State of Vermont

Agency of Natural Resources

Agency of Natural Resources
Center Building
103 **South Main Street**
Waterbury, VT 05671-0301

Telephone: 802-241-2681
Fax: 802-244-1102

December 21,2007

Mrs. Susan Hudson, Clerk
Vermont Public Service Board
112 State Street Drawer 20
Montpelier, Vermont 05620

RE: Docket No. 7250 – Direct Testimony

Dear Mrs. Hudson:

Attached please find the Agency of Natural Resources' Prefiled Direct Testimony in the above-referenced matter. Please be advised that the Agency has coordinated the overall position of the State of Vermont with the Department of Public Service.

Please contact me if you have any questions.

Sincerely,

David C. Englander
Environmental Litigation Attorney

cc: Service List

I, Glennis Drew, certify that on December 21, 2007, I forwarded copies of Agency of Natural Resources, ***Prefiled Direct*** Testimony to the following Service List by first class mail.

Parties:

Sarah Hofmann, Esq.
Director for Public Advocacy
Vermont Department of Public Service
112 State Street - Drawer 20
Montpelier VT 05620-2601

Brian S. Dunkiel, Esq. (For Deerfield Wind, LLC)
Andrew N. Raubvogel, Esq.
Geoffrey H. Hand, Esq.
Shems Dunkiel Kassel & Saunders PLLC
91 College Street
Burlington, VT 05401

David Englander, Esq.
Vermont Agency of Natural Resources
103 South Main Street - Center Building
Waterbury, VT 05671-0301

Statutory Interested Persons:

The Honorable William H. Sorrell
Vermont Attorney General
Pavilion Building - 109 State Street
Montpelier VT 05609

Sharon Moffatt, Commissioner
Vermont Department of Health
108 Cherry Street - PO Box 70
Burlington VT 05402

Jane Lendway, VT Historic Preservation Officer
Agency of Commerce & Community Development
Vermont Historic Preservation Division
National Life Building - Drawer 20
Montpelier VT 05620-0501

Betsy Bishop
Vermont State Planning Office
c/o Office of the Governor
109 State Street
Montpelier VT 05609

Jill Michaels, Chair
Vermont Scenery Preservation Council
P.O. Box 320
Ascutney, VT 05030

Neal Lunderville, Secretary
Vermont Agency of Transportation
National Life Building - Drawer 33
Montpelier VT 05633-5001

Roger Allbee, Secretary
Vermont Agency of Agriculture, Food & Markets
116 State Street - Drawer 20
Montpelier VT 05620-2901

Chairperson, Town of Searsburg Selectboard
c/o Josephine Kilbride, Town Clerk
P.O Box 157
Wilmington, VT 05363

Chairperson, Town of Searsburg Planning Commission
c/o Josephine Kilbride, Town Clerk
P.O Box 157
Wilmington, VT 05363

Chairperson, Town of Readsboro Selectboard
c/o Annette Caruso, Town Clerk
P.O. Box 187
Readsboro, VT 05350

Chairperson, Town of Readsboro Planning Commission
c/o Annette Caruso, Town Clerk
P.O. Box 187
Readsboro, VT 05350

Rex Burke, Executive Director
Bennington County Regional Commission
111 South Street #200
Bennington, VT 05201-2246

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Windham Regional Commission
139 Main Street - Suite 505
Brattleboro, VT 05301

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Naples, FL **34103**

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Save Vermont Ridgelines
P.O. Box **1414**
Wilmington, VT **05363**

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National Grid USA, Inc.
25 Research Drive
Westborough, MA **05182**

Donald J. Rendall, Jr.
Green Mountain Power Corporation
163 Acorn Lane
Colchester, VT **05446**

John W. Kessler, Esq.
Julie F. Kelliher, Esq.
VT Dept. of Housing & Comm. Affairs
Agency of Commerce & Comm Dev.
National Life Bldg, D **20**
Montpelier, VT **05602-0501**

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Montpelier, VT **05602**

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P.O. Box **66**
Burlington, VT **05402-0066**

Robert Rusten, Town Manager
Town of Wilmington
2 East Main Street
P.O. Box **217**
Wilmington, VT **05663**

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Vermont Public Interest Group
141 Main Street, Suite **6**
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Kensington, NH **03833**

Clifford and Diana Duncan
Duncan Cable TV Services
P.O. Box **685**
Wilmington, VT **05363**

Lisa Linowes
Industrial Wind Action Group
286 Parker Hill Road
Lyman, NH **03585**

Nancy S. Malrnquist, Esq.
Downs Rachlin Martin PLLC
90 Prospect Street
P.O. Box **99**
St. Johnsbury, VT **05819-0099**

Dated at Waterbury, Vermont, December 21, 2007.

By: Glennis Drew
Glennis Drew, Legal Secretary

STATE OF VERMONT
PUBLIC SERVICE BOARD

Docket No. 7250

Petition of Deerfield Wind, LLC, for a certificate of public good, pursuant to 30 V.S.A. Section 248. The application requests a Certificate of Public Good for the construction of a wind facility comprising of 15 to 24 turbines, with a capacity of up to 45MW. Deerfield Wind proposes to place half of the new turbines on the eastern side of Route 9 (extending the existing turbine string) and the other half of the turbines on the western side of Route 9.

The Agency of Natural Resources' List of Prefiled Direct Testimony and Exhibits

Name	Exhibit No.	Admitted
Prefiled Direct Testimony of Mic X. Metx		
Resume of Mic X. Metx	ANR-MM-1	
Prefiled Direct Testimony of Matthew Probasco		
Resume Matthew Probasco	ANR-MP-1	
Prefiled Direct Testimony of Scott Darling		
Resume of Scott Darling	ANR-SD-1	
Prefiled Direct Testimony of Forrest Hammond		
Resume of Forrest Harnmond	ANR-FH-1	
Partial Direct Testimony of Dr. William Kilpatrick, Docket 7156	ANR-FH-2	

STATE OF VERMONT
PUBLIC SERVICE BOARD

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DIRECT TESTIMONY OF
MIC METZ

ON BEHALF OF THE
VERMONT AGENCY OF NATURAL RESOURCES

Mr. Metz is District Wetland Ecologist with the Vermont Agency of Natural Resources, stationed at the Rutland office. He provides the Agency's position on the proposed Deerfield Wind Project (Project) with respect to impacts on wetlands under the environmental criterion reviewed by the Public Service Board pursuant to 30 V.S.A. § 248(b)(5).

DIRECT TESTIMONY OF MIC METZ

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

A1. Mic Metz, District Wetland Ecologist with the Vermont Agency of Natural Resources, 430 Asa Bloomer State Office Building, Rutland, Vermont 05701.

Q2. Please describe your educational background and relevant work experience.

A2. I hold a B.S. in Biology from Cook College, Rutgers University and a M.S. in Environmental Studies from the University of Montana, with a focus on Aquatic Ecology and Wetland Science. I have been employed by the Agency of Natural Resources (Agency) since December of 2002. My resume is included as an exhibit (Exhibit ANR MM-1).

Q3. What is the purpose of your testimony in this proceeding?

A3. The purpose of my testimony is to provide the Agency's position on the proposed Deerfield Wind Project (Project) with respect to impacts on wetlands under the environmental criterion reviewed by the Public Service Board pursuant to 30 V.S.A. § 248(b)(5).

Q4. Have you reviewed the petition?

A4. Yes. I am familiar with the Project and have reviewed the prefiled testimony of Michael Lew-Smith regarding wetlands. On November 9,2007, I conducted a site visit to the areas proposed by Petitioner for wind turbines.

Q5. Have all the wetlands within the project footprint been delineated?

A5. From the information provided me to this point, I have concluded that most wetlands within the turbine footprint and access route areas have been delineated. Some small wet areas noted during my November 9 site visit have subsequently been investigated by Michal Lew-Smith and Dori Barton of Arrowwood Environmental who have determined these areas to be non-jurisdictional. I will reserve final judgment on this question until I have received and reviewed the supplemental report Arrowwood has completed regarding these areas and visited the sites during the growing season.

Q6. Are there any Class Two wetlands, or wetlands of special significance?

A6. There are no Class One or Class Two wetlands within the proposed project area.

Q7. Would you explain the function that wetlands serve within the ecosystem?

A7. Wetlands are a major feature of the landscape in Vermont, although they represent less than five percent of the total land mass. Wetlands are unique because of their position between terrestrial and aquatic landscapes within the ecosystem. Within Vermont, wetlands often occur in association with lakes, ponds, rivers, and streams, but they may also be isolated from any obvious connection to surface water.

Wetlands serve a variety of important functions within the ecosystem, including, but not limited to, flood control, sediment retention, water quality protection, fisheries and wildlife habitat, and erosion control. Higher elevation wetlands like those found within the project area may provide feeding habitat for moose, black bear and beaver. If the wetland supports an open water component for a sufficient duration within the growing

season, wetlands may also be used as amphibian breeding pools. Higher elevation wetlands located within the headwaters of streams provide the cold water necessary for native fish species downstream. According to the Clean Water Act, the degradation and destruction of wetlands is considered to be "among the most severe environmental impacts."

Q.8 Are there any other wetlands of concern, including Class III wetlands, that may be affected by the project?

A. 8 Yes. All the wetlands identified within the project area are considered Class Three wetlands under the Vermont Wetland Rules. According to the testimony of Michael Lew-Smith, there are three small conifer swamps near turbine #4E. I was unfortunately unable to locate these wetlands during our November 9 site visit. Mr. Lew-Smith testified that these wetlands are likely significant for water quality, sediment retention, erosion control and potentially for amphibian habitat.

Q9. What species of wildlife are likely impacted by the project?

A9. There exists the potential for amphibian breeding habitat within some of the identified wetlands along the eastern portion of the proposed project. Bear may also use these wetlands for spring feeding, if sufficient sedge species are present. I will reserve final judgment on this question until I have visited the sites in the spring and received and reviewed the wetland data sheets and functional evaluation forms that Arrowwood Environmental has completed regarding these wetland.

Q10. Do you have any specific recommendations to assist you in the review of potential wetland impacts from this project?

A10. Conducting a site visit in the spring with members of Arrowwood Environmental when amphibians are breeding and vegetation is present will assist me in reviewing the functional evaluation of these wetlands. Also, the receipt of wetland data sheets, functional evaluation forms and supplemental reports prepared by Arrowwood Environmental will further assist me in my assessment.

Q11. Will the petitioner require a Condition Use Determination?

A11. No.

Q12. Does this project require a **Sec.** 401 Water Quality Certification?

A12. To the best of my knowledge, no. Any project that triggers Section.404 of the federal Clean Water Act, by, for instance, placing more than 3,000 square feet of fill within wetlands, triggers Army Corps of Engineer permit jurisdiction. **A** 404 Permit requires a 401 Water Quality Certificate from the Agency. Since there will not be any filling of wetlands or waters of the State other than Wetland F (approximately 400 square feet), Section 404 is not triggered and therefore a 401 Water Quality Certification is not required.

Q13. If a Certificate of Public Good is issued for this project, do you have any specific recommendations with regard to construction?

A13. Yes. I would ask that snow fence be placed along the limits of disturbance for Turbine **4E** to avoid any impacts to the adjacent wetlands and their buffer zones. I would also request that construction occur during the winter months in order to lessen impacts to any intermittent stream or wet areas that may need to be crossed by construction equipment to gain access to the turbine sites.

Q14. Does this conclude your testimony?

A14. Yesitdoes.

Public Service Board
Deerfield Wind, LLC
Docket No. 7250
Exhibit No. ANR NIM-1
Admitted ____ Date _____

Michael X. Metz

293 Maplewood Drive **802/438-2108**
West Rutland, VT 05777 **802/786-5921**
micxrnetz@hotmail.com mic.metz@state.vt.us

EDUCATION:

University of Montana, Missoula, MT
MS Environmental Studies, May 1998
My thesis analyzed the ecological and legal efficacy of wetland mitigation projects in western Montana.

Rutgers University, New Brunswick, NJ
BS Biology, May 1989

WORK EXPERIENCE:

State of Vermont, Agency of Natural Resources, Water Quality Division
Waterbury, **VT –** December 2002 to present
District Wetlands Ecologist
- Coordinate and assist with the implementation of the Vermont Wetland Rules.
- Review Act 250 projects and determine their possible effect on wetlands.
- Conduct 401 water quality certifications for the State of Vermont.
- Assist in the evaluation of wetland mitigation projects within Vermont.
- Conduct Wetland Office enforcement actions for projects in violation of the Vermont Wetland Rules.
- Present lectures and educational workshops for the public on wetland related issues.
- Update and distribute GIS maps of Class Two wetlands in Vermont.
- Develop annual work plans.

Nez Perce Tribe, Water Resources Division
Lapwai, ID – June 2001 to December 2002
Wetlands Planner
- Assisted with the creation of a draft wetland functional assessment methodology.
- Located Reservation wetlands using aerial photos and draft NWI maps.
- Conducted jurisdictional determinations of wetlands within Lapwai Creek watershed.
- Initiated development of a Wetland Conservation and Management Plan.
- Conducted preliminary assessments of hydrologic and biological functions of Reservation wetlands.
- Wrote final report for the National Fish and Wildlife Foundation Five Star Grant.
- Reviewed and commented on projects that impacted Reservation wetlands.
- Initiated monitoring protocols for wetland restoration projects.
- Performed plant community and noxious weed surveys on Reservation wetlands.
- Authored quarterly reports for EPA Wetland Grant.
- Assessed fish and wildlife habitat in the Lapwai Creek watershed.
- Made mitigation recommendations for Tribal projects impacting Reservation water resources.
- Supervised a crew of volunteers in the restoration of a wet meadow and stream.
- Assisted the Non-point Source Coordinator with native shrub and tree plantings.

