STATE OF CONNECTICUT
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May 19, 2011

TO: Parties and Intervenors

FROM: Linda Roberts, Executive Director LR

RE: **PETITION NO. 983** - BNE Energy, Inc. petition for a declaratory ruling that no Certificate of Environmental Compatibility and Public Need is required for the construction, maintenance, and operation of a 4.8 MW Wind Renewable Generating facility located on Flagg Hill Road, Colebrook, Connecticut.

As stated at the hearing on April 26, 2011, after the Council issues its draft findings of fact, parties and intervenors may identify errors or inconsistencies between the Council's draft findings of fact and the record; however, no new information, evidence, argument, or reply briefs will be considered by the Council.

Parties and Intervenors may file written comments with the Connecticut Siting Council on the Draft Findings of Fact issued on this docket by May 27, 2011.

LR/cm

Enclosure

CSC
CONNECTICUT SITING COUNCIL

PETITION NO. 983 - BNE Energy, Inc. petition for a declaratory ruling that no Certificate of Environmental Compatibility and Public Need is required for the construction, maintenance, and operation of a 4.8 MW Wind Renewable Generating facility located on Flagg Hill Road, Colebrook, Connecticut.	}	Connecticut
	}	Siting
	}	Council

May 19, 2011

DRAFT FINDINGS OF FACT

Introduction

1. On December 6, 2010, BNE Energy Inc. (BNE), pursuant to Connecticut General Statutes (CGS) §16-50k and §§16-50j-38 to 16-50j-40 of the Regulations of Connecticut State Agencies, submitted a petition to the Connecticut Siting Council (Council) for a declaratory ruling that no Certificate of Environmental Compatibility and Public Need is required for the construction, maintenance, and operation (Petition) of a 4.8 megawatt (MW) Wind Renewable Generating facility at Flagg Hill Road in Prospect, Connecticut. The proposed project is referred to as "Wind Colebrook South." (BNE 1, Vol. 1, p. 1)

2. BNE proposes to install three General Electric (GE) 1.6 MW wind turbines at the site, referred to as Turbine 1, Turbine 2 and Turbine 3. (BNE 1, Vol. 1, pp. 7-8; BNE 1, Vol. 2, Ex. F; BNE 18b)

3. Pursuant to CGS §16-50k(a), the project is eligible to be approved by a declaratory ruling since it is a grid-side distributed resources facility under 65 MW that is in compliance with air and water quality standards of the Connecticut Department of Environmental Protection (DEP). (BNE 1, Vol. 1, p. 1)

4. Pursuant to CGS § 16a-35k, Connecticut state energy policy includes the goal to "develop and utilize renewable energy resources, such as solar and wind energy, to the maximum extent possible." (BNE 1, Vol. 1, p. 1)

5. BNE is a Delaware corporation with a principal place of business located at 29 South Main Street in West Hartford, Connecticut. BNE was founded in 2006 for the purpose of constructing and operating commercial wind generation projects in Connecticut and elsewhere. (BNE 1, Vol. 1, p. 2)

6. The State of Connecticut has implemented renewable portfolio standards (RPS) that required 14 percent of electric generation within the state be produced by renewable resources by 2010. By 2020, RPS requirements increase to 27 percent, and at least 20 percent of which must be from Class I renewable energy sources, which includes wind. (BNE 1, Vol. 1, p. 3)

7. The parties in this proceeding are the Petitioner (BNE), Robin Hirtle, Stella and Michael Somers, FairwindCT, Inc., Dr. David Lawrence and Jeannie Lemelin, the Town of Colebrook (Town), Benjamin and Kristin Mow, Walter Zima, Brandy Grant, Eva Villanova, and Susan Wagner. The intervenor in this proceeding is The Connecticut Light and Power Company (CL&P). Robin Hirtle and Benjamin and Kristin Mow were grouped for the purpose of these proceedings. Dr. David Lawrence, Jeannie Lemelin and Eva Villanova were also grouped. FairwindCT, Inc., Stella and Michael Somers, and Susan Wagner were also grouped. (Transcript 1, 03/22/11, 6:39 p.m. [Tr. 1], pp. 8-9; Transcript 2, 03/23/11, 3:00 p.m. [Tr. 2], pp. 6-7)

8. On November 24, 2010, BNE provided notice of the filing to all adjacent landowners via certified mail, return receipt requested. BNE received return receipts for all abutting property owners except for one, which is the Nature Conservancy of Connecticut, Inc. BNE sent a second notice to this property owner via first class mail. (BNE 1, Vol. 1, Tab D; BNE 2, R. 1)

9. Pursuant to § 16-50j-21 and 16-50j-40 of the Regulations of Connecticut State Agencies, the Council, after giving due notice thereof, held a public hearing on March 22, 2011 beginning at 6:30 p.m. and on March 23, 2011, beginning at 3:00 p.m. and continuing at 6:30 p.m. at the Northwestern Regional 7 High School, Battistoni Drive, Winsted, Connecticut. (Tr. 1, p. 4; Tr. 2, p. 4; Transcript 3, March 23, 2011, 6:30 p.m.[Tr. 3], p. 4)

10. Evidentiary hearings were continued on April 14, April 21 and April 26, 2011 at the office of the Connecticut Siting Council, 10 Franklin Square, New Britain, Connecticut. (Transcript 4, April 14, 2011, 11:11 a.m. [Tr. 4], p. 3; Transcript 5, April 21, 2011, 11:10 p.m. [Tr. 5], p. 3; Transcript 6, April 26, 2011, 11:05 a.m. [Tr. 6], p. 3)

11. The Council and its staff inspected the proposed site and surrounding area on February 23, 2011. (Council Hearing Notice dated February 7, 2011)

12. BNE published notice of the petition filing in the Litchfield County Times on December 3, 2010. (BNE 1, Vol. 1, p. 33 and Tab D)

13. The Council published a legal notice announcing the date, time and place for the public hearings in The Hartford Courant on February 11, 2011. (Council Hearing Notice dated February 7, 2011)

14. BNE installed a sign at the edge of 17 Flagg Hill Road that presented information regarding the petition and the Council hearing. (Tr. 2, pp. 34-35)

15. BNE expects the proposed project to be completed and ready for commercial operation in late 2011, if approved by May 2011. (BNE 1, Vol. 1, p. 31)

16. The Town of Colebrook has an area of 41 square miles with a population of approximately 1,471. The population density is approximately 36 people per square mile. (Council Admin. Notice 15, Colebrook Mail-A-Map)

17. There are approximately 738 people per square mile in the State of Connecticut and approximately 87.4 people per square mile in the United States. (Council Admin. Notice 44, United States Census 2010)

State Agency Comment

18. Pursuant to CGS § 16-50j (h), on February 7, 2011, and April 26, 2011, the following state agencies were solicited by the Council to submit written comments regarding the proposed facility: DEP, Department of Public Health (DPH), Council on Environmental Quality (CEQ), Department of Public Utility Control (DPUC), Office of Policy and Management (OPM), Department of Economic and Community Development (DECD), Department of Agriculture (DOAg) and the Department of Transportation (DOT). (Council Hearing Package dated February 7, 2011; Council Request for Additional State Agency Comments dated April 26, 2011)

19. On April 6, 2011, DEP submitted comments regarding the proposed project, which are referred to in various portions of the Environmental section of these findings. (DEP comments dated April 6, 2011)

20. On March 23, 2011, the DOT submitted a no comment letter. (DOT comments dated March 23, 2011)

21. The following agencies did not respond with written correspondence: DPH, CEQ, DPUC, OPM, DECD and DOAg,. (record)

Municipal Consultation

22. On November 24, 2008, BNE received local approval from the Town for the installation of a meteorological (Met) tower to be located on the property. (BNE 1, Vol. 1, p. 5)

23. On October 8, 2010, BNE submitted an informational filing for the proposed project with the Town of Colebrook. (BNE 1, Vol. 1, p. 5)

24. On November 10, 2010, BNE conducted a public informational meeting regarding the project. (BNE 1, Vol. 1, p. 5)

25. The Town of Colebrook Planning and Zoning Commission expressed concerns about the proposed project; primarily the incompatibility with the Town zoning regulations and Plan of Conservation and Development. (Town 3)

26. The Town of Colebrook Inland Wetlands Commission expressed concern about the project's potential permanent direct wetlands impacts associated with the proposed gravel access road, potential temporary direct wetlands impacts associated with tree clearing and potential temporary disturbance associated with clearing and grading. (Town 2)

27. The Inland Wetlands Commission has asked for permission to enter the property at reasonable times to inspect the proposed project as it goes forward, and has requested a list of contacts from BNE that would be available to call in the event of an emergency during project construction. (Town 2)

28. The Town Conservation Commission expressed concern about the proposed project's potential damage to scenic, historic and recreational values. (Town 5)

State and Federal Permits

29. BNE will file with DEP for a General Permit for the Discharge of Stormwater and Dewatering Wastewaters Associated with Construction Activities. (BNE 1, Vol. 1, p. 31)

30. On December 15, 2009, the Federal Aviation Administration (FAA) issued a determination that the proposed turbines do not exceed obstruction standards and would not be a hazard to air navigation; however, the structures must be marked and/or lighted in accordance with FAA regulations. (BNE 1, Vol. 1, p. 32)

31. BNE would install flashing red lights on the nacelle of the turbines, which would be lit at night, and paint the towers white, which would eliminate the requirement of lighting the structures during the day. The proposed lights would flash approximately 20 to 30 times per minute. BNE would also notify the FAA within five days after the construction reaches its greatest height. (BNE 1, Vol. 1, p. 32-33)

Proposed Site

32. The proposed site is located at 29 Flagg Hill Road and 17 Flagg Hill Road in Colebrook with a total area of 79.44 acres. To the west, the host property boundary is bounded by the Norfolk/Colebrook Town Line. To the east, the host property boundary is Flagg Hill Road. To the south, the host property boundary is located approximately 700 feet north of the Winchester Town Line (refer to Figure 1). To the north, BNE's property abuts The Northwestern Connecticut Sportsman's Association, Inc. (BNE 1, Vol. 1, p. 4)

33. Surrounding land uses include a Nature Conservancy tract to the west, land owned by a gun club to the north, and residential properties to the east and south. (BNE 1, Vol. 1, p. 7)

34. The host property is currently undeveloped and zoned residential (R-2), which requires just under 2-acres to develop a residential parcel. Based on zoning, a maximum of roughly five to six residences could be constructed on the parcel, excluding areas with greater than a 20 percent slope. (BNE 1, Vol. 1, pp. 2, 7; Tr. 5, pp. 39)

35. There are 19 residences within 2,000 feet of the proposed turbine locations. (BNE 2, R. 4)

36. The distance of the proposed turbines to nearby properties is shown in the following table.

	Western Turbine	Eastern Turbine	Southern Turbine
Distance to nearest property line	206 feet	408 feet	150 feet
Distance to nearest residential property line	206 feet	600 feet	150 feet
Distance to nearest residential building	1,000 feet	875 feet	700 feet
Distance to Flagg Hill Road	2,063 feet	886 feet	1,550 feet

(BNE 1, Vol. 3, Sheet C-100)

Project Description

37. BNE proposes to install three GE 1.6 MW wind turbines and associated equipment; an ancillary building for storage, office space and an educational area; an access road; and an electrical interconnection at the proposed site (refer to Figure 2). (BNE 1, Vol. 1, p. 7)

