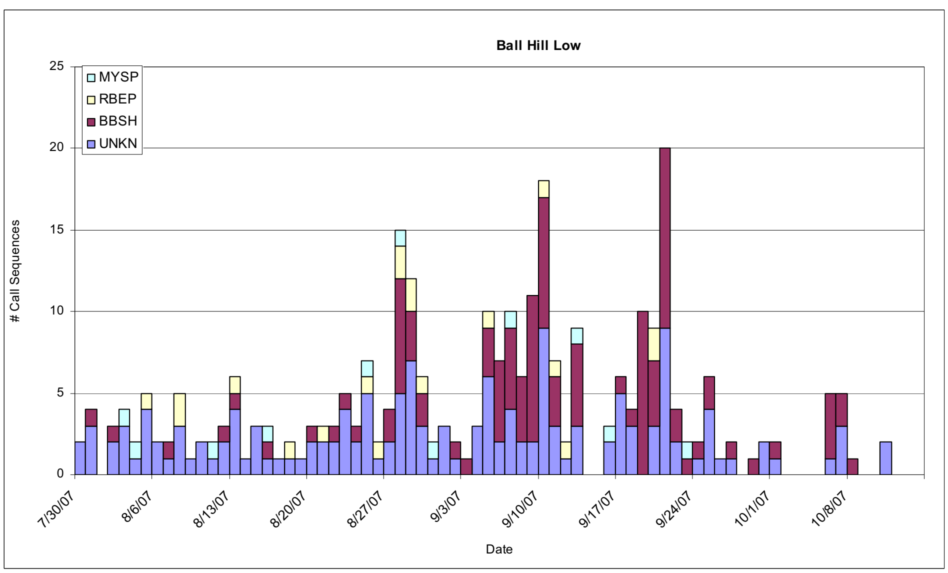


Figure 2. Total nightly bat call sequence detections

The majority of the recorded call sequences (54%) were labeled as unknown due to very short call sequences (less than five pulses) or poor call signature formation (probably due to a bat flying at the edge of the detection zone of the detector or flying away from the microphone) (Table 2-2). Of the calls that were identified to species or guild, those of the BBSHHB guild were the most common (36% of all call sequences) followed by the species within the RBEP and MYSP guilds (both at 5% of all call sequences). Species composition was similar between the high and low detectors (Figure 2).

Table 2-2. Summary of the composition of recorded bat call sequences.

Detector	Guild				Total
	Big brown guild	Red bat/ E. pipistrelle	Myotis	Unknown	
High Detector	86	8	15	137	246
Low Detector	111	19	11	154	295
Total	***197***	***27***	***26***	***291***	***541***

Appendix A provides a series of tables with more specific information on the nightly timing, number, and species composition of recorded bat call sequences. Specifically, Appendix A Tables 1 and 2 provide information on the number of call sequences, by guild and suspected species, recorded at each detector and the weather conditions for that night. Upon request, Stantec can provide a table with the detailed information for all 541 recorded call sequences, including the Analook file name, the night during which the call sequence was recorded, the timing of the recording, and the suspected identity of the species recorded.

Overall, the nightly timing of bat activity peaked at approximately 8:00 pm (Figure 3).

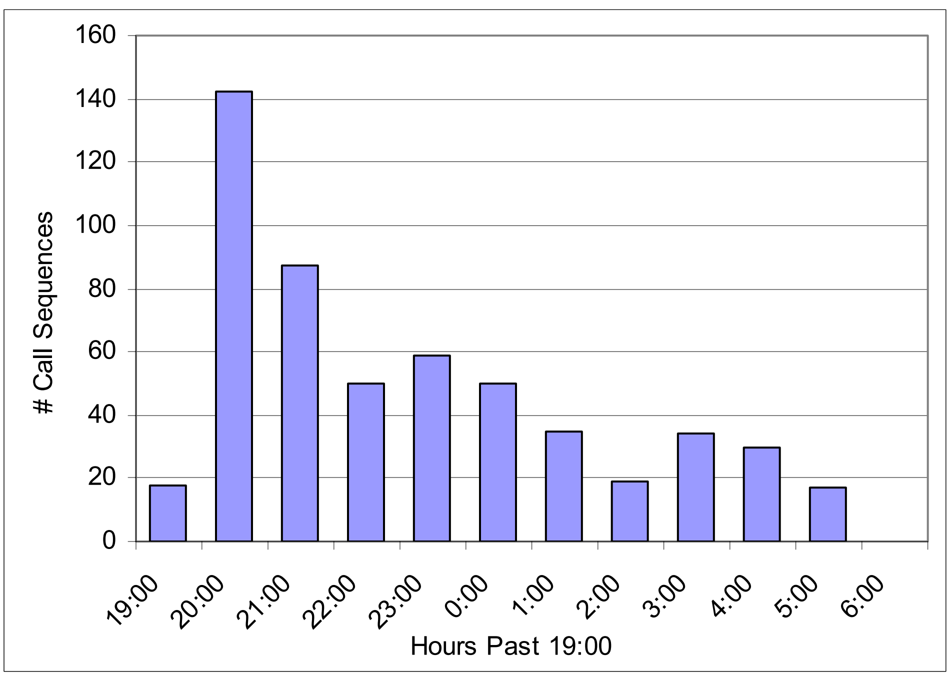


Figure 3. Hourly distribution of bat call sequences recorded by both detectors

2.2.2 Weather Data

Mean nightly temperatures varied between 6.1º C (43º F) and 23.7º C (74.6º F), with an overall mean of 16.3ºC (61.3º F; Figure 4). Nightly mean relative humidity ranged from 57 percent to 99 percent (Figure 5). A linear regression of recorded echolocation sequences and mean nightly temperature and echolocation sequences and mean nightly humidity found no correlations at both detectors (Figure 6).

