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Memorandum

To: **Dana Valleau, TRC Augusta, ME** **Project No.: 165796**

From: Tony Agresti, TRC Millburn, NJ

Subject: **Sisk Mountain (Kibby Expansion) Summary and Response to LURC Comments**

Date: April 6, 2010
CC:

This memo provides a summary of the Sisk Mountain (Kibby Expansion) noise modeling analysis that was provided in the November 24, 2009 noise report (original analysis) and presents responses to LURC comments regarding that analysis. Additionally, information is presented regarding cumulative (with the Kibby Project) noise modeling results.

Original Kibby Expansion Noise Analysis

The assumptions contained in the original noise model included the following:

- No foliage included (i.e., the model did not take into account attenuation due to foliage);
- Topography was included;
- Ground absorption was set to zero (acoustically reflective surface);
- Each turbine modeled as a point source at the 80 meter hub height;
- All receivers assumed to be downwind of all sources simultaneously under moderate winds or atmospheric inversion conditions;
- All turbines operating simultaneously under maximum sound output (109.4 dBA sound power level)
- A + 2 dBA data uncertainty addition was made to the above 109.4 dBA power level;
- Model is ISO 9613-2 based.

The above assumptions result in a very conservative noise model. In particular, the ground absorption setting of zero is equivalent to assuming that the entire area is paved surface or a water body.

TransCanada was informed by Vestas that the sound power level for the turbines installed at Kibby, and those proposed for the Kibby Expansion, have a lower sound power level of 107 dBA than the 109.4 dBA utilized for modeling in the original analysis. The data for the 107 dBA units were used for subsequent revised noise modeling (below) and a review of any tonal sounds as defined by MDEP.

LURC Comments

The LURC provided comments regarding the original Kibby Expansion analysis. Responses to these comments are provided below.

Model Search Radius

The model search radius was set to eight kilometers. This included all of the Kibby Expansion wind turbines and the protected areas in the report. The model did not include the contribution from the Kibby Project. As discussed below, TRC has conducted additional modeling such that the cumulative results of both the Kibby and Kibby Expansion projects could be determined.

Tonal Sounds

The MDEP noise standard defines tonal sounds as a sound level in a one-third octave band that exceeds the arithmetic average of the sound levels in the two contiguous one-third octave bands by a certain level depending on the frequency. Specifically, these levels are:

Table 1: MDEP Tonal Sound Definition

One-Third Octave Band	Level
25 Hz to 125 Hz	15 dB
160 Hz to 400 Hz	8 dB
500 Hz to 10,000 Hz	5 dB

The MDEP noise standard requires adding 5 dBA to the observed levels for the purpose of determining compliance with the standard if a tonal sound is present.

TRC reviewed the one-third octave band data for the 107 dBA sound power level V90 turbine as provided by Vestas. The data do not contain tonal components as defined by MDEP.

Short Duration Repetitive Sounds

Short duration repetitive sounds are defined under the MDEP standard as "a sequence of repetitive sounds which occur more than once within an hour, each clearly discernible as an event and causing an increase in the sound level of at least 6 dBA…immediately before and after the event, each typically less than ten seconds in duration…". The MDEP noise standard requires adding 5 dBA to a SDR, if present, for the purpose of determining compliance with the standard.

Wind turbines will generate sound that varies at closer in distances to the turbines. The variation is caused by the difference in sound level from the highest part of the blade to the lowest part. Based on the literature, this change varies from about two to four dBA, below the definition of a SDR (Minnesota Department of Health, 2009). A literature search was also conducted to determine if any SDR has been observed with operating wind turbine projects. In particular, testing of the Stetson Wind Project in Washington County, Maine did not reveal SDR (Resource Systems Engineering, 2009). Based on the information available, the project is not expected to generate SDR. In any event,

as shown below, even if SDRs occur, the predicted sound levels are so far below regulatory thresholds that application of the penalty for SDRs would not result in any violation of applicable limits.