Proposed Access Road

38. Access to the proposed site would extend approximately 1,480 feet from Flagg Hill Road in a southwesterly direction to the site. The access drive would traverse the 17 Flagg Hill Road parcel and then continue onto the subject parcel located at 29 Flagg Hill Road. (BNE 1, Vol. 1, p. 8; BNE 1, Vol. 2, Tab F, Sheet C-002)

Ancillary Building

39. The proposed ancillary building would include restroom facilities and use an on-site well to meet sanitary and drinking needs. An on-site septic system would be required to dispose of wastewater. (BNE 1, Vol. 1, pp. 8-9)

Electrical Collector Yard

40. BNE proposes to install an electrical collector yard on the property. Electrical equipment would include a utility class circuit breaker or recloser with a multifunctional relay to serve as the interconnection interruption device. (BNE 1, Vol. 1, p. 8)

41. BNE would make the electrical interconnection with CL&P's 23-kV distribution system at Winsted-Norfolk Road (Route 44). (BNE 1, Vol. 1, p. 9)

42. The electrical interconnection of the wind turbines would be subject to an agreement with CL&P to provide power on to the electrical distribution system. (Tr. 2, pp. 85-86)

GE 1.6 Turbines

43. The hub or tower of each proposed turbine is approximately 328 feet (100 meters) tall. The nacelle is at the level of the hub and contains the operation equipment. The proposed rotor blades are 132 feet each with a diameter of approximately 270 feet (82.5 meters) for the three-blade configuration. BNE is requesting approval for 164-foot (50 meter) rotor blades with a 328-foot (100 meter) diameter for this petition. The total maximum height of the tower and rotor blades would be 492 feet (150 meters). (BNE 1, Vol. 1, pp. 7-8)

44. Independent pitch motors are used for each blade to provide adjustment of the blade pitch angle during operation. (BNE 1, Vol. 1, p. 10)

45. The turbine foundations are proposed to be octagonal, approximately 48 feet in diameter, and about four feet deep made of reinforced concrete. (Tr. 6, p. 50)

46. The power generated from the proposed wind turbines would be sold at wholesale to the grid. (Tr. 2, p. 85)

47. The useful lifespan of the proposed turbines is over 20 to 30 years. At the end of that period, the equipment would be reviewed and a determination would be made to decommission or change out existing equipment. BNE would be willing to file a plan for decommissioning of the turbines during the Development and Management (D&M) Plan phase of the proposed project, if required by the Council. (BNE 1, Vol. 1, p. 9; Tr. 6, pp. 62-63)

Facility Operation

Capacity

48. BNE began searching in Colebrook for a site because of Colebrook's ground elevation and potential for wind resources. The search was focused on available property with enough acreage to accommodate several turbines, with the ability to interconnect with the electric grid, and with a low residential density in the surrounding area. (BNE 1, Vol. 1, p. 13)

49. BNE installed a Met tower on the property on December 2008 to begin collecting wind data. (BNE 1, Vol. 1, p. 13)

50. Data from the Met tower was collected for approximately 14 months, from December 2008 through to January 2010. (BNE 1, Vol. 3, Tab M, p. 12)

51. The average wind speeds for each month are shown in the table below.

Month	**Extrapolated Average at 100 m**
January	8.6 m/s (19.2 mph)
February	8.7 m/s (19.5 mph)
March	7.3 m/s (16.3 mph)
April	7.3 m/s (16.3 mph)
May	6.7 m/s (15.0 mph)
June	5.1 m/s (11.4 mph)
July	5.6 m/s (12.5 mph)
August	5.7 m/s (12.8 mph)
September	6.5 m/s (14.5 mph)
October	7.1 m/s (15.9 mph)
November	7.2 m/s (16.1 mph)
December	9.0 m/s (20.1 mph)

(BNE 1, Vol. 3, Tab M, p. 12)

52. The proposed 328-foot (100 meter) hub height would result in a higher energy output and capacity factor compared to the 262-foot (80 meter) hub height. (Tr. 2, pp. 39-40)

53. The cut-in wind speed for the 270-foot (82.5 meter) diameter blade 7.8 mph (3.5 m/s). The cut-in speed is the same for the 328-foot (100 meter) diameter blade. (BNE 2, R. 16)

54. If the proposed wind turbines were placed too close together, there would be a potential of wind coming through one turbine and causing turbulence in wind for the second turbine. The turbine would be affected by turbulence could be damaged over time and/or produce less electricity. (Tr. 5, p. 80)

Reliability

55. The proposed project would generate approximately 12,614 megawatt-hours (MWh) of Class I renewable energy annually. (BNE 1, Vol. 1, p. 11)

56. The proposed wind turbines are designed to have an availability of approximately 98 percent. The capacity factor of the proposed project is expected to be approximately 30 percent, based on the 82.5 meter blade diameter. The capacity factor would increase to roughly 35 percent with a 100 meter blade diameter. (BNE 1, Vol. 1, pp. 12; Tr. 2, pp. 39-40)

57. The remaining two percent of time that the turbines may be unavailable is typically due to routine maintenance or needed repairs. (Tr. 4, p. 83)

58. Maintenance is generally scheduled every six months and requires turbines to be shut down for approximately one and a half days. Maintenance includes tightening of bolts, changing filters, and topping off lubricants in the nacelle. (Tr. 2, pp. 68-69)

59. The proposed turbines could operate in a maximum extreme gust for a three-second period of approximately 125 miles per hour (mph) and for ten minutes at approximately 89.5 mph, in accordance with International Electrotechnical Commission standards. (BNE 1, Vol. 1, p. 13)

Public Health and Safety

Setbacks

60. Connecticut does not have state-issued setbacks for commercial wind turbines. Per the record in P 983, only four states do (Minnesota, Ohio, South Dakota, Wisconsin). (BNE 9g with attachment from OLR)

61. Twelve states have established model siting ordinances or similar guidance concerning wind turbines (commercial and noncommercial) at the state level, despite having assigned regulatory control over such facilities to county or local jurisdictions (California, Delaware, Illinois, Maine, Massachusetts, Michigan, New Hampshire, New York, North Carolina, Oregon, Pennsylvania, and Wyoming). North Dakota and Vermont have also delegated control to lower jurisdictions. Vermont and New Jersey are currently debating whether to set state standards, while the record is ambiguous on the extent of North Dakota's state guidance. (BNE 9g, with attachment from OLR; FairwindCT Administrative Notice Items 66, 67)

62. Setbacks mandated or advised by these 18 states are typically worded as being a multiple of total turbine height, (tower plus blade length), with the multiple most commonly used varying from 1.1 to 1.5. A few variations are as follows: setbacks with a specified increase for residential zones; setbacks as multiples of rotor diameter; setbacks based on one multiple of rotor diameter in the direction of the prevailing wind. (BNE 9g, with attachment from OLR; FairwindCT Administrative Notice Items 66, 67)

63. Setbacks tend to be measured to property lines, not residences, except in cases where the setbacks are based on noise. (BNE 9g, with attachment from OLR)

64. Exceptions to setbacks are typically allowed where adjoining property owners agree. (BNE 9g, with attachment from OLR)

Operational Safety

65. The proposed turbines can be controlled from: a) the nacelle, by use of an interface; b) the bottom of the tower, by use of a control box; and c) a remote location, by use of a Supervisory Control and Data Acquisition System with local lockout capacity. (BNE 1, Vol. 1, pp. 10, 14)

66. Emergency stop buttons would be located within the tower base and within the nacelle to stop the turbine in the event of an emergency. (BNE 1, Vol. 1, p. 10)

67. Each proposed turbine would have automatic and hand held fire extinguishers and automatic fire alarms. (Tr. 4, p. 54)

Noise

68. Noise—unwanted sound—is conveyed from a source to the human ear as waves of air pressure. Sound pressures can be measured in terms of sound-level (loudness, volume), or in terms of frequency (pitch, tone). Sound-levels are expressed in decibels (dB). Frequencies are expressed in cycles-per-second, known as Hertz (Hz). (BNE 1, Vol. 3, Tab M, pp. 2-3)

84. The decibel scale extends from zero dB (the threshold of hearing) to above 120 dB (painful). The scale is logarithmic, not linear. A 1 dB increase is not perceptible to the average person. Adding two equal sound levels creates a 3 dB increase in the overall sound level: that increase is at the threshold of perceptibility. A 10 dB increase is a tenfold increase in sound pressure but is only perceived as a doubling in loudness. (BNE 1, Vol. 3, Tab M, pp. 2-3)

85. In terms of frequencies, the ear can hear from about 20 Hz up to about 20,000 Hz, but it is most sensitive to sounds in the middle range (1,000 to 8,000 Hz). (Fairwind Administrative Notice xx)

86. Community noise is measured in ways that combine the scale of loudness (in dB) with the range of frequency response (in Hz) for the human ear. Noise measurement devices can present a simple graph of combined pressures and frequencies in one-third octave bands. However, they can also weight sound pressure changes in ways that more closely track human sensitivities. The most commonly-used weighting scheme is called the "A-weighted" scale (dBA): it emphasizes sound-levels at middle to high frequencies and de-emphasizes sound-levels at low frequencies. Another scheme (dBC) is equally sensitive to all frequencies above 32 Hz, with the result that, compared to dBA, it comes closer to representing perceived loudness in cases where low frequencies matter. (Fairwind Administrative Notice xx)

87. Wind turbines emit two main sources of noise: noise from the mechanical components that drive the blades (mechanical noise); and noise from the rotor blades sweeping through the air (aerodynamic noise). (BNE 1, Vol. 3, Tab M, p. 9)

88. The sound-level for the GE 1.6 MW wind turbine at 9 m/s (20.1 mph)—its maximum sound-level—is 106 dBA. The noise levels would be the same for both blade diameters (i.e. 82.5m and 100m). (BNE 1 Vol. 3, Tab N; Tr. 2, p. 37)

89. Aerodynamic noise is generally characterized by rhythmic pulsations (modulations) that vary according to wind conditions and the rotor's positions in the air. For instance, a blade passing by the tower itself at the low point of its cycle can make a noise up to five dB louder than at the top of its cycle. Blades can also sound different as they encounter wind-shear. Finally, certain contours of the terrain cause turbulence, which in turn can cause variations in the aerodynamic noise produced by blades. (Fairwind Administrative Notice xx)

90. Modulations of aerodynamic noise occur at low frequencies (20-200 Hz), sometimes occurring at frequencies even lower than 20 Hz, a frequency range called "infrasound", which is generally inaudible. (Fairwind Administrative Notice xx)

91. Loud mechanical noise in the environment can cause disturbance to people's sleep. DEP has developed noise control regulations to limit community exposure. These regulations allow higher sound-levels during the daytime than at night. (Council Administrative Notice 42 [DEP Noise Regulations]; BNE 14, R. 6)

92. Audible low-frequency noise (20-300 Hz) can cause sleep disturbance, headaches, ear pressure, skin sensations, and other similar symptoms in some people. Complaints of annoyance about noise appear to increase when outside noise levels exceed 35 dBA. (Fairwind Administrative Notice xx)

93. DEP's noise regulations are expressed in terms of the "A-weighted" scale (dBA). (Council Administrative Notice 42 [DEP Noise Regulations])

94. To establish a baseline for existing conditions, BNE monitored noise at two locations, in the area of the proposed turbines. Both daytime sound levels (37 dBA) and nighttime sound levels (37-38 dBA) were consistent. Background noise modeling of one location performed for a longer duration by FairwindCT found a background nighttime noise level of 30 dBA. None of the results suggested a "High Background Noise Area", which would have increased the noise limits allowable for the proposed project. (BNE 1, Vol. 3, Tab M, pp. 6-7; FairwindCT 4, R. 56, R. 57)