USDA Forest Service, Content Analysis Enterprise Team

Missoula, MT – August 1999 to June 2001
GS – 303 – 07
Analyst; Writer; Editor

- Established writing and editing protocols for the Roadless Initiative public comment report.
- Analyzed, summarized, and edited final report of BIA Phase I public hearings.
- Analyzed, summarized, and edited final report of USDA Private Land Stewardship forums.
- Established proofreading, writing and editing protocols for Merced River EIS project.
- Coded and analyzed public comments on a variety of topics for a diverse set of projects.
- Created, developed, and tracked public concerns from a variety of sources.
- Performed all aspects of data entry, coding, writing, and editing on a daily basis.

USDOI National Park Service, Zion National Park

Springdale, UT – March 1999 to August 1999
GS – 401 – 07
Biological Technician (Wetlands)

- Identified, classified, delineated, and mapped wetland and riparian sites following scientific protocols.
- Established the definitions of key wetland and riparian terms as they pertained to the ecosystems of Zion.
- Created a database of all the wetland habitats of Zion National Park for the National Wetland Inventory.
- Assisted in the completion of draft maps with the Fish and Wildlife Service.

Assiniboine and Sioux Tribes, Fort Peck Reservation

Poplar, MT – June 1998 to September 1998
Wetland Technician

- Established a standard operating procedure for the delineation and assessment of all tribal wetlands.
- Reviewed, edited, and contributed to the FWS draft report on Tribal Wetland Mitigation Policy.
- Delineated and assessed potentially impacted wetland habitats on the Fort Peck Reservation.
- Supervised a field crew sampling soils, identifying vegetation, and recording data.
- Wrote and edited final document for the EPA.

USDA Forest Service, Kootenai National Forest

Troy, MT – June 1996 to November 1996; May 1997 to August 1997
GS – 404 – 04
Forestry Technician; Stand Exams

- Completed quick plot stand exams, walk through surveys, and old growth validation examinations.
- Conducted root rot plot remeasurements and stand exam contractor inspections.
- Trained new employees in the science and mechanics of data collection for various forest exams.
- Participated in controlled burns and wildfire suppression activities.

HONORS:

Kappa Delta Pi – National Education Honor Society
Alpha Sigma Tau – National Dramatic Honor Society
Eagle Scout – BSA Troop 110

STATE OF VERMONT
PUBLIC SERVICE BOARD

Docket No 7250

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DIRECT TESTIMONY OF MATTHEW PROBASCO

ON BEHALF OF THE VERMONT AGENCY OF NATURAL RESOURCES

Mr. Probasco is an Environmental Analyst for the Stormwater Program in the Water Quality Division of the Department of Environmental Conservation. His district encompasses Bennington, Addison and Rutland Counties. He provides the Agency's position on the proposed project with respect to a number of the environmental criteria that are reviewed by the Public Service Board pursuant to 30 V.S.A. § 248(b)(5). He discusses the project's potential impacts regarding stormwater pollution and soil erosion as well as other water quality-related criteria, principally focusing on the petitioner's obligation to obtain both State Stormwater and Construction Discharge Permits.

DIRECT TESTIMONY OF MATTHEW PROBASCO

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

A1. Matthew Probasco, Water Quality Division – Stormwater Section, 103 South Main Street, Building 10 North, Waterbury, VT. I am an Environmental Analyst for the Stormwater Program in the Water Quality Division of the Department of Environmental Conservation. My district encompasses Bennington, Addison and Rutland Counties.

Q2. Please describe your educational background and relevant work experience.

A2. My educational background includes a B.S. in Natural Science from The Ohio State University and a Master of Public Administration from the University of Vermont. I have worked as an environmental analyst for 8 years, including 6 years working for environmental analytical laboratories. I have attached my resume to this testimony. (Exhibit ANR MM-1)

Q3. Please describe your role and responsibilities at the ANR.

A3. I have been employed at the ANR as an Environmental Analyst since August 2006. My responsibilities at the Department of Environmental Conservation (DEC) Stormwater Program include the review of stormwater discharge permit applications, the drafting of permits, and the provision of regulatory and technical assistance. I also conduct site inspections and pursue compliance and enforcement. I have reviewed approximately 100 projects and conducted dozens of site inspections.

Q4. Have you previously provided testimony to the Public Service Board?

A4. No, I have never provided testimony to the Public Service Board.

Q5. Is there anything that the applicant and the Board should be apprised of regarding the Department of Environmental Conservation's (DEC) Stormwater Program?

A5. The Stormwater Program issues separate permits for runoff from impervious surfaces and construction sites. All new projects, redevelopment projects and expansion projects are evaluated to determine whether a State Stormwater Permit (General Permit 3-9015) and/or a Construction Stormwater Permit (General Permit 3-9020) are needed.

The State Stormwater Permit Program addresses runoff from impervious surfaces – rooftops, roadways, etc. The State Stormwater Discharge Permit program has specific jurisdictional thresholds based on the amount of impervious surface, typically triggered at one acre. Stormwater discharges from impervious surfaces under both State Stormwater Management Rules – Environmental Protection Rules Chapter 18 and 22. Applications for coverage under this program must attain the five treatment standards within the Vermont Stormwater Management Manuals (VSMM).

The Construction Stormwater Permit Program addresses stormwater runoff from construction activity that disturbs one or more acres of land. Stormwater discharges from earth disturbance for construction activity are regulated via the Clean Water Act under the National Pollution Discharge Elimination System (NPDES) state's federally-delegated construction permit program through technical review of erosion prevention and sediment control (EPSC) plans.

Q6. What is the purpose of your testimony in this proceeding?

A6. The purpose of my testimony is to provide the Agency's position on the proposed project with respect to a number of the environmental criteria that are reviewed by the Public Service Board pursuant to 30 V.S.A. § 248(b)(5). I will discuss the project's potential impacts regarding stormwater pollution and soil erosion as well as other water quality-related criteria, principally focusing on the petitioner's obligation to obtain both State Stormwater and Construction Discharge Permits.

Q7. Are you familiar with the proposed project site?

A7. Yes, I am. I participated in a joint site visit on November 9,2007, walking nearly the entire length of the proposed project site.

Q8. Have you reviewed the petition and pre-filed testimony?

A8. Yes, I have reviewed all of the relevant testimony and exhibits related to water quality and stormwater management relative to the construction and operation of the proposed project including the supplemental testimony.

Q9. Do you have any observations regarding the petition and pre-filed testimony?

A9. this project will be required to obtain two stormwater-related permits, one for the construction and the other for the operation of the project: Construction Stormwater Permit (General Permit 3-9020) and State Stormwater Discharge Permit (General Permit 3-9015), respectively. However, I believe it is fair to assume that given the nature and scale of the project, it will not be eligible for coverage under the Construction Stormwater Permit 3-9020 and will need to apply for an individual construction permit.

Q10. What are the requirements of an individual construction permit?

A10. **An** Individual Construction Stormwater Discharge Permit is a customized permit and EPSC plan for discharges of stormwater from construction activities. Typically, individual construction permits are issued for projects that, by their nature and scale, have a higher risk to discharge stormwater pollution into waters of the state. **An** individual construction permit is specifically tailored to the proposed activity and includes additional protective measures (e.g. the requirement for oversight by an Environmental Specialist and water quality monitoring). Unlike General Permit 3-9020, which has already been through a

public comment and appeal process, individual permits require a 30-day public comment period and a 30-day appeal period once they are issued.

Q11. Have you formed any opinions to the completeness of the information?

A11. Yes, due to the lack of information regarding the nature of the proposed activities, I am unable to provide a comprehensive evaluation of the proposed stormwater pollution prevention plans, especially relative to the Construction and Stormwater Discharge Permit technical requirements. Such plans will need to be included in a formal application for permit coverage filed for thorough technical review. Nonetheless, upon completing a preliminary review of the information provided, the proposed stormwater management design does not meet the treatment standards within the Vermont Stormwater Management Manuals or the Vermont Standards and Specifications for EPSC.

Q12. What further information would be useful for you to have in reviewing a project of this kind?

A12. Short of submitting formal applications for permit coverage, the petitioner could provide draft stormwater pollution prevention plans. It is difficult to assess the risk of the project without information of project phasing, knowledge of how much area will be disturbed at any one time, and details of the stabilization methods and schedule. Additionally, it would be useful for the petitioner to identify all waters of the State that will receive stormwater discharges and to identify what post-construction stormwater treatment practices will be used at

each discharge location in addition to providing information as to how those practices met the specifications and standards within the VSMM.

Q13. Do you have any particular concerns about the information provided?

A13. Yes, as mentioned, comprehensive stormwater pollution prevention plans were not provided. A suitable EPSC plan would include detailed information on all the areas where a risk of a discharge is thought to exist, and would provide sufficient detail on the plan to ensure that the risk is minimized. Also, the information provided regarding the operational stormwater management plan was inadequate to allow for a suitable technical review.

Q14. Can you describe the general components of an EPSC Plan?

A14. There are five required plans that typically comprise an EPSC Plan: a location map, an existing conditions site plan, a grading plan and timetable, an erosion prevention and sediment control plan, and a narrative that summarizes the four other plans and makes the argument for why the proposed plan would suitably protect against erosion and sediment discharges to waters of the state.

Q15. What is your greatest concern at this point?

A15. At present, a sand filter is proposed for attaining the Channel Protection Volume Standard and the Flood Protection Standards. The VSMM indicates that filtering systems should not be designed to provide treatment for these standards. Additionally, by their nature, linear projects such as this pose enormous technical

challenges to meeting all of the applicable treatment standards making it a difficult to adequately collect, convey and treat an adequate volume of water. Furthermore, the steep slopes inherent to this project site are also going to make protecting water quality more difficult, warranting additional protective measures which, at present, are not part of the submitted testimony.

Generally though, I am concerned that the applicant has not adequately identified the stormwater management measures that will be utilized on-site. It should be noted that it is very likely that the applicant's choice in stormwater management, practices will change as the ultimate footprint of project evolves. It would be useful to everyone involved to know what types of practices will be employed.

Q16. What further information will you need to make a full examination of the project?

A16. In order to conduct a full examination of the project, formal applications for permit coverage under the Construction and Stormwater Discharge Permit programs will need to be formally submitted.

Q17. Are you aware of the Board practice of undertaking a post-certification process?

A17. Yes. I understand that the Board has issued Certificates of Public Good (CPG) to a petitioner before the petitioner undertakes all the engineering needed to construct the project because of the expense involved. In that light, I understand

that, if the project is granted a CPG, I will be provided with the information I listed above during that post-certification. Again, the kind of information that was included in the petition, from a storrnwater pollution prevention point of view, does not allow for a suitable evaluation of the merits of the plan in addressing potential water quality problems.

Q18. Does this conclude your testimony?

A18. Yes, it does at this time.

Matthew Probasco

Curriculum Vitae

Public Service Board
Deerfield Wind, LLC
Docket No. 7250
Exhibit No. ANR MP-1
Admitted ____ Date _____

WORK EXPERIENCE

Environmental Analyst
Vermont Agency of Natural Resources ***8/2006 - Present***
Department of Environmental Conservation
Water Quality Division – Stormwater Section

- District Analyst for the Stormwater Section in Bennington, Addison and Rutland County; Provide technical review of permit applications, technical design assistance and jurisdictional determinations for state (operational) stormwater permits and construction stormwater permits.

Committee Member
City of South Burlington, Vermont ***3/2006 - Present***
Natural Resources Committee

- Involved in natural resource planning, development and protection efforts for the City of South Burlington; review all projects that may impact surface waters and wetlands; work to advise the City's Development Review Board, Planning Commission and Department of Planning and Zoning.

Graduate Public Policy Intern
Snelling Center for Government ***8/2005 - 3/2006***
University of Vermont

- Worked in collaboration with local, state and federal government agencies as well as non-profit organizations to foster a broad understanding of non-native, invasive species (NNIS) policy. Assisted in the research, preparation and revision of a forest-based NNIS policy brief. Prepared a regional stakeholders list, regulatory analysis and risk assessment for effective NNIS management. Researched the cost of an economic development proposal. Drafted a comprehensive NNIS management plan for Vermont.

Microbiologist
Clancy Environmental Consultants, Inc. ***5/2003 - 5/2004***

- Collaborated in the implementation of U.S. Environmental Protection Agency (EPA) policy regulations for a microbiological research, consulting and testing company. Used EPA methods to assess the safety of water produced by municipal drinking and waste water plants. Participated in the development of new analytical methods, and contributed to water distribution system studies. Responsibilities included developing standard operating procedures for multiple methods and general laboratory techniques. Maintained highly detailed quality control and data records. Provided support during EPA audits and other regulatory programs.

