SECTION 5.
NOISE

Bodwell EnviroAcoustics LLC conducted an assessment of the sound levels within the Turbine Area from operation of the Number Nine Wind Farm (Project) proposed by Number Nine Wind Farm LLC (Applicant). Commonwealth Associates prepared audible noise calculations for both portions of the Generator Lead Line.

The Project consists of the Turbine Area, North Generator Lead Line (North Line), and Bridal Path Generator Lead Line (Bridal Path Line). It is anticipated that the Bridal Path Line will be acquired by a utility and the North Line may also be acquired by a third-party in the future. As such, the North Line and Bridal Path Line are evaluated as distinct Project components in anticipation of the potential transfer of these components of the Project. As described in Section 2 of the application, the Applicant has agreements with landowners on whose lands (Wind Parcels) it will construct and operate the Project.

5.1 TURBINE AREA

The Turbine Area will include 119 turbines. The Project designs depict 129 turbine locations and the sound assessment assumes that all 129 turbines are operating; however the Applicant will ultimately select 119 of these turbine sites for construction. The turbines will be one of two Gamesa G114 models, with a rated capacity of either 2.0 or 2.1 megawatts (MW), hub height of 93 meters, rotor diameter of 114 meters, and maximum height of 150 meters (492 feet) with the blade fully extended.

As described in Section 2 of the application, the Applicant is party to leases with timberland landowners on whose lands (Wind Parcels) it will construct and operate the Project, including but not limited to the installation and operation of wind turbines on these Wind Parcels. The Applicant is also party to easements with those timberland landowners. There are recreational leases granted by the timberland landowners within the bounds of the Wind Parcels and there are dwellings and/or camps, mostly seasonal, located on certain of those recreational lease sites.

5.1.1 Noise Standards

The sound level assessment was conducted in accordance with the Site Law Regulations promulgated as Chapter 375.10(I), Sound Level Standards for Wind Energy Developments.

As set forth in Chapter 375.10(I), the Project is required to meet the following hourly sound level limits for turbines:

a) 75 dBA at any time of day at any property line of the wind energy development or contiguous property owned or controlled by the wind energy developer; and
b) 55 dBA between 7:00 a.m. and 7:00 p.m. (daytime) and 42 dBA between 7:00 p.m. and 7:00 a.m. (nighttime) at any protected location.

In contrast to other developments, sound level limits for wind projects do not depend on local zoning or pre-construction sound levels. The most restrictive sound limits apply at noise sensitive land uses that meet the definition of a "protected location," as set forth in Chapter 375.10(G). At locations more than 500 feet from a residence or sleeping quarters, the 55 dBA daytime sound limit applies during all hours of operation.

The closest dwelling on a regulated protected location subject to the 42 dBA nighttime sound limit is approximately 2,260 feet from a turbine. There are several recreational leases granted by the timberland landowners within the bounds of the Wind Parcels and there are dwellings and/or camps, mostly seasonal, located on certain of those recreational lease sites. Those recreational lease sites are generally depicted in Exhibit 5-A, Figure 3-2 and are further identified in Exhibit 5-A, Table 6-3.

5.1.2 Predictive Sound Model

The sound level assessment describes the terrain-based sound model developed for the Project that was used to calculate predicted sound levels at all locations in the vicinity of the Project.

All 129 turbine sites are included in the sound model calculation and were modeled as G114-2.1 MW turbines. Sound levels were calculated with all 129 turbines operating at full rated sound power output (106.6 dBA) plus turbine manufacturer uncertainty (2.0 dBA) and model uncertainty (1.0 dBA), for a total modeled sound power level of 109.6 dBA.

The predictive sound model conservatively estimates wind turbine sound levels and outdoor sound propagation by assuming the following:

a) All turbines operating simultaneously at full rated sound output;
b) Receptor points located downwind of all turbines;
c) A ground absorption coefficient of 0.5 to represent a mix of hard and soft ground;
d) Surface water bodies were mapped and assigned a ground absorption factor of 0.0 similar to hard ground for an acoustically reflective surface;
e) Attenuation from intervening terrain and atmospheric absorption for standard day conditions; and
f) Uncertainty of 1 dBA per the demonstrated accuracy of ISO 9613-2 model and 2 dBA per turbine manufacturer specification was added to the rated turbine sound output.

5.1.3 Sound Level Findings

The sound level assessment demonstrates that with all wind turbines at 129 locations operating simultaneously at full rated sound output, the Project will meet the Maine DEP 55 dBA daytime sound limit at all regulated protected locations and the 75 dBA limit at the Project boundary.

To ensure compliance with nighttime limit of 42 dBA within 500 feet of dwellings on nearby regulated protected locations, 5 turbines (turbines B17, B18, B19, BB22, and BB23) in the vicinity of Number Nine Lake are proposed to operate in noise-reduced operating (NRO) mode during nighttime hours.

The sound level assessment evaluates the potential for short duration repetitive and tonal sounds based on information from Gamesa and operations sound testing of wind projects at similar sites in Maine. The Project is not expected to generate these types of sounds at regulated protected locations.

5.1.4 Operations Sound Testing

Operations sound testing will be conducted in accordance with Chapter 375.10.I(8) to evaluate compliance with applicable sound limits and adjust turbine operations if needed. Prior to operations, the Applicant will prepare, and submit to MDEP, an operations sound testing plan to identify sound test locations and other testing details. Testing will be conducted during the first year and every successive fifth year of commercial operation.

In the event that operations sound testing, including assessment of associated dBA penalties for short duration repetitive sounds or tonal sounds, results in exceedance of applicable sound limits, the Project will implement NRO or other adjustments to meet the applicable limits at all regulated protected locations.

In addition, a formal protocol for addressing sound complaints will be established to ensure that each sound complaint is fully documented and resolved in a consistent manner. Prior to operations, the Applicant will prepare, and submit to MDEP, a complaint response protocol that establishes guidelines for reporting, documenting, investigating, reporting, and responding to sound complaints.

5.1.5 Sound Easements

The sound limits do not apply to sound received within the Project boundary or Wind Parcels which are subject to a sound easement. As set forth by Chapter 375.10.C(5)s, a landowner may grant a sound easement that exempts the Project from sound limits for the parcel of land and term covered by the easement. The Wind Parcels for the Turbine Area include such sound easements, as described in Exhibit 5-A, Table 6-3.

5.2 NORTH GENERATOR LEAD LINE

Commonwealth Associates evaluated sound levels expected for the North Line. The Project is required to meet the sound limits of Chapter 375.10 and Commonwealth determined that the sounds generated are within sound limits for quiet areas at regulated protected locations (Exhibit 5-B).

The sound limits do not apply to sound received within the Project boundary or Wind Parcels, or to those areas in which the Applicant has obtained a sound easement. As set forth by Chapter 375.10.C(5)s, a landowner may grant a sound easement that exempts the Project from sound limits for the parcel of land and term covered by the easement. One Wind Parcel on the North Line includes such a sound easement and there are no recreational lease dwellings within 500 feet of the edge of the right-of-way for this portion of the North Line (Exhibit 5-B).

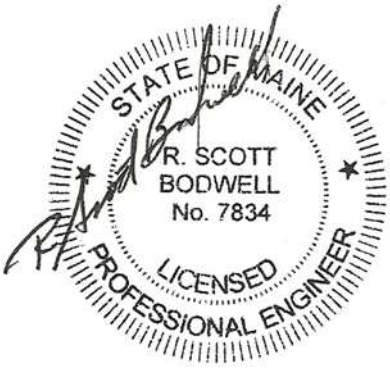
5.3 BRIDAL PATH GENERATOR LEAD LINE

Commonwealth Associates evaluated sound levels expected for the Bridal Path Line. The Project is required to meet the sound limits of Chapter 375.10 and Commonwealth determined that the sounds generated are within sound limits for quiet areas at regulated protected locations (Exhibit 5-B).

EXHIBIT 5-A SOUND ASSESSMENT – TURBINE AREA

Sound Level Assessment
Number Nine Wind Farm LLC
Aroostook County, Maine

April 2015



Prepared for:
EDP Renewables North America LLC
Number Nine Wind Farm LLC

Prepared by:
R. Scott Bodwell, PE
Bodwell EnviroAcoustics, LLC
55 Ocean Drive
Brunswick, Maine 04011

Bodwell EnviroAcoustics LLC

1.0 Introduction

Number Nine Wind Farm LLC (Applicant), a subsidiary of EDP Renewables North America LLC proposes to construct the Number Nine Wind Farm Project (Project), a grid-scale wind energy facility, in Aroostook County, Maine. The Project will consist of 119 Gamesa G114 wind turbines to be located on 129 permitted sites in T10 R3 WELS, E Township, T9 R3 WELS, TD R2 WELS, T8 R3 WELS, and St. Croix Township, Maine. The G114 turbines will be one of two types, 2.0 MW (megawatts) or 2.1 MW, resulting in a total rated generating capacity of approximately 250 MW of electricity. Other Project components include an operations and maintenance building, a collector system and substation, and generator lead line.

Bodwell EnviroAcoustics LLC (BEA) assessed sound levels expected to result from construction and operation of the Number Nine Wind Farm. The main objective of this Sound Level Assessment is to evaluate sound levels from simultaneous operation of all proposed wind turbines at maximum rated sound power output during nighttime stable atmospheric conditions. Predicted sound levels are calculated at noise sensitive land uses in the vicinity of the Number Nine Wind based on turbine sound power levels and sound propagation determined in accordance with proven international standards and verified by sound level testing of operating turbines at numerous wind energy projects in Maine. In addition, BEA evaluated the potential for sound levels emitted from the proposed collector substation and generator lead lines. Project sound levels are compared to applicable noise standards as set forth in Maine Department of Environmental Protection (DEP) Site Location of Development regulations for Control of Noise (ref. 06-096 CMR c. 375.10).

2.0 Environmental Acoustics

The study of environmental acoustics relates to the role that sound (or noise) plays in the environment. Geographically, this is an extremely diverse area of study ranging from wilderness to urban settings and from airborne sound to the underwater sound environment of oceans and lakes. Environmental acoustics is most commonly associated with assessing the noise impact of land-based developments such as wind energy projects. The following subsections provide an overview of acoustic terminology and wind turbine sound.

2.1 Sound and Decibels (Standard)

Sound is produced by many different sources that generate pressure fluctuations in air that the human ear often has the capability to detect as audible. Sound can also travel through other media such as water or structural components of a building. The types of sounds that humans experience every day can generally be divided into two categories, natural and man-made sound.

There are many types of natural sounds that can be heard by humans. The most common of these are wildlife (e.g. birds, frogs and insects), sounds generated by the forces of wind acting on terrain and vegetation, and sounds generated by water action such as ocean waves, river flow and rain. There are also many man-made sounds generated by industrial, transportation and construction sources as well as

sounds generated for the purposes of enjoyment such as music. Residential sounds are also common in many areas and include recreation, yard maintenance, human voices, and amplified music.

The magnitude or loudness of sound waves is measured in units of pressure (pascals) that yield large numbers that are difficult to interpret. For simplicity, the decibel unit or dB was developed to quantify sound pressure levels to reduce the range of numbers. The dB unit represents a ratio of the sound pressure to a standard pressure, usually 20 micropascals. This is a logarithmic ratio similar to the Richter scale for earthquakes so that a small change in sound level expressed in dB represents a larger change in the sound pressure. For example, a 10 dB change in sound level is a tenfold increase in sound pressure. However, this does not mean that the sound is perceived as ten times as loud. A change in sound levels of 3 dB is a doubling of the sound pressure but is considered to be the minimum change that is perceptible to human hearing. A change of 5 dB becomes quite noticeable and an increase of 10 dB is perceived as twice as loud.

The frequency or pitch of sound is expressed in Hertz (Hz) and is the number of sound waves passing a specific point each second, i.e. cycles per second. Frequencies generally considered audible to the human ear range from 20 to 20,000 Hz. Within this range, there are octaves that represent a band of frequencies for purposes of characterizing sound and calculating sound propagation and attenuation. Standard whole octave bands are centered around 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz and 8000 Hz. The center frequency of each octave is double that of the previous octave. Octave bands can be further divided (typically third octaves) and used to determine if a sound source generates an audible pure tone such as a whistle or hum that may be more perceptible than a broad mixture of frequencies. Low frequency sound is typically considered to be at frequencies of 200 Hz and below. Within this range, infrasound has frequencies below 20 Hz and is not generally considered audible to humans except at very high decibel levels.

Sound levels in frequencies ranging from 500 to 2500 Hz are more audible to humans than frequencies below 100 Hz. Consequently, the A-weighting scale was developed to measure sound levels in units of dBA to simulate the hearing response of humans. Under this weighting system, the sound pressure level at low frequencies is reduced based on its audibility to humans. The linear (no weighting) and C-weighting scales are often used to determine the relative contribution of low frequency sounds during a sound measurement. These low frequency sounds may not be audible to humans, hence the use and wide acceptance of the A-weighting network. Figure 2-1 provides a graph that shows the reduction by frequency for A- and C-weighting scales.

Sound level measurements are also time-weighted to represent the relevant parameters or timeframes of interest or identify short duration events. The most common time weightings are “Fast” and “Slow”. Fast-time weighting is based on 1/8 second intervals and is useful for determining rapid changes in sound levels. The slow-time weighting integrates the measured sound levels over a one-second period that reduces the rapid fluctuations for ease of observation.

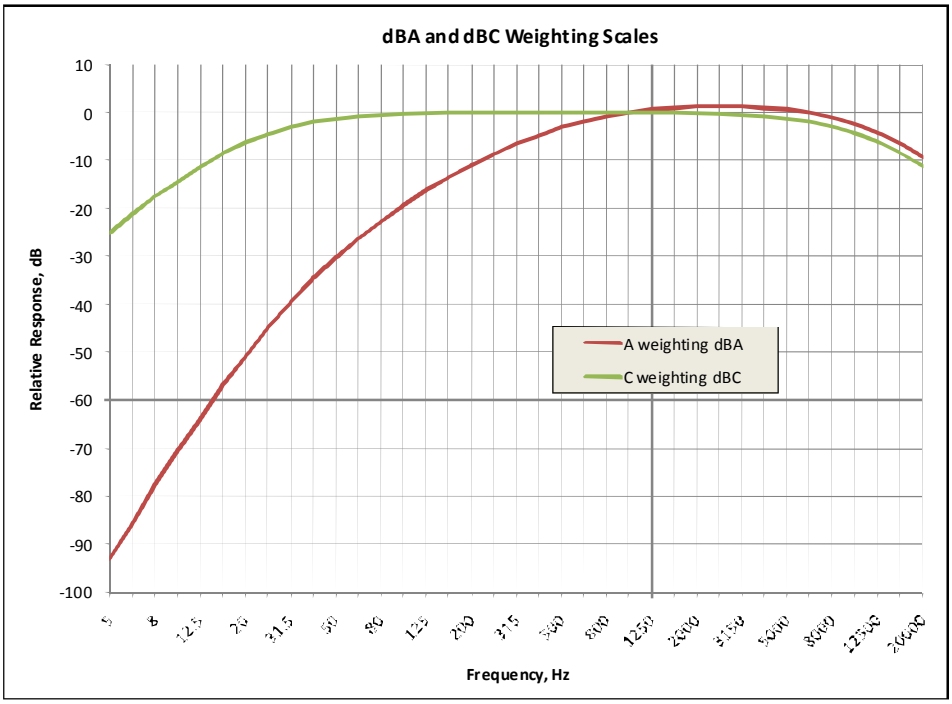


Figure 2-1. Weighting Curves for dBA and dBC Sound Levels

Similar to the size and period of ocean waves, sound waves can vary considerably in amplitude and frequency. When using fast-time weighting, a sound level meter will measure a sound pressure level every 1/8 of second which results in 480 measurements each minute and 28,800 measurements in an hour. Because it would be nearly impossible to evaluate over 28,000 measurements per hour, numerous statistical parameters have been developed for use in quantifying long-term sound level measurements.

The most common is the A-weighted equivalent sound level or LAeq, which represents the time-varying sound level as a single dBA level by effectively spreading the sound energy across the entire measurement period. Other common parameters are percentile levels that represent the percentage of time that a specific sound level was exceeded. For example, the LA10 provides the sound level that was exceeded 10% of the time during the measurement period. This means that 10% of the measured sound levels were higher and 90% were lower than the measured LA10. Other commonly used percentiles include the LA50 or median sound level and the LA90 for which 90% of the measured sound levels are higher. The LA90 is often referred to as the background sound level as it eliminates most fluctuations from short term sound events such as aircraft flights and wind gusts. Figure 2-2 presents a graph that shows the measured sound pressure levels and the resulting equivalent (LAeq), LA10 and LA90 sound level parameters.