95. In Connecticut, noise is controlled in terms of the sound-levels that may be emitted from a source property (Class A, B, or C) to an abutting property (Class A, B, or C). The class of any property is determined by its actual use. Class A is generally residential use. Class B is generally commercial use. Class C is generally industrial use. (Council Administrative Notice 42 [DEP Noise Regulations])

96. DEP noise criteria from an emitter to a receptor is as follows:

Emitter Class	**Receptor Noise 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

*(7:00 a.m. to 10:00 p.m.) ** (10:00 p.m. to 7:00 a.m.)
(Council Administrative Notice 42 [DEP Noise Regulations])

97. Properties abutting the site are zoned residential. (BNE 1d, p. 6; FairwindCT 2a, R. 16)

98. In determining compliance with DEP noise regulations, BNE categorized the wind turbine as a Class C emitter. (BNE 1, Vol. 3, Tab M, p. 4)

99. To predict the sound-level of the proposed turbines, BNE conducted noise modeling in accordance with the ISO-9613-2 standard using sound levels contained within GE's specifications. (BNE 1, Vol. 2, Tab M)

100. BNE's noise modeling indicates that the maximum noise emissions from the turbines would be 49 dBA at the nearest residence during the daytime and 47 dBA at nighttime. This is based on maximum daytime wind speeds of 9 m/s and maximum nighttime wind speeds of 8 m/s. (BNE 1, Vol. 3, Tab M)

101. If the site property was considered a Class A use, then the Class A to Class A criteria would be applied (55 dBA during the daytime and 45 dBA during the nighttime). In this case, noise levels from the turbine would exceed the nighttime noise threshold by 2 dB. (Council Administrative Notice 42 [DEP Noise Regulations]; FairwindCT 2a, R. 16)

102. There are no DEP criteria regarding the time limit for the type of noise produced by a turbine. Turbine noise can occur repeatedly as long as it meets the noise level criteria. Council Administrative Notice 42 [CT DEP Noise Regulations]

106. Connecticut noise regulations have also been established for certain special types of noise: impulsive noise, prominent discrete tones, infrasonic noise, and ultrasonic noise. Impulsive noise and ultrasonic noise would range from 13 to 29 dBA, below DEP's criteria of 100 dBA. (Council Administrative Notice 42 [CT DEP Noise Regulations]; BNE 14, R. 5)

107. A prominent discrete tone, in general terms, is acoustic energy concentrated in a narrow frequency range. This type of noise shows up on the graph of one-third octave bands as a noticeable "spike." The graph of one-third octave bands for the GE 1.6 MW turbine does not display this feature. (FairwindCT 2a, R. 32; Tr. 6, pp. 88-89)

Noise Mitigations

108. Noise mitigation can be accomplished by through wall and window treatments. (Tr. 5, p. 264)

109. Neither landscaping nor sound barriers are effective to screen noise from wind turbines, given the turbines' height. (Tr. 5, p. 264)

Ice Throw/Drop

110. Ice can form under appropriate weather conditions that typically include temperatures in the range of 28° F to 36° F, and a relative humidity greater than 97 percent. Glaze ice is of most concern with wind turbines and can be formed through accumulations of freezing rain or drizzle. (BNE 9h, R. 6; Tr. 4, pp. 57-58)

111. Ice can collect on the rotating and non-rotating portions of the turbine although ice formation on operating blades is more likely under appropriate weather conditions. Ice fragments can be thrown from the blade of an operating turbine or fall off a stationary turbine. (BNE 9h)

112. The risk level associated with ice throw and ice drop depends on the amount of icing assumed for the site. An estimate was made based on climate data obtained from the Met tower during one winter season. Based on the collected climate data, the estimated amount of icing at the site is 288 hours per season, consistent with information maintained by the U.S. Department of Commerce National Climatic Data Center. The risk level associated with the ice throw and ice drop analysis is dependent on the amount of icing assumed for the site. An increase in the hours of icing would increase the risk of ice being thrown. (BNE 9h; Tr. 4, p. 39; Tr. 5, pp. 217-218)

113. Ice can accumulate on stationary turbines and can fall off during melting conditions. The worst-case ice drop distance assumes a 0.5 kg (1.1 pound) ice fragment falling from a turbine with 50 meter blades. At worst, the ice fragment would fall 394 feet from the turbine, within the site property boundaries. (BNE 9h)

114. The range of potential ice throw from a turbine, assuming no mitigation methods are employed, is given below:

	50 meter blades	**40.3 meter blades**
Typical range of ice throw for 0.5 kg ice fragment (90% of occurrences)	0 to 492 feet	0 to 427 feet
Exceptional range of ice throw for 0.5 kg ice fragment (10% of occurrences)	492 to 869 feet	427 to 820 feet
Typical range of ice throw for 1 kg ice fragment (90% of occurrences)	0 to 525 feet	0 to 459 feet
Exceptional range of ice throw for 1 kg ice fragment (10% of occurrences)	525 feet to 935 feet	459 to 869 feet

(BNE 9h)

115. The closest residence to the turbines, 17 Flagg Hill Road, is approximately 676 feet east of the turbine S-2. If ice mitigation methods were not employed, the probability that an ice fragment striking a square meter section of the residence is once in every 512 years, assuming 50 meter blades, or once in every 1,810 years, assuming 40.3 meter blades. (BNE 9h)

116. GE has developed recommended setback distances related to ice throws. All three turbines would meet such setback distances as specified by GE. (BNE 9g and 9h)

Ice Throw and Ice Drop Mitigations

117. Remote and internal monitoring of the turbines can detect icing events, or other problems, through changes in turbine operating characteristics when compared to wind speed. Ice formation can affect the aerodynamics of the turbine: accumulating ice slows the blades down. Sensors would detect lower power outputs when compared to wind speed, or detect vibrations, causing the turbine to automatically shut down. (BNE 9h, p. 6)

118. The turbine would be monitored continuously by GE during operation. During known or predicted icing events, BNE would dispatch personnel to the site to monitor the turbines visually for icing. (Tr. 2, pp .67-68)

119. Once the turbines are shut down, BNE would have personnel on-site to assess ice accumulation and operating conditions. (BNE 2, Q. 24; Tr. 4, pp. 114-116)

120. Restarting and operation of a turbine with ice on the blades is the most dangerous scenario for ice throws. To prevent ice throws upon re-start, BNE would have on-site personnel inspect and ensure ice has melted and fallen from the blades prior to re-start. (BNE 9h; Tr. 4, p. 29)

121. GE offers an optional Winter Ice Operation mode that would allow the turbine to spin at slower speeds during icing events to keep the turbines operational while decreasing the risk of ice throws and ice drops. (BNE 2, R. 24)

Shadow Flicker

122. "Shadow flicker" describes the alternating pattern of light and dark that happens when wind turbine blades sweep through the path of sunlight low in the sky. (BNE 9b)

123. Under certain circumstances, shadow flicker can be cast through an unobstructed window of a home so that a room could experience repetitive changes in brightness. Shadow flicker can also occur outside, where the alternating shadows would appear on the ground. (BNE 9b)

124. The frequency of shadow flicker is determined by rotor blade speed and the number of blades on the rotor. The frequency is measured in Hertz (Hz), with 1 Hz being equivalent to one flicker per second. (BNE 9b)

125. The proposed turbines, with 82.5-meter blade diameter, would rotate at a speed of 9.75 to 16.18 revolutions per minute which corresponds to 29.2 to 48.5 shadows per minute or 0.49 to 0.81 Hz. (BNE 9b)

126. The Epilepsy Foundation determined that flicker frequencies above 3 Hz could be a concern to individuals that are afflicted with photosensitive epilepsy. Shadow flicker from the turbines would be below this recommend level. (BNE 9b)

127. There are no Federal or State of Connecticut standards for shadow flicker. Some communities in various parts of the county have adopted standards that range from 10 hours per year to 30 hours per year at an occupied structure. (BEN 9b)

128. In order to measure the likely occurrence of shadow flicker in areas surrounding the proposed turbines, a computer generated probable case shadow flicker model was generated. The model accounts for vegetation and weather conditions not favorable for generating shadows, such as lack of sun or absence of wind. Additionally, the model assumes a conservative "greenhouse mode", which stipulates line-of-sight shadows falling on a residential dwelling from all sides. (This model is conservative in that the windows of many houses do not face the sun directly during all shadow flicker occurrences.) However, varying widths of the blade are not factored into the model. (Shadow flicker is more pronounced when the shadow is cast by the portion of a blade close to the hub than by the blade tip.) (BNE 9b)

129. The probable case model was limited to a distance of approximately 1.25 miles from the turbines. Beyond this distance, shadow flicker would be negligible. (BNE 9b)

130. The probable case model indicates seven residential dwellings would experience some shadow flicker ranging from 10 hours to 48 hours per year. Of those seven residences, one would experience over 30 hours per year. Three would experience 20 to 30 hours per year. Three would experience 10 to 17 hours per year. (refer to figure 4). (BNE 9b)

131. The residence receiving the most shadow flicker (i.e. over 30 hours per year) is located on the subject property at 17 Flagg Hill Road. (BNE 9b)

Environmental Impacts

Air and Water Quality Standards

132. The proposed project would comply with DEP air quality standards. The project would produce no air emissions during operation. (BNE 1, Vol. I, pp. 1-2; Council Administrative Notice 41)

133. Water quality standards have been developed by the DEP to protect surface and groundwater resources in Connecticut. (Council Administrative Notice 40)

134. Surface water quality can be affected by construction and development activities through direct discharge or through run-off. (Council Administrative Notice 40)

135. Permanent structural controls would not be required for the treatment of stormwater runoff. Following construction, the site would be returned to pre-construction conditions. The constructed access road would remain in place, but the width would be reduced by one-half. The diversion swale constructed as part of the Erosion and Sedimentation Control Plan would remain in place and would be converted to a water quality swale. Once site conditions and vegetation have been reestablished, stormwater discharges would return to the pre-construction state for quality and quantity. (BNE 1, Vol. II, Tab G)

136. Stormwater generated at the site would be controlled in accordance with the *2004 Connecticut Stormwater Quality Manual* and the *2002 Connecticut Guidelines for Soil Erosion and Sediment Control*. (BNE 1, Vol. I, p. 30)

Wildlife

137. The BNE site property generally contains a second growth, northern hardwood forest with a small hilltop clearing (used recently to collect wind data) and a large wetland complex including an approximately 6.70-acre beaver pond that is centrally located. (refer to Figure 6). (BNE 1, Tab I, p. 2)

138. The site has moderate to high wildlife habitat value with good interspersion (i.e. intermixing) of habitat types, including upland and wetland forest, various early successional habitat types including meadow and forest, a pond, and an intermittent watercourse. Good interspersion generally attracts a greater diversity of wildlife species. Thus, the subject property has the potential to support several dozen species of wildlife ranging from amphibians and reptiles to large mammals. (BNE 1, Tab I, p. 15)

139. Construction of the project would cause relocation of some wildlife to adjacent areas and cause some mortality of slower moving species. Once construction is completed, it is expected that many of the individuals and species will return to the subject property and occupy suitable habitats once again. Generally, long-term impacts to wildlife would be minimal. (BNE 1, Tab I, pp. 17)

