APPENDIX J

Response to Public Comments

Response 17C: See Responses 1C, 1D, 12F, and 13A.

Comment 17D: In order to place twelve 2 MW turbines in Lempster, NH, one million pounds of explosives were required.

Response 17D: The need for blasting and the amount of explosives required is site-specific, and conditions at the Lempster site are not indicative of what would be required at the Deerfield site. Regardless of the quantity of explosives that may be used, if blasting is required at the Project site, it would be conducted in accordance with an approved blasting plan. As described in the FEIS, "The Blasting Plan would be prepared by a qualified blasting contractor, and all blasting activities would be carried out by licensed and certified blasting technicians. The Plan would detail pre- and post-blasting inspections, safety measures, notification procedures, hours of operation, fly rock control, and other steps to be taken to ensure blasting is conducted properly. Furthermore, the Blasting Plan would require all blasting activities be conducted in accordance with applicable laws and regulations, including the CPG for the Project; the Blasting Guidance Manual issued by the U.S. Department of Interior Office of Surface Mining, Reclamation, and Enforcement; and the U.S. Department of Interior Rules 816.61-68 and 817.61-68." See Section 3.2.2.1.6 for more information.

Comment 17E: A former Clipper employee stated, "the turbines do have an oil heating element that enables them to operate in cold climates." These turbines leak often enough to require splash decks. It has recently been reported in England that the turbines are using more energy to stay warm than they are putting out.

Response 17E: The Forest Service would require compliance with a Spill Prevention Containment, and Countermeasures Plan (SPCCP) in any Special Use permit issued for the Project. The project-specific draft SPCCP outlines procedures to be implemented to prevent the release of hazardous substances into the environment. The hierarchical objectives of the SPCCP are as follows: (1) to prevent spills from occurring, (2) to prepare for potential spills, and (3) to respond quickly and appropriately if a spill does occur. Storage specifications and inspection standards described in the SPCCP would reduce the likelihood of spills. Any releases of oil or hazardous materials would be addressed immediately upon detection, using the procedures and equipment described in the SPCCP, and reported in accordance with all applicable laws and regulations (CH2M HILL, 2008b). See Section 3.2.2.1.5 of this FEIS. With regard to reports of wind turbines using more energy than they produce, a life cycle study of the 2.0 MW Vestas V80, similar to the Gamesa models proposed for the Project, found an energy balance of 7.7 months, i.e., the turbine must be in operation approximately 8 months to produce the energy used throughout its entire life cycle. This study included the energy used during all phases of a wind turbine: raw material extraction and manufacturing, turbine production, transportation, erection, operation, maintenance, and decommissioning of the turbines, foundations, and electrical interconnect (Elsam, 2004).

biased document. The Forest Supervisor cannot make a decision until she has sufficient information. Please ask for more information that is not produced by a consultant who is currently working as a paid consultant in New Hampshire for Iberdrola, the same company that is seeking the Forest Service permit.

Response 141A: The third party contractor on this project, edr Companies (edr), works for a variety of clients in both the public and private sector. On wind projects edr has worked for several project developers (including Iberdrola, Horizon, EverPower, and others), as well as the agencies and municipalities charged with reviewing proposed projects (e.g., New York Power Authority, Maryland Department of National Resources, U.S. Forest Service, and various towns serving as the Lead Agency in accordance with the State Environmental Quality Review Act [SEQR] in New York State). edr's professional reputation and ability to operate a viable business are dependent on objective and unbiased analysis and presentation of information.

The team of edr and ESS Group were selected from among many possible candidates as the third party contractor tasked with completing the Deerfield Project analysis and documentation by the Forest Services in 2004 based on their experience in the evaluation of environmental impacts associated with utility-scale wind energy projects in the Northeast. At the time of consultant selection, few other firms in the Northeast had comparable experience, and such experience could only be obtained through working as a consultant to private companies developing commercial wind projects. Specific to the Deerfield project, edr's involvement pre-dated Iberdrola's (then PPM Energy) acquisition of the project from EnXco in 2006. At that time, all scoping for the DEIS had been completed, and review of studies prepared by the previous developer was already underway. When the acquisition was announced, edr advised the Forest Service of its involvement on other projects proposed by Iberdrola. The Forest Service determined that this involvement did not constitute a conflict of interest. The Forest Service does not believe its third party contractor could introduce a bias to the NEPA review of the Deerfield project based on the following facts:

- edr's interaction with Iberdrola on the Deerfield project was limited to emails, meetings, and conference calls where the Forest Service was present.
- edr's primary role on the project was to draft sections of the DEIS and SDEIS for review, editing, and approval by the Forest Service.
- edr's draft text was based on data sources and studies provided, reviewed, and/or approved by the Forest Service, along with published literature.
- Studies prepared by consultants retained by the project developer typically pre-dated Iberdrola's acquisition of the project.

- On chapters where the Forest Service has in-house expertise (soils, water resources, ecological resources, avian, bats, bears, visual resources, heritage/cultural resources, recreational resources, transportation), Forest Service specialists had significant input to, and at times took the lead in the preparation of draft text.

- All chapters of the DEIS and SDEIS are based on existing data or site-specific support studies, none of which were prepared by edr. The analysis and conclusions presented in the EIS chapters are based on this data, along with the professional opinion of Forest Service specialists and the third party contractor.

- All draft chapters received multiple rounds of review by the Forest Service specialists and the Forest Service NEPA Coordinator. Each draft chapter of the EIS received approximately 5 to 7 rounds of Forest Service review and comment (some, such as bears and bats, received many more rounds of review).

- The final version of both the DEIS and SDEIS were reviewed by the District Ranger and Forest Supervisor before being approved for release to the public, with portions also reviewed by the Forest Service Regional Office and the Forest Service Office of General Counsel. All work, including data collection, studies, and document preparation, has been completed to Forest Service standards.

- edr's work on Iberdrola's Groton, New Hampshire project was limited to the preparation of a visual impact assessment (VIA) that presented an objective evaluation of the visibility and visual contrast of that project. edr's experience with the preparation of VIAs, along with the expertise of Forest Service IDT members, allowed for a critical evaluation of the VIA prepared for the Deerfield Project.

Comment Letter 145. Josephine Carothers

Comment 145A: Massachusetts Audubon painstakingly reviewed the Cape Wind project for several years and subsequently approved it. While that is an ocean-based project, the fact remains that their decision marks the response of a group dedicated to nature to a proposed wind project. Birds are not unduly threatened. There are enough wind power sites in the U.S. to assess the minimal (at best) damage they inflict.

Response 145A: Section 3.10.1 of the FEIS describes the affected environment and various studies used to evaluate impacts to avian species. Section 3.10.2 describes the potential impacts and likelihood of bird mortality for each of the alternatives, and provides updated mortality information and species-specific mortality for nearby wind facilities, particularly the Lempster Wind Project in New Hampshire and the Mars Hill Wind Farm and Stetson Mountain I and II Wind Projects in Maine.

Response 164D: Comment noted. See Section 3.3.2 of this FEIS, which addresses Project impacts to climate and air quality. See also Sections 3.9.2, 3.10.2, 3.11.2, and 3.12.2, which evaluate potential impacts to ecological resources (including threatened and endangered species and management indicator species), birds, bats, and bears, respectively.

Comment Letter 165. Justin Lindholm

Comment 165A: The commenter is concerned about impacts to the Aiken Wilderness. The Wilderness Act of 1964 will be violated if either the eastern or western arrays of industrial turbines are allowed to be built. Human developments on Federal lands which project sights and sounds into wilderness thereby diluting the strict visual, sound, and recreational standards of solitude are not allowed. A study of Roadless Area #92002 states that the 200 foot tall wind turbines on private land 2 miles away are one of the reasons it cannot be designated as wilderness.

Response 165A: See Response 12E. There were a number of reasons which precluded Roadless Area #92002 (Yaw Pond) from Wilderness designation as stated in Appendix C (page C-21) of the Forest Plan's Final EIS. Most significant is the motorized use surrounding the area and the outstanding rights for power line construction. Visual and noise disturbances were also listed.

Comment 165B: There are several picturesque ponds and other naturally and permanently open areas in the Aiken Wilderness from which the turbines will be seen year round. Also, there are countless areas throughout the Aiken Wilderness where, during some or all of the year, the turbines will be plainly visible through the trees.

Response 165B: Visual Quality impacts for the George D. Aiken Wilderness are discussed in detail in Section 3.5.2.1.2 of the FEIS. The assessment recognizes the possibility of occasional filtered views of the Project but also recognizes that the overall visibility, even in the winter months, would be minimal. Key to the assessment is the fact that there are not any designated trails or overlook points within the wilderness from which the Project would be viewed. The assessment also found that there would be minimal to no visibility along one of the most scenic and well-used pathways along the frozen wetlands, drainage ways, and old roads in this area. The assessment also found that the Aiken Wilderness is not a place people visit for distant views, but rather for the diversity of the vegetation, wetlands, and the possibility of glimpsing the wildlife this area supports. The very occasional filtered views of the Project that may be available are unlikely to diminish the experience of the users of this area as the turbines would appear as a minor and subordinate part of the natural landscape.

Comment 165C: The Lempster wind turbines overlook a high mountain plateau, a quite similar topographical situation to that of the Aiken Wilderness and surrounding ridges. The commenter owns land near Lempster, and after extensive experience listening, is certain the Deerfield Wind turbines will be clearly heard most of the way across the Aiken Wilderness.

Response 165C: Depending on alternative selected, the proposed Project could result in up to 7 dBA increase near the eastern border of the Aiken Wilderness, approximately 1.5 miles away. This represents the maximum levels that would occur there (i.e., the worst-case scenario), and does not take into account the masking effects of vegetation, background noise due to winds in the forest, or intervening topography. See FEIS Section 3.4.2 for additional information on potential noise impacts to the Aiken Wilderness.

Comment 165D: Wildernesses allow the occasional noise of aircraft, but not much else. The noise standards for wilderness do not hinge on decibel levels, according to the enclosed Minnesota Wilderness ruling. This ruling says that, "noise that is louder, more frequent, more constant, or of a different quality, than the sound that presently exists within the wilderness, is more likely to degrade the wilderness character from its present condition and thus result in a violation of Section 4(b) of the Wilderness Act."

Response 165D: According to Forest Service policy and Wilderness law, management of Wilderness areas stops at the boundary and does not include air space since we cannot manage/restrict over-flights by airplanes. In other words, the land defined as the George D. Aiken Wilderness Area is managed according to Plan direction for Management Area 5.1, Wilderness (which includes all GMNF Wildernesses), up to its boundaries; there are no buffers around the areas nor is there any extension of Wilderness attribute management beyond its boundaries. For example, vegetation management with chainsaws is allowed right up to the Wilderness boundary, and several of the Wilderness areas on the GMNF are bordered by motorized trails and highways. There are many sources of noise that may or may not be heard within various portions of the Aiken Wilderness. Each Wilderness area is unique in its settings and physical environment, including its surrounding area. For example, the character of a wilderness close to an urban area or areas of high population (i.e., eastern Wilderness areas) is likely to include more visitors, air pollutants, and sights and sounds of modern civilization than the character of a wilderness that is far from an urban area (i.e., many remote western Wilderness areas).

The FEIS discloses the noise effects of the Deerfield Wind Project on the Aiken Wilderness in Section 3.4.2.1.2. It describes the modeled difference between Project-related noise from the Proposed Action and the No Action alternative that would occur at Site MB1 near the eastern border of the Aiken Wilderness, at the end of Forest Road 74 in Woodford (Figure 3.4-4). At this location, the modeled Project-related sound levels would reach 29 dBA(exterior)(Leq)(1 hr), while existing noise levels are currently 25 dBA(exterior)(Leq)(24). Therefore, a net increase of 4 dBA would occur at this site. The Reduced West alternative would produce a slightly higher difference of 7 dBA (Figure 3.4-6), while the East Side Only alternative would resources. Additionally, as part of the SDEIS, the claim that there will be "little" impact is not sufficient and must be calculated.

Response 400ZF: The statement referenced in this comment is presented out of context. The SDEIS states, "Wet ponds, in conjunction with other treatment measures, are proposed to meet the water quality, channel protection, overbank flood, and extreme storm criteria, while grass channels are proposed to meet the recharge standard in areas of existing low slope. Opportunities for supplement swales to provide additional recharge and infiltration are also under consideration for areas where site conditions would facilitate such practices." As written in the SDEIS, the qualifier "as site conditions would facilitate" only applies to supplement swales that would provide additional recharge and infiltration, and this statement remains in the FEIS.

With regard to amount of soil disturbance, the extent of actual soil erosion and sedimentation cannot be quantified. However, the acreage of soil that would be graded (i.e., exposed to the forces of erosion), is presented for each alternative. As stated in Section 3.2.2.1.1 of the FEIS, with the implementation of the proposed S&Gs and EPSCP, adverse impacts from stormwater runoff are anticipated to be negligible. Water quality goals would include the capture of 90% of the annual storm events, and removal of 80% of the average annual total suspended solids load.

Comment 400ZG: The discussion regarding soil displacement (section 3.2.2.1.3) addresses the possible impacts on soil loss of excavation, filling and blasting. The SDEIS discussion of blasting and soil loading states explicitly the potential for mudslides (and landslides) and that monitoring will be completed during construction. This is inadequate. Prior to any design, there must be a site specific geotechnical investigation that reviews the existing stability of the proposed Project site and a post design analysis that also analyzes the geotechnical stability of the fills and cuts. The removal of significant rock mass can create the potential for slides, while the placement of fills can create a load that would also initiate such slides. Such an impact would be devastating to downhill upland and water resources as well as create a hazard for human health and life.

Response 400ZG: Layout and design of proposed Project facilities, including proposed grading and associated cuts and fills, have been prepared by professional civil engineers, licensed to practice in the State of Vermont. These designs are guided by site-specific data and professional standards and practices that take into account slope stability and the avoidance of conditions that are conducive to slope failure. Preliminary construction drawings have been developed. Should the Responsible Official decide to issue a land use authorization for the Proposed Action or one of the action alternatives, final stamped construction drawings would be reviewed and approved by Forest Service engineers prior to commencement of construction activities.

Comment 400ZH: The blasting section (section 3.2.2.1.6) discusses the possible effects of blasting on impacts to local drinking water supplies and mitigation through monitoring.

RSG INC.
RESOURCE SYSTEMS GROUP, INC.

Revised Noise Impact Study for:

DEERFIELD WIND PROJECT

Searsburg/Readsboro, Vermont

Prepared for:

Deerfield Wind, LLC

28 November 2007

55 Railroad Row, White River Junction, Vermont 05001

All sites were monitored with ANSI Type 1 Cesva SC310 integrating sound level meters set to log average, 90th percentile, 50th percentile, and full octave band sound levels every ten seconds. Each sound level meter was calibrated before and after the measurements and fitted with windscreens. The windscreens reduce the self-noise created by wind passing over the meter's microphone. Each microphone was placed between approximately 0.8 and 1.4 meters above the ground. In each case, the ground was considered "soft", that is, it was suitable for the growth of vegetation.

Figure 2 identifies the monitoring locations in reference to the project area. Each monitoring location and hourly sound level readings are shown in greater detail in the figures that follow. A location description of each meter site is given below. This Universal Transverse Mercator (UTM) coordinates of each site is shown in Table 2. A summary of the monitoring results, including distances to the existing and proposed wind turbines is shown in Table 3. Three different levels are shown: the Leq, L90 and L50. As mentioned above, the Leq is the equivalent average sound level. This measure weights louder sounds more than quieter sounds. For example, the Leq average of 60 dB and 40 dB is 57 dB. The L50 is the fiftieth percentile level and the L90 is the ninetieth percentile level.

1) Site 1 is located at the end of George D. Aiken Wilde Road (Forest Road. 74) in Woodford. The meter was set up 20 feet east of the end of the road. Site 1 is shown in Figure 3. The sound monitoring results are shown in Figure 4 along with wind speeds as monitored at the ridgeline of wind turbines. As shown in the chart, the Leq, L50, and L90 generally follow a similar trend indicating that there is not a lot of traffic or infrequent and relatively loud events. The sound levels also tend to rise and fall along with the ridgetop wind speeds.

2) Site 2 is located 47 feet south of Old Route 9, east of Bishop Hill Road, and south of VT Route 9 in Searsburg. Site 2 is shown in Figure 5 and the monitoring results in Figure 6. The results show a more diurnal pattern in the sound levels. Levels are highest during the day and lowest during the night. This indicates that traffic patterns heavily influence noise in this area.

