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## PROTOCOL

# CASSADAGA WIND SOUND MONITORING AND COMPLIANCE PROTOCOL



55 Railroad Row  
White River Junction, VT 05001  
802.295.4999  
[www.rsginc.com](http://www.rsginc.com)

**PREPARED FOR:**  
CASSADAGA WIND, LLC

**SUBMITTED BY:**  
RSG





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## 1.0 INTRODUCTION

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This is a post-construction sound monitoring protocol for the Cassadaga Wind project. It covers the methodology for a post-construction compliance test and complaint response.

Clause (l) of Stipulation 19-1001.19 requires that Cassadaga Wind LLC establish a protocol for monitoring sound levels in the vicinity of its Project following its construction and upon assumption of normal operations:

“A post-construction noise evaluation protocol and studies that will be performed to establish conformance with operational noise design goals.”

This document details the sound monitoring protocol and complaint resolution procedure needed to meet these requirements.

## 2.0 FIRST-YEAR SOUND MONITORING PROTOCOL

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The protocol is enumerated as follows:

### ***Timing***

- 1) Sound monitoring will take place immediately following the first full year of operation to assess compliance with the permitted noise limits that are established in the Article 10 Certificate and Town wind laws.

### ***Locations***

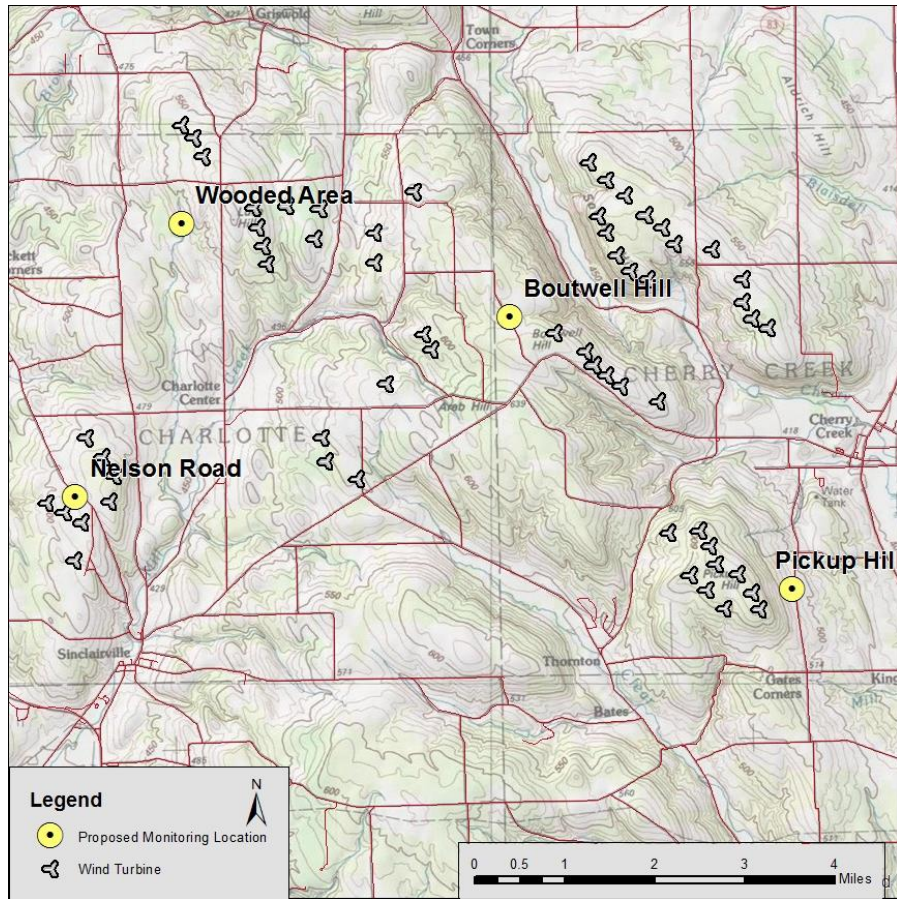
- 2) Monitoring stations will be set up at the following locations at which pre-construction sound level monitoring was conducted (see Table and Figure, below):

<b>Location</b>	<b>Distance to closet wind turbine (ft)</b>	<b>Modeled Sound Level (dB)</b>
<b>Nelson Road</b>	1,145	45.7 <sup>1</sup>
<b>Pickup Hill</b>	2,305	43.7
<b>Boutwell Hill</b>	2,600	39.9
<b>Wooded Area</b>	4,130	38.4

Nelson road, Pickup Hill, and Boutwell Hill are adjacent to homes.

