STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

Petition of BNE Energy Inc. for a Declaratory Ruling for the Location, Construction and Operation of a 4.8 MW Wind Renewable Generating Project on Winsted-Norfolk Road in Colebrook, Connecticut ("Wind Colebrook North")	**Petition No. 984** **March 15, 2011**

PRE-FILED TESTIMONY OF NOISE CONTROL ENGINEERING, INC., BY MICHAEL BAHTIARIAN, INCE Bd. Cert.

I. Introduction

Q1. Please state your name, position and business address.

A1. I am Michael Bahtiarian, Vice President at Noise Control Engineering, Inc. (NCE). My business address is 799 Middlesex Turnpike, Billerica, Massachusetts 01821.

Q2. Please describe your educational background and work experience.

A2. As outlined in my professional biography attached as NCE Exhibit 1, I have a Masters of Science in Mechanical Engineering from Rensselaer Polytechnic Institute and a Bachelor of Science in Mechanical Engineering from the Pennsylvania State University. All of my work experience has been in the field of sound and vibration starting at General Dynamics Electric Boat Division in Groton Connecticut where I was employed as a sound and vibration engineer and worked on the *SEAWOLF* submarine program.

Noise Control Engineering, Inc. (NCE) is a private engineering consulting company which provides expertise in the areas of noise and vibration control. I joined NCE in 1994 and was the third employee of what is now a twelve person consulting firm. In the past sixteen years I have carried out numerous acoustical evaluations for clients in "heavy" and bio/high-tech industries, marine/shipbuilding, commercial/retail, site development and construction. Most recently and under my management, NCE has reviewed wind turbine noise studies in the towns of Falmouth, Wareham, Bourne and Brewster, Massachusetts.

Q3. Have you previously testified before the Connecticut Siting Council?

A3. Yes. I provided prefiled testimony on the behalf of Save Prospect before this Council in Petition No. 980. I have also been an expert witness in four other cases in New Hampshire, Vermont and Massachusetts. These cases are listed in NCE Exhibit 1.

Q4. Do you have any other qualifications or certifications that make you suited for testimony in this case?

A4. Yes, I am a Board Certified member of the Institute of Noise Control Engineering (INCE Bd. Cert.). This certification is equivalent to a Professional Engineer (PE) license for the field of noise and vibration. The requirements for receiving the certification are similar to PE; greater than 4 years experience, recommendations from colleagues, and passing a rigorous 8 hour written exam.

II. Summary of Testimony

Q5. What is the purpose of your testimony in this proceeding?

A5. The purpose of my testimony is to report my peer review of the noise evaluation performed by VHB/Vanasse Hagen Brustlin, Inc. (VHB) of the "Wind Colebrook North" wind turbine project located at Winsted-Norfork Road and Rock Hall Road in Colebrook, Connecticut. The subject evaluation was performed for BNE Energy Inc. and dated November 2010. This study is provided in NCE Exhibit 2.

Q6. Please summarize your testimony.

A6. My review of the subject VHB report found unsubstantiated claims, incorrect use of noise regulations, questionable computation methods and only a token study of existing conditions. Based on my own computations of expected noise levels from the project, I have computed sound levels that will exceed the State of Connecticut Department of Environmental

Protection (CTDEP) noise regulations. I conclude that the subject report is not adequate and sufficient and misrepresents the future project generated sound pressure level.

III. Detail Peer Review Issues

Q7. What were you asked to do in this proceeding?

A7. I have been retained by a FairwindCT, Inc., Susan N. Wagner and Michael and Stella Somers to perform a technical peer review of the Wind Colebrook North noise evaluation.

Q8. What material did you review?

A8. I have reviewed the VHB/Vanasse Hagen Brustlin, Inc. (VHB) noise evaluation of the "Wind Colebrook North" wind turbine project located at Winsted-Norfork Road and Rock Hall Road in Colebrook, Connecticut. The subject evaluation was performed for BNE Energy Inc. and dated November 2010 (NCE Exhibit 2). I have also reviewed the Town of Colebrook Zoning Regulations (NCE Exhibit 3) and the relevant Connecticut state noise regulations. The evaluation includes an appendix with noise monitoring summary, sound level calculations and wind assessment. My review includes all of the above materials.

Q9. Did you reach any conclusions after reviewing the Wind Colebrook North Noise Evaluation?

A9. Yes, I have reached a few conclusions.

Q10. If so, what are your conclusions?

A10. As a peer reviewer I conclude that the subject report is not adequate and sufficient for a project of this scale. Further, from my own estimates, I conclude that the subject report is incorrect to state that the operation of three 1.6 MegaWatt wind turbines will meet the State of Connecticut noise regulations.

Q11. Do you have any other more specific conclusions?

A11. Yes, I have five more specific conclusions regarding details presented in the subject VHB report.

Q12. Can you tell us the first of the five specific conclusions?

A12. Yes, the first conclusion is that the subject VHB report has made the unsubstantiated statement that it has evaluated ALL CTDEP noise criteria and shown the project to be in compliance.

Q13. What is the basis for this conclusion?

A13. The "Introduction" states that predicted sound levels were compared to Connecticut Department of Environmental Protection (CTDEP) noise regulations (Regulations of Connecticut State Agencies (RCSA) Title 22a, Section 22a-69-1 and 22a-69-7). The "Conclusion" states that these regulations would be met. Section 22a-69-3.2 provides limitations for impulsive noise. The study did not address nor assess impulsive noise and thus falsely claims such a requirement is achieved. Section 22a-69-3.3 provides limitations for sound with prominent discrete tones. The study does not address nor assess prominent discrete (pure) tones and thus falsely claims such requirement is achieved. Section 22a-69-3.4 provides limitations for infrasonic and ultrasonic sound. The study does not assess nor address infrasonic or ultrasonic sound and thus falsely claims such requirement is achieved.

Q14. Are impulsive, prominent discrete tones, infrasonic and ultrasonic types of noise likely to occur for a wind turbine?

A14. Only two of these noise types are likely to occur. These are prominent discrete tones (or pure tones) and infrasonic noise. Impulsive and ultrasonic noise would not typically be an expected concern for wind turbines.

Q15. Can you tell us the second of the five specific conclusions?

A15. My second conclusion is that the VHB report has incorrectly selected the CTDEP A-weighted sound pressure level (SPL) noise limit.

Q16. What is the basis for this conclusion?

A16. The VHB report classifies the **State of Connecticut** noise criteria based on the "emitter zone" (i.e. the location of the noise source) as being "Industrial". The Town of Colebrook Zoning Regulation and map shows the subject parcel for the three wind turbines to be "Residential" (R-2). If the emitter zones were classified correctly as "Residential", the noise limits listed would be 6 dB lower (i.e. going from 61 to 55 dB(A) during daytime and going from 51 to 45 dB(A) during the nighttime).

Q17. Can you tell us the third of the five specific conclusions?

A17. My third conclusion is that the methods used to predict project sound levels at the receptors are not worst case.

Q18. What do you mean?

A18. A worst case evaluation would make assumptions for using maximum justifiable source sound levels and minimal justifiable attenuation factors. The result of such a computation would yield higher predicted SPL at the receptors. However, if such a result meets the noise criteria, it is unlikely to be incorrect given the accuracy of the computations and all the variability in the input assumptions such as wind speed, direction, etc.

Q19. What is the basis for this conclusion?

A19. First, the sound level computation included a parameter for geometrical divergences (attenuation of sound with distance) and atmospheric absorption (absorption of sound due to molecular interaction). The atmospheric absorption factor, reported in dB/km (or dB/m) is controlled by meteorological conditions (temperature and relative humidity) and is defined in octave bands from 63 to 8,000 Hertz. The factor is typically small compared with geometrical divergence.

The value of atmospheric absorption factor used for the Wind Colebrook North is 5 dB/km (0.005 dB/m) which is found at the top of the sound computation worksheets under the heading absorption coefficient. Based on examination of ISO-9613-2, the factor appears to be for the condition of 20°C (68°F), 70% RH and 1,000 Hertz octave band. According to ISO-9613-2 when performing the computations in overall A-weighted SPL the atmospheric absorption factor for the 500 Hertz octave band should be used. Accordingly, the value of the factor that should have then been used for the above meteorological conditions is 2.8 dB/km. Further, for a worst case situation the minimum factor should be used which would have been at meteorological conditions of 10°C (50°F), 70% RH. In this case the value would be 1.9 dB/km. In many of my evaluation studies I have not taken into account this factor (i.e. the coefficient is set to 0 dB/km). This would provide an even more conservative assessment.

The lower the atmospheric absorption factor the higher the predicted SPL. The report's conclusion states that the computation is a "worst case analysis". This does not appear to be the case. If the 1.9 dB/km value were to be used the predicted SPL would be 1 to 5 decibels higher. If no atmospheric absorption was taken into account (0 dB/km) the predicted SPL would be 2-8 decibels higher.

Q20. Were there any other problems you found with the computation methodology?

A20. Yes, I also have problem with the selection of the "source sound power levels" which are measured and reported by the manufacturer of the wind turbines and are a function of wind speed.

Q21. What was the problem with the turbine source sound level section?

A21. The section, "Project Generated Sound Levels" describes the wind speed conditions assumed for the noise predictions. It states that the wind turbines will operate between 3 meters/second (cut in speed) and 12 meter/second (cut out speed). Further, the report states that the maximum daytime sound levels would occur at maximum wind speeds of 9 meters/second and the maximum nighttime sound levels would occur at maximum wind speeds of 8 meters/second. It is unclear why a lower wind speed and thus a lower source sound power level (Lw) would be applicable during the night. Over the course of a year, it is entirely possible that higher source sound level from daytime could occur on some nights and would then be a better choice for a worst case evaluation.

Q22. Are those the only problems you found with the computation methodology?

A22. No, the subject VHB report used a sound computation method given in ISO-9613-2. This method generally applies to computations performed in octave bands. NCE reviewed the sound level calculations given in the appendix and finds that VHB performed the computation using a less rigorous method wherein only the overall A-weighted sound pressure levels (SPL) were used. Overall A-weighted SPL is determined from individual octave band SPL in frequencies from 63 to 8,000 Hertz octave bands. This method is acceptable for sources of sound with minimal frequency characteristics such as typical HVAC machinery. A wind turbine has significant frequency and temporal characteristics, in which case the less rigorous method may result in incorrect noise predictions. Further, this less rigorous method does not allow determination of compliance with CTDEP regulations sections 22a-69-3.2, 22a-69-3.3 and 22a-69-3.3 as discussed in Question 13 above.

Q23. Can you tell us the fourth of the five specific conclusions?

A23. My fourth conclusion is that the study of existing conditions (i.e. background noise measurements) was diminutive for a project of this scale.

Q24. What is the basis for this conclusion?

A24. I have reviewed the Noise Monitoring Summary provided in the Appendix. NCE Exhibit 4 is a table summarizing the start times and duration of the one measurement taken from the monitoring logs provided in the appendix. The table shows that the noise measurement at Site "M1" was only performed for fifteen to twenty minutes.

Further, I believe that 20 minutes of sampling is too short a period to accurately characterize the background sound level conditions. For my projects, the surveys are usually for a period of three to seven days using automated "logging" instrumentation which collects the background sound levels continuously. Page 6 of the VHB report says noise monitoring was performed "following the procedures of Section 22a-69-4 of the CTDEP noise control regulation." This section of the regulation codifies requirements for personnel performing the study, instrumentation used and instrumentation settings. It does not provide guidance on the duration of the noise measurements.

Q25. Can you tell us the fifth of the five specific conclusions?

A25. Yes. My fifth conclusion is that based on my own computations of expected noise levels from the project, worst case sound levels will exceed the State of Connecticut Department of Environmental Protection (CTDEP) noise regulations.

Q26. 2What is the basis for this conclusion?

A26. I do not believe the VHB report represents a worst case computation so I recomputed the expected noise level using the same methodology but making three changes.

Q27. What were the three changes?