3) Site 3 is in the tree line between the cemetery and the intersection of VT Routes 9 and 8 in Searsburg. The meter was setup 94 feet east of Route 8 and 107 feet south of Route 9. Site 3 is shown in Figure 7 and the monitoring results are shown in Figure 8. Similar to Site 2, the results show a diurnal pattern of sound levels. However, this site also shows a rise in sound levels during the night of December 3. This night experienced very high wind speeds at the ridgeline (above 25 mph) which resulted in wind noise at this location. Note that the existing turbines are not readily audible at Site 3.

4) Site 4 is located near the transmission line that crosses VT Route 8 approximately 1.3 km (0.8 miles) south of the VT 8/VT 9 intersection in Searsburg. The meter at Site 4 was located 56 feet west of Route 8 in the woods immediately south of the transmission lines. Site 4 is shown on Figure 9 and the monitoring results are shown in Figure 10. At this site, there is a very clear difference between the Leq values, which follow a diurnal pattern, and the L90 and L50 levels which are more stable. The difference is due to relatively low traffic volumes on VT 8. That is, there are not enough vehicles on VT 8 to affect the percentile

Table 3: Summary of Overall Monitoring Results by Site

Site	Distance to Existing Turbines (m)	Distance to Proposed Turbines (m)	Day			Night		
			LEQ	L50	L90	LEQ	L50	L90
Site 1	4,500	2,500	45	33	32	39	29	28
Site 2	4,350	1,150	50	45	43	46	38	37
Site 3	3,550	1,300	56	49	46	52	39	38
Site 4	2,350	1,050	56	41	40	51	41	40
Site 5	800	650	57	42	42	50	43	42
Site 6	20	300	63	56	55	62	62	61
Site 7	2,750	1,400	51	29	28	49	33	32

5.2. MANUFACTURER SOUND EMISSIONS ESTIMATES

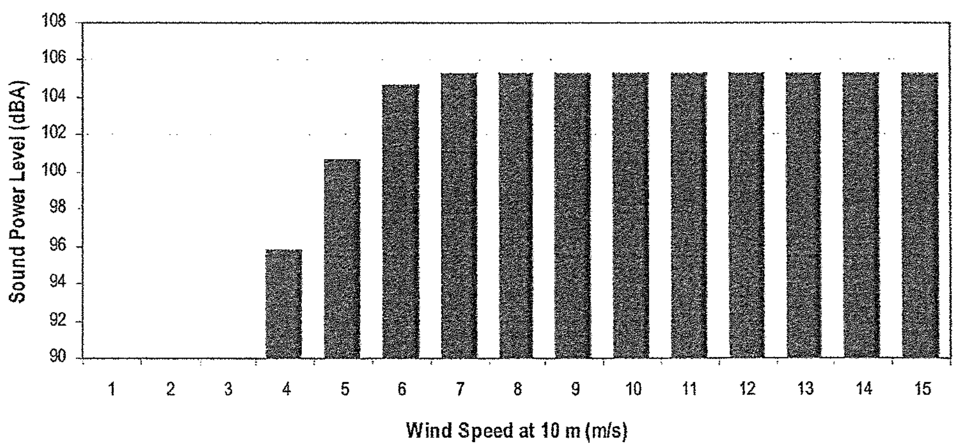
The proposed wind farm will use the Gamesa G80 2.0 MW wind turbine. The maximum sound power level from this unit is 105 dBA at the worst-case wind speed. The sound levels by wind speed for the turbine is shown in Figure 18.

The ANSI S12.9 Part 3 standard suggests a method for determining prominent discrete tones. Appendix C of the standard states,

> "For a prominent discrete tone to be identified as present, the equivalent-continuous sound pressure level in the one-third octave band of interest is required to exceed the average equivalent continuous sound pressure level for the two adjacent one-third octave bands by some constant level difference, K_t.
>
> "Note: The constant may vary with frequency. Possible choices for the level differences are: 15 dB in low one-third octave bands (25-125 Hz), 8 dB in middle-frequency bands (160-400 Hz), and 5 dB in high-frequency bands (500-10,000 Hz)."

As shown in Figure 19, the G80 has no prominent discrete tones as defined by ANSI, as there are no 1/3 octave bands that exceed both of its neighbors. The Gamesa G80 wind turbine would meet ANSI guidelines for tonality.

Figure 18: A-weighted Sound Power Level by Wind Speed for the Gamesa G80 Wind Turbine



6. SOUND FROM WIND TURBINES – SPECIAL ISSUES

Wind turbines are special sound generators in that their sound emissions are often masked by noise from the wind moving through trees and other vegetation, and their sound level is highly dependent on meteorological conditions. In addition, wind turbines generate low frequency sound which tends to propagate better than higher frequency sound. These aspects are discussed below.

6.1. METEOROLOGY

Meteorological conditions can significantly affect sound propagation. The two most important conditions to consider are wind shear and temperature lapse. Wind shear is the difference in wind speeds by elevation and temperature lapse rate is the temperature gradient by elevation. In conditions with high wind shear (large gradient), sound levels upwind from the source tend to decrease and sound levels downwind tend to increase. With temperature lapse, when ground surface temperatures are higher than that aloft, sound levels on the ground will decrease. The opposite is true when ground temperatures are lower than those aloft (an inversion condition).

As a substitute for these conditions, we often use "stability class". Stability classes range from A to G, where A is a highly unstable condition (high solar radiation and high winds) and G is very stable (clear night, no wind, strong temperature inversion).

In general terms, sound propagates best under stable conditions with a strong inversion. This occurs during the night and is characterized by low winds.[2] In those situations, sound levels from wind turbines would be at their lowest. Wind speeds under very stable conditions (Stability Class G) are generally too low to generate electricity and thus the wind turbines would produce little or no noise. As a result, worst-case conditions for wind turbines tend to be under moderate nighttime inversions. An analysis of wind turbine noise under stable conditions is provided later in this report.

6.2. MASKING

As mentioned above, sound levels from wind turbines are a function of wind speed. Background sound is also a function of wind speed, i.e., the stronger the winds, the louder the resulting background sound. In areas that are covered by trees and bushes, such as is found in this region, the effect is amplified. Combined with the fact that the frequency spectrum from wind is very similar to the frequency spectra from a wind turbine, the sound from a wind turbine is easily masked by wind noise at downwind receivers. Figure 20 compares the sound spectrum measured at Site 1 during a 20 to 26 mph wind event on the ridge to the sound spectrum from a Gamesa G80 wind turbine. As shown, the shapes of the spectra are very similar.

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[2]The amount of propagation is highly dependent on surface conditions and the frequency of the sound. Under some circumstances highly stable conditions can show lower sound levels.

Finally, low frequency sound propagates better than higher frequency sound and tends to diffract more in the atmosphere under inversion conditions. Our modeling takes into account nighttime inversions and the differential atmospheric absorption of low and high frequency sound.

7. SOUND MODELING

7.1. MODELING SOFTWARE

Modeling was completed for the project using Cadna A acoustical modeling software. Made by Datakustik GmbH, Cadna A is an internationally accepted acoustical model, used by many other noise control professionals in the United States and abroad. The software has a high level of reliability and follows methods specified by the International Standards Organization in their ISO 9613-2 standard, "Acoustics – Attenuation of sound during propagation outdoors, Part 2: General Method of Calculation." The standard states,

> "This part of ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level … under meteorological conditions favorable to propagation from sources of known sound emissions. These conditions are for downwind propagation … propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs at night."

The model takes into account source sound power levels, surface reflection and absorption, atmospheric absorption, geometric divergence, meteorological conditions, walls, barriers, berms, and terrain.

A 25 meter by 25 meter grid of modeled receivers was set up covering 12,900 acres (20 square miles) around the site. A receiver is a point on the ground at which the computer model calculates a sound level. In addition, discrete receivers were placed at all residential homes using the Vermont Emergency 911 database. In an effort to be conservative, we excluded sound attenuation from forest cover. The model included the 11 existing turbines at a height of 40 meters above ground and the 17 proposed turbines at 78 meters above the ground.

Details of the modeling input assumptions are shown in Appendix A.

7.2. MODELING RESULTS

We modeled several different scenarios to quantify sound levels from the project:

1) The proposed Deerfield wind turbines only, assuming all 17 are operating at their highest rated sound power.

2) The existing GMP wind turbines only, assuming all 11 are operating under the highest sound emissions derived from the recent monitoring data.

ATTACHMENT 4A

CONFLICT OF INTEREST AND OBJECTIVITY CERTIFICATION

USDA FOREST SERVICE, REGION 9
GREEN MOUNTAIN NATIONAL FOREST
and
DEERFIELD WIND LLC

For Oversight and Coordination of the Environmental Analysis Process and Preparation of the Searsburg Wind Power Project Environmental Impact Statement

ATTENTION

False statements in the following certification are punishable by fine and imprisonment (U.S. Code, Title 18, Sec. 1001). Read the certification carefully before completion and execution.

CONFLICT OF INTEREST AND OBJECTIVITY CERTIFICATION

I certify that Environmental Design and Research, P.C. (EDR) is a consultant retained by Deerfield Wind LLC to conduct an analysis which will result in the preparation of an Environmental Impact Statement for the proposed Searsburg Wind Power Project Special Uses Authorization. The project is located on the Green Mountain National Forest in Vermont. I certify that Environmental Design and Research, P.C. (EDR):

1. Has no financial or other interest in the outcome of the environmental analysis process and the resulting environmental documents; and

2. It is not financially dependent upon the project proponent (Deerfield Wind LLC).

I further certify that I am authorized by Environmental Design and Research, P.C. (EDR) to sign this certification on its behalf and that all of the statements made are true, correct, and to the best of my knowledge are made in good faith.

[signature] 2/13/07

Authorized Signature Date

USDA

United States
Department
of Agriculture

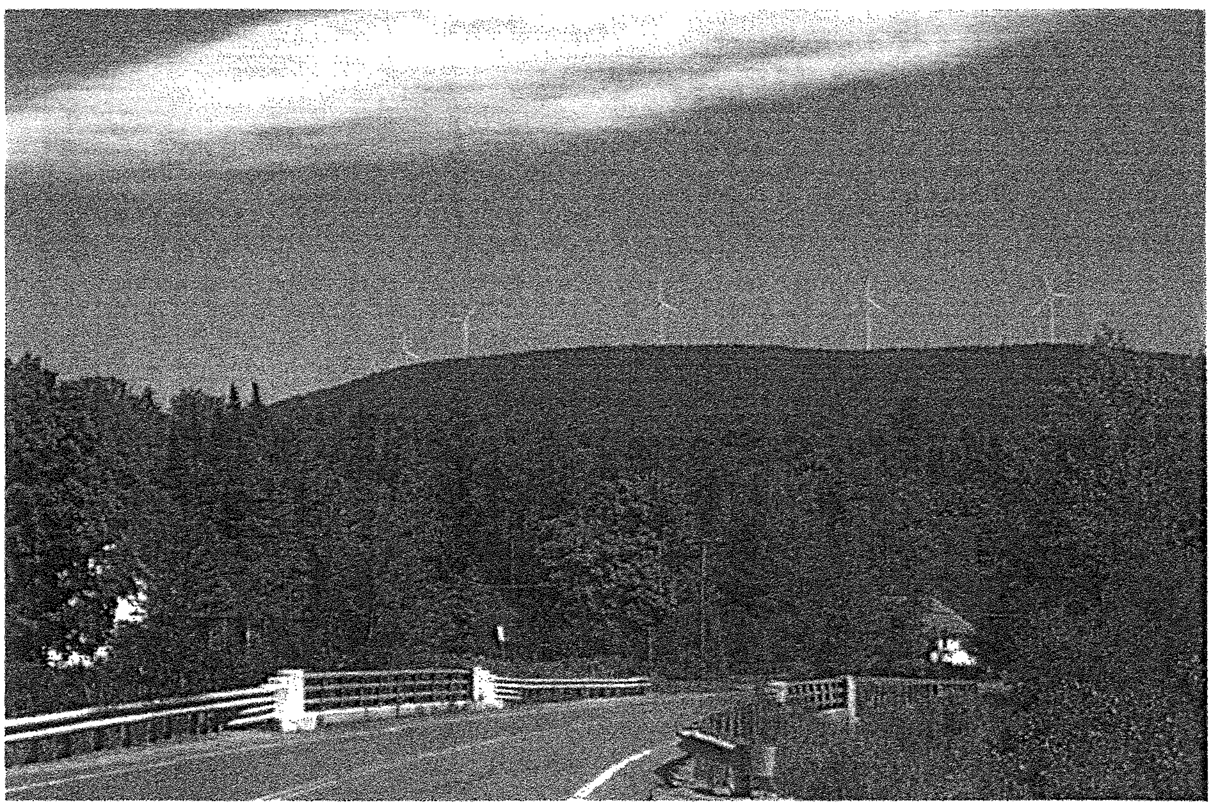
Forest
Service

September
2008

Draft Environmental Impact Statement

Deerfield Wind Project

Manchester Ranger District, Green Mountain National Forest
Towns of Searsburg and Readsboro, Bennington County, Vermont



The increased production and transmission of energy in a safe and environmentally sound manner is essential to the well being of the American people. In general, it is the policy of this Administration that executive departments and agencies shall take appropriate actions, to the extent consistent with applicable law, to expedite projects that will increase the production, transmission, or conservation of energy.

The Project is consistent with Executive Order 13212.

Important goals of the May 2001 National Energy Policy are to increase domestic energy supplies, modernize and improve our nation's energy infrastructure, and improve the reliability of the delivery of energy from its sources to points of use. The use and occupancy of federal lands is recognized as an important element in facilitating the exploration, development, and transmission of affordable and reliable energy to meet these goals.

Title II of the Energy Policy Act of 2005 seeks to increase the use of renewable energy resources for electric generation. Section 211 of the Energy Policy Act of 2005 states that:

It is the sense of the Congress that the secretary of the interior should, before the end of the 10 year period beginning on the date of enactment of this Act, seek to have approved non-hydropower renewable energy projects located on the public lands with a generation capacity of at least 10,000 megawatts of electricity.

The Project is consistent with Title II of the Energy Policy Act of 2005, as it would help meet the stated need for the production and transmission of renewable energy, and thereby serve the public interest. The Project's location on public lands and the Forest Service's role in its implementation is also consistent with the Energy Policy Act of 2005.

1.3.2.2 Need to Reduce Fossil Fuel Use for Electric Energy Generation

In the Northeast, a major shift has occurred over the past decade toward the use of natural gas to supply electric energy. Increased demand for natural gas and the inability of the supply to keep pace with demand has led to volatility in prices and supply concerns. Natural gas has become a marginal fuel in the Northeast, and therefore gas price volatility has led to volatile electricity prices. This is evident in the short period of time since the filing of the application for a land use authorization in 2004. Since that time, the price of commercial natural gas has increased from $9.05 to $11.76 per thousand cubic feet (EIA, 2008a) and the price of oil from $34.83 to $108.98 per barrel (EIA, 2008b). Recently oil prices have exceeded $140 per barrel. The Department of Energy has identified a need for additional sources of energy to offset New England's dependence on natural gas.

Emissions from fossil fueled electric generation sources contribute to acid rain, which has been implicated in damage to forests and other vegetation as well as human health effects. Carbon dioxide (CO_2) from the combustion of fossil fuels has also raised concerns about greenhouse gas effects and global climate changes that could occur as a result. Nitrogen oxides (NO_X) are formed in the combustion process primarily as a result of the thermal reaction between nitrogen and oxygen (introduced in the combustion air) under the elevated temperature conditions inherent in

Supplemental Draft Environmental Impact Statement
Proposed Deerfield Wind Project
Abstract

Proposed Action Location:	Towns of Searsburg and Readsboro Manchester Ranger District Green Mountain National Forest
Lead Agency:	USDA-Forest Service Green Mountain National Forest
Responsible Official:	Colleen Pelles Madrid, Forest Supervisor Green Mountain and Finger Lakes National Forests 231 North Main Street Rutland, Vermont 05701
For Further Information:	Bob Bayer, Project Coordinator Manchester Ranger District 2538 Depot Street Manchester Center, Vermont 05255 (802) 362-2307 ext. 218

Abstract: The Supplemental Draft Environmental Impact Statement (SDEIS) documents analysis of the Deerfield Wind Project, proposed in the Towns of Searsburg and Readsboro, Bennington County, Vermont. The Proponent, Deerfield Wind LLC, has applied for a land use authorization to construct and operate a 17-turbine 34 Megawatt commercial wind energy facility on up to 80 acres of National Forest System land on the Manchester Ranger District of the Green Mountain National Forest. The Project is proposed on two ridges located east and west of Route 8. This SDEIS has been prepared pursuant to Section 102 (2)(c) of the National Environmental Policy Act (NEPA) (1969 as amended). The SDEIS documents a detailed analysis of the environmental impacts of the Proposed Action and three alternatives for development of a wind facility on this site. The four alternative courses of action have been evaluated in terms of direct, indirect, and cumulative impacts on natural, physical, and socio-economic resources. These include: A) the Proposed Action consisting of 17 turbines as submitted by Deerfield Wind, LLC; B) Alternative 1, No Action; C) Alternative 2, or the Reduced West alternative, a reduction in turbines on the ridge west of Route 8 from 10 to eight (for a total of 15 turbines); and D) Alternative 3, or the East Side Only alternative, which only includes turbines on the ridge east of Route 8 (for a total of seven turbines). This document meets NEPA requirements to analyze a reasonable range of alternatives and disclose potential physical, biological, and social effects related to the proposed Project. This document also presents the Purpose of and Need for the Proposed Action, identifies significant and other issues raised during the scoping process, describes the affected environment, and identifies potential design criteria and mitigation measures to avoid or reduce impacts.