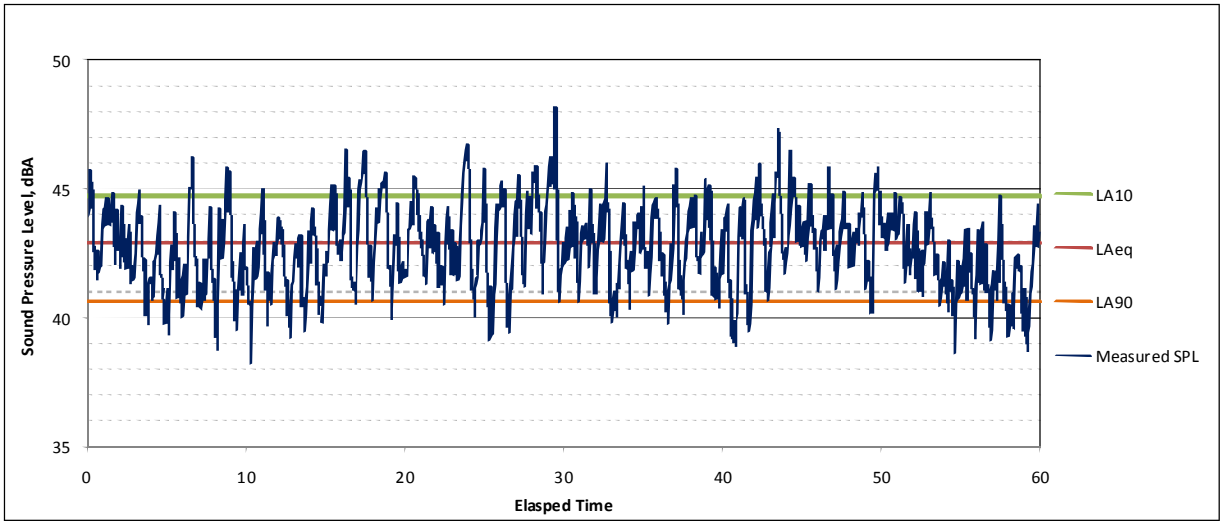


Figure 2-2. Measured Sound Pressure Levels and Statistical Parameters

For purposes of quantifying industrial and other man-made sound sources, the term "sound power level" is used. The unit of sound power level is watts and the term is commonly expressed as Lw. When applied to sound power, the dB unit represents a logarithmic ratio of the source sound power to a reference sound power (10^{-12} watt). Sound power levels are determined by measuring the sound pressure level from a source at a specific distance and calculating the sound attenuation between the source and measurement location. The sound power level provides a mechanism for ranking and quantifying sources of sound, such as wind turbines, in a consistent and standardized manner. It is commonly used in sound performance specifications and as a source input to sound level prediction models. By its nature, the sound power level cannot be measured directly and can be a source of confusion to the public relative to sound pressure levels that are predicted and measured at community locations.

The combination of all existing sound sources, natural and man-made, at a specific location or in a community is known as the ambient sound environment or soundscape. The amplitude and characteristics of the soundscape vary significantly depending on the amount of industrial and residential development, proximity to transportation uses such as highways and airports, and the presence of natural sounds such as wind, flowing water, and wildlife. In general, the more rural or undeveloped an area is, the lower the ambient sound levels will be. Ambient sound levels are usually higher during daytime hours than at night due to more traffic and human activity, higher wind speeds and other natural sounds during the day. At night, these daytime sources typically diminish and sound levels are reduced with the exception of strong winds or rain occurring during the overnight period.

The character of sound is determined by its loudness or amplitude and its pitch or frequency. Humans can detect a wide range of sound level amplitudes and frequencies as audible but are more sensitive to a specific range of frequencies. Consequently, the perceived loudness of sound also depends not only on its amplitude but on its frequency characteristics as well. For example, the sound of birds, frogs or flowing water is often perceived as quieter than man-made sounds at the same amplitude. The sound levels associated with some common sources and sound environments is presented as Table 2-1.

Indoor Setting	Outdoor Setting	Sound Sources	Sound Pressure Level, dBA
*Rock Concert**		*Jet Takeoff at 300 feet**	*120*
Ship Engine Room	*Loud Thunder**	*Rifle Blast at 100 feet*	*110*
*Movie Theater**		*Chain Saw high rpm at 5 feet* *Siren at 100 ft*	*100*
*Heavy Industrial Work Space**		*Lawn Mower high rpm at 10 feet* *Large Truck or Loader high rpm 50 feet**	*90*
Busy Airport	*Heavy Rain*	*Motor Boat high rpm at 100 feet*	*80*
Light Industrial Workspace	*Heavy Surf Beach** *Busy City or Highway*	*AC Unit at 5 feet* *Automobile 45 mph at 50 feet*	*70*
Busy Office/Conversation Room with TV	*Urban Daytime*	*Strong Wind in Trees** *Nighttime Frogs* *Airplane Flyover**	*60*
	Suburban Daytime/Urban Nighttime	*Bird Calls/Morning Chorus* *Small waves on shoreline*	*50*
Quiet Office *Library*	*Rural Area Daytime*	*Moderate Wind in Trees*	*40*
Sleeping Quarters at Night	*Rural Area Nighttime*	*Light Wind in Trees*	*30*
Idle Recording Studio	*Very Remote Area* *Nighttime* *Perceived Silence*		*20*
			10
		Threshold of Hearing	*0*

Table 2-1. Typical A-Weighted Sound Levels

Note: These are typical sound levels and subject to significant variation depending on the number of and distances from sound and transportation sources.

**Sound with prominent Low Frequency components*

Sources:
www.mvn.usace.army.mil/ss/osha600/s600/refer/menu14c.pdf
Measurements and Observations by R. Scott Bodwell, P.E.

2.2 Outdoor Sound Propagation

Sound travels through air at a speed of approximately 1126 feet per second or 768 miles per hour. Thus it takes just over two seconds for a sound wave to travel a half mile. The number of sound waves that travel past a given point in one second is determined by its frequency or pitch. The sound pressure level decreases or attenuates as sound spreads out and travels over distance through the air. Attenuation results from distance, atmospheric absorption, and terrain effects. The rate of attenuation due to distance or spreading of the sound wave (i.e. divergence) is the same for all frequencies, which is approximately 6 dB per doubling of distance from a simple point source.

Table 2-2 provides the sound pressure level at various distances from a point source having a sound power level of 106 dBA. This relationship is shown graphically in Figure 2-3. The sound level reduction shown in Table 2-2 and Figure 2-3 is due only to distance attenuation and does not include attenuation from atmospheric absorption, terrain and foliage, or reflection from hard surfaces.

Source Sound Power Level, LwA = 106 dBA	
Distance, Feet	**Sound Pressure Level, dBA**
25	80
50	74
100	68
200	62
400	56
800	50
1600	44
3200	38

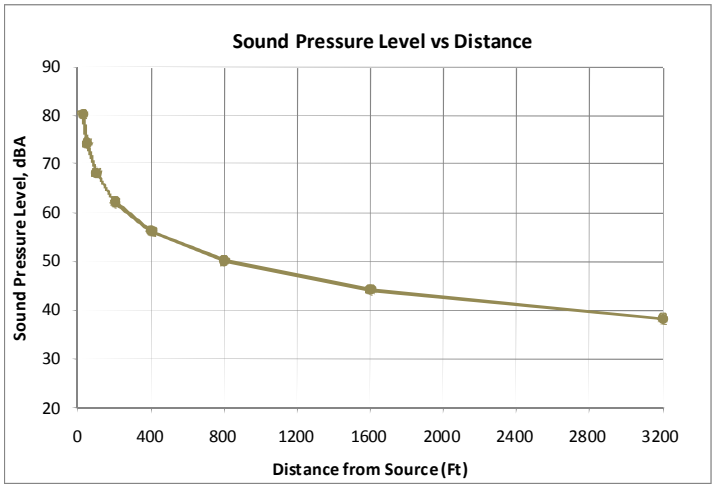


Table 2-2 & Figure 2-3. Attenuation of Sound Levels over Distance

Sound energy is absorbed by the atmosphere as it travels through the air. The amount of absorption varies by the frequency of the sound and the temperature and humidity of the air. More sound is absorbed at higher frequencies than at lower frequencies due to the relative wavelengths.

In addition to temperature and humidity, wind speed and direction can affect outdoor sound propagation. When sound travels upwind the sound waves can bend upward creating a "shadow" zone near the ground where sound levels decrease when compared to downwind sound propagation. Wind gradients, temperature inversions and cloud cover can cause refraction or bending of sound waves toward the ground resulting in less sound attenuation from terrain and ground cover over large distances.

Sound attenuation can also result from intervening terrain and certain types of ground cover and vegetation. An example of intervening terrain is a hill or ridge that blocks the horizontal sound path

between a sound source and receiver. This same effect can result from buildings and other solid structures such as a sound barrier fence. Sound will also attenuate as it travels over soft ground cover or through vegetation such as trees and shrubs. The amount of ground and foliage attenuation depends on the characteristics of the ground cover and the height and density of vegetation. Conversely, reflective ground or the surface of a water body can cause reflection of sound and less overall attenuation.

When multiple sound sources are present in an area, the sound level contribution from each source must be added to determine of the combined sound level of all sources. Due to logarithmic basis of the dB unit, adding sound levels is different than standard arithmetic. Adding two equal sound sources that each measure 50 dBA at a specific point results in a combined sound level of 53 dBA. It will then take two more equal sound sources of 50 dBA each, or four total, to cause the sound level to increase by another 3 dBA. Thus, four equal sources at 50 dBA yields a total sound level of 56 dBA.

Specifications for calculating outdoor sound propagation have been developed by international standards organizations as well as individual countries based on empirical data developed over many years. These specifications form the basis for sound level prediction programs that allow calculation of outdoor sound propagation using three-dimensional terrain models. The most widely used and accepted standard for calculating outdoor sound propagation is ISO 9613-2 *Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General Method of Calculation*. This standard has been applied to accurately calculate the sound levels from operation of wind turbines and is the standard applied in this analysis. Further details concerning the sound level prediction model developed for Bingham Wind to account for various site and weather conditions can be found in Section 6.2 of this report.

2.3 Wind Turbine Sound

The sources of sound from operation of wind turbines are mechanical gears, motors and cooling equipment and the aerodynamic effects of the rotor blades traveling through the air. When operating at or near full sound output, the primary sound source from a wind turbine is rotation of the rotor blades with more sound energy generated from the outer sections of the blade and blade tip.

An international standard has been developed as IEC 61400-11 *Wind turbine generator systems – Part 11: Acoustic noise measurement techniques* that provides specific and detailed procedures for determining the sound power level from wind turbines. The IEC standard was developed by industry and acoustic experts to establish a consistent and repeatable methodology with full documentation for determining the sound output of any type of vertical blade wind turbine. Manufacturers of utility-scale wind turbines follow this methodology to determine the sound output and uncertainty of their turbines for purposes of estimating community sound levels and providing performance guarantees to owners and operators of wind energy facilities.

There has been much advancement in the technology of wind turbines over the last 10 to 20 years. The first generation of utility wind turbines consisted of downwind rotors that were capable of generating significant levels of low frequency sound. Turbines with upwind rotors have replaced the early designs

and drastically reduced low frequency sound emissions. Modern wind turbines are known to generate a "whoosh" type sound from the passage of each blade under certain operating and weather conditions. A short-term increase in sound levels that can occur on the down-stroke motion of the blade is referred to as "amplitude modulation" and generally results in sound level fluctuations of 2 to 5 dBA for utility-scale wind turbines with occasional excursions above 6 dBA.[1] Amplitude modulation occurs at a mixture of audible frequencies and should not be confused with low frequency sound and infrasound.

Sound from wind turbines has been the subject of extensive research, conferences and publications over the past 10 to 15 years. There is considerable technical and related information available that addresses the characteristics, control and impact of sound from wind turbines. There is an abundance of well-researched and informative studies and reports from reputable institutions and individuals.

It is a common assertion that wind turbines generate significant and perhaps harmful levels of infrasound and low frequency sound. In relation to the modern generation of upwind turbines, there is limited evidence for this claim that can be found in impartial technical studies and literature. The general consensus of the independent research community is that annoyance from wind turbine sound is primarily in the most audible mid to high frequencies and not from infrasound or low frequency sound.[2]

2.4 Noise Impact and Regulation

The noise impact that results from wind turbines depends on several factors, notably the change or increase in ambient or background sound levels that will result from turbine operation. For rural areas where hill or ridge top wind turbines are located, the ambient sound level at lower elevations and community locations varies by time of day, weather conditions, and to some degree, by season. Sound levels from wind turbines vary based on the wind speed and turbulence at the turbine hub and can range from no sound output during calm winds to full sound output when winds at the turbine hub reach approximately 20 miles per hour. Sound from wind turbines is most noticeable during stable atmospheric conditions when surface winds are light and the winds aloft (at the turbine hub) remain high enough for full turbine sound output. At other times, when surface winds increase or when wind turbine output diminishes, the sound from operating wind turbines will be less noticeable.

During the planning stages of a wind energy project, considerable effort is made to accurately map land uses and the topography of the entire area potentially impacted by sound from wind turbine operation. Along with wind turbine sound level performance data, this information is used to develop a sound level prediction model for the project. The model inputs and settings are typically adjusted to produce conservative sound level predictions for wind turbine operation. These results are compared to various noise regulations and guidelines to assess the impact of the proposed wind energy project.

---

[1] Observations and analysis of sound level measurements for Mars Hill Wind Farm and Stetson Wind Project, R. S. Bodwell, P.E. G.P. van den Berg, The Sounds of High Winds.

[2] G.P. van den Berg, The Sounds of High Winds.
Danish Electronics, Light and Acoustics (DELTA), Low Frequency Noise from Large Wind Turbines.

In 2012, the Maine Board of Environmental Protection adopted noise control regulations that are specific to wind energy developments. Chapter 375.10(I) of Maine DEP regulations specifies sound level limits for wind energy generating facilities as 55 dBA daytime and 42 dBA nighttime for hourly equivalent sound levels (LAeq) at protected locations. Maine DEP nighttime limits apply within 500 feet of a residence on a protected location or at the property line if closer to the dwelling. The resulting sound levels at a residence itself are usually lower than at 500 feet from the dwelling or at the property line where the 42 dBA nighttime limit applies. Beyond 500 feet, the daytime limit of 55 dBA applies 24 hours per day.

The Maine DEP Chapter 375.10 noise rules establish sound level limits on an hourly basis although compliance for wind energy facilities is evaluated by averaging sound levels over twelve or more ten-minute measurement intervals with turbines operating at full-rated sound output. There are also special provisions and "penalties" that apply when the sound generated by a wind project result in tonal or short duration repetitive sounds. This standard is described in more detail in the remainder of this report.

3.0 Project Description

Number Nine Wind Farm will consist of 119 wind turbines to be constructed on 129 proposed turbine sites located in T10 R3 WELS, E Township, T9 R3 WELS, TD R2 WELS, T8 R3 WELS, and St. Croix Township, Maine, resulting in a total rated generating capacity of approximately 250 megawatts (MW) of electricity. For purposes of permitting and the sound level assessment, all proposed turbine sites are evaluated as if 129 turbines were operating simultaneously at full rated sound output on all proposed turbine sites although a maximum of 119 turbines are planned for construction.

An operations and maintenance building and collector substation will be constructed in T9 R3. The collector substation will consist of a step up transformer, synchronous condenser and associated switchgear. Two segments of a 345 kV Generator Lead Line, from T9 R3 to Houlton, and from Houlton to Haynesville, will deliver power to the grid. Other project features include: upgrades to existing roads and new roads to access the turbines and crane paths; up to four permanent and four temporary meteorological (met) towers; and overhead and underground electrical collector lines among the turbines.

The proposed wind turbines are one of two Gamesa G114 models with a rated capacity of either 2.0 or 2.1 MW, hub height of 93 meters, rotor diameter of 114 meters, and maximum height of 150 meters (492 feet) with the blade fully extended. The wind turbines will be constructed on ridges and hills across several unorganized townships in the vicinity of Number Nine Lake, including Hedgehog Mountain, Hovey Mountain, Meduxnekeag Mountain, Collins Ridge, Nineteen Mountain, Burnt Land Ridge and unnamed hills and ridges west of U.S. Route 1. Figure 3-1 provides a topographic map of the proposed turbine locations.

Number Nine Wind Farm LLC has lease agreements which allow construction and operation of the project including proposed turbines and met towers, O&M Building, collection lines, substation and

electrical generator lead line. Surrounding land uses consist mostly of undeveloped forestry land, with limited rural residential and seasonal properties such as hunting and lakeside camps. Several residential and seasonal properties in the vicinity of the Project are located along the shores of Number Nine Lake and Presque Isle Lake in T9 R3 WELS. The closest dwelling not located within the project lease area is approximately 2,260 feet from a turbine.

Number Nine Wind Farm LLC is party to leases, easements and other agreements which allow for construction and operation of the Project, including proposed turbines and met towers, O&M building, substation, collection lines and electrical generator lead line. Specifically, Number Nine Wind Farm LLC is party to leases ("Wind Lease") with those landowners ("Wind Lessor" or "timberland landowners") on whose lands it will construct and operate the Project, including but not limited to the installation and operation of wind turbines at the proposed locations on these lands ("Wind Lease Parcel"). Number Nine Wind Farm LLC is also party to easements with those landowners on whose lands it will construct and operate the generator lead line for the Project ("Wind Easement Parcel").

There are recreational leases granted by the timberland landowners within the bounds of the Wind Lease Parcels and Wind Easement Parcels, and there are dwellings and/or camps, mostly seasonal, located on certain of those recreational lease sites. These recreational lease dwellings are subject to a sound easement. Additional details concerning Number Nine Wind Farm LLC Wind Leases and sound easements in relation to potentially applicable sound standards can be found in Section 5.0.

Figure 3-2 consists of three sheets (north, center, and south) that provides mapping of the proposed wind turbine locations along with parcel and land use information including topographic contours of the study area and dwellings within the study area. Figure 3-2 also depicts by hatching the Wind Lease Parcels and Wind Easement Parcels that are under a lease or easement agreements for construction and operation of the Project.