President, Board of Directors
Stonehedge North Area Association ***1/2001 - 1/2004***

- Led six-member board for 77-home association. Worked with board members and a property manager to develop and implement association-wide regulations and policies. Prepared and forecast $150,000 annual budget for $8 million, 16-acre property. Over saw the implementation of numerous capital improvement and maintenance plans including a $120,000 roofing and $90,000 paving project. Analyzed property assessment policy for tax-based monthly dues. Effectively addressed homeowner questions and concerns. Provided oversight of contractual employees. Encouraged policy outreach and awareness.

Laboratory Coordinator
Analytical Services, Inc. ***8/2000 - 5/2003***

- Supervised and coordinated laboratory analyses. Managed quality control, daily schedules, final reports, and issue troubleshooting. Coordinated laboratory operations including equipment and supply maintenance, method protocol adherence, and report generation and review. Maintained quality control and analytical databases according to regulatory procedure. Over saw four laboratory analysts through a team approach with effective task definition, clear communication and successful motivation.

EDUCATION

University of Vermont
Master's Degree - 5/2006
36 Semester Hours
Major: Public Administration
GPA: **3.63** out of 4.00
MPA Graduate Comprehensive Examination - Pass with Distinction

The Ohio State University
Bachelor's Degree - 6/1995
198 Quarter Hours
Major: Natural Science
GPA: 2.90 out of 4.00

JOB RELATED TRAINING

Stewardship of the Urban Landscape, completion certification
International Erosion Control Association, Coursework, attendance certification
Project Wet Certification
Project Learning Tree Certification
Project Wild Certification
Grant Administration Certification - UVM's ed2go.com

STATE OF VERMONT
PUBLIC SERVICE BOARD

Docket No 7250

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DIRECT TESTIMONY OF SCOTT DARLING

ON BEHALF OF THE VERMONT AGENCY OF NATURAL RESOURCES

Mr. Darling is a wildlife biologist with the Vermont Department Fish and Wildlife. He provides the Agency's review of the potential impacts of the proposed project on Vermont's bats, makes recommendations to minimize any impacts from the project, and proposes a course of further evaluation of potential impacts and necessary responses where warranted.

DIRECT TESTIMONY OF SCOTT DARLING

Q1. Please state your name, place of employment, your current position and any other position you have held with the Department.

A1. Scott Darling, wildlife biologist for the Vermont Fish and Wildlife Department and stationed at the Rutland office. I have formerly held the position of Director of the Wildlife Division for the Department from 1999 to 2001.

Q2. Please provide a description of your educational background.

A2. I have a B.S. in Wildlife Biology from the University of Vermont and an M.S. in Administration from St. Michael's College. I have been a certified wildlife biologist by the Wildlife Society since 1987. My resume is attached. (Exhibit ANR-SD-1).

Q3. Have you previously provided testimony to the Public Service Board?

A3. Yes, I provided testimony on behalf of the Department regarding Dockets 6860, 6911, and 7156. The latter two dockets were proposals for wind energy facilities in East Haven and Sheffield, Vermont.

Q4. Please describe your experience and training regarding migratory and resident bats.

A4. My training and experience with bats has been extensive since 2001. In this time, I have attended formal bat conservation and management workshops throughout the country, ranging from week-long workshops on bat management techniques to regional and international bat symposia. I am an active participant in the Northeast Bat Working Group, an organization of state, federal, and university bat biologists focusing on bat conservation and management issues in the Northeast.

I have worked closely with other bat biologists from the U.S. Fish and Wildlife Service, other state fish and wildlife agencies, and universities. In many instances, research and evaluation of bat conservation and management issues take place on a regional level, and Vermont is now a principal player in such efforts. As a result, I have co-authored two recent peer-reviewed articles on Indiana bats.

My responsibilities for the conservation of Vermont's nine bat species require me to develop and implement the state's bat conservation and recovery plan. A significant element of the state's bat conservation and management program is to conduct numerous field surveys and research projects. In the past several years, field surveys have included bat hibernacula (i.e., caves and mines) surveys, summer mist-netting and acoustic surveys, and fall swarming surveys to inventory and monitor bat species composition or monitor population indices. Research work has focused primarily on the Indiana bat (Myotis sodalis) and includes capture and radio telemetry to study spring emergence and migration, maternity colony habitat, and summer foraging habitat of this federally endangered species.

More recently, survey work is being conducted on migratory bats, the state threatened small-footed bat, and the eastern pipistrelle.

Q5. Do you have a role in assessing Vermont's bat populations and their habitat for the Department of Fish and Wildlife?

A5. One of my roles as the state's bat biologist is to apply my expertise in evaluating Vermont's bat populations, designing research projects to further our understanding of these populations, and developing and implementing conservation and management programs to maintain bat populations. One of these programs includes evaluating land use and management activities for their impacts to bat populations and, where appropriate, providing the DFW with an assessment of the impacts of these activities in preparation for specific regulatory procedures (e.g., Vermont endangered species permits, Act 250 permits applications, Section 248 proceedings). I am currently preparing both forest management guidelines and habitat mitigation guidelines for the Indiana bat.

Q6. What is the purpose of your testimony in this proceeding?

A6. To provide the Agency's review of the potential impacts of the proposed project on Vermont's bats, to make recommendations to minimize any impacts from the project, and to propose a course of further evaluation of potential impacts and necessary responses where warranted.

Q7. Have you reviewed the petitioner's prefiled direct testimony, in particular the testimony of Robert Roy and Wallace Erickson?

A7. Yes, I have. I also visited the project site in June and July of 2005.

Q8. Have you reviewed the petitioner's supplemental direct testimony, in particular the testimony of Steven Pelletier and Wallace Erickson?

A8. Yes, I have.

Q9. Please describe the other background work you have conducted in order to assist you in the review of the petitioner's proposed project?

A9. The effects of utility-scale wind facility development on bats in the Northeast continue to receive great attention within the bat biologist community due to continued findings of unexpectedly high levels of bat mortality at recently constructed ridge top utility-scale wind projects from New York to Tennessee. In addition, some existing windfarms have now been re-evaluated for their impacts to bats. As a result, bat biologists now communicate regularly regarding on-going research and monitoring at existing windfarm sites, pre-construction survey needs and methods, post-construction surveys needs and methods, as well as bat fatality thresholds that are sustainable at the population level. Unfortunately, in many

instances, the information from many of the studies is not available to state or federal agencies; this information is often owned by utility-scale wind companies and is not readily available. Over time, however, an increasing number of published reports documenting bat fatality survey work is being published.

I have participated in meetings, workshops, and discussions about utility-scale wind projects and bats through the Northeast Bat Working Group, the New England Chapter of The Wildlife Society, and through numerous discussions on the issue with state fish and wildlife agency bat biologists from New York, Pennsylvania, West Virginia, and Virginia, Susi Von Oettingen, U.S. Fish and Wildlife Service, Ed Amett, Bat Conservation Intemational, and Tom Kunz, Boston University. I have participated in organized meetings throughout the nation of windfarm organizations (e.g., American Wind Energy Association, National Wind Coordinating Committee) and bird and bat biologists to work toward a common understanding of the information needs and appropriate methods for addressing impacts of utility-scale wind projects on wildlife. More recently, I attended the wind energy symposium at the XIV Intemational Bat Research Conference in Merida, Mexico.

In addition to information gathered from these sources, I have participated in the review of other proposed utility-scale wind projects in Vermont, namely at East Mountain, Sheffield, Grandpa's Knob, and Little Equinox. In each case, I am

consulted on information needs and the proposed methods to address these needs relative to bat species.

I have also reviewed numerous publications on regional and national evaluations of the effects of utility-scale wind energy development on bats from such entities as the Government Accounting Office, the National Academy of Sciences, American Fish and Wildlife Association, and The Wildlife Society. I also review publications available on research work being conducted at specific wind energy facilities in the United States, Canada, and Europe.

Q10. Can you provide an overview of Vermont's bat resources?

A10. First of all, it is important to understand the life history of Vermont's bat species in assessing the potential impacts of a utility-scale wind project on Vermont's bats. There are nine species of bats found in Vermont. In general, six of the species hibernate in caves or mines during the winter and then emerge in the spring to migrate to their summer range. The migrations of these species vary from a mile or more, to a few hundred miles. The remaining three bat species are considered long-distance migrants in that they migrate out of the Northeast in late summer and early fall and spend the winter months in the southeastern United States or further south (Fleming and Eby 2003). They then return to Vermont and the Northeast in late spring.

Second, Vermont's bat populations are forced to survive at the more northern latitudes of their range in North America. Vermont's bats must deal with shorter summers, longer hibernation periods, and cooler, more volatile temperatures. These factors all result in lower bat populations relative to other parts of North America. Because bat numbers may be fewer at our latitude, their populations may, in fact, be more vulnerable to added mortality factors.

Third, it is important to understand that Vermont's bat species are long-lived (i.e., 20 years or more) and all have very low reproductive potential that makes them particularly vulnerable to additional mortality factors. Bats give birth to generally one young (long-distant migrants often give birth to two young) per year. Factors such as cool spring temperatures and poor quality food supplies may further reduce reproduction and/or survival. Migrating long distances likely increases the annual mortality rate for those species traveling so far.

Finally, it is vital to acknowledge how little we know about Vermont's bat species and populations, particularly the long-distant migrant bat species that have been found to be most vulnerable to collisions with utility-scale wind projects. Only since 2001 has the Vermont Fish and Wildlife Department dedicated any significant financial and staff resources to bat conservation and management. Prior to this, most of the information on Vermont's bats was limited to surveys of bat hibernacula and periodic fall capture and banding projects at specific hibernacula. More recently, summer mist-netting and acoustical surveys for

Indiana bats and general bat surveys on public lands have provided important insights into bat species distribution and relative abundance. However, there remain significant data gaps regarding the distribution, abundance, and stability of the species' populations in the state, particularly during the summer season. This is particularly true of the species that are more difficult to capture and less abundant in the state, such as the long-distance migrants.

Q11. Now let's discuss the potential impact on resident and migratory bats. Please describe the concerns the Agency has with regard to this utility-scale wind facility development on bats.

A11. Concerns about the potential effects of the Deerfield wind project are derived from findings initially revealed in 2003 from three new ridge-top wind facilities in the East that suggested that these developments yielded the highest bat collision mortality levels among wind facilities in the nation. Between the spring and fall period of 2003, one site, the Mountaineer Wind Project in West Virginia, observed 475 dead bats, resulting in an total facility estimate of 2092 dead bats (47.5 dead batslturbine) (Kerns and Kerlinger 2004). These findings may have been underestimates since mortality searches were conducted no more than once per week. Ensuing research conducted at Mountaineer and Meyersdale windfarm sites between August 1 and September 13,2004 killed an estimated 38 batslturbine and 25 bats/turbine, respectively, for the six week study period (Arnett 2005). This comprehensive analysis demonstrated that searcher efficiency,

the character of the habitat searched, and scavenging activity were critical components for accurate estimates of the total number of bats killed during this survey period.

Similar, although not identical, bat fatality surveys conducted at other operating utility-scale wind facilities have shown comparable fatality rates in Alberta (22 bats/turbine) (Baenvald, pers. cornm.), New York (25 bats/turbine – daily searches)(Jain et al. 2007), Tennessee (64 bats/turbine) (Fiedler et al. 2007), and even Germany (12 – 21 bats/turbine)(Brinkman et al. 2006). Furthermore, as turbine and rotor heights have increased to over 400 feet in recent years, there is evidence that the taller turbines may actually be killing a greater number of bats (Barclay et al. 2007). These findings have only heightened bat biologist concerns about the levels of bat mortality experienced at utility-scale wind energy facilities.

While as many as eight different bat species have been found dead at wind facilities, the species composition of the mortality is not evenly distributed (Johnson 2002, Kunz et al. 2007). In fact, the long-distant migrant species (red bat (Lasiurus borealis), silver-haired bat (Lasionycteris noctivagans), and hoary bat (Lasiurus cinereus)) comprise the majority (nearly 75%) of the mortality at these sites (Kunz et al. 2007).

Intensive, multiple-year post-construction research studies will provide more information on the effects of these individual sites as well as the pool of utility-scale wind projects in the East on bats.

Q12. Given bats' use of echolocation to avoid obstacles and find prey at night, how is it that bats are colliding with wind turbines?

A12. We now know that bats are being killed by the wind turbines in at least two manners. One, bats are actually colliding with the turbine rotors and dying from traumatic bodily injuries. Second, post-construction bat fatality surveys have observed a large proportion of the dead bats with intact bodies showing no external injuries. Recently, autopsies of such bats killed in Alberta showed signs of significant pulmonary trauma. Such symptoms support a hypothesis (i.e. Decompression hypothesis) that many of the bats are actually killed by drastic changes in barometric pressure resulting from quickly being swept up through the rotors and forced down on the leeward side (National Research Council 2007).

Currently, there are numerous theories as to why bats are not able to avoid turbines. The Petitioner's bat survey reports note a few of these. Kunz et al. 2007 offers as many as 11 hypotheses to rationalize this phenomenon. These hypotheses range from bats not consistently using their echolocation while migrating at high elevations to bats being attracted to wind turbines for roosting. Some researchers now suggest that migratory bats may even view turbines as

superb roost trees where such bat species may congregate for breeding in the autumn.

Q13. The initial Searsburg wind energy facility conducted a bird carcass search in 1997 and observed no dead bats at the site. Does this observation inform us about the level of risk to bats at this site?

