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SECTION 5. NOISE

5.A Developments – Minor Noise Impact

This section does not apply.

5.B. Developments Potentially Producing a Major Noise Impact

Construction Noise

Construction noise impacts resulting from clearing and construction vehicles and equipment are estimated to range between 50 and 60 dBA, depending on the phase of construction. This noise will occur over a period of several months during the summer-fall construction season (June through October). Construction of the turbines and associated access roads on the Mars Hill ridgeline, as well as most of the main access road up the hill will occur at considerable distances of a mile or more from potential receptors. The proposed substation and operations building to be constructed at the base of Mars Hill are approximately $\frac{3}{4}$ of a mile from the nearest receptor, a farm located at the corner of Tower Road (the main access road to Mars Hill) and East Ridge Road.

The power delivery line from the substation to the MPS switching station will pass mainly through agricultural properties. Given the short period of time that power line construction takes in a given area, construction noise impacts will be very limited at any potential receptor.

Noise from increased local construction traffic and construction equipment will not result in adverse long-term impacts on humans or wildlife. Section 20: Blasting, includes a description of the standards and procedures that will be followed during construction to minimize noise effects.

Noise During Operation

Sounds that may be produced by the proposed wind turbines during operation were evaluated to determine the potential for noise impacts to occur at protected locations (e.g., dwellings) in the

surrounding area. According to the American Wind Energy Association (<http://www.awea.org>) modern wind turbines most commonly produce broadband sound, usually described as “swishing” or “whooshing” as their revolving rotor blades encounter turbulence in the passing air. Some wind turbines (usually older designs, unlike those proposed for Mars Hill) can also produce tonal sounds (whirring or humming) caused primarily by mechanical components. An important distinction between wind turbines and conventional industrial facilities is that wind turbines only operate when the wind is blowing, and any noise they generate is often masked by the background noise caused by the wind.

■ **Uses, Zoning, and Plans**

A plan of the northern portion of the proposed project (where the potential for impacts exists) showing proposed turbine locations, property lines, properties currently under agreement or pending, and known protected features is provided (Figure 5-1). The Town of Mars Hill Planning Board has approved the project and found it to be consistent with their comprehensive plan, applicable zoning, and in compliance with all applicable local standards. Town approval is contingent on meeting requirements for state and federal environmental permits, including noise standards under Maine’s Site Law.

■ **Protected Locations and Quiet Areas**

Protected locations that may be affected by the project were identified from aerial photos and town tax records, and verified in the field by Evergreen Wind Power (Figure 5-1). For the purposes of this analysis, all of the protected locations are assumed to fall within quiet areas as defined under Site Law because of their rural setting.

■ **Noise Generated by the Proposed Development**

An analysis of potential noise impacts of the proposed project, prepared by Resource Systems Engineering, Inc. (RSE) is attached, including a description of the types of sounds that may be generated and predicted sound levels throughout the surrounding area (Appendix 5-1). Based on the assumption that all protected locations are located within quiet areas, the applicable noise

standard for the project is 45 dBA. Most of the proposed turbines are located along the ridgeline, more than 3,000 feet from the nearest dwellings. According to the modeling, sounds associated with the operation of turbines along the ridgeline fall below 45 dBA before reaching any protected locations located to the south, east, or west. Sound from the project may exceed noise standards at some of the dwellings located to the north of the project along Knoxville Road. Turbine locations in these areas will only be used if easements or leases are acquired for all necessary protected locations, or if more detailed analysis shows that noise standards will be met.

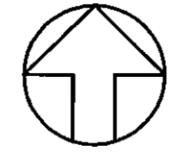
■ Control Measures

The proposed GE 1.5 MW turbines have been designed and constructed to reduce the potential for adverse noise impacts from the project. Specific design features to reduce noise include:

- slow-rotation technology;
- mounting of the rotor on the upwind side of the supporting tower to eliminate the noise effects of the tower's wind shadow;
- noise-reducing insulation of the gearbox and generator;
- noise-reducing design of the gearbox and nacelle; and
- noise-reducing design of the rotor blades.

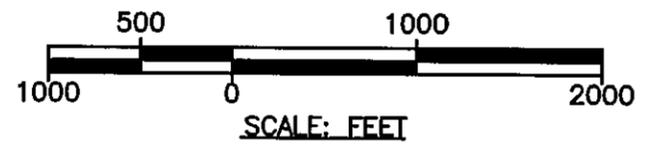
Potential noise impacts have also been minimized by selection of turbine locations that are far from protected locations, and by the acquisition of rights to potentially affected properties.

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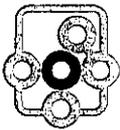
LEGEND

- * KNOWN PROTECTED LOCATION
- PROPERTY LINES
- PROJECT LEASE BOUNDARY
- 50 PREDICTED SOUND LEVEL CONTOUR (dBA)



MARS HILL WIND FARM PROJECT
 PROJECT BOUNDARY AND NEARBY
 PROTECTED LOCATIONS
FIGURE 5-1

APPENDIX 5-1
NOISE ANALYSIS BY RESOURCE SYSTEMS ENGINEERING, INC.



December 26, 2003
File 030625/2.5.3.2

Devine Tarbell & Associates, Inc.
970 Baxter Boulevard
Portland, Maine 04103

ATTENTION: David P. Cowan, Senior Scientist

REFERENCE: Mars Hill Wind Farm

SUBJECT: Sound Level Analysis

Dear Mr. Cowan:

RSE has completed a preliminary analysis of sound levels for the Mars Hill Wind Farm, a proposed 49.5 megawatt (MW) wind energy facility to be located in the Town of Mars Hill, Aroostook County, Maine. The objective of the analysis was to determine the expected sound levels from routine operation of the Mars Hill Wind Farm and compare them with relevant noise control standards.

The Maine Department of Environmental Protection (DEP) regulates noise under authority of the Site Location of Development Law (38 M.R.S.A 481-490). Maine DEP established Chapter 375.10, Control of Noise, as a state regulation to protect certain existing land uses, such as residential properties, schools, and recreation areas, from excessive noise levels generated by new or expanded developments.

