Appendix J: Sound Level Assessment Report, Ball Hill Wind Project

SOUND LEVEL ASSESSMENT REPORT

Ball Hill Wind Project
Towns of Villenova & Hanover
Chautauqua County, NY

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TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY 1-1

2.0 PROJECT OVERVIEW 2-1

3.0 SOUND METRICS 3-1

4.0 NOISE REGULATIONS 4-1
- 4.1 Federal Regulations 4-1
- 4.2 New York State Regulations 4-1
- 4.3 Local Regulations 4-1
- 4.4 NYSDEC Guidelines 4-2

5.0 EXISTING SOUND LEVELS 5-1

6.0 FUTURE CONDITIONS 6-1
- 6.1 Equipment and Operating Conditions 6-1
  - 6.1.1 Vestas V126-3.45 Wind Turbines 6-1
  - 6.1.2 Transformers 6-2
- 6.2 Modeling Methodology 6-2
- 6.3 Modeling Sound Level Results 6-4

7.0 EVALUATION OF SOUND LEVELS 7-1
- 7.1 Local Regulations 7-1
- 7.2 NYSDEC Criteria 7-3
- 7.3 Low Frequency Sound 7-4
- 7.4 Construction Noise 7-5

8.0 CONCLUSIONS 8-1

LIST OF APPENDICES

Appendix A Vestas V126-3.45 Sound Level Modeling Results

LIST OF FIGURES

Figure 3-1 Common Sound Levels in the Environment 3-3

Figure 6-1 Predicted Maximum Project-Only L_{10} Sound Levels – Vestas V126-3.45 6-6

LIST OF TABLES

Table 4-1	Thresholds for Sound Pressure Level Increases	4-2
Table 6-1	Vestas V126-3.45 Broadband Sound Power Level (dBA) as a Function of Wind Speed	6-1
Table 6-2	Vestas V126-3.45 Octave-Band Sound Power Levels (dBA)	6-1
Table 6-3	Comparison of Background SPL and Vestas V126-3.45 Turbine PWL to Determine "Critical-Case" Design Wind Speed	6-2
Table 6-4	Transformer Sound Power Levels[1] (dBA)	6-2
Table 7-1	Tonal Analysis: Vestas V126-3.45 Sound Power Level Emissions	7-1
Table 7-2	Tonal Analysis: Vestas V126-3.45 Received Sound Pressure Levels	7-2
Table 7-3	Predicted Worst-Case Low Frequency Sound Levels	7-4

1.0 EXECUTIVE SUMMARY

Epsilon Associates, Inc. (Epsilon) has conducted a sound level assessment for Renewable Energy Systems Americas, Inc. (RES) of the Ball Hill Wind Project, a proposed wind power generation facility in Chautauqua County, New York. RES is considering up to 29 wind turbine generators comprised of Vestas V126-3.45 units with a hub height of 87 meters and a rotor diameter of 126 meters. The study references a previously completed sound-monitoring program conducted to determine existing sound levels in the vicinity of the Project, includes computer modeling to predict future sound levels when the wind turbines and the associated electrical substations are operational, and compares the operational sound levels to applicable state and local criteria.

Sound impacts associated with all 29 proposed wind turbine generators and two proposed electrical transformers were modeled at 768 discrete receptor locations, including the closest structures, using Cadna/A noise calculation software. Maximum operational sound levels at all of the nearest structures to the Project are predicted to be equal to or less than 50 dBA, in compliance with local noise limits specified by the Towns of Hanover and Villenova. Additionally, the Project is anticipated to meet the suggested noise guidelines recommended by the New York State Department of Environmental Conservation (NYSDEC) to avoid the potential for adverse noise impacts in the community.

An evaluation was also performed to assess tonality and low frequency sound with respect to Project operation. No pure tones were identified in the sound power level spectra for the Vestas V126-3.45 unit, or in the calculated received sound pressure levels at the closest structure to the Project. Low frequency sound levels at all modeled structures are also well below the recommended criteria to avoid disturbance indoors as well as any potential vibration and rattle.

2.0 PROJECT OVERVIEW

Renewable Energy Systems Americas, Inc. (RES) is proposing to install twenty-nine (29) Vestas V126-3.45 wind turbines and a 5.8 mile 115kV transmission line at the proposed Ball Hill Wind Project site (the Project) located in the Towns of Hanover and Villenova in Chautauqua County, NY. Hessler Associates, Inc. (Hessler) completed a background sound level monitoring program in March 2008 to determine existing sound levels in the vicinity of the Project. Epsilon Associates, Inc. (Epsilon) has conducted computer modeling to predict future sound levels when the proposed wind turbines and associated electrical transformers would be operational. The results of this analysis and an evaluation of compliance with applicable criteria are presented herein.

3.0 SOUND METRICS

There are several ways in which sound levels are measured and quantified, all of which use the logarithmic decibel (dB) scale to accommodate the wide range of sound intensities found in the environment. An interesting property of the logarithmic scale is that the sound pressure levels of two distinct sounds are not directly additive. For example, if a sound of 50 dB is added to another sound of 50 dB, the total sound level is only a three-decibel increase (to 53 dB), not a doubling to 100 dB. Thus, every three dB change in sound level represents a doubling or halving of sound energy. A change in sound level of less than three dB is generally considered just perceptible to the human ear[1].

Another property of the decibel scale is that if one source of sound is 10 dB (or more) louder than another source, then the quieter source does not contribute significantly to the overall sound level which remains the same as that of the louder source. For example, the combined sound level of a source of sound at 60 dB plus another source of sound at 47 dB is simply 60 dB.

The sound level meter used to measure noise is a standardized instrument.[2] It contains "weighting networks" to adjust the frequency response of the instrument to approximate that of the human ear under various conditions. One network is the A-weighting network (there are also B- and C-weighting networks). The A-weighted scale (dBA) most closely approximates how the human ear responds to sound at various frequencies, and is typically used for community sound level measurements[3]. Sounds are frequently reported as detected with the A-weighting network of the sound level meter. A-weighted sound levels emphasize the middle frequency (*i.e.,* middle pitched – around 1,000 Hertz (Hz) sounds), and de-emphasize lower and higher frequency sounds. A-weighted sound levels are reported in decibels designated as "dBA." For reference, sound pressure levels for some common indoor and outdoor environments are shown in Figure 3-1.

Two methods exist for describing sounds in our environment that vary with time: these are exceedance levels and the equivalent level, both of which are derived from a large number of moment-to-moment A-weighted sound level measurements. Several sound level metrics that are commonly reported in community sound monitoring programs are described below.

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[1] Bies, David A., and Hansen, Colin H. *Engineering Noise Control: Theory and Practice*. 4th ed. New York: Spon Press, 2009. 85. Print