A13. The initial fatality search conducted by Paul Kerlinger in 1997 focused primarily on birds. More importantly, however, the existing turbines searched in 1997 are an estimated 40 meters in tower height (198 feet to tip of rotor blade), compared to the Petitioner's most recent proposal to construct 17 turbines with a hub height of 78 meters (393 feet to tip of rotor blade). An evaluation of existing utility-scale wind energy facilities in the United States and Canada showed a positive, relationship between turbine tower height and bat fatalities (Barclay et al. 2007). Bat fatality research at the Buffalo Mountain wind energy facility in Tennessee, where existing 65 meter (tower height to nacelle) turbines were augmented with 78 meter turbines, resulted in fatality estimates of 35 and 70 dead bats/turbine, respectively (Fiedler et al. 2007). As a result, in my opinion, bat fatality levels from the smaller, existing turbines provide little to no indication of potential bat fatalities that the taller turbines may yield.

Q14. What species of bats are potentially affected by this project?

A14. There are several bats that may be affected by this project, primarily as a result of collisions with the turbines and their rotating blades. The long-distant migrant species include the silver-haired bat (Lasionycteris noctivagans), the hoary bat (Lasiurus cinereus), and the red bat (Lasiurus borealis). These species, along with the eastern pipistrelle (*Pipistrellus subflavus*) have comprised the significant majority of bat fatalities at existing wind utility-scale wind projects in the East.

The summer residential bat species most likely to be affected include the little brown bat (Myotis *lucifugus*) and the big brown bat (Eptesicus *fuscus)*. Both of these species are present in the area and have been documented as killed by turbine collisions in the East.

The remaining three bat species – the state and federally endangered Indiana (Myotis sodalis), northern long-eared bat (Myotis septentrionalis), and the state threatened small-footed bat (Myotis leibii) are not likely to be impacted by collisions with turbines at this site. Increasingly, the northern long-eared bat has shown not to be vulnerable to such collisions. Both of the listed species – the Indiana bat and the small-footed bat – are not likely present in the immediate project area as a result of the Petitioner's habitat suitability assessment of the project area.

Q15. Briefly, how are acoustic bat surveys conducted, and how does one identify bat species that are detected?

A15. The Anabat system of bat detectors record high frequency sounds, including the echolocation calls of bats. Sounds are picked up on a microphone on the bat detector and recorded digitally onto a memory card. The recorded bat calls can be used to draw conclusions about either levels of bat activity or the presence of particular bat species at a given site. In order to determine the latter, using special software, these high frequency sounds are visually displayed for either qualitative or quantitative analysis of the call characteristics to determine the bat species. Unfortunately, some of the calls, particularly of the *Myotis* genus, cannot easily be distinguished from each other. Under such circumstances, one may need to look at other factors such as roost sites (e.g., buildings, trees, cliff faces) to help increase the likelihood of a particular *Myotis* species being present.

Q16. Did the Agency request pre-construction studies and did the Petitioner undertake those studies?

A16. I have been involved in the review of the project to some degree since January 2005. At that time, I provided recommendations to conduct habitat suitability assessments for small-footed bats and Indiana bats, as well to begin planning for both radar and acoustic monitoring surveys for bat activity at the project site. The Petitioner conducted the necessary radar, acoustic, and habitat suitability

assessments in order to provide adequate information to determine the level of risk to the various bat species populations.

Q17. What is your overall evaluation of the results of these surveys and the data provided?

A17. In May 2005, Arrowwood Environmental completed its habitat assessment and mapping for both the Indiana bat and the small-footed bat, two listed bat species. The work was conducted with consultation with the U.S. Fish and Wildlife Service and me. I concurred with the methods and conclusions drawn regarding the lack of suitable habitat in the vicinity of the project site for the Indiana bat.

The assessment did identify potential small-footed bat roosting sites. I conducted a field review of these sites with U.S. Forest Service personnel from the Green Mountain National Forest in June 2005. Of the sites visited, only one site showed high potential to serve as roosting habitat for the small-footed bat. Forest Service personnel and I conducted acoustic monitoring at the cliff site that evening and no bat calls of the genus Myotis were collected at the site. As a result of this work, I am comfortable in concluding that the site does not serve as roosting habitat for this species.

Woodlot Alternatives, Inc. conducted acoustic bat surveys over portions or all of spring and fall seasons during 2005 and 2006. The surveys used Anabat acoustic

detectors to provide an index of bat activity levels, by species when possible. Each of the four survey efforts had shortcomings in either the number of acoustic detectors employed or in the number of detector nights fully sampled during the survey period. As an example, in total, acoustic detectors sampled **800** detector nights of the possible 1277 detector nights in the sampling periods for all four seasons – a 63% coverage rate. Fortunately, the petitioner's effort to sample over a two year period provided enough total effort to offer insights into the level of bat activity at the project site. In essence, it is my opinion that the level of bat activity as estimated through the acoustic surveys is sufficiently low to conclude that the project ***does not necessarily*** pose an undue adverse risk to bats.

Q18. Can you explain what you mean by the terms "does not necessarily"?

A18. In my opinion, the pre-construction bat activity surveys at Deerfield do not suggest that bat activity levels are so high at the site as to warrant a finding of undue adverse effect to bats. However, given the high levels of bat mortality at other sites in the East, the level of uncertainty regarding realized bat fatality levels from the project requires that adequate measures be taken to monitor and, if necessary, address bat fatalities to reduce project impacts to bat populations by means such as operational protocols.

Currently, I believe there is general agreement among scientists that pre-construction indices of bat activity (i.e., activity levels derived from acoustic

surveys) are not predictive of potential bat fatality levels at a given site. A recent GAO report described the numerous challenges in making projections of the magnitudes of potential wind-power related fatalities (GAO 2005). CITATION(S) The Petitioner's expert on bats admits "[t]he predictability of bat fatalities from pre-construction data is highly speculative, as relationships between bats and wind turbines and potential factors causing bat collisions are largely unknown" (Deerfield's Response to ANR's First Set of Information Requests, Dec 3, 2007).

Yet, the Petitioner's conclusion that the project is ***not*** likely have an undue adverse effect is based upon their analysis of bat mortality and activity levels at five wind energy facilities in the United States. While I concur with their acknowledgement of the uncertainty of the effects of the project on bats, I disagree with their reliance on that data alone to conclude that the proposed project, fully operating, will not likely have an undue adverse effect on bats.

Beyond the lack of predictability, the data from each of the five sites in Table 6 vary in survey intensity, duration, and the methods used in estimating fatality levels. For example, some of the bat activity data offered are from studies done after the turbines were erected and operating. Should turbines act as any attractant to bats (several hypotheses to explain bat fatalities include this element), then bat activity measures taken at existing turbines should not be compared to those taken at sites without turbines. Consequently, in my opinion, such data should not be

used to make predictions about the relationship between pre-construction bat activity and post-construction bat fatality rates.

In addition, the table excludes other wind energy sites that now provide similar types of data, but offer a different conclusion. For example, pre-construction bat activity levels at the Maple Ridge wind energy facility in New York were relatively low (0.09 bat passes/detector night in the spring 2005) (Reynolds 2006), yet the first year of post-construction bat fatality surveys yielded an estimated 20 dead bats per turbine (Jain et al. 2007). It is noteworthy that the Deerfield's project's spring acoustic surveys resulted in very similar pre-construction bat activity levels of 0.07 and 0.10 bat passes per detector night for spring 2005 and 2006, respectively. As a result, I believe it is inappropriate to predict that such bat activity levels will yield low fatality rates.

Q19. Are there any particular bat species about which you have concerns?

A19. I have already identified the three long distance migratory bat species – the hoary, red, and silver-haired bat – that are most vulnerable to collisions with utility-scale wind turbines in this region. These three species comprised 73.4% of the total bat fatalities at the Maple Ridge wind energy facility in New York. This concentration of mortality within these three species has raised significant concerns among scientists as to the potential long-term cumulative implications on their population sustainability (Kunz et al. 2007).

Q20. What level of post-construction mortality would be a concern for the Agency?

A.20. First, any bat fatalities of threatened and endangered species would be a concern. However, I believe the Petitioner has adequately evaluated the habitat suitability for both the Indiana and small-footed bats and I concur that likelihood of bat fatalities of either of these species is extremely low.

I am certain that a fully operating project will kill migratory bats. A critical question is what fatality levels are significant enough to warrant concerns about the species in Vermont. This is particularly difficult for a type of project that is being developed throughout the species' range, much of which is outside of the state during certain periods of the year. For example, the projected annual number of hoary bat fatalities alone from two estimates of total wind turbine capacity in the mid-Atlantic Highlands region range from 9300 to over **3**1,000 hoary bats killed by wind turbines per year (National research Council 2007).

This need to evaluate the effects on bat species populations on a regional level is why I have been actively involved in discussions with my professional counterparts working for state wildlife agencies in the states of New York, Pennsylvania, West Virginia, and Virginia. As a result of these discussions, my opinion of acceptable thresholds for bat fatalities at a given project site has

evolved. In earlier reviews of wind energy facility petitions in Vermont, I established a single acceptable total bat fatality level (i.e., 4.0 dead bats/turbine/year) as a guide for when further actions would be needed to reduce these fatalities. More recently, I have adopted bat fatality threshold guidelines similar to other states that establish fatality thresholds at the species or species group level. This approach gives more consideration to the effects on a particular species population. As a result, it is my opinion that undue adverse impacts to bat populations may be occurring and should be addressed when estimated bat fatalities (per turbine per year) exceed:

- 3.0 migratory bats (combinations of red bat, hoary bat, and silver-haired bat), or
- 0.0 threatened and endangered bat species (Indiana bat or small-footed bat), or
- *5.0* more common bats (combinations of little brown bat, big brown bat, northern long-eared bat, and eastern pipistrelle)

These thresholds allow for increasing sensitivity from threatened/endangered species to uncommon migratory species to the more common resident bat species.

Q21. Do you have any specific recommendations as to how estimates of post-construction fatality levels should be made?

A.21 In order to adequately estimate bat fatalities at an operating wind energy facility, a significant effort must be made to conduct post-construction bat fatality searches of sufficient design and methodology to adequately estimate fatalities at the

project site. Currently, post-construction fatality surveys are being conducted at several wind energy facilities in the East. Unfortunately, there is no single scientifically adopted survey methodology/protocol to conduct such surveys. As a result, many of the fatality surveys are conducted using different methods, particularly regarding survey period (e.g., spring, summer, fall, or all seasons), search interval (e.g., 1 day, 3 days, or 14 days), proportion of turbines searched, plot size, and the methodology for searcher efficiency and scavenging rate trials. The latter two items can greatly influence the resulting estimates of total bat fatalities at a given facility. With specific bat fatality thresholds as triggers for further actions, it becomes very critical that the bat fatality surveys use the best scientific and statistically rigorous methodology to yield reasonable estimates of mortality.

Q22. Is the Petitioner's commitment to one year of post-construction mortality studies sufficient to address the Agency's concern's as described above?

A.22 No. The Petitioner has committed to conduct one year of post-construction mortality surveys with details on survey methodology to be developed following discussions with ANR. Unfortunately, we are only beginning to have multiple year bat fatality data on a few utility-scale wind energy facilities in the East, and, consequently, it is impossible to draw any conclusions about the year to year variability in bat fatality rates. It is the Agency's opinion that a standard of three years of post-construction bat fatality surveys must be conducted in order for the

Agency to be satisfied that the project is not killing bats at levels that exceed the above thresholds. It is also the Agency's opinion that a scientific and statistically valid survey protocol to conduct this work must be developed in concert with the Agency and approved by the Agency prior to facility operation. The Agency recommends that the Petitioner establish and fund an escrow account to support the necessary post-construction monitoring by independent, qualified professionals for three years.

Q23. Would such post-construction bat fatality surveys impact other natural resource values of the project site?

A23. Yes, the Agency is appropriately concerned that the intensity and duration of the post-construction bat fatality surveys needed to properly estimate fatality levels may introduce human activity at the project site at such a level as to impact bear use of the habitat on and around the project site. This is a potential conflict when utility-scale wind energy facilities are constructed in and proximate to necessary black bear habitat.

One approach to partially address this conflict is to schedule bat fatality surveys during fall and spring seasons when beechnut production/availability is determined to be low for that particular year. In addition, survey protocols would need to be established to minimize human noise and activity as much as possible.

Neither of these solutions is ideal, and the Agency and the Petitioner should discuss alternative solutions to the conflict.

Q24. What if the project should exceed any of the bat fatality thresholds?

A.24. If average bat fatality estimates for the three post-construction fatality surveys exceed the thresholds, then appropriate mitigation measures should be required to attempt to reduce bat fatalities below such thresholds. Because the scientific community is still researching the causes and conditions under which these fatality levels are occurring, I prefer some level of adaptive management as a tool to work with the Petitioner to address this issue. Most likely, some forms of operational adjustments seem the most promising near-term measure that could result in significantly fewer bat fatalities. Depending on the degree to which estimated bat fatalities exceed the thresholds, operational adjustments may vary from date-specific shutdown periods to limiting operation during specific wind and temperature regimes that pose the greatest threat of bat fatality events. Proper adaptive management would also require some level of monitoring for documenting its efficacy.

Q25. Have such strategies/approaches been applied in Vermont or in other states?