This SDEIS responds to public comments received on the Draft Environmental Impact Statement (DEIS), released in September 2008. It has also been updated with new information made available since release of the DEIS, including culmination of the state Public Service Board process and issuance of the Certificate of Public Good. Once released for public comment, reviewers should provide the Forest Service with their comments on this SDEIS during the required comment period. The Forest Service will analyze and respond to those comments during preparation of the Final Environmental Impact Statement and Record of Decision. Comments on the SDEIS should be specific and should address the adequacy of the document and the merits of the alternatives discussed (40 CFR 1503.3). Comments will be accepted for a minimum of 45 days following publication of the Notice of Availability of this SDEIS in the *Federal Register*.

1.3 Purpose of and Need for Action

The Proposed Action for the purpose of analysis is to issue a land use authorization for the use and occupancy of up to 80 acres of land in the Green Mountain National Forest for construction and operation of a utility-scale renewable wind energy facility in the Towns of Searsburg and Readsboro, Vermont.

1.3.1 Purpose and Need Statement

The Purpose and Need for the Proposed Action is to:

(1) work toward implementing the 2006 Forest Plan goals and objectives, and the National Energy Policy. Renewable energy is a growing part of the U.S. energy future. National mineral and energy policies recognize development of federal energy resources to meet the nation's continuing energy needs. The Proposed Action contributes toward meeting the need for development of renewable energy resources in an environmentally sensitive manner as embodied in GMNF Forest Plan goals and objectives, specifically goals 11, 5, and 17. The Proposed Action works toward meeting the goals and objectives of the May 2001 National Energy Policy as expressed in federal law and policy including Executive Orders 13212, 13423, and 13514 and the Energy Policy Act of 2005, with the purpose of encouraging development of a utility-scale renewable energy facility on federal land consistent with applicable laws, plans and environmental protection;

(2) fulfill the agency's obligation to consider this site-specific wind energy development proposal. Once a formal application was accepted according to Forest Service regulations 36 CFR 251.54(g)(2)(i), the Proposed Action must be independently evaluated to determine whether the actions proposed at this site, as presented by the Applicant, are consistent with applicable federal law, policy, and the Forest Plan, and can be authorized; and

(3) give due consideration, in the review of the application, to the findings of the Vermont PSB.

1.3.1.1 Forest Plan Needs

As required by the National Forest Management Act (NFMA), the Forest Plan sets a number of multiple use goals and objectives that includes a description of "the desired future condition of the Forest and identification of the quantities of goods and services that are expected to be produced or provided during the planning period." Forest-wide goals and objectives are used to measure progress achieved by implementing the Forest Plan. Forest goals are not requirements to be met by a specific date; they describe future desired conditions to be achieved. Forest objectives are concise, time-specific statements of measurable planned results or outcomes that are needed to achieve established goals.

One of these goals, Goal 11, is to "provide opportunities for renewable energy use and development" on GMNF lands with the objective of increasing "opportunities for renewable energy use and development."[1] As such, Goal 11 provides the basis and framework for scoping the reasonable range of alternatives as project sites that use GMNF lands (see Chapter 2.0).

[1] Goal 11 applies to the use and management of all lands in the Green Mountain National Forest. A second objective of Goal 11 relates specifically to energy efficiency and alternative energy sources for Forest Service facilities.

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GEOFF H. HAND
ANDREW N. RAUBVOGEL
EILEEN I. ELLIOTT
OF COUNSEL

To: Brian Dunkiel
From: Geoff Hand
Re: Initial Analysis of Alternatives to the Proposed Searsburg Expansion Project
Date: September 26, 2005

The purpose of this memo is to identify the range of alternatives that should be considered in an Environmental Impact Statement ("EIS") for the proposed Searsburg Expansion Project ("Proposed Action" or "Project"), and to evaluate the extent to which each alternative should be considered in the EIS. The memo begins with a brief review of case law relevant to an evaluation of alternatives under the National Environmental Policy Act ("NEPA"); then briefly describes the Proposed Action's Purpose and Need; and finally moves on to outline and evaluate the broad groups of alternatives that might be considered in the Proposed Action's EIS.

The memo primarily focuses on identifying the factors that indicate whether each alternative – or group of alternatives – may be reasonable in light of the Proposed Action's identified purpose and need. This memo is not meant to serve as a complete or final evaluation of alternatives, or as a final determination on the merits of any alternative. Other reasonable alternatives may be identified during the EIS process, and each reasonable alternative will be evaluated in further detail, as appropriate, during the EIS process.

Based on this initial evaluation, the EIS will need to initially screen alternative locations for wind generation on the Green Mountain National Forest, as well as alternative configurations for the Proposed Action at the site surrounding the existing Searsburg Wind Farm, to determine if they are reasonable.

It may also be necessary to initially screen other methods for generating renewable energy on the Green Mountain National Forest, such as hydroelectric, biomass, methane or solar energy. However there are numerous questions about the technical and economic feasibility, as well as environmental consequences of these alternatives, and more information on each alternative should be developed during the scoping process before a conclusion can be reached on their reasonableness.

Fossil fuel generation, nuclear energy generation, and energy conservation methods likely will not require detailed analysis in an EIS, as they fail to meet the purpose and need of the Proposed Action. In addition, the Forest Service likely will not need to consider alternative locations for the Proposed Action on state or privately owned land, as these alternatives likewise

In certain circumstances, when presented with specific proposals – such as a proposal to develop a specific type of energy generation facility, or a proposal to develop a project at a particular location – agencies may limit consideration of alternatives to *only* those specific energy generation methods or locations.[11] However, CEQ guidelines generally caution against narrowing consideration of alternatives to *only* those alternatives acceptable to an applicant, and courts have previously invalidated such limited alternatives analyses.[12] As a result, an adequate alternatives analysis should consider, be guided by, and give substantial weight to the applicant's proposed project, but it should not be restricted to consideration of that alternative alone.

(4) <u>The Extent of Analysis Required for each Alternative is related to the Reasonableness of the Alternative.</u>

An EIS must provide an adequate discussion of each of the reasonable alternatives to the proposed project. The extent to which each particular alternative must be discussed is also guided by a "rule of reason." [13] Thus, the level of analysis for each alternative is directly related to the reasonableness of the alternative. With respect to alternatives that are unreasonable, and are eliminated from detailed study, NEPA requires only a brief discussion of the reasons for their elimination.[14] On the other hand, NEPA requires an agency to "rigorously explore and objectively evaluate reasonable alternatives." 40 C.F.R. 1502.14(a). The agency's discussion of reasonable alternatives "must go beyond mere assertions and provide sufficient data and reasoning to enable a reader to evaluate the analysis and conclusions and to comment on the

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[11] *See Pit River Tribe v. BLM*, 306 F. Supp. 2d 929, 939-41 (D. Cal. 2004) (upholding Bureau of Land Management (BLM) decision not to review other locations when evaluating a site-specific proposal to develop geothermal energy generation facility on BLM land based, in part, on BLM's previous consideration of other methods of energy generation alternatives in a broader programmatic EIS).

[12] Forty Most Asked Questions Concerning CEQ's NEPA Regulations, 46 FR 18026 (March 23, 1981) ("Section 1502.14 requires the EIS to examine all reasonable alternatives to the proposal. In determining the scope of alternatives to be considered, the emphasis is on what is "reasonable" rather than on whether the proponent or applicant likes or is itself capable of carrying out a particular alternative. Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant."); *see Van Abbema v. Fornell*, 807 F.2d 633, 638 (7th Cir. 1986); *Simmons v. United States Army Corps of Eng'rs*, 120 F.3d 644, 669 (7th Cir. 1997); *S. Utah Wilderness Alliance v. Norton*, 237 F. Supp. 2d 48, 53 (D.D.C. 2002).

[13] *Citizens Against Burlington,* 938 F.2d at 195 ("rule of reason governs both *which* alternatives the agency must discuss, and the *extent* to which it must discuss them") (emphasis in original).

[14] 40 C.F.R. § 1502.14(a); *Sierra Club v. Dombeck*, 161 F. Supp. 2d 105, (D. Conn. 2001).

Comments on Deerfield Wind Project
<u>Range of Alternatives Issue Assistance</u>
Green Mountain National Forest
December 19, 2005

<u>Paul/Bob</u>: Thanks for the opportunity to review this process for developing the range of alternatives on the Deerfield Wind Project. Most of the time I'm knee deep in appeals related to timber sales. This is a refreshing change, and came in at a time when I had a reduced appeals workload. I might note that either Jim or Ron may have different opinions. I'm giving you my first impressions as it relates to my understanding of NEPA and my past experiences related to Region 9 appeals. I can assure you, *"Not having an adequate range of alternatives"* will be an issue in any future appeals for this project.

I want to commend you for trying to iron out differences and seek a common understanding with the USFWS and EPA. From reading their letters, it's apparent that a keen interest exists from both agencies. Working with them up-front should help alleviate some concerns. At the least we will have an opportunity to gain some valuable face-to-face input on what they expect.

The process you propose appears to be logical. As someone reviewing the Record, I would want to see a step-by-step procedure whereby pubic comments on different alternatives were sifted from a very broad list to something that was more manageable/reasonable. The table you propose should be a good starting point for summarizing the different alternatives and indicating how the selection was made to arrive at the final mix. I will talk a little more about the table later.

I also like the approach for identifying how best to outline what is required by NEPA. The contractor walks through the law, associated regulation, and then gives interpretation using established case law. I have no problems with the 4 main analysis categories in the document (e.g., *"An Agency Need Only Consider 'Reasonable' Alternatives"*). Of course, Ron would know better if the case law examples are appropriate. <u>My concern lies with how we interpret Item 3</u> -- *"The Scope of Alternatives Evaluated Should Take into Consideration Both the Agency's Underlying Statutory Authority and the Private Developer's Objectives."* The write-up is good and the concepts applicable, but when we go to apply them to the Searsburg Expansion, I fear we may have gone a little too far.

<u>Geographic Scope of Analysis</u> (p. 10):
I believe we have narrowed too far the geographic scope of analysis for the alternatives. We place too much emphasis on our policy to utilize National Forest land for renewable energy resources. Yes, we have that direction, but it's not exclusive of the fact that we also have to manage for multiple resources in the best pubic interest. I cannot come to the same conclusion as the author did:

> *"Based on these considerations, it is both rational and reasonable for the Forest Service to limit its evaluation of alternatives to alternatives that*

can be implemented on National Forest land. As a result, consideration of alternatives to the Proposed Action on state-owned or privately held land should not be required." (p. 10).

I base my concerns on several points:

Is looking at private land for development a "reasonable alternative"? I believe so. CEQ states that an EIS should present the environmental impacts that sharply define the issues and provide a clear basis for choice.

- Issues are often developed though public comment – Your work so far indicates the public is concerned about development on NFS lands. The Searsburg site is also apparently next to an area held near and dear by some members of the public promoting additional wilderness ("Alternative" Column in Table).
- USFWS and EPA have expressed a concern that alternative development should be expanded to include private and state land.
- CEQ regulations provide further direction to "include reasonable alternatives not within the jurisdiction of the lead agency".
- A logical person may want to know why the current facility could not expand on private land. It may be apparent to those who work on the project, but not to others who know little about the site. What, if any, options are available? I don't believe that the current purpose and need automatically jumps you to the conclusion that NFS land is the only reasonable alternative.
- We made some promises within the Draft EIS for issuing new permits (Plan Revision) stating that a new Forest Plan will contain general requirements *"... such as ensuring there are no available alternatives using private land ...."* (DEIS, p. 3-284). This is followed up in the Plan with the statement, *"Special use authorizations should be issued only when there are no reasonable private land alternatives, or when the use has a clear and significant public benefit."* We may try to hang our hat on the last part of this statement, but I believe that would be ill-advised.

It appears that some court cases support limiting the scope to what the applicant would like, but we also have Plan direction that we need to follow. We need to be sure we can say, *"It's in the public interest"*. Without looking outside of the National Forest boundary, I'm not sure how we would make that conclusion. "Substantial weight" (p. 5) to the private developer's objectives, does not mean abandonment of our agency role.

I don't agree with the EPA whereby they would like to see a discussion that covers the entire New England Regional Power Grid. The scale of analysis needs to be smaller. I might suggest that we try to build on work already done (perhaps by the State or other Federal agencies) and then tie back to areas around the Forest. I would assume that certain factors (criteria) are important to building a site like this (beyond just the fact it needs to be in a wind location). One of the items might be the availability of transmission facilities (power lines to tie to the grid). If readily available transmission facilities are not available at other wind locations, this may be one reason to consider the current site and expansion on National Forest land. I believe we must have some kind of analysis at a scale that considers possibilities beyond just National Forest land, and then weed it down to what is practical considering this proposal.

Generally the write-ups related to the different energy developments (e.g., "Fossil Fuel Alternatives", "Nuclear Energy Alternatives", ...) look good. However, I would remove the reference to only providing these on "Forest Service land" – Again for the reasons I stated above. I believe the discussion on "State and Private Land" development needs to be re-written (p. 20).

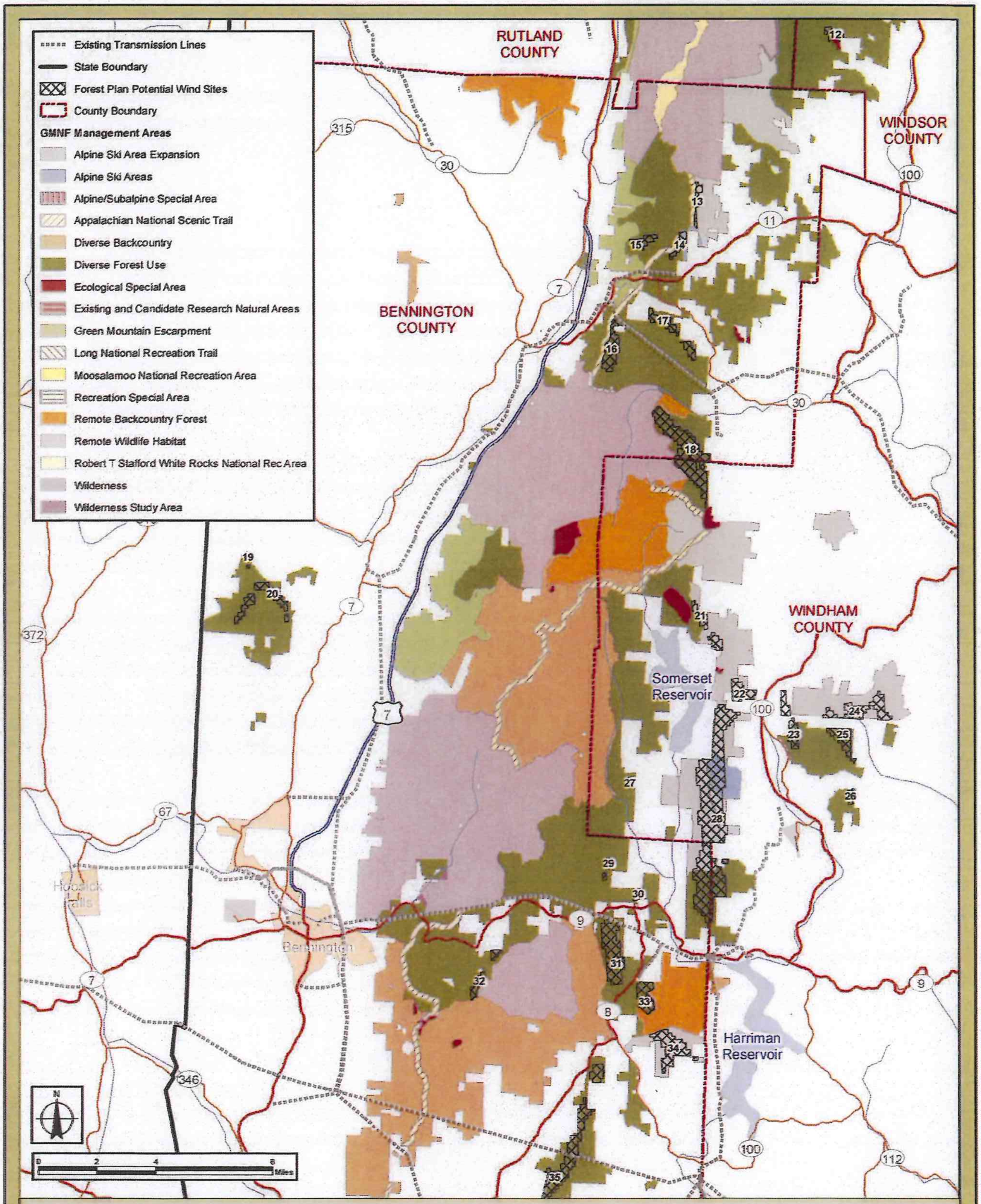
Definition/Categories of Reasonable Alternatives (p. 10):
We need to be aware that NEPA does require us to look at all alternatives – Even those outside our jurisdiction or the capability of the agency (See CEQ 40 Questions). It's written, *"Statutory limitations on an agency decision making cannot limit the range of alternatives an agency must consider."* I believe the fact that we are only looking at a "violation" of the statutory limitations as one factor to consider, should support our case. We just don't want to rely on statutory limitations as a major item kicking out an alternative.