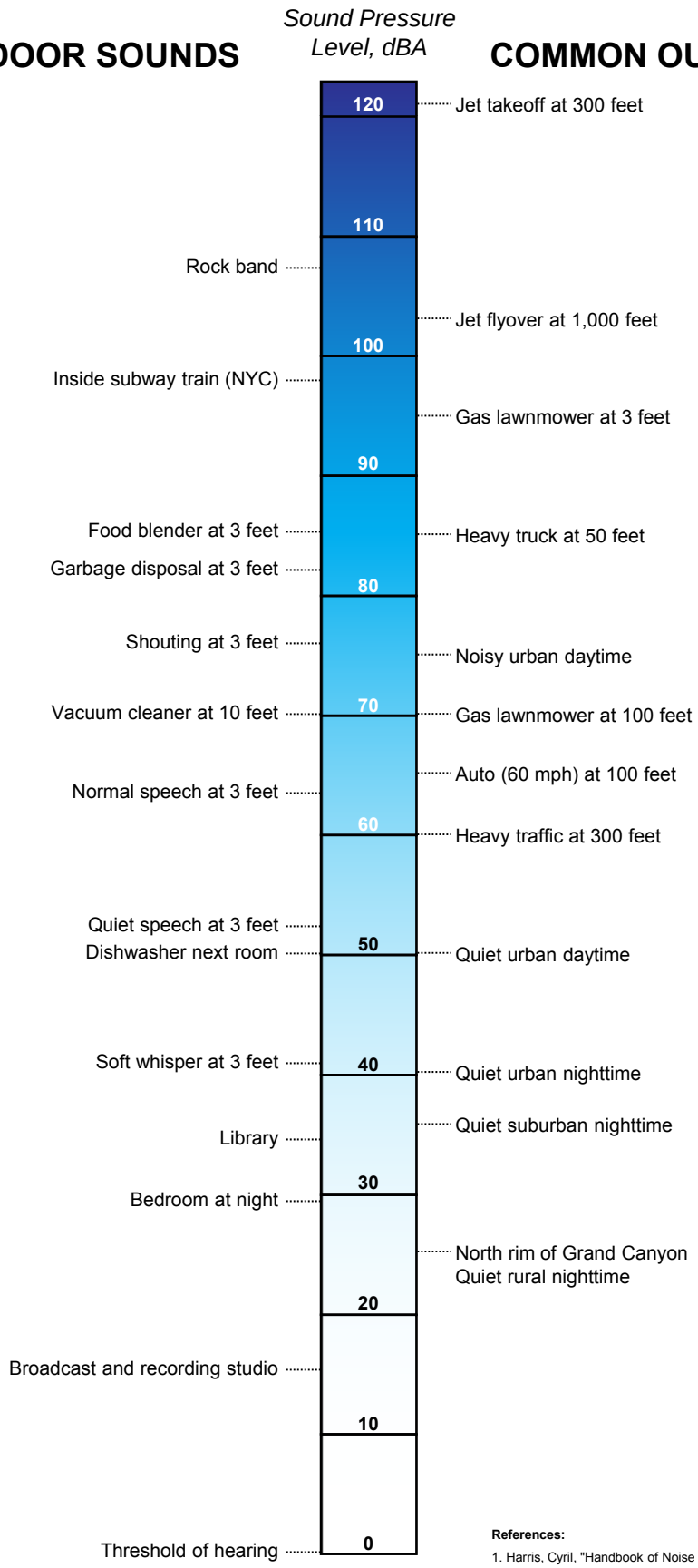
[2] American National Standards Institute. *"ANSI S1.4-1983: Specification for Sound Level Meters."* Acoustical Society of America.

[3] Bies, David A., and Hansen, Colin H. *Engineering Noise Control: Theory and Practice*. 4th ed. New York: Spon Press, 2009. 103. Print

- Exceedance levels, designated L_n, where n can have a value of 0 to 100 percent, are values from the cumulative amplitude distribution of all of the sound levels observed during a measurement period. L_{90} is the sound level in dBA exceeded 90 percent of the time during the measurement period and is close to the lowest sound level observed. It is essentially the residual sound level when there are no obvious nearby intermittent noise sources. L_{10} is the sound level in dBA exceeded 10 percent of the time during the measurement period.

- L_{eq}, the equivalent level, is the level of a hypothetical steady sound that would have the same energy (*i.e.,* the same time-averaged mean square sound pressure) as the actual fluctuating sound observed. The equivalent level is designated L_{eq} and is also A-weighted. The equivalent level represents the time average of the fluctuating sound pressure, but because sound is represented on a logarithmic scale and the averaging is done with linear mean square sound pressure values, the L_{eq} is mostly determined by occasional loud noises, such as a passing vehicle or an aircraft flyover.

In short, by using various sound metrics it is possible to separate prevailing, steady sounds (the L_{90}) from occasional, louder sounds (L_{10}) in the acoustic environment or combined equivalent levels (L_{eq}).



References:

1. Harris, Cyril, "Handbook of Noise Acoustical Measurements and Noise Control", p 1-10., 1998
2. "Controlling Noise", USAF, AFMC, AFDTC, Elgin AFB, Fact Sheet, August 1996
3. California Dept. of Trans., "Technical Noise Supplement", Oct, 1998

Figure 3-1

Common Sound Levels in the Environment

4.0 NOISE REGULATIONS

Noise is officially defined as "unwanted sound". The principal feature of this definition is that there must be sound energy and that there must be someone hearing it who considers it unwanted. Noise impact is judged on two bases: the extent to which governmental regulations or guidelines may be exceeded, and the extent to which it is estimated that people may be annoyed or otherwise adversely affected by the sound. Regulatory authority for assessing and controlling noise is contained in both the State Environmental Quality Review Act (SEQRA) and specific Department program policy documents. Specific regulatory references are discussed below.

4.1 Federal Regulations

There are no federal community noise regulations applicable to wind farms.

4.2 New York State Regulations

Noise is an aspect of the environment under SEQRA (see 6 NYCRR 617.2(1)), and a substantial adverse change in existing noise levels can be (if not mitigated to the maximum extent practicable) among the indicators of significant adverse impacts on the environment.

4.3 Local Regulations

Article XVI, Section 1606 (Zoning District and Bulk Requirements), Parts 3 through 6 of the Town of Hanover Wind Law contains a noise limit applicable to Wind Energy Conversion Systems (WECS) which requires that:

> "The statistical sound pressure level generated by a WECS shall not exceed L_{10} – 50 dBA measured at any off site residence existing at the time of application. If the ambient sound level exceeds 48 dBA, the standard shall be ambient dBA plus 5 dBA. Independent certification shall be provided before and after construction demonstrating compliance with this requirement.

In the event audible noise due to WECS operation contains a steady pure tone, such as a whine, screech or hum, the standards for audible noise set forth in this subsection shall be reduced by five dBA. A pure tone is defined to exist if the 1/3 octave band sound pressure level in the band, including the tone, exceeds the arithmetic average of the sound pressure levels of the two contiguous bands by:

- 5 dB for center frequencies of 500 Hz or above
- 8 dB for center frequencies between 160 and 500 Hz
- 15 dB for center frequencies less than or equal to 125 Hz

In the event the ambient noise level (exclusive of the development in question) exceeds the applicable standard given above, the applicable standard shall be adjusted so as to equal the ambient noise level."

Section 690.12 (Setbacks for Wind Energy Conversion Systems), Parts A through D of Local Law No. 1 of 2007 for the Town of Villenova contains an identical noise limit to the Town of Hanover, as described above.

4.4 NYSDEC Guidelines

The NYSDEC has published a guidance document[4] for assessing noise impacts (NYSDEC, 2001). The guidance document states that the addition of any noise source, in a non-industrial setting, should not raise the ambient noise level above a maximum of 65 dBA. Ambient sound levels in industrial or commercial areas may exceed 65 dBA with a high end of approximately 79 dBA. In these instances, mitigation measures utilizing best management practices should be used in an effort to ensure minimum impacts.

This guidance document also states that sound level increases from 0-3 dBA should have no appreciable effect on receptors, increases from 3-6 dBA may have potential for adverse noise impact only in cases where the most sensitive of receptors are present, and increases of more than 6 dBA may require a closer analysis of impact potential depending on existing sound levels and the character of surrounding land use and receptors. An increase of 10 dBA deserves consideration of avoidance and mitigation measures in most cases.

The typical ability of an individual to perceive changes in noise levels is summarized in Table 4-1. These guidelines allow direct estimation of an individual's probable perception of a change in community noise levels.

Table 4-1 Thresholds for Sound Pressure Level Increases

Increase in Sound Pressure (dBA)	Community Reaction
0-3	No appreciable effect
3-6	Potential effect for sensitive receptors
Over 6	Closer analysis required

Source: NYSDEC, "Assessing and Mitigating Noise Impacts", Division of Environmental Permits, February 2, 2001.

[4] Program Policy Assessing and Mitigating Noise Impacts issued by the New York State Department of Environmental Conservation (NYSDEC), Feb. 2001

5.0 EXISTING SOUND LEVELS

Details of the existing sound level measurement methodology, measurement locations, instrumentation, and meteorological conditions can be found in §2.0 of the Environmental Sound Survey and Noble Impact Assessment Report issued by Hessler Associates, Inc. [Report No. 1813-063008-A], dated July 16, 2008 ("Hessler's Report"). A brief discussion of the measured background sound levels as a function of wind speed for use in evaluating compliance with NYSDEC noise guidelines can be found in §6.0 below.