NUMBER NINE WIND FARM

Number Nine Wind Farm

Project Turbine Location Map

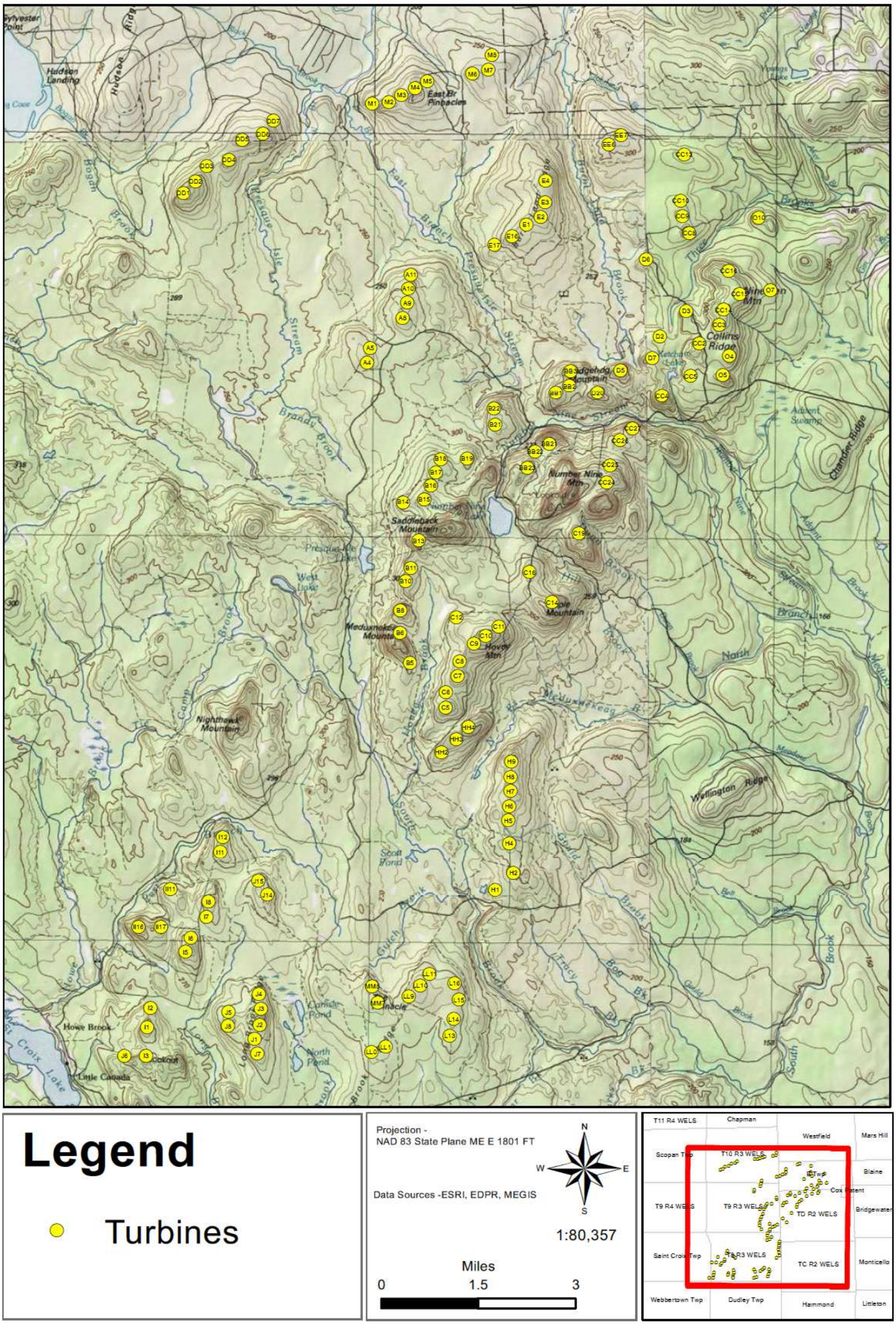


Figure 3-1. Project Turbine Location Map

Number Nine Wind Farm

NUMBER NINE WIND FARM

Figure 3-2 (1 of 3)
Land Uses, Topography,
& Proposed Wind Turbines

Legend

- Wind Turbine
- Dwelling
- Recreational Lease Dwelling
- Recreational Lease Dwelling will shift at least 1,500ft away from Wind Turbine
- Project Lease Parcel
- Project Easement Parcel

N
W E
S

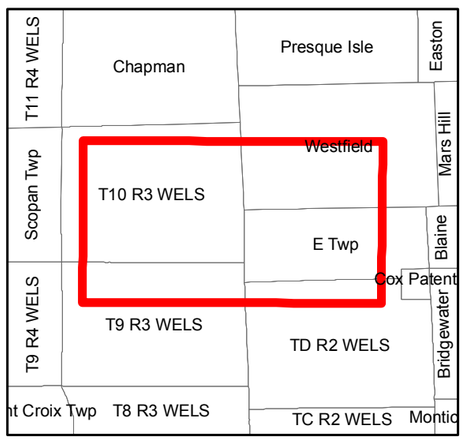
Date: 4/2/2015

Projection -
NAD 83 State Plane ME E 1801 FT

1:47,151

Data Sources -ESRI, EDPR, MEGIS

0 2,200 4,400 8,800 Feet



Number Nine Wind Farm

NUMBER NINE WIND FARM

Figure 3-2 (2 of 3)
Land Uses, Topography, & Proposed Wind Turbines

Legend

- Wind Turbine
- Dwelling
- Recreational Lease Dwelling
- Project Lease Parcel
- Project Easement Parcel

N
W E
S

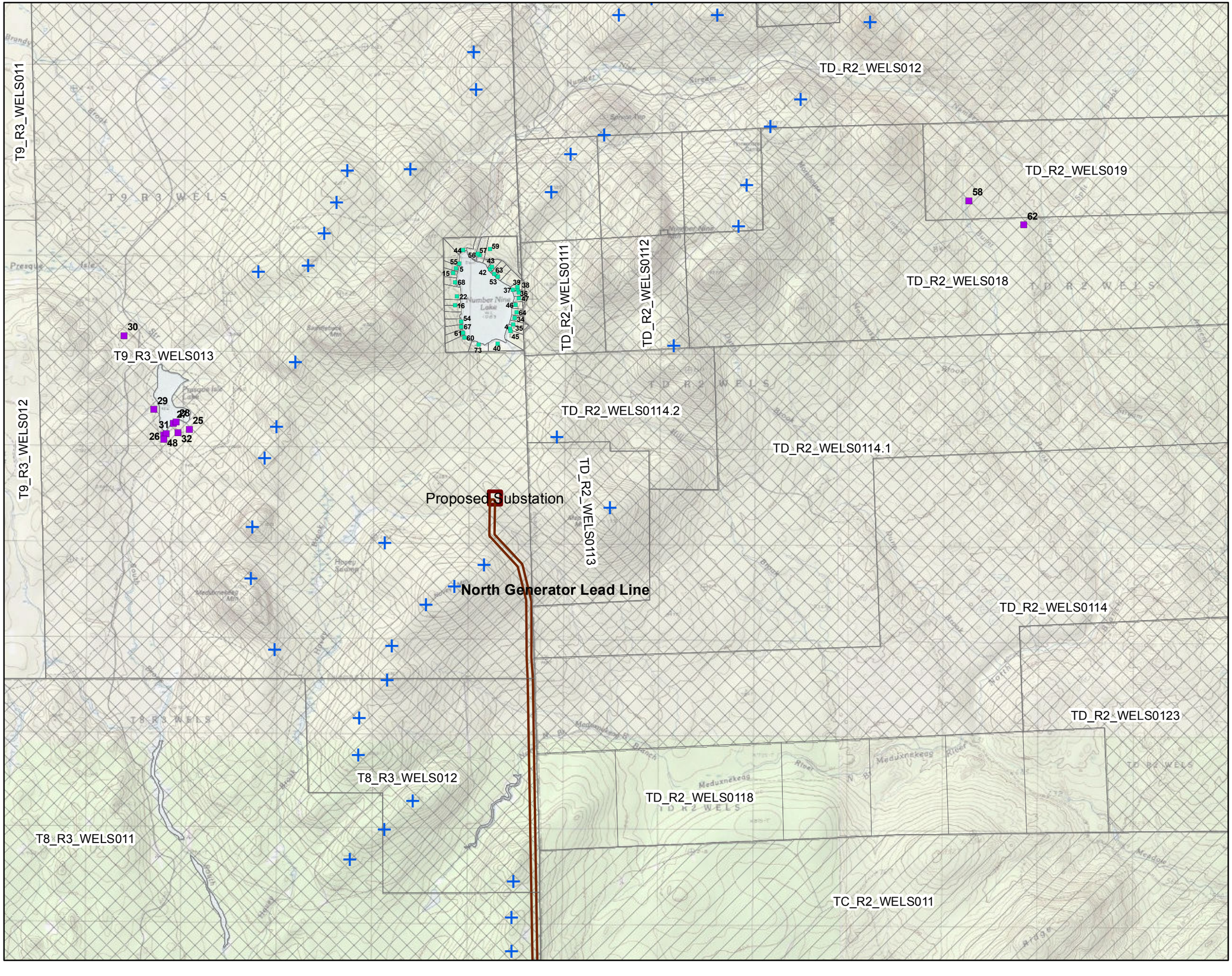
Date: 3/31/2015

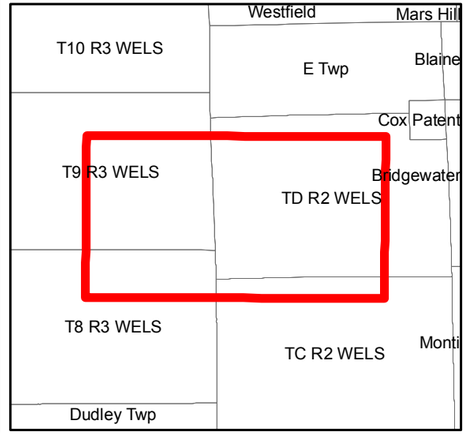
Projection -
NAD 83 State Plane ME E 1801 FT

1:37,188

Data Sources -ESRI, EDPR, MEGIS

0 1,750 3,500 7,000 Feet





Number Nine Wind Farm

NUMBER NINE WIND FARM

Figure 3-2 (3 of 3)
Land Uses, Topography,
& Proposed Wind Turbines

Legend

- Wind Turbine
- Dwelling
- Recreational Lease Dwelling
- Recreational Lease Dwelling will shift at least 1,500ft away from Wind Turbine
- Project Lease Parcel
- Project Easement Parcel

N
W E
S

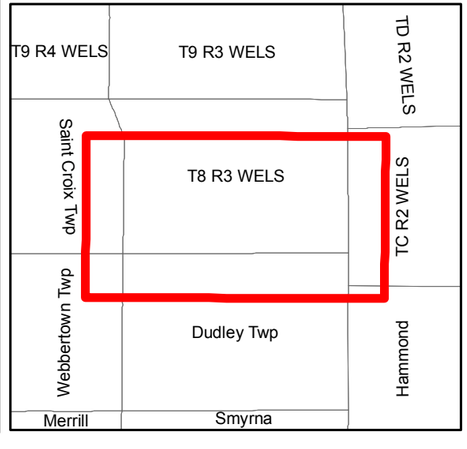
Date: 4/2/2015

Projection -
NAD 83 State Plane ME E 1801 FT

1:37,188

Data Sources -ESRI, EDPR, MEGIS

0 1,750 3,500 7,000 Feet



Saint_Croix_Twp012

T8_R3_WELS011

Saint_Croix_Twp014

Webbertown_Twp011

Dudley_Twp011

TC_R2_WELS011

Hammond031

T8 R3 WELS

T8 R3 WELS

20

24

21

66

52

51

23

41

Approx. 2,240 feet from Right Of Way

North Generator Lead Line

4.0 Wind Turbine Sound Levels

Number Nine Wind Farm LLC proposes to erect Gamesa G114 IIIA wind turbines to generate electric power for the Project. IEC 61400-11 is an international standard that establishes detailed procedures for measurement of wind turbine sound and calculation methods for determining the sound power level of a utility-scale wind turbine as a point source for the stated purpose of conducting community assessments of sound emissions from wind turbine operation. The following provides a brief description of the G114 turbine and its sound performance.

4.1 Gamesa G114 Sound Levels

The Gamesa G114 is an upwind turbine with blade pitch control regulation, a rotor diameter of 114 meters and a rated capacity of 2.0 or 2.1 megawatts (MW). The G114 turbines would be mounted on a tower that would put the hub height at 93 meters above the ground. The turbines operate at variable rotational speeds and electric power output depending on the wind speed acting on the turbine rotor and operational settings.

Gamesa provided sound level performance specifications, noise emission analysis and sound warranties for the proposed G114 wind turbines. The sound power levels were derived from proprietary computer models developed by Gamesa and acoustic testing of similar wind turbines in accordance with IEC 61400-11. Sound power levels per IEC 61400-11 are intended for use to calculate the measureable sound pressure levels at nearby community points and protected locations. In its standard operation mode, the overall sound power levels produced by the G114-2.0 MW range from 95.8 dBA at low rpm to 106.0 dBA at full rated sound output. Sound power levels from the G114-2.1 MW range from 95.8 to 106.6 dBA. At full unrestricted operation, the Gamesa G114 wind turbines generate the maximum rated sound power levels with an increase of 2 dBA as defined in IEC 61400-14.[3] At a hub height of 93 meters, the G114-2.0 MW generates maximum rated sound output with a hub wind speed of approximately 8.6 meters/second and the G114-2.1 MW at approximately 9.3 meters/second. Noise-reduced operating (NRO) modes are available for both turbines that reduce the sound power output by 1 to 5.6 dBA at higher wind speeds. When operating in NRO modes, the electric power output of the turbine is also reduced.[4] Exhibit 1 provides sound warranty from Gamesa for each proposed turbine model.

The Gamesa Noise Emission Analysis provides normalized one-third octave band sound levels that can be applied for the range of sound levels depending on wind speed. This information was conveyed confidentially as a trade secret to EDP Renewables and Bodwell EnviroAcoustics LLC and cannot be disclosed publicly. From this information, octave band sound levels ranging from 31.5 to 8,000 Hz were calculated for the full rated sound output of the G114 2.0 MW and 2.1 MW turbines as shown in Table

[3] G114 2.0MW 60 Hz Wind Turbine noise emission level, Gamesa Wind, 1/26/15.
G114 2.1 MW 60 Hz Wind Turbine noise emission level, Gamesa Wind, 1/26/15.

[4] G114 IIIA 2.1MW 50/60 Hz Wind Turbine Power and Noise curves for low noise operating mode (NRS), Gamesa Corporation, July 2014.
G114 IIIA 2.0MW 50/60 Hz Wind Turbine Power and Noise curves for low noise operating mode (NRS), Gamesa Corporation, February 2014.

4-1.[5] For NRO modes developed by Gamesa, the sound level for each octave band is reduced by the level of NRO.

G114-2.0 MW Sound Power Level (dBA) by Octave Band Frequency (Hz)									
31.5	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**Overall**
81.5	90.7	97.2	101.1	100.4	97.8	94.2	86.7	83.2	106.0
G114-2.1 MW Sound Power Level (dBA) by Octave Band Frequency (Hz)									
31.5	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**Overall**
82.1	91.3	97.8	101.7	101.0	98.4	94.8	87.3	83.8	106.6

Table 4-1. Sound Power Levels for Gamesa G114 2.0 and 2.1 MW Wind Turbines 93 m Hub Height– Standard Operation Mode.

4.2 Meteorological Conditions

Meteorological conditions have the potential to contribute to higher turbine sound levels and sound level fluctuations (i.e. amplitude modulation) from the passage of turbine blades. The primary meteorological factors are generally considered to be wind shear and turbulence intensity. These factors have been analyzed from long-term measurements of wind data at other wind projects in Maine and at operating wind projects where sound testing has been conducted under high wind shear conditions in accordance with the Maine DEP testing protocol. Wind measurement data indicates that wind speeds are lowest during the summer months and highest during the winter months. Wind shear is typically higher during nighttime hours and turbulence intensity is higher during daytime hours.

The majority of available wind and sound measurement data indicates that extremes in turbulence intensity and wind shear are unlikely to occur at wind projects in Maine operating at sites with characteristics similar to Number Nine Wind Farm. In addition, the sound level assessment uses a widely recognized sound level prediction methodology and modeling assumptions that have been demonstrated by testing to be reliable for accuracy.[6] See Section 6.3 of this report for further detail on verification of sound level prediction methodology.

5.0 Noise Standards and Guidelines

The following provides a description of State of Maine noise regulations including applicable sound level limits, predictive modeling and uncertainty, compliance determination, and consideration of any noise standards enacted by any applicable municipality.

[5] G114 2.0MWand 2.1 MW 60 Hz Noise Emission Analysis, Gamesa Wind, 1/26/15.
[6] Town of Oakfield Wind Energy Review Committee, 2011 Review of Evergreen Wind Power II, LLC's Proposed Wind Energy Facility, Final Report, October 2011.
Stetson II Operations Sound Testing Peer Review, Warren L. Brown, EnRad Consulting, June 2011.
Pre-Filed Direct Testimony of R. Scott Bodwell, P.E., Bodwell EnviroAcoustics LLC, July 2011.
Bodwell EnviroAcoustics, LLC, Blue Sky East, LLC – Bull Hill Wind Project Operations Sound Testing (Year 1), May 2013; Blue Sky East, LLC – Bull Hill Wind Project Operations Sound Testing (Year 2), February 2014.
Resource Systems Group, Spruce Mountain Wind Sound Compliance Monitoring Year 2 Report, October 2013.