Initial Screening of Alternatives Table
I like the idea of having a table that summarizes your findings. Nevertheless, the Project Record and eventual EIS still must have some discussion and rationale documented to include/exclude different alternatives. I would expect this discussion to be a little more involved than what the table will show.

The "Alternatives" as currently listed in the Table seem confusing. I question that some are not alternatives at all, but just statements (e.g., *"Do not proceed until the FMP is final"; "Sufficient information should be collected on all reasonable alternatives by an objective evaluation."*). I would also suggest you group alternatives under some headings within the Table (e.g., Conservation Alternatives, Alternatives on Private Land, Alternatives Adjacent to Existing Searsburg Site, ...). It would help to focus the discussion.

That's it for now. I'm sending this along in an informal note prior to the holidays – Not knowing what time I will have when I return. I would be happy to get on a conference call to discuss my comments or any from Jim and Ron. They may have a different perspective on what you presented. I believe this is an important issue that needs resolved. Thanks again! I appreciate the opportunity to review.

JOEL



Deerfield Wind Project
Searsburg & Readsboro, Vermont
FIGURE 2-1B:
POTENTIAL SITES FOR WIND RESOURCE DEVELOPMENT, MANCHESTER RANGER DISTRICT
December 2011

Notes:
Base Map: ESRI StreetMap USA, 2006.
Management Areas and Potential Wind Sites: USDA Forest Service, 2006.

To: Bob Bayer July 29, 2009
From: Meg Mitchell

DRAFT

I reviewed EDR's work on the comments to the DEIS that you provided me last week, and their content analysis and summary dated June 30, 2009. Listed below I have provided my suggestions for moving forward to address the substantive comments, or those comments that might result in additional analysis or documentation in an FEIS as we move from DEIS toward Final EIS. I have focused here mainly on the more substantive comments that I believe have the potential to require additional studies, analysis or documentation. As you know, all comments to the DEIS will need to be responded to and addressed. Please ensure that EDR creates in tabular form, a summary list of all comments with a short summary of a proposed response that I can review and approve. Also, I will want to send response letters to all the respondents.

Proposed Approach- SDEIS followed by FEIS

I would propose that we respond with a letter to each of the organizations and agencies that sent us comments to the DEIS and issue a Supplement to the DEIS for only the sections that we will be adding substantive information. Open for 45 days again for comment to give agencies and organizations another chance to comment post PSB decision and with more specific monitoring and mitigations outlined. As the comment period runs, complete other sections and develop FEIS.

I am open to further advice or a contrary opinion about this approach, but here's what I think we would be better off Supplementing first, and taking further comment on, before moving to an FEIS. The Supplement to the DEIS could include:

- Any changes to P&N/Alternatives sections that responds to comments, and improves our explanation while also incorporating a coarse assessment or analysis of other sites on the NFS and surrounding Deerfield. This will hopefully improve and address comments regarding "Why this site vs. some other site? Why here Why now? Questions we got from the DEIS comment period.
- Identifies Preferred Alternative and makes minor changes to West-lite alternative to match what was submitted and ultimately approved by the Public Service Board. Acknowledges PSB decision.
- Adds additional mitigation and specific monitoring plans, including those substantive items that are appropriate for USFS to include from the PSB decision. Note that many of these would be applied to all action alternatives, not just West-lite.
- Revised Wildlife sections that will have substantive edits (Bear, Bat, Bird) with additional and specific mitigation and monitoring for these key species garnering most of the comments. Also adds the additional mitigations agreed to with the State ANR (items not part of the PSB decision). This includes approximately 2000 acres of additional bear habitat offset (via acquisition or easement over the next 5 years) and identification of a special management area in the Forest Plan

(no change in MAs) in cooperation with the State of VT. Again, some of these changes will be applied to more than one, or the preferred alternative.

- Revised Science Panel Appendix.

Visual and Aesthetics

I agree with EDR and the suggestions that some kind of nighttime simulations or photos of similar projects would be useful to the public in their understanding of the projects' visual impact particularly along or in sensitive viewpoints like Wilderness. Please provide this further disclosure in the FEIS. I think it is also may be possible to provide a video or photos on the project web site in the meantime.

I agree that an additional simulation, long-distance from the Appalachian Trail would verify the analysis and help address comments raised regarding possible long-distance visual effects. Please provide this further disclosure in the FEIS. Please also ensure that the effects analysis includes review of effects to any additional viewpoints suggested by those commenting. Additional simulations will not be necessary if the effects to these additional viewpoints are similar or can be described using simulations that have already been provided.

Please also address comments about a "strobe effect" with any information that is available on this topic and its corresponding aesthetic or potential health effects.

All the comments I reviewed regarding the visual resource could be addressed by a direct response to the comment or some additional clarification or disclosure in the FEIS.

Alternatives and Relationship to the Purpose & Need

I would like Ron Mulach (from OGC) and Jay Strand to review this section based on the comments we got from ANR, EPA and DOI. I believe this section could be improved. We may have been confusing to the public in the way we explained the Purpose and Need for the project and then proceeded to examine alternatives that were outside the P&N in our alternatives chart. I'm looking for some suggestions on what specifically will improve this section from Ron and Jay.

The Purpose of the project is to evaluate a site-specific wind energy proposal that the Forest Service received (the same or similar proposal received and being simultaneously evaluated by the Public Service Board). The purpose of this EIS is not to evaluate all potential wind energy sites on or near the National Forest as some commenter's have suggested. Such an evaluation could only be programmatic in nature and could never fully evaluate the site specific implications to the degree required for permitting, under the NEPA process. We simply can not both cover every possible wind or energy generation possibility AND fully disclose the effects of development of each of these sites in a site specific way.

Still, I do believe that some information regarding the relative suitability of this site to address the public's concern for why we are evaluating this particular site, at this particular time, relative to the other possible sites needs further discussion (a hard look at why here why now). I would recommend that a "coarse screen assessment" of the other potential sites on NFS lands and private lands surrounding the Deerfield project area based on the presence or absence of certain economic, social and environmental indicators or thresholds (using the same key issues in the Deerfield analysis) would be helpful to address the agency and public comments. I believe EDR and Iberdrola has a start on such an analysis. I also believe that I'm on record as having requested this analysis be done and included before. I believe this assessment and it's results will show less than a half dozen (if that) sites for wind power on the NFS lands that are currently both feasible and suitable. I also believe it will show that the Deerfield site is one of the top sites to consider (because it's been being considered a top site for over 20 years and has wind on it already), and is timely for consideration (the State must have thought so too).

I believe some parts of the 'alternative' screening table and process that was described in the alternative section might better be moved to the Purpose and Need section, specifically as providing some background and further explanation of the "Need" for the project. I believe the description of options we 'walked through' early in this process of evaluating whether or not to accept this application, and subsequent discussion of biomass and other options, was to assure ourselves that we were thinking through the purpose and need for this project, not as an evaluation of alternatives under the purpose and need. This may be why some of the agencies and comments express confusion about our intentions, and the "narrowing" of alternatives. It was never the Forest Service's intent to pursue anything but an evaluation of the possible expansion of a wind energy generation facility from the private land at Searsburg on to the public land.

In my mind, we are evaluating this particular site, at this particular time, because our analysis and screening shows that this site is one of the better sites, and it is timely for review under a site-specific analysis.

I do not disagree with some of those commenting, that a State-wide screening or evaluation of potential wind energy sites based on some basic environmental criteria for relative comparisons between sites would be useful. However, that's not the EIS we are doing here, and could be done concurrently while we conduct site specific evaluations of sites. I maintain that such an analysis at best would be programmatic and not capable of the detailed studies and analysis being done under this EIS. We do not have the capability or roughly $1Million in funding to fully evaluate (other than a coarse screen assessment based on known information) several different wind energy sites at one time.

Also, sites on or off the NFS lands are not mutually exclusive and still require site specific analysis and review under both State and Federal laws. The concurrent State review process has the same issue, and even requires a narrower range of alternatives than the Forest Service EIS. To fully evaluate a wind energy proposal under the State's Public Service process, only one alternative can be submitted and evaluated.

Biological Resources

I concur with EDRs recommendation to include more information from the Science Panel in the bear section and also to properly capture ANRs testimony based on their comments to the DEIS. I would add the additional mitigations and monitoring agreed to with ANR and appropriate requirements we should match from the PSB decision. When it comes to bear monitoring studies, I do want to acknowledge that there will be a hair snag study and a bear GPS study in the project area and address the cumulative effects of these on bears. I do not look at these two monitoring studies as being required mitigation however. They will both be occurring after most of the effects to bears have occurred, and will likely add to effects to bears, but they are not likely to change the projects effects to bears. I do think the GPS study will yield benefits largely to future projects and access management in the area, as part of a cooperatively managed area by the State and FS. I think the snag study may be only slightly helpful to managing the Deerfield site over time. Most of the benefits of the bear monitoring and studies will be to the development of other possible sites in the State.

Again I concur with EDR recommendations that we should include the additional analysis of the date requested by DOI (radar data combined with weather data to shed light on bird movement patterns). I believe I have requested this be included in the past as well. I also concur that we need to be more specific and include the exact monitoring, thresholds and adaptive management strategies that will be used by this project. I do need further advise from John Sease on the practicality of DOI's request for additional studies that they cite in their letter. EDRs analysis of DOIs comments state that there were really no requests for additional studies, but that's not my reading of DOIs comments. They seem to feel that we need additional studies that they've requested earlier in their August 2005 scoping document, and we should respond directly to this. Please refresh my memory. Is there some additional data we should consider gathering in August?

With regard to bats, I concur with EDRs assessment that we should include more specific monitoring, thresholds and adaptive strategies. We could do this by adopting USF&WS suggestion to evauate a range of possible impact scenarios and what we will do about them when/if they occur. We may also want to update the section on WNS in light of more recent information. Also, John, please consult with Rob on when he's planning to complete the review (SIR) of the GM Forest Plan relative to WNS. This might be useful to have completed before issuing the FEIS.

We should consider additions requested for analysis of Reptiles & Amphibians, Forest Fragmentation (breading bird territory maps and analysis) and Moose including any known information on effects from turbine wake or noise. I agree with EDRs assessment, this is additional information and disclosure we can provide in the FEIS in response to comment.

Historic Resources

I need more information and consultation with Dave Lacy on EDRs assessment and how to address comments regarding the need for additional analysis in this section, before I can decide if this further disclosure is substantive.

Noise

Adjust the attenuation assumptions and potential effects based on the revised Alternative modeling and change the discussion to reflect this modified analysis. Add any disclosures on effects of this noise to wildlife directly in the FEIS and response to comments.

Recreation

We should be able to describe more completely the methods we will use for closure of the site to access and our ability to keep ATVs from using the site. Add any additional recreation use data we have.

Regulation and Policy

Please consult Ron Mulach on the Lamb Brook issue, but I do not believe any further assessment is necessary. This can be addressed in the FEIS and response to comment.

Non-compliance with the Forest Plan and Forest Service mission can be addressed in a response to comment. I believe our P&N speaks strongly to this issue, but that's something Jay and Ron can address in their review of the P&N.

Bias of consultants- Address in response to comment.

Inadequate treatment of cumulative impacts and indirect impacts. This should be addressed and reevaluated in light of additional mitigations. Please take a close look at the sections that comments highlighted to see if there are improvements in disclosure that need to be made.

Coordination limiting relative to the 248 process and other process concerns will be addressed through the Supplement.

Lack of detail and commitment to regarding mitigation and design criteria does need to be addressed as stated above.

I am not interested in fully evaluating other off-site alternatives, but I do think we can add a coarse screen analysis of other sites. We won't know if these other sites have bear scarred beach or the extent that they do, even if we can tell there's beach or not.

Socio-Economics

I believe most of these can be addressed with additional information from the PSB decision and testimony.

Water Resources

Please include more detail on the proposed SPCC and stormwater management plan. Refer to permit process for this specific aspect is provided for in the decision.

Meg Mitchell

APPENDIX I

Analysis of Other NFS Sites for Wind Energy Development

ignoring wind direction and undesirable downwind spacing. A more detailed analysis was then completed that looked at wind direction and topographic orientation for each of the 16 sites meeting the preliminary size criteria. This screen eliminated 12 sites due to insufficient size or poor wind resource: they truly could not support 15 turbines once the wind resource and orientation was considered. As explained by the Applicant, most of these eliminated 12 sites had irregular features (knobs that would create an unreliable wind source), did not have consistently good (prominent) elevation, or were too small to accommodate a utility-scale development.

The four sites left included Site #1, Site #16, Site #24, and Site #61. Each of these sites were further considered by the Applicant, but also eliminated for the reasons described below:

- Iberdrola Site #1 corresponds to GMNF Site #35. The wind resource was rated good, but Iberdrola believed incorrectly that this land area was "reserved" for testing by another developer. It also is a considerable distance from transmission lines (3.5 miles, according to their calculations).
- Iberdrola Site #16 roughly corresponds to GMNF Site #32. The Applicant determined that this site has marginal elevation and would require too great a distance between turbine strings to be practical. Note that the Forest Service, in its independent review of the Applicant's analysis, found that much of the land area of Iberdrola Site #16 does not lay within any of the 37 sites identified as suitable by the Forest Plan. The small portion of Site #16 that overlaps GMNF Site #32 is only large enough to support up to 6 turbines. See Table I-2 below.
- Iberdrola Site #24 corresponds to Forest Plan Site #28. The Applicant eliminated this site due to some of the area not lying prominently enough along a long ridgeline, which would result in separate small segments of turbine strings. More importantly, the site is close to populated developments (visual concerns), adjacent to the Mt. Snow Ski Area, and the ridge proposed for development contains some key recreation trails.
- Iberdrola Site #61 corresponds to Forest Plan Site #8. This site is located in the northern half of the GMNF. A large area, it has very irregular orientation that would result in turbine strings in some remote areas only capable of supporting 1 or 2 turbines. Iberdrola determined that the high round prominent peak in the center of the area would create up-flow and turbulence issues, reducing the length of ridgeline with sufficient wind resource. Based on this data, the site could only support about 24 MW of development scattered over the area in multiple strings.