6.0 FUTURE CONDITIONS

6.1 Equipment and Operating Conditions

6.1.1 Vestas V126-3.45 Wind Turbines

Each of the twenty-nine (29) proposed Vestas V126-3.45 wind turbines being considered for the Ball Hill Wind Project have a rotor diameter of 126 meters and a hub height of 87 meters. Table 6-1 presents the manufacturer-provided broadband sound power level, PWL, as a function of wind speed for the Vestas unit used as input to the model. Under peak sound-producing operating conditions, each turbine has an A-weighted sound power level of 107.3 dBA plus an uncertainty factor of 2.0 dBA, as provided by the manufacturer. Octave-band sound power levels, as calculated from one-third octave band data, are presented in Table 6-2 for hub height wind speeds of 11 m/s, corresponding to the maximum A-weighted sound power level output. This represents the operating condition for which compliance with the Town of Hanover and Town of Villenova noise limit of 50 dBA shall be evaluated.

Table 6-1 Vestas V126-3.45 Broadband Sound Power Level (dBA) as a Function of Wind Speed

	Wind Speed at Hub Height of 87m AGL (m/s)							
	4	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Turbine PWL[1] (dBA)	91.9	93.2	96.2	99.5	102.5	105.2	107.1	107.3

1. Does not include uncertainty factor

Table 6-2 Vestas V126-3.45 Octave-Band Sound Power Levels (dBA)

Turbine PWL[1] (dB) by Octave-Band Center Frequency (Hz)								
31.5 Hz	**63 Hz**	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**	**8 kHz**
76.2	85.9	92.6	99.0	102.4	102.9	97.8	90.0	69.4

1. Octave-band sound power levels at hub height wind speeds of 11 m/s, not including uncertainty factor

The NYSDEC criteria discussed in §4.4 is based on an evaluation of the increase over ambient sound levels which vary both as a function of turbine output and wind speed. Critical operating conditions occur at a wind speed when the turbine sound level is highest relative to the ambient sound level. Table 6-3 below compares the relative difference between turbine output and ambient sound level based on the regression analysis provided in Figure 2.7.2 of Hessler's report which presents the measured background L_{eq} sound level as a function of normalized wind speed at 10 meters above ground level (AGL).

It can be seen from Table 6-3 that a hub height wind speed of 10 m/s corresponds to the highest wind turbine sound power output relative to measured background sound levels, representing "critical-case" conditions in terms of an increase over ambient. For the Vestas V126-3.45 turbine model, the turbine sound power output at this wind speed is only 0.2 dBA less than the maximum output at 11 m/s.

Table 6-3 Comparison of Background SPL and Vestas V126-3.45 Turbine PWL to Determine "Critical-Case" Design Wind Speed

Wind Speed at 87m (m/s)	4	5	6	7	8	9	**10**	11	12	13
Wind Speed at 10m[1] (m/s)	2.8	3.6	4.3	5.0	5.7	6.4	**7.1**	7.8	8.5	9.2
Turbine PWL (dBA)	91.9	93.2	96.2	99.5	102.5	105.2	**107.1**	107.3	107.3	107.3
Background L_{eq} SPL[2] (dBA)	39.5	40.2	41.0	41.8	42.5	43.3	**44.1**	44.8	45.6	46.4
Turbine PWL – Background SPL (dBA)	52.4	53.0	55.2	57.7	60.0	61.9	**63.0**	62.5	61.7	60.9

1. Normalized using logarithmic profile described in IEC Standard 61400-11, Equation (7)
2. Calculated using regression line equation provided in Figure 2.7.2 of Hessler's report

6.1.2 Transformers

A 5.8 mile 115kV transmission line will connect the wind turbines to the electrical grid. This transmission line will have a substation at either end. The interconnection substation at the northern end of the transmission line ("northern substation") will have one 230 MVA transformer, while the collection substation ("southern substation") will have one 120 MVA transformer. The two transformers were included in the model assuming the sound power level inputs presented in Table 6-4 below, as calculated based on their respective MVA ratings.

Table 6-4 Transformer Sound Power Levels[1] (dBA)

MVA	dBA	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
120	100	57	76	88	91	96	93	89	84	75
230	102	59	78	90	93	98	95	91	86	77

1. Based on MVA rating of 120 or 230 MVA, as calculated using the methodology described in Table 4.5 of the Edison Electric Institute's "Electric Power Plant Environmental Noise Guide (Volume I, 2nd Ed., 1984). Sound levels for the 230 MVA transformer are 2 dB lower than estimated by the EEI method. This reduction will be achieved by either specifying quieter equipment or installation of a sound wall.

6.2 Modeling Methodology

Sound impacts associated with the proposed wind turbine generators and proposed substation transformers were predicted using Cadna/A noise calculation software

(DataKustik Corporation, 2015). This software, which implements the ISO 9613-2 international standard for sound propagation (Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation), offers a refined set of computations accounting for local topography, ground attenuation, drop-off with distance, barrier shielding, and atmospheric absorption of sound from multiple sound sources.

Inputs and significant parameters employed in the model are described below:

- *Project Layout:* A project layout comprised of a total of 29 proposed wind turbine locations and two proposed transformer locations was provided by RES along with a shapefile of the Project property boundary for use as input in the model.

- *Sensitive Receptors:* A shapefile of 768 receptors, including the closest structures to the Project, was provided by RES and used as input to the model. All receptors were modeled with a height of 1.5 meters AGL to mimic the ears of a typical standing observer.

- *Terrain Elevation:* Elevation contours for the modeling domain with 3 meter resolution were directly imported into Cadna/A which allowed for consideration of terrain shielding where appropriate. These contours were generated from elevation information derived from the National Elevation Database (NED) developed by the U.S. Geological Survey.

- *Source Sound Levels & Controls:* Manufacturer-provided octave-band sound power levels for the Vestas V126-3.45 MW units, presented above in §6.1.1 were used as input in the model.

- *Meteorological Conditions:* A temperature of 10ºC (50ºF) and a relative humidity of 70% was assumed in the model.

- *Ground Attenuation:* Spectral ground absorption was calculated using a G-factor of 0.5 to represent a moderately reflective surface.

Several modeling assumptions inherent in the ISO 9613-2 calculation methodology, or selected as conditional inputs by the user, were implemented in the Cadna/A model to ensure conservative results (i.e., higher sound levels), and are described below:

- Modeled source sound power level inputs represent acoustic emissions measured in accordance with IEC 61400-11 corresponding to maximum sound power output, plus an additional manufacturer-provided uncertainty factor of 2 dBA for the wind turbines.

- All modeled sources were assumed to be operating simultaneously and at the design wind speed corresponding to maximum sound power emissions.

- Predicted sound levels were computed with the assumption that each receptor was always located directly downwind from every turbine simultaneously. While a physical impossibility, this provides conservative results and is required by the ISO 9613-2 standard.

- As per ISO 9613-2, the model assumed favorable conditions for sound propagation, corresponding to a moderate, well-developed ground-based temperature inversion, as might occur on a calm, clear night.

- A mixture of hard and porous ground was assumed for the surrounding Project area to represent a surface that is partially reflective, a conservative assumption for much of the year when the ground would be covered in vegetation.

- Meteorological conditions assumed in the model (T = 10°C/RH = 70%) were selected to minimize atmospheric attenuation in the 500 Hz and 1 kHz octave-bands where the human ear is most sensitive.

- No additional attenuation due to tree shielding, air turbulence, or wind shadow effects was considered in the model.

Sound levels due to the operation of all 29 wind turbines and the two transformers were modeled at each of the 768 discrete receptor locations, including the closest structures to the Project. In addition, sound levels were modeled across a large grid of receptor points, spaced 100 meters apart, to create sound level isopleths across the entire Project area.