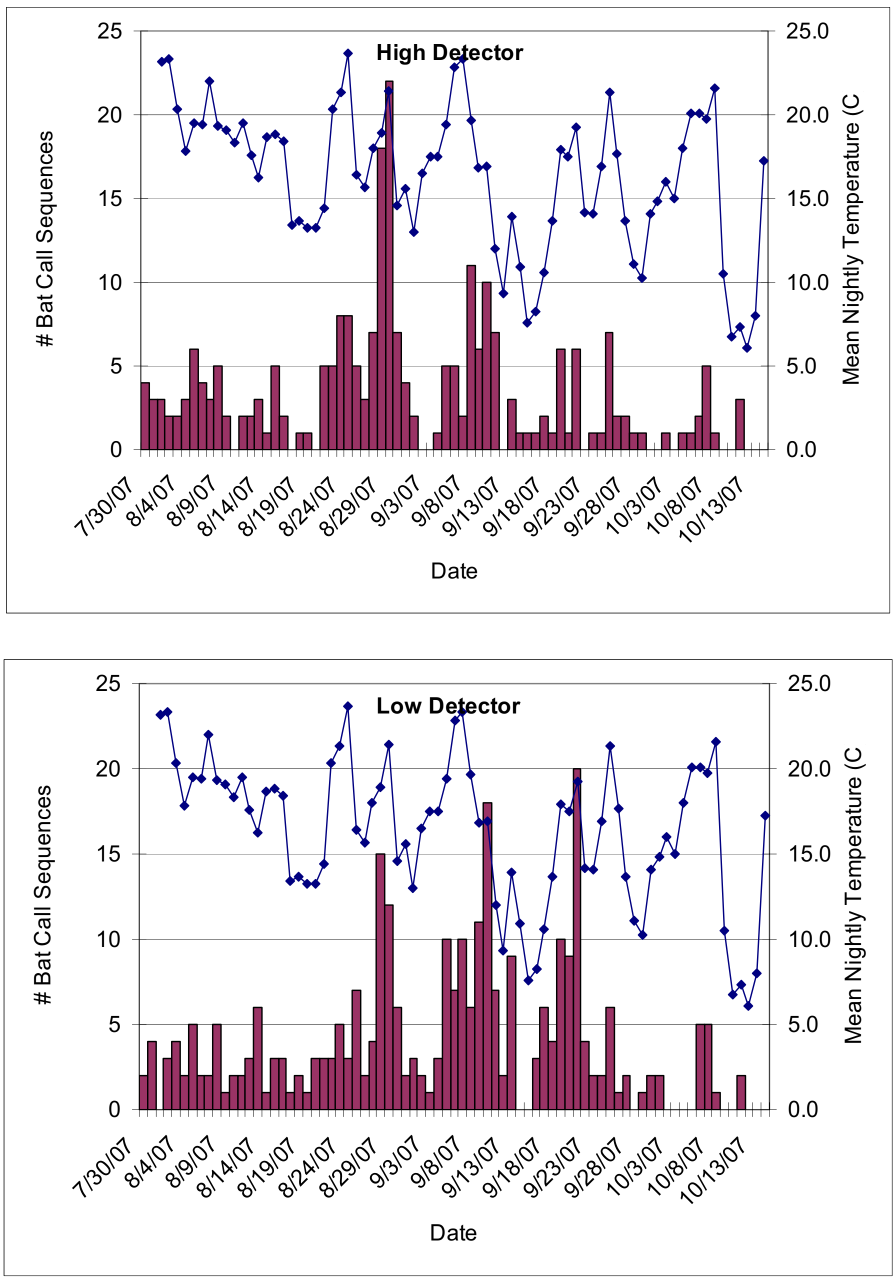
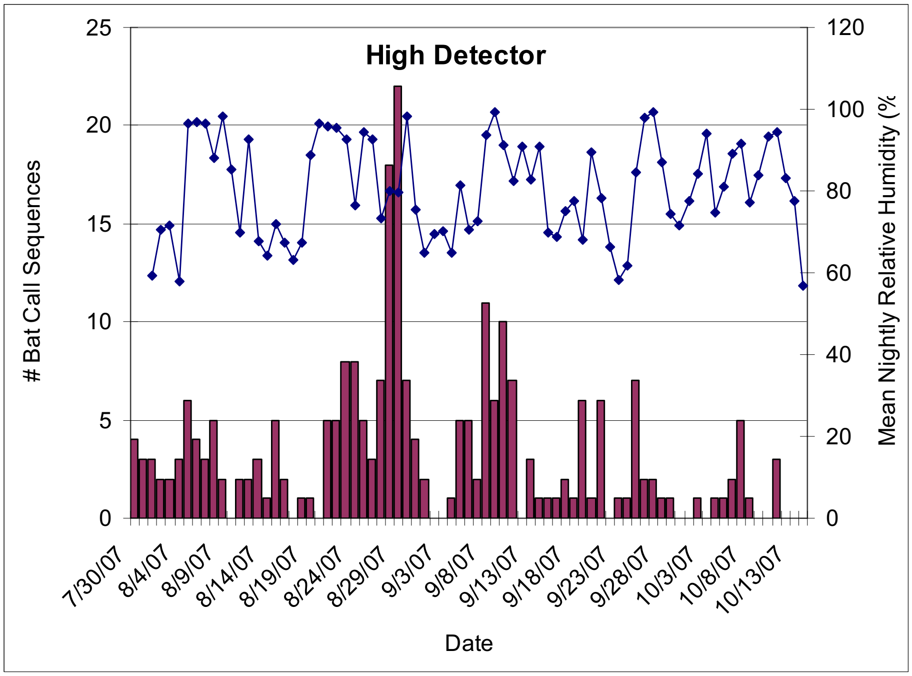


