

The Black Nubble Wind Farm

## **Section 5: Sound**

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## **1.0 Introduction / Overview**

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The Black Nubble Wind Farm is sited in a remote forested area, with the nearest residential (camp) property 5 miles from the proposed turbine sites. For the most part, the only creatures that will hear the wind farm construction and operation will be its operating personnel, visitors, and the resident animals.

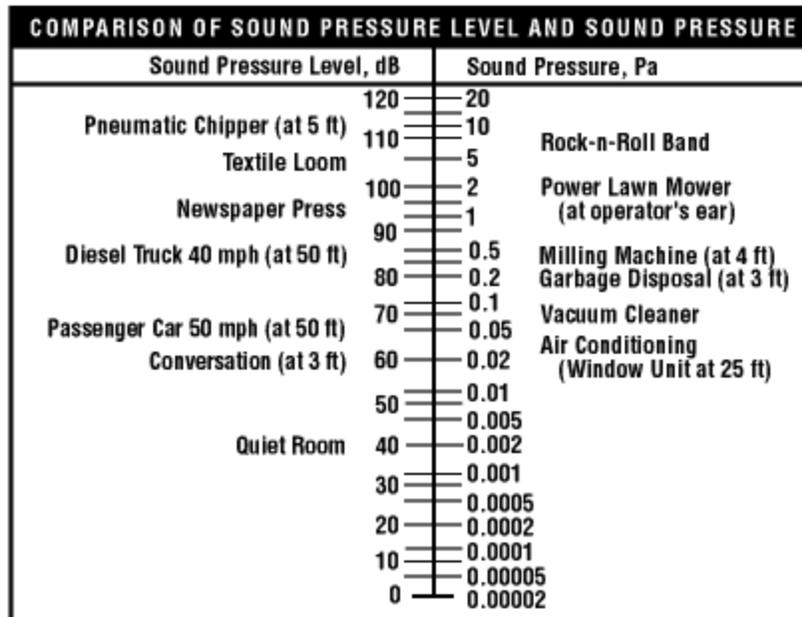
The expected sound levels from the wind farm have been calculated utilizing specialized wind farm simulation software called WindPRO. This software has predicted the maximum sound levels at the borders of the property to be approximately 50-55 dBA, which are less than what LURC requires. This sound level is less than a typical air conditioner from a distance of 25'. See the Vestas Sound Level Acoustic Map (Appendix 5.1) for further detail.

There are only two inhabited sites near the proposed wind farm that may experience noise levels within the audible range. Sound levels at both sites are well below regulatory thresholds. The United States Navy runs a training facility in the forested area south of the project, and a segment of the Appalachian Trail is located about over 3 miles south of Black Nubble Mountain. The minor effects of noise at these two sites are described below and detailed in Redington sound map in Appendix 5.2. From this map it can be seen that noise levels at these two sites will be low, and will have no adverse impact on their current uses.

### **1.1 Sound Levels**

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Sound is the sensation felt by the human ear from vibrations transmitted through the air. Noise is generally considered to be undesirable sound. Sound is measured in decibels (dB), a logarithmic scale designed to compress a wide range of values into a more easily managed range. The threshold of hearing is around 20dB, normal conversation is about 65dB, and a loud train blast at 100 ft is around 100dB. A chart of normal sounds and their sound pressure levels in dB is shown below.



**Typical Sound Pressure Level Chart**  
 from: [www.ccohs.ca/oshanswers/phys\\_agents/noise\\_basic.html](http://www.ccohs.ca/oshanswers/phys_agents/noise_basic.html)  
 (Canadian Centre for Occupational Health & Safety)

Sound outdoors from a stationary source dies out over distance, dropping by 6dB whenever the distance from the source doubles. This formula for the drop in sound level over distance is not always accurate in the real world; decreases in actual sound level vary somewhat with changes in terrain slope, terrain cover and/or atmospheric (weather) conditions.

While humans can generally hear sounds in a frequency range from 20 Hz to 20,000 Hz, the ear’s response is not linear, with greater sensitivity between 1,000 and 4,000 Hz. To match the relative sound levels in nature with the uneven response of the human ear, a sound curve weighted by frequency, called an A-weighted scale or dBA, is used. An A-weighted sound level will seem equally loud to the human ear regardless of frequency. Many sound level limits are expressed in dBA, including the Maine regulatory limits

**1.2 Maine LURC Noise Regulations**

LURC Chapter 10.25 section F sets the maximum permissible sound pressure levels produced by different developments at the development property or boundary lines. The sound requirement for

D-PD subdistrict is “as determined by the Commission.” Requirements for D-GN subdistricts (General Developments) are 65 dBA daytime (7:00 AM to 7:00 PM) and 55 dBA at night. It is likely that the Redington development will be held to a similar standard as this subdistrict. Sounds from construction-related activities during the daytime period of 7:00 AM to 7:00 PM are exempted.