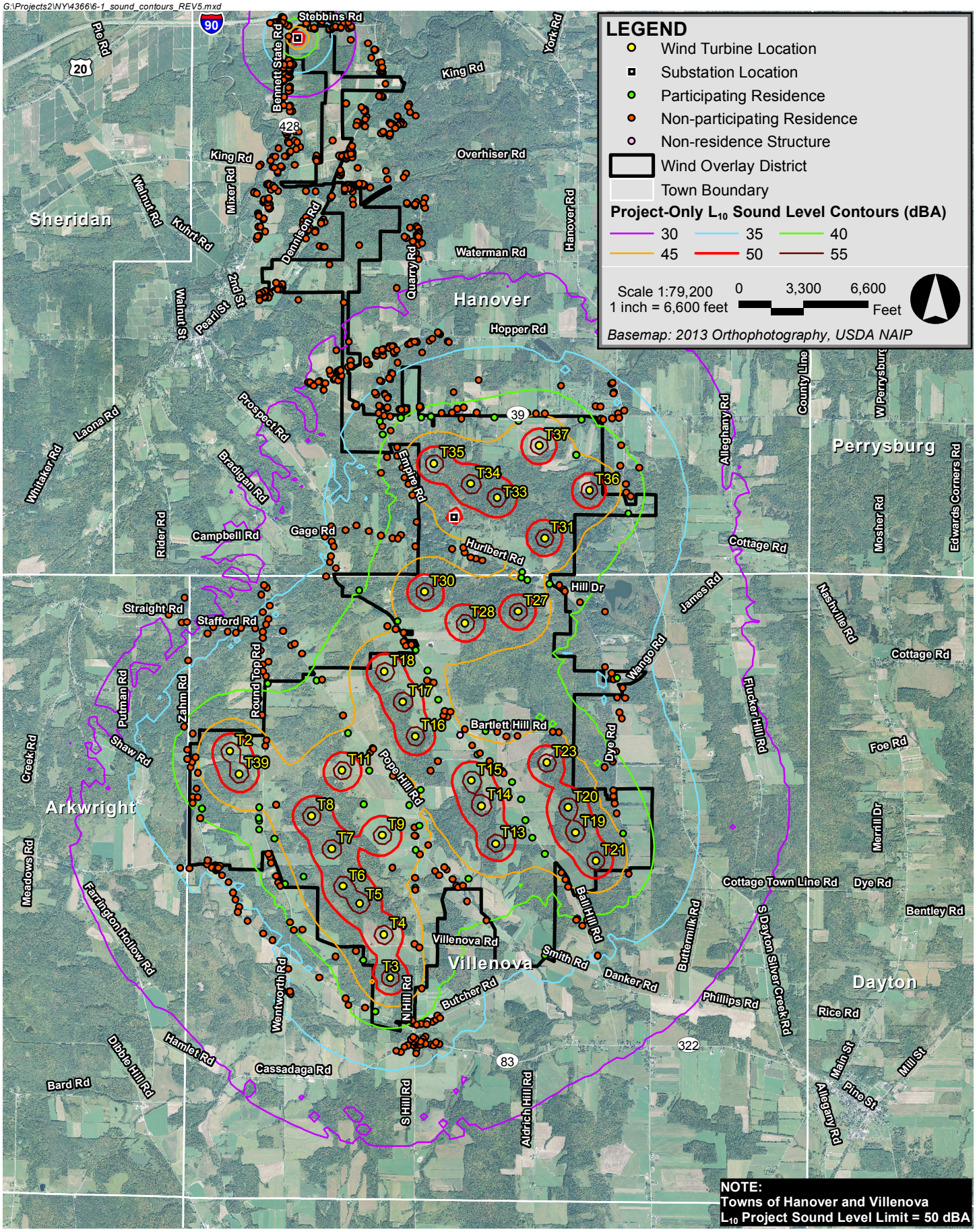
6.3 Modeling Sound Level Results

Modeling results for the Vestas V126-3.45 turbine, representing maximum Project-only L_{10} sound levels, are illustrated in Figure 6-1 as iso-dBA contour lines overlaid on aerial imagery of the Project site. Predicted L_{10} sound levels, ranging from 20 to 49 dBA, and L_{eq} sound levels, ranging from 19 to 48 dBA, at the closest structures to the Project are presented in tabular form in Table A-1 of Appendix A at all 768 discrete modeling receptors. These predicted sound levels which contain a wind turbine manufacturer-provided uncertainty factor of 2 dBA are "Project-only" and do not include any contributions from existing background sound sources.

The calculated maximum L_{10} values shown in Figure 6-1 and presented in Table A-1 include an adjustment of 1 dBA added to the modeled maximum L_{eq} turbine sound levels. This allows for the approximate conversion of L_{eq} to L_{10} sound levels used for evaluating compliance with the local noise limits, and is based on empirical data from several Epsilon Associates, Inc. measurement programs where wind turbines are the primary noise source.

In addition, data from a recent acoustical research study found similar results where the L_{10} sound level is approximately 1 dBA higher than the L_{eq} sound level.[5]

[5] RSG et al, "Massachusetts Study on Wind Turbine Acoustics," Massachusetts Clean Energy Center and Massachusetts Department of Environmental Protection, 2016.



Ball Hill Wind Project Hanover & Villenova, New York

Epsilon ASSOCIATES INC.

Figure 6-1

Maximum Project-Only L_{10} Sound Levels
Vestas V126-3.45 MW (11m/s at 87m HH)

7.0 EVALUATION OF SOUND LEVELS

7.1 Local Regulations

As presented in Table A-1 of Appendix A and illustrated in Figure 6-1, predicted L_{10} sound levels from the Project under conditions of maximum wind turbine sound output (corresponding to a hub height wind speed of 11 m/s) are less than or equal to the 50 dBA limit specified by the Towns of Hanover and Villenova at all receptors representing the closest structures to the Project.

With regard to "pure tones", as defined in §4.3, an evaluation of the maximum one-third octave-band sound power levels for the Vestas V126-3.45 model, provided by the turbine manufacturer, is presented in Table 7-1. This analysis indicates that even under conditions of maximum turbine sound power output, corresponding to hub height wind speeds of 11 m/s, no pure tones shall be emitted.

Table 7-1 Tonal Analysis: Vestas V126-3.45 Sound Power Level Emissions

One-Third Octave-band Center Frequency (Hz)	Sound Power Level[1] (dB)	Average Sound Power Level of Contiguous Bands (dB)	Difference between Sound Power Level and Contiguous Average[2] (dB)	Tonal Limit (dB)	Meets Tonal Limit?[3]
25	114.3	-	-	-	-
32	108.6	111.4	-3	15	Yes
40	108.5	108.4	0	15	Yes
50	108.1	107.9	0	15	Yes
63	107.3	106.8	0	15	Yes
80	105.5	106.0	0	15	Yes
100	104.6	105.1	0	15	Yes
125	104.6	103.4	1	15	Yes
160	102.1	103.3	-1	8	Yes
200	102.0	102.1	0	8	Yes
250	102.1	102.5	0	8	Yes
315	103.0	101.8	1	8	Yes
400	101.5	101.9	0	8	Yes
500	100.7	101.0	0	5	Yes
630	100.4	99.8	1	5	Yes
800	98.8	99.5	-1	5	Yes
1000	98.5	98.0	1	5	Yes
1250	97.1	95.9	1	5	Yes
1600	93.3	94.6	-1	5	Yes
2000	92.1	91.5	1	5	Yes
2500	89.7	89.2	1	5	Yes
3150	86.3	87.4	-1	5	Yes
4000	85.0	81.4	4	5	Yes
5000	76.5	76.8	0	5	Yes
6300	68.6	69.1	0	5	Yes

Table 7-1 Tonal Analysis: Vestas V126-3.45 Sound Power Level Emissions (Continued)

One-Third Octave-band Center Frequency (Hz)	Sound Power Level[1] (dB)	Average Sound Power Level of Contiguous Bands (dB)	Difference between Sound Power Level and Contiguous Average[2] (dB)	Tonal Limit (dB)	Meets Tonal Limit?[3]
8000	61.6	63.9	-2	5	Yes
10000	59.2	-	-	-	-

1. One-third octave-band sound power level for Vestas V126-3.45 turbine at hub height wind speeds of 11m/s
2. Rounded to the nearest whole number decibel
3. Compliance evaluation of "pure tone" criteria described in §4.3

Additionally, one-third octave-band received sound pressure levels were calculated at the closest structure (receptor #177) to a turbine (T15), accounting for geometric divergence and atmospheric absorption, at a distance of approximately 1,150 feet (350 meters). Results presented in Table 7-2 show that received sound pressure levels due to the wind turbines are not expected to result in any pure tones, as defined by the Towns of Hanover and Villenova.