A27. First, for a nighttime assessment, I used the daytime turbine sound source level of 106 dB(A) as discussed in Question 21. Second, I used 0 dB/km absorption coefficient as discussed in Question 19. Third, I compared the results to the residential-to-residential nighttime noise limit of 45 dB(A) as discussed in Question 16. The results are given in a table in NCE Exhibit 5 for only the receptors within 1,800 feet of the turbines.

Q28. What did these results show?

A28. The table in NCE Exhibit 5 show small excesses to the CTDEP nighttime limit of 45 dB(A) at all receptors within 1,800 feet. These results show two receptor locations with a 1 dB excess to CTDEP limits. It also shows two receptor locations with levels at the CTDEP noise limit of 45 dB(A).

Q29. Is that all that matters; being below the appropriate CTDEP noise limit which in this case is 45 dB(A) for residential-to-residential sound transmission?

A29. Certainly not! Wind turbines create unique and complex acoustic characteristics which are not evaluated using a single A-weighted sound pressure level (i.e. dB(A)) limit as was done in the VHB report.

Q30. What are these unique acoustic characteristics?

A30. We mentioned two of these above, such as infrasound and pure tones. Other acoustical characteristics are low frequency sound, amplitude modulation and wind turbine sound directionality.

Q31. Can you elaborate on the issues regarding infrasound and pure tones?

A31. Yes, as I mentioned in questions 13 and 14, the CTDEP has requirements for both of these parameters. The VHB report incorrectly claimed that all parts of the regulation were achieved, even though they could not have even addressed infrasound or pure tones.

Q32. Can you quickly define infrasound and pure tones?

A32. Infrasound is sound with energy below audible frequencies, typically less than 20 Hertz. Pure tones are sound with large amplitude in very narrow frequency range. For example a squealing brake is an example of a pure tone.

Q33. Why couldn't infrasound and pure tones not be evaluated?

A33. The data provided by the wind turbine manufacture is only in terms of A-weighted sound pressure levels, that is in dB(A). Infrasound and pure tones require data that is provided in terms of sound pressure level vs. frequency. I have yet to see a wind turbine manufacture provide such data to allow evaluation.

Q34. Can you also briefly define low frequency sound?

A34. Low frequency sound would be audible sound in the frequency range of 20 to 200 Hertz or thereabouts. Low frequency sound is typically measured in un-weighted or

C-weighted sound pressure levels.

Q35. Can you also briefly define amplitude modulation?

A35. Amplitude modulation as related to wind turbines is the sound pressure from aerodynamic action of the turbine blades. This sound is sometimes distinguished as a "swishing noise", or "thumping". Amplitude modulated noise is characterized by a fluctuation in sound amplitude having a period equivalent to the blade passage frequency (rotational speed of the hub multiplied by the number of blades).

Q36. Why wasn't low frequency sound or amplitude modulation evaluated by the developer?

A36. For the same reason that infrasound and pure tones were not evaluated. The wind turbine manufacturers do not provide sufficient data.

Q37. Why are infrasound, pure tones, low frequency sound and amplitude modulation important?

A37. I believe these are the important acoustic parameters to predicting human response and annoyance. Sound is much more complex than a single A-weighted sound pressure level as offered by the subject VHB report. Could a single A-weighted sound level allow judgment of a song for a Grammy award, obviously not. Each of these parameters define very specific attributes to sound character of the wind turbine.

Q38. Can you also briefly define wind turbine sound directionality?

A38. Yes, this term is different than the previous parameters. Wind turbine sound directionality (or just directionality) defines how emitted sound from a source depends on direction. Sound emitted from a source is often not equal in magnitude in all directions. For example, a stereo speaker has much higher sound output from the front of the speaker than the rear of the speaker. The VHB report stated that the directionality was uniform which means that the wind turbine produces the same sound in all directions. I do not believe that assumption is accurate.

Q39. How does sound directionality play a role for wind turbines?

A39. Unlike fixed sound sources, such as roof top mechanical equipment, wind turbines constantly change direction. Thus at any single location, the levels of sound will vary with changes in both wind speed and wind direction.

Q40. Why is this an issue?

A40. I believe one of the important factors in annoyance is not just sound amplitude, but sound variability. At any one location, both wind speed and wind direction play significant roles in sound variability and thus also annoyance.

Q41. How big an issue is this for this Colebrook?

A41. I believe this is a very significant issue, especially for the homes located between the Colebrook North and Colebrook South projects. For all previous projects I have worked on, the wind turbines have been situated on only one side of abutting residences. In this situation, I have found that the abutters experience "good days" (when turbines are not overly audible) and "bad days" (when the turbines are extremely audible). Many factors control whether it is a "good" or "bad" day including wind speed, wind shear, local weather, time of day and wind direction. The large number of homes located between the North and South Colebrook projects will be impacted nearly all of the time from either the North or South project. This is an atypical situation to have homes surrounded by wind turbines which can result in higher levels of impact (stress, sleep loss, and annoyance) than what has been experienced at previous sites.

Q42. If the Siting Council were to decide that BNE may proceed based on VHB Report, which you have called into question, and it is later determined that actual sound levels are excessive or interfere unreasonably with neighboring property owners' rights to the peaceful use and enjoyment of their property, are there any mitigation strategies that can be applied to the turbines to reduce the noise impacts?

A42. No. There are no noise control treatments such as barriers, silencers or acoustical cladding that can be added after the wind turbine is installed. The only method of minimizing noise after-the-fact is to shut the turbine down during noisy (i.e. windy) conditions. However, this option reduces the owner's ability to produce electricity.

Q43. Can you offer any firsthand experience of what happens in such situations?

A43. Yes, I would also like to add that, from my personal involvement with a case in Falmouth, Massachusetts, such a situation is highly disruptive to the abutters, many of which suffer headaches, sleep loss, stress and anxiety. With the size of the wind turbines, the sound they produce envelopes an abutter's entire property. This is unlike sound from a rooftop HVAC unit which may only impact one side of an abutter's home. It is also a major burden to the municipality required to enforce noise ordinances who then needs to have very complex sound monitoring performed to determine if the installed wind turbines are compliant with regulations.

Q44. Does that conclude your testimony?

A44. Yes it does.

The statements above are true and accurate to the best of my knowledge.

3/15/2011
Date

INCE Bd. Cert.
Noise Control Engineering, Inc.
By: Michael Bahtiarian

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NCE EXHIBIT LIST

Michael Bahtiarian, INCE Bd. Cert.

NCE Exhibit 1	Professional Biography of Michael Bahtiarian.
NCE Exhibit 2	VHB Report, Noise Evaluation Wind Colebrook North, dated November 2010.
NCE Exhibit 3	Town of Colebrook Zoning Regulations/Map
NCE Exhibit 4	Table compiling the start time and duration of the background noise monitoring as reported in the VHB Report, dated November 2010, Appendix, Noise Monitoring Summary.
NCE Exhibit 5	Table of estimated Project Generated Sound Pressure Level in dB(A) recomputed based on assumptions listed in Question 27 and listed for receptor locations within 1,800 feet of the either wind turbine.

EXHIBIT 1

NOISE CONTROL ENGINEERING, INC.

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MICHAEL A. BAHTIARIAN
BOARD CERTIFIED ACOUSTICAL ENGINEER

SUMMARY: During his 15 year engineering career Mr. Bahtiarian has worked in all phases of sound and vibration including: analysis, testing, product development and marketing. At noise control engineering, Mr. Bahtiarian has managed numerous noise control projects and testified as an expert witness. He has published three papers on related topics.

EDUCATION:
Bachelor of Science, Mechanical Engineering, Pennsylvania State University, 1985.
Masters of Science, Mechanical Engineering, Rensselaer Polytechnic Institute, 1988.

PROFESSIONAL EXPERIENCE:

• Vice President	Noise Control Engineering, Inc.	1994 to present
• Technical Specialist	ADE Corporation	1990 to 1994
• Senior Engineer	Fabreeka International M/RAD Division	1989 to 1990
• Sound and Vibration Engineer	General Dynamics Electric Boat Division	1985 to 1989

HONORS AND SOCIETIES:
- Institute of Noise Control Engineers (INCE), Board Certified, 2004.
- Penn State World Campus Certificate in Noise Control Engineering, 2003.
- America Society of Mechanical Engineers (ASME), Noise Control & Acoustics Division, 1985 to present
- American Society of Mechanical Engineers (ASME), B89.4.17 CMM Vibration Standards Committee, 1992-94.
- Institute of Noise Control Engineers (INCE), Full Member, 1995 to present.
- Institute of Environmental Sciences (IES), President Boston Chapter, 1994-1997.
- Engineer-in-Training (EIT) Certificate, 1985.

PROFESSIONAL RESPONSIBILITIES AND PROJECTS:
Mr. Bahtiarian has worked in various capacities in the field of acoustical and vibration engineering throughout his career. His experiences broadly covers the areas of acoustics, noise control and sound & vibration measurement. Mr. Bahtiarian has extensive experience in the design of noise control treatments such as barriers, enclosures, damping and vibration isolation. Mr. Bahtiarian's responsibilities at NCE are to manage industrial noise reduction projects and perform product and environmental noise studies.

Mr. Bahtiarian has been involved in various industrial noise reduction projects. These include evaluation of OSHA noise exposure and reduction recommendations, design of noise barriers for industrial noise control and assessment of reverberation conditions in many plants and commercial spaces. Mr. Bahtiarian has written the environmental noise control plan and performed the noise studies for construction programs at the Deer Island Sewage Facility and the Massachusetts Central Artery/Tunnel (CA/T) projects. Mr. Bahtiarian has also performed environmental noise surveys and assessments for both industrial and private citizen clients. On these matters, Mr. Bahtiarian has testified in court and for municipal boards as an expert witness in acoustics.

Mr. Bahtiarian has also consulted to manufacturing clients on the noise reduction and vibration sensitivity of their products. Products evaluated included turbine generators, wastewater evaporators, medical test equipment and personal computers. Services performed include noise surveys, treatment design and structural and vibration testing of products.

Mr. Bahtiarian has experience in predicting noise from various types of industrial equipment and Heating Ventilation and Air Conditioning (HVAC) systems. Mr. Bahtiarian instrumentation capabilities includes operation of integrating and logging sound levels meters, octave and 1/3 octave band analyzers and spectrum analyzers. Mr. Bahtiarian has also conducted reverberation sound (RT-60), damping loss factor and wall transmission loss tests.

As a product Technical Specialist at ADE, Mr. Bahtiarian was responsible for evaluation of customer applications for non-contact vibration measurement transducers. This included a review of transducer performance (resolution, linearity & bandwidth) fixture design and transducer installation. Mr. Bahtiarian also developed a PC based dynamic measurement system for measuring vibration from bearings used in disk drives and precision machine tools. He served as Project Manager, Marketing and Technical Specialist during the 9 month development.

As an assistant to the President/Chief Engineer at Fabreeka, Mr. Bahtiarian performed routine stress, static and dynamic calculations in support of the design of vibration and shock testing equipment. He designed vibration test fixtures, and evaluated the dynamic performance using FEA and Modal Analysis methods. He also designed and engineered specialized vibration isolation platforms. These ranged from very large seismic bases for Coordinate Measuring Machines (CMM's) to desktop platforms for precision microscopes. Mr. Bahtiarian coordinated product development between customers, and in-house design and manufacturing departments, wrote technical manuals, conducted quality assurance tests and performed on-site installation of large capital equipment.

At Electric Boat, Mr. Bahtiarian served as a sound & vibration engineer on the new design program of the SEAWOLF Class Submarine. The responsibilities in this position included the evaluation of all design impacts on shipboard radiated noise. Mr. Bahtiarian developed component noise criteria for reactor plant components such as the Reactor Coolant Pumps. The development of this noise criteria involved studying the effects of structural impedance on component vibration. He also evaluated the need for quiet valves in the SEAWOLF propulsion plant. He authored the noise control sections of propulsion plant cooling systems, and the "Design Guide for the Acoustic Design of the Aft Reactor Bulkhead".