Figure 4. Nightly mean temperature (Celsius; blue line) and bat detections



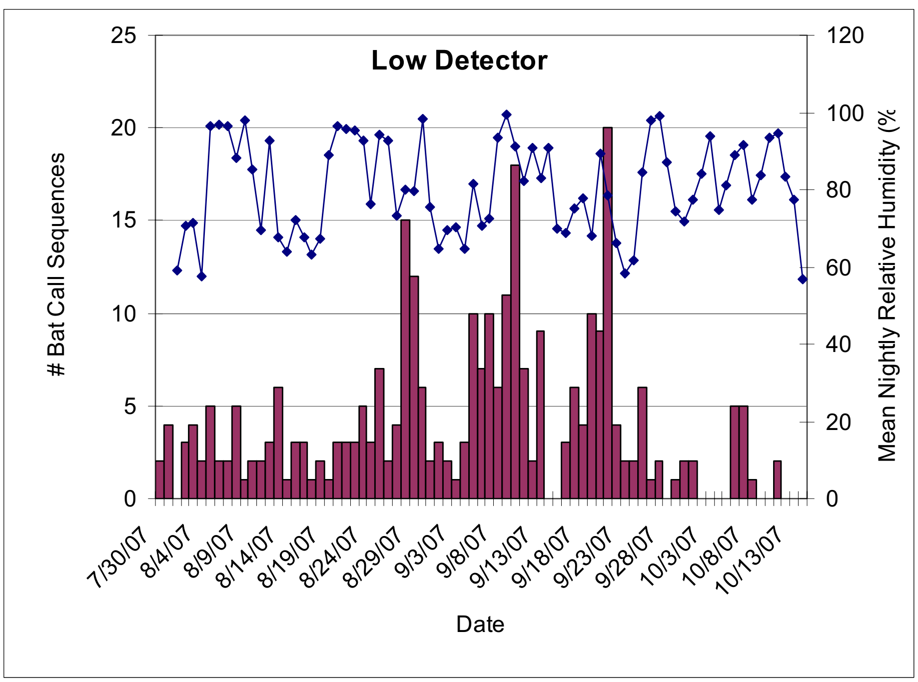


Figure 5. Nightly mean relative humidity (blue line) and bat detections

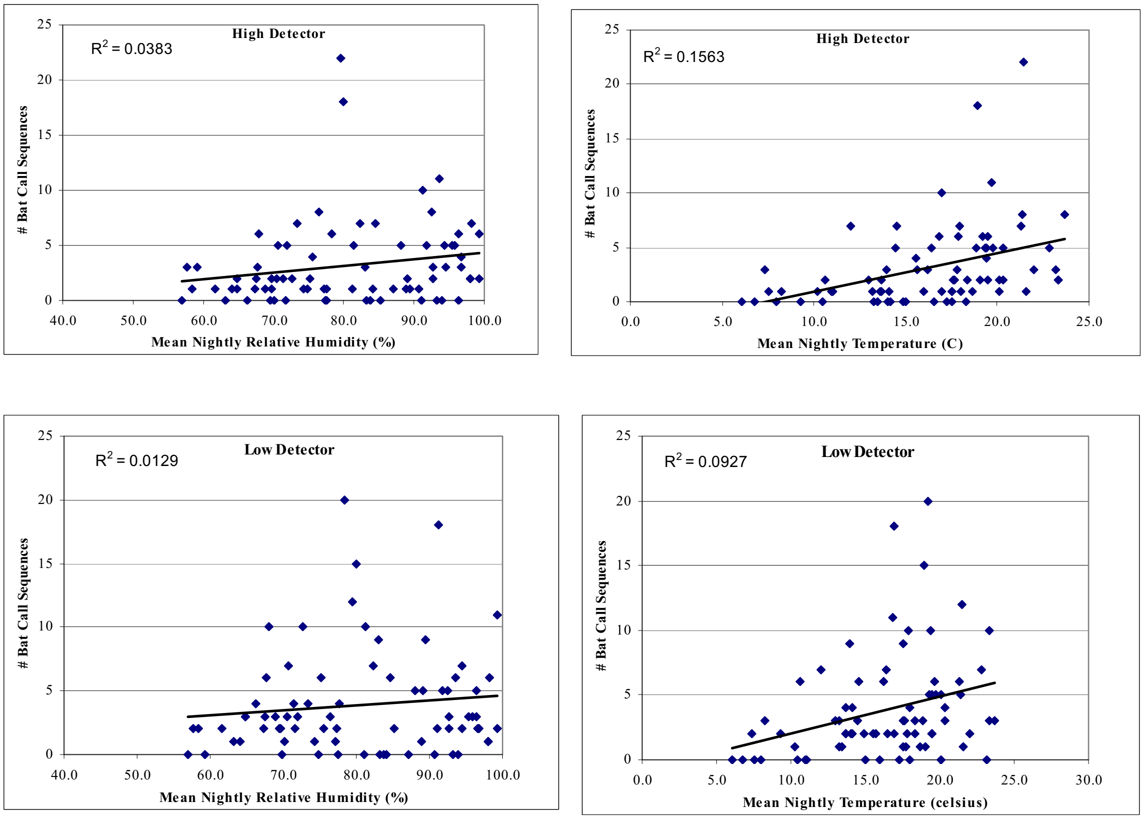


Figure 6. Relationship between mean nightly relative humidity (left) and bat activity levels and mean nightly temperature (right) and bat activity levels.

2.3 DISCUSSION

Fall bat echolocation surveys at Ball Hill documented moderate levels of bat activity from August through mid October. The overall mean detection rate during the fall survey period was 3.5 calls/detector-night. These rates are similar to other fall bat detector surveys conducted recently (Appendix A, Table 3).

Bat calls were identified to guild within this report, although calls were provisionally categorized by species when possible during analysis. Certain species, such as the eastern red bat and hoary bat have easily identifiable calls, whereas other species, such as the big brown bat and silver-haired bat, are difficult to distinguish acoustically. Similarly, certain members of the *Myotis* genus, such as the little brown bat are far more common and have slightly more distinguishable calls than other species. The following paragraphs discuss each guild separately and address likely species composition of recorded bats within each guild.

The MYSP guild includes all four species of *Myotis* potentially occurring in the project area, including the little brown bat, northern long-eared bat, eastern small-footed bat, and the federally endangered Indiana bat. Of these species, the little brown bat and northern long-eared bat are by far the most common and have calls that tend to be slightly more distinguishable using the Anabat system. None of the 26 *Myotis* calls recorded at Ball Hill during the fall 2007 survey could be identified to a particular species of *Myotis*.

The RBEP guild includes the eastern pipistrelle and eastern red bat. Eastern red bats have relatively unique calls which span a wide range of frequency and have a characteristic hooked shape and variable minimum frequency. Eastern pipistrelles tend to have relatively uniform calls, with a constant minimum frequency and a sharply curved profile. Of the 27 calls classified as RBEP, 19 were classified as red bats, one call was classified as an eastern pipistrelle and seven were