Table 7-2 Tonal Analysis: Vestas V126-3.45 Received Sound Pressure Levels

One-Third Octave-band Center Frequency (Hz)	Received Sound Pressure Level[1] (dB)	Average Sound Pressure Level of Contiguous Bands (dB)	Difference between Sound Pressure Level and Contiguous Average[2] (dB)	Tonal Limit (dB)	Meets Tonal Limit?[3]
25	55.2	-	-	-	-
32	49.5	52.3	-3	15	Yes
40	49.4	49.2	0	15	Yes
50	49.0	48.8	0	15	Yes
63	48.2	47.7	1	15	Yes
80	46.4	46.8	0	15	Yes
100	45.4	45.9	0	15	Yes
125	45.4	44.1	1	15	Yes
160	42.8	44.0	-1	8	Yes
200	42.6	42.7	0	8	Yes
250	42.6	43.0	0	8	Yes
315	43.4	42.2	1	8	Yes
400	41.7	42.0	0	8	Yes
500	40.7	40.9	0	5	Yes
630	40.2	39.5	1	5	Yes
800	38.4	39.0	-1	5	Yes
1000	37.8	37.2	1	5	Yes
1250	36.0	34.7	1	5	Yes
1600	31.6	32.9	-1	5	Yes

Table 7-2 Tonal Analysis: Vestas V126-3.45 Received Sound Pressure Levels (Continued)

One-Third Octave-band Center Frequency (Hz)	Received Sound Pressure Level[1] (dB)	Average Sound Pressure Level of Contiguous Bands (dB)	Difference between Sound Pressure Level and Contiguous Average[2] (dB)	Tonal Limit (dB)	Meets Tonal Limit?[3]
2000	29.8	29.1	1	5	Yes
2500	26.7	25.6	1	5	Yes
3150	21.3	21.8	0	5	Yes
4000	16.9	12.7	4	5	Yes
5000	4.1	8.4	-4	5	Yes
6300	0.0	2.1	-2	5	Yes
8000	0.0	0.0	0	5	Yes
10000	0.0	-	-	-	-

1. Calculated sound pressure level due to a single turbine at a distance of ~1,150 feet (receptor #177), based on Vestas V126-3.45 one-third octave-band sound power levels for hub height wind speeds of 11 m/s
2. Rounded to the nearest whole number decibel
3. Compliance evaluation of "pure tone" criteria described in §4.3

Since no one-third octave-band data has been provided for the substation equipment, a tonal analysis for the proposed transformers has not been conducted. However, as part of the project design, Ball Hill Wind will specify a custom built transformer, and will include a specification that no prominent discrete tone will be created. This unit will be tested for sound after it is built.

7.2 NYSDEC Criteria

The predicted L_{eq} sound levels at the nearest structures presented in Table A-1 of Appendix A were compared to the existing ambient L_{eq} sound levels with respect to the NYSDEC criteria discussed in §4.4. As shown in Table 6-3, the calculated background sound level for the Project area at the "critical-case" hub height wind speed of 10 m/s is 44.1 dBA. In order for the Project to meet the suggested 6 dBA cumulative increase threshold recommended in the NYSDEC guidance document, L_{eq} sound levels from the Project should remain at or below 48.8 dBA. That is to say, a Project level of 48.8 dBA added to a background level of 44.1 dBA would result in a combined level of 50.1 dBA, which is 6 dBA above background, when rounded to the nearest whole decibel.

Maximum L_{eq} sound levels from the Project at all of the nearest structures are predicted to be no greater than 48.8 dBA even under conditions of maximum turbine sound power output. Additionally, future sound levels combining the Project with the existing background are anticipated to remain less than or equal to 50 dBA, well below the suggested 65 dBA threshold recommended in the NYSDEC guidance document.

7.3 Low Frequency Sound

Table 7-3 compares predicted maximum Project-only L_{10} sound levels in the 32, 63 and 125 Hz octave-bands to the equivalent outdoor sound pressure levels corresponding to the NC-30 noise criteria curve recommended for bedrooms and to levels associated with moderately perceptible vibration and rattle."[6] Results indicate that of the ten structures of greatest potential Project impact, predicted sound levels are well below both relevant criteria, indicating that no low-frequency sound impacts are expected.

Table 7-3 Predicted Worst-Case Low Frequency Sound Levels

Modeling Receptor ID	Sound Pressure Level (dB)		
	31.5 Hz	63 Hz	125 Hz
	(dB)	(dB)	(dB)
177	62	58	51
376	49	54	52
178	61	57	50
179	61	57	50
180	61	57	50
151	61	57	50
175	61	57	50
176	61	57	50
174	61	57	50
172	61	57	50
NC-30 Equivalent Outdoor Sound Pressure Levels	74	66	57
Equivalent Outdoor Sound Pressure Levels for Moderately Perceptible Vibration & Rattle	71	79	NA

Another metric commonly used to assess low frequency noise is the "C-weighted" sound level. For the Vestas V126-3.45 turbine, the maximum C-weighted sound level at any of the modeling receptors representing the closest structures to the Project is predicted to be less than or equal to 63 dBC. For context, ANSI Standard B133.8 "Gas Turbine Installation

[6] O'Neal, Robert D., Hellweg Jr., Robert D., Lampeter, Richard M. "Low Frequency Noise and Infrasound from Wind Turbines." Noise Control Engineering Journal 59.2 (2011): 139. Print.

Sound Emissions" describes a threshold of 75 to 80 dBC as the approximate level at which complaints and the perception of vibrations due to airborne sound may occur.

7.4 Construction Noise

A qualitative discussion of construction noise related to the proposed Ball Hill Wind Project can be found in §3.9 of Hessler's report.

8.0 CONCLUSIONS

A comprehensive sound level assessment conducted for the Ball Hill Wind Project indicates that predicted sound level impacts from the 29 proposed Vestas V126-3.45 wind turbine generators and two proposed electrical transformers are expected to meet the Town of Hanover and Town of Villenova noise limit at each of the closest structures to the Project. Additionally, the Project is anticipated to meet the suggested criteria recommended in the NYSDEC guidance document for avoiding the potential for adverse community noise impacts. No pure tones were identified in the sound power level spectra, nor in the calculated received sound pressure levels at the closest structure for the turbine model under consideration. Low frequency sound levels at the closest structures to the Project are also predicted to be well below the recommended criteria to avoid disturbance, vibration, and rattle indoors.

Due to the nature of wind turbine noise and the relative background sound levels in the area, noise from the project is likely to be audible at times at some of the closest residences. However, conservative modeling assumptions were made to account for the occasional occurrence of conditions which may favor propagation of sound from the Project or increase the perceptibility of turbine noise. A vast majority of the time, nominal sound levels from the project are likely to be significantly less than those predicted in this analysis, which are based on worst-case conditions. Project impacts are anticipated to meet state guidelines for minimizing adverse impacts as well as all local noise limits applicable to the Project.