INTERNAL REPORTS (INDUSTRIAL & ENVIRONMENTAL)

1. "Background Noise Survey around DRS Fitchburg," NCE TM 08-015, January 2008.
2. "BAE: Sound Transmission Class (STC) Measurements, NCE Technical Memo 07-049, November 2007.
3. "Reverberation Evaluation at the Moultonborough Public Library," NCE Technical Memo 07-046, November 2007.
4. "Acoustic Evaluation of: Marine & Natural Science Building Laboratories Retest, School of Architecture High Bay Review Room, Performing Arts Center," NCE Technical Memo 07-031, July 2007.
5. "Noise Monitoring at 11 Oakwood Drive, Webster MA," NCE Technical Memo 07-020, April 2007.
6. "Noise Evaluation of Associates of Cape Cod," NCE Technical Memo 07-018, March 2007.
7. "Acoustical Testing of Zip Coasters & Other Attractions," NCE Technical Memo 2006-069, Dec. 2006.
8. "Noise Monitoring at 11 Oakwood Drive, Webster, MA," NCE Technical Memo 2006-051, Sept. 2006.
9. "Orchard Woods: Sound Transmission Class (STC) Measurements," NCE Technical Memo 2006-039, June 2006.
10. "NationsRent Noise Monitoring Report," NCE Technical Memo 2006-038, June 2006.
11. "Security Forces Operations Facility Noise Survey – Westover AFB", NCE Technical Memo 2006-022, March 2006.
12. "NAVFAC Fire Station Acoustic Evaluation", NCE Technical Memo 2004-046, dated November 22, 2004.
13. "GE-AE Broacher Noise Assessment", NCE Technical Memo 2004-039, dated October 21, 2004.
14. "Mechanical Room Evaluations", NCE Technical Memo 2004-006, dated April 2, 2004.
15. "Acoustic Evaluations of Roger Williams University Facilities", NCE Technical Memo 2004-002, dated January 22, 2004.
16. "Analytical Evaporator Room Vibration Survey" NCE Technical Memo 2003-027, dated December 17, 2003.
17. "Acoustic Analysis of a Bottle & Can Crushing Facility", NCE Technical Memo 2003-026, dated December 12, 2003.
18. "Quarry Sound Monitoring", NCE Technical Memo 2003-023, dated November 10, 2003.
19. "Acoustical Assessment of 131 Spring Street Lexington", NCE Technical Memo 2003-022, dated November 10, 2003.

20. "Acoustical Testing of Lodengraf™ Damping" NCE Technical Memo 2003-020, dated October 3, 2003.
21. "Acoustical Testing of Spray-on Damping", NCE Technical Memo 2003-019, dated October 3, 2003.
22. "Quarry Sound Monitoring", NCE Technical Memo 2003-018, dated September 10, 2003.
23. "Oven Acoustic Evaluation", NCE Technical Memo 2003-013, dated March 11, 2003.
24. "Wood Chipper & Sonic Horn Acoustic Evaluation", NCE Technical Memo 2002-024, dated January 8, 2003.
25. "Hammer Shop Area Noise Control Evaluation", NCE Technical Memo 2002-020, dated December 9, 2002.
26. "Press Area Noise Control Evaluation", NCE Technical Memo 2002-021, dated December 9, 2002.
27. Ft. Monmouth Buildings 1209 & 1210, Chiller Acoustic Evaluation, NCE Technical Memo 2002-011, dated July 10, 2002.
28. "Community Center Noise Barrier Design", NCE Technical Memo 2002-006, dated April 30, 2002.
29. "Locomotive Cab Noise Survey", NCE Technical Memo 2002-005, dated March 18, 2002.
30. "Acoustic Assessment of 60 Westview Avenue", NCE Technical Memo 2002-003, dated February 28, 2002.
31. "Building #80 Compressor Noise Evaluation", NCE Technical Memo 2002-002, dated January 31, 2002.
32. "Acoustic Assessment of 480 Arsenal Street, Watertown, MA", NCE Technical Memo 2001-016, dated July 24, 2001.
33. "Factory Noise Survey & Treatment Recommendations, NCE Technical Memo 2001-006, dated February 16, 2001.
34. "Classroom Acoustical Evaluation at Wildwood Elementary School", NCE Technical Memo 2000-025, dated October 25, 2000.
35. "Cooling Tower Noise Control", NCE Technical Memo 2000-024, dated October 31, 2000.
36. "Spirol Vibratory Feeder Noise Measurements", NCE Technical Memo 2000-022, dated October 10, 2000.
37. "Test Cell Acoustic Evaluation", NCE Technical Memo 2000-021, dated September 29, 2000.
38. "Nighttime Sound Monitoring at Severance Truck Terminal", NCE Technical Memo 2000-015, dated June 29, 2000.
39. "Truck Loading Facility Noise Survey", NCE Technical Memo 2000-013, dated June 6, 2000.
40. "MTSA Sound Survey & Noise Control Recommendations" NCE Technical Memo 2000-006, dated March 31, 2000.

41. "Hopkinton Meadow Noise Evaluation Study" NCE Technical Memo 99-018, dated January 14, 2000.
42. "Final Noise Survey, ArQule New Woburn Building" NCE Technical Memo 99-017, dated November 5, 1999.
43. "Sabre Street Building Sound-Proofing", NCE Technical Memo 99-015, dated September 30, 1999.
44. "Branchville Pumping Station Noise Assessment", NCE Technical Memo 99-014, dated October 8, 1999.
45. "Go-Cart Noise Assessment Study", NCE Technical Memo 99-012, dated September 7, 1999.
46. "Vibration Survey; 200 Wells Avenue, Newton, MA", NCE Technical Memo 99-011, dated June 23, 1999.
47. "Wastewater Evaporator Noise Reduction", NCE Technical Memo 99-007, dated April 23, 1999.
48. "Noise & Vibration Assessment for ArQule's New Woburn Building", NCE Technical Memo 98-012, dated January 22, 1999.
49. "Noise Control Treatment Recommendations for (deleted) Plant", NCE Technical Memo, 98-010, dated October 6, 1998.
50. "Compressor Noise Control at Amoco Cooper River Plant", NCE Technical Memo 98-006, dated June 30, 1998.
51. "Acoustic Property Evaluation of Wood & Cored Panels", NCE Technical Memo No. 97-029, dated December 10, 1997.
52. "Damping Measurements of Wood & Cored Panels", NCE Technical Memo No. 97-023, dated September 12, 1997.
53. "Vibrations Analysis of FT-IR Spectrometer Baseplates", NCE Technical Memo No. 97-019, dated July 21, 1997.
54. "CP Clare Beverly Research Facility: Seismic Vibration Survey", NCE Technical Memo No. 97-017, dated July 15, 1997.
55. "Central Artery/Tunnel Project, Contract C19B8: Noise Control Plan", NCE Technical Memo No. 97-006, dated May 20, 1997.
56. "Flagship Drive North Andover: Baseline Noise Survey", NCE Technical Memo No. 97-011, dated May 6, 1997.
57. "Central Artery/Tunnel Project, Contract C19B8: Noise Monitoring Plan", NCE Technical Memo No. 97-005, dated March 31, 1997.
58. "Noise Control & Monitoring Plan; Deer Island Construction Project, CP-160", NCE Technical Memo No. 95-018, dated September 18, 1995.

PUBLISHED PAPERS & ARTICLES

- "*Far-Field Noise Surveys using a GPS Receiver*", Proceedings of the 2003 Institute of Noise Control Engineering (INCE) Annual Meeting, NoiseCon, June 2001.
- "*Building a Quiet Vessel without a Navy Budget*" Two Part Article, Marine News January & February 2002.
- "*The Precise Acoustic Design of a Pilot Station Boat*", Proceedings of the 2001 Institute of Noise Control Engineering (INCE) Annual Meeting, NoiseCon, October 2001.
- "*The ABC's of Noise Control*", Industrial Safety & Health News (ISHN), October 2000.
- "*Diagnosing and Curing Global Ship Resonances*", Proceedings of the 2000 Institute of Environmental Science and Technology (IEST) Annual Technical Meeting, May 2000.
- "*Simpler Torsional Shafting Tests for USCG Coastal Patrol Boat*", Proceedings of the 1998 Annual Workboat Show, December 1998.
- "*Silent Treatments, Steps for Quieting Workboats*", Workboat Magazine, October 1998.

TESTIFYING EXPERIENCE

- *State of New Hampshire District Court*: Testified as an expert witness in defense of a bar/night club which was charged with noise ordinance violation.
- *State of Vermont Environmental Board*: Reviewed the proponent's environmental impact study for the installation of a Waste Transfer Station. Testified as an expert witness on behalf of the abutting residents to the proposed Transfer Station.
- *City of Salem, Massachusetts Planning Board*: Presented the results of an acoustic study for a proposed "Go-Cart" establishment on behalf of the project proponent.
- *Town of Hopkinton, Massachusetts Planning Board*: Presented the results of an acoustic study of a proposed housing development on behalf of the project proponent.
- *City of Watertown Massachusetts, Selectman's Hearing*: Presented the results of an acoustic study of a proposed building re-development on behalf of the project proponent.
- *State of Massachusetts Housing Board of Appeals Committee*: Conducted site survey of potential housing project located next to light industrial facility. Testified that site was within HUD required sound levels.
- *City of Kingston, Massachusetts Planning Board*: Conducted an evaluation of proposed bottle crushing operation within expanded portion of an existing building. Testified that new operation would be within self-imposed noise limits.
- *City of Lee, New Hampshire, Board of Selectman*: Conducted an evaluation of the affects of a noise barrier on abutter noise from the Lee Speedway. Testified to the overall design of the barrier and sound reduction to be expected.

PERSONAL

Michael Bahtiarian has been married since 1990 and lives in suburban Boston with his wife and two daughters. Hobbies include hiking, camping, biking & skiing.

EXHIBIT 2

Noise Evaluation

Wind Colebrook North

Winsted-Norfolk Road and Rock Hall Road Colebrook, Connecticut

Prepared for BNE Energy Inc.

Prepared by *VHB*/Vanasse Hangen Brustlin, Inc.
Middletown, Connecticut

November 2010

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Executive Summary

The purpose of the noise analysis was to evaluate the potential noise impacts associated with the proposed construction of up to three 1.6-megawatt wind turbines on property northeast of the intersection of Winsted-Norfolk Road (Route 44) and Rock Hall Road in Colebrook, Connecticut. This noise analysis evaluated the existing and future build sound levels. Existing condition sound levels were determined by a noise monitoring program. The project-generated sound levels were calculated using manufacturer's sound data for the wind turbines and the principles of acoustical propagation of sound over distance.

The sound levels were projected to nearby residential noise receptor locations. These receptor locations were selected based on land use considerations, and represent the most sensitive locations (i.e., the residential areas) that may experience changes in sound levels resulting from the operation of three turbines. The results of this analysis demonstrate that the operation of three turbines will meet the Connecticut Department of Environmental Protection's noise impact criteria.

Noise Impact Analysis

Introduction

The purpose of this noise analysis was to evaluate the potential noise impacts associated with construction of up to three (3) 1.6-megawatt ("MW") wind turbines ("Wind Colebrook North" or the "Project") proposed for installation by BNE Energy, Inc. ("BNE") on property located at the intersection of Winsted-Norfolk Road (Route 44) and Rock Hall Road in Colebrook, Connecticut (the "Property" or "Site"). This noise analysis evaluated the existing condition and build condition sound levels. The sound levels were compared to the noise control regulations (Regulations of Connecticut State Agencies (RCSA), Title 22a, Section 22a-69-1 to 22a-69-7) established by the Connecticut Department of Environmental Protection ("CTDEP").

Noise Background

Noise is defined as unwanted or excessive sound. Sound becomes unwanted when it interferes with normal activities such as sleep, work, or recreation. How people perceive sound depends on several measurable physical characteristics. These factors include:

- Intensity - Sound intensity is often equated to loudness.
- Frequency - Sounds are comprised of acoustic energy distributed over a variety of frequencies. Acoustic frequencies, commonly referred to as tone or pitch, are typically measured in Hertz. Pure tones have all their energy concentrated in a narrow frequency range.