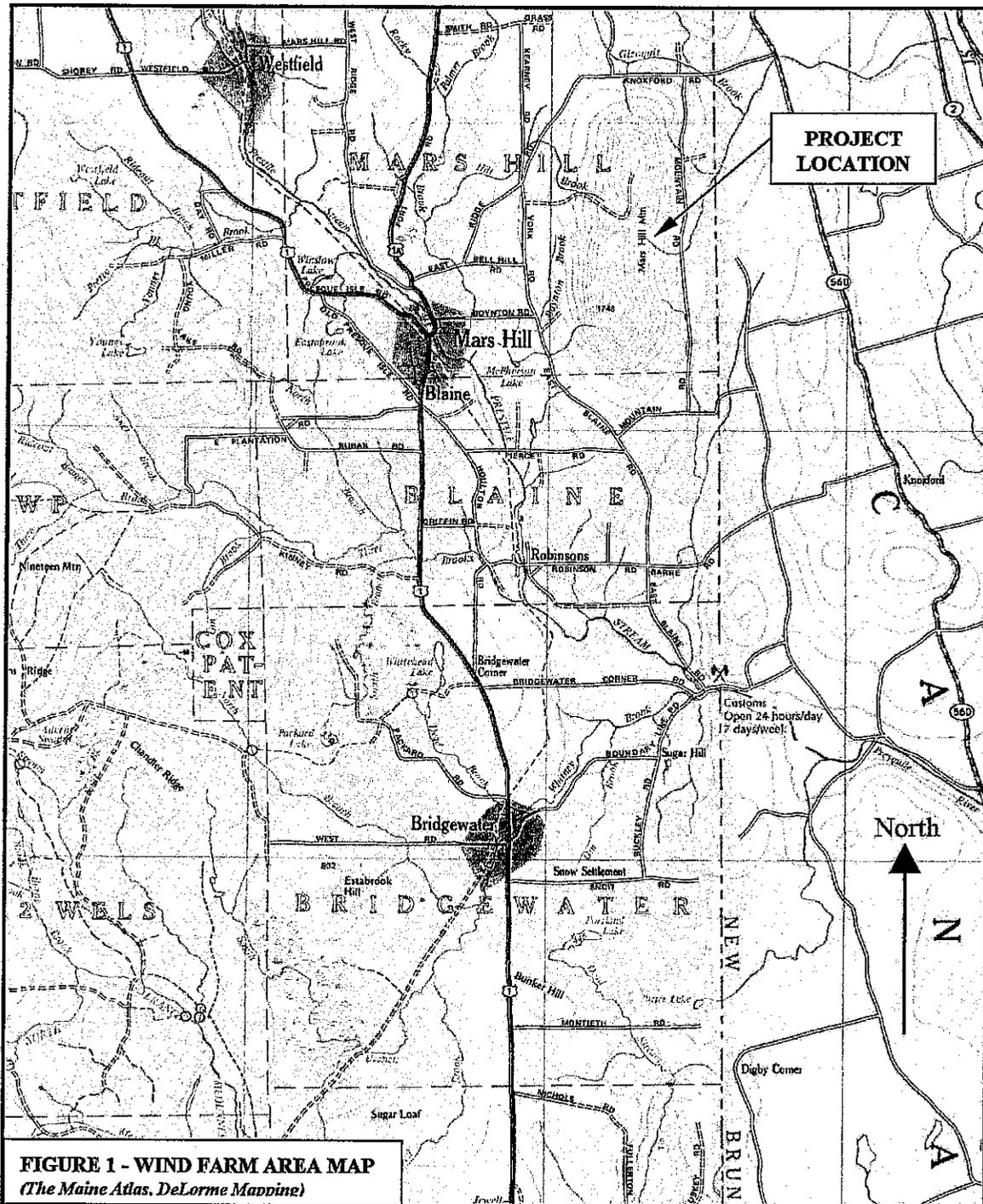
The following presents a description of the wind farm project, a summary of Maine DEP noise standards, and estimates of future wind farm sound levels. The sound level estimates are compared to the applicable sound level limits; and areas where future sound levels may approach or exceed the limits are identified.

Site Description - Evergreen Wind Power and the Town of Mars Hill plan to construct the proposed wind farm along the ridgeline of Mars Hill and nearby agricultural fields. Mars Hill is located approximately 1½ miles east of the center of the Town of Mars Hill and less than a mile from the Canadian border. Mars Hill stretches approximately 3½ miles from north to south and is over a mile wide from east to west. There are public roads on all sides of the base of Mars Hill. These roads include Knoxford Road to the north, Mountain Road to the east, Mountain Road and East Blaine Road to the south, and York Road and East Ridge Road to the west.

Surrounding land uses include a combination of agricultural, undeveloped, residential, and recreation land uses. The nearest residences to the proposed wind farm are located along Knoxford Road to the north and East Ridge Road to the west. Recreational land uses include Mars Hill Golf Course, a public nine hole course, and Big Rock Ski Area, both located on the southwest side of Mars Hill. Big Rock Ski Area has both downhill and cross county ski trails. An area map is shown as Figure 1.

The proposed wind farm will consist of up to 33 wind turbines, access roads, power collection system, a substation, an operations/maintenance building, approximately 3.4 miles of power delivery line, and a switching station located at an existing transmission line. All project components will be located in the

Town of Mars Hill. The turbines will be arranged in a north-south line along the mostly wooded ridgeline of Mars Hill, and in open fields to the north and northwest. Spacing between turbines will vary



from two to four rotor diameters, giving a spacing distance of 141 meters (463 feet) to 308 meters (1010 feet). There are no external ladders or similar structures proposed on the towers and no guy wires or external cables. Access for maintenance will be provided by ladders located inside the towers.

There are currently 35 potential wind turbine locations that are being further evaluated in order to select 33 turbine locations for construction of the wind farm. Figure 2, Wind Turbine Site Map, shows the 35 possible sites being evaluated and the local tax map and lot numbers of surrounding parcels. The site map also shows those parcels that are currently under agreement with Evergreen Wind Power. Selection of the 33 turbine sites will be based on studies related to meteorology and noise emissions as well as other environmental factors.

