Final Environmental Impact Statement
Proposed Deerfield Wind Project
Abstract

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

This FEIS responds to public comments received on the Supplemental Draft Environmental Impact Statement (SDEIS), released in December 2010.

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ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition / Denotation
AMSL	Above Mean Sea Level
ANR	Agency of Natural Resources
APE	Area of potential effect
ATV	All-terrain vehicle
BE	Biological evaluation
BSB	Bear-scarred beech
CFR	Code of Federal Regulations
CO_2	Carbon Dioxide
CPG	Certificate of Public Good
dB	Decibels
dBA	A-weighted sound pressure levels
DBH	Diameter at breast height
DEIS	Draft Environmental Impact Statement
DROS	Desired Recreation Opportunity Spectrum
EIA	Energy Information Administration
EIS	Environmental Impact Statement
EMF	Electromagnetic fields
EPSCP	Erosion Prevention and Sediment Control Plan
ESA	Endangered Species Act
F	Fahrenheit
FAA	Federal Aviation Administration
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
Forest Plan	Green Mountain National Forest's 2006 Land and Resource Management Plan
FSH	Forest Service Handbook
FSM	Forest Service Manual
GIS	Geographic Information Systems
GMNF	Green Mountain National Forest
GMP	Green Mountain Power
HUC	Hydrologic Unit Code
IROS	Inventoried Recreation Opportunity Spectrum
ISO	International Standards Organization
ISO-NE	Independent System Operators for New England
kV	Kilovolt
kW	Kilowatt
L_{10}	Tenth percentile level of L_{eq}
L_{50}	Fiftieth percentile level of L_{eq}
L_{90}	Ninetieth percentile level of $L_{eq;}$ statistical sound level
L_{dn}	Day and night sound level
L_{eq}	Equivalent energy sound level
L_{eq8}	Eight-hour exposure to noise
LBG	The Louis Berger Group, Inc.
LMR	Land Mobile Radios
MA	Management Area
mG	milli-Gauss

Acronym / Abbreviation	Definition / Denotation
MIS	Management Indicator Species
mph	Miles per hour
MW	Megawatt
MWh	Megawatt hours
NAAQS	National Ambient Air Quality Standards
NEMA	National Electrical Manufacturers Association
NEPA	National Environmental Policy Act of 1969
NFMA	National Forest Management Act
NFS	National Forest System
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NNHP	Nongame and Natural Heritage Program
NNIS	Non-native invasive species
NO_2	Nitrogen Dioxide
NOA	Notice of Availability
NOI	Notice of Intent
NO_x	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRHP	National Registers of Historical Places
NRCS	National Resource Conservation Service
NTIA	National Telecommunications and Information Administration
NTN	National Trends Network
NVUM	National Visitor Use Monitoring
NWCC	National Water and Climate Centers
NWI	National Wetland Inventory
O&M	Operations and maintenance
O_3	Ozone
OHV	Off-highway Vehicle
ORW	Outstanding resource waters
OS/OW	Oversize/overweight
OSV	Over-snow Vehicle
PAH	Polynuclear aromatic hydrocarbons
PCS	Personal communication services
pH	Acidity levels
PILT	Payments in lieu of taxes
PM	Particulate matter
PM_{10}	Particulate matter less than 10 microns in diameter
$PM_{2.5}$	Particulate matter less than 2.5 microns in diameter
PSB	Public Service Board
REDYN	Regional Dynamics, Inc.
REPP	Renewable Energy Policy Project
RFSS	Regional Forester Sensitive Species
RGGI	Regional Greenhouse Gas Initiative
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
ROW	Right-of-way
RPM	Revolutions per minute

Acronym / Abbreviation	Definition / Denotation
RPS	Renewable Portfolio Standards
RSG	Resource Systems Group, Inc.
S&G	Standards and guidelines
SCADA	Site Control and Data Acquisition
SDEIS	Supplemental Draft Environmental Impact Statement
SMS	Scenery Management System
SO_2	Sulfur Dioxide
SPCCP	Spill Prevention Control and Countermeasure Plan
SPEED	Vermont Sustainably Priced Energy Enterprise Development
SRS	Secure Rural Schools
Synapse	Synapse Energy Economics, Inc.
T&E	Threatened, endangered, and proposed species
THPO	Tribal Historic Preservation Office
USACOE	United States Army Corp of Engineers
USDA	United States Department of Agriculture
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VAPMP	Vermont Acid Precipitation Monitoring Program
VAST	Vermont Association of Snow Travelers, Inc.
VCGI	Vermont Center for Geographic Information
VELCO	Vermont Electric Power Company
VERA	Vermont Environmental Research Associates, Inc.
VIA	Visual Impact Assessment
VLTM	Vermont Long-Term Monitoring Project
VMS	Visual Management System
VNNHP	Vermont Nongame and Natural Heritage Program
VOC	Volatile organic compounds
VP	Viewpoint
Vpd	Vehicles per day
VQO	Visual quality objective
VSWI	Vermont Significant Wetlands Inventory
VTDEC	Vermont Department of Environmental Conservation
VTDHP	Vermont Department of Historic Preservation
VTFWD	Vermont Fish and Wildlife Department
WEST	Western EcoSystems Technology, Inc.
WHO	World Health Organization
WNS	White nose syndrome
WRC	Windham Regional Commission
WSPA	Water Source Protection Area

CHAPTER 1.0 INTRODUCTION, PURPOSE AND NEED, DESCRIPTION OF THE PROPOSED ACTION

Final Environmental Impact Statement

The Forest Service is preparing an Environmental Impact Statement (EIS) for the proposed Deerfield Wind Project in compliance with the National Environmental Policy Act of 1969, as amended (NEPA), and other federal and state laws and regulations. This document, the Final Environmental Impact Statement (FEIS), was prepared to incorporate new information and address comments received on the Supplemental Draft Environmental Impact Statement (SDEIS), released for public comment in December 2010. The NEPA process will culminate in a decision by the Forest Supervisor of the Green Mountain and Finger Lakes National Forests on the Project's pending application, described below, for land use authorization to occupy and use National Forest System (NFS) lands located in the Towns of Searsburg and Readsboro, Vermont for the construction and operation of a wind energy facility.

This project level EIS is part of a tiered NEPA process. Tiering refers to the coverage of general matters in broader environmental impact statements (such as an EIS on a forest plan) to subsequent narrower impact statements (such as an EIS on site-specific analysis project). The Forest Service prepared a programmatic EIS on the Green Mountain National Forest (GMNF) Land and Resource Management Plan (Forest Plan) adopted in 2006 to guide forest management for the next 10 to 15 years. The Forest Plan provides a programmatic framework to guide future decision making on the Forest. The Plan does not authorize, fund, or carry out any site-specific actions. By tiering to the Forest Plan EIS, this EIS analyzes alternatives and impacts relying on the framework provided by the Forest Plan and its EIS.

1.1 Background

The Deerfield Wind Project (the Project), proposed by Deerfield Wind, LLC (the Applicant), is the subject of an application for a land use authorization to construct and operate a wind energy facility within the Green Mountain National Forest. The Project would be located on a permitted area of of NFS lands administered by the Manchester Ranger District in the Towns of Searsburg and Readsboro, Vermont. See Figure 1-1, Project Vicinity Map. The site for the proposed facility is a combination of two adjacent sites that were among the 37 sites/areas on the GMNF deemed suitable for wind energy development in the 2006 Forest Plan. As first presented to the GMNF in March 2004, the Project proposal consisted of 20 to 30 state-of-the-art wind turbine generators (turbines) within the same basic footprint that is currently being analyzed, with a combined capacity to generate up to 45 megawatts (MW) of electricity. At that time, Deerfield Wind, LLC, was a wholly owned subsidiary of enXco, Inc. Deerfield Wind, LLC was purchased by PPM Energy in 2006, and then in 2008, Iberdrola, S.A. acquired PPM. Iberdrola Renewables, with the financial backing of the corporate parent, Iberdrola, S.A., then became the owner of Deerfield Wind, LLC (Iberdrola Renewables, 2009). Should a permit to construct and operate the Project be granted, it would be issued to Deerfield Wind, LLC.

The Applicant's proposal was considered by applying two levels of Forest Service screening to determine whether or not the GMNF could accept a formal application under the Code of Federal Regulations (CFRs) at 36 CFR Part 251 and Chapter 10 (Special Uses Application and Authorization Processing) of the Forest Service Handbook (FSH) 2709.11. In November of 2004, the Applicant was notified that the proposal satisfied the second and final screening criteria, and the GMNF formally accepted an application for authorization for the use and occupancy of a specific parcel of NFS land in the Towns of Searsburg and Readsboro to develop a commercially viable, utility-scale wind energy facility. Once the Forest Service accepts an application, it is obligated to consider the application under 36 CFR 251.54(g)(2)(i), by fully analyzing the proposal, alternatives, and potential environmental impacts under the NEPA. The NEPA process for this Project is described in Section 1.5.

In July 2005, the Forest Service began soliciting public comments on the Proposed Action. A Notice of Intent (NOI) to complete an EIS for the proposal was published in the Federal Register on July 15, 2005 (Volume 70, No. 135, page 409750). A scoping notice requesting comments, issues, and concerns was mailed to 432 interested and potentially affected persons and organizations on July 11, 2005. A total of 227 comments were received. At least 80 people attended two public meetings held on August 3 and 4, 2005.

In roughly the same timeframe that the Project has been undergoing analysis in the NEPA process, the Applicant also submitted an application for the Project to the State of Vermont Public Service Board (PSB) under the requirements of Title 30: Public Service, 30 V.S.A. § 248: New Gas and Electric Purchases, Investments and Facilities; Certificate of Public Good (Section 248). The PSB, in fulfilling its responsibilities to oversee utility projects, reviews the application and determines whether a Certificate of Public Good (CPG) that would permit the Project is warranted. The Applicant first submitted its application to the PSB on January 8, 2007. The PSB reviewed the application and, on March 9, 2007, issued an Order seeking additional details regarding the Project's design "in order to provide meaningful review." On July 30, 2007 the Applicant filed supplemental direct testimony and exhibits that provided the additional specific details as requested, refining the original PSB proposal of siting 15 to 24 turbines (adjusted by the Applicant for the PSB review down from the 20 to 30 turbines in the original 2004 proposal to the Forest Service). The July supplemental filing stated that the Project would now consist of 17 wind turbines, 10 on the ridge west of Vermont Route 8 (Western Project site) and 7 on the ridge east of Route 8 (Eastern Project site). The Eastern Project site lies to the south along the same ridgeline as the 11 existing wind turbines of the Searsburg Wind Facility, which is privately owned and operated by the Green Mountain Power Corporation (GMP) and has generated electricity from wind energy since 1997. The existing Searsburg facility is located on 35 acres of private forestlands abutting GMNF lands. Locating the Project near the existing wind facility would allow shared use of some infrastructure (primarily access roads) and limit some impacts to a general area where disturbance has already occurred. The area of disturbance attributed to all construction (clearing and grading) is estimated to be 87.4 acres, consisting of 73.1 acres of NFS lands and 14.3 acres of privately owned land.