Analysis of Forest Plan Wind Sites

The next source of data for the site analysis was completed by the third party contractor completing the Deerfield Project NEPA analysis. edr digitized the 37 sites identified in the Forest Plan as potentially suitable for wind power development, and collected key data for each site, including total acres, distance to transmission lines and highways, ridge length and orientation, distance to the AT/LT, and the estimated number of turbines that the site could accommodate. This data is presented below in Table I-2. The estimated number of turbines calculation did not consider in detail any factors that could reduce that number such as irregularities in elevation, topographic features, and orientation. The estimated number of turbines was determined by digitizing ridgetops, assigning ridge orientation (N-S vs. E-W),

Table I-2: Sites Identified in the Forest Plan as Potentially Suitable for Wind Power Development

GMNF Site Number	Management Area(s)	Total Acres	Distance to Transmission Lines (Miles)	Distance to Highway (Miles)	Highway	Ridge Direction(s)	Total Ridge Length (Feet)	Estimated Number of Turbines	Distance to AT/LT (Miles)
1	Alpine Ski Areas	350.58	0.82	2.56	VT-17	E-W, N-S	6,635	5	0
2	Alpine Ski Areas	392.80	2.08	2.18	VT-100	E-W, N-S	10,306	8	0
3	Diverse Forest Use	442.36	6.18	3.46	VT-125	N-S	3,319	4	2
4	Diverse Forest Use	131.52	3.53	1.96	VT-116	N-S	1,461	2	5.4
5	Diverse Forest Use	484.01	6.12	1.34	VT-100	N-S	11,654	12	2.6
6	Moosalamoo Recreation and Education Area	275.83	0.47	1.49	VT-125	E-W, N-S	3,258	4	4.2
7	Moosalamoo Recreation and Education Area	168.03	2.42	1.56	VT-125	E-W, N-S	2,883	3	1.8
8	Diverse Forest Use, Remote Wildlife Habitat	2,351.50	0.83	0.46	VT-73	N-S	31,502	32	1.7
9	Diverse Forest Use	99.52	0.00	0.19	US-4	E-W, N-S	3,101	3	0.1
10	Diverse Forest Use	201.37	0.79	1.13	VT-73	E-W, N-S	5,595	5	0.9
11	Diverse Forest Use	79.07	0.17	0.57	VT-73	E-W	2,309	2	3.3
12	Diverse Forest Use	112.66	8.13	2.42	VT-100	E-W, N-S	3,657	3	5.1
13	Alpine Ski Areas, Alpine Ski Area Expansion, Remote Wildlife Habitat	119.87	1.74	1.06	VT-11	E-W	1,979	1	0.1
14	Alpine Ski Areas, Diverse Forest Use	134.43	0.52	0.65	VT-11	E-W	2,067	2	0
15	Diverse Forest Use	187.80	0.74	0.97	VT-11	E-W	2,008	2	0.4
16	Diverse Forest Use	385.42	0.00	0.56	VT-11	N-S	6,314	7	0.1
17	Diverse Forest Use	283.92	0.50	0.35	VT-30	N-S	2,910	3	0.7
18	Diverse Forest Use	1,283.40	0.69	1.91	VT-30	E-W	12,888	7	0.2

GMNF Site Number	Management Area(s)	Total Acres	Distance to Transmission Lines (Miles)	Distance to Highway (Miles)	Highway	Ridge Direction(s)	Total Ridge Length (Feet)	Estimated Number of Turbines	Distance to AT/LT (Miles)
19	Diverse Forest Use	33.08	4.00	2.19	VT-313	N-S	899	1	10.1
20	Diverse Forest Use	392.39	2.97	1.33	VT-7A	N-S	3,809	4	7.7
21	Remote Wildlife Habitat	251.52	5.68	2.04	VT-100	E-W, N-S	2,254	3	1.5
22	Remote Wildlife Habitat	269.68	3.77	0.28	VT-100	E-W, N-S	6,348	6	4.4
23	Diverse Forest Use, Remote Wildlife Habitat	312.55	2.05	0.38	VT-100	N-S	7,853	8	5.8
24	Remote Wildlife Habitat	507.13	3.43	1.52	VT-100	E-W, N-S	8,875	8	7.2
25	Diverse Forest Use	283.96	2.91	2.28	VT-100	E-W, N-S	3,353	4	7.8
26	Diverse Forest Use	47.98	2.38	1.23	VT-100	E-W	677	1	9.9
27	Diverse Forest Use	29.65	4.46	4.00	VT-9	N-S	991	1	3.9
28	Alpine Ski Areas, Alpine Ski Area Expansion, Diverse Forest Use, Remote Wildlife Habitat	3,335.08	0.77	0.72	VT-100	N-S	31,388	32	6.2
29	Diverse Forest Use	49.42	1.21	0.95	VT-9	N-S	3,390	4	3.5
30	Diverse Forest Use	56.08	0.92	0.23	VT-9	E-W	1,387	1	4.9
31	Diverse Forest Use	747.27	0.00	0.17	VT-8	N-S	8,027	9	4.7
32	Diverse Forest Use	164.05	1.54	0.52	VT-9	N-S	5,184	6	1.2
33	Diverse Forest Use	317.29	0.17	0.17	VT-8	N-S	6,828	7	6.5
34	Remote Wildlife Habitat	542.15	0.65	0.87	VT-100	N-S	3,539	4	7.5
35	Diverse Forest Use	1,016.19	0.00	0.19	VT-8	N-S	20,447	21	5.1
36	Diverse Forest Use	113.44	0.15	0.59	US-4	N-S	3,022	4	0.1
37	Diverse Forest Use	192.63	0.00	0.37	US-4	N-S	1,103	2	0.1

- *Issue 4. People are concerned that the Proposed Action will adversely affect the visual resources of the area, especially those important to the character of the ridgelines.* Turbines at either site would be located along ridgelines at similar elevations. Both the proposed site and Site #35 are located a considerable distance from the Appalachian Trail (4.7 miles and 5.1 miles, respectively), from which the turbines would appear very small, and both sites are located in relatively unpopulated areas away from population centers. The proposed site is located in close proximity to the existing Searsburg Wind Facility. A similar situation occurs at Site #35, which is located in close proximity to the Hoosac Wind Project. Although not currently operational, all required permits have been issued, and construction has begun. Because the proposed Project would be similar in form, color, and scale to either the Searsburg and Hoosac facilities, it would repeat an existing pattern in the landscape at either site. This repetition of existing visual characteristics would help prevent visual clutter, and make both the proposed site and Site #35 logical settings for future wind energy development. Therefore, comparable levels of visual impact would be expected at both sites.

Conclusion

Any site deemed reasonable and worthy of further consideration as an off-site alternative of NFS lands must compare favorably to the proposed site. As stated on page 1 of this Appendix, considering an off-site alternative in more detail would only be reasonable if it appeared that site (1) clearly had the potential to result in substantially less overall impacts than what would be anticipated at the proposed site, and (2) potentially could more effectively define and address the significant issues in order to provide the decision maker a clear choice among options (alternatives).

In order to be consistent with the Forest Plan, any alternative GMNF site considered for further analysis must be one of the 37 sites identified in the Forest Plan. As described above, Forest Service screening concluded that of the 37 sites, only one other site, GMNF Site #35, would potentially meet the Purpose and Need for this Project (although it could meet it differently and to varying degrees than would the other action alternatives). Additional data was then collected on Site #35 to allow comparison to the proposed site. Using the factors/criteria defined on page 1 of this analysis, this section briefly summarizes the comparison between the proposed Deerfield site and Site #35:

1. *Wind energy availability*: Both the proposed site and Site #35 have adequate wind resource to produce electricity at a utility-scale.

2. *Proximity to needed infrastructure*: Both the proposed site and Site #35 have transmission lines located nearby or on-site, and both have immediate access to VT Route 8.

3. *Magnitude of potential environmental effects*: Environmental factors evaluated include wetlands and water resources; federally listed threatened, endangered, or proposed species, and Regional Foresters Sensitive Species (TES species); ecological communities; and wildlife habitat, including black bear habitat and state-mapped deer yards. These environmental resources appear to be very similar at the proposed site and Site #35, and therefore, similar levels of impact would be expected.

4. *Significant issues*: Due to the similarities between the proposed site and Site #35, it appears that neither would more effectively address the Project's significant issues.

5. *Location in relation to population centers, towns, and local residences*: The proposed site and Site #35 are located in proximity to one another in similar relatively unpopulated areas.

The Forest Service concluded that Site #35 has very similar characteristics to the proposed Deerfield site, and therefore would be duplicative within the existing range of alternatives already considered for detailed analysis. Site #35 would not more effectively address the significant issues, nor would it substantially avoid or reduce potential environmental, economic, or social impacts when compared to the proposed site. Similar levels of adverse and beneficial impacts would be expected at both sites. Therefore, it would not be reasonable to consider in detail an alternative at Site #35, and it is eliminated from further detailed discussion. Based on the analysis contained herein, there is no need to develop any off-site alternatives to be analyzed in detail in the Deerfield EIS.

Invited Paper

Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document

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ABSTRACT Our purpose is to provide researchers, consultants, decision-makers, and other stakeholders with guidance to methods and metrics for investigating nocturnally active birds and bats in relation to utility-scale wind-energy development. The primary objectives of such studies are to 1) assess potential impacts on resident and migratory species, 2) quantify fatality rates on resident and migratory populations, 3) determine the causes of bird and bat fatalities, and 4) develop, assess, and implement methods for reducing risks to bird and bat populations and their habitats. We describe methods and tools and their uses, discuss limitations, assumptions, and data interpretation, present case studies and examples, and offer suggestions for improving studies on nocturnally active birds and bats in relation to wind-energy development. We suggest best practices for research and monitoring studies using selected methods and metrics, but this is not intended as cookbook. We caution that each proposed and executed study will be different, and that decisions about which methods and metrics to use will depend upon several considerations, including study objectives, expected and realized risks to bird and bat populations, as well as budgetary and logistical considerations. Developed to complement and extend the existing National Wind Coordinating Committee document "Methods and Metrics for Assessing Impacts of Wind Energy Facilities on Wildlife" (Anderson et al. 1999), we provide information that stakeholders can use to aid in evaluating potential and actual impacts of wind power development on nocturnally active birds and bats. We hope that decision-makers will find these guidelines helpful as they assemble information needed to support the permitting process, and that the public will use this guidance document as they participate in the permitting processes. We further hope that the wind industry will find valuable guidance from this document when 1) complying with data requirements as a part of the permitting process, 2) evaluating sites for potential development, 3) assessing impacts of operational wind-energy facilities, and 4) mitigating local and cumulative impacts on nocturnally active birds and bats. (JOURNAL OF WILDLIFE MANAGEMENT 71(8):2449–2486; 2007)

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KEY WORDS bats, birds, methods, metrics, migration, wind energy.

Wind energy is one of the fastest growing sectors of the energy industry (Pasqualetti et al. 2004, National Research Council [NRC] 2007), a relatively recent development that has led to unexpected environmental consequences (Morrison and Sinclair 2004, Manville 2005, Kunz et al. 2007). The large number of raptor fatalities discovered at Altamont Pass in California in the early 1980s triggered widespread concern from environmental groups and wildlife agencies about possible impacts to bird populations (Anderson and Estep 1988; Estep 1989; Orloff and Flannery 1992, 1996). Anderson et al.'s (1999) comprehensive review and analysis of methods and metrics for the study of impacts of wind-energy facilities on birds provided valuable guidelines for assessing diurnally active wildlife but offered limited guidance on methods for assessing impacts on nocturnally active birds and bats. Given the projected growth of the wind-energy industry in the United States and emerging concerns over possible cumulative impacts of wind-energy facilities on nocturnally active birds and bats (Government Accountability Office [GAO] 2005, Manville 2005, NRC 2007, Arnett et al. 2008), we developed this document to supplement the earlier methods and metrics document.

The methods and metrics we consider herein include those suitable for assessing both direct and indirect impacts of wind energy. Direct impacts of wind-energy facilities refer to fatalities resulting from night-flying birds and bats being killed directly by collisions with wind turbine rotors and monopoles. Indirect impacts of wind-energy development refer to disruptions of foraging behavior, breeding activities, and migratory patterns resulting from alterations in landscapes used by nocturnally active birds and bats. Direct and indirect impacts on birds and bats can contribute to increased mortality, alterations in the availability of food, roost and nest resources, increased risk of predation, and potentially altered demographics, genetic structure, and population viability (NRC 2007).

LIMITS OF CURRENT KNOWLEDGE ABOUT IMPACTS ON NOCTURNALLY ACTIVE BIRDS AND BATS

Songbirds

Songbirds are by far the most abundant flying vertebrates in most terrestrial ecosystems, and until recently have been

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among the most frequently reported fatalities at utility-scale wind facilities in the United States. In a review of bird collisions reported from 31 studies at utility-scale wind-energy facilities in the United States, Erickson et al. (2001) showed that 78% of carcasses found at wind-energy facilities outside of California were songbirds protected by the Migratory Bird Treaty Act (16 United States Code 703–712); among these, approximately half were nocturnal, migrating passerines. The number of passerine fatalities reported in other studies has ranged from no birds during a 5-month survey at the Searsburg Vermont Wind Energy Facility, Searsburg, Vermont, USA (Kerlinger 1997) to 11.7 birds per megawatt (MW) per year during a 1-year study at Buffalo Mountain Wind Energy Center, Anderson County, Tennessee, USA (Nicholson 2003). Given the increasing number of installed and proposed wind-energy facilities, the relatively large number of passerine fatalities at wind-energy facilities on forested ridge tops in the eastern United States, such as Buffalo Mountain Wind Energy Center, Anderson County, Tennessee, and the Mountaineer Wind Energy Center, Tucker County, West Virginia has raised concern regarding the potential risk to nocturnally active songbirds (Kerns and Kerlinger 2004, GAO 2005, Fiedler et al. 2007, NRC 2007, Arnett et al. 2008).

Bats

Recent monitoring studies indicate that utility-scale wind-energy facilities in the continental United States have killed considerably more bats than were expected based on early monitoring studies where birds have been the primary focus of attention (NRC 2007). Large numbers of bats have been killed at wind-energy facilities constructed along forested ridge tops in the eastern United States (GAO 2005, Kunz et al. 2007, NRC 2007, Arnett et al. 2008). The highest fatality rates at these facilities have ranged from 15.3 bats/MW/year at the Meyersdale Wind Energy Center, Somerset County, Pennsylvania to 41.1 bats/MW/year at the Buffalo Mountain Wind Energy Center (Fiedler 2004, Kunz et al. 2007, NRC 2007, Arnett et al. 2008). A recent follow-up study conducted at the Buffalo Mountain site reported fatality rates of 53.3 bats/MW/year at 3 small (0.66-MW) Vestas V47 wind turbines (Vestas Wind Systems A/S, Ringkøbing, Denmark) and 38.7 bats/MW/year at 15 larger (1.8-MW) Vestas V80 turbines (Fiedler et al. 2007). Another recent study, conducted at the Maple Ridge Wind Power Project, Lewis County, New York, USA estimated bat fatalities ranging from 12.3 bats to 17.8 bats/MW/year (depending on carcass search frequency) at 1.65-MW Vestas wind turbines (Jain et al. 2007). Bat fatalities reported from most other regions of the United States have ranged from 0.8 bats to 8.6 bats/MW/year, although these estimates were largely based on studies designed to estimate bird fatalities (but see Johnson et al. 2003, 2004, 2005). In addition to these fatalities, bats have been killed at wind-energy facilities located in agricultural areas of southwestern Alberta, Canada (Barclay et al. 2007), and in a mixed woodland–shrub–grassland landscape in north-central Oklahoma, USA (Piorkowski 2006). Little is known, however, about potential risks and fatalities in other regions in North America where wind-energy facilities are being developed at an unprecedented rate.

Challenges to Impact Assessment and Prediction

Predicting impacts on bird and bat populations based on fatalities reported from existing wind facilities presents several challenges. Lack of reliable correction factors for biases associated with searcher efficiency and scavenging make it difficult to derive reliable estimates of fatalities for a given site or season, let alone to compare results from different regions and years to confidently predict cumulative impacts (Kunz et al. 2007, NRC 2007, Arnett et al. 2008). Several studies using radar have been conducted during preconstruction periods in efforts to estimate potential risks to nocturnal migrants. However, to date, none have provided sufficient evidence to reliably predict actual risk. In part, this may reflect the fact that existing sites typically have different ecological characteristics both before and after development (e.g., undisturbed forested ridge top vs. cleared ridge top with installed wind turbines).

Bias correction factors.—Scavengers are known to remove bird and bat carcasses before researchers are able to discover them and, thus, fatality rates will most likely be underestimated unless reliable estimates of scavenging rates are developed and applied to observed fatalities (Morrison 2002). Bias correction factors also are needed to adjust fatality estimates for searcher efficiency. For example, a study in West Virginia used test subjects (fresh and frozen bats or birds) to evaluate searcher efficiency and found that, on average, only about half of the animals were found by human observers (Arnett 2005, Arnett et al. 2008). Moreover, bats killed by wind turbines were twice as likely to be found by human observers in grassland areas compared to those in agricultural landscapes and along cleared forested ridge tops. In a recent study, trained dogs were able to find 71% of the bat carcasses during searcher-efficiency trials at the Mountaineer site in West Virginia and 81% at the Meyersdale site in Pennsylvania, compared to 42% versus 14%, respectively, for human searchers (Arnett 2006).