Amphibians and Reptiles

140. The subject property contains wetland and wooded habitat that may support several species of reptiles and amphibians. Amphibian species mostly like to be found at the site include the snapping turtle, red-spotted newt, northern redback salamander, green frogs, American bullfrogs, American toad, gray tree frog, and northern spring peeper. (BNE 1, Vol. III, Tab I, p. 11; BNE 1, Tab I, pp. 11-12)

141. Reptile species could include snakes such as the northern redbelly, eastern garter snake, and the eastern milk snake. The most likely turtle species is the snapping turtle. Other turtle species are not likely due to the high elevation and the till substrate. (BNE 1, Vol. III, Tab I, p. 11)

Mammals

142. Mammal species most likely to be found at the site include white-tailed deer, red fox, raccoon, opossum, skunk, woodchuck, coyote, beaver, grey squirrel, eastern chipmunk, eastern cottontail, various rodents, fisher, porcupine, and bats. (BNE 1, Tab I, pp. 8-11)

143. A bat survey performed from June 25 to November 1, 2010 identified six species of bats utilizing the site. Two of these species, the eastern red bat, hoary bat, and silver-haired bat, are listed as state species of special concern. (BNE 9e, pp. 16, 20; DEP Comments dated April 6, 2011)

144. Most recorded bat fatalities at wind turbine sites are of migratory tree roosting species generally during post breeding and migratory periods. The most affected species (75% of reported fatalities) are the eastern red, hoary, and silver-haired bats. (BNE 9e)

145. While wind turbines do cause collision-induced bat mortalities, it has not been shown that this would result in population-level effects. (BNE 9e)

146. The color of the wind turbine lighting (whether red or white) is not expected to significantly change the number of bat fatalities. (Tr. 2, p. 45)

147. Based on existing studies, the typical number of bat fatalities per megawatt of wind turbine output ranges from 0 to 39.7 fatalities per year. (Tr. 2, p. 48)

148. The projected number of bat fatalities for the proposed project ranges from 0 to 190 per year. (Tr. 2, pp. 48-49)

149. Known methods of mitigating or reducing bat fatalities include reduce the turbine speed during the time of year when bat fatalities are the highest. One experimental method is an electronic bat deterrent device, but it is not yet commercially available. (Tr. 2, pp. 43-44)

Birds

150. 39 unique bird species were observed in the vicinity of the proposed site. Cumulatively, three species composed 26.5 percent of the individual observations. These species were passerine, red-eye vireo, and the ovenbird. (BNE 1, Vol. III, Tab L)

151. While wind turbines do cause collision-induced bat mortalities, it has not been shown that this would result in population-level effects. (BNE 9e)

152. Based on existing studies, the typical number of bird fatalities per megawatt of wind turbine output ranges from 0 to 13.9 fatalities per year. The projected number of bird fatalities for the proposed project ranges from 0 to 66.7 per year. (Tr. 2, pp. 48-49)

153. The color of the wind turbine lighting (whether red or white) is not expected to significantly change the number of bat fatalities. (Tr. 2, p. 46)

Visibility

154. Each turbine tower would extend to a height of 328 feet (100m) above ground level to the turbine hub. Assuming a 271-foot (82.5m) blade diameter, the blades would extend to a blade tip height of 463 feet (141m) above ground level. (BNE 1, Vol. I, pp. 7-8)

155. The proposed 328-foot (100m) hub height with 164-foot (50m) blades would be visible above the trees from approximately 428 acres within a five-mile radius of each turbine (refer to Figure 7). (BNE 1, Tab J)

156. The proposed 328-foot (100m) hub height with 135-foot blades (41.3m) would be visible above the trees from approximately 457 acres within a five-mile radius of each turbine (refer to Figure 7). (BNE 9b)

157. Within one-mile of the site, approximately 28 residential properties would have views of at least some portion of the 164-foot (50m) blades above the trees. Of these residences, approximately 19 would have views above the trees of at least the hub (height of 328 feet), including the apex of the 164-foot blades (refer to Figures 8 & 9). (BNE 1, Tab J)

158. Within one-mile of the site, approximately 51 residential properties would have views of at least some portion of the 135-foot (41.3m) blades above the trees. Of these residences, approximately 35 would have views above the trees of at least the hub (height of 328 feet), including the apex of the 135-foot blades (refer to Figures 8 & 9). (BNE 1, Tab J)

159. The 328-foot high hub would be visible through vegetation during leaf-off conditions from approximately 1,202-acres within a five-mile radius of the site. Approximately 211-acres within a five-mile radius of the site would have year-round views. (BNE 9b)

160. Approximately 18 residential properties would have seasonal views of the 328-foot high hubs within one-mile of the site. (BNE 1, Vol. 3, Tab J)

161. Several hiking trails exist within five-miles of the site, notably the Naugatuck Trail to the northwest in Norfolk and the Dennis Hill Park Trail located to the west in Norfolk. The wind turbines are not

expected to be visible from the hiking trails except from the top of Haystack Mountain. (Council Administrative Notice Item 34; BNE 1, Vol. III, Tab J)

162. There are two state designated scenic roads within five miles of the site. There is Route 183 in Colebrook, located to the northeast of the proposed site. There is also Route 272 in Norfolk, located west of the proposed site. The wind turbines are not expected to be visible from Route 183. The wind turbines would be visible from Route 272 for approximately 0.1 miles. (Council Administrative Notice Item 35; BNE 1, Vol. 3, Tab J)

Site Disturbance/Restoration

163. Construction of the proposed project would include the clearing of approximately 11.32 acres of woodland. Approximately 0.6-acres of disturbance would occur within 100 feet of the wetland areas. (BNE 1, Vol. 2, Tab F)

164. Disturbed areas would include the proposed turbines, a blade assembly and laydown area, a temporary stockpile area, a crane assembly area, a tower section laydown area, and a crane pad. (BNE 1, Vol. 2, Tab F)

165. The total cut required to construct the proposed project is approximately 31,435 cubic yards and total fill would be approximately 25,985 cubic yards. There would be an excess of approximately 5,450 cubic yards of cut material to be spread on-site. (BNE 5, R. 107 and 108)

166. A wildlife/conservation seed mix containing native grasses and forbs would be used to stabilize exposed areas post-construction. (BNE 1, Vol. I, p. 30)

Wetlands

167. Five separate wetland areas were identified on the site (refer to Figure 6). Wetland 1 is a large wetland complex that is dominated by a beaver pond. Wetland 2 is a small wetland finger extending onto the site from a wetland on the adjacent property to the north. Wetlands 3 and 4 are seasonally saturated forested wetlands located immediately south of the southern property boundary (i.e. off-site). Wetland 5 is a forested hillside seep wetland draining northeast along the east property boundary. (BNE 1, Vol. I, p. 29)

168. The nearest wetland is approximately 130 feet to the west of the southern turbine. (BNE 1, Vol. I, p. 28)

169. The proposed project would require permanent direct wetland impacts associated with the construction of a gravel access road over a forested wetland (Wetland 1) totaling 4,702 square feet. (BNE 1, Vol. I, pp. 29-30)

170. In addition, approximately 213 square feet of temporary direct wetland impacts related to tree clearing to construct this crossing are required. Clearing and grading to construct the laydown and assembly areas for the blades of turbines one and three will cause temporary disturbance in proximity to Wetland 1. (BNE 1, Vol. I, pp. 29-30)

171. Best Management Practices would be utilized in accordance with the 2002 Connecticut Guidelines for Erosion and Sedimentation Control throughout construction and maintained until the disturbed areas are stabilized.

Figure 1: Site Location at Flagg Hill Road, Colebrook, CT. (BNE 1, Vol. 3, Tab I)

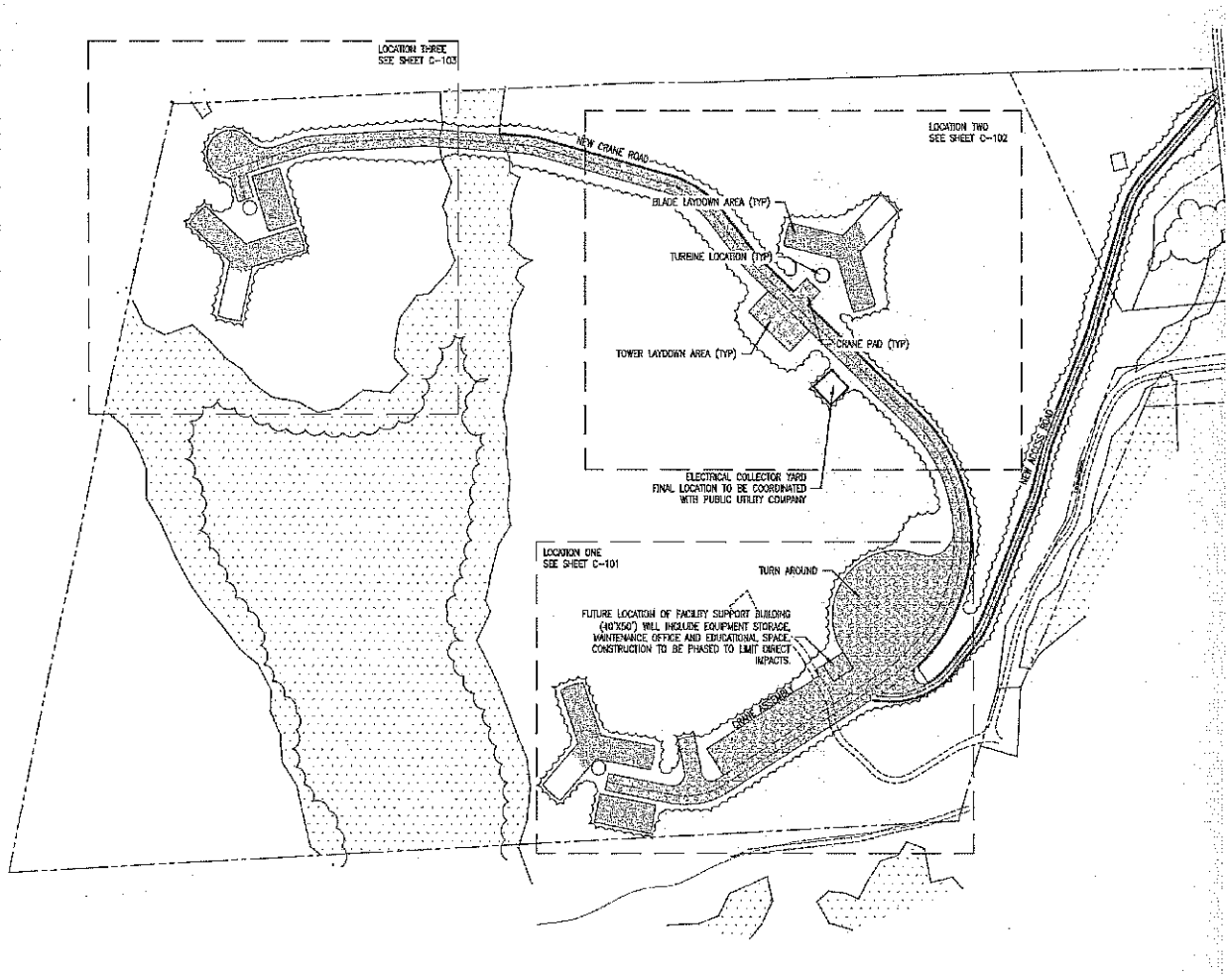
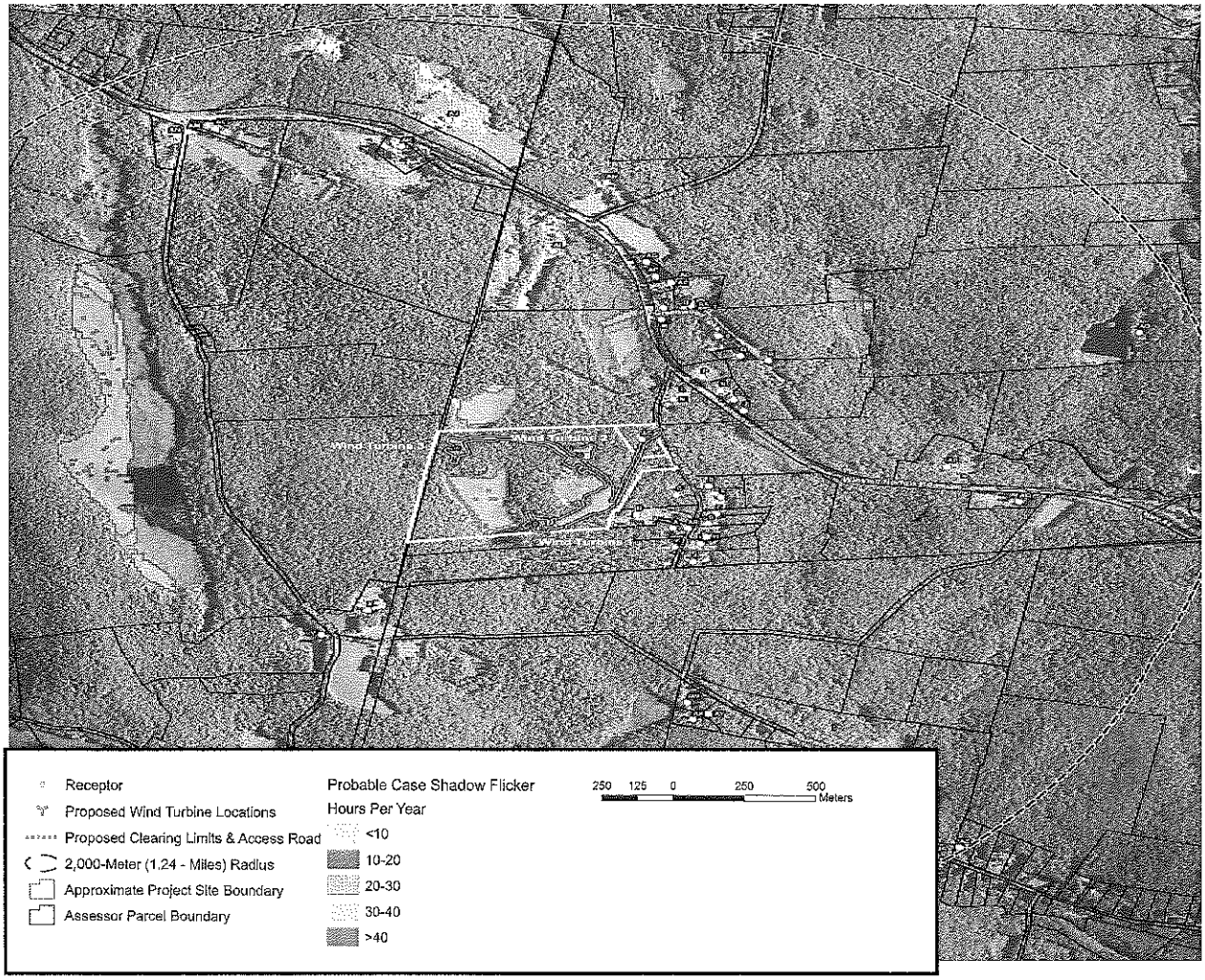