Each turbine would be capable of generating up to 2.0 to 2.1 MW for a combined capacity of up to 34 to 35.7 MW of wind-generated electricity. The Project would be expected to operate at an average annual capacity factor of 36%, and therefore, the 17 turbines would collectively generate approximately 107,222 to 112,584 megawatt hours (MWh) of electricity each year. Representative turbines in this size class included the Gamesa G87 (2.0 MW) and the Suzlon S88 (2.1 MW). The Project's electrical output would be collected at a new substation proposed in the northern section of the Western Project site. The substation would be interconnected to an existing 69 kilovolt (kV) electric transmission line that is part of the Central Vermont Public Service (CVPS) electric grid, which is connected to the New England regional electric grid operated by Independent System Operators for New England (ISO-NE). The Applicant has conducted system interconnection studies and has determined the existing transmission system has adequate capacity to accept the Project's power and deliver it to Vermont and New England electric customers.

On September 20, 2007, a Project update letter was sent to 522 people, notifying them of changes in the Proposed Action based on the decisions made in the State PSB review and requesting comments on those changes. A total of 44 responses were received. The Forest Service also published a revised NOI in the Federal Register (Volume 72, No. 187, page 54893) on September 27, 2007.

The Deerfield Wind Project Draft Environmental Impact Statement (DEIS) was developed with a Proposed Action consisting of 17 turbines, consistent with the 17 turbine configuration presented to the PSB in July 2007. The Proposed Action is described in detail below in Section 1.4. The DEIS was released for public comment in September 2008. A total of 62 responses were received, which resulted in identifying 502 separate comments.

At the time of release of the DEIS, the PSB review was still on-going. Additional changes were made to the Applicant's proposal during the PSB review, which was running concurrently with the Forest Service EIS analysis process. The Applicant dropped consideration of the 2.1 MW Suzlon turbine in favor of the 2.0 MW Gamesa G80. This turbine has a somewhat smaller rotor diameter, and would reduce the Project capacity factor to 33.5%. Therefore, the anticipated annual electricity generation for the 17 turbine Project would be approximately 99,776 MWh and the total nameplate capacity would be 34 MW. The Applicant also agreed to the use of a smaller crane for construction. This machine requires a narrower 22-foot road width over many road sections (straight sections in particular), instead of the 35-foot width previously used to calculate impacts.

On April 16, 2009, the PSB approved the project and issued its Order and a CPG, with significant conditions, to Deerfield Wind, LLC. A Motion to Alter the PSB decision was filed, and further review was conducted under the State Section 248 process. On July 17, 2009, the PSB issued its Order in Regards to Motions to Alter the original CPG and issued an amended (final) CPG with minor modifications to its conditions. The project approved by the PSB consists of a 15-turbine configuration, and allows use of either or both of the 2.0 MW Gamesa G80 and Gamesa G87 turbines. The approved turbine array in the Eastern Project site remains the same as was originally presented in the DEIS. The approved turbine array in the Western Project site is very similar to the DEIS Alternative 2, Reduced Turbines in the Western Project Site. The same three southern-most turbines were removed from the original array of 10 turbines in the Western Project site, and one additional turbine was placed near the northern end of the turbine string.

Based on the comments received on the DEIS, and given the new information and developments in the PSB review and approval of a 15-turbine configuration, the Forest Service decided to prepare a Supplemental DEIS (SDEIS) for additional public comment. The new turbine models and smaller crane were considered in the discussion of all action alternatives in the SDEIS and in this FEIS. Conditions of the CPG were also incorporated into the SDEIS and this FEIS analysis as appropriate. Finally, Alternative 2 was modified in the SDEIS to reflect the PSB approved configuration, and remains consistent with the PSB approved layout in this FEIS. Notification was sent to the project mailing list on October 8, 2009, and a revised NOI was published in the Federal Register (Volume 75, No. 11, page 2844) on January 19,

2010. The SDEIS was released for public comment in December 2010 and a Notice of Availability published in the Federal Register on December 23, 2010 (Volume 75, No. 246, page 80808). The comment period ran from December 24, 2010 to March 18, 2011. Two public meetings (January 20 and 25, 2011) were held to collect public input on the SDEIS. Each of the specific comments received was considered in this FEIS analysis, and is addressed in Appendix J.

1.2 Structure of the Document

The FEIS is organized as outlined below. Each chapter contains a number of sections. Tables are embedded throughout the document. Supporting figures and appendices that are attached to this FEIS are listed in the Table of Contents. Appendices include certain additional technical information extracted from studies that are in the Project Record.

Chapter 1.0 presents the introduction and background information, the Purpose and Need, and a description of the Proposed Action. The Proposed Action for the purpose of analysis is the Project as originally presented in the DEIS (17-turbine configuration) and now includes the modifications coming from the State PSB review process. The NEPA process is also described, as are the decision framework, public involvement process, and significant and other issues.

Chapter 2.0 provides a description and comparative evaluation of the impacts of the alternatives, including the No Action alternative and the Proposed Action, that could reasonably be expected to achieve the purpose and meet the need described in Section 1.3, in accordance with the NEPA process. This section provides a brief discussion of other alternative considered, and also identifies the Forest Service's Preferred Alternative.

Chapter 3.0 identifies those environmental resources that may be affected by the Proposed Action, and the environmental consequences (direct, indirect, and cumulative impacts) of the Proposed Action and other reasonable alternatives considered in detail. Issues and concerns relevant to specific resources that were identified by the public and by the Forest Service are noted and addressed in each impact section. Design criteria and measures proposed to reduce, minimize and/or mitigate impacts are described. Overall cumulative impacts are also disclosed.

Throughout this FEIS, the geographic area that contains the Proposed Action will be described in terms of Project site, Project area, and Project vicinity. These terms are defined as follows:

- Project site: limits/area of clearing and grading activities associated with the construction, operation, and maintenance of the proposed Project (i.e., Project footprint). The total Project site consists of both an Eastern Project site and a Western Project site. The actual area of disturbance (clearing and grading) for each alternative, including the Proposed Action, is described in the various sections of the FEIS.

- Project area: general local boundaries of the Project which are all NFS and private lands in GMNF management compartments 121, 122, 123, and 124, an area totaling 9,523 acres (Figure 1-2). This will serve as the analysis area for many of the resources.

- Project vicinity: larger geographic region surrounding the Project area, the extent of which may be determined by the resources and physical environment that are affected by the Project (e.g., southern Vermont).

It is important to note the relationship between "design criteria" and "mitigation measures" for this analysis. Design criteria are one form of mitigation measure, which represent standard, routinely implemented management practices that have been designed into the construction and operation of the proposed activity. These criteria, if implemented, would tend to avoid or minimize potential impacts to resources beyond that which would be achieved from the application of the GMNF's 2006 Land and Resource Management Plan (Forest Plan) Standards and Guidelines (S&Gs) alone. Design criteria may apply to all action alternatives.

Mitigation measures are one of the three types of alternatives under NEPA, the others being no action and other reasonable courses of action. As used in this FEIS, the term "mitigation measure" refers to additional measures proposed to avoid or otherwise address unintended or adverse environmental impacts, including monitoring and adaptive management, with respect to one or more alternatives. Many times, mitigation measures, in contrast to design criteria, are developed as a result of public comments to the DEIS, and in this case, the SDEIS. Mitigation measures developed as a result of comments on the DEIS and SDEIS, along with those developed based on requirements from the CPG, are included in this FEIS. All proposed design criteria and mitigation measures are listed in Appendix A.

Chapter 4.0 identifies the preparers of and contributors to the FEIS.

Chapter 5.0 provides the full citation for references cited in the FEIS.

Figures and Appendices are attached as needed.

1.3 Purpose of and Need for Action

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

1.3.1 Purpose and Need Statement

The Purpose and Need for the Proposed Action is to:

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

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

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

1.3.1.1 Forest Plan Needs

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

One of these goals, Goal 11, is to "provide opportunities for renewable energy use and development" on GMNF lands with the objective of increasing "opportunities for renewable energy use and development."[1] As such, Goal 11 provides the basis and framework for scoping the reasonable range of alternatives as project sites that use GMNF lands (see Chapter 2.0). Renewable energy development on private lands outside of the GMNF may be desirable but would not implement Goal 11 and its objectives. Other GMNF goals related to this need are Goal 5 to maintain and improve air quality on the GMNF, and Goal 17 to support regional and local economies through resource use, production, and protection.

The Forest Plan and its EIS specifically evaluated renewable wind energy development and identified five Management Areas (MAs) that are suitable for future consideration of wind energy projects. The EIS prepared for the Forest Plan considered studies of potentially acceptable sites for renewable wind energy development in the national forest, and identified 37 individual areas/sites, including the Project area. The Forest Plan and EIS, therefore, identified suitable areas for further analysis of possible wind energy development. The Plan also identified the non-recreation Special Use management process and criteria that apply to proposed wind energy projects.

The Proposed Action of issuing a land use authorization for the construction and operation of a wind energy facility on NFS lands is in accord with Forest Plan goals and objectives and moving toward a desired future condition of developing renewable energy on the GNMF.

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

1.3.1.2 Energy Needs Identified by Federal Government

All federal agencies including the United States Department of Agriculture (USDA) Forest Service have been directed to further the goals and objectives of the National Energy Policy to use federal lands for development of energy projects and, in particular, renewable energy projects. Federal policy has recognized the need for increased supplies of energy in the United States and has encouraged consideration of new projects, in particular, new renewable energy projects.

Important goals of the May 2001 National Energy Policy are to increase domestic energy supplies, modernize and improve our nation's energy infrastructure, and improve the reliability of the delivery of energy from its sources to points of use (National Energy Policy Development Group, 2001). The use and occupancy of federal lands is recognized as an important element in facilitating the exploration, development, and transmission of affordable and reliable energy to meet these goals. Title II of the Energy Policy Act of 2005 emphasizes the need described above by seeking to increase the use of renewable energy resources for electric generation on federal lands, which includes National Forest System lands like the Green Mountain National Forest.

Former President G.W. Bush issued at least three mandatory directives to the Forest Service and other agencies on the need to promote energy-related projects and renewable energy generation projects. As stated in Executive Order 13212 entitled Actions to Expedite Energy-Related Projects (dated May 18, 2001):

> *For energy-related projects, agencies shall expedite their review of permits or take other actions as necessary to accelerate the completion of such projects, while maintaining safety, public heath, and environmental protections. The agencies shall take such actions to the extent permitted by law and regulation, and where appropriate.*

In 2007 and 2009, the President directed federal agencies to promote renewable energy. Executive Order 13412 (dated January 24, 2007) directs the head of each federal agency to, among other things, "ensure that at least half of the statutorily required renewable energy consumed by the agency in a fiscal year comes from new renewable sources," and "implement renewable energy generation projects on agency property" for agency use to the extent feasible. Section 3 of the order requires that agencies' practices and permits encourage the use of renewable energy. Executive Order 13514 (dated October 5, 2009) requires each agency to increase agency use of "renewable energy and implementing renewable energy generation projects on agency property."