A.25. Yes, in fact the Certificate of Public Good for Docket 7156 included a joint stipulation between the Agency and the Petitioner that essentially initiated the

outer boundaries of an operational adjustment protocol under which bat fatalities would be reduced. We see that as an excellent model for how to proceed.

The use of operational adjustments have also been included in proposed and final permits from other states such as the Public Service Commission of Maryland (Case No 9008 and **8938)** as well as the Virginia State Corporation Commission (Case No. PUE-2005-00101). In all three cases, specific bat fatality thresholds are provided, above which additional operational adjustments must be initiated.

Q26. Have such strategies been implemented and tested for the efficacy in reducing bat fatalities?

A26. The examination of their efficacy is ongoing. In addition to the utility-scale wind energy facilities discussed above, there are facilities in both Pennsylvania and Alberta that anticipate testing operational adjustments in the next year or two. However; there is some encouraging information from both statewide acoustic surveys in Maryland and operating wind facilities in West Virginia and Pennsylvania that suggest that bat activity levels and, consequently, fatality events decrease dramatically during periods of higher wind speeds and lower ambient temperatures.

Recently, bat collision risk models developed by the State of Maryland indicate that curtailment of turbine operations during nights within the summer – fall

migratory season when wind speeds are at or below 4 meters/second will greatly reduce (– 80%) bat collisions. The models estimate that significant reductions in bat fatalities can be realized with as few as 400 hours of turbine curtailment per year (Sherwell 2006).

Research conducted at operating wind facilities in West Virginia and Pennsylvania suggest that bat fatality events were more common when wind speeds exceeded 6 meters/second. In many instances, the larger bat fatality events occurred during low wind speed evenings following the passing of weather fronts (Arnett 2005).

Operational adjustments based, at least in part, on wind speed seem particularly promising since most of the utility-scale wind facilities such as the one proposed by the Petitioner do not begin to generate any electricity until wind speeds exceed 4 meters/second. Even operational adjustments set at 6 meters/second would likely have a minimal impact on energy production. The total impact on energy production cannot be evaluated without the Petitioner providing site specific wind data.

Q27. Does this conclude your testimony at this time?

A27. Yes.

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Education

1979 B.S. Wildlife Biology, Univ. of Vermont, Burlington, VT
1993 M.S. Administration, St. Michael's College, Colchester, VT

Work Experience

Bat Project Biologist, VT Fish and Wildlife Department August, 2001 – Present
Serve as Department's key contact person regarding conservation and management of bats. The position includes the development and implementation of the state's bat conservation and recovery plan. Current field studies include capture, radio telemetry, and habitat assessment of Indiana bats, as well as acoustic monitoring as a strategy for statewide surveys for all bat species. Other duties include hibernacula surveys, mist-netting and acoustic monitoring surveys, and habitat evaluation.

Director of Wildlife, VT Fish and Wildlife Department January, 1999 – August, 2001
Served as director of the wildlife division, administering the division's programs in game and nongame species, state lands management, and environmental regulatory review.

VT Agency of Natural Resources Biodiversity Committee Chair 1995 – 1999
Served as chair of the Agency's Biodiversity Committee responsible for Agency matters regarding biodiversity, including Agency lands management issues on the subject.

Black Bear Project Chair, VT Fish and Wildlife Dept August, 2001 – August, 2004
Sept, 1995 – January, 1999
Chair the black bear project team which is responsible for all management activities associated with the species. Duties include assessment of population dynamics, habitat conservation, and public outreach.

White-tailed Deer Project, VT Fish and Wildlife Dept Sept. 1983 – January, 1999
Served on the management team associated with management programs for white-tailed deer. Duties included population dynamics, winter habitat conservation, and public outreach.

Wild Turkey Project Leader, VT Fish and Wildlife Dept Sept. 1983 – October, 1990
Served as the project leader for all management programs associated with wild turkeys in Vermont. Duties included population dynamics and public outreach.

Wildlife Habitat Biologist. VT Fish and Wildlife Dept Sept. 1981 – Sept. 1983
Served as a district wildlife habitat biologist responsible for habitat management on both private and state lands in southwestern Vermont.

Professional Organizations

The Wildlife Society, Certified Wildlife Biologist, 1985
The Wildlife Society, Member, 1979 – Present
New England Chapter of The Wildlife Society, President, April, 2003 – April, 2005
Society for Conservation Biology, Member, 1995 – Present

Publications

Watrous, Kristen, T. Donovan, R. Mickey, S. Darling, A. Hicks, and S. von Oettingen. 2006. Predicting minimum habitat characteristics for the Indiana bat in the Champlain Valley. J. Wildl. Mngmt. 70(5):1228-1237.

Britzke, E., A Hicks, S von Oettingen, and S. Darling. 2006. Description of spring roost trees used by female Indiana bats *(Myotis sodalis)* in the Lake Champlain Valley of Vermont and New York. Amer. Mid. Nat. 155:181-187.

Darling, S. 1993. Career plateauing within state fish and wildlife agencies in New England. M.S. Thesis, St. Michael's College, Colchester, VT.

Darling, S. 1991. Thoughts on use of mitigation when implementing statewide species management plans. Trans. Northeast Sect. Wildl. Soc. 48:154-163.

Numerous other technical publications and popular articles, generally on the subjects of habitat management, species management technical reports, and wildlife conservation.

STATE OF VERMONT
PUBLIC SERVICE BOARD

Docket No. 7250

Petition of Deerfield Wind, LLC, for a certificate of public good, pursuant to 30 V.S.A. Section 248. The application requests a Certificate of Public Good for the construction of a wind facility comprising of 15 to 24 turbines, with a capacity of up to 45MW. Deerfield Wind proposes to place half of the new turbines on the eastern side of Route 9 (extending the existing turbine string) and the other half of the turbines on the western side of Route 9.

DIRECT TESTIMONY OF FORREST M. HAMMOND

ON BEHALF OF THE VERMONT AGENCY OF NATURAL RESOURCES

Mr. Hammond is a Wildlife Biologist employed by the Vermont Fish and Wildlife Department, Agency of Natural Resources a. The purpose of his testimony is to provide the Agency's review of the potential impacts of the proposed project on wildlife resources, including impacts to migrating birds and resident birds, as well as small and large mammals (excluding bats) and their respective habitats.

DIRECT TESTIMONY OF FORREST HAMMOND

Q1. Please state your name, place of employment and your position.

A1. My name is Forrest M. Hammond. I am a Wildlife Biologist employed by the Vermont Fish and Wildlife Department, Agency of Natural Resources and I am stationed in the Springfield regional office. I have been employed with the Department for the past 18 years.

Q2. Please describe your educational background and any relevant certifications that you hold.

A2. I hold a B.S. degree in Wildlife Biology and Zoology and an M.S. degree in Wildlife Management from the University of Wyoming. My Master's thesis dealt specifically with the ecology of black bears. In addition, I am a Certified Wildlife Biologist through The Wildlife Society. I have extensive experience in addressing complex issues regarding assessing impacts from various types of development on wildlife and related habitats in both Vermont and Wyoming. I have included a resume with my testimony. (Exhibit ANR-FH-1)

Q3. Have you previously provided testimony to the Public Service Board or the Environmental Board?

A3. Yes, I have testified before the Public Service Board on matters related to impacts to significant wildlife habitat associated with regulated development including Docket 6860.

I have also testified before the Vermont Environmental Board on a project that posed impacts to wildlife habitats and provided testimony on many occasions to District Environmental Commissions regarding similar matters. It is a regular part of my duties to review Act 250 projects and provide comments on behalf of the Department regarding impacts to wildlife.

Q4. Please describe a few examples of the types of issues related to evaluating wildlife impacts or risks to wildlife resources you have participated in during your time with the Department.

A4. I have been conducting assessments of impacts to fish and wildlife habitats associated with regulated development in Vermont for nearly 18 years. My first involvement with these issues in Vermont was as the principal investigator of a black bear behavioral study investigating the effects of resort and residential development on black bears in southern Vermont. Information gained from this study has been used as the basis for the Department's involvement in minimizing the impacts to black bears from ski areas and other high elevation development projects. Since 1994, my Department responsibilities have broadened to incorporate habitat protection for Vermont's other wildlife species as well. These assessments and positions developed on behalf of the Department have involved a variety of important wildlife habitats and species. In some cases, mitigation agreements are developed with the Department to address project impacts. I have been involved in master plan development and permitting at every ski resort in the southern half of Vermont. These projects have involved collecting, analyzing and interpreting

complex data and information on various types of significant black bear habitat, deer winter habitat, wetlands, riparian habitats, nesting habitat for Bicknell's thrush, bobcat den habitat, as well as information and data pertaining to potential impacts of wind energy development on migratory and resident birds and other wildlife. As part of my regular duties reviewing Act 250 projects, I reviewed hundreds of proposals for large-scale residential and commercial development to assess how each may affect wildlife habitat. I reviewed numerous communications tower projects and have offered positions regarding their effects on migrating birds. I reviewed numerous transportation projects and provided positions on their impacts to fish and wildlife habitats, and to rare, threatened, and endangered species. This work requires that I consider the life history, habitat requirements, and behavioral characteristics for an array of wildlife taxonomic groups and species. It also requires that I develop and consider contemporary science and strategies for addressing and mitigating impacts to these habitats and species.

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

A5. The purpose of my testimony is to provide the Agency's review of the potential impacts of the proposed project on wildlife resources, including impacts to migrating birds and resident birds, as well as small and large mammals (excluding bats) and their respective habitats. Furthermore, the purpose of my testimony is to make recommendations to avoid, minimize, or mitigate any impacts and propose a course of further evaluation of potential impacts where warranted.

Q6. Have you reviewed the petitioner's prefiled testimony and exhibits?

A6. Yes I have. In particular I have reviewed the testimony of Jeffrey Wallin, Robert Roy, Wallace Erickson, Paul Kerlinger, and Jeff Parsons.

Q7. In addition to reviewing petitioner's prefiled testimony, how else has the Department evaluated the proposed project?

A7. I have conducted several site visits to the areas proposed by Petitioner for wind energy infrastructure development as well as to the original Searsburg wind generation facility. I have reviewed all reports provided by Petitioner that pertain to their testimony. I have attended numerous meetings and discussions with Petitioner regarding the Department's interests in data and information for the proper evaluation of impacts to wildlife resources associated with the proposed project. I was also a member of the Collective that met for approximately two years in an effort to resolve issues related to the proposed wind facility. That group was comprised of the project proponent (which changed from EnXco to PPM), their representatives and consults, ANR, the United States Fish and Wildlife Service, and numerous other interested non-governmental organizations.

Prior to the project proposal, I assisted in an evaluation of bear scarred beech stands in the general area as part of a Master's degree project for Antioch graduate student Dan Wolfson. I also participated in a review of the same area for a different wind energy company prior to this proposed project. Finally, I have informed myself on the existing

body of science and information pertaining to wind energy development and related effects on wildlife and wildlife habitat, in particular black bears and migratory birds.

Q8. **First let us discuss large mammals. Please describe what species and habitats have been evaluated for impacts at the project.**

A8. The Agency has considered impacts to wildlife habitats including deer winter habitat, moose winter habitat, black bear feeding habitat, black bear travel corridors, and wetland habitats that are important for species of wetland-dependant wildlife. In addition, the Department has considered the broader habitat values of the project area and surrounding landscape in terms of the relative value it provides as remote, contiguous habitat for wide-ranging species such as black bear.

Q9. What, if any, concerns does the Agency have with respect to the species and habitats you have identified above?

A9. Several elements of the proposed utility-scale wind energy facility present potential impacts to significant wildlife habitat and the wildlife that rely upon them including: (1) the activity and disturbance associated with project construction; (2) the linear nature and extensive scale of the project; (3) the degree of clearing; and (4) the potential and unknown level of human activity associated with operation and maintenance of the facility. I will endeavor to cover each of the aforementioned species and their habitats

to move freely within their winter range. These recommendations should be applied in this instance also.

Q 11. Does the Department have concerns with regard to impact to significant black bear habitat?

A 11. Yes. Based on the information provided by Petitioner and the Department's interpretation of science related to black bear behavior, survival, reproductive success and relationships to specific habitat conditions, the project, as currently proposed, would result in significant adverse impacts to black bear habitat.

In Vermont, black bear require large areas of forest habitat conditions with a variety of food resources to serve as core habitat that allows for successful reproduction and avoidance of human disturbance (Hugie 1982; Hammond 2002). Black bears rely on concentrated stands of American beech trees as an essential source of high nutrition food (Hammond 2002; McLaughlin 1998; McLaughlin et al 1994; Wolfson 1992; Hugie 1982; Beeman et *al.* 1977). Other essential hard and soft mast food resources in Vermont include oak, cherry, berries, apples, and mountain ash, but these alternative foods are not as important as beech nuts for bear reproduction and cub survivorship. Elowe and Dodge (1989) state that the availability of hard mast in the fall affects the minimum reproductive age of bears, productivity rates, as well as cub survival. Only acorns and beech nuts provide the fat and high carbohydrate diet that the bears need for putting on the fat reserves that improve survival and reproduction. Berries are important sources of sugars

but are usually available for a shorter duration of time than are hard mast, especially beechnuts. Beechnuts have the added benefit of still being available to the bears for several months in the early spring unlike their other important fall foods (Harnmond 2002). Elowe and Rogers (1989) also reported that female bears exhibit reproductive "skips" after poor mast years and that fall weight gains were keyed to mast availability, This phenomenon of synchronous reproduction has also been reported for Maine bear populations (McLaughlin et al 1994). Beechnut production is cyclical and during years when beech nuts are in short supply bears travel widely in search of alternative foods and suffer heavier rates of mortality (McLaughlin et al 1994). The reliance of black bears and other mammals on beech mast is well documented in the Northeast (Jakubis et al. 2004, McLaughlin 1998, Costello 1992, Hugie 1982). Even in other areas of the country where bears have access to more alternative foods, berries are not as important as nuts. In West Virginia, Ryan et al. (2007), found that soft and hard mast were both important but that in years where hard mast was lacking, significantly more bears died from non-hunting mortality sources.