Sound levels are most often measured on a logarithmic scale of decibels (dB). The decibel scale compresses the audible acoustic pressure levels which can vary from the threshold of hearing (0 dB) to the threshold of pain (120 dB). Because sound levels are measured in dB, the addition of two sound levels is not linear. Adding two equal sound levels creates a 3 dB increase in the overall level. Research indicates the following general relationships between sound level and human perception:

- A 3 dB increase is a doubling of acoustic energy and is the threshold of perceptibility to the average person.
- A 10 dB increase is a tenfold increase in acoustic energy but is perceived as a doubling in loudness to the average person.

The human ear does not perceive sound levels from each frequency as equally loud. To compensate for this phenomenon in perception, a frequency filter known as A-weighted (dBA) is used to evaluate environmental noise levels.
A variety of sound level indicators can be used for environmental noise analysis. These indicators describe the variations in intensity and temporal pattern of the sound levels. The indicators used in this analysis are defined as follows:

- Lmax is the maximum A-weighted sound level measured during the time period.
- L_{10} is the A-weighted sound level, which is exceeded for 10 percent of the time during the time period.
- L_{90} is the A-weighted sound level, which is exceeded for 90 percent of the time during the time period. The L_{90} is generally considered to be the background sound level. It should be noted that the L_{90} eliminates the highest 10 percent of the sound levels that occur in the study area.

It should be noted that CTDEP requires that the noise analysis use the L_{90} A-weighted sound levels. Table 1 presents a list of common indoor and outdoor sound levels.

Table 1
Indoor and Outdoor Sound Levels

Outdoor Sound Levels	Sound Pressure (μPa)		Sound Level (dBA)	Indoor Sound Levels
	6,324,555	-	110	Rock Band at 5 m
Jet Over-Flight at 300 m		-	105	
	2,000,000	-	100	Inside New York Subway Train
Gas Lawn Mower at 1 m		-	95	
	632,456	-	90	Food Blender at 1 m
Diesel Truck at 15 m		-	85	
Noisy Urban Area—Daytime	200,000	-	80	Garbage Disposal at 1 m
		-	75	Shouting at 1 m
Gas Lawn Mower at 30 m	63,246	-	70	Vacuum Cleaner at 3 m
Suburban Commercial Area		-	65	Normal Speech at 1 m
	20,000	-	60	
Quiet Urban Area—Daytime		-	55	Quiet Conversation at 1 m
	6,325	-	50	Dishwasher Next Room
Quiet Urban Area—Nighttime		-	45	
	2,000	-	40	Empty Theater or Library
Quiet Suburb—Nighttime		-	35	
	632	-	30	Quiet Bedroom at Night
Quiet Rural Area—Nighttime		-	25	Empty Concert Hall
Rustling Leaves	200	-	20	
		-	15	Broadcast and Recording Studios
	63	-	10	
		-	5	
Reference Pressure Level	20	-	0	Threshold of Hearing

μPA MicroPascals describe pressure. The pressure level is what sound level monitors measure.
dBA A-weighted decibels describe pressure logarithmically with respect to 20 μPa (the reference pressure level).
Source: Highway Noise Fundamentals, Federal Highway Administration, September 1980.

Impact Criteria

The CTDEP has developed noise impact criteria that establish noise thresholds deemed to result in adverse impacts. The noise analysis for Wind Colebrook North used these criteria to evaluate whether the proposed Project will generate sound levels that result in adverse impacts.

Connecticut DEP Criteria

The CTDEP's noise control regulations identify the limits of sound that can be emitted from specific premises and what activities are exempt. The noise control regulations (Title 22a, §§ 22a-69-1 to 22a-69-7) are contained in the Regulations of Connecticut State Agencies (RCSA). This policy states that a source located in a "Class C Noise Zone" shall not emit noise exceeding the levels stated in Table 2 at the adjacent noise zones.

Table 2
Noise Zone Standards, L_{90} (dBA)

	Receptor Noise Zone			
Emitter Zone	Class A (Daytime)	Class A (Nighttime)	Class B	Class C
Class A (Residential)	55	45	55	62
Class B (Commercial)	55	45	62	62
Class C (Industrial)	61	51	66	70

Source: Control of Noise (Title 22a, Section 22a-69-1 to 22a-69-7.4), Regulations of Connecticut State Agencies, June 1978.

A Class C land use is defined as generally industrial where protection against damage to hearing is essential, and the necessity for conversation is limited. The land use for Class B is defined as generally commercial in nature, where human beings converse and such conversations are essential to the intended use of the land. The land use in Class A is defined as generally residential where human beings sleep or areas where serenity and tranquility are essential to the intended use of the land.

The noise analysis assumed that the Emitter Zone for the proposed wind turbines is Class C (Industrial) and that the Receptor Noise Zone for the receptor locations is Class A (Residential).

Methodology

This noise analysis evaluated the sound levels of Wind Colebrook North. The noise analysis consists of two components: existing ambient sound levels and Project contributions. The existing condition sound levels were determined by conducting noise measurements at sensitive receptor locations surrounding the Project Site. The Project-generated sound levels were calculated using manufacturer's sound data and the principles of acoustical propagation of sound over distance.

Noise monitoring was conducted to determine the existing sound levels in the vicinity of the Project Site following procedures established in Section 22a-69-4 of the CTDEP noise control regulations. Noise monitoring was conducted at two locations that are representative of the receptor locations during the weekday daytime and nighttime periods. The noise monitoring data was used to establish existing conditions in areas that may experience changes in sound levels associated with Wind Colebrook North.

Noise associated with wind turbines consists of two sources: the aerodynamic sound produced by air flow over the rotor blades and sound from the mechanical components that drive the blades. The Project-generated sound levels were calculated for each receptor location based on manufacturer reference sound level data of the 1.6-MW wind turbines. The noise analysis assumed that the proposed wind turbines would be operating at the maximum wind speed during the daytime period and at the mean wind speed for the nighttime period. The wind speed was based upon wind data collected from the region by BNE to determine the feasibility of the Project. The manufacturer's sound level data for these operating conditions were projected to the receptor locations using the acoustical properties of sound propagation over terrain.

The calculations of the sound level projections to the receptor locations follow the methodology outlined by the International Organization of Standardization (ISO). The following equation, from the publication *ISO 9613-2: Attenuation of sound during propagation outdoors – Part2: General method of calculation,* was used to calculate the sound levels at the receptor locations.

Lft(DW) = Lw + Dc – A, where…

- Lw is the sound power level produced by the sound source.
- Dc is the directivity correction to account for deviation of the sound power level in a specified direction. For an omni-directional sound source radiating into open space, Dc = 0.
- A is the attenuation occurring during propagation from sound source to receptor location. Attenuation may include geometrical divergences (or spherical spreading), atmospheric absorption, ground effect, barrier, and other miscellaneous effects, such density of vegetation and buildings.

The calculation of the proposed Project's sound levels took into consideration geometric divergences and atmospheric absorption due to the surrounding environment.

Receptor Locations

Eight noise receptor locations were identified in the vicinity of Wind Colebrook North. The receptor locations were selected based on their proximity to the Site and their land use. These receptor locations represent the most sensitive locations in the immediate area that may experience changes in sound levels once Wind Colebrook North is in operation. These receptor locations represent the residential parcels that surround the Project Site. They include:

- Receptor Location 1 (R1) – Residence on Rock Hall Road,
- Receptor Location 2 (R2) – Residence on Rock Hall Road,
- Receptor Location 3 (R3) – Residence on Greenwoods Turnpike,
- Receptor Location 4 (R4) – Residence on Greenwoods Turnpike,
- Receptor Location 5 (R5) – Residence on Greenwoods Turnpike,
- Receptor Location 6 (R6) – Residence on Greenwoods Turnpike,
- Receptor Location 7 (R7) – Residence on Winsted Norfolk Road (Route 44)
- Receptor Location 8 (R8) – Residence on Pinney Street,
- Receptor Location 9 (R9) – Residence on Pinney Street,
- Receptor Location 10 (R10) – Residence on Pinney Street,
- Receptor Location 11 (R11) – Residence on Stillman Hill Road (Route 182)
- Receptor Location 12 (R12) – Residence on Rock Hall Road, and
- Receptor Location 13 (R13) – Residence on Rock Hall Road.

The primary land use in the vicinity of the Project Site is residential. The receptor and existing conditions noise monitoring locations used in the noise analysis are presented in Figure 1.

Existing Conditions

The existing sound levels in the vicinity of the Project Site were established by conducting actual measurements of sound levels at the neighborhood of Flagg Hill Road to the south of the Project Site. The measured sound levels were used to establish a baseline for the study area.

The noise monitoring was conducted using a Larson Davis 824 Type I sound level analyzer and followed noise monitoring procedures outlined in Section 22a-69-4 of the CTDEP's noise control regulations. The sound levels were measured at each location during both the weekday daytime (7 AM. to 10 PM) on April 1, 2010 and weekday nighttime periods (10:00 PM. to 7:00 AM) on April 1, 2010 to April 2, 2010. The noise sources included local vehicular traffic and natural occurrences, such as wind, birds and other animals. The sound levels represent conservative values because the wind conditions during the measurements were calm.

The existing sound levels do not exceed the local and State criteria of 61 dBA and 51 dBA during the daytime and nighttime, respectively. The recorded hourly L_{90} sound levels are presented in Table 3.

Table 3
Existing Sound Levels, L_{90} (dBA)

Monitoring Location*	Daytime Sound Level	Nighttime Sound Level
M1 - Flagg Hill Road	37	38

* Refer to Figure 1 for location

Project-Generated Sound Levels

There are two noise sources associated with a wind turbine. These sources include aerodynamic noise associated with the blade movement through air and the mechanical noise associated with the interaction of parts that drive the blades. Aerodynamic sound from the movement of the blade through air is a function of wind speed, which can be controlled by the rotational speed of the blades. Existing background sound levels are also dependent of wind speed. Therefore louder background sound levels would be result from higher wind conditions. With increasing wind speeds, the sound from wind turbines can often be masked by increasing wind noise.

Each of the wind turbines consists of three blades with the hub located at 100 meters from the ground. Under operational conditions, the blades will rotate at speeds between 3 meters per second (m/s) to 12m/s. The maximum daytime sound levels from the proposed wind turbines will occur with the maximum wind speeds of 9 m/s. The maximum nighttime sound levels from the wind turbine will occur with the maximum wind speeds of 8 m/s. The Project-generated sound levels based upon the wind speed were projected to each receptor location based upon the properties of sound propagation over distance, terrain, and geometry. Following the methodology outlined in ISO 9613-2, the calculation of Wind Colebrook North's sound levels included attenuation due to geometric divergences and atmospheric absorption. The Project-generated hourly L_{90} sound level contribution for each receptor location is presented in Table 4.

Table 4
Project-Generated Sound Levels, L_{90} (dBA)

Receptor Location*	Daytime Noise Criteria**	Project Daytime Sound Levels	Nighttime Noise Criteria**	Project Nighttime Sound Levels
R1 – Rock Hall Road	61	45	51	43
R2 – Rock Hall Road	61	46	51	44
R3 – Greenwoods Turnpike	61	46	51	44
R4 – Greenwoods Turnpike	61	44	51	42
R5 – Greenwoods Turnpike	61	43	51	41
R6 – Greenwoods Turnpike	61	40	51	38
R7 – Winsted Norfolk Road (Rt 44)	61	34	51	32
R8 – Pinney Street	61	34	51	32
R9 – Pinney Street	61	32	51	30
R10 – Pinney Street	61	33	51	31
R11 – Stillman Hill Road (Rt 182)	61	32	51	30
R12 – Rock Hall Road	61	36	51	34
R13 – Rock Hall Road	61	38	51	36

* Refer to Figure 1 for receptor locations.

The results of the preliminary noise analysis demonstrate that Wind Colebrook North will generate sound levels that range from 30 dBA to 46 dBA. These sound levels are below the daytime or nighttime noise criteria of 61 and 51 dBA respectively.