Wind Turbines - Evergreen Wind Power has selected the widely-used General Electric (GE) 1.5s and 1.5sl model wind turbines with a rated electric generating capacity of 1.5 megawatts (MW). The proposed turbines feature variable speed control for constant frequency power. Each turbine consists of a free-standing monopole tower, an enclosed nacelle mounted at the top of the tower, and an upwind-mounted, three-blade rotor.

For the Mars Hill project, the turbines will have hub heights of 64.7 meters (212 feet) or 80 meters (262 feet) above the base elevation; and rotor diameters of 70.5 meters (231 feet) or 77 meters (253 feet), respectively. Maximum heights, with one rotor blade straight up, will be approximately 100 meters (328 feet) or 119 meters (389 feet), respectively. The turbines will begin rotating (cut-in) at wind speeds of 3 to 4 meters/second (6.7 to 8.9 mph), and shutdown (cut-out) when winds reach 25 meters/second (56 mph). Rotation speed varies from about 10 to 22 rpm, or one rotation every three to six seconds. Tower oscillation is kept to a minimum through active damping of the entire turbine system.

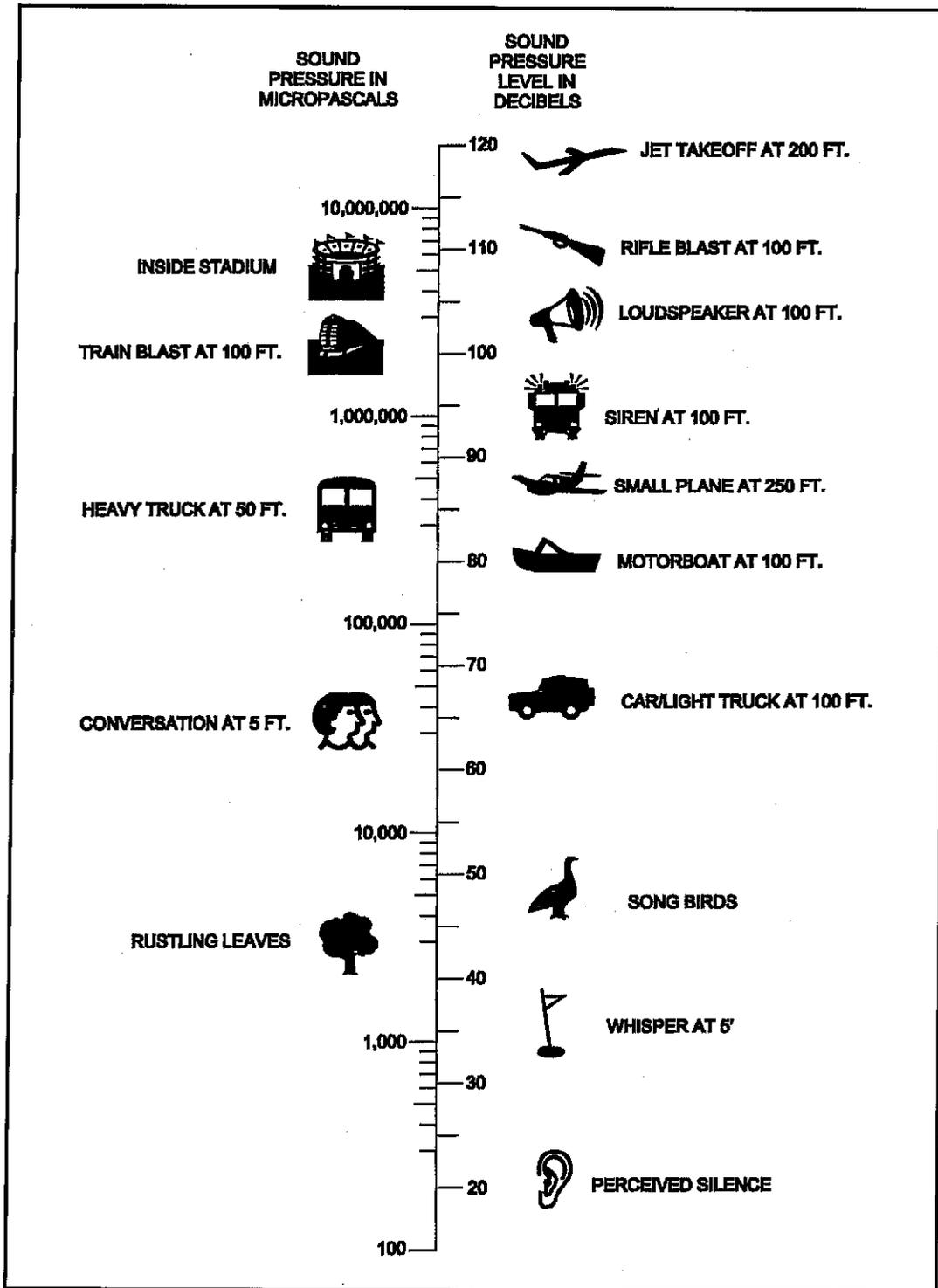
Major components of the wind turbine are a three-blade rotor; main shaft, gear box, and generator installed inside the nacelle (enclosure) at hub height, and a transformer at ground level. In addition to the nacelle enclosure, the gear box and generator are supported by elastomeric elements to minimize noise emissions. Rotor blades with active blade pitch control are also designed to minimize noise emissions. (GEA-13550, 6/03 5M).

Sound Levels - Sound is a rapid fluctuation in pressure that the human ear has the potential to detect. The decibel (dB) is the standard unit of sound measurement. The decibel scale is logarithmic to avoid very large numbers associated with units of pressure change. Figure 3 shows a comparison of sound pressure and decibel levels for some typical sound environments.

Undesirable sound is generally referred to as *noise*. The effects of noise depend on its frequency (or pitch), decibel level, and duration, particularly in relationship to changes in existing sound levels. The frequency of a sound refers to the number of vibrations per second, measured in hertz (Hz). Sounds audible to humans range from about 20 Hz to 20,000 Hz, with greater sensitivity between 1,000 and 4,000 Hz. Sound is generally a disorderly mixture of many frequencies, but may consist of a single frequency known as a pure tone. A-weighted sound levels, expressed as dBA, simulate the hearing response of the human ear to varying sound level frequencies.