5.1 Sound Level Limits

Maine DEP Chapter 375.10, *Control of Noise*, establishes hourly sound level limits for wind energy facilities based on time of day, land uses, and physical location. These limits are described in Section I, *Sound Level Standards for Wind Energy Developments* and apply to sound levels resulting from routine operation of a wind energy development measured in accordance with the measurement procedures described in subsection I(8).

Number Nine Wind is required to meet the following sound level limits (ref. Maine DEP 375.10.I(2)):

(a) 75 dBA at any time of day at any property line of the wind energy development or contiguous property owned or controlled by the wind energy developer; and

(b) 55 dBA between 7:00 a.m. and 7:00 p.m. (the "daytime limit"), and 42 dBA between 7:00 p.m. and 7:00 a.m. (the "nighttime limit") at any protected location.

In contrast to other developments, sound level limits for wind projects do not depend on local zoning and pre-construction sound levels. Although the DEP noise regulation specifies a 75 dBA at the facility property line, the most restrictive limits apply at noise sensitive land uses that meet the definition of a "protected location". A protected location is defined as:

> "Any location accessible by foot, on a parcel of land containing a residence or planned residence or approved residential subdivision, house of worship, academic school, college, library, duly licensed hospital or nursing home near the development site at the time a Site Location of Development application is submitted; or any location within a State Park, Baxter State Park, National Park, The Appalachian Trail, the Moosehorn National Wildlife Refuge, federally-designated wilderness area, state wilderness area designated by statute (such as the Allagash Wilderness Waterway), or locally-designated passive recreation area; or any location within consolidated public reserve lands designated by rule by the Bureau of Public Lands as a protected location.
>
> At protected locations more than 500 feet from living and sleeping quarters within the above noted buildings or areas, the daytime hourly sound level limits shall apply regardless of the time of day.
>
> Houses of worship, academic schools, libraries, State and National Parks without camping areas, Historic Areas, nature preserves, the Moosehorn National Wildlife Refuge, federally-designated wilderness areas without camping areas, state wilderness areas designated by statute without camping areas, and locally-designated passive recreation areas without camping areas are considered protected locations only during their regular hours of operation and the daytime hourly sound level limits shall apply regardless of the time of day.
>
> Transient living accommodations are generally not considered protected locations; however, in certain special situations where it is determined by the Board that the health and welfare of the guests and/or the economic viability of the establishment will be unreasonably impacted, the Board may designate certain hotels, motels, campsites and duly licensed campgrounds as protected locations." (ref. Maine DEP 375.10 G(16))

Maine DEP Chapter 375.10 defines a "residence" as:

> "A building or structure, including manufactured housing, maintained for permanent or seasonal residential occupancy providing living, cooking and sleeping facilities and having permanent

> indoor or outdoor sanitary facilities, excluding recreational vehicles, tents and watercraft." (ref. MDEP 375.10 G(14))

The nighttime limit of 42 dBA applies on portions of a protected location within 500 feet of a residence or other sleeping quarters, or at the property boundary line of the protected location, whichever is closer to the dwelling. At locations greater than 500 feet from the residence or sleeping quarters, the 55 dBA daytime limit applies 24 hours a day. Sound from regular and routine maintenance of the wind project is subject to the same sound level limits as routine operation.

Construction during daytime or daylight hours, whichever is longer, is exempt from the Maine DEP sound limits by Maine statute (ref. 38 MRSA 484(3)(A)). Sound from nighttime construction that occurs beyond daytime or daylight hours is subject to the nighttime limits that apply to routine operation. More information concerning construction of Number Nine Wind is presented in Section 6.1 of this report.

Sound associated with certain equipment and activities is exempt from the Maine DEP noise regulation. Examples that may be associated with the proposed project include:

- Registered and inspected vehicles traveling to and from the project
- Forest management, harvesting and transportation
- Snow removal and landscaping
- Emergency maintenance and repairs, warning signals and alarms
- Major concrete pours when started before 3:00 pm
- Sounds from a regulated development received at a protected location when the generator of the sound has been conveyed a sound easement for that location
- A force majeure event and other causes not reasonably within control of the owners or operators of the development

The Maine DEP limits do not apply to sound received within the project boundary, Wind Lease or Wind Easement areas, which are subject to a sound easement. As set forth by Maine DEP 375.10, Section C.5.s, a landowner may grant a sound easement that exempts the project from Maine DEP noise limits for the specific development, parcel of land and term covered by the easement.

In particular, the Wind Leases grant to Number Nine Wind Farm LLC the following:

> "A nonexclusive easement for ... noise (sometimes hereafter "sound"), ... and any other effects attributable to any Project or Operations located on the Property or on adjacent properties over and across the Property and any other property owned by Landowner adjacent to or in the vicinity of the Property (collectively, for purposes of this section, "Servient Land"), including but not limited to (a) the right to have sound generated from the Project or Operations impact the Servient Land and exceed otherwise applicable federal, state or local maximum sound level limits applicable to locations on the Servient Land ..."

Prior to the renewal date of each recreational lease within a Wind Lease Parcel and affected by a sound easement, the timberland landowner has provided or will provide written notice to each such

recreational tenant a) of the existence of such sound easements and b) that such recreational leases, automatically upon renewal, are amended to be expressly subject to the same.

5.2 Tonal and Short Duration Repetitive Sounds

Maine DEP Chapter 375.10 Section I requires that a 5 dBA penalty be added for certain occurrences of tonal and short duration repetitive (SDR) sounds when determining compliance with hourly sound level limits. Further details and assessments for these types of sounds for Number Nine Wind are presented in Section 6.3 of this report.

5.2.1 Tonal Sounds

For wind energy facilities, a tonal sound exists if, at a protected location, the 10-minute equivalent one-third octave band sound pressure level in the band containing the tonal sound exceeds the arithmetic average of the sound pressure levels of the two contiguous one-third octave bands by 5 dB for center frequencies at or between 500 Hz and 10,000 Hz, by 8 dB for center frequencies at or between 160 and 400 Hz, and by 15 dB for center frequencies at or between 25 Hz and 125 Hz. When a tonal sound occurs from routine operation of the wind energy development, 5 dBA is added to the 10-minute equivalent sound level (LeqA 10-min) for purposes of demonstrating compliance with the applicable daytime and nighttime sound level limits (ref. Maine DEP 375.10.I(3)).

5.2.2 Short Duration Repetitive Sounds

An SDR sound is a sequence of repetitive sounds clearly discernible as an event resulting from the development and causing an increase in the sound level of 5 dBA or greater on the fast meter response above the sound level observed immediately before and after the event. An SDR sound event for wind turbines is typically slightly longer that one second in duration and can potentially result from the down-stroke of wind turbine blade.

When routine operation of a wind energy development produces SDR sounds, a 5 dBA penalty is added to each 10-minute LAeq (LeqA 10-min) measurement interval in which greater than five SDR sound events are present (ref. Maine DEP 375.10.I(4)).

5.3 Compliance with the Sound Level Limits

Compliance with the applicable sound level limits for wind energy developments is demonstrated in accordance with the following:

(a) Sound level data shall be aggregated in 10-minute measurement intervals within a given compliance measurement period under the atmospheric and site test conditions set forth in subsection I(8) of Maine DEP 375.10.
(b) Compliance will be demonstrated when the arithmetic average of the sound level of twelve or more 10-minute measurement intervals (i.e. average of twelve 10-min measurement intervals) in a given compliance measurement period is less than or equal to the applicable sound level limits.
(c) Alternatively, if a given compliance measurement period does not produce a minimum of twelve, 10-minute measurement intervals under the atmospheric and site conditions set forth in subsection I(8), the wind energy development may combine six or more contiguous 10-minute measurement intervals

from one 12 hour (7:00 am to 7:00 pm daytime or 7:00 pm to 7:00 am nighttime) compliance measurement period with six or more contiguous 10-minute intervals from another compliance measurement period.

Compliance is demonstrated when the arithmetic average of the combined 10-minute measurement intervals is less than or equal to the applicable sound level limits. The 10-minute intervals are measured under required atmospheric and site conditions and include any applicable adjustments for the presence of tonal and SDR sounds (ref. Maine DEP 375.10.I(5)).

5.4 Local Standards

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 MDEP, then the MDEP is to apply the local standard rather than the Maine DEP standard. When noise produced by a facility is received in another municipality, the quantifiable noise standards of the other municipality must be taken into consideration (ref. Maine DEP 375.10.B.1).

All the proposed wind turbine sites for Number Nine Wind are located in the unorganized townships or territories of Maine, which have no local land use ordinances. Nearby residential land uses are located in the Town of Westfield which has not enacted a quantifiable noise standard.

5.5 Sound Model Factors and Uncertainty

Maine DEP noise rules require the use of a predictive model to calculate sound levels produced by wind turbines. The model "shall be designed to represent the "predictable worst case" impact on adjacent properties". In particular, the predictive model is required to include the following (ref. Maine DEP 375.10.I(7)):

a. The maximum rated sound power output (IEC 61400-11) of the sound sources operating during nighttime stable atmospheric conditions with high wind shear above the boundary layer and consideration of other conditions that may affect in-flow airstream turbulence;
b. Attenuation due to geometric spreading, assuming that each turbine is modeled as a point source at hub height;
c. Attenuation due to air absorption, ground absorption and reflection, three dimensional terrain and forestation;
d. Attenuation due to meteorological factors such as but not limited to relative wind speed and direction (wind rose data), temperature/vertical profiles and relative humidity, sky conditions, and atmospheric profiles;
e. Inclusion of an "uncertainty factor" adjustment to the maximum rated output of the sound sources based on the manufacturer's recommendation; and
f. Inclusion, at the discretion of the Maine DEP, of an addition to the maximum rated output of the sound sources to account for uncertainties in the modeling of sound propagation for wind energy developments. This discretionary uncertainty factor of up to 3 dBA may be required by Maine DEP based on the following conditions: inland or coastal location, the extent and specificity of credible evidence of meteorological operating conditions, and the extent of evaluation and/or prior specific experience for the proposed wind turbines. Subject to the Maine DEP's discretion based on the information available, there is a rebuttable presumption of an uncertainty factor of 2 to 3 dBA for coastal developments and of 0 to 2 dBA for inland developments.

6.0 Sound Emissions

The following provides an assessment of sound levels associated with construction and operation of Number Nine Wind Farm.

6.1 Construction Sound Levels

Construction of Number Nine Wind will involve the use of earth-moving machinery to clear and grade roads and turbine pad sites, and cranes to erect wind turbine towers and to assemble the nacelle and turbine blades. In addition to specialty cranes, this equipment will include heavy trucks, excavators, loaders, bull dozers, portable generators and compressors among other machines. Construction staging yards will also be established in designated areas for storage of equipment, materials, and wind turbine components.

Depending upon whether aggregate material can be found on site or will be transported to the project, there may also be equipment operating at the project site to excavate gravel, crush rock and process aggregate. Sound levels from mobile construction and portable processing equipment is likely to generate sound levels in the range of 75 to 95 dBA at 50 feet. Due to the arrangement and size of the project site, most of this equipment will be well distributed and not focused in a single area.

Operation of heavy equipment for site work and other major construction activity between 7 am and 7 pm or during daylight hours is not subject to the Maine DEP noise control regulation as set forth by Maine statute (ref. 38 MRSA Section 484(3)(A)). Operation of construction equipment during nighttime non-daylight hours must comply with the nighttime limits applicable to routine facility operation. All construction equipment must also comply with applicable federal noise regulations and include environmental noise control devices in proper working condition as originally provided by the equipment manufacturer.

6.2 Wind Turbine Sound Power Levels

As described in Section 4.0, wind turbine sound power levels were provided by Gamesa based on sound testing per IEC 61400-11 and proprietary computer models. Turbine sound performance data and noise emission reports by Gamesa indicate that the full rated sound power of the G114-2.0 MW is 106.0 dBA and G114-2.1 MW is 106.6 dBA both with an uncertainty of $\pm$2.0 dBA. Adding the uncertainty to the full sound output yields maximum continuous sound power levels of 108.0 dBA and 108.6, respectively, for modeling purposes. At a hub height of 93 meters (305.1 ft) above ground, the resulting elevations of the turbine hubs (modeled point sources) range from 1122 to 1665 feet above msl.

Gamesa provided third-octave band sound levels for the range of sound power output from the G114 turbines. From this sound emissions data, whole-octave band sound levels were calculated at full rated sound output of the proposed turbines for use in the sound level prediction model.

6.3 Predictive Sound Model

A predictive sound model was prepared to calculate the sound levels from full daytime and proposed nighttime operation of Number Nine Wind. The sound model was created using Cadna/A software developed by DataKustik of Germany. Cadna/A provides the platform to construct topographic surface models of area terrain for calculating sound attenuation from multiple sound sources such as wind turbines. Mapping of proposed turbine locations, roads, parcels, land uses and water bodies was imported to Cadna/A in order to calculate the resulting sound levels at points within the vicinity of the Project (study area).

Sounds emitted by the generator lead lines, and the equivalent sound levels, have been evaluated in detail by Commonwealth Associates in a separate report included under Section 5 of the Application. Specifically, Commonwealth evaluated sound levels expected from both the North Generator Lead Line and the Bridal Path Generator Lead Line under the sound limits of Maine DEP Chapter 375.10. Commonwealth has determined that the sounds generated by these generator lead lines are within the sound limits for quiet areas at regulated protected locations as set forth in Maine DEP Chapter 375.10. Although generator lead lines emit sound, the northern section is not a significant sound source at regulated protected locations in the vicinity of proposed wind turbines. Therefore, the predictive sound model for the proposed wind turbines does not include sound from the generator lead lines.

The nearest regulated protected location is approximately 0.9 miles north of the proposed Project substation. The substation will be designed so that the combined sound level from operation of the transformer and synchronous condenser will not exceed 54 dBA at 100 meters from its acoustic center. The predictive sound model for the proposed wind turbine area includes the contribution of sound from the Project substation. Octave band sound levels for the substation were derived from measurements of similar equipment.

Predictive sound levels are calculated in accordance with ISO 9613-2, an international standard for calculating outdoor sound propagation. This method calculates sound levels as though all receivers were located downwind simultaneously from the sound sources, which is a conservative approach for calculation purposes and not a physical possibility. According to ISO 9613-2, the calculation method is also equivalent to sound propagation for a "well-developed moderate ground-based temperature inversion." The stated accuracy of the ISO 9613-2 method is $\pm$3 dBA for a source and receiver mean height of 5 to 30 meters and a distance of 100 to 1000 meters. Although the mean source height between wind turbines (93 meters) and receivers (1.5 meters) is approximately 47 meters, use of Cadna/A and ISO 9613-2 has been found to be accurate for prediction of wind turbine sound levels at distances in the range of the regulated protected locations.[7]

[7] Town of Oakfield, Wind Energy Review Committee, Final Report.
Stetson Wind, Operations Compliance Sound Level Study.
EnRad Consulting, Oakfield Wind Project Amendment, Sound Level Assessment – Peer Review.
Stetson II Wind Project, Operations Sound Testing.
Rollins Wind Project, Operations Sound Testing.

The surface model terrain was digitally mapped from USGS topographic contours at 6 meter intervals (20 ft) provided to BEA by EDP Renewables with turbine base elevations ranging from approximately 817 feet to 1360 feet above mean sea level. The parcel boundaries and dwelling locations for the model were prepared by mapping consultants to EDP Renewables and provided to BEA. Dwelling locations were mapped through use of aerial photography and field verification with the parcel associations confirmed from review of tax assessor records. Parcels with approved residential building permits or that are part of an approved residential subdivision were researched by review of state and municipal records, and interviews with local officials.

Cadna/A allows flexibility in defining model settings and adjustments related to calculation methods, ground absorption and other factors. Additionally, as discussed above, conservative assumptions are utilized with respect to each of these factors. Turbine sound measurements have been used to ensure that the model is "calibrated" to actual sound levels for reliable sound model predictions. As the following describes, model settings have been applied to predict the high range (i.e. predictable worst case) of wind turbine sound levels as measured under a wide variety of site and weather conditions at other projects in Maine.

Other model settings were selected to calculate ground attenuation using the spectral method per ISO 9613-2 and using a default ground absorption factor of 0.5 to represent an equal mix of hard and soft ground. Surface water bodies were mapped and assigned a ground absorption factor of 0.0 similar to hard ground for an acoustically reflective surface. Attenuation resulting from intervening terrain and atmospheric absorption for standard day conditions (temperature 10^{o}C, relative humidity 70%) was also calculated. No attenuation was calculated due to trees or other foliage that could act to reduce sound levels at protected locations, especially during seasonal foliage (leaf-on) conditions.

Sound power levels for the proposed Gamesa wind turbines are determined by the same international specification for wind turbine testing (IEC 61400-11) used to determine sound power levels for the turbines operating at existing wind power projects in Maine. Results from other wind energy facilities in Maine where wind turbines are located on similar ridge top settings indicate that the high end of the measurement range can be predicted by adding the manufacturer's sound power level uncertainty of 2 dBA and 1 dBA for the demonstrated accuracy of ISO 9613-2 in accordance with Section I of Maine DEP 375.10. This yields a total uncertainty of 3 dBA added to the rated sound power level of the proposed turbines.