## **2.0 Developments Producing a Minor Noise Impact**

### **2.1 Noise Generated by the Wind Turbines**

Modern wind turbines have made significant improvements in engineering and design to reduce sound emissions. Today’s wind turbines are extremely quiet. The Sound Engineering division of Vestas, Inc. modeled the impact of the propose turbines on the surrounding area (See Appendix 4.1)

When applying the wind farm development to the General Development standard of 65 dBA in the daytime and 55dbA at night, the wind farm will meet the daytime standard, but at a few areas along the property borders, the 55 dBA sound level night time standard will be barely exceeded (see Appendix 5.1). There are no residences or other facilities in or near these steep terrain areas. The remaining areas along the property line will see between 45 and 55 dBA.

Wind turbines generate sound from two sources: the nacelle (which houses the generator and gearbox at the top of the tower) and the blades as they “swoosh” by. Both the turbine nacelle and blades have been extensively studied and specifically engineered to minimize sound output. Turbine blades have been engineered to eliminate aerodynamic drag, and nacelles are designed with sound insulation.

### **2.2 Construction Noise**

Construction will occur from early winter through early spring, stop for melt/mud season, then continue from late spring through the fall completion of the wind farm. Construction sound will be variable and intermittent, from a variety of machines and activities, including light and heavy trucks, excavators, bulldozers and graders building roads

and power lines, drilling rigs and cement trucks building foundations, and medium and heavy lift cranes erecting turbines. Typical sound impacts from clearing and earth moving machinery are estimated to range between 50 and 60 dBA at property boundaries.

The size of the site and nature of the construction work makes complete control of sound infeasible. Sound from mountaintop construction will be 5 miles from the nearest residential lot, for the most part inaudible due to distance. Sound from construction will be audible at the two close inhabited areas mentioned previously, the Appalachian Trail and the U.S. Navy's SERE s training site, but at very low levels.

Construction of the wind farm will take place between 7:00 AM and 7:00 PM, and therefore construction-related sound will not be subject to specific Maine limits. .

Finally, consistent with best construction practices, the project will ensure that manufacturers' sound muffling devices on all construction equipment are maintained in good working condition. Section 20, "Blasting," describes procedures to be used to minimize sound impacts for any road and foundation blasting that is necessary.

### 2.3 U.S. Navy SERE School

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The Search Evasion and Rescue E-training (SERE) school is located on heavily forested land directly south of the wind farm, federally owned property that abuts the proposed development. Permanent installations of the SERE school include an administration building and a helipad, located approximately 2.5 miles south of the project's Black Nubble property line, which are the only consistently occupied facilities on the property. The rest of the area is used intermittently for training in outdoor skills.

Training exercises for Navy personnel are occasionally staged in the forested area to the south of the project, but not in the steep terrain immediately south of the property line. Maximum sound levels for some active training areas will thus range from at 45-40 dBA, a soft conversation level, or quieter, as the sound level map in Appendix 4.2 shows. Construction sounds are also likely to be audible in the training areas, but at the same unobtrusive level, due to distance.

Because the Navy does not-use the steep terrain immediately adjacent to the common boundary between the properties, and because their use of surrounding area is intermittent and variable, occurring at distances where sound levels are expected to range from quiet to inaudible, sounds from the wind farm will not adversely impact the SERE school.

## 2.4 Appalachian Trail

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The Appalachian Trail (AT) winds through the mountainous terrain in the region. At its closest point to the wind farm, below and to the east of Poplar Ridge, the AT is approximately 16,500 feet (3.1 miles) from the nearest turbine. At this location, depending on the wind direction, it is unlikely the turbines will be audible. Computer simulations show that the sound at this distance will be well below 35 dB(A). Since that section of the AT is essentially a through-hiking section, with no designated stopping places, and since any operating sounds from the wind farm will be either very faint or inaudible, sounds from wind turbines will not have an undue adverse impact on AT users.

An additional, larger map was created (see Appendix 5.3) that is an overlay of the sound map on an Appalachian Trail map. The map shows that sound intrusion on the trail will be minimal, quite probably inaudible.

During construction, given the proximity of the AT to the wind farm, occasional construction sounds may be audible. Again, because of the “in transit” nature of that trail section, and the variability and limited intermittence of sounds from construction, noise levels will not create an undue impact for trail users.

## **3.0 Developments – Major Noise Impact**

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This section does not apply.

## **4.0 Appendices**

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### 4.1 Appendix – Redington Sound Map

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Produced by the Sound Engineering division of Vestas, Inc.

### 4.2 Appendix – AWEA Fact Sheet - Noise

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