Sound propagation outdoors can be compared to ripples created by throwing a stone into a pond with a calm surface. The ripples spread out uniformly in all directions of the pond surface decreasing in amplitude as they move away from the source. For a stationary noise source outdoors, the sound level

FIGURE 3
RELATION BETWEEN SOUND PRESSURE IN MICROPASCALS
AND SOUND PRESSURE LEVEL IN DECIBELS



drops by 6 dB every time the distance from the source is doubled. Thus, if the sound level is 50 dBA at 500 feet, the sound level at 1000 feet will be 44 dBA and will be 38 dBA at 2000 feet. Obstacles in the sound path, such as intervening terrain or buildings, and weather conditions can greatly affect outdoor sound propagation.

For constant sounds, a brief measurement close to the source can generally quantify the level of sound over both long and short periods. However, when sound sources vary, longer sampling periods are needed to accurately quantify the sound levels. Integrating sound level meters are commonly used to measure fluctuating sound sources. These meters record the sound level every 1/8 of a second when set to fast response and every one-second on slow response. When set to fast, the instrument measures 480 sound level readings every minute and 28,800 readings in an hour. Due to the large number of readings, statistical parameters are used for analysis and comparison of measurement data.

The most commonly used parameter for measuring outdoor sound is the A-weighted equivalent sound level or L_{Aeq} . The L_{Aeq} represents the sound energy during a given sampling period as a constant decibel level, taking all fluctuations into account similar to an averaging technique. Other common statistical parameters include L_{A10} , L_{A50} and L_{A90} , which represent the sound level exceeded 10%, 50%, and 90% of the time during the measurement, respectively. The L_{A90} excludes most transient or intermittent noise sources and therefore, is commonly used to determine the value of constant or *background* sound during a measurement.

As described herein, the Maine DEP applies sound level limits based on characteristics of the site and vicinity such as existing land uses, local zoning designations and existing sound levels. The Maine DEP limits are based primarily on hourly L_{Aeq} measurements. In addition, the Maine DEP applies specific limits for potentially disturbing types of sounds based on their frequency and duration.

In order to calculate sound levels resulting from multiple noise sources, such as wind turbines, it is necessary to combine decibel levels from each source. Decibels add exponentially to reflect their logarithmic nature. When two sounds of equal decibel levels are combined, the resulting sound level is just 3 dB higher than the individual sound levels (e.g. 50 dBA + 50 dBA = 53 dBA). RSE's analysis of the wind farm addresses both individual and combined sound sources associated with the wind farm.

Maine Site Law and Regulations - Section 484 (3) of the Site Location of Development Law (Site Law) requires a developer to make adequate provision for fitting a development harmoniously into the existing natural environment and to demonstrate that the development will not unreasonably affect existing land uses and the natural environment. Site Law Regulation, Maine DEP Chapter 375.10, *Control of Noise*, establishes sound level limits at property boundaries of a development and at nearby sensitive land uses referred to as *protected locations*. The regulation defines a protected location as "*any location accessible by foot, on a parcel of land containing a residence or approved subdivision...*" In addition to residential parcels, protected locations also include, but are not limited to, schools, state parks, and designated wilderness areas (ref. MEDEP 375.10.G.16).

The hourly L_{Aeq} resulting from routine operation of the wind farm is limited to 75 dBA at any facility property boundary. The limits at protected locations vary depending on local zoning or surrounding land uses and existing (pre-development) ambient sound levels. At protected locations within commercially or industrially zoned areas, or where the predominant surrounding land use is non-residential, the hourly sound level limits for routine operation are 70 dBA daytime (7:00 a.m. to 7:00 p.m.) and 60 dBA nighttime (7:00 p.m. to 7:00 a.m.). At protected locations within residentially zoned areas or where the

predominant surrounding land use is residential, the hourly sound level limits for routine operation are 60 dBA daytime and 50 dBA nighttime. In addition, at any protected location where the daytime pre-development ambient hourly sound level at a protected location is equal to or less than 45 dBA and/or the nighttime hourly sound level is equal to or less than 35 dBA, the hourly sound level limits for routine operation are 55 dBA daytime and 45 dBA nighttime (ref. MEDEP 375.10.C.1).

In all cases, nighttime limits at a protected location apply up to 500 feet from sleeping quarters. At distances over 500 feet or where no sleeping quarters exist, daytime limits apply during all facility operating hours (ref. MEDEP 375.10.G.16).

For areas where pre-development ambient sound levels exceed the specified limits at a protected location, limits may be chosen as 5 dBA less than existing sound levels for new developments or 3 dBA more than the pre-development sound levels for modifications or expansions to existing developments (ref. MEDEP 375.10.C.1).

The Maine DEP regulation also establishes sound level limits for construction, maintenance, and tonal and short duration repetitive sounds as follows:

Construction - Sound from nighttime construction is subject to the same nighttime limits as routine operation. Even though daytime construction limits are contained in Maine DEP Chapter 375.10, normal daytime construction sound levels are exempt from this regulation by Maine Statute (38 M.R.S.A. Section 484). Equipment used in construction must comply with applicable federal noise regulations and include environmental noise control devices in proper working condition as originally provided by its manufacturer (ref. MEDEP 375.10.C.2).

Maintenance -- Sound from routine, ongoing maintenance activities are considered part of routine operations and subject to the daytime and nighttime limits for routine operation. Sound from occasional, major overhaul activities is regulated as construction activity (ref. MEDEP 375.10.C.3).

Short Duration Repetitive and Tonal Sounds - When routine operations produce a short duration repetitive or tonal sound, 5 dBA is added to the observed sound levels of these sounds for determining compliance. There is also a maximum sound level (L_{Amax}) limit for certain types of short duration repetitive sounds (ref. MEDEP 375.10.C.1.d and e).

Sounds associated with certain activities or at certain locations are exempt from regulation under Maine DEP Chapter 375.10. Exempt activities and locations associated with the proposed wind farm may include (ref. MEDEP 375.10.C.5):

- Construction activity during daylight or daytime hours, whichever is longer;
- Registered and inspected vehicles operating on public ways or making deliveries or pickups that do not operate on site for more than 60 minutes at one time;
- Safety and protective devices installed in accordance with code requirements;
- Test operations of emergency equipment that occur during daytime hours and no more than once per week;
- Protected locations where a noise easement has been conveyed to the regulated development; and
- Emergency maintenance and repairs.