Conclusion

The noise analysis demonstrates that the operation of up to three (3) 1.6 MW wind turbines to be located on property northeast of the intersection of Winsted-Norfolk Road (Route 44) and Rock Hall Road in Colebrook, Connecticut will meet the CTDEP's noise control regulations (Regulations of Connecticut State Agencies (RCSA), Title 22a, Section 22a-69-1 to 22a-69-7). The noise analysis evaluated the worst-case daytime and nighttime sound levels, based upon operational wind speeds, calculated sound levels for the receptor locations (residential area) adjacent to Wind Colebrook North. It should be noted that the actual sound levels for the majority of the time will be lower because the wind speeds will be lower.

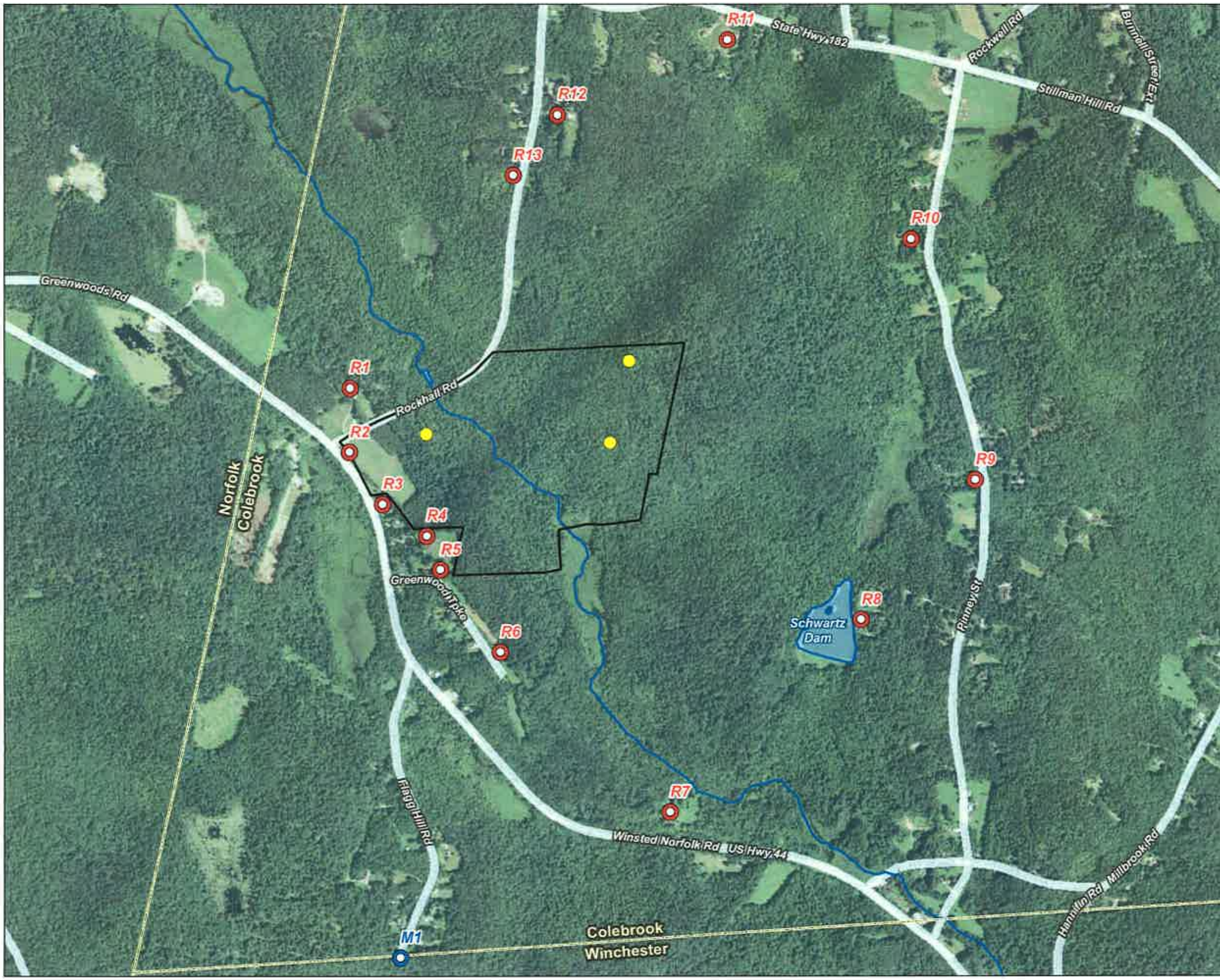


Figure 1
Wind Colebrook North Noise Monitoring and Receptor Locations

Winsted-Norfolk Road
Colebrook, CT

Legend

- Receptor Location
- Monitoring Location
- Proposed Wind Turbine Location
- Approximate Site Property Boundary
- Town Boundary

Base Map Source: 2008 aerial photograph with 1-meter resolution.

1,000 500 0 1,000 Feet

Vanasse Hangen Brustlin, Inc.

Appendix

- Noise Monitoring Summary
- Sound Level Calculations
- Wind Assessment

Noise Monitoring Summary

Vanasse Hangen Brustlin, Inc.
Transportation | Land Development | Environmental Services

VHB
101 Walnut Street
Post Office Box 9151
Watertown, Massachusetts 02471
Phone (617) 924-1770
Fax (617) 924-2286

Noise Monitoring Data Sheet

Notes Taken By: Q. Tat

Date: April 1, 2010

Weather: Sunny, mid 60's F

Project Number: 41604.00

Location: Flagg Hill Road
Colebrook, CT

Start Time: 2:55 PM

Noise Monitor: Larson Davis 824

Duration: 20 min.

What is the name of the data run? Run#1

Measured Leq | **41.0** | **dBA**

Traffic Data	Volume	Speed
Automobiles		
Medium Trucks		
Heavy Trucks		

Sketch

Monitor setup at end of Flagg Hill Rd.

Notes:

What was the angle of exposure to the highway? Norfold Road (Rte 44) approximately half mile away.

Were there any objects blocking the highway noise sources? (Such as buildings or hills) Flagg Hill Rd uphill with curves.

Were there other roadway or highway noise sources nearby? N/A

Were there significant other non-highway noise sources? Wildlife (bird and critter noises), running stream, airplane, gun shots (Northwestern Connecticut Sportsman's Association Facility).

SLM & RTA Summary

Translated:	5-Apr-10	14:23:48
File Translated:	Z:\41604.00\tech\Noise\Noise Monitoring Data\FlaggHillRd-Day.slmdl	
Model Number:	824	
Serial Number:	A0184	
Firmware Rev:	4.283	
Software Version:	3.12	
Name:	Enter Company Name	
Descr1:	Enter Address Line 1	
Descr2:	Enter Address Line 2	
Setup:	VHBGen1h.ssa	
Setup Descr:	VHB-Gen1hr-1sec	
Location:	Flagg Hill Rd	
Note 1:	Daytime	
Note 2:		

Overall Any Data

Start Time:	1-Apr-10	14:53:57
Elapsed Time:	20:01.1	

	A Weight	C Weight	Flat
Leq:	41.0 dBA	54.1 dBC	56.7 dBF

Spectra

Start Time:	1-Apr-10	14:53:57	Run Time:	20:01.1

Freq Hz	Leq 1/1 Oct	Max 1/1 Oct	Min 1/1 Oct
16	-0.5	---	-7.5
31.5	13.2	20.2	-7.5
63	23.9	34.9	1.9
125	31.1	49	6.6
250	34.8	53.9	13.1
500	32.4	50.1	21.3
1000	33.5	42.2	27.8
2000	33.5	34.5	30
4000	30.2	30.2	28.3
8000	26.7	26.8	25.6
16000	28.7	28.7	28

L 90.00 37.1 dBA

Vanasse Hangen Brustlin, Inc.
Transportation | Land Development | Environmental Services

VHB
101 Walnut Street
Post Office Box 9151
Watertown, Massachusetts 02471
Phone (617) 924-1770
Fax (617) 924-2286

Noise Monitoring Data Sheet

Notes Taken By: Q. Tat

Date: April 2, 2010

Weather: Clear, low 40's F

Project Number: 41604.00

Location: Flagg Hill Road
Colebrook, CT

Start Time: 1:15 AM

Noise Monitor: Larson Davis 824

Duration: 15 min.

What is the name of the data run? Run#6

Measured Leq 38.4 **dBA**

Traffic Data	Volume	Speed
Automobiles		
Medium Trucks		
Heavy Trucks		

Sketch

Monitor setup at end of Flagg Hill Rd.

Notes:

What was the angle of exposure to the highway? Norfold Road (Rte 44) approximately half mile away.

Were there any objects blocking the highway noise sources? (Such as buildings or hills) Flagg Hill Rd uphill with curves.

Were there other roadway or highway noise sources nearby? N/A

Were there significant other non-highway noise sources? Wildlife (bird and critter noises), running stream

SLM & RTA Summary

Translated:	5-Apr-10	14:24:13		
File Translated:	Z:\41604.00\tech\Noise\Noise Monitoring Data\FlaggHillRd-Night.slmdl			
Model Number:	824			
Serial Number:	A0184			
Firmware Rev:	4.283			
Software Version:	3.12			
Name:	Enter Company Name			
Descr1:	Enter Address Line 1			
Descr2:	Enter Address Line 2			
Setup:	VHBGen1h.ssa			
Setup Descr:	VHB-Gen1hr-1sec			
Location:	Flagg Hill Road			
Note 1:	Nighttime			
Note 2:				

Overall Any Data

Start Time:	2-Apr-10	1:18:49
Elapsed Time:	15:26.6	

	A Weight	C Weight	Flat
Leq:	38.4 dBA	42.4 dBC	45.3 dBF

Spectra

Start Time:	2-Apr-10	1:18:49	Run Time:	15:26.6

Freq Hz	Leq 1/1 Oct	Max 1/1 Oct	Min 1/1 Oct
16	-6.7	---	---
31.5	-2.5	8.2	-7.5
63	11	24	-7.5
125	14.6	27	6
250	21.6	28.8	16.9
500	29.1	38	24.5
1000	31.8	37.5	27.6
2000	32.9	40.1	29
4000	30.6	42.8	27.6
8000	27.7	35.8	25.9
16000	28.8	29.2	28.1

L 90.00 38.1 dBA

Sound Level Calculations

Colebrook North Wind Turbine
Noise Model - Daytime Conditions (9 m/s)

hub height	h =	328	ft
sound power level	Lw =	106	db
absorption coefficent	a =	0.005	db/m

Background Levels, L90 (dBA)	RN1	RN2	RN3	RN4	RN5	RN6	RN7	RN8	RN9	RN10	RN11	RN12	RN13
Wind Turbine N1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1
Wind Turbine N2	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1
Wind Turbine N3	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1
Wind Turbine S1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1
Wind Turbine S2	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1
Wind Turbine S3	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1

Horizontal Distance to Rec.(feet)	RN1	RN2	RN3	RN4	RN5	RN6	RN7	RN8	RN9	RN10	RN11	RN12	RN13
Wind Turbine N1	929	820	853	1047	1404	2387	4664	4905	5725	5426	5136	3568	2822
Wind Turbine N2	2769	2717	2451	2136	2198	2451	3876	3180	3810	3765	4333	3426	2939
Wind Turbine N3	2924	3061	2963	2775	2916	3299	4690	3595	3796	3183	3466	2644	2265
Wind Turbine S1	3955	3303	2825	2675	2438	2268	3713	5868	7476	8261	8663	7210	6469
Wind Turbine S2	4290	3687	3388	3428	3295	3394	4934	7076	8637	9249	9372	7768	7001
Wind Turbine S3	5246	4600	4151	4008	3758	3437	4256	6758	8479	9473	9986	8543	7801