Under direction from the Secretary of Agriculture, the Department of Agriculture, which includes the Forest Service, is supporting the President's initiative to reduce energy consumption derived from fossil fuels and to increase production from renewable energy sources. The Department has committed itself to work with other federal agencies, as well as outreach to state, local, tribal and private entities, to encourage maximum use of renewable energy and development of renewable energy projects.[2]

1.3.1.3 Energy Needs Identified by State Government

State and regional studies and state law have identified a need and specific requirements to develop renewable energy projects. All New England states, including Vermont, have established Renewable Portfolio Standards (RPS)[3], which call for an increasing percentage of electric energy to be supplied from renewable sources in each year. Additionally, energy consumption forecasts continue to predict an increase in energy use in Vermont and regionally. Given the controversy surrounding renewal of the license for the Vermont Yankee Nuclear Power Plant as of this writing, uncertainty remains as to the continued availability of approximately 35% of Vermont's peak electric power mix beyond the next decade.

The Forest Service has independently reviewed the findings of the Vermont PSB. The PSB, at the conclusion of its review, determined that the Deerfield Project would help meet a number of State and Regional needs for renewable energy. As stated in their Order dated April 16, 2009:

> *After careful consideration of the comments raised by parties and the public and the evidence in the record, we find that, subject to a number of conditions set out in this Order, the proposed Project will promote the general good of the State and Deerfield should be granted a Certificate of Public Good ("CPG") under Section 248 authorizing construction of the Project. The Project is expected to produce clean, renewable power — power that is needed in the New England energy market. The additional power will contribute to lowering the overall price for power on the wholesale market and meeting electrical demands of regional consumers.*
>
> *Furthermore, the Project is a source of energy that does not produce greenhouse gases. As a non-emitting renewable resource, it will contribute to meeting the growing need for renewable energy in the region and aid in achieving the standards of the Regional Greenhouse Gas Initiative ("RGGI"). The new source will help meet the State's goals of increasing reliance upon renewable energy. These include the standards in the Sustainably Priced Energy Enterprise Development Program ("SPEED") requiring that, by 2012, at least 10% of the State's energy load (as of 2005) be served by new sources of renewable energy, as well as the longer-term goal of providing 25% of the energy used in Vermont from renewable resources.*

Project-specific studies prepared prior to and during the PSB review also identified renewable energy needs to which the proposal is responding. A study was undertaken in 2004 by Synapse Energy Economics, Inc. (Synapse), a research firm specializing in energy, economics, and

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[2] An example is the Memorandum of Understanding between the Department of Agriculture and the Department of the Navy, signed by the heads of both agencies on January 21, 2010, committing the agencies to these federal policies and goals for renewable energy, which are consistent with GMNF Plan Goal 11 discussed above.

[3] Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont have RPS, as do several nearby mid-Atlantic states, including New York, New Jersey, Pennsylvania, Delaware, and Maryland.

environmental issues. Synapse's full evaluation, conducted using publicly available data, is included in their report entitled *The Searsburg/Readsboro Wind Project: An Analysis of Need*. In January 2006, Synapse updated the study to include the economic and environmental attributes of the proposed Deerfield Wind Project, as well as how it would meet the identified needs. The updated report is entitled *The Deerfield Wind Project: Assessment of Need for Power and the Economic and Environmental Attributes of the Project*. Both studies may be found in the Project Record and are available upon request. In brief, recognizing the particular characteristics of wind energy, the key points these studies note regarding energy needs at the State and Regional levels include:

1. The Northeast's electric grid needs new sources of renewable energy.
2. Renewable Portfolio Standards (RPS) in the Northeast will require a considerable amount of new renewable energy.
3. The Project would provide a reliable and needed source of power, helping to contribute to long-term cost stability in a region where the availability of cost-stable resources is quickly diminishing.
4. The Project would serve as a supply of renewable energy consistent with Vermont Sustainably Priced Energy Enterprise Development[4] requirements, and as a source of renewable energy credits to satisfy renewable portfolio standards throughout New England.

Furthermore, in June 2005, the Vermont General Assembly adopted renewable energy goals that specifically support the finding in the Synapse report, that the Project could provide a substantial benefit to Vermont's resource base as a fixed-cost source of renewable energy. In 2007, the ISO-NE, operators of the New England electric grid serving the six New England states, identified the need for additional generating resources, both conventional and alternative (renewable generation), in order to keep pace with the region's accelerating energy demands.

1.3.2 Summary: Need for the Proposed Action

The Proposed Action is needed to work toward meeting the Forest Plan goals and objectives (see Section 1.3.1.1) of providing opportunities for renewable energy use and development on GMNF lands including, specifically, renewable wind energy projects.

The Proposed Action is needed to work toward meeting the goals and objectives of the National Energy Policy and executive orders (see Section 1.3.1.2) to use federal lands for development of renewable energy projects. National policy and direction provides the authority for federal agencies such as the Forest Service to thoroughly consider and evaluate proposals for development of energy projects on federal lands rather than immediately dismissing those proposals because there may be similar opportunities on private lands. Furthermore, it encourages development of non-hydropower

[4] Established by Act 61 in 2005.

renewable energy sources, such as the Deerfield Wind Project, on federal lands such as the Green Mountain National Forest.

The Proposed Action is also needed to help move the State of Vermont toward meeting its Renewable Portfolio Standards (see Section 1.3.1.3), which call for an increasing percentage of electric energy to be supplied from renewable sources; to help contribute to long-term cost stability in Vermont and the region; and work toward meeting the state's future energy needs.

Therefore, the independent Forest Service NEPA evaluation of the site-specific Project proposal (i.e. Proposed Action) to use Green Mountain National Forest land for wind energy development is needed to meet the Purpose of and Need for Action.

1.3.3 Consideration of the Applicant's Proposed Project

As noted previously, in March 2004 the Applicant submitted a proposal for authorization to construct and operate the Deerfield Wind Project. Based on almost 20 years of testing and data collection regarding its viability as a wind source, it was determined that the Project site has the capability to effectively produce wind energy. Other attributes that make this site attractive for consideration include:

1. On-site existing transmission lines that connect to the grid, thereby eliminating costs of building additional transmission lines and avoiding the environmental effects that would result from that construction.
2. The capability of using some of the infrastructure of the existing Searsburg Wind Facility (e.g., access roads, electrical collection lines), and thereby reducing environmental effects.
3. No issues with the Federal Aviation Administration (FAA) regarding safe and efficient use of the navigable or restricted airspace.
4. No obvious threatened and endangered species issues identified early in the process (investigated in detail in the analysis).
5. Acquisition of rights to use private land for the Western Project site access (much less environmentally sensitive than accessing the site from the south across NFS lands).
6. The relative remoteness of the site (away from major population centers and high recreation use areas).
7. The Searsburg facility turbines, in place since 1997, provide an existing "context" to the landscape and viewshed.

The GMNF applied the screening criteria mandated in the agency's Special Uses process to the Applicant's proposal in 2004 and determined, among other things that:

- The proposal was consistent with the laws, regulations, orders, and policies establishing or governing NFS lands [FSH 2709.11 Chapter 10 (12.21)],

- The proposed use appeared to be consistent or can be made consistent with standards and guidelines in the applicable forestland and resource management plan, i.e., the Project would not be inconsistent or incompatible with direction in the GMNF 2006 Forest Plan for the Diverse Forest Use Management Area or with other uses,
- The proposed use would not unreasonably conflict or interfere with administrative uses by the Forest Service, other scheduled or authorized existing uses of the National Forest System, or use of adjacent to non-National Forest System lands,
- The proposed use would be in the public interest, and
- The Applicant demonstrates technical and economic feasibility of the proposed use and has the financial and technical capability to undertake this proposed use and to fully comply with the terms and conditions of the authorization.

One important criterion evaluated during the screening process was the proposal's compatibility with Forest Plan direction. The Project was proposed in the Diverse Forest Use MA, which does not prohibit development and construction of wind turbines. The proposed site was also included in the 37 areas identified in the Forest Plan as potentially suitable for wind energy development (Forest Plan FEIS, p. 3—298).

Considering all of the above, it was determined that the proposal was an appropriate use of GMNF lands in this location at this time, and as such, the application was accepted for this site-specific proposal. Once accepted, the GMNF was obligated to consider the application and has done so by analyzing it using the NEPA process, and preparing a final decision on the proposal described herein. No other proposal for developing alternative energy on the GMNF has been presented to the Forest, and thus the evaluation of this site-specific proposal will determine whether or not this Proposed Action or one of the action alternatives is the right project at the right time and in the right place. Should the analysis support a decision that the Project is not appropriate at this time and place, then the Project would not be authorized (i.e., the No Action alternative would be selected), and no other project considered in its place at this time.

1.4 Description of Proposed Action

The site-specific NEPA analysis of the Applicant's application describes the environmental effects of constructing and operating the proposed facility as presented in the application. The facility and its associated infrastructure are proposed to be located on a permitted area of up to 80 acres of NFS lands. At the time of application, 80 acres was determined to be the threshold for the type of permit anticipated being needed. The release of the new wind energy directives in August 2011 has removed any acreage threshold for the type of permit that would be issued if the Project is approved. The actual area of disturbance attributed to all construction (clearing and grading, including areas temporarily affected during construction) totals approximately 87.4 acres, 73.1 acres of NFS land and 14.3 acres of private land. The Project would occupy portions of two ridgelines east and west of Route 8, in the Towns of Searsburg and Readsboro, Vermont.

The proposed Project would consist of 17 state-of-the-art utility-scale wind turbines, each capable of generating 2.0 MW of electricity, and associated ancillary facilities. Today's technology for developing commercial, or utility-scale, facilities dictates the need for larger, taller turbines that can more effectively and efficiently gather the wind resource for power generation when compared to smaller, less efficient turbines of past years such as those at the Searsburg facility. The ancillary facilities would include a substation, overhead and underground electrical collection systems and communication cables, two small wind data collection devices (LIDAR), access roads, temporary laydown areas, and an operations and maintenance (O&M) building. The proposed locations of Project components are shown on Figure 1-3. The Project would generate up to 34 MW of new wind energy and capacity to Vermont consumers and the New England electric supply grid. As proposed by the Applicant, and/or required by the State of Vermont, the Project would include various design criteria and mitigation measures to avoid and minimize adverse environmental impacts. Location of the Project next to the existing 11-turbine Searsburg facility on adjacent private land would allow shared use of some of the existing infrastructure and thereby reduce impacts. The existing Searsburg Wind Facility infrastructure is also shown on Figure 1-3.