6.4 Predicted Sound Levels

Wind turbine sound level predictions for the study area were calculated at a height of 5 feet above ground level as specified by Maine DEP 375.10. Sound levels were calculated and are presented for specific community receptor points to evaluate compliance with applicable sound limits. "Receptor points" are the protected locations in each direction from the Project with the greatest potential to exceed the Maine DEP sound level limits. The receptor points are generally at the nearest protected

Bull Hill Wind Operations Sound Testing (2 Years).
Spruce Mountain Wind Operations Sound Testing (2 Years).

locations to proposed wind turbines, which are parcels with seasonal dwellings. Sound level isopleths as 1 dBA contour lines were also calculated for the entire study area using a grid spacing of 20 meters by 20 meters.

All proposed and alternate wind turbines were modeled as G114-2.1 MW. Sound levels were initially calculated with all proposed wind turbines operating at full rated sound power output (106.6 dBA) plus 3.0 dBA for turbine manufacturer uncertainty (2.0 dBA) and model accuracy (1.0 dBA), for a total modeled sound power level of 109.6 dBA. The sound level isopleths were calculated for the G114 turbines as presented in Figure 6-1 (3 sheets - see sheet 2 for key of map coverage) along with predicted sound levels at the receptor points. Sound level contours corresponding to Maine DEP daytime limit of 55 dBA and the nighttime limit of 42 dBA are shown as bold lines. Figure 6-1 also shows the proposed wind turbine locations, parcel boundaries, dwelling and/or camp locations, water bodies, Wind Lease and Wind Easement parcels. As noted in Section 5.1 of this report, the Maine DEP limits do not apply to protected locations within recreational lease sites that lie within larger parcels owned by a landowner that are subject to a sound easement that encumbers such larger parcel, including recreational lease sites thereon.

A review of predicted sound levels with all turbines operating at full sound output indicates that Number Nine Wind will comply with Maine DEP daytime sound level limit of 55 dBA at all regulated protected locations. The model predictions further indicate that some curtailment of nighttime operations will be required for predicted sound levels to be at or below the nighttime limit of 42 dBA that applies within 500 feet of a dwelling at a regulated protected location. Curtailment options are: 1) limit the operation of a specific turbine to daytime hours only or 2) implement noise-reduced operating (NRO) modes to reduce turbine sound levels at night.

Turbine specifications from Gamesa provide overall sound power levels for NRO modes that reduce sound output from 1 dBA to 5.6 dBA based on turbine settings. For example, when operating at N2 mode, the sound power level of the G114-2.1MW wind turbine is reduced by 2.6 dBA, from 106.6 dBA to 104.0 dBA.[8] According to Noise Emission Analysis by Gamesa, the normalized sound spectrum applies to both full and noise-reduced operating modes.[9] Sound level reductions for the NRO modes are accomplished by lowering the rotational speed of the turbine rotor to slow the blade tips. Although operating a turbine in NRO mode reduces turbine sound output, it also results in lower energy production from the wind turbine.

A nighttime operations plan for the Project was developed so that predicted sound levels from wind turbines would be at or below the nighttime sound level limit of 42 dBA at all regulated protected locations. This plan consists of curtailing nighttime operation of five wind turbines in the vicinity of Number Nine Lake at the NRO modes listed in Table 6-1.

[8] G114 IIIA 2.1MW 50/60 Hz Wind Turbine Power and Noise curves for low noise operating mode (NRS), Gamesa Corporation, July 2014.
G114 IIIA 2.0MW 50/60 Hz Wind Turbine Power and Noise curves for low noise operating mode (NRS), Gamesa Corporation, February 2014.
[9] G114 2.0MWand 2.1MW 60 Hz Noise Emission Analysis, Gamesa Wind, 1/26/15.

Turbine No. – Rated Output	Noise-Reduced Operating Mode	Net Sound Power Level (dBA Reduction)	Modeled Sound Power Level*
B17–2.1MW	N 1	105.0 (-1.0 dBA)	108.0
B18–2.1MW	N 1	105.0 (-1.6 dBA)	108.0
B19-2.1MW	N 3	103.0 (-3.0 dBA)	106.0
BB22-2.1MW (Alternate)	N 2	104.0 (-2.6 dBA)	107.0
BB23-2.1MW	N 5	101.0 (-5.6 dBA)	104.0
*Modeled sound power Includes turbine uncertainty (2.0 dBA) and model accuracy (1.0 dBA) or plus 3.0 dBA overall			

Table 6-1. Wind Turbines with Noise-Reduced Operating Modes during Nighttime Hours

The predicted sound levels for proposed nighttime operation of Number Nine Wind at the receptor points and study area in the vicinity of Number Nine Lake are shown on Figure 6-2. A summary of predicted sound levels for daytime and nighttime operation at all receptor points is provided in Table 6-2. Distances from each receptor point to the nearest proposed turbine and the difference between the predicted daytime and nighttime sound levels are also shown for each receptor point.

Receptor Point	Description and Approximate Distance to Nearest Wind Turbine		Predicted Hourly Sound Level, dBA		
	Description	Distance (ft)	Full Daytime Operation	Nighttime Operation	Reduction
N1	Protected Location - Westfield	5,433	36.3	36.3	0.0
N2	Protected Location – Westfield	4,505	37.4	37.4	0.0
C1	Protected Location – T9 R3 WELS	2,802	43.3	41.3	-2.0
C2	Protected Location – T9 R3 WELS	3,451	43.0	41.8	-1.2
C3	Protected Location – T9 R3 WELS	4,203	42.5	41.4	-1.1
C4	Protected Location – T9 R3 WELS	3,914	42.4	41.4	-1.0
C5	Protected Location – T9 R3 WELS	4,439	42.7	41.0	-1.7
C6	Protected Location – T9 R3 WELS	3,619	43.7	42.0	-1.7
S1	Protected Location – Dudley Twp	5,427	38.5	38.5	0.0
S2	Protected Location – Dudley Twp	3,173	39.2	39.2	0.0

Table 6-2. Predicted Daytime and Nighttime Sound Levels from Wind Turbine Operations at Receptor Points

The results in Table 6-2 indicate that the predicted sound levels with the proposed nighttime operating mode for five turbines, specified model settings, and uncertainty (i.e. 3.0 dBA added to sound power level) are below the Maine DEP nighttime limit of 42 dBA at all regulated protected locations in the vicinity of Number Nine Wind. This 42 dBA nighttime limit is the most restrictive sound limit that applies to the Project. Predicted sound levels with all proposed turbines at full operation are below the daytime limit of 55 dBA at all regulated protected locations and the property line limit of 75 dBA.

Table 6-3 provides a list of recreational lease dwellings where the predicted nighttime sound level exceeds the Maine DEP nighttime limit of 42 dBA. These dwellings are not regulated protected locations as they are located on Wind Lease Parcels and are subject to a sound easement. Of the 17 dwellings listed, Number Nine Wind plans to relocate six dwellings so that they will be at least 1500 feet from any proposed wind turbine site.

Dwelling ID[A]	Dwelling Relocation[B]	Sound Easement	Map Coordinates		Landowner for Wind Lease Parcel
			Latitude	Longitude	
1	No	Yes	46° 28' 38.112" N	68° 1' 54.926" W	Griswold Trust
65	No	Yes	46° 28' 38.430" N	68° 1' 55.263" W	Griswold Trust
7	Yes	Yes	46° 31' 15.957" N	68° 3' 2.016" W	Prentiss and Carlisle
8	No	Yes	46° 30' 43.879" N	68° 3' 47.333" W	Prentiss and Carlisle
9	Yes	Yes	46° 29' 43.547" N	68° 7' 50.594" W	Prentiss and Carlisle
11	Yes	Yes	46° 30' 41.334" N	68° 4' 21.854" W	Prentiss and Carlisle
12	No	Yes	46° 30' 51.818" N	68° 3' 44.988" W	Prentiss and Carlisle
13	Yes	Yes	46° 30' 32.569" N	68° 5' 31.036" W	Prentiss and Carlisle
17	No	Yes	46° 31' 16.879" N	68° 3' 46.887" W	Prentiss and Carlisle
21	Yes	Yes	46° 17' 53.202" N	68° 9' 54.713" W	Lakeville Shores, Inc.
24	No	Yes	46° 18' 20.120" N	68° 6' 39.208" W	Lakeville Shores, Inc.
66	No	Yes	46° 17' 41.298" N	68° 6' 56.257" W	Lakeville Shores, Inc.
2	Yes	Yes	46° 29' 4.297" N	67° 57' 53.026" W	R.A. Crawford & Son Land & Timber, Inc.
25	No	Yes	46° 24' 15.907" N	68° 5' 16.512" W	R.A. Crawford & Son Land & Timber, Inc.
27	No	Yes	46° 24' 18.110" N	68° 5' 24.471" W	R.A. Crawford & Son Land & Timber, Inc.
28	No	Yes	46° 24' 18.547" N	68° 5' 23.064" W	R.A. Crawford & Son Land & Timber, Inc.
32	No	Yes	46° 24' 14.937" N	68° 5' 22.132" W	R.A. Crawford & Son Land & Timber, Inc.

[A] Refer to Figure 3-2 for Dwelling Location Map
[B] If Yes, Dwelling will shift at least 1,500 ft away from Wind Turbine

Table 6-3. Recreational Lease Dwellings within Project Lease Area where Predicted Sound Levels Exceed 42 dBA

6.5 Tonal and Short Duration Repetitive Sounds

The Maine DEP regulation requires adding 5 dBA to the measured 10-minute equivalent sound level at a protected location if sound from a development generates either 1) a tonal sound or 2) more than five SDR sound events over a ten-minute measurement interval.

6.5.1 Tonal Sounds

The Gamesa Noise Emission Analysis (ref. footnote 8) provides third-octave band sound levels that indicate the G114 turbine does not generate tonal sounds as defined by Maine DEP 375.10. The Gamesa

report provides the expected sound spectrum in normalized format for standard operation mode and can be applied to any sound level depending upon wind speed and noise reduction mode.

6.5.2 Short Duration Repetitive Sounds

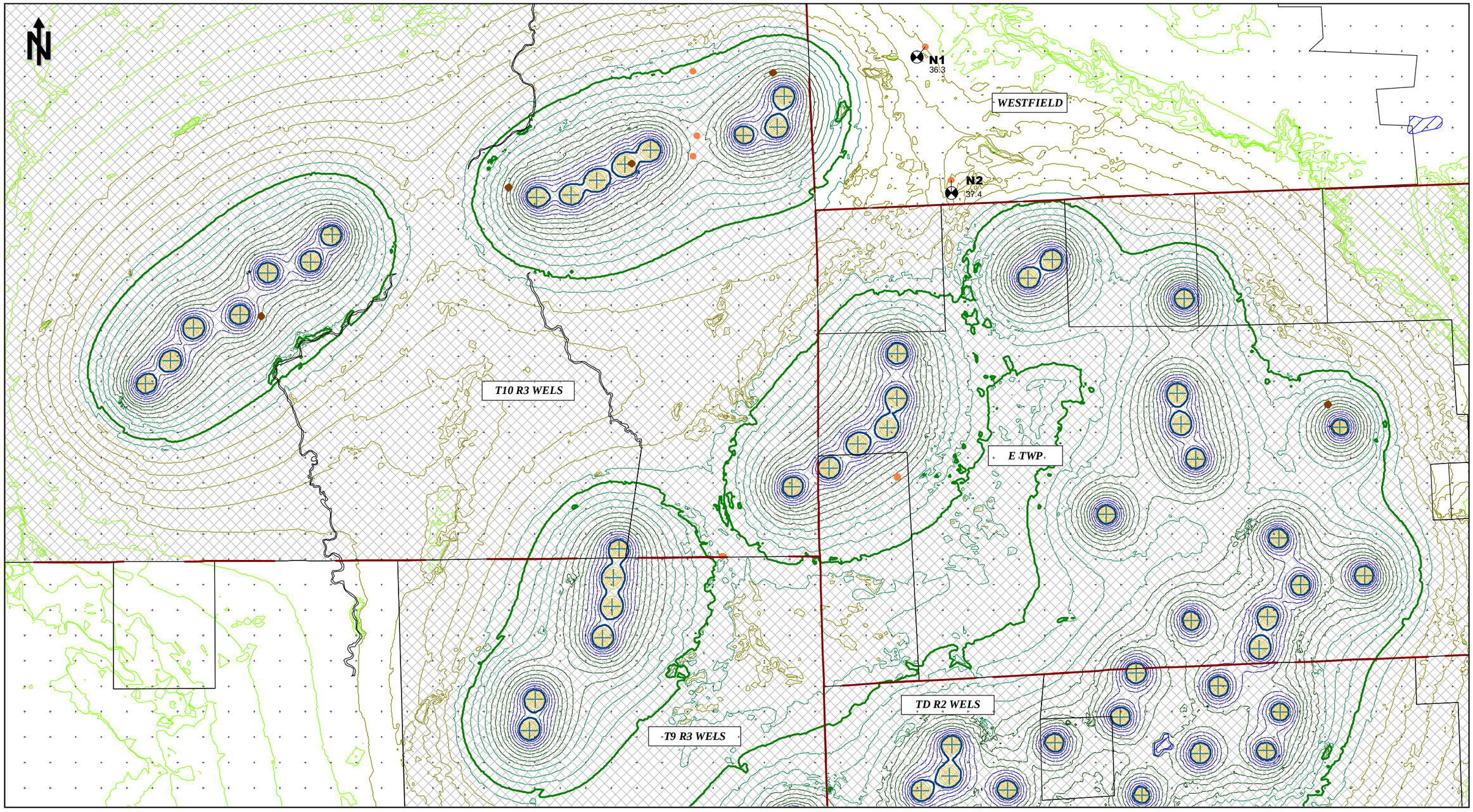
For wind turbines, short duration changes in sound levels occur with the passage of rotor blades. This is commonly referred to as "amplitude modulation." The highest sound levels are generally recognized to occur on the down stroke of each rotor blade at a rate of slightly greater than once per second at full rotational speed. The sound performance data and noise emission analysis provided for the G114 by Gamesa do not specifically address the sound level change that occurs due to amplitude modulation.

Measurements of operating wind turbines at other projects in Maine and published literature concerning amplitude modulation from wind turbines indicates that sound level fluctuations during the blade passage of wind turbines typically range from 2 to 5 dBA (see also Section 2.3), with occasional but infrequent events reaching 6 dBA or more.[10] Overall, sound testing at operational wind projects including Stetson I, Stetson II, Rollins, Bull Hill, and Spruce Mountain indicates that SDR sound events are relatively uncommon even under stable atmospheric conditions, high wind shear, and other factors identified in technical studies as having the potential to increase amplitude modulation. Operational sound testing of Number Nine Wind will evaluate the potential presence of SDR sound events and, if present, apply the required penalty for determining compliance.

As specified in Section I(5)(b) of MDEP 375.10, compliance is determined based on the arithmetic average of the equivalent sound levels of, at a minimum, twelve, 10-minute measurement intervals in a given compliance measurement period. If operations sound testing indicates that occurrence of SDR sounds results in sound levels exceeding applicable limits, Number Nine Wind will be required to modify turbine settings or operations to meet applicable limits including appropriate penalties for SDR sounds.

[10] Operations Sound Testing, Rollins Wind Project, Bodwell EnviroAcoustics LLC, July, 2012.
Lee, Seunghoon, Lee, Seungmin, & Lee, Soogab, Time domain modeling of aerodynamic noise from wind turbines, 2011.
Oerlemans, S. & Schepers, G., Prediction of wind turbine noise directivity and swish, 2009.
Palmer, K.G.,A New Explanation for Wind Turbine Whoosh – Wind Shear, 2009.
Richarz, W. & Richarz, H., Wind Turbine Noise Diagnostics, 2009.
Siponen, D., The assessment of low frequency noise and amplitude modulation of wind turbines, 2011.