Cumulative Sound Level with the Kibby Project

Additional noise modeling was conducted in order to determine the cumulative noise level of the Kibby Expansion project with the Kibby project. The noise model from the Kibby Expansion project was used as a base, and all 44 of the turbines from the Kibby Project were added. Both projects will utilize the same wind turbines. The same assumptions detailed above were used, with the following exceptions:

- The 107 dB sound power level wind turbine data from Vestas was utilized;
- In addition to the +2 dBA data uncertainty included in the original analysis, an additional + 3 dBA was added to the sound power level of all turbines to account for modeling uncertainty (for a total uncertainty correction of +5 dBA).
- Two separate models were run. The first utilized the same acoustically reflective ground absorption value of zero as the original model. A second model was run with a more realistic, yet still conservative, setting of 0.5 (mix of reflective and absorptive surfaces).

The modeling results for the original analysis, and for the cumulative projects, are provided in Table 2.

Table 2: Noise Modeling Results (1) (dBA)

Receiver	Original Report (Kibby Expansion Only) Does not include 3 dBA Uncertainty Original 109 PWL Turbines Acoustically Reflective Ground ("0")	Kibby Expansion Only With 3 dBA Uncertainty Added 107 PWL Turbines Acoustically Reflective Ground ("0")	Cumulative (Kibby Expansion plus Kibby) With 3 dBA Uncertainty Added 107 PWL Turbines Acoustically Reflective Ground ("0")	Cumulative (Kibby Expansion plus Kibby) With 3 dBA Uncertainty Added 107 PWL Turbines Mixed Ground ("0.5")	MDEP Noise Standard Applicable Within 500 Feet of Living or Sleeping Quarters (2)
S1	23.8	22.3	22.8	19.9	45
S2	21.9	20.4	21.2	18.3	45
S3	22.5	21	21.8	18.9	45
S4	22.3	20.8	21.7	18.8	45
S5	21.9	20.4	21.3	18.4	45
S6	24.2	22.7	23.2	20.3	45
S7	24.2	22.6	23.2	20.3	45
S8	24.2	22.9	24.3	21.6	45
S9	25.4	24.5	25.6	22.8	45
S10	23.1	21.6	23.8	21	45
S11	20.2	18.6	25.1	22.3	45

(1) The 107 dBA power level turbines contain a different spectral shape than the 109 dBA units used in the original analysis, with less energy in the lower frequencies. Therefore, the total dBA sound is attenuated to a greater degree by the atmosphere with distance, resulting in reductions of more than just the 2 dBA difference in power level.
(2) For protected areas greater than 500 feet from living or sleeping areas, the less restrictive daytime standard of 55 dBA applies.

A review of the data in Table 2 reveals that the cumulative projects, maintaining the same extremely conservative acoustically reflective ground cover of "0" and adding an additional 3 dBA for modeling uncertainty, still results in sound levels of 25.6 dBA or lower at protected areas, well below the MDEP limit of 45 dBA for protected areas. Utilizing the more realistic, yet still conservative mixed ground cover of "0.5" results in calculated noise levels of 22.8 dBA or lower at all protected locations. Noise contour maps of the cumulative projects for both the "0" and "0.5" ground cover settings are provided as Figures 1 and 2 to this memo.

Lastly, as discussed above, no SDR or tonal sounds are anticipated from the project. Yet, even if they were present, occurred simultaneously and consistently for the entire compliance period of one hour, application of a 10 dBA penalty (5 dBA penalty for SDR and 5 dBA for tonal sounds) to the maximum predicted sound levels would still remain well below the MDEP standard.

References

Minnesota Department of Health. 2009. Public Health Impacts of Wind Turbines.

Resource Systems Engineering. 2009. Appendix 7. Wind Turbine Sound Amplitude Modulation vs. Short Duration Repetitive Sound.