Table 1 presents a summary of Maine DEP sound level limits.

TABLE 1				
MAINE DEP SOUND LEVEL LIMITS				
Location	Daytime Limit (Hourly L_{Aeq})	Nighttime Limit (Hourly L_{Aeq})	Tonal Sounds	Short Duration Repetitive Sounds (SDRS)
Facility Property Line	75 dBA	75 dBA	No 5 dBA assessment	No 5 dBA assessment or L_{Amax} limit
Protected Location zoned Commercial, Industrial or Transportation	70 dBA	60 dBA within 500 feet of sleeping quarters otherwise 70 dBA	5 dBA assessment applies to Tonal Sounds	5 dBA assessment and possible L_{Amax} limit for SDRS
Protected Location zoned Residential, Rural or Similar Land Use	60 dBA	50 dBA within 500 feet of sleeping quarters otherwise 60 dBA	5 dBA assessment applies to Tonal Sounds	5 dBA assessment and possible L_{Amax} limit for SDRS
Quiet Area - Protected Location where existing daytime sound level is 45 dBA and/or less and nighttime sound level is 35 dBA or less	55 dBA	45 dBA within 500 feet of sleeping quarters otherwise 55 dBA	5 dBA assessment applies to Tonal Sounds	5 dBA assessment and possible L_{Amax} limit for SDRS
Noisy Area - Protected Location where existing daytime or nighttime sound level exceeds standard daytime and/or nighttime limits	Pre-development daytime sound level minus 5 dBA (per election of applicant)	Pre-development nighttime sound level minus 5 dBA (per election of applicant)	5 dBA assessment applies to Tonal Sounds	5 dBA assessment and possible L_{Amax} limit for SDRS

A review of area maps and project information for the proposed wind farm indicate that some nearby protected locations are likely quiet areas per Maine DEP regulations. At these protected locations, Maine DEP regulations limit the hourly L_{Aeq} generated by the wind farm to 55 dBA during daytime hours, and to 45 dBA during nighttime hours (within 500 feet of a residence). The Maine DEP regulation also adds 5 dBA to short duration repetitive and tonal sounds, if present at a protected location, when determining compliance with quiet area limits.

When a development is located in a municipality that has duly enacted a quantifiable noise standard that (1) contains limits that are not higher than the Maine DEP limits by more than 5 dBA, and (2) limits or addresses the types of sounds regulated by the Maine DEP, then the Maine DEP is to apply the local standard rather than the Maine DEP standard. Further, when noise produced by a facility is received in another municipality, the quantifiable noise standards of the other municipality must also be taken into consideration (ref. MEDEP 375.10.B.1). RSE understands that neither the Town of Mars Hill nor nearby Blaine, Maine to the south have enacted a quantifiable noise standard. Further, RSE understands that there are no international or Canadian noise standards applicable to the proposed wind farm.

Sound Levels During Wind Farm Operation - RSE has developed a sound level prediction model of the proposed wind farm using the CADNA/A software program to map area terrain in three-dimensions, locate the proposed wind turbines, and calculate outdoor sound propagation to the surrounding area. Area topography and base tower elevations, for entry to CADNA, were provided to RSE by Devine Tarbell based on USGS topographic maps and the proposed site layout.

Although 33 wind turbines are proposed, preliminary sound level estimates for the wind farm were calculated as if wind turbines would operate on all 35 sites under consideration. Further, sound levels were calculated as if all 35 turbines were operating simultaneously at 95% of rated power as defined by General Electric (GE). These near-full load conditions exist at a wind speed of 10 meters per second (22.4 miles per hour) at a height of 10 meters above grade. RSE modeled the wind turbines as point sources at a hub height of 65 meters (212 feet) above base/grade elevation using a sound power specification from GE (Sound Emission Characteristic Values for the GE Wind Energy 1.5s, GE Wind Energy, September 18, 2003). Table 2 provides sound power levels by third octave and whole octave frequency from the GE specification.

TABLE 2
WIND TURBINE SOUND POWER LEVELS (Wind Speed = 10 m/s)

3rd Octave Center Frequency Hz	Sound Power Level dBA	Sound Power Level dB	Tonal Estimate dB	Tonal Threshold dB	Tonal Yes or No	Octave Band Frequency Hz	Sound Power Level dBA
20	58.8	109.3					
25	66	110.7	-0.7	15	No		
31.5	74.1	113.5	4.25	15	No	31.5	77.0
40	73.2	107.8	-3.55	15	No		
50	79	109.2	1.25	15	No		
63	81.9	108.1	0	15	No	63	87.1
80	84.5	107.0	0.7	15	No		
100	85.4	104.5	-1.45	15	No		
125	88.8	104.9	0.75	15	No	125	93.4
160	90.4	103.8	-0.8	8	No		
200	93.4	104.3	2.4	8	No		
250	91.4	100.0	-1.8	8	No	250	97.3
315	92.7	99.3	0.6	8	No		
400	92.6	97.4	0.45	8	No		
500	91.4	94.6	-1.95	5	No	500	97.5
630	93.8	95.7	1.5	5	No		
800	93	93.8	-1	5	No		
1000	93.9	93.9	0.2	5	No	1000	98.5
1250	94.2	93.6	1.6	5	No		
1600	91.1	90.1	-0.85	5	No		
2000	89.5	88.3	-0.05	5	No	2000	94.5
2500	87.9	86.6	-0.15	5	No		
3150	86.4	85.2	0.15	5	No		
4000	84.5	83.5	0.85	5	No	4000	89.2
5000	80.6	80.1	0.5	5	No		
6300	75.6	75.7	0.45	5	No		
8000	69.3	70.4	-1.45	5	No	8000	76.8
10000	65.5	68.0	-0.95	5	No		
12500	63.2	67.5					
SUM	103.9	119.2				SUM	103.9

Source: Sound Emission Characteristic Values for the GE Wind Energy 1.5s, GE Wind Energy, September 18, 2003

Table 2 also provides an analysis of the potential for tonal sounds to be generated by the wind turbines based on the GE noise specifications. The Maine DEP definition for tonal sounds is based on the difference between linear (unweighted) sound levels at adjacent third octave bands. RSE calculated the linear sound levels from the A-weighted sound power levels and the differences between third-octave sound levels and the average of sound levels at adjacent third octaves. The threshold differences to meet tonal sound criteria can also be found in Table 2. The results show that the wind turbines are not likely to generate a tonal sound while operating with a wind speed of 10 meters per second. This finding is consistent with the GE specification which found no "Pollution-relevant tonality content". Further, the GE Specification indicates no "pulse addition", which leads to the conclusion that the wind turbines are unlikely to generate short duration repetitive sounds during routine operation.