Concentrated areas of American beech trees that have a history of bear feeding use ("necessary wildlife habitat" as defined by Act 250), are essential for the long-term survival, well-being, and reproductive success of black bears in Vermont. This opinion is supported by numerous scientific research efforts in Vermont, Maine, North Carolina, Minnesota and elsewhere (Harnmond 2002; Rogers 1976; McDonald 1998).

Areas of beech with a history of bear feeding use are considered to be necessary wildlife habitat as defined by Act 250, and recognized by the Public Service Board in Docket 7156, which supports a long history of successfully protecting bear-scarred beech stands, especially those large enough to be considered of regional significance. The Department has conducted its own research on the effects of ski resort development and human disturbance on black bears at the Stratton Ski Area and Resort (Hammond 2002). Findings from this research confirm that black bears require concentrated areas of American beech trees as an essential food resource. Research makes clear the significant relationship between bear survival, population dynamics, reproductive success, and cub survival to hard mast production and availability.

In Vermont, American beech is the most common source of hard mast (nut) producing tree species within black bear range. A recent study published in the Journal of Wildlife Management by black bear expert Michael Pelton concludes that production of hard mast (beech nuts, acorns) have a significant influence on reproductive success and cub survival for black bears (Clark et al. 2005). This research simply augments the existing wealth of research that supports the significant relationship between nut production, black bear survival, reproductive success, and cub survival all of which are a function of the population dynamics and viability for black bears.

Black bears are opportunists and will make use of whatever high quality foods are available to them. When these foods are lacking, bears suffer; when they are plentiful, bears prosper (Rogers 1976). In Maine, researchers have documented that bear

populations in different parts of the same state may be effected much differently by the availability of beech nuts. In many'other areas of the country, there are so many optional hard and soft mast species available to the bears that beech nuts are not the essential food source that they are in Vermont, where important alternate foods are lacking (Edwards et al. 1993).

Simply put, these stands of beech used by black bear are absolutely essential for the survival and reproduction of this species in Vermont. The beech stands surrounding this proposed project contain thousands of beech trees whose scarred bark is testimony to its importance in drawing large numbers of bears to the area in years of good nut production. The bear-scarred beech stands in the project area some of the most extensive and important in the state. **An** industrial project the size of the one proposed would displace large numbers of bears from this critical habitat and cause long-term harm to the bear population in southern Vermont.

Q12. Could you describe the importance of these beech stands to the population of black bear in this area?

Yes. Beech nuts are important for all of the bears of Vermont, but they may be even more essential to the bears of this area as there are fewer alternative foods available to them than in other areas in Vermont and the rest of New England. Recent findings from research conducted by Dr. William Kilpatrick at the University of Vermont, suggests that the bears living to the south of State Highway 11 may be a separate population genetically distinct from those in the rest of the state. He also reports that it appears that

this population is substantially smaller in numbers and more isolated than bear populations in the northern portion of the state and thus, bear habitat here is of greater importance in maintaining a breeding population of black bears. Harvested female bears from southern Vermont also tend to be nearly 10% lighter in weight which suggests that availability of alternative highly nutritious foods may be more limited for them than for bears elsewhere (Hammond 2002).

Q13. What is your opinion regarding Mr. Wallin's conclusions on the project's potential impacts to black bear habitat?

A13. The Agency does not agree with the conclusions presented in Mr. Wallin's testimony. He states that the project's impacts to the bears will be only temporary, that bears will habituate to the presence of the turbines and roads and other associated infrastructure, as well as become used to the human activity generated by the project. His testimony is counter to the Department's experience with development impacts to bear-scarred beech stands and to peer-reviewed and published research on bear behavior in relation to roads and different human activities.

He cites the results of several small studies that he conducted as the basis for his conclusions. His project methodology and designs, however, lack rigor and his sample sizes are too small to justify his conclusions regarding a bear population's behavioral response to the proposed project. Dr. Kilpatrick, reviewed Mr. Wallin's studies for possible testimony relating to the Sheffield Wind Project, PSB Docket 7156, and

concluded that the sample sizes were too small in the camera study and for the hair snag study that "the sample sizes are much too small and the experimental errors and variables among years were much too great to allow any conclusion other than that some bears crossed the fence and were snagged. This study provides no data to support the conclusion that bear activity near an operating wind farm returned to pre-construction levels." (Exhibit ANR-FH-2).

The Agency agrees that bears living in close association to some human activities can sometimes habituate to different activities over time. This behavior is typical of "nuisance" bears that visit bird feeders and trash containers in backyards in some communities in Vermont and elsewhere. In some urban areas with bear populations, such as in New Jersey and Connecticut, most bears frequent back yards and are habituated to people to the point that bears in these areas are considered pests.

In Vermont, although we have some nuisance bears, the Department manages for wild, free-ranging bears that are wary of people and, that for the most part, avoid areas where people are found. Vermont's greatest concentrations of bears are found in their "core" habitats that tend to be remote from roads, human developments and people. During years of good beech nut or "mast" production, large numbers of these wild bears migrate to areas of concentrated beech trees where generations have fed undisturbed on this critical resource. The great majority of the bears migrating to the Deerfield Project area in search of beech nuts will not be habituated to the project's structures and human activities and will be displaced from the area for a distance of from one-quarter to one-

half mile. (Reynolds-Hoagland and Mitchell 2007; Harnmond 2002, Brown 1980; and Pelton 1980). This displacement effect could effectively reduce the bear use on thousands of beech trees that the bears have depended on for generations.

It is part of the foundation of the Department's bear management philosophy that if we protect the core habitat critical to the bears then bears are not forced into becoming nuisance bears and we can continue to manage them as wild animals that are not dependent on human foods.

Mr. Wallin also asserts that the number of bear-clawed beech trees scheduled to be removed during construction of the project is insignificant given that there are so many of them found within eight square miles of the project. The Agency disagrees with this conclusion. This conclusion is contrary to the Department's long-standing position and guidance where there are concentrated areas of bear-scarred beech with evidence of fidelity on the part of bears (that is, in the case of concentrated bear-scarred beech habitat, a repeated reliance on, use of, and access to the habitat as evidenced by degree of climbing activity). The fact that there are so many bear-scarred beech trees in the area is evidence of the regional importance of the Deerfield Project area to the bear population of southern Vermont. Over 600 bear-scarred beech trees would be removed for the project and thousands more made indirectly unavailable to the bears.

In over twenty years of the Agency reviewing development projects in Vermont, we have never encountered one that would impact even a tenth this number of bear-scarred trees.

This project has the potential to impact more critical bear habitat than any other ever proposed in the state. We consider these potential impacts to be very significant.

Q14. Are the potential impacts to bear habitat mitigatable?

A14. The Agency has worked with a variety of developers in Vermont, such as ski resorts, whose projects have presented significant impacts to black bear habitat. The Agency has relied on a consistent impact assessment and mitigation process for many years to address unavoidable impacts to black bear habitat from regulated development. Several projects involving ski resorts have resulted in mitigation for unavoidable impacts to black bear habitat including concentrated areas of bear-scarred beech habitat. Information gained from the Stratton Bear Study (Hamrnond 2002) has been used extensively for ski resort master planning and protection of bear habitat. Ski resorts including Stowe Mountain Resort, Smugglers' Notch Resort, Killington Ski Resort, Stratton Mountain Resort, Sugarbush Resort, Bear Creek, and Jay Peak Resort, among others, have done habitat mitigation with the Agency to address necessary mitigation for unavoidable impacts to black bear habitat. Therefore, it is possible that impacts to significant black bear habitat associated with development projects may be mitigated when there is a willingness to do so. It is also important to be mindful that there are circumstances where an area of black bear habitat may be considered so significant, that impacts to that habitat should not be allowed. For instance, there may be circumstances where extensive wetlands are used frequently by a large population of black bears. This sort of habitat may be considered unique and impacts from development would not be readily mitigated or compensated.

Q. 15 **Is mitigation possible for the project as proposed?**

A. 15. There may be a possibility that the Petitioner's proposed wind energy facility, or a portion thereof, may be mitigated; however, we do not have sufficient information to determine the full extent and scope of impacts to the habitat based on the information in the record at this time. It is standard Agency policy to work with each development applicant to evaluate the proposed project to find ways of avoiding and minimizing impacts when they are identified. Mitigation strategies are negotiated and employed, whenever possible, for impacts that are unavoidable.

The initial step in our review of a given project is to identify and measure the amount of habitat that might be impacted. In this case the petitioner has failed to do this first step making a complete review impossible and thus effectively ruling out the possible development of a mitigation plan that would allow the project to proceed.

The applicant's wildlife biologist, Mr. Wallin, has conducted an inventory of bear-scarred beech feeding habitat, but he limited the scope of it to much less than that recommended by the Department – the Department recommended 1/4 mile, but only those areas within 150 feet of the access roads were mapped.

The Department requested that the petitioner conduct a search to more appropriately characterize the extent of potentially significant black bear habitat, but this has not been done.

Only a fraction of the habitat has been mapped at this time. The concentrations of bear-scarred beech have not been sufficiently identified in a manner that allows an understanding of the full extent of the habitat. This identification is necessary in order to fully assess the relative significance of that habitat and the potential impacts of the project. It is our understanding that the Petitioner has conducted further investigations to sample stands of beech trees remote from the project area, but this sampling was done in a manner that does not allow an assessment of the habitat that might be impacted by the project. The large number of bear-scarred trees that resulted from their sampling (over 27,000 within an area of 8 square miles of the project) did not delineate locations of the beech stands but simply reinforced the historically heavy use of the area by the bears of southern Vermont. The critical habitat remains unmapped.

This information is critical to the Agency's formation of an informed opinion as to the degree of impact the project may present to necessary bear habitat, as well as any recommendations for addressing those impacts.

Lastly, I should note that the Petitioner has not engaged in the avoidance and minimizations strategies I have discussed above. On the contrary, they have consistently held to essentially the current alignment.

Q16. Please describe the different levels or types of impacts that can occur to significant black bear habitat.

A16. Assessing the degree of impact to black bear habitat such as concentrated areas of bear-scarred beech and wetlands is a function of both direct and indirect impacts associated with a project. Direct impacts involve the direct, physical destruction of those habitats (or portions thereof); Indirect impacts involve a measure of disturbance and displacement from those habitats based on a project's close proximity. There is likely to be some degree of indirect effect from the construction, operation, and maintenance of the project that may influence the extent of impact to the habitat beyond the direct loss of habitat associated with the footprint of the project. It is unclear the extent to which operation of a utility-scale wind facility may disturb or displace black bears.from accessing and utilizing concentrated bear-scarred beech habitat. This type of information can only be obtained by conducting a long-term behavioral study involving a large number of marked bears interacting to a wind facility. This type of study has been done for ski areas and bears, but not for wind generation projects. Lacking more specific information the Agency typically applies an area of indirect impact of one quarter (¼)-mile beyond the footprint of the project.

Q17. What effect does fragmentation of bear habitat and roads have on the bear population?

A. 17 This issue was one of the primary reasons for the Stratton Bear Study and is addressed in detail in the final report (Hamrnond 2002).

Today, the largest populations of black bears exist in the most remote and expansive tracts of forests, such as those in Maine and in the northern and higher elevations of parts of New Hampshire and Vermont, which are relatively unbroken by paved roads and housing developments. Many other states, with large metropolitan areas along the eastern seaboard, have reduced populations of black bears. Scientists believe habitat fragmentation to be a serious concern for black bears across their range and especially problematic in areas experiencing rapid increases in human population growth such as in the southeastern United States. Pelton (1990) stated that at least 30 relatively disjunct populations exist in 13 southeastern states, each with differing degrees of isolation and vulnerability to human impacts. This problem is perhaps most evident in Florida and Louisiana which, until recently, had large black bear populations comparable to the Northeast. Rapid habitat development in these states has reduced their numbers to small, genetically non-viable levels which now face uncertain futures (ibid.).

Highways and roads have several direct and indirect negative impacts on black bear populations. Habitat fragmentation, the hardest indirect impact to define, occurs when highways and other developments create a partial "barrier effect" which limits black bear population movements and distribution by isolating sub-populations, restricting access to seasonally important foods, reducing rates of immigration and emigration, limiting breeding opportunities (gene flow), and ultimately causing local extinctions. Apparently, roads and associated developments can be a semi-permeable barrier for black bears (Berringer et al. 1989), with the permeability being a function of the amount of human

activity, traffic volume (Carr and Pelton 1984, Brody and Pelton 1989), and perhaps even whether or not a road is paved (Miller 1975).