Figure 1 – Kibby Cumulative Project Noise Contour Map Utilizing "0" Ground Cover

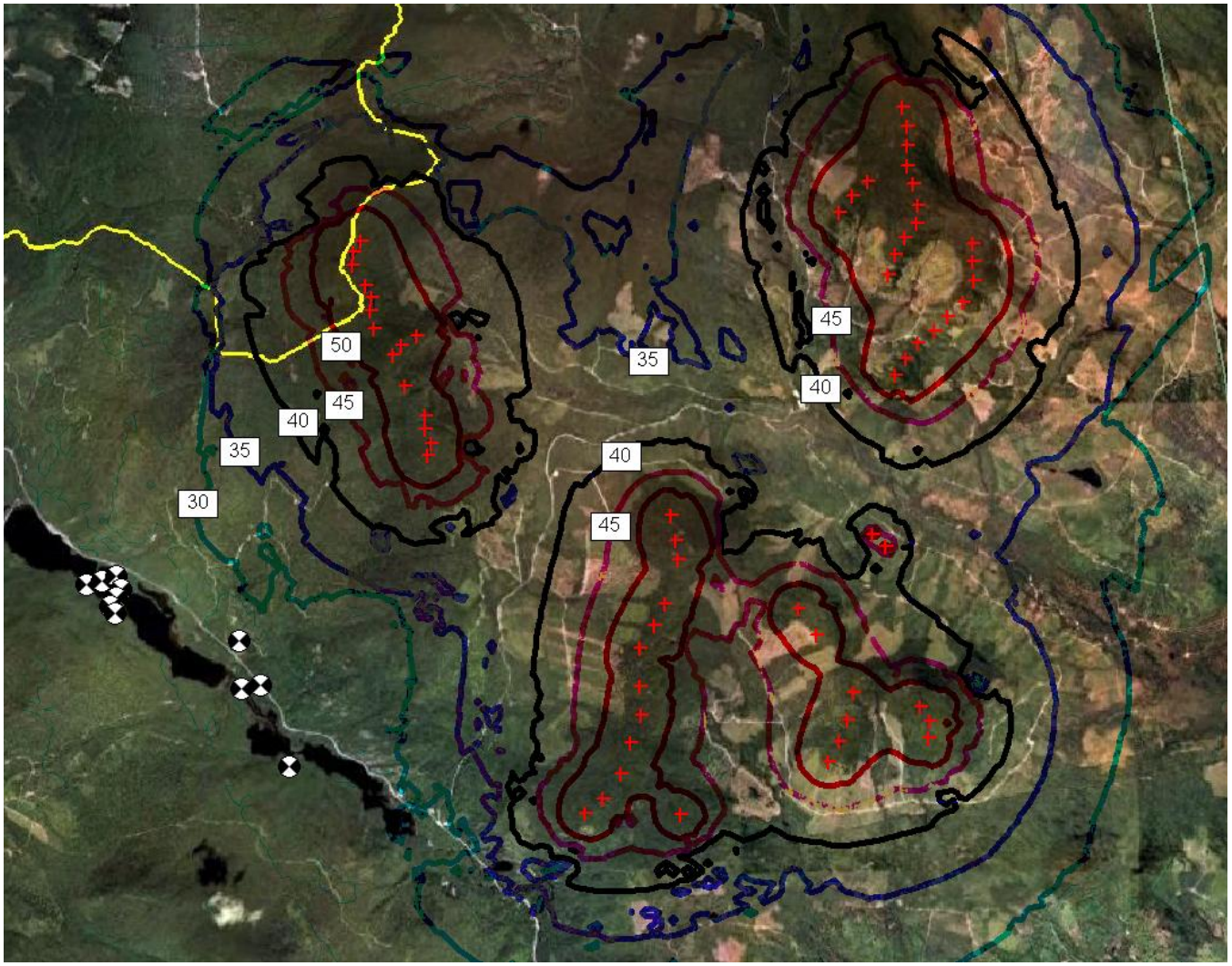

Figure 2 – Kibby Cumulative Project Noise Contour Map Utilizing "0.5" Ground Cover