Distance to Rec., R (feet)	RN1	RN2	RN3	RN4	RN5	RN6	RN7	RN8	RN9	RN10	RN11	RN12	RN13
Wind Turbine N1	985	883	914	1097	1442	2409	4676	4916	5734	5436	5146	3583	2841
Wind Turbine N2	2788	2737	2473	2161	2222	2473	3890	3197	3824	3779	4345	3442	2957
Wind Turbine N3	2942	3079	2981	2794	2934	3315	4701	3610	3810	3200	3481	2664	2289
Wind Turbine S1	3969	3319	2844	2695	2460	2292	3727	5877	7483	8268	8669	7217	6477
Wind Turbine S2	4303	3702	3404	3444	3311	3410	4945	7084	8643	9255	9378	7775	7009
Wind Turbine S3	5256	4612	4164	4021	3772	3453	4269	6766	8485	9479	9991	8549	7808

Distance to Rec., R (meters)													
	300	269	279	335	440	735	1425	1499	1748	1657	1569	1092	866
	850	834	754	659	678	754	1186	975	1166	1152	1325	1049	902
	897	939	909	852	895	1011	1433	1101	1162	976	1061	812	698
	1210	1012	867	822	750	699	1136	1792	2281	2521	2643	2200	1975
	1312	1129	1038	1050	1010	1040	1508	2160	2635	2822	2859	2370	2137
	1603	1406	1269	1226	1150	1053	1301	2063	2587	2890	3046	2606	2380

Sound pressure level with atmospheric absorp. Lp=Lw-20logR-11-ar	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13
	43.9	45.1	44.7	42.8	39.9	34.0	24.8	24.0	21.4	22.3	23.2	28.8	31.9
	32.2	32.4	33.7	35.3	35.0	33.7	27.6	30.3	27.8	28.0	25.9	29.3	31.4
	31.5	30.9	31.3	32.1	31.5	29.9	24.7	28.7	27.9	30.3	29.2	32.7	34.6
	27.3	29.8	31.9	32.6	33.7	34.6	28.2	21.0	16.4	14.4	13.3	17.1	19.2
	26.1	28.3	29.5	29.3	29.9	29.5	23.9	17.5	13.4	11.9	11.6	15.7	17.7
	22.9	25.0	26.6	27.1	28.0	29.3	26.2	18.4	13.8	11.3	10.1	13.6	15.6
	44.6	**45.7**	**45.6**	**44.4**	**42.7**	**40.2**	**34.0**	**33.7**	**31.6**	**32.9**	**31.7**	**35.6**	**37.8**

Colebrook North Wind Turbine
Noise Model - Nightime Conditions (8 m/s)

hub height	h =	328	ft	
sound power level	Lw =	104	db	Average wind speed of 8 m/s
absorption coefficent	a =	0.005	db/m	

Background Levels, L90 (dBA)	RN1	RN2	RN3	RN4	RN5	RN6	RN7	RN8	RN9	RN10	RN11	RN12	RN13
Wind Turbine N1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1
Wind Turbine N2	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1
Wind Turbine N3	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1
Wind Turbine S1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1
Wind Turbine S2	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1
Wind Turbine S3	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1

Horizontal Distance to Rec.(feet)	RN1	RN2	RN3	RN4	RN5	RN6	RN7	RN8	RN9	RN10	RN11	RN12	RN13
Wind Turbine N1	929	820	853	1047	1404	2387	4664	4905	5725	5426	5136	3568	2822
Wind Turbine N2	2769	2717	2451	2136	2198	2451	3876	3180	3810	3765	4333	3426	2939
Wind Turbine N3	2924	3061	2963	2775	2916	3299	4690	3595	3796	3183	3466	2644	2265
Wind Turbine S1	3955	3303	2825	2675	2438	2268	3713	5868	7476	8261	8663	7210	6469
Wind Turbine S2	4290	3687	3388	3428	3295	3394	4934	7076	8637	9249	9372	7768	7001
Wind Turbine S3	5246	4600	4151	4008	3758	3437	4256	6758	8479	9473	9986	8543	7801

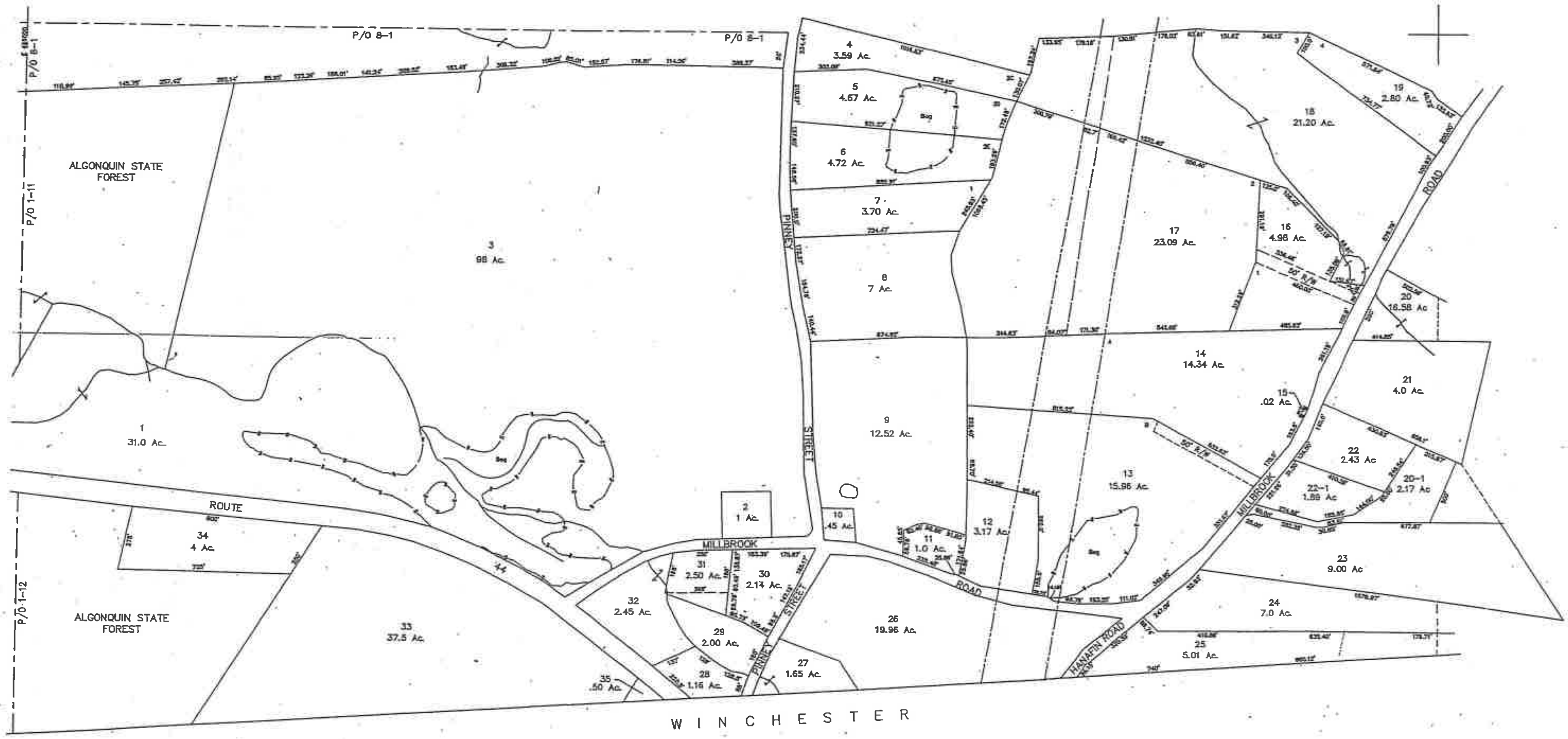
Distance to Rec., R (feet)	RN1	RN2	RN3	RN4	RN5	RN6	RN7	RN8	RN9	RN10	RN11	RN12	RN13
Wind Turbine N1	985	883	914	1097	1442	2409	4676	4916	5734	5436	5146	3583	2841
Wind Turbine N2	2788	2737	2473	2161	2222	2473	3890	3197	3824	3779	4345	3442	2957
Wind Turbine N3	2942	3079	2981	2794	2934	3315	4701	3610	3810	3200	3481	2664	2289
Wind Turbine S1	3969	3319	2844	2695	2460	2292	3727	5877	7483	8268	8669	7217	6477
Wind Turbine S2	4303	3702	3404	3444	3311	3410	4945	7084	8643	9255	9378	7775	7009
Wind Turbine S3	5256	4612	4164	4021	3772	3453	4269	6766	8485	9479	9991	8549	7808

Distance to Rec., R (meters)													
	300	269	279	335	440	735	1425	1499	1748	1657	1569	1092	866
	850	834	754	659	678	754	1186	975	1166	1152	1325	1049	902
	897	939	909	852	895	1011	1433	1101	1162	976	1061	812	698
	1210	1012	867	822	750	699	1136	1792	2281	2521	2643	2200	1975
	1312	1129	1038	1050	1010	1040	1508	2160	2635	2822	2859	2370	2137
	1603	1406	1269	1226	1150	1053	1301	2063	2587	2890	3046	2606	2380

Sound pressure level with atmospheric absorp. Lp=Lw-20logR-11-ar	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13
	41.9	43.1	42.7	40.8	37.9	32.0	22.8	22.0	19.4	20.3	21.2	26.8	29.9
	30.2	30.4	31.7	33.3	33.0	31.7	25.6	28.3	25.8	26.0	23.9	27.3	29.4
	29.5	28.9	29.3	30.1	29.5	27.9	22.7	26.7	25.9	28.3	27.2	30.7	32.6
	25.3	27.8	29.9	30.6	31.7	32.6	26.2	19.0	14.4	12.4	11.3	15.1	17.2
	24.1	26.3	27.5	27.3	27.9	27.5	21.9	15.5	11.4	9.9	9.6	13.7	15.7
	20.9	23.0	24.6	25.1	26.0	27.3	24.2	16.4	11.8	9.3	8.1	11.6	13.6
	42.6	**43.7**	**43.6**	**42.4**	**40.7**	**38.2**	**32.0**	**31.7**	**29.6**	**30.9**	**29.7**	**33.6**	**35.8**

Wind Assessment

EXHIBIT 3



LEGEND
PARCEL NUMBERS 2
MATCH LINE . . .

North

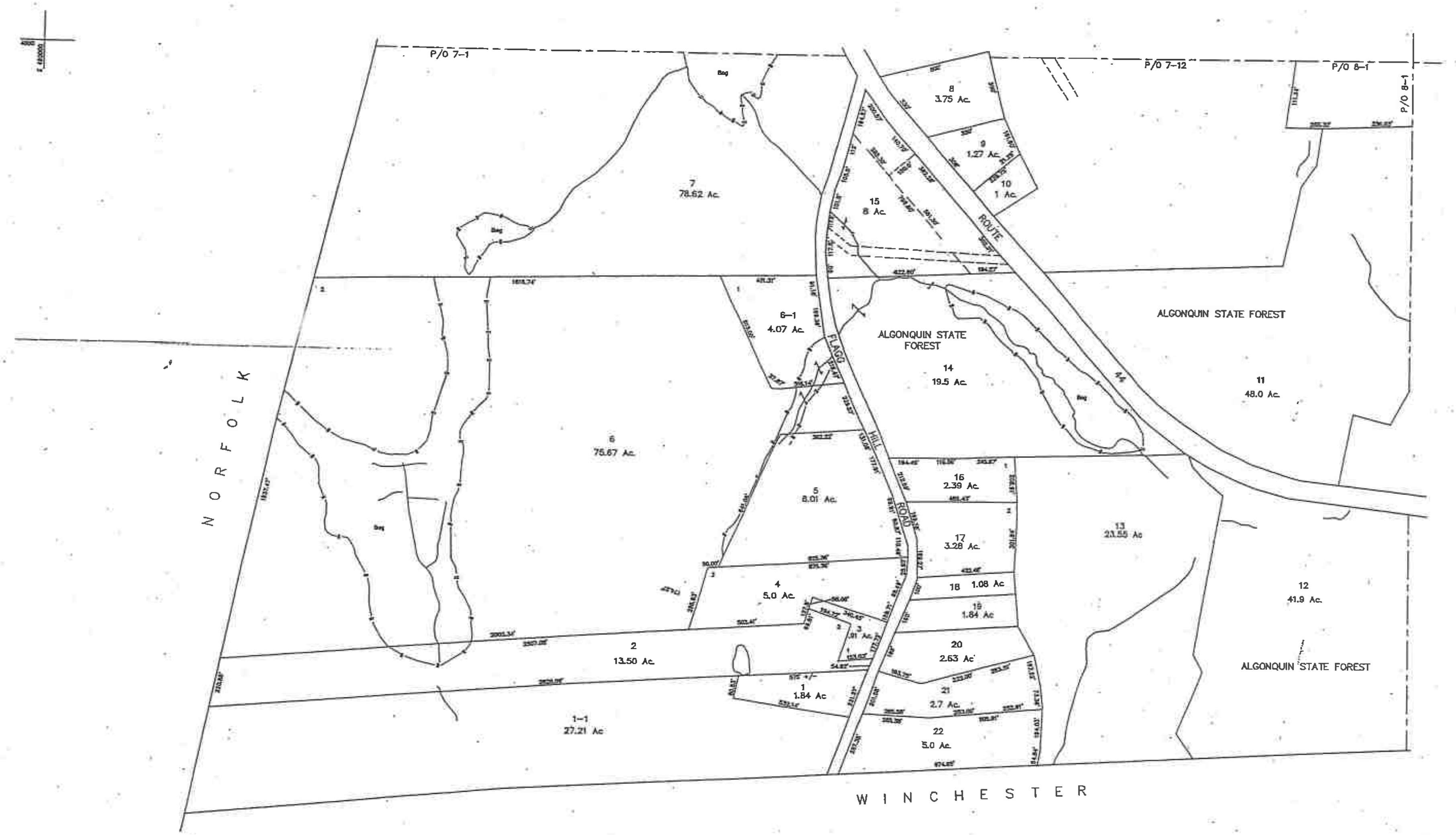
DATE OF AERIAL PHOTOGRAPHY 4-10-1957
DATE OF COMPLETION
DATE OF REVISIONS UPDATED 10/97
UPDATED 06/01
UPDATED 12/04
REV 03-09