The Project's seven turbines in the Eastern Project site would be placed on the east side of Route 8 on the same ridgeline as the existing Searsburg Wind Facility turbines. The remaining 10 turbines proposed for the Western Project site would be placed along a separate ridgeline to the west of Route 8. Both arrays are located in relatively remote Diverse Forest Use MA lands, in lightly used areas proximal to Vermont Route 8.

The Project area encompasses all NFS and private lands in GMNF management compartments 121, 122, 123, and 124, an area totaling 9,523 acres. Elevation in the Project area ranges from approximately 1,510 feet above mean sea level (AMSL) in the northeastern Project area along the Deerfield River to approximately 3,110 feet AMSL along the eastern ridgeline, south of the existing Searsburg Wind Facility. The Project site consists of the footprint of activity associated with the proposed Deerfield Wind Project. Elevation in the Project site ranges from approximately 2,401 feet AMSL near the intersection of Route 8 and the Putnam Road access to approximately 3,110 feet AMSL along the eastern ridgeline, south of the existing Searsburg Wind Facility. The existing turbines of the Searsburg Wind Facility are located north of, and at slightly lower elevations (from 2,700 to 2,900 feet AMSL), than those proposed in the Eastern Project site, as the eastern ridge increases in elevation to the south.

The Searsburg Wind Facility turbines on the eastern ridge are each a maximum of 198 feet high, from the ground level pad to the tip of the blade when in a vertical position. These existing turbines have a combined electric generating capacity of 6 MW, with an annual energy potential to meet the needs of approximately 2,000 households. Construction of the Searsburg Wind Facility resulted in 1.5 miles of new transmission lines, approximately 1.5 miles of service roads, and about 21.1 acres of permanently cleared forest.

Although the Deerfield Wind Project would be developed as a separate facility, it would rely in part on the existing infrastructure of the Searsburg Wind Facility, including use of existing facility roads to access the Eastern Project site. The Project facilities and components are described below. Construction methods are described in Section 1.4.2; continued public access to NFS lands and planned safety measures are detailed in Section 1.4.3.

1.4.1 Facilities Description

1.4.1.1 Wind Turbine Generators

As stated above, the proposed Project would consist of 17 wind turbines, each capable of generating 2.0 MW for a combined capacity of up to 34 MW of power, or approximately 99,776 MWh annually. The Project would use the Gamesa G80 turbine model, which has been identified as appropriate for the specific conditions at the Project site. The Gamesa G80 turbines are horizontal axis turbines with a three-blade upwind design. Additional mechanical specifications are provided in the Project Record. Turbines would be spaced a minimum of approximately three rotor diameters apart (about 786 feet, or 240 meters), in order to maximize power production and efficiency.

Each turbine consists of three major components – the tower, the nacelle, and the rotor assembly (including three rotor blades attached by a hub to the nacelle). The nacelle sits atop the tower, and the rotor hub is mounted to the nacelle. The total turbine height (i.e., distance from the highest blade tip position to the ground) is approximately 389 feet (118.6 meters), including any grading and pedestal height. Descriptions of each of the turbine components are provided below.

1.4.1.2 Tower Structure and Foundation

Each turbine would stand on a single tubular steel tower, which would be painted white or off-white and be approximately 16 feet in diameter at its widest dimension. The height of the tower, or "hub height" (distance from foundation to hub at the top of tower) would be up to approximately 256 feet (78 meters). The tower would be assembled from four sections transported separately to each turbine location. Once assembled, the turbine structure would be anchored to a concrete foundation or pad approximately 16 feet in diameter.

1.4.1.3 Nacelle

The tower is topped by a nacelle that houses the main mechanical components of the turbine, including the generator. The nacelle is approximately 15 feet high, 46 feet long, and 11 feet wide, and connects to the rotor hub. The nacelle consists of a machine platform mounted on a roller bearing sliding yaw ring that allows it to rotate (or "yaw") to keep the turbine pointed into the wind to maximize energy capture. A wind vane and anemometer are mounted at the rear of the nacelle to signal the controller with wind speed and direction information.

The main components inside the nacelle are the drive train, gearbox, generator, and transformer. The nacelle is housed in a fully enclosed steel-reinforced fiberglass shell that protects internal machinery from the environment and dampens noise emissions. The housing is designed to allow for adequate ventilation to cool internal machinery such as the gearbox and the generator. Lighting required by the Federal Aviation Administration would be attached to the top of the nacelle.

1.4.1.4 Rotor Assembly

The rotor assembly is mounted to the nacelle at the hub and operates upwind of the tower. Each rotor assembly consists of three fiberglass or composite blades. Each blade is up to approximately 128 feet (39 meters) in length, resulting in a maximum blade tip height[5] from the ground surface of up to 389 feet (118.6 meters).[6] The rotor assembly diameter is approximately 262 feet (80 meters), including the width of the hub. The swept area or circular area covered by the rotating blades is approximately 54,110 square feet (5,027 square meters).

The rotor attaches to the drive train emerging from the front of the nacelle. Hydraulic motors within the rotor hub adjust the pitch and feather each blade according to wind conditions, which enables the turbine to operate efficiently at varying wind speeds. The rotor spins clockwise at varying speeds for more efficient operation at both low and high wind speeds. The turbines would operate at wind speeds from 9 miles per hour (mph) (4 meters per second [m/s]) up to full power rating at 30 mph (13.4 m/s). The maximum rotor speed is 19 revolutions per minute (rpm). The rotor has a braking mechanism that would stop and lock the rotor when wind speeds are above a maximum allowable wind speed of 56 mph (25 m/s).

1.4.1.5 Night Lighting

Aircraft safety lighting would be specified by the FAA, whose current guidelines call for lighting the turbines at each end of a ridgeline array with one red flashing light atop the nacelle. In addition, those turbines approximately 0.5 miles apart within the array must be lit. Based upon these guidelines, the FAA Obstruction Marking and Lighting Advisory Circular (AC70/7460-1K), and lighting on similar projects operating under FAA guidelines, the following lighting and marking plan for the Project is anticipated. Red flashing lights are proposed to be mounted on the nacelles of those turbines at the ends and intermittently within each string, such that an estimated total of seven turbines would be lit at night, four at the Western Project site and three at the Eastern Project site. No daytime lighting would be required, since the turbines would be white or pale off-white.

The FAA's authority to promote the safe and efficient use of the navigable airspace, whether concerning existing or proposed structures, is predominantly derived from 49 United States Code (U.S.C.), Section 44718, Title 14, CFR, Part 77, Objects Affecting Navigable Airspace. It was adopted to establish notice criteria for proposed construction or alteration that would protect aircraft from encountering unexpected structures. The regulations apply to structures located within any state, territory, or possession of the United States, within the District of Columbia, or within territorial waters (12 nautical miles) surrounding such states, territories, or possessions.

The primary objective of an evaluation under Part 77 is to ensure the safety of air navigation and efficient utilization of navigable airspace by aircraft. The Applicant has the responsibility to notify the FAA of proposed construction of any structure with a height greater than 200 feet above ground that may affect the protected areas/airspace around airports, commonly referred to as

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[5] Height above grade to the tip of the blade when in the highest vertical position.
[6] Assumes a 78-meter tower and an 80-meter diameter rotor.

Part 77 surfaces. This notification is accomplished by the submission of an FAA Form 7460-1, Notice of Proposed Construction or Alteration. The notices consist of descriptions of the pertinent structures and any proposed lighting or markings. The FAA reviews the notices to determine the hazard to aircraft, if any, and recommend or require appropriate lighting and markings as necessary. In compliance with applicable regulations and guidance, the Applicant filed a notice with the FAA. Responses from the FAA were received February 2, 2009. All proposed turbines received a "Does Not Exceed" determination, indicating that the structures would not exceed obstruction standards, would not have substantial adverse physical or electromagnetic interference effect upon navigable airspace or air navigation facilities, and would not be a hazard to air navigation.

1.4.1.6 Substation and Electrical Collection System

The Project's turbines would connect to a new substation constructed on NFS lands in the extreme northwest corner of the Western Project site, adjacent to the existing regional 69 kV transmission line that crosses the ridge at this location (see Figure 1-3). In total, approximately 2.9 acres would be cleared and/or graded for the new substation. The footprint of the new substation and electrical interconnection equipment, however, would occupy an area of approximately 1.41 acres. The substation would be within the forest, which would minimize visibility from off-site locations. The facility would be enclosed in a chain link fence approximately 8 feet high for security and safety purposes. It would contain transformers, electrical switch gear, and other components, generally with a profile of less than 25 feet. Lightning protection devices would extend as high as approximately 45 feet.

A new overhead and underground 34.5 kV electrical collection system totaling approximately 4.77 miles in length to service the east and west arrays would be constructed. New electric collection cables would need to be constructed for the Western Project site. The existing Searsburg Wind Facility cable system would be utilized by the Eastern Project site, but would need to be extended. Collection lines are typically either buried 3 to 4 feet deep or placed overhead on poles 35 to 45 feet high. The collection lines would mostly be buried underground beneath or adjacent to the access roads, and would rise overhead at the southern end of the western turbine array, traveling overhead to the Eastern Project site where they would be co-located with the existing Searsburg collection line and continue underground along the eastern turbine array (see Figure 1-3). The corridor for the new overhead line between the western and eastern arrays would disturb an area approximately 30 feet wide and 0.47 mile long (approximately 1.63 acres).

Another important infrastructure component are the two LIDAR (Light Detection and Ranging) units that use laser light technology to measure the various components of wind energy (i.e., speed, direction, and so on). In order to reduce impacts, these units would be used in place of permanent meteorological towers. One would be placed on the Eastern Project site and one on the Western Project site, each a short distance from the turbines so that turbine wind wake does not interfere with the unit function. The units consist of small box-shaped devices approximately 24 inches wide and 22 inches high, and are typically mounted on a small platform a few feet above ground. The unit setup would be placed on a poured concrete pad about 4 feet by 4 feet.

Access to the units would be on short spur trails off of the main access roads. Power and data cables to each unit would be buried under the access trail.

1.4.1.7 Roads

The Project has been designed to utilize existing roads to the extent possible to minimize disturbance associated with construction of new roads. In general, existing roads off Route 8 would be extended into the Eastern and Western Project sites. Existing and proposed access roads are shown on Figure 1-3. The Project would create 5.07 miles of new roadway and upgrade 1.03 miles of roadway at the existing Searsburg facility to accommodate widths needed for construction. In areas of steep embankments or sharp turns, guardrails would likely be constructed for the safety of long-term operations and maintenance personnel.

During construction, the gravel surface of the access roads would be 22 feet wide over most sections, which, by using a smaller crane than originally proposed, has been reduced from the 35-foot nominal width described in the DEIS. Where necessary, the gravel surface would be wider (up to approximately 36 feet) to allow large construction equipment to navigate sharp turns. Grading would typically extend approximately 5 to 10 feet to either side of the gravel road surface, and clearing approximately 20 to 30 feet to either side. All widths would be kept to a minimum as much as possible, yet allow for safe and efficient movement of equipment. Where possible, the gravel surface of the access roads would be reduced to approximately 16 feet wide after completion of construction, with the margins revegetated to reduce erosion. However, in order to maintain a stable road surface, the cut and/or fill required to support the roads would not be re-graded during Project operation. In total, approximately 46.2 acres would be cleared and/or graded for Project roads. Of this, approximately 11 acres of forest would be impacted for construction and widening of existing roadways and approximately 35.2 acres of forest would be impacted for construction of new roads. Construction methods are described in Section 1.4.2. Roads on NFS lands would be constructed and maintained to applicable Forest Service standards.