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<sup>1</sup> This is a participating location



**MAP OF PRE-CONSTRUCTION MONITORING LOCATIONS FOR CASSADAGA**

- 3) Up to three additional sound monitoring locations will be identified for monitoring, representing areas where complaints were received during the first full year of operation. If more than three locations received complaints, then three will be selected based on the modeled sound levels of each location and how well a site can represent other complaint locations. Consideration of whether monitoring will be done at a location will also be based on
  - a) The type of complaint,
  - b) Whether the complaint was due to a continuing operational issue or a non-recurring event,
  - c) Whether the modeled sound level is above 40 dBA (see Section 3.6, below), and
  - d) Whether the landowner cooperates with the study.

**Equipment Setup**

- 4) Each monitoring station shall meet the following criteria:
  - a) Sound level meters shall be certified to meet the Type 1 or Type 2 accuracy requirements as specified in ANSI S1.4 and IEC 61672-1.

- b) Sound level meter microphones shall be placed in accordance with the following criteria. If, at a given site, any of these criteria interfere with the others, they shall take precedence in the order listed:
  - i) The microphone shall be fitted with a hydrophobic windscreen of diameter 7 inches.
  - ii) The microphone shall be placed outside, approximately 1.5 meters above the ground.
  - iii) The microphone shall not be placed such that any structure blocks the line of sight between the microphone and otherwise visible wind turbines.
  - iv) The microphone location at each site will be placed no closer than 7 meters to the nearest reflective surface facing wind turbines, such as the wall of a building, to the extent practical.
  - v) The microphone shall be located in such a way that it is representative of the noise exposure at the monitoring location.
- c) Each sound level meter shall be calibrated immediately before and after each monitoring period, and during any battery checks. Any calibration drift will be noted.
- d) When an anemometer is included as part of a monitoring station, it will be placed at the same height as that of the microphone at that location.

**Data Collection**

- 5) Sound levels and spectra as  $L_{EQ}(1\text{-sec})$  will be logged at one-second time intervals over the entire monitoring period. These include
  - i) A-weighted sound levels
  - ii) 1/3-octave band sound level spectra from, at a minimum, 20 Hz to 10,000 Hz
- 6) Additional supporting data to be logged during the monitoring period shall include:
  - a) Temperature and rainfall data during the monitoring period, either measured at the site (in 10-minute intervals), or from meteorological data reported from the Chautauqua County airport (station KJHW), substituted as a proxy.
  - b) Wind speed and wind direction as measured at each turbine nacelle within 1.5 miles of each monitoring location, logged at 10-minute intervals.
  - c) Power output at each turbine logged at 10-minute intervals.
- 7) Background sound levels shall be determined using turbine shutdown periods.
  - a) All wind turbines within 1.5 miles of each monitoring station shall be shut down for 10 minutes on each of six occasions.
  - b) The shutdown periods shall occur between the hours of 7 pm and 7 am
  - c) The shutdown periods shall be selected so as to cover a variety of hub height wind speeds. During at least one shutdown, the combined average of the hub height wind speeds for all turbines within one mile of each sound monitor will exceed the wind speed that of the highest sound power ( $\pm 1$  dB).



- d) The sound levels measured during the periods one hour prior to and one hour following each shutdown period shall be designated as “Turbine-plus-background” sound levels at each monitoring location.<sup>2</sup>
- e) The sound levels measured during the shutdown period shall be designated as “Background.”
- f) If the average wind speed during the Background period is greater than 1 m/s different from the Turbine-plus-background period, then the results will either be excluded, or adjustments for background levels to account for changing wind speed may be used.