classified as RBEP because they lacked sufficient characteristics to be identified definitively as either species. Eastern pipistrelles tend to be solitary foragers, often feeding over water and emerging around sunset, whereas eastern red bats will occasionally forage in groups of 20-30 individuals and emerge 1-2 hours after sunset (DeGraaf and Yamasaki 2001).

The BBSHHB guild includes the big brown bat, silver-haired bat, and hoary bat. Within this grouping, the hoary bat has easily distinguishable calls characterized by highly variable minimum frequencies often extending below 20 kHz, and a hooked profile similar to the eastern red bat. Calls of silver-haired bats and big brown bats are occasionally distinguishable, but often overlap in range and can be difficult to distinguish, especially when comparing short duration calls typical of those recorded during passive monitoring. Of the 197 calls classified as BBSHHB, 52 were classified as silver-haired bats, 30 were hoary bats, 1 was a big brown bat, and 114 lacked sufficient characteristics to be label as a specific species of the BBSHHB guild. Typically with this type of survey there is a noticeable difference in species distribution between the high and low detectors, with the larger species of the BBSHHB guild recorded more frequently at higher elevations and smaller species such as those of the MYSP guild recorded at the lower detectors. The high and the low detectors at Ball Hill, however, recorded similar numbers of species within the BBSHHB guild.

Of the 541 total calls recorded at Ball Hill, 291 or 54 percent were classified as UNKN, due to their short duration or poor quality. These unknown calls were identified as “high frequency” or “low frequency”. The high and low met tower detectors recorded similar numbers and composition of unknown bat calls. The high detector recorded 137 unknown bat calls; 38 percent of those were high-frequency (n = 52) and 62 percent were low-frequency (n = 85). The low detector recorded 154 unknown bat call sequences; 40 percent were high frequency (n=62), 59 percent were low-frequency (n = 91), and one was classified as an unknown. Both the high and low detectors recorded more BBSHHB call sequences than any other guild. The characteristics of low frequency unknown calls at both the high and low detectors appear similar to calls belonging to the BBSHHB guild.