Project road construction would involve the use of several pieces of heavy machinery, including bulldozers, track-hoe excavators, front end loaders, dump trucks, motor graders, water trucks, and rollers for compaction. Road construction would typically involve clearing, grubbing, topsoil stripping, and removal of stumps, as necessary. Blasting may be required to construct appropriate road grade. Stripped topsoil would be stockpiled along the road corridor for use in site restoration, so that the topsoil is not mixed unnecessarily with sub-soil or gravel. This practice has been developed to assure that the topsoil, when replaced, will support re-establishment of vegetation.

Any grubbed stumps or cleared trees would be chipped and properly spread on-site or hauled off site for disposal or further processing. Following removal of topsoil, subsoil would be graded, compacted, and surfaced with a minimum of 12 inches of gravel or crushed stone in accordance with the requirements of the wind turbine supplier and recommendations from the geotechnical engineer based upon the soil investigations. As required by design specifications, geotextile fabric or similar material would be installed beneath the road surface to provide additional support.

Along each ridge, the new access roads would run approximately parallel to the turbines, to allow installation and servicing of the wind turbines. The electric collection and communication cables system described above would be installed along road corridors. As described above, the cables would primarily be installed underground beneath or adjacent the access roads, but would rise to overhead lines to cross Route 8.

1.4.1.8 Eastern Project Site Access Road

A portion of the existing Searsburg Wind Facility access road off Route 8 heading south would be utilized to install and access the seven turbines in the Eastern Project site. A single new access road (with short spurs to the turbine sites) totaling approximately 1.69 miles in length would extend south from the end of the existing facility road onto NFS land to link the new turbines. Improvements to the existing roads would be required to transport equipment and construction vehicles to the turbine sites. The existing Searsburg Wind Facility road would be temporarily widened, as described above in Section 1.4.1.7, to allow tractor trailers carrying turbines components and cranes to reach the Eastern Project site. Following construction, access roads would be reduced in width and shoulders allowed to revegetate. Access roads approximately 16 feet in width would provide continuing access for maintenance.

1.4.1.9 Western Project Site Access Road

The original proposal called for construction of a new access road at the southern end of the western turbine array, directly off Route 8. However, to address grade issues and to avoid impacting wetlands and cultural resources identified along that route, the southern access road was eliminated from further consideration, and several other potential access routes were evaluated. A northern access route is now proposed that would utilize Putnam Road, an existing private road off Route 8 approximately 2,000 feet (0.38 mile) south of the Route 9 intersection, thereby reducing impacts to sensitive resources. The full length of Putnam Road would be utilized to access the Western Project site, from Route 8 to the 69 kV transmission line corridor. This access road would enter NFS lands approximately 0.6 mile from Route 8. Putnam Road would be temporarily widened, as described above in Section 1.4.1.7, to allow tractor trailers carrying turbine components and cranes to reach the Western Project site. Following construction, excess gravel would be removed, and access roads would be allowed to revegetate to approximately 16 feet in width to provide continuing access for maintenance.

1.4.1.10 Operations and Maintenance Facility

O&M equipment would be housed in a new O&M building on private land off the southern side of Putnam Road near Route 8 (see Figure 1-3). The building would be approximately 4,000 square feet in size and of metal frame construction with neutral-colored, non-reflective siding. A private well and waste disposal system is anticipated to be installed for the facility, in accordance with applicable regulatory standards.

1.4.2 Construction Sequencing and Methodology

Construction of the Project would be anticipated to occur over one typical construction season (nine to twelve months) with commissioning desired in the early winter. All construction work, including earth work and tree clearing, would be scheduled in a manner consistent with Forest Service practices and engineering standards, and would ideally be completed over the course of one year and one construction season. Tree clearing, grading, and blasting (if necessary) would not be conducted during May or June to minimize impacts to breeding birds, and other seasonal restrictions may apply. Construction and installation would be targeted to start during 2012, depending on completion of all regulatory and environmental review, and acquisition of all permits. Final sequencing and construction methods, as described below, would be finalized during permit development.

1.4.2.1 Laydown Area

An area of approximately 4.2 acres would be cleared and/or graded for a temporary laydown area at an existing clearing at the terminus of Putnam Road. This area would be utilized for construction trailers, vehicle parking, and the temporary storage of construction equipment, stockpiles, and Project components, such as turbine parts. In addition, other secure lay down areas in reasonable proximity to the construction sites would be required for turbine tower sections and other turbine parts. These satellite laydown areas would consist of clearings, approximately 300 to 350 feet in diameter, situated around the base of each turbine during construction. A smaller portion of this area around each turbine (about 150 square feet) would be required for maintenance. Once construction and installation is completed, these satellite lay down areas would be allowed to revegetate. A planting plan would be developed prior to construction.

1.4.2.2 Land Clearing

After erosion control measures have been installed to protect soils, wetlands, and waterbodies, clearing and harvesting of trees would commence. Clearing would be done to temporarily widen the existing access roads and create new access roads (as described above in Section 1.4.1.7), around each turbine site (as described above in Section 1.4.2.2), and along the route of the new electrical collection lines (as described above in Section 1.4.1.6). The locations for the substation and O&M facilities would also be cleared. Clearing would be done in linear strips, and in accordance with Forest Service S&Gs.

Approximately 73.1 acres of NFS lands and 14.3 acres of private land would be impacted (clearing and grading operations) to construct all components of the Project, including the temporary 1.9-acre work area required at each turbine site for assembly and erection of the turbines. Some of the land impacted is already cleared, i.e., is an existing open area or roadway. Following construction, temporary work areas would be graded and restored (seeded and planted, as needed) to prevent erosion and allow revegetation.

1.4.2.3 Turbines

The tower sections, nacelles, and rotor blades that comprise the turbines would be delivered to the temporary laydown area and satellite laydown areas by truck. Turbine erection is performed in multiple stages including: setting of the electrical cabinet on the foundation, erection of the tower, erection of the nacelle, and the assembly and erection of the rotor. Towers for the Project would be fabricated, delivered, and erected in at least three sections using a crane. Turbine assembly and erection would be accomplished using large track-mounted cranes and smaller rough-terrain cranes, support vehicles such as boom trucks, and other light trucks. The erection cranes would move from one tower to another along the access roads.

In total, approximately 31.9 acres would be cleared and/or graded for turbine placement, which is equivalent to approximately 1.9 acres of disturbance per turbine. Wind turbine installation typically involves stripping and stockpiling topsoil within a 150- to 175-foot radius around each turbine. Following topsoil removal, backhoes would be used to excavate a foundation hole. In order to determine the specific type of foundation to be used, geotechnical investigations would be completed. If a spread foot foundation were to be used, it would be approximately 7 to 10 feet deep and approximately 50 to 60 feet in diameter, and would require approximately 320 cubic yards of concrete. A rock anchor foundation is a potential alternative design with a slightly smaller diameter of 30 to 40 feet. It would use approximately 150 cubic yards of concrete, and would include of several anchors drilled, grouted, and pre-tensioned into existing bedrock for structural stability.

Once the foundation is cured, it would be buried and backfilled with the excavated on-site material. The top of the foundation would be an approximately 16-foot diameter pedestal that may extend 6 to 8 inches above grade. At the base of each tower, a rectangular area approximately 100 by 60 feet would be developed as a temporary crane pad. Based on preliminary calculations and depending on the type of foundation used, approximately 100 cubic yards of excavated soil should remain from each turbine foundation excavation. The material would be used as backfill for the foundations, or to level out low spots on roads and wind turbine erection areas. Permanent impacts would be due to the physical footprint of the turbine and a small maintenance pad, and would total approximately 0.065 acre.

1.4.3 Access and Safety

The proposal in the DEIS to close the area immediately surrounding the turbines and access roads received considerable public comment. To address the issues raised by the public, that closure is not proposed to be implemented in the SEDIS. Public access to public lands adjacent to the Project site would not be restricted, except for gating the access roads and fencing some of the ancillary facilities. Fencing/gating would close the access roads to public vehicle access. The proposed substation would be fenced in to prevent public and wildlife access to high-voltage equipment.

Safety signing would be posted around the roads, turbines, and all ancillary facilities where necessary, in conformance with state and federal regulations and guidelines. Public use of the area would be monitored during the first one or two years of operation and, if desired for public safety, site security, or to minimize potential disturbance to black bears, an area closure could then be implemented surrounding the access roads and turbines, with a setback of an appropriate number of feet from the edge of the facilities (roads and turbines). Safety and security is discussed further in Section 3.17.

1.4.4 Operations & Maintenance Facility

The Applicant's land use authorization application requests authorization for a minimum of 30 years of Project operation. Authorization would most likely be granted by a Special Use permit for the appropriate length of time in accordance with regulations. O&M of the Project would be in accordance with an O&M plan that would become a component of the permitting process. The O&M plan would include the following components, at a minimum:

- A centralized Site Control and Data Acquisition (SCADA) system would monitor the condition of the wind plant equipment, alert service technicians to any fault or alarm conditions, record and sort data, and allow remote control of the turbines.
- Routine maintenance of the individual wind turbines, transmission facilities, and site improvements (roads, gates, fences, etc.) would generally be scheduled in two separate inspections at intervals of approximately six months, averaging 40 to 50 person hours per year for each turbine.
- Controlled year-round access to the Project facilities would be maintained so site operators can monitor the facilities and equipment and quickly respond to any unforeseen condition that might impact the safety of the operations staff or the public. The site operator would ensure that the facility is operated according to the terms and conditions of the Special Use permit in a manner that is both safe and consistent with the management objectives of the surrounding NFS land.

The Project would be operated year-round over its useful efficient life as consistent with proper maintenance and refurbishment. Approximately 2.5 employees would operate and maintain the facility.

1.4.5 Decommissioning

At the end of its useful efficient life or the loss of permission to maintain the facility from the Forest Service, Project facilities would be dismantled and removed and the site restored to pre-existing conditions as practicable. The Applicant prepared and submitted a Decommissioning Plan as part of the State PSB process. According to the Plan, decommissioning would most likely consist of the following activities: (1) all turbines, including the blades, nacelles and towers, and other support infrastructure would be disassembled and transported off-site for reclamation and sale; (2) all of the transformers would be transported off-site for reuse or reclamation; (3) the overhead power collection conductors and the power poles would be removed from the site; (4) all underground infrastructure at depths less than two feet below grade would be removed from the site; and (5) all underground infrastructure at depths greater than two feet below finished grade would be abandoned in place. Areas where subsurface components are removed would be filled, graded to match adjacent contours, stabilized with an appropriate seed mix, and allowed to re-vegetate naturally.