Figure 6-1 (1 of 3). Predicted Sound Levels from Full Routine Operation of Number 9 Wind Farm - NORTH



Wind Turbine

Dwelling

Recreational Lease Dwelling will Shift at Least 1500 ft from Wind Turbine

Project Lease Parcel

37.2 ------- 500 ft

Receptor Point & Predicted Sound Level

55 dBA (Daytime Limit)

42 dBA (Nighttime Limit)

Coordinate Grid Spacing = 1000 ft

Sound Level Contour Interval = 1 dBA

Figure 6-1 (2 of 3). Predicted Sound Levels from Full Routine Operation of Number Nine Wind Farm - CENTER

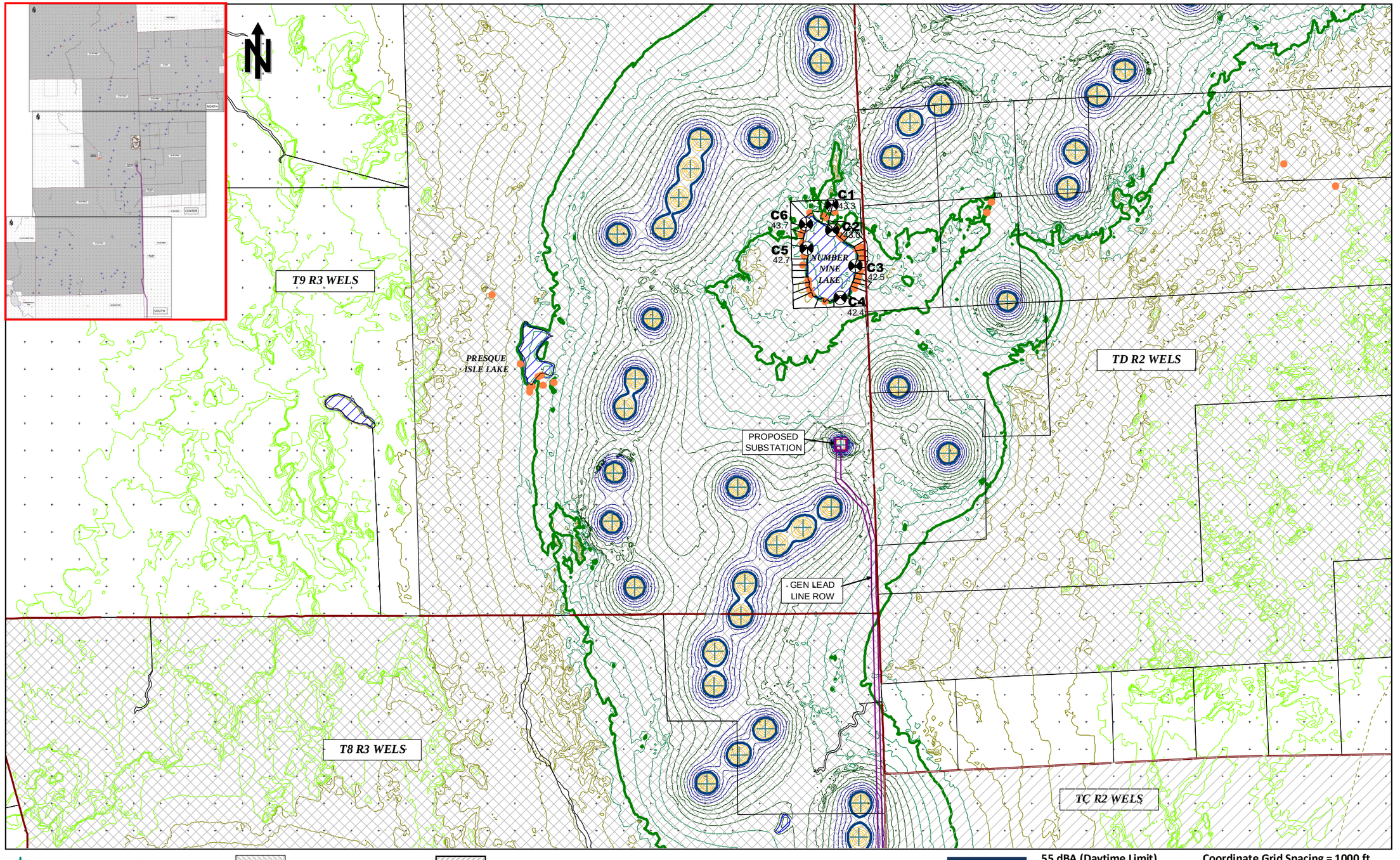


Figure 6-1 (3 of 3). Predicted Sound Levels from Full Routine Operation of Number Nine Wind Farm - SOUTH

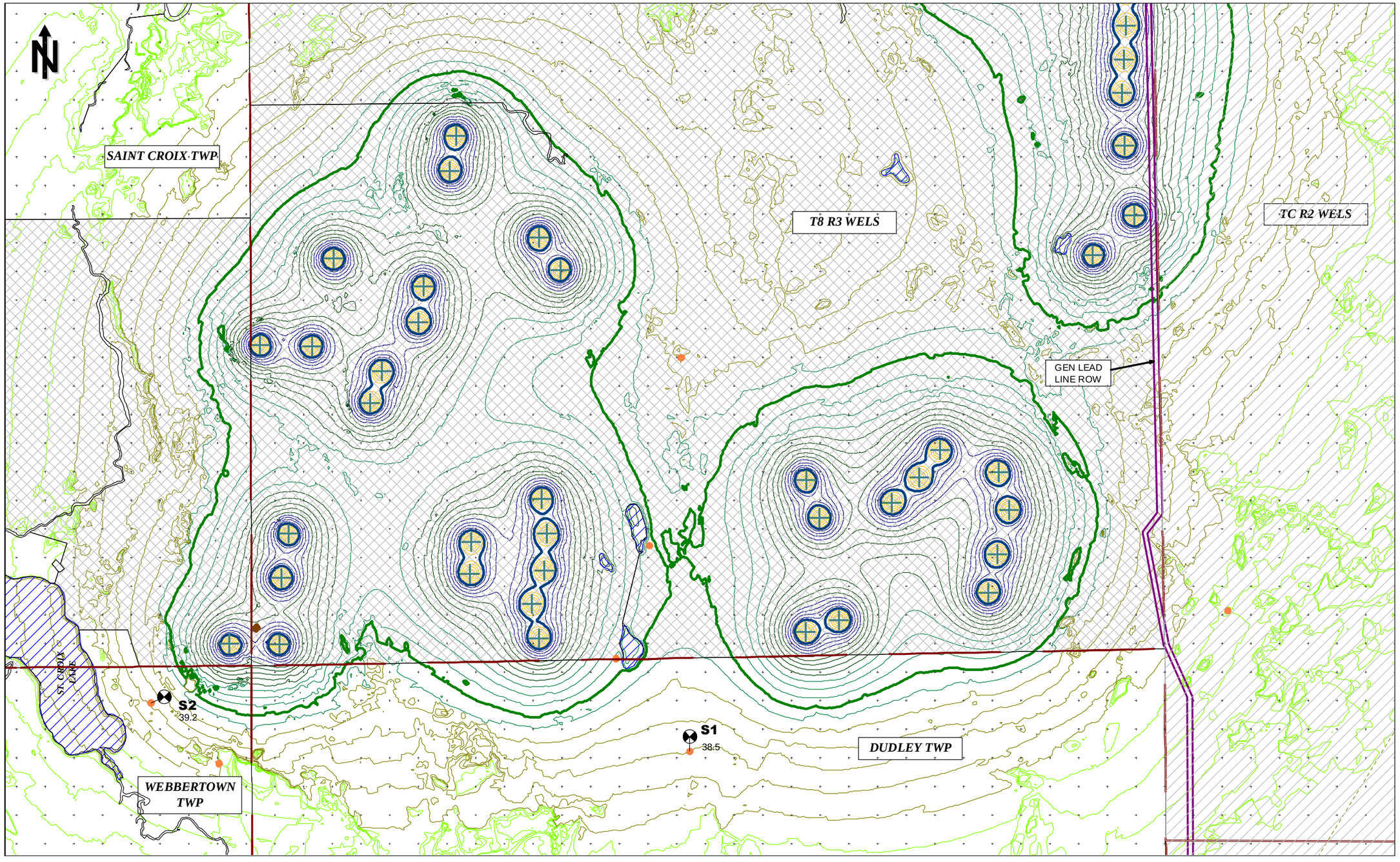
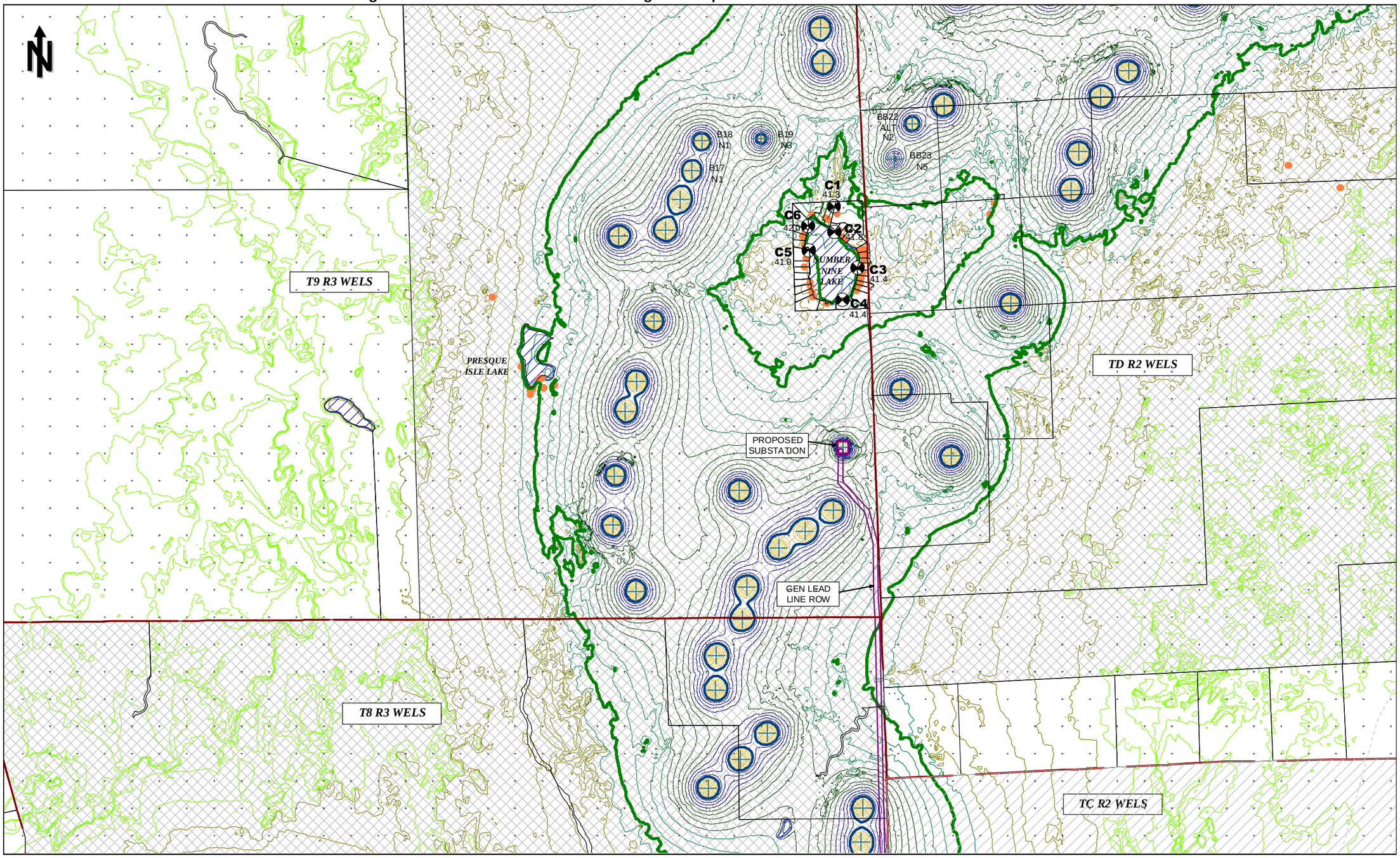


Figure 6-2. Predicted Sound Levels from Nighttime Operation of Number Nine Wind Farm - CENTER



7.0 Sound Level Testing

The purpose of sound level testing is to confirm by measurement that sound levels emitted by Number Nine Wind are at or below the applicable sound level limits.

7.1 Project Construction

Construction of Number Nine Wind Farm is planned to occur primarily during daylight and daytime hours when sound levels generated by construction activity are exempt from the Maine DEP sound level limits by Maine statute. Consequently, no sound level testing is planned for the construction phase of the Project. If nighttime non-daylight construction occurs, such construction activity is required to comply with nighttime sound level limits for routine operation and maintenance of the Project.

7.2 Wind Turbine Operations

Sound level testing of wind turbine operations is a complex and critical component of the proper and responsible operation of a wind energy facility. The most difficult aspect of wind turbine sound testing is to perform the required measurements under the proper site and weather conditions. Operation of wind turbines at full sound output requires a significant level of wind acting on the turbine hubs for an extended period of time. Often when hub wind speeds are at the required levels, surface winds will also be high enough to cause extraneous sound levels from wind forces acting on terrain and vegetation. These extraneous sources can mask sound from turbines and make it difficult to isolate and quantify sound emissions from the wind power project.

However, during nighttime periods, the winds aloft along the project ridges and wind turbine hubs can remain strong while the surface winds at lower elevations near protected locations can diminish to light or nearly calm. These conditions are commonly referred to as a “stable atmosphere” and are the best conditions under which to measure the sound level contributions of wind turbines for several reasons. First, the ambient (non-wind turbine) sound levels from wind and daytime activities are lower so that the sound levels from wind turbines become more prominent and easier to quantify. Second, technical literature concerning wind turbine sound emissions indicates that the potential for amplitude modulation (and resulting potential for SDR sounds) increases with wind shear, which is more pronounced under stable atmospheric conditions. Therefore, full sound output under stable atmospheric conditions is preferable for measuring sound levels for the presence of SDR sounds.

Since inception of wind energy projects in Maine, BEA has worked closely with the Maine DEP and EnRad Consulting, former acoustical consultant to Maine DEP, to develop a specific and detailed testing protocol for measuring sound levels from wind turbines. This testing protocol was refined and adopted as Subsection I(8) of Maine DEP 375.10 noise regulations for wind energy developments. The purpose of this protocol is to facilitate measurement of wind turbine sound levels under worst-case conditions to evaluate compliance with Maine DEP sound level limits, including appropriate adjustments for tonal and SDR sounds.

Prior to operation of Number Nine Wind, an operations sound testing plan will be prepared to identify sound test locations and other testing details. Test locations will represent receptor points C1 and C6 as the protected locations with the highest potential to exceed sound limits applicable to Number Nine Wind. If these receptor points are not suitable for sound testing due to accessibility, wind direction under protocol conditions, or extraneous sound sources, proxy test locations will be selected to represent the receptor points.

If tonal sounds occur or amplitude modulation reaches the Maine DEP threshold for SDR sounds of 5 dBA for more than 5 events in a 10-minute test interval, a 5 dBA "penalty" will be added to the measured 10-minute equivalent sound level for that test interval. Compliance will be demonstrated based on the arithmetic average of the sound levels for a minimum of twelve, 10-minute measurement intervals in a given compliance measurement period. In the unlikely event that SDR sounds occur more frequently than anticipated, adjustments such as nighttime NRO modes per section 6.5 would be required to ensure that turbines are operating within the applicable limits, including any penalties for SDR sound events.

8.0 Complaint Response Protocol

Number Nine Wind will develop and implement a formal protocol for addressing sound complaints from local residents during wind turbine operations. The purpose of this protocol will be to ensure that local residents are informed on how to report a sound complaint and that each sound complaint is fully documented and resolved in a consistent manner. Similar to complaint response protocols approved by Maine DEP for other wind power projects, Number Nine Wind will establish guidelines for reporting, documenting, investigating, reporting and responding to sound complaints prior to commencement of turbine operations.

9.0 Summary of Findings

This Sound Level Assessment establishes sound level limits to be applied to the Number Nine Wind Farm and provides sound level predictions for turbine operations using a terrain-based computer sound model. Model settings adhere to Section I of Maine DEP 375.10 and turbine sound level testing results at similar wind energy facilities in Maine. Maine DEP hourly sound level limits of 55 dBA daytime and 42 dBA nighttime apply at all regulated protected locations. A sound limit of 75 dBA applies at the Project boundary.

Sound level predictions indicate that with all wind turbines operating simultaneously at full sound output, Number Nine Wind will meet the Maine DEP daytime sound level limit of 55 dBA and nighttime limit of 42 dBA at all protected locations where those limits apply, and the 75 dBA limit at the Project boundary. In the event that SDR or tonal sounds occur and associated dBA penalties indicate that sound level limits are exceeded, Number Nine Wind will implement noise-reduced operations or other turbine adjustments to meet the applicable limits at all protected locations.

The Sound Level Assessment establishes procedures for sound level testing of turbine operations to evaluate compliance with applicable sound level limits, including methods for measurement and analysis of tonal and SDR sounds. A formal protocol for response and resolution of sound complaints will be established to reduce the potential for noise problems associated with long-term operation of Number Nine Wind.

10.0 References

Bodwell, R. Scott, Pre-Filed Direct Testimony, Bodwell EnviroAcoustics LLC, July 2011.

Bodwell EnviroAcoustics, LLC, Stetson II Wind Project, Operations Sound Testing, March 2011.

Bodwell EnviroAcoustics, LLC, Rollins Wind Project, Operations Sound Testing, July 2012.

Bodwell EnviroAcoustics LLC, Bull Hill Wind Project, Sound Level Assessment, Exhibit 17, LUPC Development Permit Application, February, 2011.

Bodwell EnviroAcoustics, LLC, Blue Sky East, LLC – Bull Hill Wind Project Operations Sound Testing (Year 1), May 2013; Blue Sky East, LLC – Bull Hill Wind Project Operations Sound Testing (Year 2), February 2014.

Danish Electronics, Light and Acoustics (Delta), Low Frequency Noise from Large Wind Turbines, 2008.

EnRad Consulting, Warren L. Brown, Stetson II Operations Sound Testing, Peer Review, June 2011.

Gamesa Wind, G114 2.0 MW 60 Hz Wind Turbine noise emission level, 1/26/15.

Gamesa Wind, G114 2.1 MW 60 Hz Wind Turbine noise emission level, 1/26/15.
.
Gamesa Corporation, G114 IIIA 2.0MW 50/60 Hz Wind Turbine Power and Noise curves for low noise operating mode (NRS), February 2014.

Gamesa Corporation, G114 IIIA 2.1MW 50/60 Hz Wind Turbine Power and Noise curves for low noise operating mode (NRS), July 2014.

Gamesa Wind, G114 2.0MW and 2.1MW60 Hz Noise Emission Analysis, 1/26/15.

GL Garrad Hassan, Results of acoustic measurements according to IEC 61400-11 on a Vestas V112 Near Niebull/Germany, May 2012.

IEC 61400-11 Wind turbine generator systems – Part 11: Acoustic noise measurement techniques, Edition 3.0, November 2012.

IEC 61400-14 Wind turbines –Part 14: Declaration of apparent sound power level and tonality values, First Edition, 2005.

ISO 9613-2 Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General Method of Calculation, 1996.

K. Kaliski and E. Duncan, Propagation Modeling Parameters for Wind Power Projects, Sound & Vibration, December 2008.

Lee, Seunghoon, Lee, Seungmin, and Lee, Soogab, Time domain modeling of aerodynamic noise from wind turbines, 2011.