The results of the CADNA noise model predictions for operation of the wind turbines are shown as sound level contour lines on the Mars Hill Wind Farm site map (see Figure 4, Sound Level Contours). The predicted sound levels on Figure 4 are shown at an interval of 5 dBA and range from 30 to 55 dBA. An interval of 5 dBA was chosen to emphasize sound levels from the wind turbines that correspond to potential Maine DEP sound level limits at protected locations (i.e. 45, 50, and 55 dBA). The results of Figure 4 were used to identify parcels where the proposed wind farm has the potential to exceed Maine DEP limits for protected locations. A listing of these parcels and Maine DEP limits is shown in Table 3.

TABLE 3				
PARCELS WHERE ESTIMATED SOUND LEVELS FROM WIND FARM ARE AT OR ABOVE 45 dBA				
Sound Levels ≥ 45 dBA		Wind Turbine on Lot?	Sound Levels Also:	
Tax Map	Lot No.		≥ 50 dBA	≥ 55 dBA
2	4A	No	No	No
2	33	Yes	Yes	Yes
2	38B	Yes	Yes	Yes
3	4	No	No	No
3	6	Yes	Yes	Yes
3	7	Yes	Yes	Yes
3	13	No	Yes	Yes
3	14	Yes	Yes	Yes
5	6B	No	No	No
5	13	Yes	Yes	Yes
5	14	Yes	Yes	Yes
5	16A	No	Yes	Yes
5	16B	No	No	No
5	17	Yes	Yes	Yes
5	19	No	No	No
5	20	No	No	No
5	21	No	Yes	No
5	22	No	Yes	No
6	1	Yes	Yes	Yes
6	2	Yes	Yes	Yes
6	3	Yes	Yes	Yes

TABLE 3				
PARCELS WHERE ESTIMATED SOUND LEVELS FROM WIND FARM ARE AT OR ABOVE 45 dBA				
Sound Levels ≥ 45 dBA		Wind Turbine on Lot?	Sound Levels Also:	
Tax Map	Lot No.		≥ 50 dBA	≥ 55 dBA
6	4	No	Yes	No
6	5	No	Yes	No
6	6A	No	Yes	Yes
6	13	No	No	No
6	13A	No	No	No
6	17	Yes	Yes	Yes
8	13	Yes	Yes	Yes
8	15	No	No	No
8	15A	No	No	No
8	16	No	No	No
8	17B	No	No	No
8	17C	No	No	No
8	19	No	Yes	Yes
9	1	No	No	No
9	1B	No	No	No
9	2	No	No	No
9	3	No	Yes	No
9	4A	No	No	No
9	12	No	No	No
9	12D	No	No	No
9	13	No	No	No
9	14	Yes	Yes	Yes
9	15	No	Yes	No

In addition, Table 3 indicates parcels upon which one or more of the 33 planned wind turbines may be located. RSE understands that Evergreen Wind Power and Devine Tarbell & Associates will use the results from Table 3 and Figure 4 to identify parcels for further noise assessment and for turbine site selection. First, a determination will be made whether a parcel is a protected location or if a landowner agreement qualifies the parcel for an exemption from Maine DEP sound level limits. Such agreements will be in place for parcels where wind turbines will be built. Second, site selection options will be considered for compliance with potential sound level limits. Overall, the objective is to site the wind turbines and reach landowner agreements to ensure that the applicable Maine DEP sound level limits will be met.

A significant factor in sound emissions and outdoor propagation from the wind farm is the effect of wind speed on turbine operations and ambient, non-turbine sound levels. There are likely to be significant fluctuations in wind speed from the hub height of the wind turbines at 212 feet to the regulated height of 4 to 5 above ground level.

The quietest periods of the day or night generally occur when the winds are light or calm. In addition, as the wind speed incident on a wind turbine drops, sound levels from the turbine are reduced. The wind

turbines do not operate at wind speeds below 3 meters per second (6.7 mph). Thus, during periods of light or calm winds, sound level emissions from the wind farm will be virtually non-existent. As wind speed increases, the turbines begin to rotate reaching 95% rated load at a wind speed of 10 meters per second (22.4 mph). Sound level estimates from the noise model are based on the operating sound level at 95% rated load. The range of wind speeds for which GE has provided a sound level specification is 6 meters per second (13.4 mph) to 10 meters per second. At 6 meters per second, the overall sound power level is approximately 2 dBA less than at 95% rated load.

Maine DEP standards for measuring pre-development ambient sound (MDEP 375.10.H.3.1) require monitoring sound levels at representative protected locations during "all hours that the development will operate". Depending on wind conditions, the wind farm is capable of operating any time of the day or night, including holidays and weekends. However, the wind farm will only operate when the wind incident to the turbines is at or above the cut-in wind speed of 3 meters per second (6.7 mph), and will only reach 95% rated load with a wind speed of 10 meters per second (22.4 mph). Ambient, non-turbine sound levels may increase significantly when the wind speed reaches 10 meters per second at 10 meters above the ground, as required for turbine operation at 95% rated load. The wind gradient may result in very different wind speeds near the ground than at turbine/rotor heights.

The Maine DEP establishes a maximum wind speed of 12 mph for purposes of measuring both pre-development and operating sound levels at nearby protected locations (MDEP 375.10.H.2.4). This presents some difficulties for measuring pre-development ambient sound levels during periods when the wind turbines will operate, as well as measuring operating sound levels under the meteorological conditions set forth in Maine DEP standards. Such technical issues related to wind turbine sound levels are not addressed by the current Maine DEP noise standard.