As described in the Decommissioning Plan, a Decommissioning Fund would be established and endowed prior to the start of construction. Such a fund is necessary in the event the Project does not succeed, and/or to ensure its timely and permanent removal at the end of its useful life. The Decommissioning Plan would allow the fund to grow as the construction process proceeds, such that the funding level is commensurate with the costs of removing infrastructure in place. Salvage value for scrap is vulnerable to market price volatility, and thus would not be considered a reliable funding source. The amount placed in the Decommissioning Fund would represent the full estimated costs of decommissioning, and would be increased over time to account for inflation. Furthermore, the Decommissioning Fund would be bankruptcy-remote to protect it against creditor claims in the event that the Applicant encounters financial difficulty.

The Vermont Public Service Board would be responsible for conducting decommissioning reviews and issuing any decommissioning orders, and would be entitled to draw from the Decommissioning Fund in the event that the Applicant is unable to commence decommissioning activities within 90 days of the issuance of a final decommissioning order no longer subject to appeal. Decommissioning review would be initiated if actual power production falls below 65% of projected production during any consecutive two-year period; however, if the Applicant demonstrates that it has entered into power contracts with Vermont utilities through which power is to be sold at stable prices, the Board could reduce the decommissioning trigger to as low as 50%.

Conditions #19 through #23 of the Certificate of Public Good issued by the PSB pertain to decommissioning requirements, described above (in part). Although already approved by the PSB, the Decommissioning Plan would still be subject to review by the GMNF during the Special Use permit process, and the Forest Service could impose additional requirements. As such, the details of the Plan would most likely be finalized and agreed upon at the time of issuance of the Special Use permit. Should the Responsible Official approve the proposal and subsequently issue a Special Use permit for the Project, the Forest Service permit would, at a minimum, require compliance with the terms and conditions of the CPG.

1.5 NEPA Process

The Forest Service has set forth management objectives, policy, and responsibilities for meeting the requirements of the NEPA. In brief, the NEPA requires federal agencies, including the Forest Service, to consider the environmental impacts of a proposed action (such as authorizing construction and operation of the Project). These include identifying adverse environmental effects that may or may not be avoided, considering alternatives to the proposed action, and identifying any irreversible commitments of resources that would be involved in the proposed action should it be implemented.

The Forest Service, an agency of the United States Department of Agriculture, follows regulations to implement the NEPA according to 40 CFR 1500-1508. Forest Service NEPA procedures are now codified in 36 CFR 220. Forest Service guidance to interpret the regulations may also be found in the Forest Service Handbook, FSH 1909.15. Forest Service objectives, policy, and responsibilities to meet the intent of the NEPA are contained in Forest Service Manual (FSM) 1950. The Forest Service has determined that an EIS must be prepared for this Project, in accordance with the requirements of the NEPA.

A brief description of the NEPA process for this Project includes the following steps:

- The Forest Service accepted an application from the Applicant in November of 2004 for a land use authorization to construct and operate a wind energy facility at the proposed site, thus triggering the need for evaluation under the NEPA process.
- The Notice of Intent to complete an EIS for the proposal was published in the Federal Register on July 15, 2005 (Volume 70, No. 135, page 409750), and public and agency comments were requested.
- In addition to the NOI, the Forest Service began gathering public comments on the Proposed Action through its scoping process.
- A revised NOI was published in the Federal Register (Volume 72, No. 187, page 54893) on September 27, 2007 to notify the public of modifications to the Project, as originally proposed, including more specific information pertaining to the size and number of turbines. Public and agency comments were also requested through an additional scoping notice.
- At the same time that the Forest Service was conducting the analysis and preparation of the DEIS, the State of Vermont Public Service Board was undertaking review of the Project under its jurisdictional duties.
- The DEIS was completed and released for public comment in September 2008. A Notice of Availability (NOA) was published in the Federal Register on October 3, 2008 (Volume 73, No. 193, page 57620).
- The State PSB completed all phases of its review and issued a Certificate of Public Good subject to terms and conditions that approved a 15-turbine configuration of the Project on July 17, 2009.
- Based on public comments and the completion of the PSB process, it was decided to complete a Supplemental DEIS. A revised NOI was published in the Federal Register on January 19, 2010 notifying the public that a SDEIS was being prepared (Volume 75, No. 11, page 2844). A notice to that affect was also mailed to the parties and individuals interested in the Project on October 8, 2009.
- The SDEIS was completed and released for public comment in December 2010. A NOA was published in the Federal Register on December 23, 2010 (Volume 75, No. 246, page 80808).
- The Forest Service prepared this Final EIS (FEIS) to address issues raised in response to comments on the SDEIS, complete the analysis and disclosure of impacts, propose appropriate mitigation, and provide the basis for decision documentation. Appendix J includes written responses to all specific comments submitted on the SDEIS.
- The Responsible Official will issue documentation either approving or denying the Project. If approved, a Record of Decision (ROD) will be released documenting the decision and any conditions, including any additional mitigation measures and monitoring required for implementation of the selected activities (either the Proposed Action or one of the

alternatives). The Forest Supervisor of the Green Mountain and Finger Lakes National Forests is the Responsible Official for the Project.

If the proposal for a land use authorization is approved, a Special Use permit will be issued.

1.6 Decision Framework

1.6.1 Decision to be Made

The Applicant made application to the Forest Service for a land use authorization seeking authorization to occupy and use NFS lands in the Towns of Searsburg and Readsboro, Vermont for the construction and operation of a wind energy facility and ancillary facilities. The Responsible Official for the Project must decide to:

1. Approve the Applicant's application for a land use authorization for the Proposed Action, OR
2. Deny the application for the land use authorization (No Action), OR
3. Approve a land use authorization for one of the other alternatives presented in detail in this FEIS.

Another decision to be made concerns any necessary Forest Plan amendments. During the analysis, it was determined that in order for the Proposed Action to be consistent with the GMNF Forest Plan, it would be necessary to modify standard S-2 for soil, water and riparian area protection and restoration for this Project. See Section 3.8.2.1.4 for further details. Therefore, the Responsible Official must decide whether or not to amend the Forest Plan standard S-2 for soil, water and riparian area protection and restoration with the amendment conditions applying only to the site-specific Deerfield Wind Project. It is anticipated that this Forest Plan amendment would apply to any action alternative.

Concurrent with these primary decisions would be decisions to implement any specified terms and conditions, and design criteria and mitigation measures necessary or desired to avoid, reduce, or minimize environmental impacts. The Certificate of Public Good issued by the PSB on July 17, 2009 included a number of required terms and conditions. All these conditions have been carefully reviewed by the Forest Service and have been deemed consistent with Forest Service laws and regulations. The Forest Service would apply the PSB mitigation (i.e., conditions of the CPG and accompanying Order) to all action alternatives in this FEIS to the extent possible and practical. The development of any Special Use permit issued for the Project would include the conditions of the CPG as appropriate and consistent with Special Use rules and regulations.

In August 2011, the Forest Service published its final directives for Forest Service Wind Energy Special Use Authorizations (76 FR 47354). These final directives add a new chapter 70, "Wind Energy Uses," to the Special Uses Handbook, FSH 2709.11, and a new chapter 80, "Monitoring at Wind Energy Sites," to the Wildlife Monitoring Handbook, FSH 2609.13. These new chapters supplement, rather than supplant or duplicate, existing special use and wildlife directives. In particular, new chapter 70 provides direction on siting, processing proposals and applications, and issuing permits for wind energy uses. New chapter 80 provides specific guidance on wildlife monitoring at wind energy sites before, during, and after construction. In addition, the directives make corresponding revisions to FSM 2726, "Energy Generation and Transmission," and FSH 2709.11, chapter 40, "Special Uses Administration." Although the DEIS and SDEIS for the Deerfield Wind Project were released prior to the Final Directives, all matters and considerations in the FEIS and previous documents related to Special Use administration and to monitoring and adaptive management are consistent with the Final Directives. In summary, the vast majority of the newly issue directives provide guidance related to wind energy facilities on NFS lands rather than specific requirements.

1.6.2 List of Permits

The development and operation of the Deerfield Wind Project is likely to require or involve the following primary federal, state, and regulatory agency notifications, actions, permits and approvals listed in Table 1.6.2-1. Any additional regulatory requirements would be addressed as needed.

Table 1.6.2-1: List of Permits and Approvals for the Deerfield Wind Project

Agency	Relevant Authorization / Permit / Approval / Recommendation	Action Requiring Review	Relevant Statutory / Regulatory Provisions
		Federal	
Forest Service	Land Use Authorization (Special Use permit). At least two types of Special Use permits are anticipated: one to the Applicant for the facility, and one to the utility company allowing upgrade to their switchyard associated with the substation.	Use of NFS Lands requires Land Use Authorization, generally a Special Use permit	16 U.S.C., Section 497; 36 C.F.R., Section 251 et seq.
US Forest Service/ Council on Environmental Quality, NEPA	NEPA EIS (Draft and Final EIS) and ROD	NEPA review is part of the Forest Service review. The NEPA of 1969 was implemented to ensure that Federal agencies consider the environmental impacts of their actions, and protect the quality of the environment through consideration of alternatives that would serve to avoid or minimize damage to the environment.	42 U.S.C., Section 4371 et seq; 40 U.S.C., Section 1500 et seq.
	Review and consultation compliance with Section 7 of the Endangered Species Act (ESA) of 1973	ESA review is part of the Forest Service review. Section 7 requires that all Federal agencies ensure that any action authorized, funded, or executed will not jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of any critical habitat of such species.	

Agency	Relevant Authorization / Permit / Approval / Recommendation	Action Requiring Review	Relevant Statutory / Regulatory Provisions
	Review and consultation compliance with Section 106 of National Historic Preservation Act (NHPA), as amended through 2000	NHPA review is part of the Forest Service review. Assess undertaking's effects on designated historic properties, and seek ways to avoid minimize or mitigate adverse effects, in consultation with the State Historic Preservation Officer.	
Federal Aviation Administration	Facility Lighting and Marking Recommendation	Any temporary or permanent structures, including all appurtenances, that exceed an overall height of 200 feet above ground level requires review by FAA as to marking and lighting	49 U.S.C., Section 44718; 14 C.F.R., Section 77.13
US Environmental Protection Agency (delegated to the Vermont Agency of Natural Resources)	National Pollutant Discharge Elimination System (NPDES) Permit – Construction Activities	Required for discharges of stormwater associated with construction activities within construction areas that total greater than 1 acre	33 U.S.C. 134 to 35.72(p); 40 C.F.R. §§ 122.26 & 122.28
US Army Corps of Engineers (New England Division)	General or Individual Permit – Impacts to Jurisdictional Wetlands pursuant to Section 404 of the Clean Water Act.	Required for the discharge of dredged or fill material into waters of the U.S..	33 U.S.C. Section 1344
State			
Vermont Public Service Board	Certificate of Public Good	Construction and operation of a new utilities generation facility	30 V.S.A. § 248
Vermont Agency of Natural Resources	Stormwater Permit (O&M Phase)	Facilities that discharge into waters of Vermont and have greater than 1 acre of impervious surface	10 V.S.A. § 1264; Vermont Pollution Control Regulations
Vermont Agency of Natural Resources	State Water Quality Certification, pursuant to Section 401 of the Clean Water Act.	Federal facilities, or facilities permitted by a federal agency that may result in a discharge to waters of the state require state certificate under the CWA	33 U.S.C. Section 1341; Vermont Water Pollution Control Regulations section 13.11
Vermont Agency of Transportation	State Highway Access Permit	Access road to Western Project site may require new highway access point	19 V.S.A. § 1111

1.7 Public Involvement

Involvement by the public in the assessment of a proposed action is an important part of the NEPA process. The identification of issues, concerns, and opportunities by the public, the Forest Service, and other involved parties, such as regulators and cooperating agencies, helps to guide the early scoping process, whereby specific studies and other actions required to effectively assess a Project's impacts can be determined.