Maine Department of Environmental Protection (DEP) Site Location of Development Regulations for Control of Noise (06-096 CMR c. 375.10), 1989 and 2012.

Maine DEP, Site Location of Development Act Order, Oakfield Wind Project, January 2010.

Maine Revised Statutes, Standards for Development, 38 MRSA 484, Subsection 3, 1993.

Mills, D.A., MD, MPH, Wind Turbine Neuro-Acoustical Issues, Maine CDC/DHHS, June 2009.

Oerlemans, S. and Schepers, G., Prediction of wind turbine noise directivity and swish, 2009.

Palmer, K.G., A New Explanation for Wind Turbine Whoosh – Wind Shear, 2009.

Resource Systems Group, Spruce Mountain Wind Sound Compliance Monitoring Year 2 Report, October 2013.

Resource Systems Engineering, Stetson Wind, Operations Compliance Sound Level Study, 2009.

Richarz, W. and Richarz, H., Wind Turbine Noise Diagnostics, 2009.

Siponen, D., The assessment of low frequency noise and amplitude modulation of wind turbines, 2011.

Town of Oakfield, Wind Energy Review Committee, Final Report, October 19, 2011.

Van den Berg, G. P., The Sounds of High Winds, the effect of atmospheric stability on wind turbine sound and microphone noise, University of Groningen, 2006.

EXHIBIT 1

WIND TURBINE SOUND WARRANTY

March 31, 2015

Number Nine Wind Farm LLC
541 Min St.
Presque Isle, ME 04769

Number Nine Wind Farm LLC,

This letter certifies that Gamesa Wind US, LLC intends to provide in accordance with the terms of a supply agreement to be entered into between the parties, a guarantee to Number Nine Wind Farm LLC that the Gamesa G114 2.1MW wind turbine generator to be used at the Number Nine project and operated by Number Nine Wind Farm LLC will produce a maximum sound output of 106.6 dBA with an uncertainty factor of 2dBA where such sound output and uncertainty are per IEC 61400-14; and similarly the Gamesa G114 2.0MW wind turbine generator to be used at the Number Nine project and operated by Number Nine Wind Farm LLC will produce a maximum sound output of 106.0 dBA with an uncertainty factor of 2dBA where such sound output and uncertainty are per IEC 61400-14.

Noise –reduced operating modes are available for both turbines that reduce the sound power output by 1 to 5.6 dBA at higher wind speeds.

This guarantee should be used for the purposes of modeling sound outputs at selected receiver points to meet state standards.

Sincerely,

Gamesa Wind US, LLC

Name: Gonzalo Onzain
Title: VP Sales North America

Gamesa Wind US
1150 Northbrook Drive, suite 150
Trevose, PA 19053
T: 215-710-3100 F: 215-741-4048
www.gamesacorp.com

EXHIBIT 5-B SOUND ASSESSMENT – GENERATOR LEAD LINES

AUDIBLE NOISE SOUND LEVEL

NUMBER NINE WIND FARM
345 kV GENERATOR LEAD LINE

Prepared for:

SGC ENGINEERING, LLC

Prepared by:

Connect With Confidence
Commonwealth associates, inc.

AUDIBLE NOISE SOUND LEVEL

NUMBER NINE WIND FARM
345 kV GENERATOR LEAD LINE

Prepared for:

SGC ENGINEERING, LLC

Prepared by:

Richard D. Cook, P.E.
Katherine J. Klaus
Paula S. Engle

Approved for submittal by:

David A. Shafer, P.E.

Manager, Electrical Systems

At the Offices of:
Commonwealth Associates, Inc.
P.O. Box 1124
Jackson, Michigan 49204-1124

March 30, 2015
0313.0002\309

TABLE OF CONTENTS

EXHIBITS

INTRODUCTION

Commonwealth Associates, Inc. was contracted by SGC Engineering to perform audible noise calculations for two sections of a 345 kV generator lead line interconnecting the new Number Nine Wind Farm located in Aroostook County in northern Maine. Section 1, Bridal Path, is 25.4 miles long with a 150 foot right-of-way (ROW) and will use bundled 3 x 795 kcmil ACSR Drake conductors. Section 2, Northern Section, is 26.1 miles long with a 170 foot ROW. To reduce audible noise levels at protected locations within 500 feet from the Edge-of-Right-of-Way (EROW), the first 6.5 miles, south to north, of Section 2 (Section 2a) will use bundled 3 x 795 kcmil ACSR Drake. The remaining 19.6 miles (Section 2b), where there are no regulated protected locations, will use bundled 2 x 795 kcmil Drake conductors. All sections include two 7 No. 8 Alumoweld shield wires. Sections 1 and 2 both have the H-frame generator lead line (see Exhibit 1) located at the center of their respective rights-of-way. The H-frame 345 kV generator lead line will be constructed using wood pole structures designed for a minimum ground clearance of 30 feet and a conductor separation of 21 feet. The calculated Audible Noise profiles for "Wet Conductor" and "Fair Weather" conditions for each section are shown in Exhibit 2 as profiles measured at the EROW of the generator lead line at the point of maximum conductor sag, which is where the highest sound levels occur.

SUMMARY OF RESULTS

This table describes the Wet Conductor and Fair Weather (Dry) audible noise for Sections 1, 2a and 2b, including the audible noise at the EROW and 500 feet beyond the EROW.

			EROW		**EROW +500'**	
			Wet (dBA)	**Dry (dBA)**	**Wet (dBA)**	**Dry (dBA)**
Section 1	Bridal Path	3x795 - 150 ft ROW	37.4	24.6	24.6	11.9
Section 2a	Northern Section	3x795 - 170 ft ROW	36.8	24.0	24.5	11.7
Section 2b*	Northern Section	2x795 - 170 ft ROW	50.4*	42.5	38.1	30.2

* For this Section, 2b, there are no regulated protected locations within 500 feet of the EROW

CALCULATIONS

The calculations for audible noise profiles were made using the TRALIN module of the CDEGS program utilizing the EPRI/GE method. The audible noise calculations were performed for both "Wet Conductor" and "Fair Weather" weather conditions at an altitude of 300 meters above sea level.

Coordinates used for calculations were based on the tangent structure and are shown below. The first number in each set is the horizontal distance in feet from the center line of the structure/right-of-way. The second number is the lowest height above level ground that the generator lead line is predicted to reach.

Phase A	Phase B	Phase C	Shield Wire 1	Shield Wire 2
(-21', 30')	(0', 30')	(21', 30')	(-10.5', 57.75')	(10.5', 57.75')

Sections 1 and 2 were studied as summarized below:

Sections	kV	Conductor	Amp	Ground Clearance*	ROW Width
1	345	Triple 795 kcmil 26/7 ACSR "Drake" Overhead Ground Wire 7 No. 8 Alumoweld	418.4	30'	150'
2a	345	Triple 795 kcmil 26/7 ACSR "Drake" Overhead Ground Wire 7 No. 8 Alumoweld	418.4	30'	170'
2b	345	Twin 795 kcmil 26/7 ACSR "Drake" Overhead Ground Wire 7 No. 8 Alumoweld	418.4	30'	170'

*Ground clearance for center of conductor or center of bundle used for calculating audible noise.

AUDIBLE NOISE RESULTS

Corona is a common characteristic of EHV lines like the Number Nine Wind Farm 345 kV generator lead lines. The corona discharges from the surfaces of the 345 kV conductors cause audible noise. As stated previously these calculations were made for both wet conductor and fair weather conditions. Wet conductor conditions, which includes conditions following rainfall and conditions where heavy humidity causes overnight condensation on the warmed generator lead line conductors, will cause additional corona activity due to the water drops hanging from the bottom side of the conductors and result in higher audible noise levels. During heavy rain, audible noise levels are modestly higher than under wet conductor conditions, but the noise from the heavy rainfall masks the noise from the generator lead line.

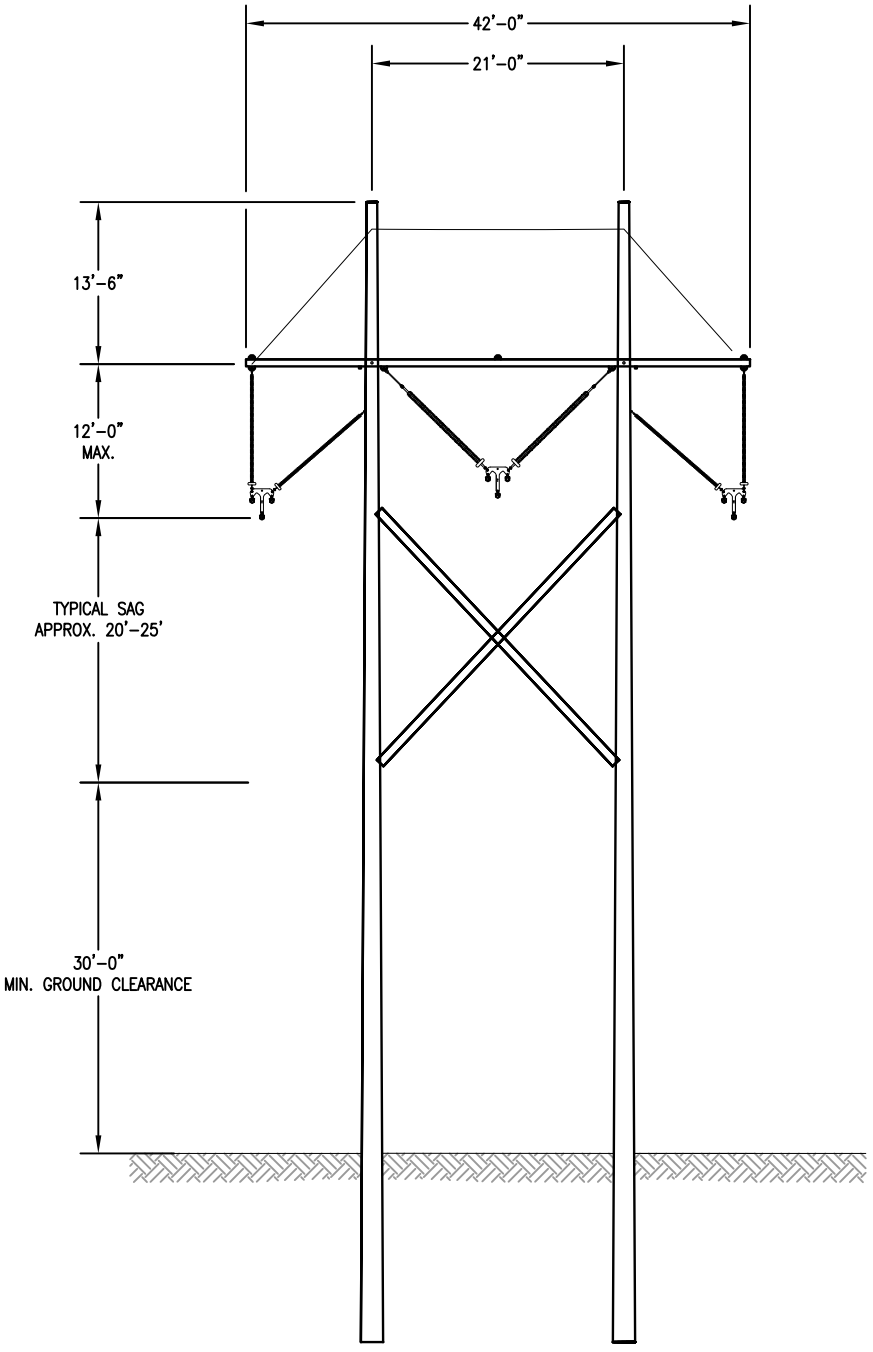
Commonwealth evaluated sound levels expected from the generator lead lines (both the North Generator Lead Line and the Bridal Path Generator Lead Line) with the sound limits of Section 10 of Chapter 375 of the Maine Department of Environmental Protection (DEP) Rules. Commonwealth has determined that the sounds generated by these generator lead lines are within the sound limits for quiet areas at regulated protected locations as set forth in Section 10 of Chapter 375 of the Maine DEP Rules.

Adjustments were made to the original transmission line design to meet the above sound level standard for protected locations, which primarily consisted of adding a third 795 kcmil ACSR Drake conductor to form a triple conductor bundle (3x795) for each of the three phases of the 345 kV generator lead line. The effect of adding the third conductor is a reduction in the sound level at the EROW. Both Section 1 and Section 2a provide a conservative margin for the nighttime sound level limit for protected locations as measured at the EROW. Section 2b was found to have no regulated protected locations within 500 feet from the EROW and therefore meets the 75 dBA requirement defined in the standard. Exhibit 2 provides audible noise profiles at the EROW and out 500 feet:

Section 1	Exhibit 4.1.1: 3x795 Wet Conductor	Exhibit 4.1.2: 3x795 Fair Weather
Section 2a	Exhibit 4.2a.1: 3x795 Wet Conductor	Exhibit 4.2a.2: 3x795 Fair Weather
Section 2b	Exhibit 4.2b.1: 2x795 Wet Conductor	Exhibit 4.2b.2: 2x795 Fair Weather

EXHIBIT 1

345 kV Generator Lead Line EAR-3 (Compact Structure) Drawing



NOTES:
1. POLE HEIGHTS VARY FROM 80' TO 120'. MINIMUM GROUND CLEARANCE OF 30' TO BE MAINTAINED ACROSS ENTIRE LENGTH OF LINE.
2. GUY AND ANCHOR CONFIGURATIONS SHOWN ARE TYPICAL. ACTUAL MAY VARY.

SGC Engineering, LLC
a part of Senergy

TITLE: 345 kV GENERATOR LEAD LINE
TYPE EAR-3 (COMPACT STRUCTURE)

PROJECT: NUMBER NINE WIND FARM
AROOSTOOK COUNTY, MAINE

CLIENT: NUMBER NINE WIND FARM, LLC.
c/o EDPR, NA LLC., 808 TRAVIS, SUITE 700, HOUSTON, TEXAS 77002

edp renewables

DATE:	DRAWN:
MARCH 19, 2015	SJF
SCALE: AS NOTED	DESIGN: DLH / APPD: TMH

SGC PROJECT NUMBER
1233001

DRAWING NUMBER
EAR-3

REVISION
C

SHEET NUMBER
1 OF 1

EXHIBIT 2

Audible Noise Profiles

Exhibit 2.1.1
345 kV Generator Lead Line in Maine - Section 1 Bridal Path
25.4 Miles - Triple Bundled 795 Drake, 30' GC, 150' ROW
Calculated for Wet Conductor Conditions

Audible Noise Levels (dBA)

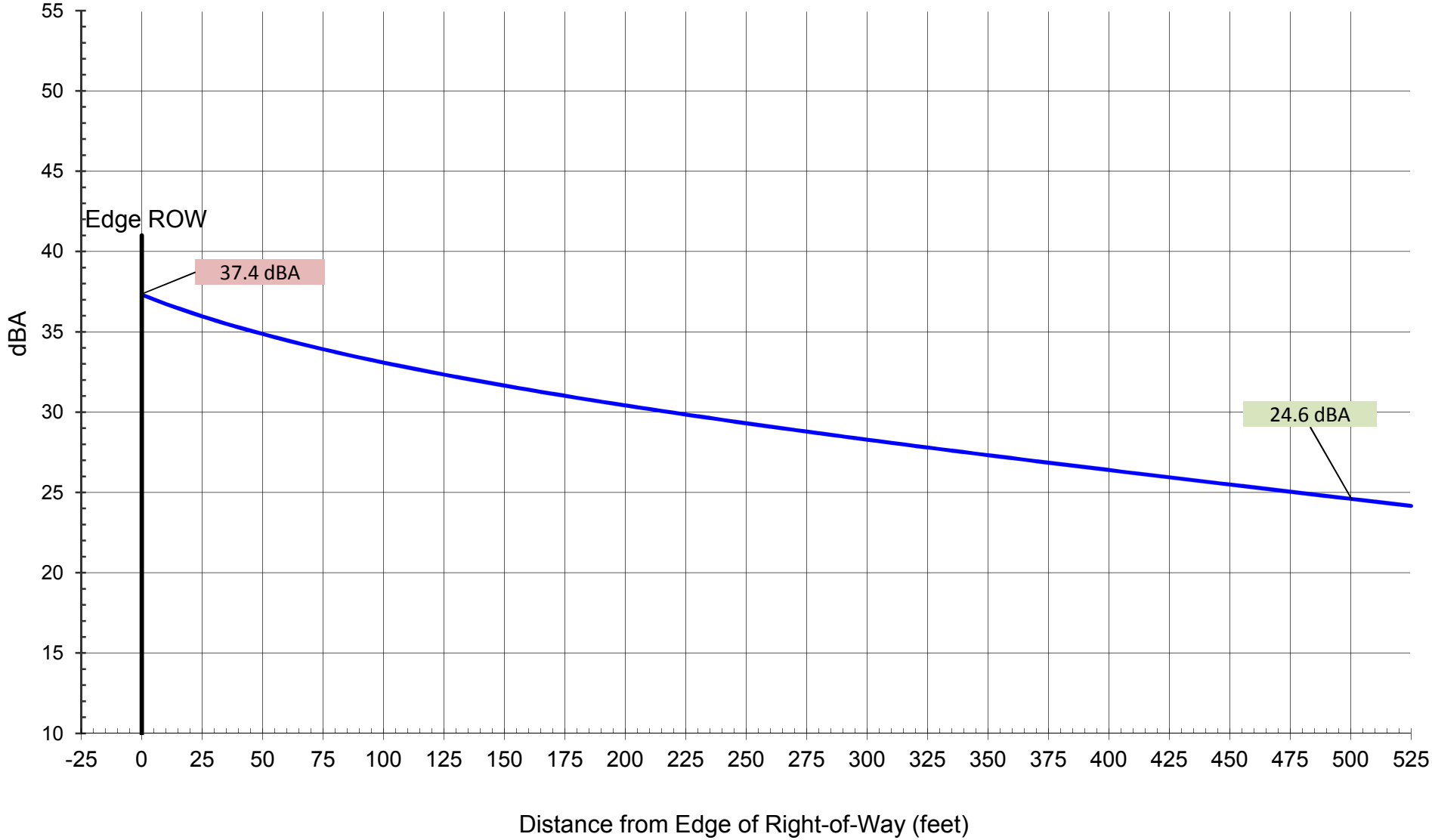


Exhibit 2.1.2
345 kV Generator Lead Line in Maine - Section 1, Bridal Path
25.4 Miles - Triple Bundled 795 Drake, 30' GC, 150' ROW
Calculated for Fair Weather Conditions