### **Data Analysis**

- 8) The data resulting from the monitoring period shall be analyzed as follows:
  - a) For both Background and Turbine-plus-background monitoring periods, data shall be excluded from analysis if any of the following conditions occurs:
    - i) The presence of contaminating sound caused by human or other activity;
    - ii) Ground level wind gust speeds exceeding 5 m/s or creating notable contaminating noise;
    - iii) Ambient temperatures outside the specified limits of the monitoring equipment;
    - iv) Precipitation in the form of rain, sleet, or hail.
    - v) Humidity outside the monitoring equipment specifications.
  - b) Periods for which data must be excluded for a given station can be determined by one or more of the following methods:
    - i) Examining (listening to) the station’s audio recordings;
    - ii) Analyzing the spectrograms of logged sound levels;
    - iii) Applying data from the meteorological instrumentation.
  - c) Data that are contaminated by high-frequency sound emitted by insects, birds, and amphibians, may be low-pass filtered using an “Ai” weighting.<sup>3</sup>
  - d) For those nighttime periods during which Turbine-plus-background sound levels exceed 45 dBA, Background will be subtracted to determine the sound level attributable to the Project (Turbine-only level).
    - i) The Background level is the adjusted Background  $L_{EQ}$  with a factor added for uncertainty according to ANSI S12.9 Part 3 Clause 7.3.
    - ii) The sound level attributed to turbine operations shall be determined by subtracting, on an energy basis, the Background from the Turbine-plus-background level, by 1/3 octave band.

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<sup>2</sup> Studies have shown that sound levels can be elevated for a few minutes when wind turbines start up after a manual shutdown. Therefore, the Turbine-plus-background period after the turbine shutdown will start three to five minutes after all turbines have restarted to allow time to return to normal operation.

<sup>3</sup> “Ai” weighting eliminates sound for all frequencies above 1,250 Hz. “Ai” weighting is described in “Proposed ‘Ai’-weighting; A weighting to remove insect noise from A-weighted field measurements”, Paul D. Schomer, Ian M. Slauch, and George F. Hessler, InterNoise Proceedings, Volume 221, pp. 3991-4000 (2010).

- iii) Background sound levels determined by subtraction for a given shutdown period shall be considered of sufficient accuracy only if the Turbine-plus-background sound level exceeds the Background sound level by at least 3 dB.
- e) If, after subtraction, the sound level attributed to turbine operations (Turbine-only) exceeds 45 dBA outside, audio recordings of the sound and other data will be examined to determine whether the wind turbine contributed to the sound received at the station.
- f) 1/3-octave band  $L_{EQ(10\text{ min})}$  will be evaluated to identify periods with steady pure tones using the criteria of ANSI S12.9 Part 3 Annex B<sup>4</sup>.
  - i) Tonal periods will be further screened to determine if the tonal sound is audible and if so, originated from the wind turbines.
  - ii) Wind turbine tonal periods will be identified along with the tonal frequency.

### **Reporting**

- 9) Cassadaga Wind shall submit a report within six weeks of the end of the sound monitoring that includes the following information.<sup>5</sup>
  - a) The locations of all sound monitors and the distance from each to the nearest turbine;
  - b) A summary of all data collected, including sound levels, meteorological data at the monitoring stations, and turbine operating conditions;
  - c) A list of periods with Turbine-only sound levels greater than the 45 dBA nighttime design goal at monitoring stations representing non-participating permanent receptors or 50 dBA  $L_{10}$  Town standard at monitoring stations representing non-participating permanent and seasonal homes, and/or have audible pure tones. Details of the analyses of each of those periods will be provided.
  - d) An Appendix listing sound levels around each shutdown and the nacelle wind speed and power output for each turbine in 10-minute intervals around the turbine shutdowns during the monitoring period
- 10) The raw data collected at any monitoring station will be made available in electronic form upon request. However, audio recordings from those stations will not be made available if they contain recognizable human speech or other human activities for which there may be concerns over privacy.

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<sup>4</sup> The Arkwright and Cherry Creek tonal sound methodologies are modeled after this ANSI standard.

<sup>5</sup> Some portions of the report may include information proprietary to the turbine operator, in which case distribution of that information would be limited per an appropriate protective agreement.

### 3.0 COMPLAINT RESOLUTION

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The following complaint resolution procedure assures that nearby residents' concerns regarding wind turbine noise are addressed in a timely manner while, at the same time, preventing abuse of the complaint process.

This complaint resolution process shall be in place for the life of the Project. This process can be amended at any time as mutually agreed to by the NYS DPS and Cassadaga Wind.