Figure 2: Site Plan – showing turbine locations, blade laydown areas and clearing limits. (BNE 1, Vol. 2, Tab F)



Hours Per Year
<5
5 - 10
10 - 20
20 - 30
>30

Figure 3: Shadow Flicker Probable Case Model using turbines in original locations with worst-case 100-meter blade diameter - showing exterior shadow flicker. (BNE 2, R17)

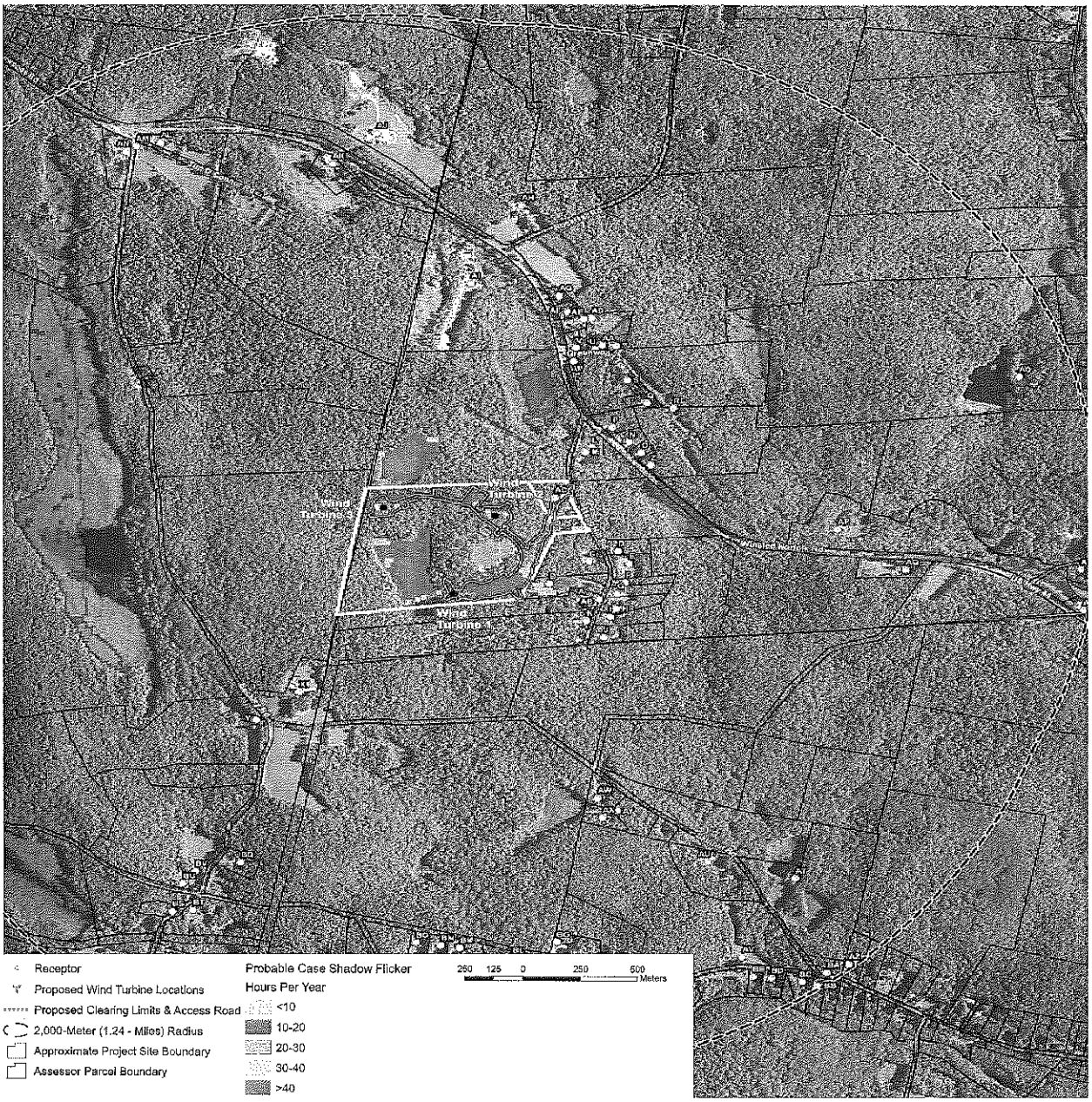


Figure 4: Shadow Flicker using 82.5-meter blade diameter - showing exterior shadow flicker. (BNE 9b)

