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August 31, 2010

NH Site Evaluation Committee
c/o Jane Murray, Secretary
29 Hazen Drive, PO Box 95
Concord, New Hampshire 03301-0095

Re: Application of Groton Wind, LLC
Docket No. 2010-01

Dear Ms. Murray:

Enclosed for filing with the New Hampshire Site Evaluation Committee with reference to the above-captioned matter please find an original plus three copies of *Pre-Filed Testimony Gregory C. Tocci, INCE Bd. Cert., FASA, F-INCE Cavanaugh Tocci Associates, Inc Sudbury, Massachusetts.*

Thank you for your attention to this matter.

Very truly yours,

Manuela Perry
Paralegal II
Environmental Protection Bureau
(603) 271-3679

/MP
Enclosure
cc: Service List

THE STATE OF NEW HAMPSHIRE
SITE EVALUATION COMMITTEE

In the matter of the Application for Certification Pursuant to RSA 162-H of GROTON WIND LLC	)	**Docket No. 2010-01**

Pre-Filed Testimony
Gregory C. Tocci, INCE Bd. Cert., FASA, F-INCE
Cavanaugh Tocci Associates, Inc.
Sudbury, Massachusetts

1. I, Gregory C. Tocci, am a Senior Principal Consultant with and President of Cavanaugh Tocci Associates, Inc., Sudbury, Massachusetts. In 1975, Mr. William J. Cavanaugh and I founded Cavanaugh Tocci Associates—an acoustical consulting firm currently employing 15 staff members. The firm has operated continuously since its founding and provides acoustical consulting services in architectural, environmental, and industrial acoustics, vibration, and sound system design. I am an Institute of Noise Control Engineering Board Certified Member and a Fellow of that organization. I am also a Fellow of the Acoustical Society of America, and a registered professional engineer (mechanical) in Massachusetts and Rhode Island.

2. I have been retained by the Attorney General of the State of New Hampshire pursuant to RSA 162-H:10 to assist Counsel for the Public and the Committee with the review of acoustics-related information pertaining to the proposed Groton Wind LLC project.

3. I have reviewed the following documents:

- Sound Level Assessment Report, Groton Wind Farm, Groton, NH dated January 14, 2010 (Epsilon 2010);
- Pre-filed Direct Testimony of Robert D. O'Neal on behalf of Groton Wind, LLC dated March 2010;
- Docket No. 2006-01, Application of Lempster Wind, LLC, Decision Issuing Certificate of Site and Facility with Conditions, dated June 28, 2007 (pp. 121-142).

I requested the Applicant's data underlying the Epsilon Report and Mr. O'Neal's testimony, but I did not receive that data with sufficient opportunity to review and analyze it.

4. I attended a technical session on August 10, 2010, where sound produced by the proposed Groton Wind Farm was discussed. The following are comments and observations about points raised in the information I have been provided and from discussions at the technical session that, in my expert opinion, require further study before any scientifically supportable conclusions can be drawn about the noise impacts of the proposed wind farm on nearby residents. Without further sufficient information about measured background sound levels and the sound generating characteristics of the proposed wind turbines, there is a risk that assessed noise impacts on people residing in proximity to this significant project might be underestimated. Such exposures can lead to annoyance and disruption of regular indoor and outdoor activities.

5. In Table 6-1 of the Epsilon January 2010 report, median and average equivalent and 90^{th} percentile sound levels are provided for conditions when wind

speeds at the met tower were 9.3 m/s or higher. I would like to examine this and all other equivalent and 90th percentile sound level data, and the corresponding wind speeds, to evaluate the correlation between wind speed measured at the met tower and background sound levels measured at receptor locations. These data are required to ascertain the appropriateness of wind farm sound criteria at receptor locations indicated in Table 8-1 of the Epsilon January 2010 report.

6. Data in Figure 5-2 (Location 1, Halls Brook Road) and in Figure 5-3 (Location 2, Groton Hollow Road) suggest that background sound levels are largely controlled by sound produced by water flow in nearby brooks. I have suggested, and discussed with Mr. Robert O'Neal, re-measuring sound at these receptor locations, or locations nearby, at a time of year when water flow sound is less evident. Because of a legal filing deadline of October 22, 2010, sound level monitoring at these two locations would need to commence no later than October 4 to permit measurement over a two-week period, as has been previously conducted by Epsilon, downloading, processing, and reporting by Cavanaugh Tocci Associates, Inc. to the NH AG for submission to the Committee on or prior to the October 22 date.