A meteorological study could be done to establish typical wind gradients in the vicinity of the proposed wind farm and determine relationships between wind speeds at turbine heights and near the ground. If such relationships can be established, then a written measurement protocol could be developed for monitoring pre-development ambient sound levels under weather conditions expected to occur during operation of the wind farm. This protocol should be submitted to Maine DEP for review and approval prior to monitoring pre-development sound levels. Establishing pre-development sound levels under conditions when the wind farm will operate may lead to different sound level limits than measurements as set forth in Section H of Maine DEP Chapter 375.10.

Construction Sound Levels - Construction noise is temporary and variable. Many construction machines operate intermittently and equipment varies with each construction phase. A variety of construction equipment will be used to build the wind farm including earth-moving equipment for land clearing, excavation, and site grading, and cranes. Typical earth moving equipment and cranes generate sound levels of 75 to 88 dBA at a distance of 50 feet.

Noise from construction may be noticeable at nearby residences, especially during excavation and final grading. Local traffic during construction is expected to increase along with associated vehicle noise. Because of the temporary nature of construction noise, no adverse or long-term effects are anticipated.

The mobile nature of construction equipment and the manner in which construction work must be done makes complete control of construction noise infeasible. Construction activity will occur between the hours of 7 a.m. and 7 p.m., and therefore is not subject to specific Maine DEP sound limits. Other measures to mitigate construction noise will include compliance with federal regulations limiting noise

from trucks and portable compressors, and ensuring that equipment and sound muffling devices provided by the manufacturer (or equivalent) are kept in good working condition.

Findings and Recommendations – The results of this preliminary analysis indicate potential exists for the wind farm to generate sound levels at or above Maine DEP residential and quiet area limits at several nearby parcels. Land use information shows that most of these parcels are not likely to be protected locations and/or will be the subject of landowner agreements with Evergreen Wind Power for siting of one or more wind turbines. Among other items, RSE understands that landowner agreements will cover noise emissions from the wind farm. RSE has also found that sound level limits at protected locations could vary if pre-development sound levels were measured during weather conditions when the wind farm will operate at or near full-rated load. The following recommendations are made in consideration of these findings.

1. Review the list of parcels with potential to exceed Maine DEP limits (Table 3) to identify protected locations and parcels covered by landowner agreements (encompassing noise emissions).
2. For protected locations without landowner agreements, determine likely daytime and nighttime sound level limits based on location of dwellings and sleeping quarters. Compare these limits with estimated wind farm sound levels to determine if future sound levels will meet Maine DEP limits. Where sound levels are found to approach or exceed Maine DEP limits, evaluate options related to wind turbine siting or pursue additional landowner noise easements.
3. Consider performing a meteorological study to establish relationships between wind speeds at rotor heights and near the ground. Based on the meteorological study, determine whether pre-development ambient sound levels should be measured under meteorological conditions expected during wind farm operation. Prior to monitoring sound levels during periods of wind conditions exceeding Maine DEP standards, develop a written protocol for approval by Maine DEP. Use sound level monitoring results to determine applicable sound level limits for comparison to predicted sound levels. At protected locations where sound levels are found to approach or exceed Maine DEP limits, evaluate options related to wind turbine siting or pursue additional landowner noise easements.
4. Prior to construction of the wind farm, it would be advisable to monitor pre-development sound levels at nearby protected locations under various meteorological conditions to form a baseline for isolating wind farm sound levels during future operation.
5. Once construction and startup of the wind farm are complete, sound levels at nearby protected locations should be monitored during a range of routine wind farm operations to verify compliance with applicable Maine DEP limits.