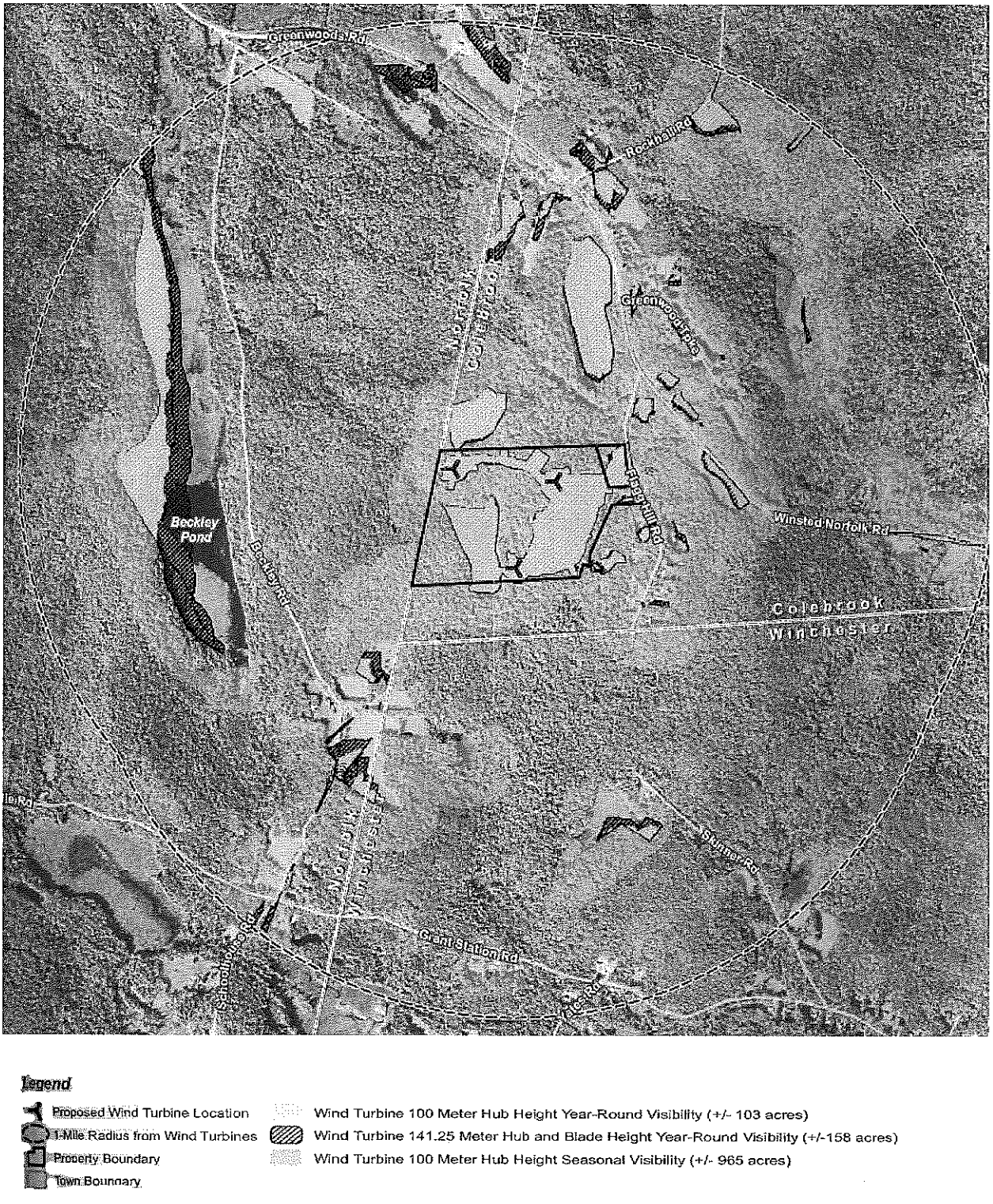
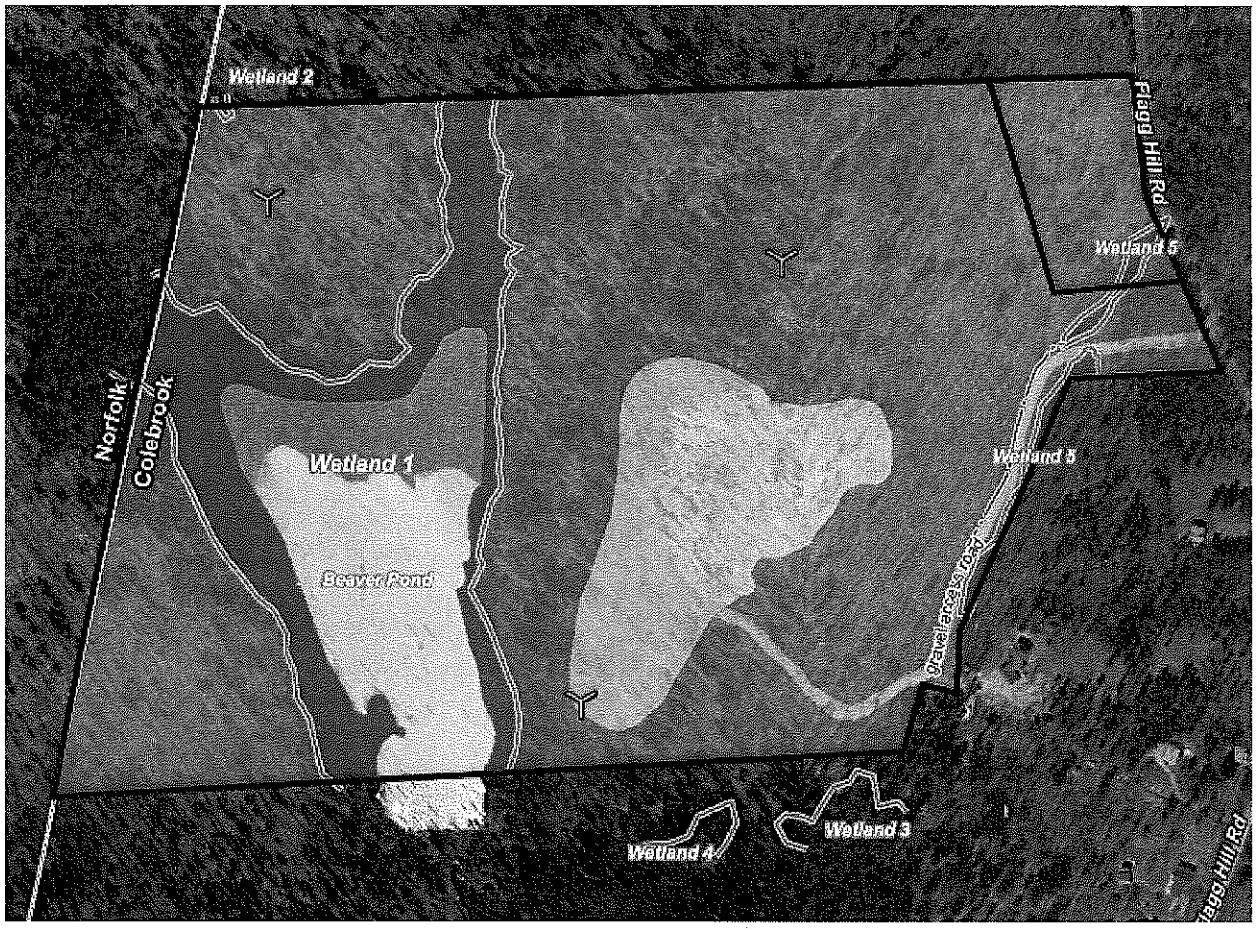


Figure 5: Visibility of turbines from areas near turbines. Black dashed line represents one-mile radius around turbines. (BNE 1, Vol. 3, Tab J; BNE 14, R. 50)



Legend

Proposed Wind Turbine Location

Property Boundary

Habitat Type

Early Old Field Meadow

Existing Telecommunications Tower Compound

Forested Wetlands

Second Growth Upland Hardwood Forest

Open Water

I Forest

Second Growth Northern Hardwood Forest

Forest Wetland

Scrub/Shrub - Emergent Wetland

Open Water (Beaver Pond)

Gravel Access Road

Base Map Source: ConnDOT 2004 aerial photograph with 0.5-foot resolution.

Figure 6: Habitat types on site property. (BNE 1, Vol. 3, Tab I)

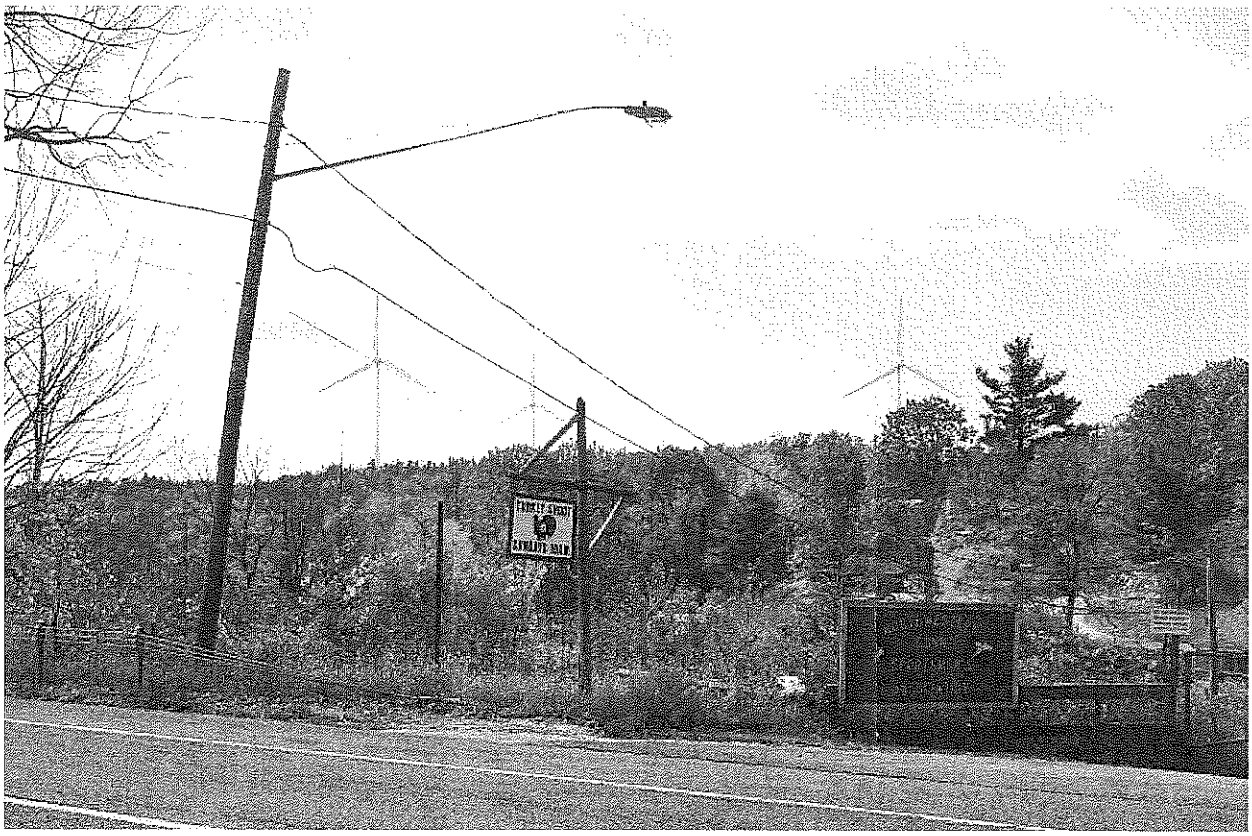


Figure 7: Photosimulation of turbines from Route 44 adjacent to The Northwestern Connecticut Sportsmen's Association property (100m blade diameter) (distance: 0.69 miles) (BNE 1, Vol. 3, Tab I)

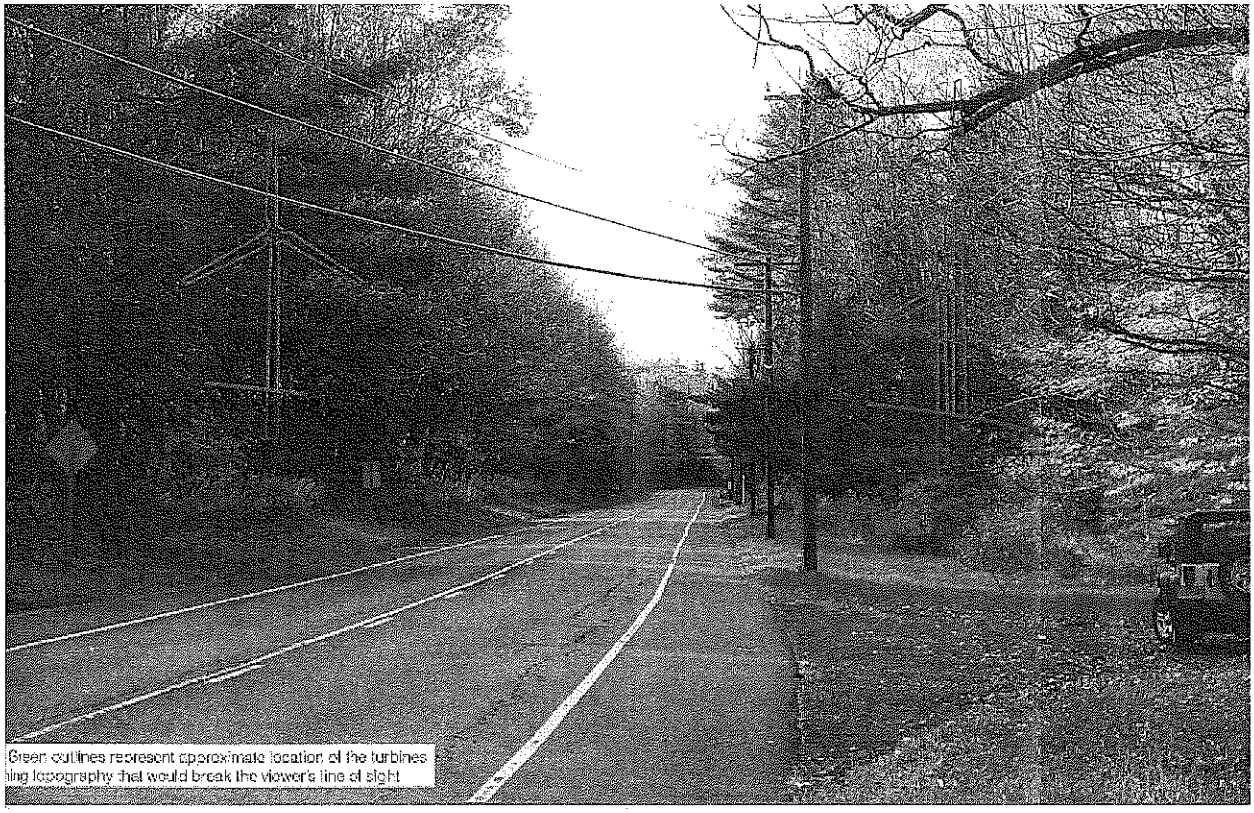


Figure 8: Photosimulation of turbines from Route 44 (100m blade diameter) (distance: 1.08 miles) (BNE 1, Vol. 3, Tab I)