Differences in detection rates among guilds at the high and low detectors may reflect varying vertical distribution and habitat preferences of bat species (Hayes 2000). Recent research (Arnett *et al*. 2006) found that small *Myotis* species were more frequently recorded at lower heights while larger species were typically recorded more often at higher heights. In forested habitat, both large and small species were recorded in greater numbers at a medium height of 22 m, rather than at 1.5 m or 44 m. In comparison, the detectors in the project both had similar species composition. This similarity in composition could be due to deployment in a met tower in an agricultural habitat, which is not the preferred habitat for foraging bats,

Bat activity patterns during migration seem to be related to weather conditions based on mortality studies and acoustic surveys. Acoustic surveys have documented a decrease in bat activity rates as wind speeds increase and temperatures decrease, and bat activity has been shown to correlate negatively to low nightly mean temperatures (Hayes 1997, Reynolds 2006). Similarly, weather factors appeared related to bat collision-mortality rates documented at two facilities in the southeastern United States, with mortality rates negatively correlated with both wind speed and relative humidity, and positively correlated to barometric pressure (Arnett 2005). These patterns suggest that bats are more likely to migrate on nights with low wind speeds (less than 4-6 m/s) and generally favorable weather (warm temperatures, low humidity, high barometric pressure). In general bat activity at both the high and the low detector decreased as the mean nightly temperature decreased.

Overall activity was similar relative to other surveys and appeared to vary by time of night, with a peak in activity occurring around 8:00 p.m. Patterns of bat activity within nights are known to vary, and anywhere from one to several peaks of activity have been documented. Anthony *et al*. (1981) documented that bats appear to leave roosting sites at dusk to forage for a given period, return to their roosts during the middle portion of the night, then forage again later in the evening, closer to dawn.

Results of acoustic surveys must be interpreted with caution. Considerable room for error exists in identification of bats based upon acoustic calls alone, especially if a site or regionally specific library of recorded reference calls is not available. Also, detection rates are not necessarily correlated with the actual numbers of bats in an area, because it is not possible to differentiate among individual bats (Hayes 2000). Stantec can provide a digital file of all acoustic calls, including all information about species identification and timing of calls from each detector on an hourly and nightly basis, should that information be desired.

2.4 CONCLUSIONS

Acoustic bat surveys during fall 2007 documented low rates of bat activity. Identification of calls suggested that members of the big brown guild were the most common species at the site during the fall period. Most calls could not be identified properly, due to poor call quality or short duration of calls. Comparison with bat activity levels and weather variables did not identify any strong correlations, although it appeared that bats were more active on warmer nights, which is consistent with results of other bat acoustic surveys in the region.

3.0 Literature Cited

Anthony E. L. P., M. H. Stack, T. H. Kunz. 1981. Night roosting and the nocturnal time budget of the little brown bat, *Myotis lucifugus:* Effects of reproductive status, prey density, and environmental conditions. Oecologia 51:151–6.

Arnett, E. B., editor. 2005. Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of bat fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International, Austin, Texas, USA.

Arnett, E. B., J. P. Hayes, and M. M. P. Huso. 2006. An evaluation of the use of acoustic monitoring to predict bat fatality at a proposed wind facility in south central Pennsylvania. An annual report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.

DeGraaf, Richard M. and M. Yamasaki. 2001. New England Wildlife: Habitat, Natural History, and Distribution. University Press of New England. Lebannon, New Hampshire.

Gannon, W.L., R.E. Sherwin, and S. Haywood. 2003. On the importance of articulating assumptions when conducting acoustic studies of habitat use by bats. Wild. Soc. Bull. 31 (1):45–61.

Hayes J. P. 1997. Temporal variation in activity of bats and the design of echolocation-monitoring studies. Journal of Mammalogy 78:514–24.

Hayes, J.P. 2000. Assumptions and practical considerations in the design and interpretation of echolocation-monitoring studies. Acta Chiropterologica 2(2):225-236.

O’Farrell, M.J., and W.L. Gannon. 1999. A comparison of acoustic versus capture techniques for the inventory of bats. Journal of Mammalogy 80(1):24–30.

O’Farrell, M.J., B.W. Miller, and W.L. Gannon. 1999. Qualitative identification of free-flying bats using the anabat detector. Journal of Mammalogy 80(1):11–23.

Reynolds, D. S. 2006. Monitoring the potential impacts of a wind development site on bats in the Northeast. Journal of Wildlife Management 70(5):1219 – 1227.

Whitaker, J.O., and W.J. Hamilton. 1998. *Mammals of the Eastern United States*. Cornell University Press.

Woodlot Alternatives, Inc. 2005a. A Radar and Acoustic Survey of Bird and Bat Migration at the Proposed Liberty Gap Wind Project in Franklin, West Virginia – Fall 2004. Prepared for US Wind Force, LLC.

_____. 2005b. A Fall 2004 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Windfarm Prattsburgh Project in Prattsburgh, New York. Prepared for UPC Wind Management, LLC.

_____. 2005l. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Marble River Wind Project in Clinton and Ellenburg, New York. Prepared for AES Corporation.

_____. 2005m. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Clayton Wind Project in Clayton, New York. Prepared for PPM Atlantic Renewable.

_____. 2005n. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed High Sheldon Wind Project in Sheldon, New York. Prepared for Invenergy.

_____. 2005o. A Fall 2005 Survey of Bird and Bat Migration at the Proposed Howard Wind Power Project in Howard, New York. Prepared for Everpower Global.

_____. 2005p. A Fall 2005 Radar Survey of Bird and Bat Migration at the Proposed Top Notch Wind Project in Fairfield, New York. Prepared for PPM Atlantic Renewable.

_____. 2005q. A Fall 2005 Radar and Acoustic Survey of Bird and Bat Migration at the Proposed Jordanville Wind Project in Jordanville, New York. Prepared for Community Energy, Inc.