Audible Noise Levels (dBA)

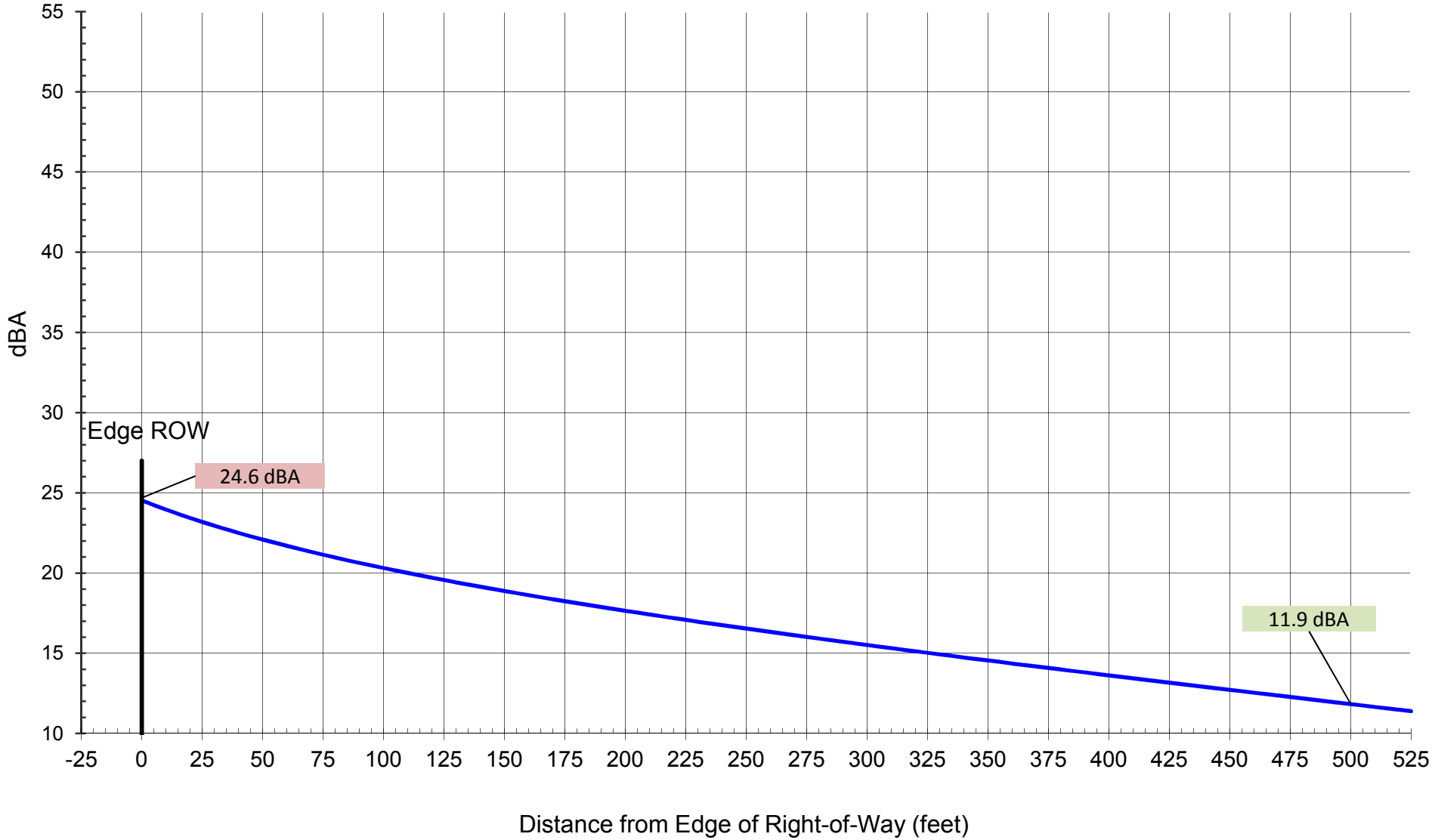


Exhibit 2.2a.1
345 kV Generator Lead Line in Maine - Section 2a
6.5 Miles - Triple Bundled 795 Drake, 30' GC, 170' ROW
Calculated for Wet Conductor Conditions

Audible Noise Levels (dBA)

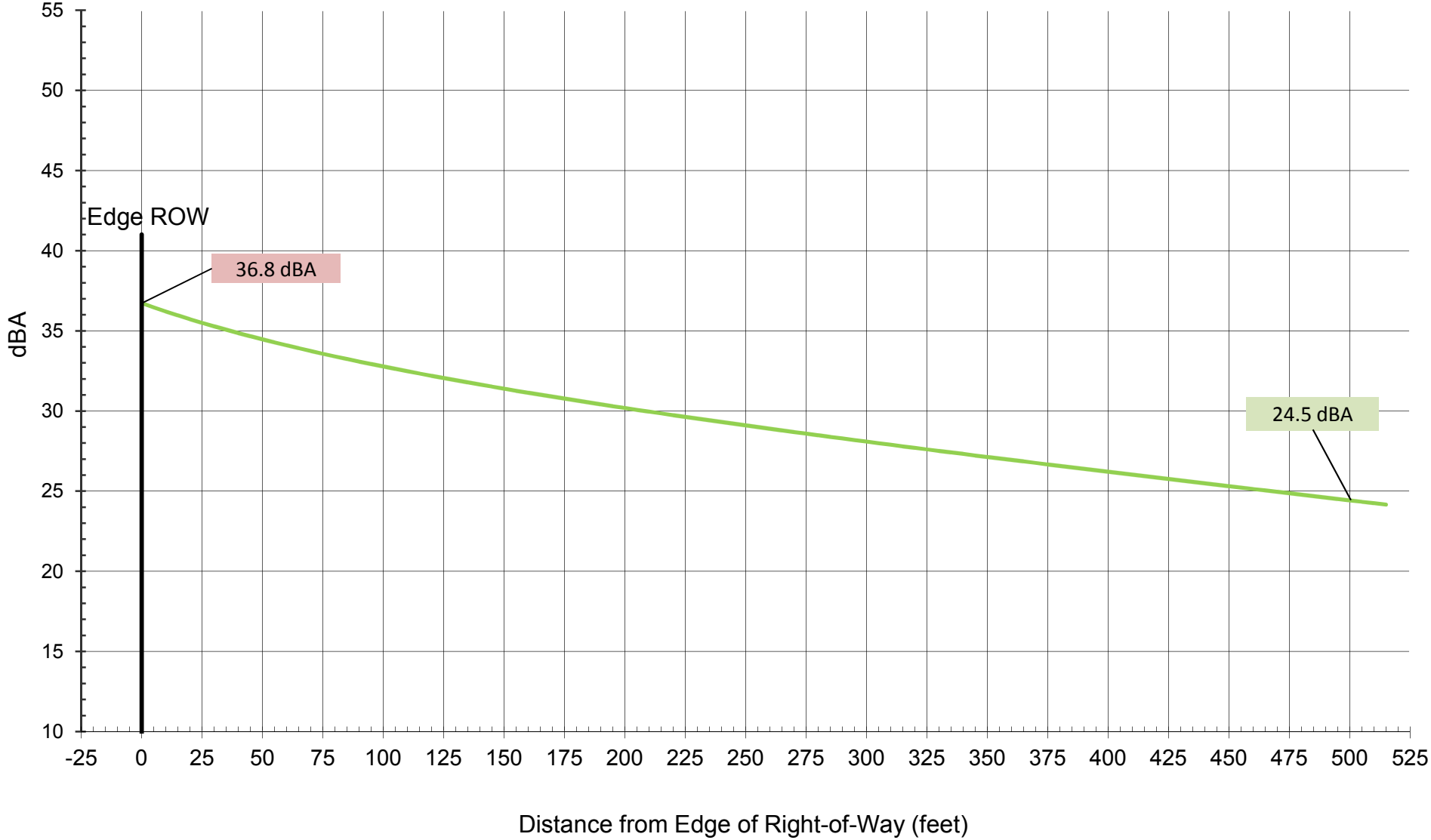


Exhibit 2.2a.2
345 kV Generator Lead Line in Maine - Section 2a
6.5 Miles - Triple Bundled 795 Drake, 30' GC, 170' ROW
Calculated for Fair Weather Conditions

Audible Noise Levels (dBA)

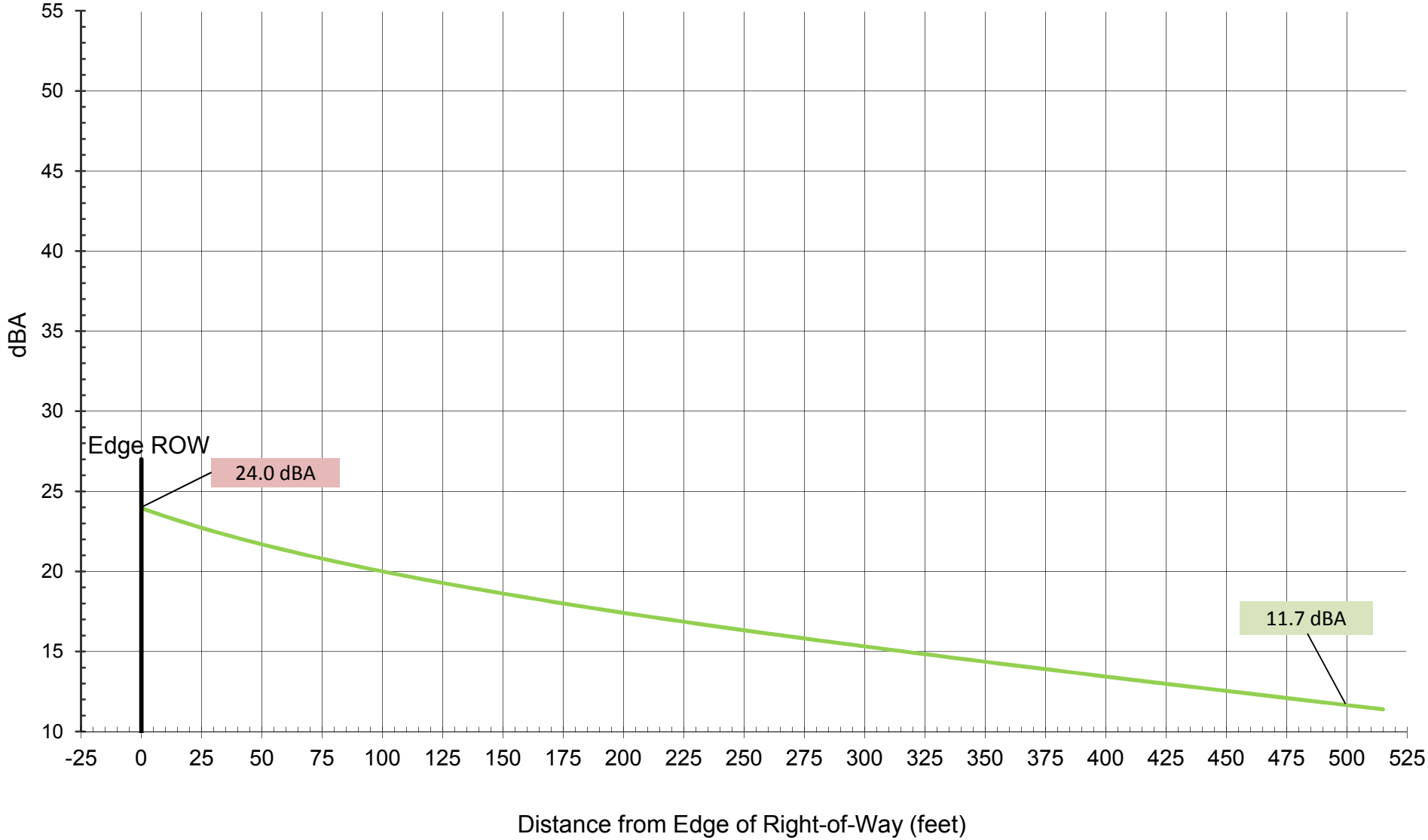


Exhibit 2.2b.1*

345 kV Generator Lead Line in Maine - Section 2b

19.6 Miles - Twin Bundled 795 Drake, 30' GC, 170' ROW

Calculated for Wet Conductor Conditions

* For this Section, 2b, there are no regulated protected locations within 500 feet of the EROW.

Audible Noise Levels (dBA)

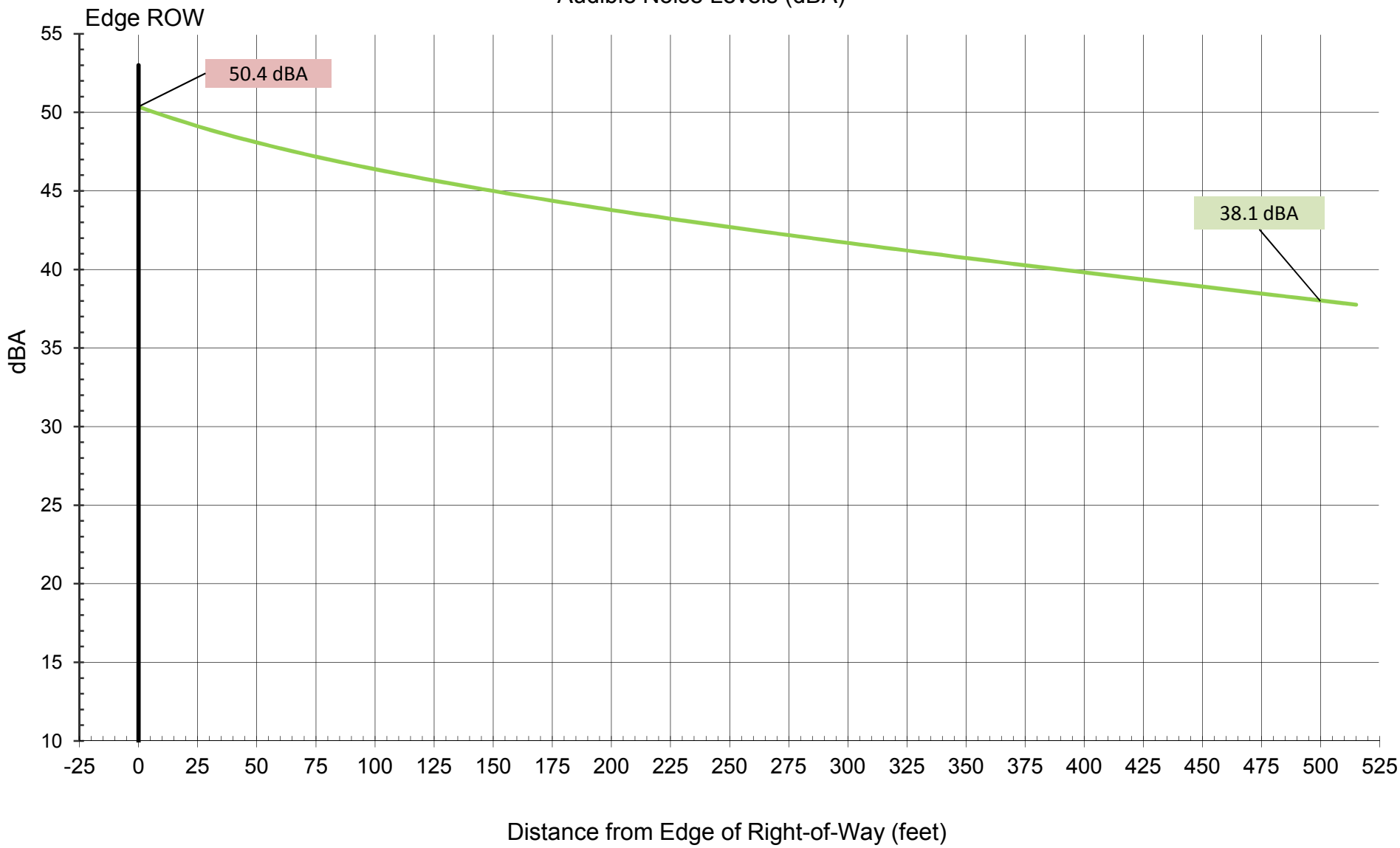


Exhibit 2.2b.2*

345 kV Generator Lead Line in Maine - Section 2b

19.6 Miles - Twin Bundled 795 Drake, 30' GC, 170' ROW

Calculated for Fair Weather Conditions

* For this Section, 2b, there are no regulated protected locations within 500 feet of the EROW.

Audible Noise Levels (dBA)