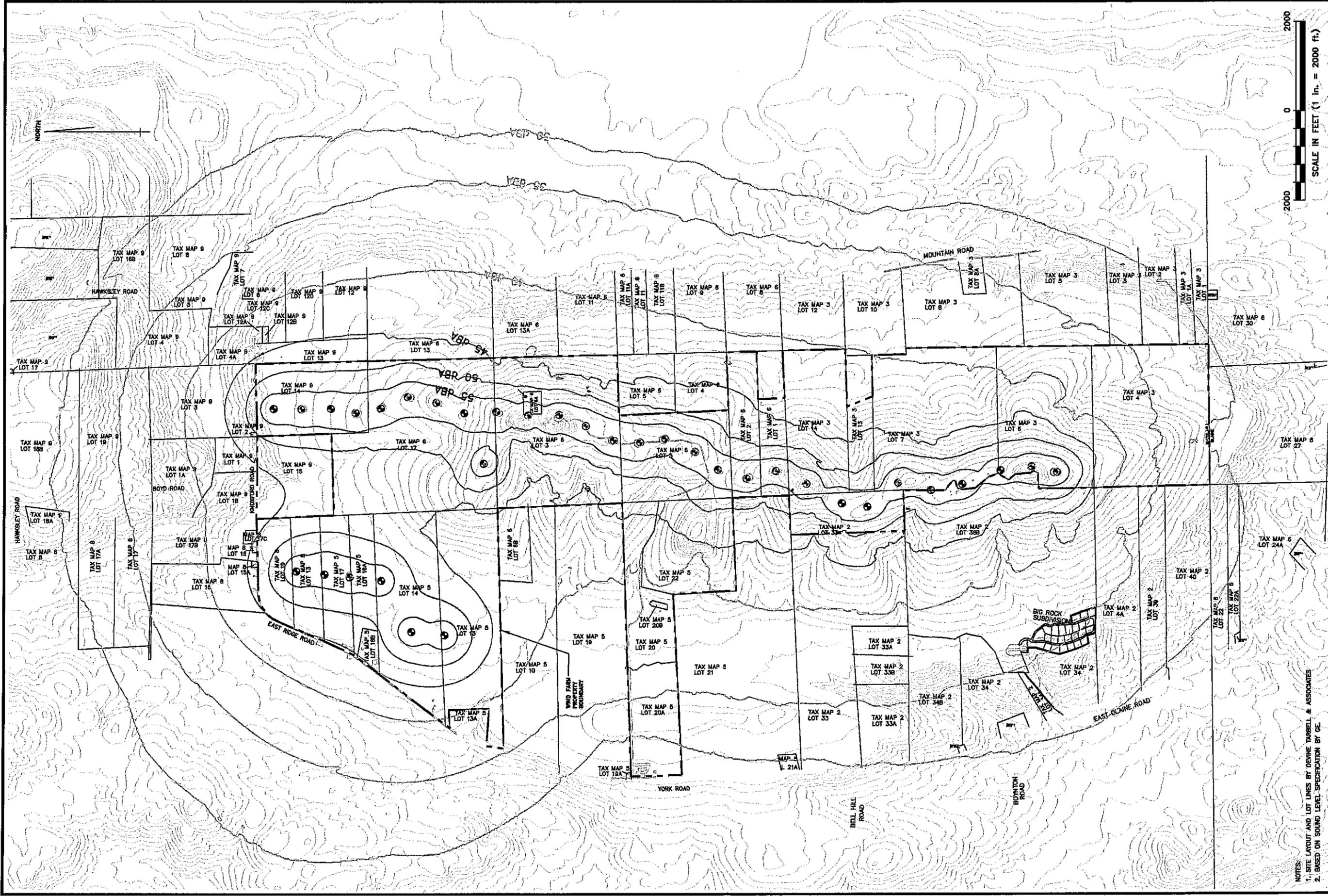
Sincerely,

Resource Systems Engineering


R. Scott Bodwell, P.E.
Project Engineer



Enclosures



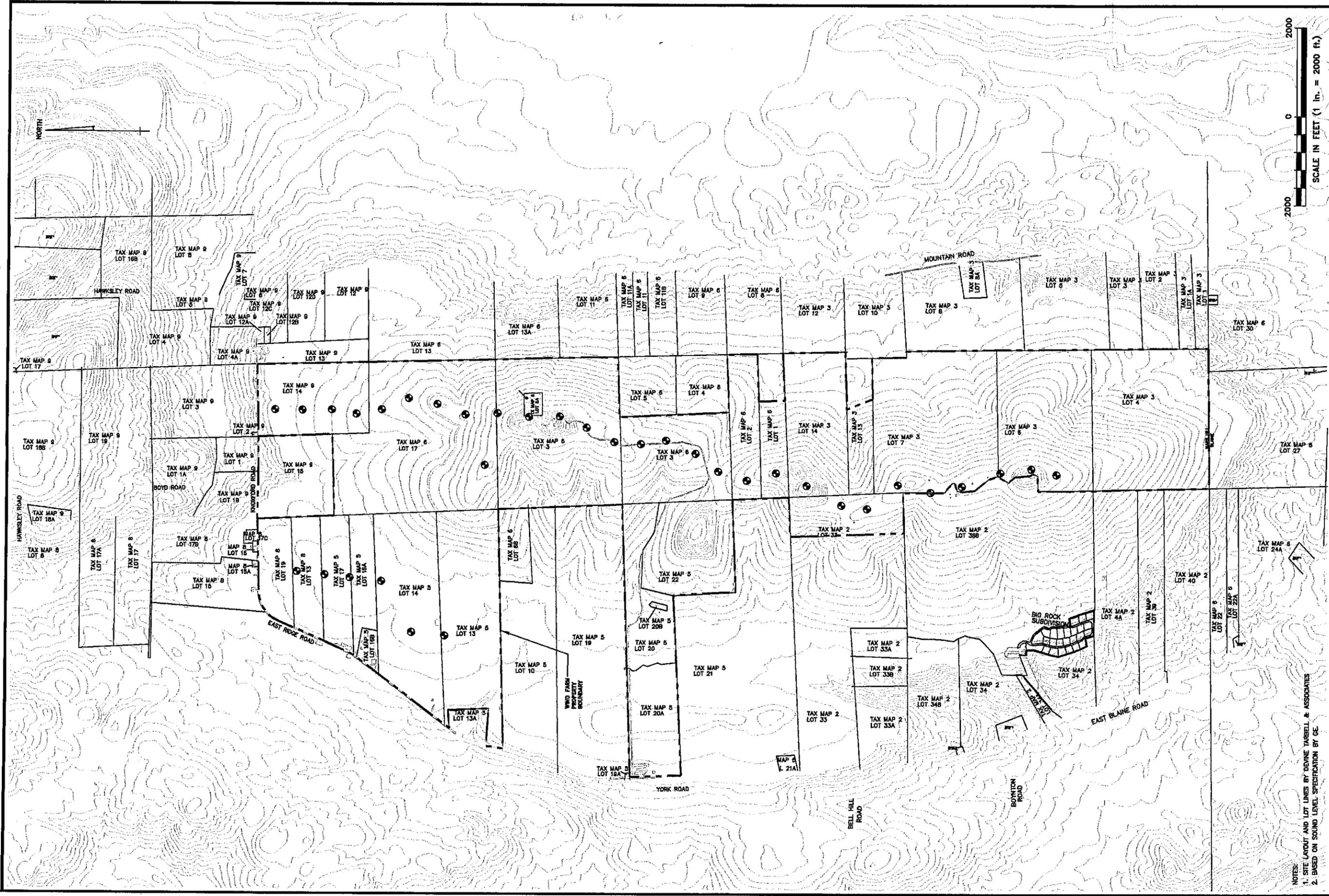
NOTES:
 1. SITE LAYOUT AND LOT LINES BY DEBIE TARBELL & ASSOCIATES
 2. BASED ON SOUND LEVEL SPECIFICATION BY GE.

DWG NO.: SLS-02 SHEET: 1 OF 1
 PROJECT: 030625 REV: 0
 DRWN: RSB DATE: 12-26-03
 CHECK: APP'D:

FIGURE 4
 SOUND LEVEL CONTOURS
 MARS HILL WIND FARM

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 35 Church Rd.
 P. O. Box K
 Brunswick, Maine
 (207) 725-7896





NOTES:
 1. SITE LAYOUT AND LOT LINES BY DEVINE FARRELL & ASSOCIATES
 2. BASED ON SOUND LEVEL SPECIFICATION BY GE

DWG NO.: SLS-01 SHEET: 1 OF 1
 PROJECT: 030625 REV: 0
 DRWN: RSB DATE: 12-26-03
 CHECK: APP'D:

FIGURE 2
 WIND TURBINE LOCATIONS
 MARS HILL WIND FARM

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