_____. 2005r. Summer and Fall 2005 Bird and Bat Surveys at the Proposed Munnsville Wind Project in Munnsville, New York. Prepared for AES-EHN NY Wind, LLC.

_____. 2005s. A Fall 2005 Radar and Acoustic Survey of Bird and Bat Migration at the Proposed Deerfield Wind Project in Searsburg and Readsboro, Vermont. Prepared for Deerfield Wind LLC and Vermont Environmental Research Associates.

_____. 2005t. A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Mars Hill Wind Project in Mars Hill, Maine. Prepared for UPC Wind Management, LLC.

_____. 2005u. A Fall 2005 Survey of Bat Migration at the Proposed Redington Wind Power Project in Redington, Maine. Prepared for Maine Mountain Power.

_____. 2006a. Avian and Bat Information Summary and Risk Assessment for the Proposed Sheffield Wind Power Project in Sheffield, Vermont. Prepared for UPC Wind Management, LLC.

_____. 2006c. Avian and Bat Information Summary and Risk Assessment for the Proposed Cohocton Wind Power Project in Cohocton, New York. Prepared for UPC Wind Management, LLC.

_____. 2006j. A Fall 2006 Survey of Bird and Bat Migration at the Proposed Chateaugay Windpark in Chateaugay, New York. Prepared for Ecology and Environment, Inc. and Noble Environmental Power, LLC.

_____. 2006l. A Fall 2006 Survey of Bird and Bat Migration at the Proposed Centerville and Wethersfield Windparks in Centerville and Wethersfield, New York. Prepared for Ecology and Environment, Inc. and Noble Environmental Power, LLC.

_____. 2006m. Summer/Fall 2006 Survey of Bat Activity at the Proposed Kibby Wind Power Project in Kibby and Skinner Townships, Maine. Prepared for TransCanada Maine Wind Development Inc.

_____. 2007a. A Fall 2006 Survey of Bird and Bat Migration at the Proposed Lempster Mountain Wind Power Project in Lempster, New Hampshire. Prepared for Lempster Wind, LLC.

_____. 2007b. A Fall 2006 Survey of Bird and Bat Migration at the Proposed Stetson Mountain Wind Power Project in Washington County, Maine. Prepared for Evergreen Wind V, LLC.

Appendix A

Bat survey results

Appendix A Table 1. Summary of acoustic bat data and weather during each survey night at the Ball Hill High detector – Fall 2007

		BBSHHB				**RBEP**			**MYSP**	**UNKN**					
Night of	**Operated Okay?**	**big brown bat**	**hoary bat**	**silver-haired bat**	**silver-haired/big brown**	**eastern pipistrelle**	**eastern red bat**	**pipistrelle/red bat**	**MYSP**	**high-frequency**	**low-frequency**	**unknown**	**Total**	**Relative Humidity (%)**	**Temperature (ºC)**
7/30/07	Y								1	1	2		**4**		
7/31/07	Y		1							1	1		**3**		
8/1/07	Y									3			**3**	59.2	23.2
8/2/07	Y		1							1			**2**	70.5	23.3
8/3/07	Y									1	1		**2**	71.5	20.3
8/4/07	Y								1	2			**3**	57.7	17.8
8/5/07	Y						1			3	2		**6**	96.4	19.5
8/6/07	Y				2						2		**4**	96.7	19.4
8/7/07	Y				1						2		**3**	96.6	22.0
8/8/07	Y							1		4			**5**	88.1	19.3
8/9/07	Y						1			1			**2**	98.1	19.0
8/10/07	Y												**0**	85.2	18.3
8/11/07	Y									1	1		**2**	69.7	19.5
8/12/07	Y		1					1					**2**	92.8	17.6
8/13/07	Y				2				1				**3**	67.8	16.2
8/14/07	Y										1		**1**	64.1	18.7
8/15/07	Y		1				1			2	1		**5**	72.0	18.8
8/16/07	Y				1					1			**2**	67.5	18.4
8/17/07	Y												**0**	63.3	13.5
8/18/07	Y								1				**1**	67.4	13.7
8/19/07	Y										1		**1**	88.9	13.2
8/20/07	Y												**0**	96.4	13.2
8/21/07	Y				1					2	2		**5**	95.9	14.4
8/22/07	Y									2	3		**5**	95.4	20.3
8/23/07	Y		1		1		1			1	4		**8**	92.5	21.4
8/24/07	Y		1						1	1	5		**8**	76.4	23.7
8/25/07	Y			1					2	1	1		**5**	94.4	16.4
8/26/07	Y				1					2			**3**	92.7	15.7
8/27/07	Y		1		1					2	3		**7**	73.3	18.0
8/28/07	Y		1	2	2		1			1	11		**18**	79.9	19.0
8/29/07	Y		2	1	4		1		2	2	10		**22**	79.5	21.4
8/30/07	Y			1	1				2	2	1		**7**	98.2	14.6
8/31/07	Y								2	2			**4**	75.6	15.6
9/1/07	Y									2			**2**	64.8	13.0
9/2/07	Y												**0**	69.5	16.5
9/3/07	Y												**0**	70.2	17.5
9/4/07	Y									1			**1**	64.9	17.5
9/5/07	Y			2							3		**5**	81.3	19.4
9/6/07	Y		1		2						2		**5**	70.7	22.8
9/7/07	Y				2								**2**	72.7	23.3
9/8/07	Y			1	6					1	3		**11**	93.6	19.7
9/9/07	Y		1	1						1	3		**6**	99.4	16.8
9/10/07	Y		1		6					1	2		**10**	91.2	16.9
9/11/07	Y				6						1		**7**	82.4	12.0
9/12/07	Y												**0**	91.0	9.3
9/13/07	Y			1	1						1		**3**	83.0	14.0
9/14/07	Y									1			**1**	90.8	10.9
9/15/07	Y									1			**1**	69.8	7.6
9/16/07	Y									1			**1**	68.9	8.2
9/17/07	Y		1								1		**2**	75.2	10.6
9/18/07	Y										1		**1**	77.6	13.7
9/19/07	Y		2	1	3								**6**	68.0	17.9
9/20/07	Y										1		**1**	89.5	17.5
9/21/07	Y				1						5		**6**	78.4	19.2
9/22/07	Y												**0**	66.3	14.2
9/23/07	Y								1				**1**	58.4	14.1
9/24/07	Y		1										**1**	61.6	16.9
9/25/07	Y			2	3						2		**7**	84.6	21.3
9/26/07	Y			1					1				**2**	98.0	17.7
9/27/07	Y									2			**2**	99.2	13.7
9/28/07	Y									1			**1**	87.1	11.0
9/29/07	Y			1									**1**	74.4	10.2
9/30/07	Y												**0**	71.7	14.1
10/1/07	Y												**0**	77.4	14.9
10/2/07	Y				1								**1**	84.1	16.0
10/3/07	Y												**0**	94.0	15.0
10/4/07	Y										1		**1**	74.8	18.0
10/5/07	Y									1			**1**	81.1	20.1
10/6/07	Y			1	1								**2**	89.1	20.1
10/7/07	Y			1							4		**5**	91.7	19.8
10/8/07	Y			1									**1**	77.2	21.6
10/9/07	Y												**0**	83.8	10.5
10/10/07	Y												**0**	93.3	6.8
10/11/07	Y				2						1		**3**	94.5	7.4
10/12/07	Y												**0**	83.2	6.1
10/13/07	Y												**0**	77.6	8.0
10/14/07	Y												**0**	57.0	17.3
By Species		**0**	**17**	**18**	**51**	**0**	**6**	**2**	**15**	**52**	**85**	**0**	**246**		
By Guild		**86**				**8**			**15**	**137**					
		BBSHHB				**RBEP**			**MYSP**	**UNKN**			**Total**		