Causal mechanisms of impact.—Cooperation of the wind-energy industry is needed to help researchers develop a better understanding of how birds and bats interact with wind-energy facilities and to help identify the causal mechanisms of impact (Kunz et al. 2007, NRC 2007). Research and monitoring studies are needed to assess activities and abundance of birds and bats 1) before construction (e.g., before forests have been cleared and linear landscapes have been created); 2) after turbines have been installed (but before they become operational); and 3) after they have become operational, to test hypotheses needed to assess impacts of wind-energy facilities on birds and bats (Kunz et al. 2007, NRC 2007).

Results of such research could help researchers identify and the wind industry implement mitigation measures to avoid or minimize impacts on nocturnally active wildlife at existing facilities. For example, studies using thermal infrared imaging (Horn et al. 2008) and evidence from bat

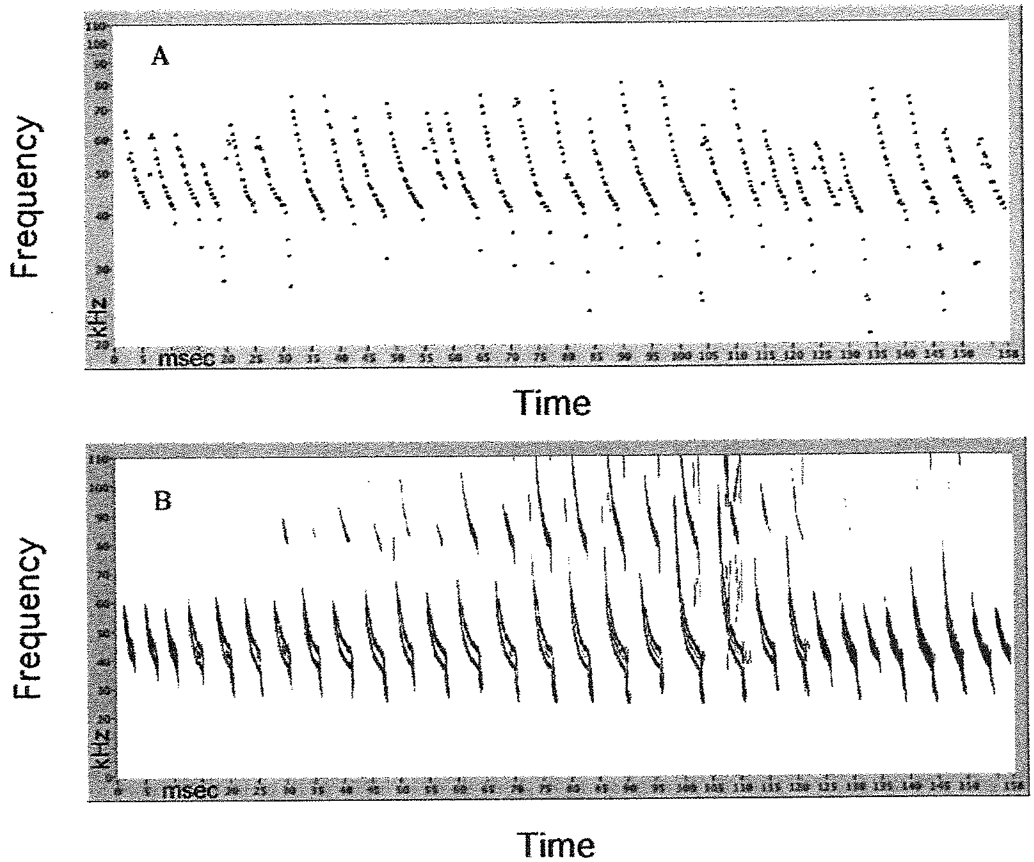

Figure 12. Sonograms of a small-footed myotis (*Myotis ciliolabrum*) flying past a recording bat detector recorded at (Birchim Canyon, near Bishop, CA, USA, 11 Jun 2001). Both panels display the same bat pass rendered with zero-crossing data reduction in the manner of an Anabat bat detector and Analook software (Titley Electronics, Ballina, New South Wales, Australia; A), and in full-spectrum data revealing amplitude distribution using a Pettersson detector (Pettersson Electronik AB, Uppsula, Sweden) and SonoBat software (SonoBat, Arcada, CA; B). In each sonogram the actual time between calls has been compressed to better display the calls. The zero-crossing processed sonogram is plotted with the frequency scale mapped logarithmically as is the convention with Analook, the Anabat processing software (J. Szewczak, Humboldt State University, unpublished data).

species (Siemers et al. 2005). For most species, however, obtaining such data requires that bats be captured, although captures are difficult or impractical to achieve in open environments at the heights of rotor-swept areas. Acoustic, visual, and radar observation methods provide an alternative to capture methods because the former do not interfere with the normal behavior and flight trajectories of bats. In addition, compared with visual methods and radar, acoustic monitoring methods better support long-term monitoring because of their lower data burden and ability to proceed remotely without the need for operating personnel (Reynolds 2006). However, questions remain as to whether migrating bats echolocate continuously while they are flying (Van Gelder 1956, Griffin 1970, Johnson et al. 2005). Thus, methods such as thermal infrared imaging or other night-vision methods should be used simultaneously with acoustic monitoring during expected times of migration until this issue can be resolved.

Acoustic detection and monitoring of bats begins with acquisition of a signal using a microphone sensitive to ultrasonic frequencies. A microphone and detector–recorder system having a frequency response up to 150 kHz suitably covers all North American bat species. The acquired ultrasonic signals must then be translated into a useable form. This can be accomplished by transforming ultrasonic signals into humanly audible tones for manual monitoring, or by directly converting the digital data for storage and processing. Digital data can then be transduced and interpreted by one of 3 primary approaches of increasing signal resolution: 1) heterodyne, 2) frequency division, including zero-crossing, and 3) full-spectrum, including time expansion (Table 4).

Heterodyning reduces the frequency of the signal from the microphone by mixing it with a synthesized tone (Andersen and Miller 1977). This mixing produces an output signal with a frequency based on the frequency difference between the 2 mixed signals (i.e., the beat frequency). The frequency of an artificially generated signal is set by the user by tuning the detector to listen for calls at a particular frequency. Heterodyne units are the simplest ultrasound detector to

North American Bat Death Toll Exceeds 5.5 Million From White-nose Syndrome

January 17, 2012

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On the verge of another season of winter hibernating bat surveys, U.S. Fish and Wildlife Service biologists and partners estimate that at least 5.7 million to 6.7 million bats have now died from white-nose syndrome. Biologists expect the disease to continue to spread.

White-nose syndrome (WNS) is decimating bat populations across eastern North America, with mortality rates reaching up to 100 percent at many sites. First documented in New York in 2006, the disease has spread quickly into 16 states and four Canadian provinces. Bats with WNS exhibit unusual behavior during cold winter months, including flying outside during the day and clustering near the entrances of caves and mines where they hibernate. Bats have been found sick and dying in unprecedented numbers near these hibernacula.

"This startling new information illustrates the severity of the threat that white-nose syndrome poses for bats, as well as the scope of the problem facing our nation. Bats provide tremendous value to the U.S. economy as natural pest control for American farms and forests every year, while playing an essential role in helping to control insects that can spread disease to people," said Fish and Wildlife Service Director Dan Ashe. "We are working closely with our partners to understand the spread of this deadly disease and minimize its impacts to affected bat species."

Estimating the total number of bat deaths has been a difficult challenge for biologists. Although consistent population counts for federally listed endangered bats, like the Indiana bat, have been a priority for state and federal biologists, establishing population counts of once "common" bat species, like little brown bats, was historically not the primary focus of seasonal bat population counts.

"White-nose syndrome has spread quickly through bat populations in eastern North America, and has caused significant mortality in many colonies," said National WNS Coordinator, Dr. Jeremy Coleman, "Many bats were lost before we were able to establish pre-white-nose syndrome population estimates."

More than 140 partners, including tribal, state and federal biologists and bat researchers convened in Carlisle, Pennsylvania for the 2012 Northeast Bat Working Group (NEBWG) meeting last week to discuss challenges facing bat research, management and conservation. Coordinating with wildlife officials in Canada, the group discussed population-level impacts to hibernating bats and developed the estimate of bats lost to WNS.

In addition to the lack of population data for many bat species, there has also been a lack of consistency in how bat population data was reported among agencies. As part of the May 2011 national WNS response plan, which was developed by the Service in partnership with a team of federal, state, tribal, and NGO scientists, agencies are addressing this by establishing methods for consistent data collection.

The National Plan for Assisting States, Federal Agencies and Tribes in Managing White-Nose Syndrome in Bats provides a framework for the coordination and management of the national WNS investigation response, and the Service leads an extensive network of partners in implementing the plan.

The Service serves as the primary resource for up-to-date information and recommendations for all partners, such as important decontamination protocols for cave researchers and visitors and a cave access advisory that requests a voluntary moratorium on activities in caves in affected states to minimize the potential spread of WNS.

In addition to developing science-based protocols and guidance for land management agencies and other partners to minimize the spread of WNS, the Service has funded numerous research projects to support and assess management recommendations and improve our basic understanding of the dynamics of the disease.

The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people. We are both a leader and trusted partner in fish and wildlife conservation, known for our scientific excellence, stewardship of lands and natural resources, dedicated professionals, and commitment to public service.

For more information about white-nose syndrome, visit www.fws.gov/whitenosesyndrome. Connect with our Facebook page at www.facebook.com/usfwswns, follow our tweets at *www.twitter.com/usfws_wns, and download white-nose syndrome and bat photos from our Flickr page at http://www.flickr.com/photos/usfwshq/collections/72157626455036388/.*

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White-Nose Syndrome in Bats

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« Guest blog: Carol Meteyer from the USGS National Wildlife Health Center discusses a recent study confirming white-nose syndrome (WNS) in bats of Europe: Discovery may help to better understand WNS in bats of North America

The science and uncertainty of estimating the impacts of white-nose syndrome in North American bat populations.

February 14, 2012 by Ann Froschauer

Eastern small footed bat with WNS, credit

Follow

Ryan von
Linden/NYDEC

Recently, the U.S. Fish and Wildlife Service released an updated estimate for the number of bats that have died as a result of white-nose syndrome. This estimate, that at least 5.7 to 6.7 million bats have been lost to this terrible disease, represents a considerable and alarming increase from the previous estimate. But sadly, to many us who have been working on WNS for the past few years, I don't think the number came as a surprise.

The last time the scientific community got together to assess how many bats had died from WNS was 2009, just three years after the disease was discovered in New York. Significant mortality events had been documented in New York and western New England, but the disease had yet to spread into most of the now-affected area.

Healthy gray
bats, credit Ann
Froschauer/USFWS

Since that time, we have been through two additional hibernation seasons with extensive geographic spread and mortality events. And as we head into yet another winter, the outlook isn't good for bat populations across the affected area. From Ontario and New Brunswick south to North Carolina, Tennessee, Ohio, Indiana, and Kentucky, early reports of new sites and bats exhibiting the telltale signs of WNS have already been coming in. Across the rest of the already affected area, the disease continues to spread and affect bats that have managed to thus far avoid the fate of the missing and the dead among their ranks.

Bat remains in Aeolus
Cave, credit Ann
Froschauer/USFWS

It is difficult to wrap our brains around a million of any one thing, let alone 5.5 million, and it is particularly difficult if that something is as elusive and mysterious as a bat. I've been working with bats for about seven years, and it wasn't until my first trip last year to a grey bat cave with over 200,000 hibernating bats that I could even visualize what "a million" hibernating bats could look like.

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And unfortunately, a visit to Aeolus Cave in Vermont showed me the devastating aftermath of what losing 300,000 bats in one cave to white-nose syndrome looks like, too.

The reality is that we don't know much about our hibernating bats. There are hundreds of thousands of caves and mines in North America, the majority of which have never been surveyed for bats. Unfortunately, in the east WNS moved so quickly we will never know exactly how many bats there were. But what we do have is solid population data from many sites and the expert opinions of state and federal bat biologists and bat researchers- some with over 30 years of experience working with bat populations- to help us understand what the pre-WNS hibernating bat population likely was.

The question "how many bats have died?" is a vexing one, so I asked Dr. Jeremy Coleman, the National White-Nose Syndrome Coordinator, to explain- from the scientific perspective- the processes and challenges to estimating the mortality of bats from this terrible disease.

> WNS mortality estimates, January 2012.
>
> White-nose syndrome (WNS) is an infectious disease responsible for unprecedented mortality in hibernating bats in eastern North America since its discovery in 2007. In 2009 WNS was known to exist in nine states, with mass mortality largely restricted to portions of New York, Vermont, Massachusetts, and Connecticut. At that time, it was estimated that losses from WNS exceeded one million bats (BCI 2009). Since 2009 the disease has continued to spread, and WNS, and/or the causative fungus Geomyces destructans (Lorch et al. 2011), has now been detected in 19 states and 4 provinces. Population declines have continued at most affected sites, with 85-100% losses reported at many winter hibernacula. There are some hibernacula and maternity colonies in the affected area where remnant populations of bats continue to be observed. We are working to improve our understanding of the nature of these populations and to document their numbers. As the majority of these animals are not banded or marked, however, it is premature to infer that these bats are likely to survive with WNS, or that they will be capable of maintaining viable populations that could eventually lead to the recovery of affected populations.
>
> Decades of targeted monitoring of federally listed species has bestowed confidence in the consistency of our assessments of Indiana bats (Myotis sodalis) and other listed bats, however we are limited in our knowledge of other cave-hibernating bat species at the landscape-scale. Largely because of the monitoring efforts for listed species, we do have consistent counts of non-listed bats at many hibernacula in the eastern United States. These historic data have allowed us to assess population declines at specific WNS-affected hibernacula, and thus to ascertain the relative impacts of WNS on bat populations by species (see Turner et al. 2011). Assessing total population losses in terms of numbers of individual bats, however, poses a considerable challenge given the relative lack of pre-WNS count data for the bat species that were, until recently, considered "common." Additionally, there are tens of thousands, possibly hundreds of thousands, of abandoned mines and natural caves in the affected region that have never been surveyed. There are also several known hibernacula that have not been surveyed post-WNS in order to minimize disturbance to infected bats. Unfortunately, it was with the arrival of WNS that several little brown bat (Myotis lucifugus) hibernacula of considerable size were discovered, when dead and dying bats appeared on the landscape in large numbers. We cannot know the number of bats that inhabited such sites, or the number of sizeable hibernacula that have gone undetected. For these reasons, efforts to determine pre-WNS

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bat populations and/or the number of bats that have died from WNS are rife with uncertainty.

In hopes of better understanding the greater ecological impacts of WNS, and to convey the gravity of the population-level effects of this disease on affected bat populations, on 12 January 2012 we convened a group of approximately 20 bat biologists (state and federal agency personnel and academic researchers) to update the estimates of total mortality to date. We employed 2 different methods to estimate total mortality, and both are reflected in the numbers we released on 17 January of 5.7-6.7 million bats lost to WNS through 2011. The first estimate was generated using the same general methods used in 2009, when we estimated that over one million bats had died. This approach is based on known losses of bats at hibernacula, and the expert knowledge of state bat biologists regarding the proportion of the total bat population captured by their assessments. Estimates of mortality in 10 states were tallied to derive a total estimate for WNS-affected states in the northeastern U.S. The second method involved estimating the total bat population in affected states based on published estimates of bat populations by species. Observed declines reported by Turner et al. (2011) were then used to estimate total losses by species, which were then tallied. Lastly, in consultation with Canadian partners, we estimated bat losses in affected provinces based on estimates from WNS-affected states and the assumption that bat densities in the affected region of Canadian provinces are comparable to those in bordering states. This assumption is based on summer capture data and knowledge of wintering populations and habitat.

The estimates of bat mortality released by the U.S. Fish and Wildlife Service on 17 January 2012 are based on the best available data and derived by experts in the field. Given the uncertainties inherent in the development of this assessment, as detailed above, we felt it was important to both replicate the methods employed in 2009 for consistency, but also to employ an alternate approach to provide a range of values. The methods we used for this exercise preclude the generation of confidence estimates, but it suffices to say that all involved were generally satisfied by the relative agreement of the estimates generated by the different methods. We are preparing a manuscript for publication in a peer-reviewed journal to provide a detailed treatment of the data and a refinement of the methodology. As part of the national response to WNS, we are also developing guidance for a national bat population monitoring strategy that will help to standardize data collection and improve our ability to track the impacts of WNS on bat populations as the disease continues to spread.

Literature Cited:

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4 Responses

1. *on February 14, 2012 at 9:46 pm* | *Reply* *Laurence Burris (@LBurris597)*

   This is so very, very sad. At the Seattle Flower & Garden, at the Bats Northwest booth, we were able to talk to people about WNS. We need to really spread the words and educate the public.