Formal scoping for the NEPA analysis of the Deerfield Wind Project began on July 15, 2005, when the Notice of Intent to prepare an EIS was published in the Federal Register. Outreach (scoping) was also conducted by the Forest Service by mail, public announcements, and meetings, to inform persons and organizations interested in or potentially affected by the Proposed Action and request their comments concerning the scope of the analysis. Two public scoping meetings (on August 3 and 4, 2005) were held, and were attended by at least 80 persons.

A total of 227 written or verbal comments were submitted during the scoping comment period in 2005, identifying issues and concerns about the Proposed Action and the preparation of the EIS. Comments were received via phone, voicemail, electronic mail, postal mail, and orally at the two public meetings. These comments were carefully reviewed and categorized into numerous issues that informed development of the environmental studies for the DEIS and SDEIS, as discussed below.

A request for more site-specificity by the Public Service Board during review of the Applicant's initial Section 248 application resulted in minor changes to the Proposed Action, including a reduction in the number and size of turbines. To capture these changes, a Revised NOI to prepare the EIS was published in the Federal Register (Volume 72, No. 187, page 54893) dated September 27, 2007. Additionally, a second scoping notice was sent to the Project's contact list to notify the public of the changes and ask for comments. A total of 44 comments were received and incorporated into the original content analysis (described below). No new significant issues were identified.

The DEIS was released for public comment in September 2008 and a Notice of Availability published in the Federal Register on October 3, 2008 (Volume 73, No. 193, page 57620). The comment period ran from October 4 to November 28, 2008. Two public meetings (November 5 and 6, 2008) were held to collect public input on the DEIS. Comment forms were available at the public meetings, and all written and verbal responses were collected and incorporated into the Project Record. Sixty-two separate comment letters (hardcopy, email, personal comments) were received that provided 502 individual comments being considered during the SDEIS analysis.

The SDEIS was released for public comment in December 2010 and a NOA published in the Federal Register on December 23, 2010 (Volume 75, No. 246, page 80808). The comment period ran for an extended period of time, from December 24, 2010 to March 18, 2011. Two public meetings (January 20 and 25, 2011) were held to collect public input on the SDEIS. Comment forms were available at the public meetings, and all written and verbal responses were collected and incorporated into the Project Record. Five hundred sixty-eight separate comment letters (hardcopy, email, telephone, and personal comments) were received that provided 1,007 individual comments being considered during this FEIS analysis.

1.8 Issues

1.8.1 Process to Define Significant Issues

All the comments received during the scoping period in 2005, and during the second scoping period in 2007 that asked for comments on changes to the original proposal, were analyzed and categorized during content analysis in order to focus the environmental analysis of the Project. All comments were reviewed and placed into 22 preliminary categories by topic, then were reviewed again to identify substantive issues. Comments so categorized were considered to 1) be within the scope of the Proposed Action, 2) be specific to the Proposed Action, 3) have a direct relationship to the

Proposed Action, and 4) include reasons for the Responsible Official to consider during decision making.

These comments were then categorized into 13 topic areas, including Project definition, regulation and policy, physiography, geography and soils, water resources, biological resources including wildlife, wildlife habitat and vegetation, socioeconomics, noise, visual resources and aesthetics, recreational and heritage resources, health and human safety, climate and air quality, and alternatives analysis. These topics are addressed in the applicable resource sections in Chapter 3.0 of both the DEIS and SDEIS.

Analysis of the public and agency comments was used to identify areas of potential controversy and define significant issues that need to be resolved, along with other issues that were also considered in disclosing environmental impacts. The significant issues were used to drive the analysis, and were important to the development of the range of alternatives. The issues statements can be found at the beginning of the discussion of environmental impacts in the applicable sections of Chapter 3.0.

1.8.2 Significant Issues

The four significant issues are:

Issue 1: People are concerned that the Proposed Action will adversely impact soil and water resources resulting in unacceptable sedimentation, erosion, and loss of wetlands.

Issue 2: People are concerned that the Proposed Action will result in unacceptable mortality to avian and bat species, including migrating and local populations, due to collisions with turbines and turbine blades.

Issue 3: People are concerned that the Proposed Action will adversely impact black bears by removing critical beech habitat, particularly in the western expansion area.

Issue 4: People are concerned that the Proposed Action will adversely affect the visual resources of the area, especially those important to the character of the ridgelines.

1.8.3 Other Issues

Many other substantive issues and concerns were raised by the public during the scoping process. These are being addressed in the EIS through disclosure of the potential environmental impacts. Some examples of other issues noted by the public are listed next. While these issues and concerns are important, and are addressed within the appropriate resource sections, they did not lead to development of other alternatives.

- People are concerned that the Proposed Action will adversely affect the solitude and wildland attributes of the nearby Lamb Brook Area.
- People are concerned that the public benefits provided by the Proposed Action will not be justified by the economic costs and environmental impacts.

- People are concerned that the Proposed Action will adversely affect the socioeconomic status of the local area including taxes, costs and benefits to the communities, property values, and tourism.
- People are concerned that the Proposed Action will adversely affect recreation use of the area and will encourage undesired all-terrain vehicle (ATV) activities on the facility roads.

1.9 SDEIS Comment Analysis

The same content analysis structure described in Section 1.8.1 was used to analyze the comments received to the SDEIS. A similar report was prepared to document the process, and can be found in the Project Record. No new significant issues were raised. Responses to the public comments received on the SDEIS can be found in Appendix J of this FEIS.

CHAPTER 2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 Introduction

This Chapter briefly summarizes alternatives that were considered or were eliminated from detailed study, describes the alternatives analyzed in detail in the EIS, and provides a comparative evaluation that focuses on substantial environmental differences among the alternatives. The comparative evaluation presents the consequences of the proposed activities as they relate to the significant issues identified for the Project and to the key GMNF Forest Plan goals.

The Forest Service is completing the Deerfield Project EIS to analyze, in the context of the programmatic framework set forth in the Forest Plan, a pending site-specific application to develop renewable wind energy. This analysis of the proposed activities described in the application tier to the programmatic Forest Plan Environmental Impact Statement and its Record of Decision. The Forest Plan allows for development of wind energy on the GMNF and has identified 37 sites as potentially suitable for potential future wind energy development (Forest Plan FEIS p. 3-298). The suitability determination in the Plan identifies possible sites but does not commit the GMNF to future analysis or to development of those or any other site on the Forest. In other words, it is possible that some sites could be determined, upon site-specific analysis, to be unsuitable.

The role of this EIS is not to select the best site for a wind energy project on the GMNF. The role of this EIS is to disclose and analyze site-specific environmental effects associated with the pending application for the Deerfield Project, taking into consideration the design criteria and other mitigation requirements, and the conditions required by the Vermont PSB Certificate of Public Good. The site-specific decision before the agency is to determine whether or not to permit the Deerfield Project."

In order to complete the NEPA analysis for the Deerfield Project, a reasonable range of alternatives to the Applicant's proposal that meet the purpose of and need for action must be evaluated. NEPA regulations require that a "range of alternatives" must be discussed in the environmental documents prepared for a proposed action (§ 40 CFR 1505.14). This includes all reasonable alternatives, which must be rigorously explored and objectively evaluated, as well as other alternatives eliminated from detailed study, along with a brief discussion of the reasons for eliminating them (§ 40 CFR 1502.14(a)).

In NEPA, the scope of reasonable alternatives is defined by the statement that defines the purpose of and need for the proposed action. Chapter 1.0 of the SDEIS and FEIS was revised to more clearly and concisely state the Project Purpose of and Need for Action (40 CFR 1502.13). As described in Section 1.3.1, the Purpose and Need for the proposed Project is to: (1) work toward implementing the GMNF Forest Plan goals and objectives of providing opportunities for renewable energy development on GMNF lands, while meeting direction of the National Energy Policy; (2) fulfill the agency's obligation to consider this site-specific wind energy development proposal; and (3) give due consideration, in the review of the application, to the findings of the Vermont PSB resulting from their review of the proposal. All reasonable alternatives should meet the Purpose and Need, but may do so differently and to varying degrees. As an example, each of the action alternatives provides a different level of energy output that would work toward meeting the need for renewable energy development.

Forest Plan Goal 11 is to "provide opportunities for renewable energy use and development" on GMNF lands. The Forest Plan EIS specifically analyzed potential land use authorizations for using NFS lands to develop wind energy proposals under Non-Recreation Special Uses (Plan FEIS pgs. 3-292 through 3-301). The Plan EIS identified 19,700 acres as potentially suitable for commercial wind energy development, or roughly 5% of all GMNF lands (Forest Plan FEIS p. 3-298). The Forest Plan process identified 37 discrete areas/sites that are potentially viable for development. The identification of these areas and adoption of Forest Plan Goal 11 provided a foundation for the Forest to evaluate site-specific applications for renewable (particularly wind) energy development. Moreover, as stated in Section 1.3.2, National Energy Policy and executive orders encourage the use of federal lands for development of renewable energy projects. National policy and agency guidance directs that agencies such as the Forest Service thoroughly consider and evaluate proposals for development of energy projects on federal lands rather than immediately dismissing them without screening those proposals according to Special Uses Handbook direction (FSH 2709.11, Ch. 10) because those proposals could also be implemented on private lands.

An important consideration in determining the scope of reasonable alternatives to be considered for a Special Use proposal like the Deerfield Wind Project is the proposal itself and what is needed to adequately analyze it. In developing a range of alternatives, the emphasis is on what is "reasonable" (40 CFR 1502.14(a)), rather than on whether a proponent or applicant accepts or is itself capable of carrying out a particular alternative. In the case of a specific Special Use application, the alternatives analysis should also consider the goals and objectives of an applicant. Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint, rather than simply desirable from the standpoint of an applicant. The range of alternatives is guided, but not controlled, by the goals of an applicant's proposal. Also, issues determined through scoping, and how best to address those issues, play a key role in shaping the alternatives identified by the Forest Service to be analyzed in detail. The Forest Service has independently developed and reviewed the range of alternatives for the Project proposal, and evaluated the science, local field work, and public participation upon which the range of alternatives is based.