7. The initial intent was that these measurements were to be conducted during winter months, when the brooks are frozen, thus minimizing water flow sound, to replicate frequently occurring quietest times (and times when wind farm activity might be expected to be at its greatest level). The October 4 start date for measurements represents a compromise for two reasons: 1) insect noise may not have been fully abated through one or more overnight freezes, and 2) surface water levels may still be relatively high thus raising water flow sound levels. Mr. O'Neal and I

discussed that, at the time monitors are installed, we would mutually seek a location at least partially shielded from water flow sound. The presence of insect sound may obviate this, and the mutually agreed-upon location shielded from water flow sound is at best a compromise in the interest of completing these measurements to allow legal matters to proceed as the proponent has planned. The appropriateness of these measurements to replicate wintertime conditions can only be judged in the field and after reviewing collected sound data. We therefore may still recommend after further analysis that actual wintertime sound level measurements be made prior to final approval of the wind power project.

8. On the basis of discussions during the August 10 technical session, and on the basis of my later conversation with the owner of the Baker River Campground, we recommend installing two monitors there, one at a campsite relatively close to Route 25 and one nominally the furthest away from Route 25, in order to determine the range of background sound occurring within the campground. These locations would then become two new locations for reporting impacts along the lines described for other locations in the Epsilon January 2010 report. For convenience, these measurements would be made over the same time frame as those made at Locations 1 and 2 in October 2010.

9. To render these measurements comparable to those made by Epsilon, I would request, if feasible, that the met tower be reinstalled to measure wind speed in 10-minute intervals as previously done in connection with measurements in the Epsilon 2010 report. The met tower installation and data collection would need to be by the proponent under the supervision of Epsilon as previous.

10. Once the October 2010 measurements have been completed and data analyzed, and once I have completed my analysis of data on which the Epsilon January 2010 report has been based, I will be better able to assess the impacts of the project. We will address those impacts in further testimony to be filed by October 22.

11. Infrasound, sound nominally below the range of human hearing, i.e. below 20 Hz, has been cited by many as a source of community annoyance. Modern wind turbines with blades upstream of supporting towers avoid the propensity to generate the significant levels of low frequency sound common in older propeller-downwind arrangements. Nevertheless, there is a history of complaints of low frequency sound produced by modern upwind turbines. Authors have proposed various methods for measuring wind turbine low frequency sound, but none have proposed measuring sound at wind turbine blade passage frequency, nor have manufacturers to my knowledge done so. Anecdotal descriptions of the perception of low frequency sound include "feeling" wind turbine sound, which suggests that sound caused by a blade passage may be at issue.

12. The blade passage frequency is the rate that all blades of a fan pass through a single rotation. This is the number of blades—3 typically for wind turbines—times the rotation rate in revolutions per minute divided by 60. The resulting units are cycles per second, also known as Hertz (Hz). The blade passage frequency of wind turbines of the size proposed for the Groton Wind Farm is typically less than 1 Hz. Few sound level meters are designed to measure sound at this low frequency.

13. The industry may not be entirely faulted for having not studied infrasound in more detail for a couple of reasons. How sound is properly measured at frequencies at and below 1 Hz is not clear using conventional instrumentation design standards. Even if sound levels were, through some means, measured at blade passage, without criteria by which levels can be assessed, the meaning of these data would be questionable. However, were it to be shown that sound levels at blade passage exhibited some prominence over levels at adjacent frequencies, then reasonable, cautionary criteria might be developed for assessing infrasound. It is in our opinion that there has been enough controversy over the existence or non-existence of infrasound produced by modern wind turbines, that the proponent of the Groton Wind Farm and its wind turbine supplier should undertake evaluating sound at low frequencies including at blade passage.

14. Potential modulated broadband sound, often described as a "swooshing" sound, has not been addressed in the Epsilon January 2010 report and has been a source of complaints at other wind farms. I suggest that this phenomenon be addressed in the Groton Wind Farm sound impact report.

15. In summary, issues requiring further investigation include:

- The correlation between wind speed and measured background sound used to develop the assessment of wind turbine sound summarized in Table 8-1
- Additional measurements by my firm at Locations 1 and 2 (see the Epsilon January 2010 report) to better quantify background sound levels during quieter conditions with less water flow sound.

- Additional measurements by my firm at the Baker River Campground since receptors at this location do not benefit from the noise reduction of building structures.
- Measurements of sound produced by proposed Groton Wind Farm wind turbines at low frequencies including at blade passage frequency.
- Evaluation of modulated broadband sound.

16. This completes this pre-filed testimony for now.

Gregory C. Tocci