Appendix A
Vestas V126-3.45 Sound Level Modeling Results

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting] (m)	Y [Northing] (m)		
1	302835	265921	46	45
2	302817	265099	43	42
3	305211	265779	43	42
4	303337	270719	37	36
5	306582	273125	45	44
6	306448	273126	45	44
7	306310	273130	44	43
8	306063	273131	43	42
9	305523	273141	41	40
10	304592	271431	43	42
11	304524	271857	44	43
12	304464	272023	45	44
13	304408	272125	45	44
14	304370	272276	45	44
15	304291	272464	43	42
16	304288	272601	43	42
17	304129	272449	41	40
18	304063	272798	39	38
19	304054	272920	39	38
20	304025	273005	38	37
21	304089	273088	38	37
22	304345	273055	40	39
23	304667	273065	42	41
24	304815	273077	42	41
25	305292	273044	42	41
26	305322	273216	41	40
27	305800	273064	42	41
28	306179	273013	45	44
29	307071	272480	46	45
30	306588	264701	37	36
31	307892	265960	44	43
32	307805	266595	45	44
33	307706	266908	43	42
34	307670	267064	44	43
35	307651	267168	42	41
36	307650	267265	41	40
37	307520	267624	42	41
38	307696	267868	40	39
39	307640	267712	41	40
40	307788	268380	37	36
41	307746	268479	37	36
42	307714	268704	37	36

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting] (m)	Y [Northing] (m)		
43	307627	269003	37	36
44	307655	268993	36	35
45	307626	269084	36	35
46	307132	270187	41	40
47	301451	266094	36	35
48	301466	266093	36	35
49	301483	266092	36	35
50	301500	266093	36	35
51	301516	266092	36	35
52	301532	266092	36	35
53	301570	265944	36	35
54	301671	265836	36	35
55	301738	265672	35	34
56	301780	265566	35	34
57	301829	265450	35	34
58	301965	265234	35	34
59	302204	265039	34	33
60	302353	264933	35	34
61	303080	264353	38	37
62	303951	263822	43	42
63	303790	263883	42	41
64	303484	264028	40	39
65	304671	264182	44	43
66	301336	266118	36	35
67	301338	266177	36	35
68	301228	266832	40	39
69	301114	267071	41	40
70	301116	267164	41	40
71	301191	267536	45	44
72	301079	267623	43	42
73	301106	267708	44	43
74	301041	269283	35	34
75	302266	270414	34	33
76	302218	270455	33	32
77	302179	270309	33	32
78	302198	270031	35	34
79	302304	270136	35	34
80	302288	269923	36	35
81	302252	269847	36	35
82	303188	270587	37	36
83	303244	270812	37	36
84	303257	270903	36	35
85	303267	271364	36	35

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting]	Y [Northing]		
	(m)	(m)		
86	303270	271133	36	35
87	303307	271057	36	35
88	306880	270386	43	42
89	305683	265239	40	39
90	305379	265538	42	41
91	304567	265903	45	44
92	304571	265747	44	43
93	302312	266233	43	42
94	302200	269222	38	37
95	306160	268107	45	44
96	303487	271309	37	36
97	303655	271379	38	37
98	303849	271296	39	38
99	304038	271224	40	39
100	304347	271236	42	41
101	304214	271187	41	40
102	304301	271181	41	41
103	304573	271057	43	42
104	305144	271018	44	43
105	305337	270967	44	44
106	305319	271039	45	44
107	306239	270659	46	45
108	306314	270535	46	45
109	306655	270474	45	44
110	305237	265757	43	42
111	305314	265779	43	42
112	305395	265887	44	43
113	304880	266010	44	43
114	304939	265943	43	42
115	305060	266030	44	43
116	305021	266071	44	43
117	304560	266685	46	45
118	304631	266714	46	45
119	304643	266268	45	44
120	304582	266553	46	45
121	304580	266336	46	45
122	304221	266066	47	46
123	304573	265716	44	43
124	304562	264878	47	46
125	304636	264824	46	45
126	303764	264620	48	47
127	302619	265214	42	41
128	302550	265807	43	42

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting] (m)	Y [Northing] (m)		
129	302409	265930	43	42
130	302326	266139	43	42
131	302285	266277	43	42
132	302379	266514	45	44
133	302143	266794	44	43
134	302407	267041	46	45
135	302262	268044	45	44
136	302189	268440	43	42
137	302250	269039	39	38
138	302199	269120	38	37
139	302286	269264	38	37
140	302199	269635	37	36
141	302202	269733	36	35
142	302517	269746	37	36
143	302640	269518	38	37
144	302698	269540	38	37
145	302808	269389	39	38
146	303038	268970	41	40
147	303444	268430	44	43
148	303530	268156	46	45
149	303872	267853	47	46
150	303911	267922	47	46
151	303855	267569	48	47
152	304478	267032	46	45
153	304653	267271	45	44
154	304810	267574	47	46
155	304925	267717	47	46
156	306809	268168	45	44
157	306715	268173	45	44
158	306154	268298	43	42
159	305986	268102	44	43
160	305847	268175	44	43
161	305666	268187	44	43
162	307410	264695	36	35
163	307313	265066	38	37
164	307087	265268	40	39
165	307165	265160	39	38
166	307242	265245	40	39
167	306947	265758	45	44
168	306907	265874	46	45
169	306846	265982	46	45
170	306587	266276	47	46
171	306392	266522	47	46

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting] (m)	Y [Northing] (m)		
172	306280	266803	48	47
173	306214	267120	48	47
174	306072	267387	48	47
175	305920	267565	48	47
176	305950	267530	48	47
177	305730	267653	49	48
178	305830	267632	48	47
179	305729	267720	48	47
180	305540	267818	48	47
181	305461	267962	46	45
182	305346	268213	45	44
183	305077	268412	46	45
184	305007	268430	47	46
185	305030	268499	46	45
186	305116	268483	45	44
187	304928	268671	47	46
188	304793	268945	47	46
189	304852	268940	46	45
190	304762	269125	46	45
191	304137	269816	45	44
192	304268	269771	45	44
193	304391	269573	46	45
194	304424	269508	46	45
195	304578	269443	46	45
196	304511	269528	46	45
197	304389	269720	45	44
198	304296	269893	45	44
199	303701	270372	40	39
200	304983	273128	42	41
201	305140	273136	41	40
202	305222	273197	41	40
203	307157	273030	41	40
204	307459	273045	40	39
205	307496	273029	39	38
206	307631	273047	39	38
207	307725	273122	38	37
208	307739	273054	38	37
209	307820	273167	37	36
210	307770	272626	40	39
211	308054	272278	40	39
212	307760	272313	43	42
213	307851	271897	43	42
214	307919	271835	42	41

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting] (m)	Y [Northing] (m)		
215	307525	270039	38	37
216	306902	270361	42	41
217	305613	270835	44	43
218	305510	270866	44	43
219	305433	270887	44	43
220	303164	271210	35	34
221	304756	268970	47	46
222	307127	265624	44	43
223	305147	265883	43	42
224	304777	266410	45	44
225	303534	263922	40	39
226	302441	265831	43	42
227	305267	268124	46	45
228	302146	266999	45	44
229	302684	265087	41	40
230	303648	264766	47	46
231	303329	264680	44	43
232	303767	267050	47	46
233	300989	270263	29	28
234	300939	269870	29	28
235	300734	269991	29	28
236	301022	269877	29	28
237	300982	268255	41	40
238	301111	268150	43	42
239	301024	267891	43	42
240	301156	267779	45	44
241	301028	267753	43	42
242	301174	267287	43	42
243	301193	267155	41	40
244	301253	266981	41	40
245	301059	266053	36	35
246	300915	266057	35	34
247	301423	266076	36	35
248	301411	266064	36	35
249	301474	266013	36	35
250	301487	266028	36	35
251	301498	266042	36	35
252	301505	266053	36	35
253	301809	265370	34	33
254	302594	264485	35	34
255	302638	264095	36	35
256	302599	264129	35	34
257	302623	264141	36	35