Figure 9: Photosimulation of turbines from Approx. 42 Stillman Hill Road (100m blade diameter) (distance: 2.26 miles) (BNE 1, Vol. 3, Tab I)

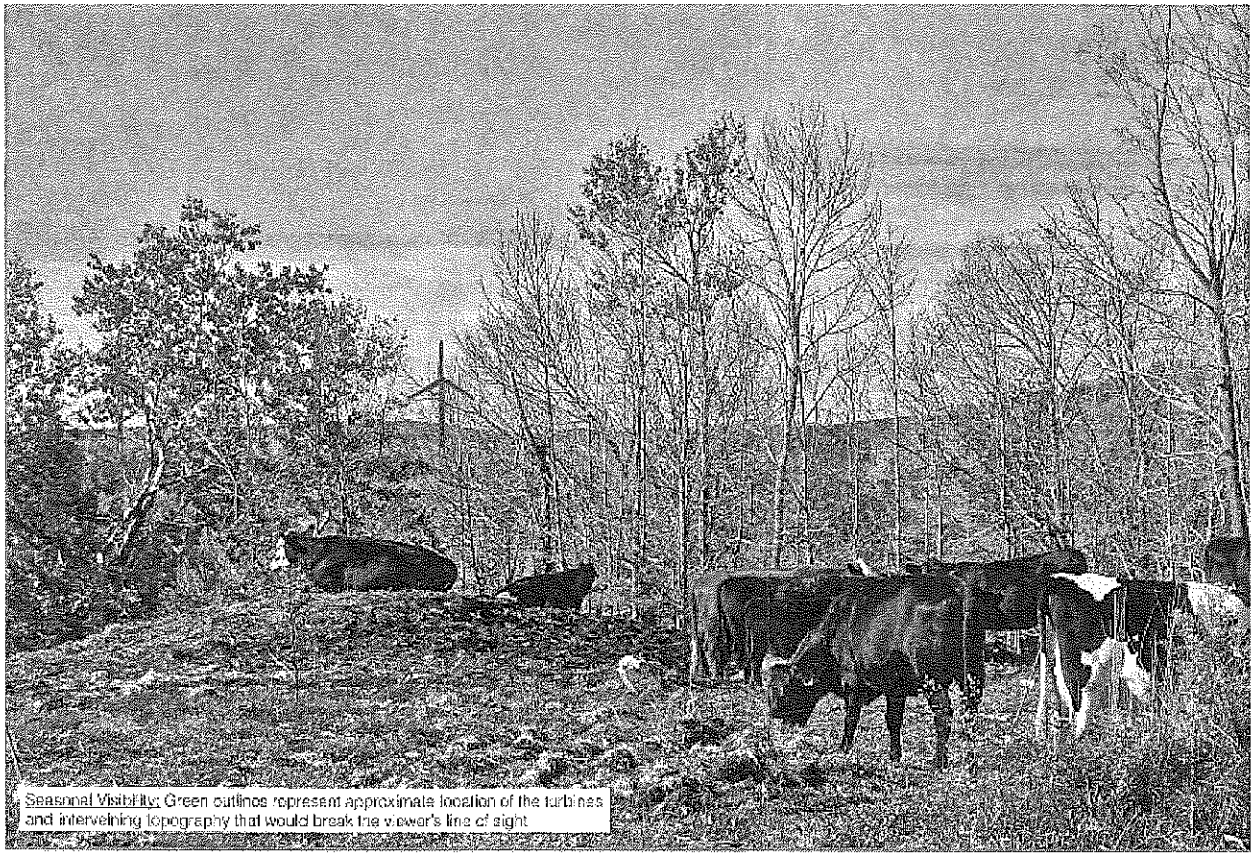


Figure 10: Photosimulation of turbines from Old Colebrook Road (100m blade diameter) (distance: 2.70 miles) (BNE 1, Vol. 3, Tab I)

Figure 11: Photosimulation of turbines from Lookout Tower on Haystack Mountain (100m blade diameter) (distance: 4.20 miles) (BNE 1, Vol. 3, Tab I)

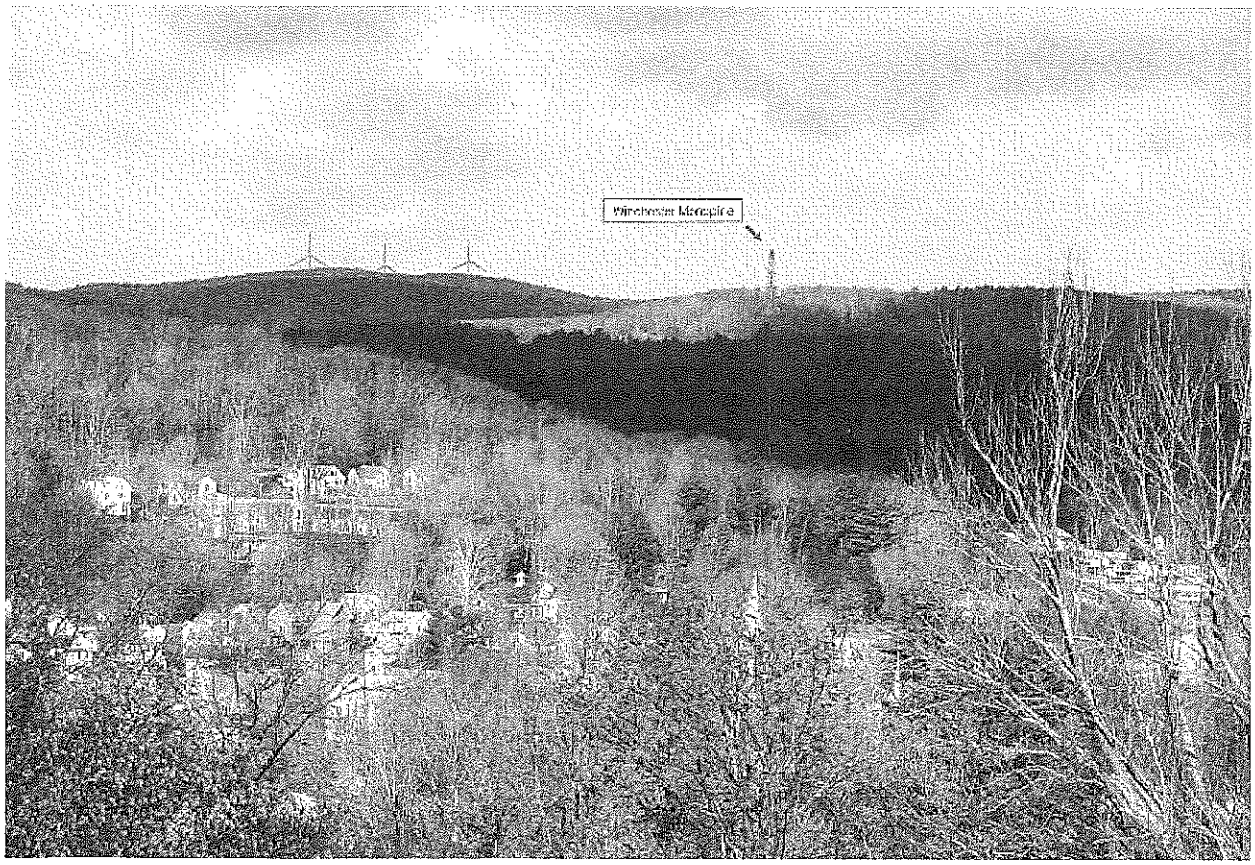


Figure 12: Photosimulation of turbines from Lookout Tower at Soldiers' Memorial Park (100m blade diameter) (distance: 4.72 miles) (BNE 1, Vol. 3, Tab I)

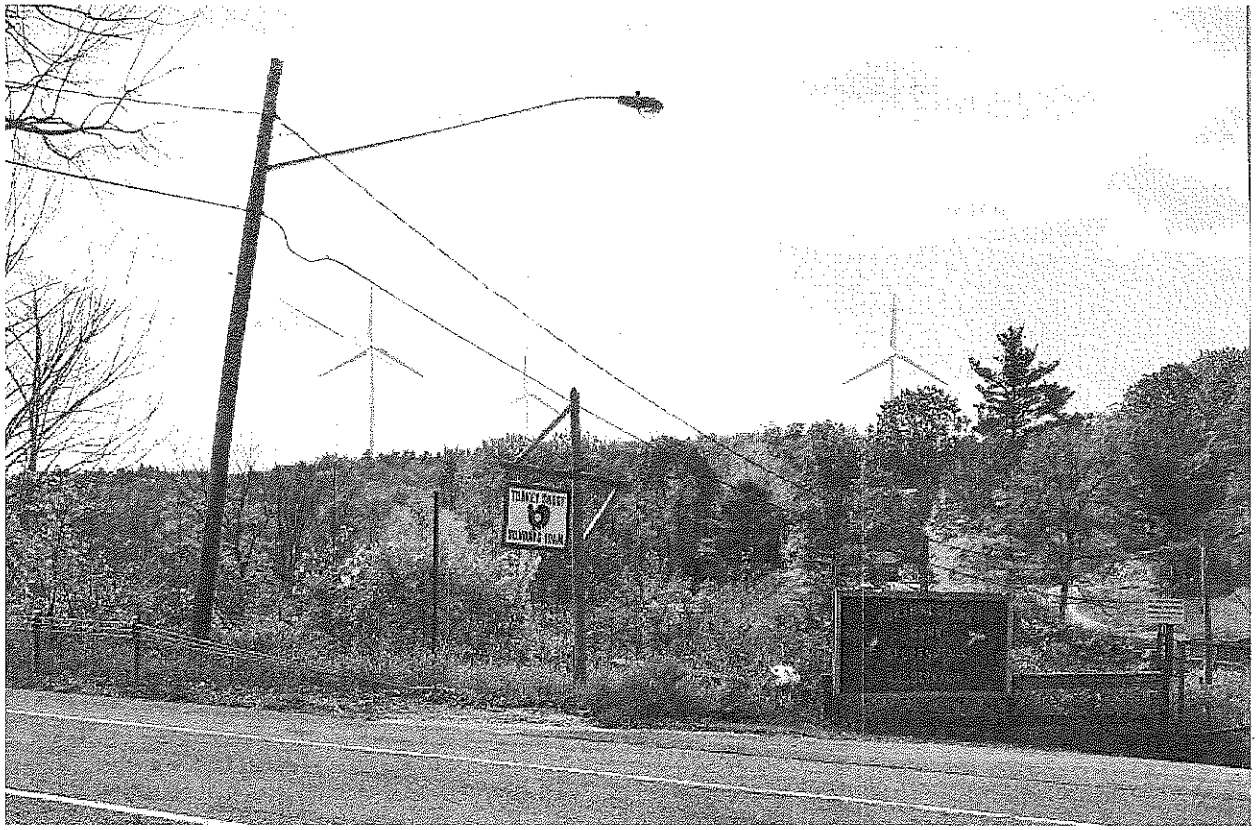


Figure 13: Photosimulation of turbines from Route 44 adjacent to The Northwestern Connecticut Sportsmen's Association property (82.5m blade diameter) (distance: 0.69 miles) (BNE 1, Vol. 3, Tab I)