Up until the past couple of decades, black bear management consisted primarily of regulating the legal harvest in a manner that ensured that the population was sustainable. Management objectives in many states, including Vermont, now revolve around maintaining wild, free-ranging, viable populations of black bears as well as the conservation of their habitat. To do this in the face of habitat loss and fragmentation, wildlife managers emphasize conserving large blocks of interconnected forest land and identifying and protecting the most critical components of black bear habitat. Although evaluating direct impacts from development has been relatively easy, measuring and mitigating for the more elusive indirect impacts has been difficult and controversial.

Both the Stratton Bear Study and a study done in Vermont to look specifically at the use of beech stands by bears (Wolfson 1992) concluded that bears (in Vermont) appear to prefer feeding on beechnuts within beech stands that are located furthest from roads and houses. Wolfson examined 42 beech stands with varying intensities of bear use and found that the 26 stands ranking highest in bear use were almost all greater than one kilometer from roads, and that conversely, the four stands ranking lowest in use were all comparatively closer to roads. Several stands, all located within 200 meters of roads, houses, or within areas of high levels of human activity exhibited only old use by bears. In general, research has shown that bears avoid paved roads with high traffic volumes the most, but some studies have shown that even roads with relatively low traffic volumes

are avoided (Clark et al,. 1993; Garner 1986). Reynolds-Hogland and Mitchell (2007) found that in an area where bears are hunted with the use of hounds, bears avoided areas within 800 meters of gravel roads. They hypothesized that the reason for this avoidance may be due to the fact that the bears had learned that hunters tended to hunt more from gravel roads than from paved.

Q18. Do you agree with Mr. Wallin's summary of the effects that disease is having on the beech trees and that it may be beneficial to remove the infected trees?

A18. No. Beech stands throughout Vermont and the Northeast have been infected for decades with a disease commonly known as beech bark disease (BBD) which can weaken or kill infected trees. Its occurrence in the project area would be expected but does not lessen the overall beech stand's importance to bears and other wildlife. Unlike some other tree diseases, BBD is a slow-acting one and over the years beech trees have developed different levels of resistance to it so that the effects of the disease are not so pronounced and only a portion of the trees in a stand will die from the disease over a given time period. As some trees die over time, however, others from the understory soon take their place with the result that the stands continue to provide the nuts so important to wildlife.

A recent workshop in New York contains several papers addressing this issue and others emphasizing the importance of beech nuts, as well as the continued importance to wildlife of stands showing this disease. One paper in particular reported the effects of the disease on nut production and stated that "beech nut mast was not significantly different

among stands with absent, light, or heavy disease abundance."(Kearney et al., 2004). The Forestry Division of the Vermont Department of Forest and Parks beech management recommendations cited by Mr. Wallin are outdated and did not consider wildlife values. Updated recommendations are being prepared by the Division in coordination with our Department. The updated recommendations will reflect both the studies reported at the New York beech bark disease workshop as well as a workshop held on the same topic in Vermont in 2006. At this workshop, the findings from the earlier New York workshop were reviewed and tree specialists reinforced the findings by demonstrating in the field that trees showing signs of the disease had still produced large numbers of viable nuts.

The Agency considers that the occurrence of this disease in the project area is not unique for Vermont and is not a relevant issue in assessing the importance of beech habitat to bears and other wildlife.

Q19. Do you agree with Mr. Wallin's comparison of the work done at the existing Searsburg site to the proposed project site?

A19. No. The information identified by Mr. Wallin in his report and testimony regarding bear movement and response to the existing wind energy facility in Searsburg, Vermont is not directly applicable in this instance because it looked only at black bear ***movements*** through a travel corridor during and after construction of the project. It did not look at black bear use of concentrated bear-scarred beech habitat due to the fact than bear-clawed

beech stands did not occur within that distance to the project. The two habitat types and the associated bear use patterns are very different.

Some level of indirect impact will result from construction and operation of the proposed project. In addition, the Agency is limited in its ability to render a full opinion on the nature and extent of indirect impacts to the bear-scarred beech habitat since the Petitioner has not provided information giving the details of the location and extent of the potentially affected habitat. The degree of human activity is a critical factor for determining the extent of indirect impacts. Restricted human access to the project site will also be important in limiting indirect impacts to the bears. Nevertheless, additional information is necessary to properly assess the full extent and scope of impacts from the project.

Mr. Wallin has used these studies as part of his justification to conclude that this project will not destroy or significantly imperil necessary wildlife habitat. His studies, however, were of such limited scope, his data was insufficient, and sample sizes much too small, to justify his conclusions. The Department's decades of experience in reviewing impacts from development, as well as our own bear behavior research reach a different conclusion – that this project has tremendous potential to destroy and imperil large amounts of black bear habitat.

In sum, the Agency has consistently requested the Petitioner, whether it be EnXco or PPM, to explore other sites, as the Western side of the project is not suitable for

development for the many reasons I have described above. There would be, as proposed, an undue adverse impact to necessary wildlife habitat for black bear.

Q20. What is your opinion of that information with respect to any potential **impact(s)** the project may present to **raptors?**

A20. The surveys conducted by Petitioner to evaluate raptor migration during the 2004 and 2005 period provide a useful set of baseline data for making some informed judgments regarding potential impacts of the proposed project to migrating raptors.

The Agency is concerned, however, with the higher number of raptors over the Western Project Area compared to the Existing Facility--nearly 5 times higher for the Western Project Area--and the fact that the consultants were not able to analyze the percentage of these raptors that were below 125 meters (400 feet) in altitude. Without this analysis, a full risk assessment for the raptors has not been done. Some of the species observed during both the Spring and Fall survey periods, such as Coopers hawk, northern harrier, American kestrel and osprey, are considered "species of greatest conservation need" in the State of Vermont Wildlife Action Plan. A species of greatest conservation need is a species whose populations, in the case of these raptors, may be experiencing certain pressures that merit attention in order to maintain their populations at levels that allow them to persist. The survey data from Fall 2004 is cause for some concern that raptors may collide with turbines in this area under certain conditions that are yet to be defined (e.g., wind, weather, behavioral). However, the Agency recognizes that raptor fatalities,

to the extent that we fully understand and appreciate them at other wind energy facilities in the northeast, have been very limited. Petitioner's reports that describe conditions and circumstances that help mitigate raptor collisions with wind turbines are well taken. For instance, the fact that raptors migrate during the day and are thus able to observe and potentially avoid contemporary wind turbines is an important consideration. It is very different than collision risks for birds that migrate at night and are not able to see wind turbines. Daytime visibility and avoidance of wind turbines may be the greatest mitigating factor that has resulted in relatively low raptor fatalities at utility-scale wind facilities in the northeast. However, it is important to note that bird fatality data at wind facilities in the northeastern United States remains limited, and some of the data that has been collected to date has not been made available to state or federal agencies responsible for reviewing these sorts of projects.

Q 21. Have you reviewed the information regarding radar studies and nocturnal bird migration? Have those studies been conducted in such a fashion as to be acceptable to the Agency?

A 21. Yes I have. In general, the protocol that was used to conduct the radar studies is in keeping with how other investigations at other utility-scale wind facilities are conducting radar evaluations of nocturnal bird migration. The results of the evaluations are helpful in understanding the level of risk presented by the proposed project to nocturnal migrating birds. In addition, the results will be an essential part of assessing the significance of any bird mortality that may result should the proposed project receive

authorization and be constructed. The primary limitations of the radar evaluations for this project are the lack of acoustic data to characterize the species composition of birds migrating over the site, the lack of accompanying weather data and an analysis of its affect on avian migration, and the lack of an analysis of possible migration channeling for the project area. These concerns are addressed in more detail below.

It is important to note that, as of yet, there is no standard protocol for conducting radar investigations of nocturnal bird migration. The Agency remains concerned with the lack of scientific investigation into the most appropriate sampling protocol for radar investigations at proposed utility-scale wind facilities in general. It is important, for instance, to understand the statistical validity of sample sizes related to radar investigations such as that presented by the Petitioner. It is important to also understand the percent of data removed from passage rate analysis based on target speed. However, the Agency recognizes that we are learning a great deal about the issues of radar sampling and bird migration data as more wind energy developers conduct these sorts of studies.

Q 22. What is your opinion of the radar studies conducted for this project and the conclusions that are presented by the Petitioner as a result of those studies?

A 22. First, let me explain why the Agency believes radar evaluations of nocturnal bird migration are essential for the proper assessment of siting and designing utility-scale

wind facilities, as well as understanding the potential effects of wind energy development on migrating birds in Vermont.

Bird fatalities have been documented for many years at wind energy facilities throughout the country as well as in other countries (Erickson et al., 2001; Richardson 2000; U.S. Fish and Wildlife Service 2003; GAO 2005). Many species of passerine birds (songbirds) migrate at night during spring and fall migration periods. While there is still a great deal to learn about the characteristics of night migration for many songbirds, we have an understanding of the variations in flight height in relation to weather, cloud cover, precipitation and, to some extent, landscape features such as topography and ridgelines. Some birds that migrate at night fly lower than others and their migration can be influenced by encounters with steep, high topography, such as is found in parts of Vermont (Erickson et al., 2001; Richardson 2000; U.S. Fish and Wildlife Service 2003; GAO 2005).. In addition, birds migrating at night that encounter low cloud cover, fog, or precipitation, as is often the case in Vermont during the fall, will fly at lower altitudes (Erickson et al., 2001; Richardson 2000; U.S. Fish and Wildlife Service 2003; GAO 2005).. These factors create risk of collision for birds with tall structures such as wind turbines. Most importantly, since very few wind energy facilities exist in Vermont, or the northeastern United States, we have little information to fully understand the degree of risk of collision to nocturnal migrating birds. As the Agency explained in detail in our testimony in the East Haven Wind Farm case, it is the lack of applicable circumstances from other utility-scale wind facilities to the high elevation montane habitat conditions in Vermont that is cause for a careful approach to proper siting and design, and

understanding the full scope of environmental implications of utility scale wind development on Vermont's ridgelines and mountains. The Agency continues to hold this opinion in the absence of additional data to suggest that this is not a cause for concern.

Most wind facilities that have examined bird migration and collision fatalities are located in the western and mid-westem United States in landscape and habitat conditions that are very different from that of Vermont or northern New England. The Agency's greatest interest in making sure that wind developers in Vermont conduct radar evaluations of nocturnal bird migration is due, in part, to the lack of wind energy infrastructure in similar environments. This point was made in detail in the Agency's testimony on the East Haven Wind Farm case.

With that said, the Agency is concerned with the possible degree of collision risk at the western site. Based on the information provided, and relative to similar information collected at sites in New York and Maine, it appears that the western site had the largest nightly passage rate of any of the 32 sites for other projects in the Northeast that were presented (Table 3. p. 16 of Pre-filed Direct Testimony of R. Roy and W. Erickson). It also appears from this table that highest nightly passage rate for fall of 2004 and 2005 may be nearly twice that reported for the Eastern project site. It is still not possible to translate these numbers into predicted bird collision fatality rates.

Q 23. Is there other information that you believe would be useful in order to fully and properly evaluate nocturnal bird migration that has not been provided by the Petitioner at this time?

A 23. Yes, there are three pieces of information that would be helpful in better understanding the characteristics of nocturnal bird migration at the site and the level of risk posed by the project. First, since acoustical assessments of birds were not conducted at the site, we have no understanding of the composition of species migrating over the site. This is important because some species are more common that others. It is important to know whether there are uncommon or rare species that fly over the site, particularly if such an event occurs on a regular basis. The Agency notes, however, that an acoustical assessment of migrating birds is limited to certain species. Some species of songbirds do not make any sounds as they migrate and thus, cannot be detected. Old Bird, Inc. in New York maintains a library of bird call spectrographs that help identify many species of night migrating songbirds. It is important to capture more information about the identity of the "targets" themselves. The data analysis section of each of the reports briefly describes the procedure used to separate bird/bat targets from insects. Presumably, this insect data was tabulated in some fashion but it is not included in the reports. This information would be useful to establish the pattern of insect activity above these ridge tops along with that of flying vertebrates. The most important component to augmenting the existing data is to collect some acoustical information to begin to characterize the species composition of migrating birds at the site. It may be possible to use acoustical technology to address all the data gaps mentioned herein, which would offer a low-cost opportunity to the Petitioner to address all these issues.

In addition, it would be useful to have data on the on-site weather patterns to compare with variations in bird passage rates and especially to understand the percent of birds reported flying below turbine height. No data is available on an hourly or other incremental basis for cloud ceiling height; percent cloud cover; wind gusts; speed and direction at ground level and aloft; and similar data for the air temperature profile at the study site. This information would be useful in determining whether there are any differences in migration behavior or flight height between the sites during periods of inclement weather. Reports of large mortality events associated with other tall structures are usually for intervals surrounding periods of severe weather and low cloud ceiling. Unfortunately, the radar equipment is usually shut down during these same time periods.

Collectively, the radar reports do not provide us with data in narrative and graphical formats that clearly articulate the volume of airspace that is sampled and the volume of airspace from which data is analyzed. Of equal importance, the reports do not show the volume of airspace at and adjacent to the proposed project that is not sampled, versus sampled but not analyzed. The reports are insufficient for determining if there is migration channeling occurring along either of the two ridgelines due to topographical or other features. This information would be useful for a full risk assessment of the project for these sites.