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting] (m)	Y [Northing] (m)		
258	302474	265774	43	42
259	302146	266655	44	43
260	302141	266834	44	43
261	302241	267952	46	45
262	302140	268685	41	40
263	302277	268929	39	38
264	302169	269437	37	36
265	302088	269783	36	35
266	301866	269792	35	34
267	301782	269714	35	34
268	301654	269728	35	34
269	301431	269805	33	32
270	301343	269705	30	29
271	303123	268986	42	41
272	303921	267910	47	46
273	304227	267491	46	45
274	304561	266556	47	46
275	304942	263321	36	35
276	304823	263316	37	36
277	304725	263437	37	36
278	304669	263313	37	36
279	304602	263271	37	36
280	304593	263236	37	36
281	304584	263172	36	35
282	304488	263322	38	37
283	304544	263298	37	36
284	304696	263398	37	36
285	304686	263355	37	36
286	304728	263326	37	36
287	304851	263295	36	35
288	304895	263345	36	35
289	304593	263315	37	36
290	304617	263316	37	36
291	304645	263313	37	36
292	304581	263360	38	37
293	304627	263358	37	36
294	304653	263358	37	36
295	304537	263360	38	37
296	304453	263302	37	36
297	304406	263272	37	36
298	304345	263191	37	36
299	304276	263213	37	36
300	304583	263402	38	37

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting] (m)	Y [Northing] (m)		
301	304509	263395	38	37
302	304542	263426	38	37
303	304661	263637	39	38
304	304864	263672	39	38
305	304841	263664	39	38
306	304892	263698	38	37
307	304917	263762	39	38
308	304758	263678	39	38
309	304749	263627	39	38
310	304954	263720	38	37
311	304594	263625	40	39
312	304523	263682	41	40
313	307076	265245	40	39
314	307835	268700	36	35
315	307798	268862	36	35
316	305581	267840	47	46
317	304039	272195	41	40
318	304193	272856	40	39
319	304005	273128	37	36
320	304187	273074	39	38
321	307847	272022	43	42
322	307885	271567	42	41
323	307710	269011	36	35
324	307523	269182	36	35
325	306815	270457	43	42
326	306226	270568	46	45
327	303952	278773	27	27
328	303934	278769	27	27
329	303935	278785	27	27
330	304005	278574	27	26
331	304041	278582	26	26
332	303890	278654	28	27
333	303403	279128	33	33
334	303832	278880	28	28
335	303275	279101	35	35
336	303091	279223	37	37
337	303100	279250	36	36
338	303538	279105	31	31
339	302881	279231	40	40
340	303566	278929	31	31
341	302951	279115	41	41
342	302998	279106	40	40
343	303006	279100	40	40

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting] (m)	Y [Northing] (m)		
344	302998	279118	40	40
345	303097	279223	37	37
346	303057	279270	32	32
347	303071	279258	37	37
348	303110	279185	37	37
349	303122	279219	36	36
350	303233	279088	35	35
351	303251	279094	35	35
352	303238	279099	35	35
353	303282	279118	35	35
354	303301	279125	34	34
355	303346	279129	33	33
356	303333	279140	34	34
357	303414	279115	33	33
358	303254	279332	33	33
359	303253	279352	33	33
360	303253	279279	34	34
361	303260	279244	34	34
362	303418	279128	32	32
363	303458	279204	27	27
364	303577	279117	31	30
365	303574	279138	31	30
366	303531	279202	26	26
367	302890	279200	41	41
368	302619	278608	38	38
369	302618	278611	38	38
370	302600	278617	38	38
371	302536	278563	37	37
372	302490	278574	36	36
373	302425	278783	39	39
374	302879	279189	41	41
376	302604	278985	47	47
377	302593	279152	42	42
378	302598	279152	42	42
379	302596	279146	42	42
380	302495	279286	38	38
381	302508	279284	38	38
382	302514	279263	38	38
383	302527	279271	38	38
384	302545	279181	41	41
385	302502	279197	39	39
386	302470	279144	40	40
387	302439	279096	40	40

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting] (m)	Y [Northing] (m)		
388	302444	279126	39	39
389	302424	279132	39	39
390	302411	279141	38	38
391	302435	279216	38	38
392	302419	279197	38	38
393	302394	279207	37	37
394	302375	279201	37	37
395	302330	279194	36	36
396	302314	279193	36	36
397	302660	277826	28	28
398	302622	277825	28	28
399	302622	277912	29	29
400	302611	277896	29	28
401	302528	277916	29	28
402	302621	278357	34	34
403	302623	278150	31	31
404	302599	278137	31	31
405	302621	278208	32	32
406	302600	278189	31	31
407	302601	278340	33	33
408	302611	278359	34	34
409	302594	278377	34	34
410	302613	278425	35	35
411	302592	278441	35	35
412	302617	278450	35	35
413	302630	278469	36	36
414	302625	278479	36	36
415	302600	278486	36	36
416	302674	278547	37	37
417	302664	278554	37	37
418	302608	278545	37	37
419	302624	278556	37	37
420	302416	278043	29	29
421	302457	278037	29	29
422	302532	278046	30	30
423	302461	278204	31	31
424	302437	278232	31	31
425	302435	278240	31	31
426	302491	278276	32	32
427	302525	278289	32	32
428	302519	278290	32	32
429	302523	278305	33	33
430	302482	278396	34	34

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting] (m)	Y [Northing] (m)		
431	302512	278421	34	34
432	302509	278476	35	35
433	302519	278494	35	35
434	302531	278548	36	36
435	303814	277735	25	25
436	303778	277598	25	25
437	303688	277646	25	25
438	303670	277655	26	25
439	303656	277599	25	25
440	303789	277581	23	22
441	303798	277696	25	25
442	303795	277810	26	25
443	303785	277852	26	26
444	303772	277832	26	26
445	303734	277884	26	26
446	303497	277946	27	27
447	303492	277948	27	27
448	304581	277748	23	22
449	304491	277803	23	22
450	304389	277614	21	20
451	304353	277657	21	21
452	304343	277644	20	20
453	304340	277620	20	20
454	304302	277600	21	20
455	304255	277573	23	23
456	304298	277736	24	24
457	304480	277933	24	24
458	304456	277901	24	24
459	304298	277747	25	24
460	304220	277620	20	19
461	304171	277641	23	22
462	304185	277629	22	22
463	304193	277614	24	23
464	304114	278250	25	25
465	304062	278044	25	25
466	304047	278062	25	25
467	304010	278061	26	25
468	304025	278433	26	26
469	304064	278417	26	26
470	304058	278432	26	26
471	304048	278455	26	26
472	304045	278488	26	26
473	304055	278488	26	26

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting] (m)	Y [Northing] (m)		
474	304053	278499	26	26
475	303871	276634	22	21
476	304260	277555	23	23
477	304114	276890	22	21
478	304426	276850	22	21
479	304391	276793	22	21
480	304139	276763	22	21
481	304174	277440	21	20
482	304066	277477	24	23
483	304038	277478	24	23
484	304072	277506	24	23
485	304177	277467	23	23
486	303284	277367	26	25
487	302870	276586	22	21
488	303593	276574	22	21
489	303774	276667	22	21
490	303778	276677	22	21
491	303758	276693	22	21
492	303703	276700	22	21
493	303023	276577	23	22
494	303543	276674	22	22
495	303569	276654	22	21
496	303577	276637	22	21
497	303562	276614	22	21
498	303533	276627	22	21
499	303475	276619	22	21
500	303414	276817	22	22
501	303420	276831	22	22
502	303391	276833	22	22
503	303402	276867	22	22
504	303417	276872	22	22
505	303405	276903	22	22
506	303677	276940	22	22
507	303569	277166	23	23
508	303574	277167	23	23
509	303039	277134	25	25
510	303026	277080	25	24
511	303041	277068	25	24
512	303039	277049	25	24
513	303385	277133	24	24
514	303436	277123	24	24
515	303494	277078	23	23
516	303505	277077	23	23