2. *on February 15, 2012 at 9:29 pm* | *Reply* *John Dunham*

   Actually, to those of us working on WNS for years, that number comes as a huge surprise, mostly because no data seems to back it up. You seem to excuse that by saying your methods don't allow confidence estimates–let us be clear: that is the same as saying your methods are not scientific. Please either release your methods and data for this estimate, or retract it as gross exaggeration.

3. *on February 15, 2012 at 11:14 pm* | *Reply* *David*

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This article claims to explain how they came up with the total mortality rate but realistically it explains nothing. The USFWS has done nothing to address this question when it was brought up[by the National Speleological Society.

Read their letter to the USFWS and you will see why this number does not make sense.

http://www.caves.org/WNS/Ashe_Bat_Estimate_Letter_1-24-12.pdf

4. *on March 6, 2012 at 5:35 am* | *Reply* *Sean Rasmussen*

   If you compare a map of bat deaths (white nose) and a map of Marcellus shale drilling (FRACKING) it becomes obvious. The fracking is killing the bats. What do they have in common? They both depend on holes that go way way deep into the earth. Fracking drills and pollutes deep in the earth. Spoiling water supplies (wells) and concievably poisoning caves and the air in them and the animals that live there. Now, what I have read puts several species of bat on the endangered species list, and this alone can stop the drillers from continuing this fracking catastrophy.

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File Code: 1950 **Date:** June 8, 2012
Route To:

Subject: Supplemental Information Report for the Deerfield Wind Project Final EIS and Record of Decision; Review of New Information Regarding Bat Mortality Estimates Caused by White-Nose Syndrome

To: File

Forest Service Handbook 1909.15 Section 18.1 guides the procedures for complying with 40 CFR 1502.9 direction for the preparation of supplemental information.... "If new information or changed circumstances relating to the environmental impacts of a proposed action come to the attention of the responsible official after a decision has been made and prior to completion of the approved program or project, the responsible official must review the information carefully to determine its importance. If, after an interdisciplinary review and consideration of new information within the context of the overall program or project, the responsible official determines that a correction, supplement, or revision to an environmental document is not necessary, implementation should continue. Document the results of the interdisciplinary review in the appropriate program or project file."

In accordance with FSH 1909.15, 18.1, this supplemental information report for the Deerfield Wind Project Record of Decision (ROD) has been prepared to document my consideration of new information pertaining to bat mortality and white-nose syndrome. New estimates of bat mortality caused by white-nose syndrome were provided by a U.S. Fish and Wildlife Service (USFWS) press release dated January 17, 2012. In addition, a study was published in March 2012 demonstrating that the causal agent for white-nose syndrome is actually a European species newly established in North America and not a native species. The information in these documents is the subject of this supplemental information report.

Background

The Deerfield Wind Project is on National Forest System (NFS) lands on the Manchester Ranger District, Green Mountain National Forest (GMNF) within the Towns of Searsburg and Readsboro, Bennington County, VT. The proposed project activities were analyzed in the site-specific Deerfield Wind Project Final Environmental Impact Statement (FEIS) dated December 2011. The FEIS provided the basis for the Deerfield Wind Project Record of Decision (ROD) which I signed on January 3, 2012 under the authority of the 2006 GMNF Land and Resource Management Plan (Forest Plan). The ROD documents my selection of Alternative 2 that approves authorization of the use and occupancy of NFS lands for the construction and operation of a 15-turbine wind energy facility. The specific construction and operation facilities approved are found on pages 1 to 6 in the ROD.

A Biological Evaluation (BE) for the Deerfield Wind Project was signed on January 5, 2012. Although the BE was signed a few days after the project was authorized in the ROD, the evaluation was complete prior to my signing of the ROD and was fully considered in my decision making process for the project. The BE concluded that the Deerfield Wind Project will have no effect on Indiana bat (*Myotis sodalis*) a federally listed threatened and endangered species (BE, p. 15). The BE also concluded there will be no impact on eastern small-footed bat (*Myotis leibii*), and is not likely to cause a trend toward federal listing for little brown bat (*Myotis lucifugus*), northern bat (*Myotis septentrionalis*), and tri-colored bat (*Perimyotis subflavus*) all of which are listed as Regional Forest Sensitive Species (BE, p. 49).

The Deerfield Wind Project FEIS and BE cited a published 2009 report that estimated total mortality from white-nose syndrome (WNS) in the Northeast had exceeded 1 million bats from at least six species (FEIS, p. 296; and BE, p. 12). The January 17, 2012 USFWS press release highlights the latest estimates of bat losses caused by white-nose syndrome. Between 5.7 and 6.7 million bats were estimated to have died as a result of this disease across the entire WNS-affected portions of North America.

In March, a new study (Warnecke et al., 2012) was published that supports the idea that *Geomyces destructans*, the fungus that causes white-nose syndrome, is in fact a European species introduced to North America. This essentially negates the idea that the fungus was a native species that had become more virulent either by mutation or some environmental factor. The study also suggests that loss of fat reserves from increased arousal is the primary mechanism leading to death.

Findings

The relevant sections of the FEIS and substantiating documents subject to this report were reviewed by a Forest Service wildlife biologist assigned to this project in light of the new information related to the new estimated bat mortality caused by white-nose syndrome (Review of New Information/Changed Circumstances – Specialist Report authored by John Sease, dated April 18, 2012). The initial estimate of 1 million bats killed by WNS, cited in the FEIS (p. 296) and BE (p.12) was derived in 2009. That estimate was based largely on known numbers of bats counted at specific hibernacula before and after WNS. Bats from other hibernacula or from inaccessible portions of known hibernacula were not considered in this estimate consistently across the entire WNS-affected area, leading to a conservative (low) estimated total mortality. Since 2009, researchers and resource managers have documented additional mortality and declining counts of bats each winter, and the area affected by WNS continues to spread outward from the epicenter in New York.

In January 2012, the U.S. Fish and Wildlife Service convened a group of approximately 20 bat biologists (state and federal agency personnel and academic researchers) to derive an updated estimate of total bat mortality. The resulting estimate that 5.7 to 6.7 million bats had died from WNS in all affected areas of North America is based on the best available data and derived by experts with field-based knowledge from each state or region. This effort resulted in a new summary of what was known regarding bat mortality across the entire WNS-affected area. The biologists did not propose any new recommendations or mitigation concerning bat habitat, nor interpret the information in the context of bat populations in Vermont or elsewhere, but simply refined their views of the magnitude of mortality across the entire WNS affected area.

The Forest Service's analysis of potential impacts of the Deerfield Wind Project to bats, in addition to and in light of the impacts of WNS, was based on a wide variety of information from published sources and from consultation with scientists and managers directly involved in research and monitoring of bats and WNS, not on a single estimate of absolute mortality. Throughout the FEIS and BE, the Forest Service repeatedly acknowledged that populations of cave- and mine-hibernating bats in the northeastern U.S. are experiencing unprecedented mortality due to WNS, and that actual mortality rates may be higher than those reported (FEIS, pp. 298 to 303; and BE, pp. 17 to 20).

The FEIS acknowledged that the Forest Service, in collaboration with the U.S. Fish and Wildlife Service and the Vermont Agency of Natural Resources (Fish and Wildlife Department), determined that pre-construction surveys of bat activity in the project area conducted prior to WNS would be updated as a result WNS, and additional acoustic monitoring for bats was necessary (FEIS, p. 309). The analysis presented in the FEIS also repeatedly acknowledged uncertainty about predicting the levels of mortality of bats that would result from construction and operation of the proposed Deerfield Wind Project, the species composition of the bat mortality, and particularly the impacts that the Deerfield Wind Project might have on populations of bats already dramatically reduced from WNS.

As a result of these uncertainties, I required some important mitigation measures, and monitoring and research activities as provided in Attachments 1 and 2 in the ROD that emphasize my intent to minimize bat mortality. These mitigation measures and monitoring and research activities are described in detail in the FEIS in Section 3.11.4 (pp. 331 and 332) and Appendices A and H. Attachment 1 of the Deerfield Wind Project ROD provides Design Criteria and Mitigation Measures that are required during project implementation. Many of the criteria and measures emphasize that operational constraints and other appropriate adjustments will be implemented to mitigate adverse effects on bat populations. This includes assembling a panel of technical and scientific experts to help with the application of applicable mitigation measures, and to provide advice in the development of state-of-the-art monitoring and research plans (ROD, p. 17). Attachment 2 of the Deerfield Wind Project ROD consists of a Monitoring and Research Plan that contains the necessary elements that will be used to continue to refine our understanding of potential impacts of the project on bats (ROD, Attachment 2-3 to 2-6). The Plan also provides for identifying potential techniques of adaptive management based on monitoring results. The ROD Attachments 1 and 2 demonstrate our ongoing commitment to evaluate and take adaptive action, as necessary, based upon the best available science in this complex situation concerning WNS and bat populations.

Although the review of the new information regarding bat mortality does not lead me to change any mitigation measures or monitoring activities required in Attachments 1 or 2 of the ROD, it does substantiate my commitment to utilize an adaptive management strategy to assess the need to change these activities as additional information is learned. As described in the ROD (pp. 16 to 18) and the FEIS (pp. 320, 322, 331, and 332), I determined that rigorous monitoring and research, based on the best available science, is critical for understanding the actual impacts of the Deerfield Wind Project. That understanding of impacts, in turn, provides the information necessary for adaptive management that allows revision of operating procedures to minimize impacts to bats and other resources.

The Forest Service wildlife biologist assigned to the Deerfield Wind Project also reviewed the new study (Warnecke et al., 2012) that supports the idea that *Geomyces destructans*, the fungus that causes white-nose syndrome, is in fact a European species introduced to North America. This new information is helpful in understanding why white-nose syndrome has spread so quickly and had such serious effects, but does not provide evidence suggesting that the potential effects of the project are different from that set forth in the FEIS and project record. This information does not indicate any new or different mitigation or monitoring that could be incorporated into the decision.

Conclusion

The Deerfield Wind Project FEIS presents an in-depth analysis of potential impacts that the project might have on bats, as well as a summary of the known impacts of WNS. The conclusions presented in the FEIS were based on the best available science consisting of a wide variety of information from published sources, and from consultation with appropriate scientists and managers directly involved in research and monitoring of bats and WNS. My decision as documented in the ROD was made with full understanding of the analysis contained in the FEIS.

I have carefully considered the new information pertaining to the new estimated bat mortality caused by white-nose syndrome, and the Warnecke et al. study that is subject to this review. I have found that there is no change in the effects specific to bats as they have been documented in the Deerfield Wind Project FEIS. No new or modifications to existing mitigation measures or monitoring and research activities have been identified as a result of this review. Consequently, I have determined that the existing environmental analysis is adequate to support my original January 3, 2012 decision; and that a correction, supplement, or revision to the FEIS is not necessary. It is therefore my determination that a new decision regarding this project is not necessary.

/s/ Colleen Pelles Madrid
COLLEEN PELLES MADRID
Forest Supervisor

Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses

Thomas H Kunz[1*], Edward B Arnett[2], Wallace P Erickson[3], Alexander R Hoar[4], Gregory D Johnson[3], Ronald P Larkin[5], M Dale Strickland[3], Robert W Thresher[6], and Merlin D Tuttle[2]

At a time of growing concern over the rising costs and long-term environmental impacts of the use of fossil fuels and nuclear energy, wind energy has become an increasingly important sector of the electrical power industry, largely because it has been promoted as being emission-free and is supported by government subsidies and tax credits. However, large numbers of bats are killed at utility-scale wind energy facilities, especially along forested ridgetops in the eastern United States. These fatalities raise important concerns about cumulative impacts of proposed wind energy development on bat populations. This paper summarizes evidence of bat fatalities at wind energy facilities in the US, makes projections of cumulative fatalities of bats in the Mid-Atlantic Highlands, identifies research needs, and proposes hypotheses to better inform researchers, developers, decision makers, and other stakeholders, and to help minimize adverse effects of wind energy development.

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Wind energy has become an increasingly important sector of the renewable energy industry, and may help to satisfy a growing worldwide demand for electricity (Pasqualetti *et al.* 2004; GAO 2005; Manville 2005). Environmental benefits of wind energy accrue from the replacement of energy generated by other means (eg fossil fuels, nuclear fuels), reducing some adverse environmental effects from those industries (Keith *et al.* 2003). However, development of the wind energy industry has led to some unexpected environmental costs (Morrison and Sinclair 2004). For example, soaring and feeding raptors have been killed in relatively large numbers in areas of high raptor abundance in the United States and Europe (Barrios and Rodriquez 2004; Hoover and Morrison 2005). More recently, large numbers of bat fatalities have been observed at utility-scale wind energy facilities, especially along forested ridgetops in the eastern US (Arnett 2005; GOA 2005; Johnson 2005; Fiedler *et al.* 2007), and in agricultural regions of southwestern Alberta, Canada (RMR Barclay and E Baerwald pers comm). Similar fatalities have been reported at wind energy facilities in Europe (UNEP/Eurobats 2005; Brinkmann *et al.* 2006). As such facilities continue to develop in other parts of the world, especially in Australia, China, and India (National Wind Watch Inc 2006), increased numbers of bat and bird fatalities can be expected.

In this paper, we highlight ongoing development of wind energy facilities in the US, summarize evidence of bat fatalities at these sites, make projections of cumulative fatalities of bats for the Mid-Atlantic Highlands (MD, PA, VA, and WV), identify research needs to help reduce or mitigate adverse environmental impacts at these facilities, and propose hypotheses to evaluate where, when, how, and why bats are being killed.

In a nutshell:

- Bat species that migrate long distances are those most commonly killed at utility-scale wind energy facilities in the US
- Future research and monitoring should emphasize regions and sites with the highest potential for adverse environmental impacts on bats
- Multi-year monitoring and hypothesis-based research are needed to address these concerns
- A policy framework that requires owners and developers to provide full access to publicly-supported wind energy facilities should be implemented, and should include funds for research and monitoring at these sites

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■ Utility-scale wind energy development in the US

In 2005, utility-scale wind energy facilities in the US accounted for approximately 9616 MW of installed capacity (also called name plate capacity or the potential generating capacity of turbines; EIA 2006). The number and size of wind energy facilities have continued to increase, with taller and larger turbines being constructed. Available estimates of installed capacity in the US by 2020 range up to 72 000 MW, or the equivalent 48 000 1.5 MW wind turbines. This is enough, according

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Figure 1. *Partial view of the Mountaineer Wind Energy Center, Tucker County, WV, located along a forested ridgetop, where large numbers of bats have been killed.*

to some projections, to account for 5% of the country's electrical generating capacity. Most existing wind energy facilities in the US include turbines with installed capacity ranging from 600 kW to 2 MW per turbine. Wind turbines up to about 3 MW of installed capacity for onshore applications are currently being tested. However, owing to seasonally variable wind speeds, the generating capacity of most existing wind turbines is less than 30% of installed capacity.

Utility-scale wind turbines (> 1 MW) installed in, or planned for, the US since the 1990s are designed with a single monopole (tubular tower), ranging in height from 45 to 100 m, with rotor blades up to 50 m in length. At their greatest height, blade tips of typical 1.5 MW turbines may extend to 137 m (as tall as a 40-story building with a rotor diameter the size of a 747 jumbo jet). The nacelle, located at the top of the monopole, houses a gearbox that is connected to an electric generator and associated electronic converters and controls. Three rotor blades are attached to a drive shaft that extends outward from the nacelle. The pitch or angular orientation of the three blades can be adjusted to control turbine output and rotation speed of the rotor. Typically, wind turbines are arranged in one or more arrays, linked by underground cables that provide energy to a local power grid (WebFigure 1). Some modern turbines (eg GAMESA G87 2.0 MW turbine) rotate up to 19 rpm, driving blade tips at 86 m s^{-1} (193 mph) or more. Since utility-scale wind turbines were first deployed in the US in the 1980s, the height and rotor-swept area has steadily increased with each new generation of turbines.

To date, most utility-scale wind turbines in the US have been installed in grassland, agricultural, and desert landscapes in western and mid-western regions. More recently, however, wind turbines have been installed along forested ridgetops in eastern states (Figure 1). More are proposed in this and other regions, including the Gulf Coast and along coastal areas of the Great Lakes. Large wind energy facilities off the coastline of the northeastern US have also been proposed.