Q 24. Does Petitioner's application address the Agency's needs regarding post-construction impact assessments for migrating birds?

A 24. No, the application includes plans for only one year of post-construction monitoring. The Agency believes additional monitoring would be needed to characterize the use of the air space and understand levels of mortality the facility is experiencing.

Q 25. In general, what does the Agency believe are the critical requirements for the Petitioner to include in a post-construction monitoring protocol?

A 25. First, keep in mind that any such protocol must consider assessing collision fatalities for bats in conjunction with birds. In general, the Agency believes the following elements are essential for a suitable post-construction bird/bat mortality monitoring protocol: (1) post-construction bird and bat mortality surveys should be conducted in accordance with a detailed mortality survey protocol that has been developed in coordination with the Agency and that has been reviewed and approved by the Agency; (2) the surveys should be conducted for a minimum of three years in order to capture the potential variability in abundance of migrants, weather, and environmental conditions; (3) all post-construction mortality surveys should be conducted in a fashion that provides statistically reliable samples and associated estimates of bird and bat mortality; and they must include searcher efficiency tests and scavenger rate tests on a regular basis. Details regarding the number of search days per week and the number of turbines searched per day should be addressed in the detailed post-construction monitoring plan. In order to capture data that will characterize the full scope of bird and bat mortality, sampling should occur during

both spring and fall migration periods – mid-April through mid-June and late July through early November.

The ability to make operational adjustments if mortality is excessive is essential and any Certificate of Public Good should require an opportunity to make such adjustments possible.

Q 26. Does this conclude your testimony at this time?

A 26. Yes.

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Public Service Board
Deerfield Wind, LLC
Docket No. 7250
Exhibit No. ANR FH-1
Admitted ___ Date _____

FORREST M. HAMMOND

EXPERIENCE

1994–Present Vermont Fish & Wildlife Department Springfield, VT
Wildlife Biologist

Provides habitat technical assistance for regulatory review processes, town/regional planning entities, and other governmental bodies.

- Chair of Dept. Habitat Assessment Team
- Serve on Moose and Deer Teams.
- Assist with Bear Team issues, esp. in regard to nuisance problems habitat conservation and research.
- Conduct district biologist responsibilities including public presentations, state land management, wildlife surveys, and supervision of wildlife seasonals and technicians.

1990- 1996 Vermont Fish & Wildlife Department Waterbury, VT
Black Bear Research Biologist

- Coordinated and supervised multi-agency study on the effects of large-scale ski area development on a population of black bears in southern Vermont.
- Oversaw bear capture operations, radio telemetry monitoring, and data analysis to determine habitat use, home range size, and behavior in relation to human impacts.
- Supervised field technicians, volunteers, and state and federal biologists.
- Assisted in design and supervision of two M.S. thesis projects related to black bear habitat use.

1989–1990 Self-employed
Wildlife Consultant and General Contractor

Analyzed four years of field data and assisted in the writing of a final report and international publication on a grizzly bear research project for the Wyoming Game & Fish Department. Montana.

1977–1989 Wyoming Dept. of Game & Fish Cheyenne, WY
Grizzly Bear Research Biologist

- Coordinated and supervised grizzly bear research and management in Wyoming.
- Directly supervised 3-7 technicians year long.

- Prepared research proposals, management plans, and status reports on research projects, population status, and habitat improvements.
- Reviewed environmental impact proposals and implemented interagency and public programs.
- Responsible for large budget.
- Supervised trapping and relocation of nuisance grizzly and black bears.

Represented Department at both interstate and international conferences and professional meetings.

Assisted with grizzly and black bear research in the Yellowstone Ecosystem portions of Idaho and

1986–1987 Wyoming Dept. of Game & Fish Cheyenne, WY

Environmental Biologist

Liaison position with Game & Fish Dept. and the Dept. of Environmental Quality to reduce negative impacts on industry and wildlife habitat.

Provided direction to developers and large energy companies to survey populations of wild animals on their lands and to create sound reclamation and monitoring plans.

- Monitored habitat reclamation efforts, project success, and compliance.

Responsible for coordinating industry and interagency meetings.

Reviewed and provided written comments on Environmental Assessments and Forest Management Plans.

1986 Wyoming Dept. of Game & Fish Cheyenne, WY

Special Projects Biologist

Tested free-roaming herds of elk and bighorn sheep for disease.

- Directed Department personnel and volunteers in capture efforts, blood testing, and vaccination of large numbers of wild ungulates.
- Tested a prototype remote-delivery vaccination system using "bio-bullets."

Trained four technicians and presented progress reports.

Used several immobilization and restraint methods including several capture drugs.

Also captured and neck-banded moose as a part of a routine movement study.

1984–1986 Wyoming Dept. of Game & Fish Cheyenne, WY

District Wildlife Biologist

Developed and implemented wildlife habitat and management programs on public and private lands.

- Reviewed impact statements and timer harvest plans.

- Performed wildhfe surveys, data collection, and computer population modeling.

  Responsibilities included proposing hunting seasons on game animals as well as monitoring programs of nongame species.

- Coordinated live-trapping operations for studies of black bear, moose, mule deer, elk, and pronghorn antelope.

  Received intensive in-service training on animal immobilization, radio telemetry, and population modeling.

- Conducted routine game check stations and harvest surveys, and coordinated seven game warden wildlife monitoring efforts.

  Represented Department at public and interagency meetings.

  Provided annual species status reports.

1977–1984 Wyoming Dept. of Game & Fish Cheyenne, WY

Special Projects Technician

- Summer months and the first year out of college, I was employed by both the WY Game & Fish Dept. and the USFWS Research Coop. at the Univ. of WY on a variety of wildlife research projects monitoring movements of game animals, doing small game, breeding bird and raptor surveys, and analyzing field data.

  While in college, I organized student volunteers to assist graduate students and state biologists to capture study animals and do wildlife surveys on holidays and weekends.

- Worked as a warden deputy one fall and worked for two years assisting state wildlife veterinarian with field and lab work.

19761977 Wyoming Dept. of Game & Fish Cheyenne, WY

Habitat Construction Worker

- Took a year's leave from college to work for the Habitat Division of WY Game & Fish Dept. Traveled statewide constructing goose nesting structures, fish barriers, strearnbank rip raps, big game fence crossings, and wildlife watering holes.

  Improved game habitat with controlled burns, cuttings, and shrub crushing.

- Worked with Forest Service employees on special timer cuts for grouse and deer.

  Operated heavy machinery and used explosives and firefighting equipment.

EDUCATION

- M.S. Wildlife Management, September 1983. University of Wyoming, Laramie, Wyoming. Thesis: *Food Habits of Black Bean in the Grys River Drainage, Wyoming.*
- B.S. Wildlife Management, June, 1980. University of Wyoming. Pres.

U.W. Wildlife Soc. 1980, V-Pres. 1979.

- University of Vermont. May 1995. Geographic Information System training course.
- Lebanon, NH College of Continuing Education. 1989. Course in aquatic invertebrate identification.
- Colorado State University. Summer 1979 as well as at UNH in 1996. Courses in Animal Restraint taught by USFWS.

ORGANIZATIONS

- The Wildlife Society
- National Wildlife Federation
- The Nature Conservancy
- Vermont Institute of Natural Science
- Wyoming Wildlife Federation (Board of Directors 1980-84)

International Bear Association

PUBLICATIONS

Austin, J.M., C. Alexander, E. Marshall, F. Hammond, J. Shippee, and E. Thompson. 2004 *Conserving Vermont's Natural Heritage. A Guide to Community-Based Planning for the Conservation of Vermont's Fish, Wildlife, and Biological Diversity.* Publ. VT Fish and Wildlife Dept. 135pp.

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rather than some other mammal, such as a moose, is also unknown. Although two published keys (neither of which was peer reviewed) were identified by Mr. Wallin, the characteristics actually used to identify bear hair from other species were not specified. Hair identification is rather subjective, even with a key, and the error rate of misidentification is greater than zero. These unknown error rates and detection probabilities make the interpretation of the data presented more difficult.

Q18. Do you agree with the conclusions presented in Wallin (1998) and the conclusions reached by Mr. Wallin in his PFT?

A18. No. In Wallin (1998) the conclusion was that "[t]hese numbers appear to lead toward the conclusion that black bear behavior may have been disrupted during the peak construction, however, first year post-construction operation and maintenance of the wind turbines does not appear to disrupt historical movement patterns." This is simply stated as bear activity returned to "normal" levels post-construction in Mr. Wallin's PFT.

First, the experimental design of Wallin (1998) can not provide any evidence that any bear traversed the ridgeline with the wind turbines as both the upper and lower fences (hair traps) are located on the same side of the project.

Second, given the experimental errors discussed above, but especially the low detection probability, there are many possible interpretations of the data obtained.

Table 1 Data from Wallin (1998):

Year	1995	1996 (construction)	1997
Lower Fence	11	1	8 (4*)
Upper fence	4**	5	13

* 8 snags reported but twice the length of fence thus sampling bias – reduce to number on any single lower fence

** 4 snags presented but sampling bias, underestimation as fence only operational from late August

Given the two sampling biases identified above, there are several ways to examine the data to remove those biases. First, one must constrain interpretation to the data that was collected during the same time period (September to December) and with the same sampling effort (upper fence) for all three years.

Table 2 Data From Wallin

Year	1995	1996 (construction)	1997
Upper fence	4	5	7

Conclusion: no differences from pre-construction to post construction.

Second, examining the lower fence data for full sampling period but using only one of the lower parallel fences used in 1997 yield the following information:

Table 3 Data from Wallin

Year	1995	1996 (construction)	1997
Lower fence	11	1	4

The conclusion I would draw from these data is that the post-construction level of activity does not appear to return to the pre-construction level. Indeed, there is a substantial decrease in activity, since post-construction activity is only 36 % of pre-construction activity.

Wallin's experiment (1998) was designed to measure the number of bears that traversed the area between the lower and upper fences. Thus, a snag on one fence was expected to result in a snag on the other fence within the same sampling period, thus indicating a bear had traversed the area. The number of multiple snags (snag on the upper and lower fences within a sampling period) is very low:

Table 4 Data from Wallin

Year	1995	1996 (construction)	1997
Lower fence	0	0	3*

* 3 shown in Table 1 of Wallin (1998) but only 2 indicated in text.

The sample sizes are much too small and the experimental errors and variables among years were much too great to allow any conclusion other than that some bears crossed the fence and were snagged. This study provides no data to support a conclusion that bear activity near an operating wind farm returned to pre-construction levels.

Q19. Dr. Kilpatrick, has the question of disturbance to travel corridors for black bears been adequately addressed?

A19. No, Mr. Wallin simply indicates that there are no known bear corridors crossing the ridgeline on which the project is proposed and that there is no reason to suspect that bears are using the project area as a travel corridor. First, I think there are several reasons to suspect that there may be corridors through the area. Radio-telemetry and genetic studies have shown that bears, especially female bears, avoid crossing major highways. Since this project is bordered on the west by I-91, thus restricting bear movement to the west, it is quite likely that bears turn around when they reach I-91 and cross back over these ridgelines. Second, there are numerous patches of bear habitat (beech stands and wetlands) within the project area and bears travel through the area to visit these resources in various seasons of the year.

The absence of known travel corridors can not be used to infer that these corridors do not exist unless someone has attempted to locate these travel corridors with a protocol that has a reasonably high probability of detection if they are present. Furthermore, the proposed project has the potential of producing two additional barriers to bear movement by the construction of wind turbines in a northern and a southern array. Female black bears are more sensitive to habitat disturbance than are male bears and females will not cross barriers often crossed by males (Hammond, 2002). In the absence of any scientifically credible data to refute the hypothesis that a

string of wind turbines along a ridge line forms a barrier to the movement of bears, then the applicant has failed to meet its burden of determining the potential of this proposed project to further fragment black bear habitat.

Q20. Dr. Kilpatrick, have you had an opportunity to review the PFT and exhibits submitted in this matter by Robert D. Roy?

A20. Yes, I have reviewed the February 21,2006 PFT prepared by Robert D. Roy, along with the associated exhibits: his Spring 2005 "Radar and Visual Survey of Bird Migration"; his January 5,2006 "Bat Survey Summary Report"; his December 22, 2005 assessment of potential small-footed bat habitat in the vicinity of the proposed Project; his February 17, 2006 "Sheffield Wind Farm Wildlife Habitat Summary and Assessment" and his responses to the first round of Discovery request.

Q21. Dr. Kilpatrick, were all rare and uncommon species of mammals that occur in Vermont addressed in Mr. Roy's impact assessment?

A21. No. Mr. Roy, in response to Q.UHS/RPI:UPC1-169, indicates that only the 5 species protected by the Vermont Endangered Species Act (10 V.S.A. Chap. 123) were considered as rare. In addition to the 5 species protected by the Vermont Endangered Species Act (Eastern mountain lion, Canada lynx, American marten, small-footed bat, and Indiana bat), the Nongarne and Natural Heritage Program's (a division within the VFWD that deals with endangered species), list "Rare and Uncommon Native Animals of Vermont" (2000) includes seven additional species of small terrestrial mammals and three additional species of bats. No surveys or data base reviews were reported for these seven species of small terrestrial mammals.

Q22. Were the surveys that were conducted for detection of Canada lynx and mountain lions scientifically credible?