For Assessment Purposes

TAX MAP
TOWN OF COLEBROOK
LITCHFIELD COUNTY, CONNECTICUT

8
MAP NUMBER
1 2 3

N 490000
E 602000



LEGEND
PARCEL NUMBERS 2
MATCH LINE . . . . ------

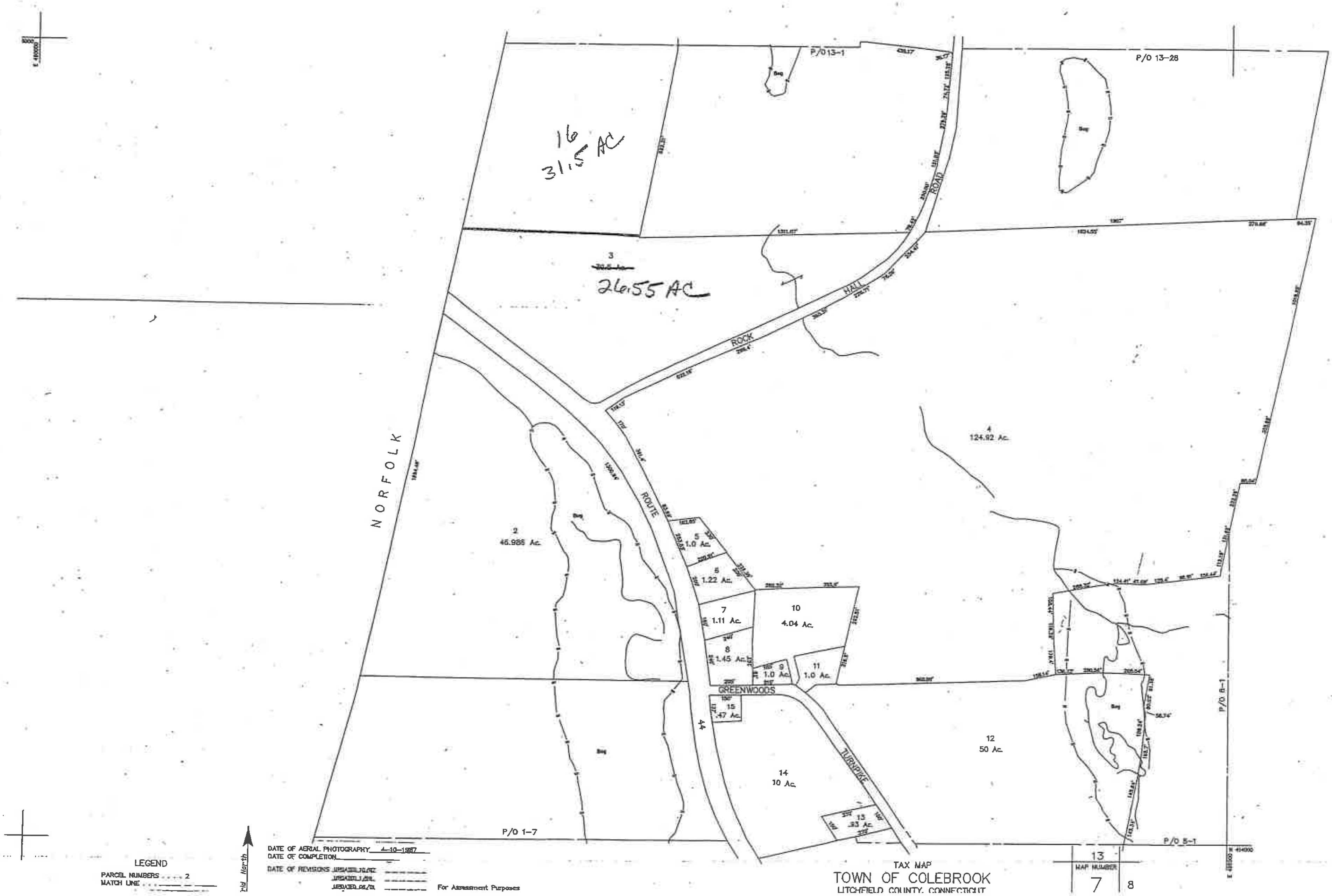
Grid North

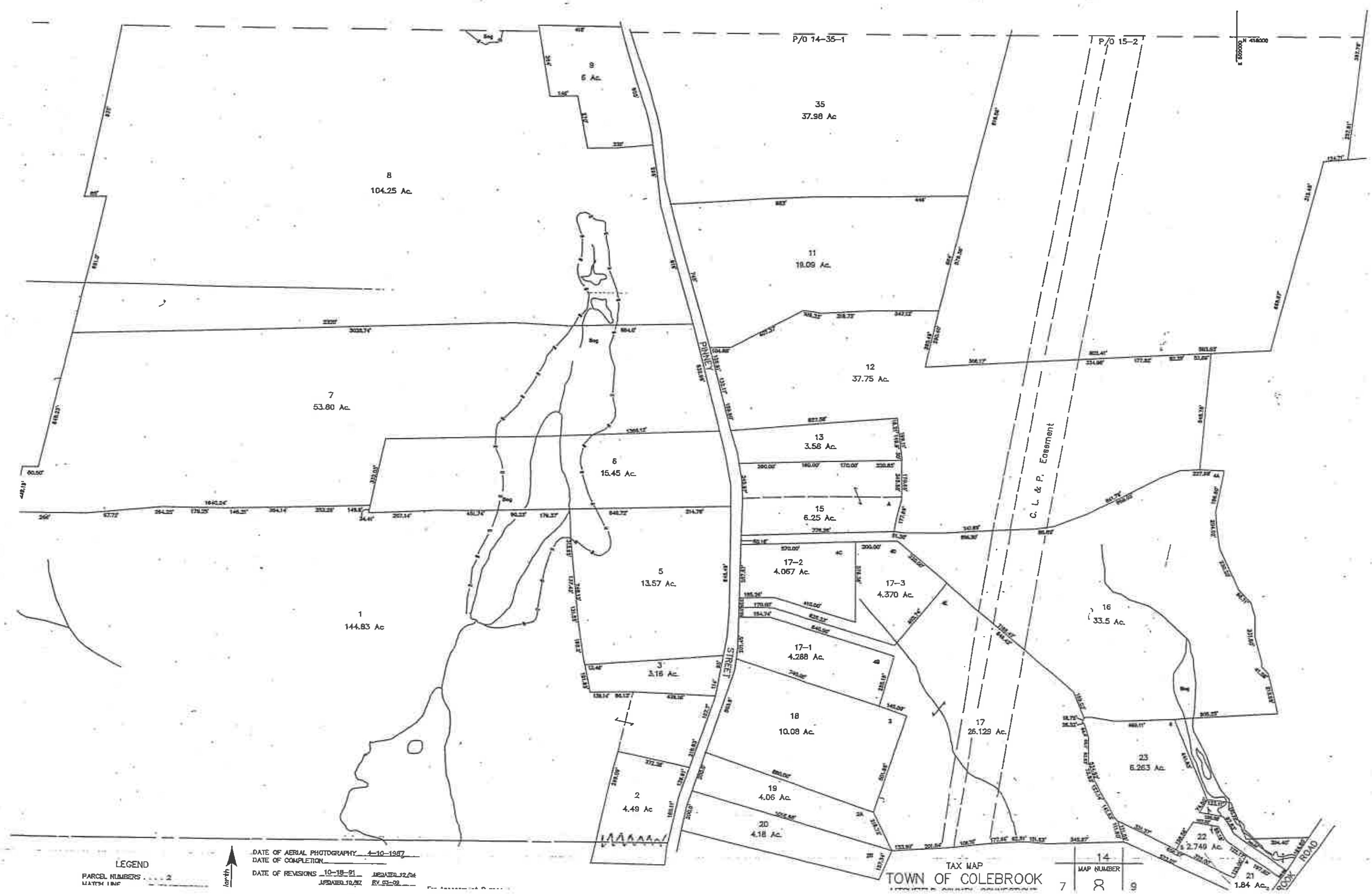
DATE OF AERIAL PHOTOGRAPHY 4-10-1987
DATE OF COMPLETION
DATE OF REVISIONS 10-07-91