n/o - indicates that detector was not operating on that night

Appendix A Table 2. Summary of acoustic bat data and weather during each survey night at the Ball Hill Low detector – Fall 2007

		BBSHHB				RBEP			MYSP	UNKN					
Night of	Operated Okay?	big brown bat	hoary bat	silver-haired bat	silver-haired/big bro	eastern pipistrelle	eastern red bat	pipistrelle/red bat	MYSP	high-frequency	low-frequency	unknown	Total	Relative Humidity (%)	Temperature (ºC)
7/30/07	Y									1	1		**2**		
7/31/07	Y		1								3		**4**		
8/1/07	Y												**0**	59.2	23.2
8/2/07	Y		1							1	1		**3**	70.5	23.3
8/3/07	Y								1		3		**4**	71.5	20.3
8/4/07	Y								1		1		**2**	57.7	17.8
8/5/07	Y						1			2	2		**5**	96.4	19.5
8/6/07	Y										2		**2**	96.7	19.4
8/7/07	Y				1					1			**2**	96.6	22.0
8/8/07	Y					1	1			3			**5**	88.1	19.3
8/9/07	Y									1			**1**	98.1	19.0
8/10/07	Y									2			**2**	85.2	18.3
8/11/07	Y								1			1	**2**	69.7	19.5
8/12/07	Y		1							2			**3**	92.8	17.6
8/13/07	Y				1		1			3	1		**6**	67.8	16.2
8/14/07	Y									1			**1**	64.1	18.7
8/15/07	Y									2	1		**3**	72.0	18.8
8/16/07	Y	1							1	1			**3**	67.5	18.4
8/17/07	Y									1			**1**	63.3	13.5
8/18/07	Y						1			1			**2**	67.4	13.7
8/19/07	Y										1		**1**	88.9	13.2
8/20/07	Y		1							1	1		**3**	96.4	13.2
8/21/07	Y						1			1	1		**3**	95.9	14.4
8/22/07	Y				1					1	1		**3**	95.4	20.3
8/23/07	Y				1					1	3		**5**	92.5	21.4
8/24/07	Y				1						2		**3**	76.4	23.7
8/25/07	Y						1		1	2	3		**7**	94.4	16.4
8/26/07	Y							1		1			**2**	92.7	15.7
8/27/07	Y				2					1	1		**4**	73.3	18.0
8/28/07	Y			6	1		2		1	3	2		**15**	79.9	19.0
8/29/07	Y			3			1	1		2	5		**12**	79.5	21.4
8/30/07	Y				2		1			3			**6**	98.2	14.6
8/31/07	Y								1	1			**2**	75.6	15.6
9/1/07	Y									3			**3**	64.8	13.0
9/2/07	Y		1								1		**2**	69.5	16.5
9/3/07	Y				1								**1**	70.2	17.5
9/4/07	Y									1	2		**3**	64.9	17.5
9/5/07	Y			3			1			1	5		**10**	81.3	19.4
9/6/07	Y		1	1	3						2		**7**	70.7	22.8
9/7/07	Y		1		4				1		4		**10**	72.7	23.3
9/8/07	Y			1	3					1	1		**6**	93.6	19.7
9/9/07	Y		1	1	7					1	1		**11**	99.4	16.8
9/10/07	Y		1	2	5			1			9		**18**	91.2	16.9
9/11/07	Y				3			1			3		**7**	82.4	12.0
9/12/07	Y						1			1			**2**	91.0	9.3
9/13/07	Y			4	1				1		3		**9**	83.0	14.0
9/14/07	Y												**0**	90.8	10.9
9/15/07	Y												**0**	69.8	7.6
9/16/07	Y								1	2			**3**	68.9	8.2
9/17/07	Y		1							4	1		**6**	75.2	10.6
9/18/07	Y		1								3		**4**	77.6	13.7
9/19/07	Y		1	3	6								**10**	68.0	17.9
9/20/07	Y				4		1	1		1	2		**9**	89.5	17.5
9/21/07	Y			7	4						9		**20**	78.4	19.2
9/22/07	Y				2					2			**4**	66.3	14.2
9/23/07	Y				1				1				**2**	58.4	14.1
9/24/07	Y				1					1			**2**	61.6	16.9
9/25/07	Y			1	1					1	3		**6**	84.6	21.3
9/26/07	Y									1			**1**	98.0	17.7