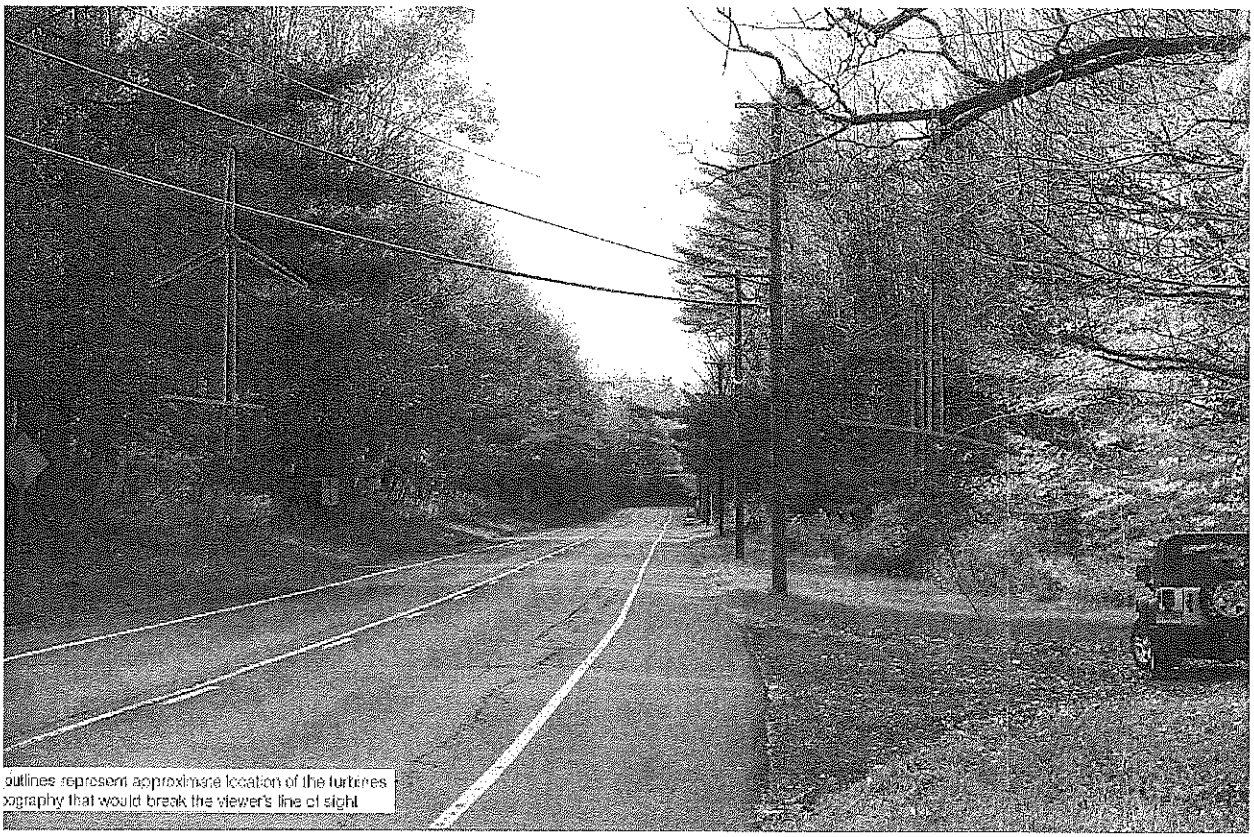


Figure 14: Photosimulation of turbines from Route 44 (82.5m blade diameter) (distance: 1.08 miles) (BNE 1, Vol. 3, Tab I)

Figure 15: Photosimulation of turbines from Approx. 42 Stillman Hill Road (82.5m blade diameter) (distance: 2.26 miles) (BNE 1, Vol. 3, Tab I)

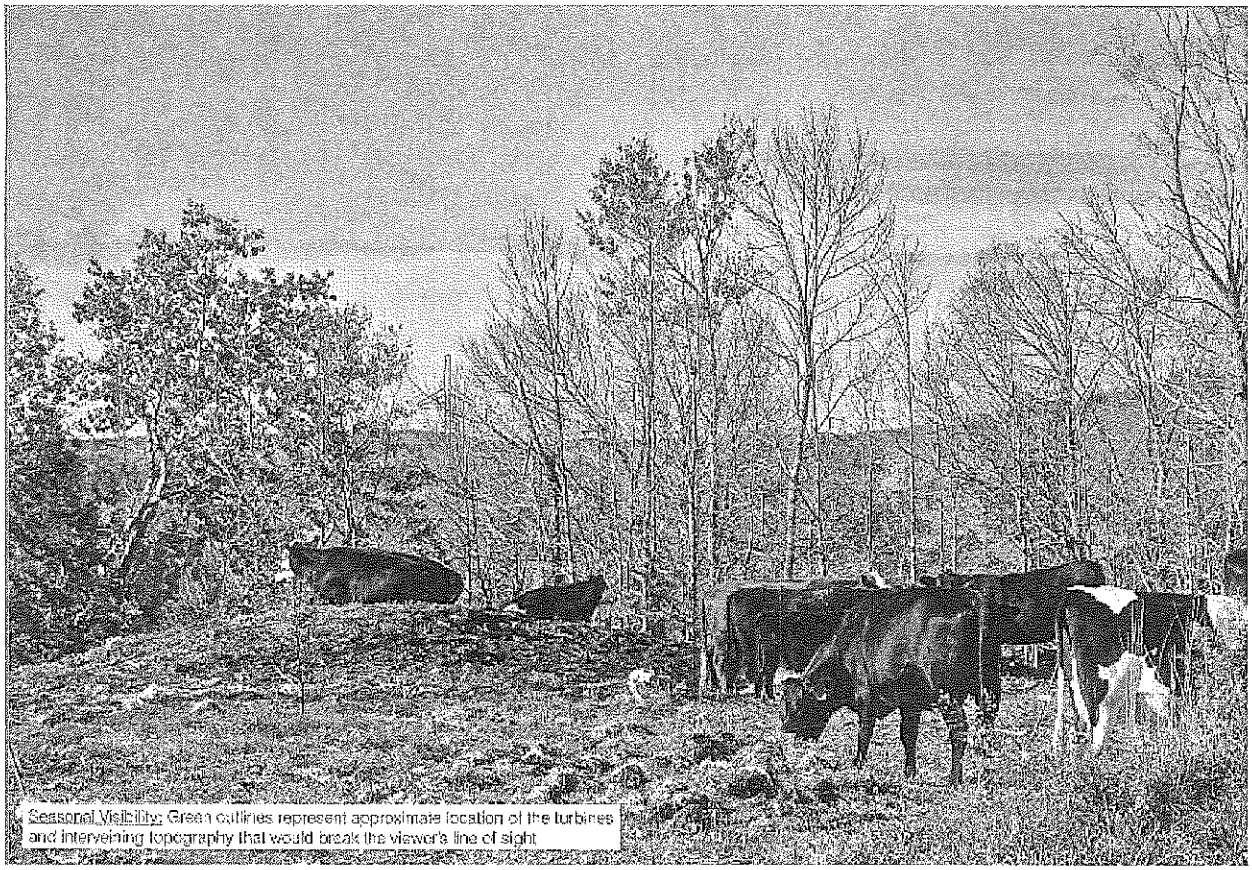


Figure 16: Photosimulation of turbines from Old Colebrook Road (82.5m blade diameter) (distance: 2.70 miles) (BNE 1, Vol. 3, Tab I)

Figure 17: Photosimulation of turbines from Lookout Tower on Haystack Mountain (82.5m blade diameter) (distance: 4.20 miles) (BNE 1, Vol. 3, Tab I)

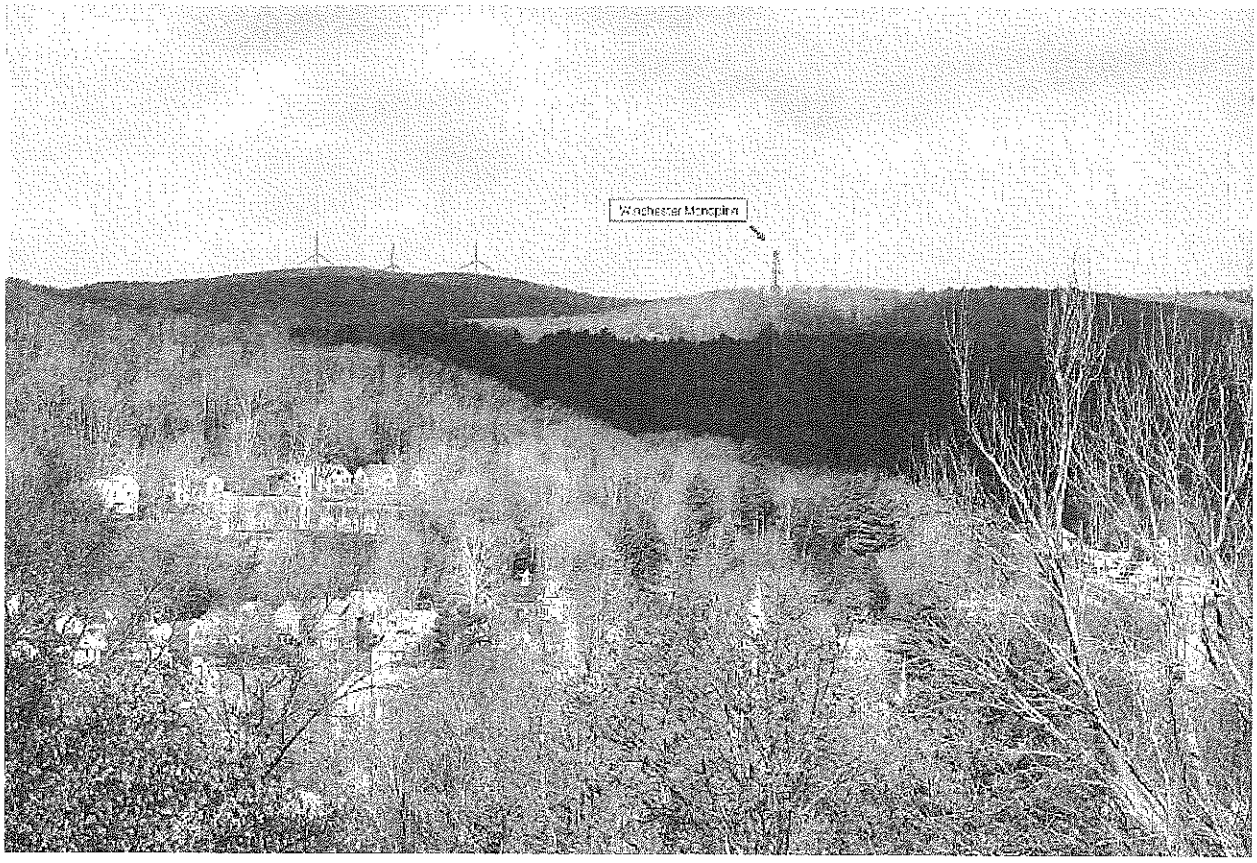


Figure 18: Photosimulation of turbines from Lookout Tower at Soldiers' Memorial Park (82.5m turbines) (distance: 4.72 miles) (BNE 1, Vol. 3, Tab I)