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting] (m)	Y [Northing] (m)		
517	303535	277098	23	23
518	303514	277141	24	23
519	303602	277112	23	23
520	303585	277102	23	23
521	303592	277177	23	23
522	303592	277165	23	23
523	303566	277158	23	23
524	303559	277257	24	24
525	303590	277285	24	24
526	302437	276861	22	22
527	302444	276583	24	24
528	302329	276605	24	23
529	302269	276682	24	23
530	302354	276951	23	22
531	302775	277268	25	25
532	302447	277249	23	23
533	302385	277112	25	24
534	302359	277114	25	24
535	302317	277052	25	24
536	302574	277464	26	26
537	302585	277491	26	26
538	302555	277494	26	26
539	302567	277548	26	26
540	302581	277522	26	26
541	302589	277345	24	23
542	302607	277328	23	23
543	302710	277501	26	26
544	302761	277502	26	26
545	302696	277368	26	25
546	302739	277344	26	25
547	302724	277233	25	25
548	302616	277181	20	20
549	302632	277198	21	20
550	302695	276984	25	24
551	302561	277113	20	20
552	302544	277123	20	20
553	302393	277115	23	23
554	302492	276944	21	20
555	302483	276963	21	21
556	302426	276888	22	22
557	302378	276946	23	22
558	302175	276994	25	24
559	302143	276966	24	24

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting]	Y [Northing]		
	(m)	(m)		
560	302069	276570	23	22
561	302290	276698	24	23
562	302306	276680	24	23
563	302357	276664	24	23
564	302380	276640	24	23
565	302123	275860	23	22
566	302107	275843	23	22
567	302304	276378	24	23
568	302316	276317	24	23
569	302068	276554	23	22
570	302102	276544	23	22
571	302242	275955	24	23
572	302128	276238	24	23
573	302206	276138	24	23
574	302299	276305	24	23
575	302286	276332	24	23
576	302213	276401	24	23
577	302211	276412	24	23
578	302213	276429	24	23
579	302221	276447	24	23
580	302281	276395	24	23
581	302278	276448	24	23
582	302294	276468	24	23
583	302672	275736	22	21
584	302830	276122	22	21
585	302826	276059	22	21
586	302213	276156	24	23
587	302134	276216	24	23
588	302137	276190	24	23
589	302132	276027	24	23
590	302163	276027	24	23
591	302144	275889	24	23
592	302119	275877	23	22
593	302702	275709	22	21
594	303087	275724	23	22
595	303138	275715	23	22
596	302923	276004	22	21
597	303047	276313	22	21
598	303156	275712	23	22
599	302873	275849	22	21
600	303704	275741	27	26
601	302872	276178	22	21
602	303602	276452	22	21

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting] (m)	Y [Northing] (m)		
603	303608	276369	22	21
604	303250	276479	22	21
605	303273	276502	22	21
606	303143	276144	22	21
607	303160	276093	22	21
608	303112	276107	22	21
609	303105	276084	22	21
610	303022	275973	22	21
611	303026	275955	22	21
612	303011	275949	22	21
613	302940	276007	22	21
614	302891	275962	22	21
615	302866	276041	22	21
616	302880	276073	22	21
617	302901	275980	22	21
618	304564	275585	28	28
619	304709	276334	27	26
620	304721	276467	26	26
621	304717	276314	27	26
622	304698	276396	27	26
623	304592	276412	26	26
624	304568	276352	27	26
625	304568	276378	27	26
626	304447	276374	26	25
627	304436	276397	26	25
628	304594	276036	27	27
629	304610	276009	28	27
630	304630	275944	28	27
631	304622	275922	28	27
632	304595	275900	28	27
633	304596	275886	28	27
634	304593	275781	28	27
635	304583	275785	28	27
636	304620	275871	28	27
637	304494	276013	27	26
638	304433	275853	27	26
639	304408	275874	27	26
640	304535	275796	28	27
641	304583	275611	28	27
642	304619	275749	28	27
643	304681	275775	28	27
644	304284	275074	30	29
645	304621	275515	29	28

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting] (m)	Y [Northing] (m)		
646	304543	275188	30	29
647	303460	274849	28	27
648	303237	275436	27	26
649	302229	275008	23	22
650	302756	274888	27	26
651	302500	275138	23	22
652	302463	275086	23	22
653	302459	275095	23	22
654	302473	275057	23	22
655	302469	275046	23	22
656	302432	275049	23	22
657	302408	275159	23	22
658	302260	274966	23	22
659	302309	274975	23	22
660	302277	274948	23	22
661	302289	274924	23	22
662	302237	274924	23	22
663	302218	274937	23	22
664	302241	275031	22	22
665	302192	274991	22	22
666	302185	275005	22	22
667	302162	274974	22	22
668	302148	274978	22	22
669	302150	274913	23	22
670	302154	274882	23	22
671	303589	273856	33	32
672	303084	273630	31	30
673	303539	274238	31	30
674	303344	274105	31	30
675	303566	273944	32	31
676	303563	273943	32	31
677	303143	273583	32	31
678	302979	273579	31	30
679	302935	273579	31	30
680	302903	273610	31	30
681	302937	273604	31	30
682	303062	273617	31	30
683	303174	273595	32	31
684	303252	273734	32	31
685	303240	273795	32	31
686	303309	273650	32	31
687	303323	273659	32	31
688	303372	273636	33	32

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting] (m)	Y [Northing] (m)		
689	303408	273711	32	31
690	303426	273712	32	31
691	303360	273776	32	31
692	303371	273784	32	31
693	303379	273778	32	31
694	303400	273801	32	31
695	303410	273792	32	31
696	303530	273846	32	31
697	303564	273866	32	31
698	303847	273887	33	32
699	303825	273893	33	32
700	303812	273958	33	32
701	304296	273918	34	33
702	304200	273757	35	34
703	304214	273744	35	34
704	304183	273653	35	34
705	304164	273671	35	34
706	304044	273623	35	34
707	304022	273633	35	34
708	304793	274253	34	33
709	304598	274231	33	32
710	304596	274236	33	32
711	304512	274234	33	32
712	304678	274071	34	33
713	303961	274013	33	32
714	303955	274055	33	32
715	303976	274046	33	32
716	303986	274097	33	32
717	304070	274025	33	32
718	304060	274087	33	32
719	304074	274125	33	32
720	304060	274118	33	32
721	304169	274172	33	32
722	304163	274138	33	32
723	304229	274173	33	32
724	304217	274163	33	32
725	304244	274057	34	33
726	304237	274082	33	32
727	304287	274112	33	32
728	304462	274198	33	32
729	304490	274204	33	32
730	304561	274239	33	32
731	304838	274286	34	33

Table A-1
Predicted Sound Level Modeling Results
Vestas V126-3.45

Receptor ID	NAD 1983 State Plane New York West FIPS 3103		L10 Sound Level (dBA)	Leq Sound Level (dBA)
	X [Easting]	Y [Northing]		
	(m)	(m)		
732	305074	274244	34	33
733	305560	273641	38	37
734	305097	274231	34	33
735	304962	274353	33	32
736	304938	274369	33	32
737	304924	274382	33	32
738	307620	273580	36	35
739	307632	273587	36	35
740	307635	273601	36	35
741	307656	273453	36	35
742	307654	273429	37	36
743	307379	273236	39	38
744	307447	273233	39	38
745	306837	273553	39	38
746	305172	273449	39	38
747	304420	273191	39	38
748	303963	273412	36	35
749	304145	273388	37	36
750	304648	273235	40	39
751	304655	273215	40	39
752	304640	273211	40	39
753	304640	273231	40	39
754	303943	273445	35	34
755	304097	273432	36	35
756	304103	273413	36	35
757	304139	273360	37	36
758	304031	273230	37	36
759	304012	273245	37	36
760	304133	273206	38	37
761	304136	273216	38	37
762	304324	273193	39	38
763	304354	273184	39	38
764	303636	273239	35	34
765	302990	273552	31	30
766	303145	273489	32	31
767	303149	273489	32	31
768	303655	273231	35	34
769	303649	273255	35	34