■ Bat fatalities

Relatively small numbers of bat fatalities were reported at wind energy facilities in the US before 2001 (Johnson 2005), largely because most monitoring studies were designed to assess bird fatalities (Anderson *et al.* 1999). Thus, it is quite likely that bat fatalities were underestimated in previous research. Recent monitoring studies indicate that some utility-scale wind energy facilities have killed large numbers of bats (Kerns and Kerlinger 2004; Arnett 2005; Johnson 2005). Of the 45 species of bats found in North America, 11 have been identified in ground searches at wind energy facilities (Table 1). Of these, nearly 75% were foliage-roosting, eastern red bats (*Lasiurus borealis*), hoary bats (*Lasiurus cinereus*), and tree cavity-dwelling silver-haired bats (*Lasionycteris noctivagans*), each of which migrate long distances (Figure 2). Other bat species killed by wind turbines in the US include the western red bat (*Lasiurus blossivilli*), Seminole bat (*Lasiurus seminolus*), eastern pipistrelle (*Perimyotis [=Pipistrellus] subflavus*), little brown myotis (*Myotis lucifugus*), northern long-eared myotis (*Myotis septentrionalis*), long-eared myotis (*Myotis evotis*), big brown bat (*Eptesicus fuscus*), and Brazilian free-tailed bat (*Tadarida brasiliensis*). A consistent theme in most of the monitoring studies conducted to date has been the predominance of migratory, tree-roosting species among the fatalities.

For several reasons (eg cryptic coloration, small body size, steep topography, overgrown vegetation), bats may have been overlooked during previous carcass searches. Based on recent evaluations of searcher efficiency, on average, only about half of test subjects (fresh and frozen bats or birds) are recovered by human observers (Arnett *et al.* in press; WebTable 1). In these studies, bats were nearly twice as likely to be found in grassland areas as in agricultural landscapes and along forested ridgetops. Moreover, scavengers often remove carcasses before researchers are able to recover them (Arnett *et al.* in press).

To date, no fatalities of state or federally listed bat species have been reported; however, the large number of fatalities of other North American species has raised concerns among scientists and the general public about the environmental friendliness of utility-scale wind energy facilities. For example, the number of bats killed in the eastern US at wind energy facilities installed along forested ridgetops has ranged from 15.3 to 41.1 bats per MW of installed capacity per year (WebTable 1). Bat fatalities reported from other regions of the western and mid-western US have been lower, ranging from 0.8 to 8.6 bats $MW^{-1}yr^{-1}$, although many of these studies were designed only to assess bird fatalities (Anderson *et al.* 1999). Nonetheless, in a recent study designed to assess bat fatalities in southwestern Alberta, Canada, observed fatalities were comparable to those found at wind energy facilities located in forested regions of the eastern US (RMR Barclay and E Baerwald pers comm).

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some way attracted to wind turbines? Some migratory species are known to seek the nearest available trees as daylight approaches (Cryan and Brown in press), and thus could mistake large monopoles for roost trees (Ahlén 2003; Hensen 2004). Tree-roosting bats, in particular, often seek refuge in tall trees (Pierson 1998; Kunz and Lumsden 2003; Barclay and Kurta 2007). As wind turbines continue to increase in height, bats that migrate or forage at higher altitudes may be at increased risk (Barclay *et al.* 2007).

Are bats attracted to sites that provide rich foraging habitats? Modifications of landscapes during installation of wind energy facilities, including the construction of roads and power-line corridors, and removal of trees to create clearings (usually 0.5–2.0 ha) around each turbine site may create favorable conditions for the aerial insects upon which most insectivorous bats feed (Grindal and Brigham 1998; Hensen 2004). Thus, bats that migrate, commute, or forage along linear landscapes (Limpens and Kapteyn 1991; Verboom and Spoelstra 1999; Hensen 2004; Menzel *et al.* 2005) may be at increased risk of encountering and being killed by wind turbines.

Are bats attracted to the sounds produced by wind turbines? Some bat species are known to orient toward distant audible sounds (Buchler and Childs 1981), so it is possible that they are attracted to the swishing sounds produced by the rotating blades. Alternatively, bats may become acoustically disoriented upon encountering these structures during migration or feeding. Bats may also be attracted to the ultrasonic noise produced by turbines (Schmidt and Jermann 1986). Observations using thermal infrared imaging of flight activity of bats at wind energy facilities suggest that they do fly (and feed) in close proximity to wind turbines (Ahlén 2003; Horn *et al.* 2007; Figure 3).

What other factors might contribute to bat fatalities? Wind turbines are also known to produce complex electromagnetic fields in the vicinity of nacelles. Given that some bats have receptors that are sensitive to magnetic fields (Buchler and Wasilewski 1985; Holland *et al.* 2006), interference with perception in these receptors may increase the risk of being killed by rotating turbine blades. Bats flying in the vicinity of turbines may also become trapped in blade-tip vortices (Figure 4) and experience rapid decompression due to changes in atmospheric pressure as the turbine blades rotate downward. Some bats killed at wind turbines have shown no sign of external injury, but evidence of internal tissue damage is consistent with decompression (Dürr and Bach 2004; Hensen 2004). Additionally, some flying insects are reportedly attracted to the heat produced by nacelles (Ahlén 2003; Hensen 2004). Preliminary evidence suggests that bats are not attracted to the lighting attached to wind turbines (Arnett 2005; Kerlinger *et al.* 2006; Horn *et al.* in press).

Do some weather conditions place bats at increased risk of being killed by wind turbines? Preliminary observations suggest an association between bat fatalities and thermal inversions following storm fronts or during low cloud cover that force the animals to fly at low altitudes (Durr and Bach 2004; Arnett 2005). Thermal inversions create cool, foggy conditions in valleys, with warmer air masses rising to ridgetops. If both insects and bats respond to these conditions by concentrating their activities along ridgetops instead of at lower altitudes, their risk of being struck by the moving turbine blades would increase (Dürr and Bach 2004). Interestingly, the highest bat fatalities occur on nights when wind speed is low ($< 6\ m\ s^{-1}$), which is when aerial insects are most active (Ahlén 2003; Fiedler 2004; Hensen 2004; Arnett 2005).

Table 1. Species composition[1] of annual bat fatalities reported for wind energy facilities in the United States, modified from Johnson (2005)

Species[2]	*Pacific Northwest*	*Rocky Mountains*	*South–Central*	*Upper Midwest*	*East*	*Total*
Hoary bat	153 (49.8%)	155 (89.1%)	10 (9.0%)	309 (59.1%)	396 (28.9%)	1023 (41.1%)
Eastern red bat	–	–	3 (2.7%)	106 (20.3%)	471 (34.4%)	580 (23.3%)
Western red bat	4 (1.3%)	–	–	–	–	4 (0.2%)
Seminole bat	–	–	–	–	1 (0.1%)	1 (0.1%)
Silver-haired bat	94 (30.6%)	7 (4.1%)	1 (0.9%)	35 (6.7%)	72 (5.2%)	209 (8.4%)
Eastern pipistrelle	–	–	1 (0.9%)	7 (1.3%)	253 (18.5%)	261 (10.5%)
Little brown myotis	2 (0.7%)	6 (3.5%)	–	17 (3.3%)	120 (8.7%)	145 (5.8%)
Northern long-eared myotis	–	–	–	–	8 (0.6%)	8 (0.4%)
Big brown bat	2 (0.7%)	2 (1.1%)	1 (0.9%)	19 (3.6%)	35 (2.5%)	59 (2.4%)
Brazilian free-tailed bat	48 (15.6%)	–	95 (85.5%)	–	–	143 (5.7%)
Unknown	4 (1.3%)	4 (2.2%)	–	30 (5.7)	15 (1.1%)	53 (2.1%)
Total	307	174	111	523	1371	2486

[1]Pacific Northwest data are from one wind energy facility in CA, three in eastern OR, and one in WA; Rocky Mountain data are from one facility in WY and one in CO; Upper Midwest data are from one facility in MN, one in WI, and one in IA; South–Central data are from one facility in OK; East data are from one facility in PA, one in WV, and one in TN.
[2]One confirmed anecdotal observation of a western long-eared myotis (*Myotis evotis*) has been reported in CA, but is not included in this table.

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APPENDIX E

Bat White Paper

Table E-6: Summary of the Composition of Recorded Bat Call Sequences at the Project Site During Summer and Fall 2006.

Detector	Guild				
	Big Brown Bat	Red Bat/ E. Pipistrelle	Myotis	Unknown	Total
Eastern Met Tower High (20m)	19	5	32	69	125
Eastern Met Tower Low (10m)	11	6	31	64	112
Western Met Tower High (35m)	3	1	1	4	9
Western Met Tower Low (15m)	25	4	49	56	134
Western Tree Detector (7m)	0	0	0	0	0
Total	**58**	**16**	**113**	**193**	**380**

A total of 193 of the 380 (54%) recorded call sequences were labeled as unknown due to very short call sequences (less than seven pulses), poor call signature formation, bats flying at the edge of the detection zone, bats flying away from the detector, or static interference. *Myotids* were the most common call sequences identified (28%) followed by the big brown guild (13%), and red bat/eastern pipistrelle guild (5%) (Woodlot, 2007).

Of the 113 call sequences in the *myotid* group, 74 (85.5%) were identified as *Myotis* genus because the pulses in the call sequences were too indistinct to allow identification of species. Approximately 12% of the *myotid* call sequences were identified as little brown bat, 2% as northern myotis, and less than 1% as possibly Eastern small-footed bat (Woodlot, 2007).

Fifty-eight call sequences were attributed to the big brown bat guild. Of these, seven (12%) appeared to be big brown bats, five (9%) silver-haired bats, and 13 (22%) hoary bats. The remaining sequences in the big brown bat guild could not be identified to species with certainty, but were either that of the big brown bat or silver-haired bat. These sequences did not appear to include any hoary bat calls. Within the red bat/Eastern pipistrelle guild (n=16), 81% of the call sequences were likely red bat and 13% Eastern pipistrelle. The remainder could not be identified to species with certainty (Woodlot, 2007).

Call detection rates were low (one or no recorded sequence) during June and began to increase in the second half of July. The call sequences peaked (12 to 19 calls per night) in early August and then remained relatively low (two to eight calls per night) through the first half of October. Vandalism resulted in the loss of approximately two weeks of data from all detectors in mid-to late August (Woodlot, 2007).

Mean nightly wind speeds near the Project area varied between 0 to 29 kilometers per hour (0 to 18 miles per hour). Mean nightly temperatures ranged from 0.25° and 26.3° Celsius (32.5° to 79.3° Fahrenheit). Woodlot did not find any significant relationship between temperature, wind, and bat call sequences. In general, however, fewer call sequences were recorded on nights with the highest wind speeds (greater than 10 kilometers [6.2 miles per hour] per hour), and temperatures cooler than 10° Celsius (50° Fahrenheit) (Woodlot, 2007).

Observational data over years of Woodlot studies indicate that passage rates are generally lower on nights of poor visibility and inclement weather and higher, both in terms of numbers and elevation, on

2011
Acoustic Bat Survey Report
for the Deerfield Wind Project
In Searsburg and Readsboro, Vermont

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Most (67%) UNKN calls at detectors deployed above tree canopy belonged to the LFUN (low frequency unknown) group.

The BBSH (Big brown/Silver-haired) guild was the second most commonly detected guild (n=489, 21.6%). Within the BBSH guild, most call sequences were not further identified to a particular species (n=338, 69% of the BBSH guild), while 19 percent (n=93) were further classified as silver-haired bats and 12 percent (n=58) were further classified as big brown bats. Detectors above and below tree canopy recorded a similar number of sequences assigned to the BBSH guild (Table 3-2), and had similar compositions of BBSH sequences that were not further identified to species (66% at detectors above tree canopy; 73% at Tree detectors). However, for those sequences further identified to species, silver-haired bats made up a higher proportion of the BBSH guild at detectors deployed above tree canopy (27% silver-haired bat versus 8% big brown bat), while big brown bats made up a higher proportion of the BBSH guild at Tree detectors (17% big brown bat versus 10% silver-haired bat).

The RBTB (Red bat/Tri-colored) guild was the third most commonly detected (n=486, 21.5%). Within the RBTB guild, most call sequences were further identified as red bats (84% of the RBTB guild); 15 percent were not further classified to a particular species; and only a small fraction (1% of the RBTB guild) was further classified as tri-colored bat. All tri-colored bat identifications were made at Tree detectors. At detectors deployed above tree canopy, 96% (n=93) of RBTB identifications were further classified as red bats. At Tree detectors, 80% (n=315) of RBTB identifications were further classified as red bats. Calls belonging to the Myotis (MYSP) guild and the Hoary bat (HB) guild were the least often identified.

Table 3-2. Distribution of detections by guild for detectors at Deerfield Wind, 2011.

Detector	Guild					Total
	BBSH	HB	MYSP	RBTB	UNKN	
5480 High	107	26	7	16	115	271
5480 Tree	69	14	34	275	251	643
5481 High	80	15	6	33	85	219
5481 Tree	42	3	8	5	42	100
5482 High	57	28	9	45	65	204
5482 Tree	51	10	20	24	93	198
5483 High	21	13	2	3	26	65
5483 Tree	62	19	16	85	381	563
Total	489	128	102	486	1,058	2,263
Guild Composition %	21.6%	5.7%	4.5%	21.5%	46.8%	
Total (High)	265	82	24	97	291	759
Guild Comp (High)	34.9%	10.8%	3.2%	12.8%	38.3%	
Total (Tree)	224	46	78	389	767	1504
Guild Comp (Tree)	14.9%	3.1%	5.2%	25.9%	51.0%	

Appendix A provides a series of tables with more specific information on the nightly timing, number, and species composition of recorded bat call sequences. Specifically, Appendix A Tables 1 through 8 provide information on the number of call sequences, by guild and suspected species, recorded at each detector and noting the weather conditions for that night. All call files are archived electronically and are available upon request.

Deerfield Cut/Fill From VHB Plans (March 2011)

Sheet	Station	Cut/Fill (ft)	B = Basin, W = west ridge, E = East Ridge
C-13	N/A	-25	B-22
C-13	N/A	-22	E-01 (southeast side)
C-2	N/A	-20	SE side of Laydown & Staging Area
C-2	108+00	-18	Compacted gravel access road
C-7	N/A	-16	W-05
C-6	42+00	-16	Compacted gravel access road
C-15	N/A	-16	E-04 (northwest side)
C-7	N/A	-15	B-11
C-6	N/A	-14	W-04 Crane Pad
C-17	123+50	-14	Compacted gravel access road
C-8	2+00	-12	Compacted gravel access road
C-6	N/A	-12	W-04
C-14	N/A	-12	B-25
C_14	81+50	-12	Road Cut
C-14	N/A	-11	E-02 (northwest side)
C-9	N/A	-10	W-08 Crane Pad
C-8	N/A	-10	W-06 Crane Pad
C-5	N/A	-10	W-02 Crane Pad
C-13	68+00	-10	Compacted gravel access road
C-10	N/A	-10	B-15
C-2	N/A	-9	B-01
C-9	N/A	-6	B-34
C-7	38+00	-6	Compacted gravel access road
C-6	N/A	-6	W-03 (west side)
C-3	99+00	-6	Compacted gravel access road
C-8	N/A	-4	W-07 (south side)
C-5	56+00	-4	Compacted gravel access road
C-11	N/A	-4	B-17
C-6	N/A	5	W-03 (east side)
C-9	13+00	6	Compacted gravel access road
C-15	100+00	6	Raising existing road
C-14	N/A	6	E-02 (southeast side)
C-10	10+00	6	Compacted gravel access road (culvert)
C-4	77+00	8	Compacted gravel access road
C-8	N/A	9	W-07 (north side)
C-6	46+00	10	Compacted gravel access road (culvert)
C-13	N/A	10	E-01 (northeast side)
C-5	63+00	12	Compacted gravel access road
C-4	N/A	12	W-01
C-12	46+00	12	Raising existing road elevation for bypass flow
C-9	N/A	13	W-08
C-16	N/A	13	E-05
C-8	17+00	14	Compacted gravel access road (culvert)
C-13	N/A	15	E-01 access road

C-8	N/A	16	W-06
C-7	33+00	16	Compacted gravel access road
C-5	N/A	16	W-02
C-17	N/A	16	E-06
C-15	N/A	18	B-27
C-14	N/A	18	E-03
C-2	N/A	20	NE side of Laydown & Staging Area
C-13	65+00	20	Raising road elevation, created bench (culvert)
C-17	N/A	23	E-07 (east side)
C-4	N/A	24	Proposed Substation
C-2	N/A	24	SW side of Laydown & Staging Area
C-14	85+00	25	Raising existing road elevation for stream crossing
C-15	90+00	34	Compacted gravel access road (culvert)
		34	Max Fill
		-25	Max Cut