9/27/07	Y		1							1			**2**	99.2	13.7
9/28/07	Y												**0**	87.1	11.0
9/29/07	Y			1									**1**	74.4	10.2
9/30/07	Y									1	1		**2**	71.7	14.1
10/1/07	Y				1					1			**2**	77.4	14.9
10/2/07	Y												**0**	84.1	16.0
10/3/07	Y												**0**	94.0	15.0
10/4/07	Y												**0**	74.8	18.0
10/5/07	Y												**0**	81.1	20.1
10/6/07	Y			1	3						1		**5**	89.1	20.1
10/7/07	Y				2						3		**5**	91.7	19.8
10/8/07	Y				1								**1**	77.2	21.6
10/9/07	Y												**0**	83.8	10.5
10/10/07	Y												**0**	93.3	6.8
10/11/07	Y										2		**2**	94.5	7.4
10/12/07	Y												**0**	83.2	6.1
10/13/07	Y												**0**	77.6	8.0
10/14/07	Y												**0**	57.0	17.3
By Species		**1**	**13**	**34**	**63**	**1**	**13**	**5**	**11**	**62**	**91**	**1**	**295**		
By Guild		**111**				**19**			**11**	**154**					
		BBSHHB				**RBEP**			**MYSP**	**UNKN**			**Total**		

n/o - indicates that detector was not operating on that night

Appendix A Table 3. Summary of available fall bat detector survey results			
Project Site	**Landscape**	**Calls Per Detector Night**	**Citation**
Fall 2004			
Prattsburgh, Steuben County, NY	Agricultural plateau	2.22	Woodlot 2005b
Cohocton, Steuben County, NY	Agricultural plateau	2.00	Woodlot 2005b
Sheffield, Caledonia County, VT	Forested ridge	1.76	Woodlot 2006a
Franklin, Pendleton County, WV	Forested ridge	9.24	Woodlot 2005a
Fall 2005			
Churubusco, Clinton County, NY	Great Lakes plain/ADK foothills	5.56	Woodlot 2005l
Clayton, Jefferson County, NY	Agricultural plateau	4.70	Woodlot 2005m
Sheldon, Wyoming County, NY	Agricultural plateau	34.92	Woodlot 2005n
Howard, Steuben County, NY	Agricultural plateau	31.06	Woodlot 2006o
Cohocton, Steuben County, NY	Agricultural plateau	1.57	Woodlot 2006c
Fairfield, Herkimer County, NY	Agricultural plateau	1.70	Woodlot 2005p
Jordanville, Herkimer County, NY	Agricultural plateau	4.79	Woodlot 2005q
Munnsville, Madison County, NY	Agricultural plateau	2.32	Woodlot 2005r
Sheffield, Caledonia County, VT	Forested ridge	1.18	Woodlot 2006a
Deerfield, Bennington County, VT	Forested ridge	0.52	Woodlot 2005s
Redington, Franklin County, ME	Forested ridge	4.20	Woodlot 2005u
Mars Hill, Aroostook County, ME	Forested ridge	0.83	Woodlot 2005t
Fall 2006			
Chateaugay, Clinton County, NY	Agricultural plateau	5.10	Woodlot 2006j
Brandon, Franklin County, NY	Agricultural plateau	13.10	Woodlot 2006j
Wethersfield, Wyoming County, NY	Agricultural plateau	0.30	Woodlot 2006l
Centerville, Allegany County, NY	Agricultural plateau	0.06	Woodlot 2006l
Sheffield, Caledonia County, VT	Forested ridge	1.10	Woodlot 2006a
Lempster, Sullivan County, NH	Forested ridge	3.47	Woodlot 2007a
Kibby, Franklin County, ME	Forested ridge	0.20	Woodlot 2006m
Stetson, Penobscot County, ME	Forested ridge	2.60	Woodlot 2007b