The complaint resolution procedure shall be as follows:

#### ***Receiving a complaint***

- 1) Cassadaga Wind shall provide the name of the person who can be contacted in the case of a complaint, as well as the phone number by which that person can be reached, and post this with the Town Clerk of each town the project is located.
- 2) Cassadaga Wind shall provide an acknowledgement to the complainant of a properly filed complaint within two business days.
- 3) Because of the complexity of wind turbine noise complaint resolution, the full cooperation of the complainant and adherence to this protocol are necessary to its success.
- 4) Complainants are requested to provide to Cassadaga Wind the following information related to a potentially offending incident:
  - a) Location at which the sound was observed;
  - b) The date and time on which the sound was observed;
  - c) Relevant weather conditions prevailing at the time the sound was observed. Such conditions would include, for example, presence of snow cover, cloudiness, any precipitation, and the approximate wind direction and speed.
  - d) A description of the sound that was observed.
- 5) Cassadaga Wind shall record the complainant's information, as well as the meteorological conditions, turbine operating status, and turbine power output that were logged during the period indicated in the complaint.

#### ***Complaint response***

- 6) If (1) the complainant represents a permanent residence within one mile of any turbine, and (2) based on monitoring and/or modeling, there appears to be a reasonable possibility that the sound level induced by the Project is greater than 40 dBA at the complainant's location, and (3) the sound is not related to Project maintenance or abnormal operational conditions, then Cassadaga Wind will investigate the incident as follows:
  - a) Determine whether the sound level at the complaint location is likely to be greater than 40 dBA by reviewing the pre-construction sound modeling.
  - b) Cassadaga Wind shall respond to the complainant in each case. However, Cassadaga Wind is not required to conduct additional sound testing if:
    - i) the modeled sound level is not greater than 40 dBA, or

- ii) the complaint has occurred as a result of abnormal operation. In this case, Cassadaga Wind shall make necessary repairs.
- 7) Cassadaga Wind shall conduct sound monitoring if:
  - a) The complaint location is further than 0.5 miles from any post-construction sound monitoring locations, or
  - b) If there is a reasonable possibility that conditions have changed that affect wind turbine sound levels, or
  - c) The last sound monitoring was conducted more than five years ago.
- 8) Cassadaga Wind will not, as a result of additional complaints, repeat sound monitoring in a representative area during any five-year period following the first complaint response procedure for that area, unless changes in system operation or turbine maintenance can be reasonably assumed to have resulted in higher turbine sound levels. This clause shall not be construed as impeding a party from petitioning the NYS DPS for additional sound level monitoring, nor does it exclude the NYS DPS from requiring additional sound level monitoring during this period in order to address extenuating circumstances.
- 9) During the first year of operation, sound monitoring in response to complaints will be addressed as part of the first-year Sound Monitoring Protocol in Section 2.
- 10) Cassadaga Wind may request that a Complainant maintain a written log of potentially offending sound events over some reasonable period of time, in order to assist in identifying influences that may affect the sound from the turbines. If the identified influences demonstrate that follow-up sound monitoring is warranted, Cassadaga Wind shall make all reasonable efforts to conduct such monitoring under conditions similar to those existing at the time the complaint arose.
- 11) Cassadaga Wind shall inform a resident when it intends to conduct any exterior sound monitoring and cooperate with the resident to determine an appropriate location for the monitoring equipment.

### **Reporting**

- 12) Cassadaga Wind shall submit a report with the official results of complaint-based monitoring to the complainant, the NYS DPS and the Town Clerk of the complainant town within 45 days of completion of that monitoring. This report shall include the following information as collected during the entire complaint monitoring period:
  - a) Wind speed and direction
  - b) Operational status of the turbines
  - c) Summary sound levels, and
  - d) Raw sound level data as logged by the sound level meter throughout the monitoring period.
- 13) If, as the result of a complaint resolution, it is determined that the sound level at any non-participating permanent residence, attributable to the Project, is above the 45 dBA  $L_{EQ(8)}$  nighttime design goal Cassadaga Wind shall take steps to identify the issue and evaluate practical measures to further minimize sound levels at the receptor. If complaint resolution monitoring determines the sound level at any non-participating

residence or seasonal home, attributable to the Project, is above the 50 dBA L<sub>10</sub> Town standard, Article 10 Certificate sound limits, or has audible pure tones, using the calculation procedures of Section 2, Cassadaga Wind shall take remedial steps to identify and mitigate the issue.