For Assessment Purposes

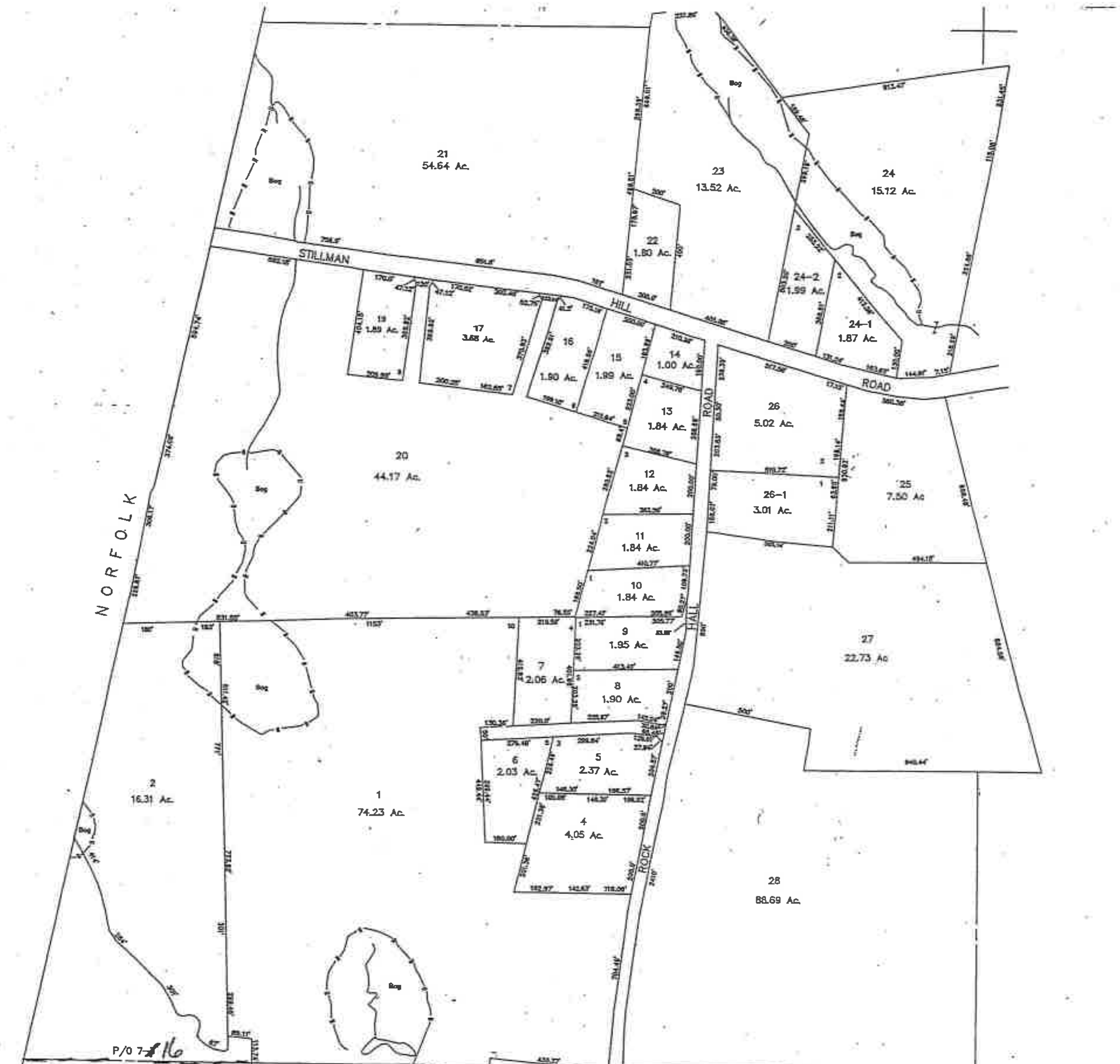
TAX MAP
TOWN OF COLEBROOK
LITCHFIELD COUNTY, CONNECTICUT

7
MAP NUMBER
1 2


P/O 13-1
P/O 13-28
16
31.5 AC
3
30.5 Ac.
26.55 AC
ROCK
HALL
ROAD
4
124.92 Ac.
NORFOLK
ROUTE
44
2
45.986 Ac.
5
1.0 Ac.
6
1.22 Ac.
7
1.11 Ac.
8
1.45 Ac.
9
1.0 Ac.
10
4.04 Ac.
11
1.0 Ac.
GREENWOODS
TURNPIKE
15
.47 Ac.
14
10 Ac.
13
.93 Ac.
12
50 Ac.
P/O 1-7
P/O 8-1
LEGEND
PARCEL NUMBERS 2
MATCH LINE
Grid North
DATE OF AERIAL PHOTOGRAPHY 4-10-1987
DATE OF COMPLETION
DATE OF REVISIONS
For Assessment Purposes
TAX MAP
TOWN OF COLEBROOK
LITCHFIELD COUNTY, CONNECTICUT
13
MAP NUMBER
7
8



P/0 14-35-1
P/0 15-2
N 416000
E 900000
9
6 Ac.
35
37.98 Ac.
8
104.25 Ac.
11
19.09 Ac.
12
37.75 Ac.
7
53.80 Ac.
13
3.58 Ac.
6
15.45 Ac.
15
6.25 Ac.
C. L. & P. Easement
PINNEY STREET
17-2
4.067 Ac.
17-3
4.370 Ac.
5
13.57 Ac.
16
33.5 Ac.
1
144.83 Ac.
17-1
4.288 Ac.
3
3.16 Ac.
18
10.08 Ac.
17
26.129 Ac.
23
6.263 Ac.
2
4.49 Ac.
19
4.06 Ac.
20
4.18 Ac.
22
2.749 Ac.
21
1.84 Ac.
ROAD
Bog
LEGEND
PARCEL NUMBERS 2
North
DATE OF AERIAL PHOTOGRAPHY 4-10-1987
DATE OF COMPLETION
DATE OF REVISIONS 10-18-91
TAX MAP
TOWN OF COLEBROOK
MAP NUMBER
14
7 8 9



LEGEND
PARCEL NUMBERS 2
MATCH LINE . . . . ——— - ———

Grid North

DATE OF AERIAL PHOTOGRAPHY 4-10-1987
DATE OF COMPLETION
DATE OF REVISIONS 10-21-91
UPDATED 10/97
UPDATED 08/01
UPDATED 12/06
REV 03-09

For Assessment Purposes
Not to be used for Conveyances.

TAX MAP
TOWN OF COLEBROOK
LITCHFIELD COUNTY, CONNECTICUT
SCALE: 1 INCH = 200 FEET

	MAP NUMBER	
	19	
	13	14
	7	

LEGEND
PARCEL NUMBERS 2
MATCH LINE . . . . ______

Grid North

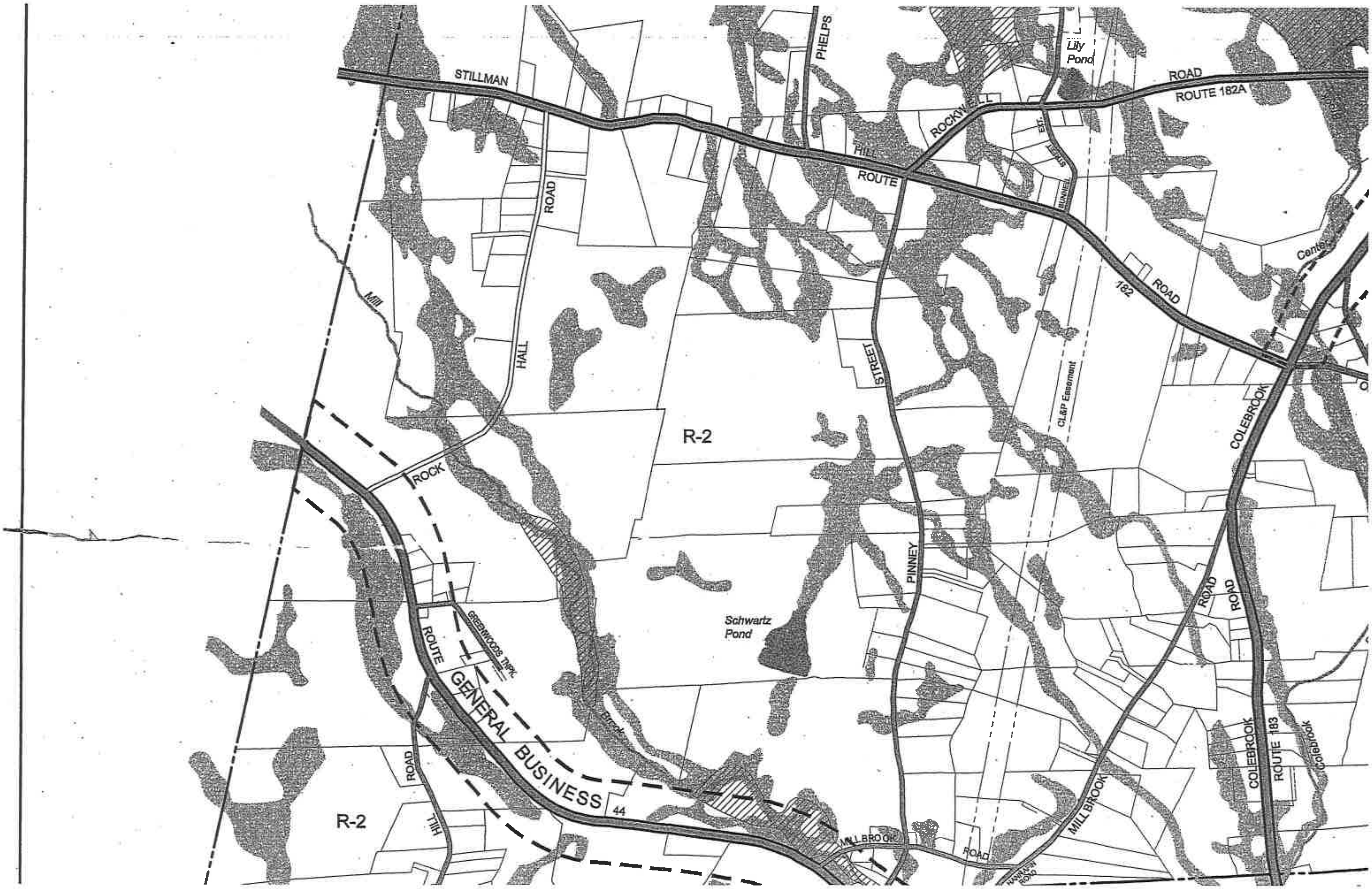
DATE OF AERIAL PHOTOGRAPHY 4-10-1987
DATE OF COMPLETION ______
DATE OF REVISIONS 10-21-91 REV 03-09
UPDATED 10/02
UPDATED 1/05
UPDATED 06/05
UPDATED 12/05

For Assessment Purposes
Not to be used for Conveyances.

TAX MAP
TOWN OF COLEBROOK
LITCHFIELD COUNTY, CONNECTICUT
SCALE: 1 INCH = 200 FEET

	MAP NUMBER	
	20	
13	14	15
	8	

STILLMAN
ROAD
ROUTE 182A
ROCKWELL
HILL
ROUTE
BUNNELL
182
ROAD
CL&P Easement
COLEBROOK
OLD
R-2
HALL
ROAD
ROCK
Mill
PINNEY
STREET
Schwartz
Pond
Brook
ROUTE
GREENWOODS TNPK
GENERAL BUSINESS
44
MILLBROOK
ROAD
MILLBROOK
ROAD
COLEBROOK
ROUTE 183
Colebrook
Brook
R-2
FLAGG
HILL
ROAD
W I N


STILLMAN ROAD
ROUTE 182A
ROCKY HILL
ROUTE 182 ROAD
PHELPS
Lily Pond
BUNNEL STREET EXT.
CL&P Easement
COLEBROOK ROAD
ROUTE 183
Colebrook
Center
HALL ROAD
ROCK
PINNEY STREET
R-2
Schwartz Pond
Mill
Brook
GREENWOODS TNPK.
ROUTE 44
GENERAL BUSINESS
HILL ROAD
MILLBROOK ROAD
R-2

NCE EXHIBIT 4

Table compiling the start time and duration of the background noise monitoring as reported in the VHB Report, dated November 2010, Appendix, Noise Monitoring Summary.

Monitoring Site	Daytime		Nighttime	
	Start Time	**Duration**	**Start Time**	**Duration**
M1 – Flagg Hill Road	2:55pm	20 min.	1:15am	15 min.

*** No log sheets were supplied for these locations.*

22942.000/534274.1

NCE EXHIBIT 5

Table of estimated Project Generated Sound Pressure Level in dB(A) recomputed based on assumptions listed in Question 27 and listed for receptor locations that are within 1,800 feet of any of the six wind turbines that are part of Wind Colebrook North or Wind Colebrook North.

RECEPTOR ID	**R1**	**R2**	**R3**	**R4**	**R5**
Wind Turbine N1	43	44	44	43	40
Wind Turbine N2	34	35	35	37	36
Wind Turbine N3	34	34	34	34	34
Wind Turbine S1	31	33	34	35	36
Wind Turbine S2	31	32	33	33	33
Wind Turbine S3	29	30	31	31	32
Total SPL	**45**	**46**	**46**	**45**	**44**
CT Nighttime Limit dB(A)			**45**		
Excess to Limit, dB	***0***	***1***	***1***	***0***	***-1***

CERTIFICATION

I hereby certify that a copy of the foregoing document was delivered by first-class mail and e-mail to the following service list on the 15th day of March, 2011:

Carrie L. Larson
Paul Corey
Jeffery and Mary Stauffer
Thomas D. McKeon
David M. Cusick
Richard T. Roznoy
David R. Lawrence and Jeannie Lemelin
Walter Zima and Brandy L. Grant
Eva Villanova

and sent via e-mail only to:

John R. Morissette
Christopher R. Bernard
Joaquina Borges King

Emily Gianquinto