2.2 Initial Consideration of Possible Alternatives

Under NEPA regulations, alternatives to be considered must include 1) the no action alternative, 2) reasonable courses of action, including the proposed action, and 3) mitigation measures (40 CFR 1502.14). Suggestions for alternatives to consider came from a number of sources including scoping comments from the public and state and other federal agencies, and from the Project ID Team and other internal Forest Service contacts. All alternative proposals provided to the Forest Service by the public or other state or federal agencies were considered in the development of this analysis.

2.2.1 Locations Off Forest Service Lands

The use of private land for the Deerfield Project was considered by the Applicant prior to beginning the NEPA process, during the Special Uses screening prior to submitting the formal application. It was determined that there was no private land available close to or adjacent to the existing private land based Searsburg facility that would allow for its expansion (i.e., integration, to the extent possible, of the existing site with the proposed facility), and for the use of its existing infrastructure to reduce environmental impacts. These were among the Applicant's objectives and one of the main reasons for the Applicant's proposal to specifically develop the Deerfield site rather than propose another site on the GMNF.

Comments were submitted asking the Forest Service to consider alternatives that evaluated wind facility development on private lands. Any specific private land tracts identified by the public as possible alternatives were considered. It was determined that these alternatives would not meet the Purpose and Need for the proposal, as explained above in Section 2.1, and would be beyond the scope of this analysis.

2.2.2 Other Sources of Energy

Comments were also submitted asking that alternatives considering development of other forms of energy be evaluated, including traditional (non-renewable) energy generation such as coal, oil, gas, and nuclear, and non-wind sources of renewable energy generation such as hydro, wave, solar, fuel cells, and hydrogen. As explained above in Section 2.1, the Deerfield Project EIS tiers to the EIS for the GMNF Forest Plan which appropriately analyzed alternatives (i.e. Forest Plan EIS alternatives) that considered renewable wind energy development in the GMNF, resulting in the identification of 37 sites/areas potentially suitable for wind energy development. No site-specific alternatives for other non-renewable energy generation were received by the Forest Service for consideration in this analysis. Given the programmatic framework set forth in the Forest Plan to provide opportunities for renewable energy use and development (Forest Plan p. 15), and the Purpose and Need for this proposal, consideration in detail of a traditional non-renewable energy generation alternative to the Proposed Action is not reasonable and would be beyond the scope of this analysis.

Alternatives that evaluate development of other non-wind sources of alternative energy were also eliminated from further consideration. Although these alternatives would partially meet the Purpose and Need by considering renewable energy development on NFS lands that meets national direction, the Forest Plan and its EIS specifically include and address goals and objectives for wind energy development. As noted above, the Deerfield EIS tiers to the programmatic EIS for the Forest Plan, and it is reasonable, given the site-specific proposal that is subject to this analysis, to only analyze alternatives that allow the Forest to work towards its programmatic goal of developing renewable wind energy in the GMNF, rather than develop alternatives for other kinds of renewable energy. Should a future applicant propose a project for development of a non-wind renewable energy source, then it may be appropriate to consider, within the programmatic framework set forth in the Forest Plan, alternatives that evaluate non-wind renewable energy development. No site-specific alternatives for non-wind renewable energy generation were received by the Forest Service for consideration in this analysis. In the context of the framework set forth in the Plan, as well as the Purpose and Need for this site-specific proposal, it is not reasonable to analyze in detail alternatives to the Proposed Action that would develop non-wind forms of renewable energy.

2.3 Final Development of Reasonable Alternatives

This section briefly summarizes the alternatives considered to develop the final range of alternatives evaluated in detail in this FEIS.

Given the discussion above and the requirement to meet the Purpose and Need for the proposal, the range of possible alternatives advanced for further consideration in detail are those alternatives that are commercially viable, utility-scale wind energy projects located on NFS lands within the GMNF. This range of alternatives includes the Proposed Action and No Action alternatives as required. The discussion of reasonable alternatives to be evaluated in detail in the FEIS has been organized around the following factors:

- Alternative design and technology; i.e. other ways to design or configure facilities on the proposed Project site; and
- Alternative sites on GMNF lands.

Each of these will be considered individually in the following sections.

2.3.1 Alternative Design and Technology

This section discusses various design and technology alternatives to the Proposed Action that were considered. These include number of turbines in the total configuration, and how they could be divided between the two specific Project sites (east and west ridges); turbines on the East Ridge only and the West Ridge only; and smaller turbines (less than 1.5 to 2.0 MW each).

Greater Numbers of Turbines

The original proposal from the Applicant to the Forest Service in November 2004 sought to develop a facility on GMNF lands capable of including 20 to 30 1.5 MW class turbines that could produce 30 to 40 MW of power. When the Applicant submitted the proposal (petition) to the Vermont Public Service Board in January 2007, it was modified to consist of a range of 15 to 24 turbines capable of producing up to 45 MW of power, using a configuration of turbines in the 1.5 to 2.0 MW class. The PSB asked the Applicant to narrow down the proposal to a specific number of turbines in a desirable size class. Further engineering and determination of possible turbine spacing resulted in a modified petition to the PSB for installing 17 turbines in the 2.0 to 2.1 MW class capable of producing 34.0 to 35.7 MW of power (note that the 2.1 MW class was eventually dropped from the Proposed Action for PSB review, as explained in the opening section of Chapter 1.0). Given that this configuration would most likely be the maximum size and number of utility-scale turbines that could be constructed on the proposed site, the Forest Service accepted that change to the proposal and limited consideration of reasonable alternatives to those that included fewer than 17 turbines.

Lesser Number of Turbines

Alternatives that consider lesser numbers of turbines have been thoroughly explored. This evaluation resulted in two alternatives being carried forward and discussed in detail in the EIS: Alternative 2, the Reduced West Alternative; and Alternative 3, the East Side Only Alternative (see Section 2.4 below for descriptions). These alternatives were developed to address the significant issues identified for the analysis. Further configurations consisting of lesser numbers of turbines were considered but dismissed because they would not add any additional value to the analysis in regards to addressing issues.

Configurations on the Two Ridges

The Forest Service reviewed the proposed configuration of turbines as they were split across the two ridgelines separated by Route 8. Placement of the 2.0 MW class utility-scale turbines has been optimally determined based on ridge orientation, wind power availability, and spacing requirements to most efficiently harvest the wind power. The eastern ridge is capable of holding 7 turbines as the ridge drops off on its southern end into the Lamb Brook area. There appeared to be no other reasonable alternative configurations for the eastern ridge, mainly due to the lack of significant issues associated with that location. The western ridge could hold up to 10 or 11 turbines as it drops off on its southern end toward Route 8 and approaches private land and homes at its northern end. Other alternative configurations for the western ridge are reflected in the existing range of alternatives developed to address issues.

The Project's significant issues, and ways to mitigate those issues, were a primary motivation for considering different alternative combinations of the east and west ridges. Concern for the proposed activities on the western ridge led to the development of the East Side Only alternative. It was reasonable to consider an East Side Only alternative in order to thoroughly address issues and differentiate between the effects of developing both ridges, and to provide the Responsible Official with a viable alternative for selection that did not include development of the western ridge. A western ridge only alternative was also considered. However, there has been little concern expressed regarding the potential impacts with development on the eastern ridge during scoping and the DEIS comment period; the majority of concern has been with the western ridge development. Therefore, analyzing a western ridge only alternative as a way to address issues with potential eastern ridge development was dismissed from further detailed consideration because it would not have affected the way significant issues were addressed and it would not have provided an alternative with substantially less overall environmental impacts.

Smaller Turbines

The use of smaller turbines was considered by both the Applicant and the Forest Service. Technological advancements in recent years has led to development of turbines that can reach higher into the air to harness wind power more effectively and produce more power, with little or no additional environmental disturbance. Turbines in the 1.0 MW and lower class are generally no longer considered utility-scale (see Appendix I for a discussion of utility-scale). Installing a facility capable of generating adequate power using small turbines would have required many more of them and hence, more ground disturbance and environmental impacts. Although 1.5 MW class turbines are generally considered to be utility-scale, the difference in height and the amount of disturbance required for their installation, when compared to 2.0 MW class turbines, did not warrant considering an alternative using the smaller turbines.

2.3.2 Alternative Sites on GMNF Lands

Alternative sites on GMNF lands are those possible locations for the proposed facility on GMNF lands that are different from the location proposed by the Applicant. Siting alternatives could be in proximity to the Applicant's proposed location, or sites that are not proximate to the location proposed by the Applicant. Detailed consideration of other sites for this analysis (i.e., developing an alternative for a site that would be considered in detail as part of the reasonable range of alternatives) would only be appropriate if it appeared that the site (1) clearly had the potential to result in substantially less overall environmental, economic, and social impacts than what would be anticipated by the Proposed Action, and (2) potentially could more effectively address and more sharply define the significant issues, thus providing a clear basis for choice among options (alternatives) by the decision maker (§ 40 CFR 1502.14).

The Forest Plan completed an analysis to identify areas/sites suitable for wind energy development on the GMNF; 37 such areas were identified (see Figures 2-1A and 2-1B). The two basic criteria used to identify these areas were wind resource and Forest Plan consistency. In order to be considered "commercially viable", the site must be capable of generating winds with a mean speed of 15.6 miles per hour (7 meters per second) at 70 meters height, or have a mean wind power of at least 400 W/m^2 at 50 meters height (Table 3.14-3, Forest Plan FEIS p. 3-300). In the class scale of winds ranging from 1 (low speed) to 7 (high speed), these are essentially Class 4 winds or better. Next, the site must lie in one of the five Management Areas that allow wind energy development. Beyond that, these areas were not screened for physical size, actual wind speed, or environmental and economic factors (USDA Forest Service, 2006c). The areas vary greatly in size. Many of these 37 sites/areas, though viable from a wind resource perspective, may not be large enough to accommodate a utility-scale facility given the spacing needed between present generation commercial turbines and the amount of power that would need to be produced in order for the facility to be commercially viable. They would be more suitable for consideration during analysis of a proposal for small-scale wind energy development, which is outside the scope of this analysis. Some areas may be large enough to accommodate more than one site for development, and some adjacent areas may be able to be combined into one viable site.

Therefore, in order to be consistent with the Forest Plan, any alternative GMNF site considered for further analysis must be one of those 37 sites. It then was necessary to test these sites for reasonableness against a set of criteria developed to determine which site(s), if any, should be advanced for further consideration. The details of the process used to screen and test the 37 GMNF sites are fully described in Appendix I.

2.3.3 Summary of the Determination of Suitable Sites on the GMNF

After detailed review of the 37 sites identified as viable for wind energy development in the programmatic Forest Plan EIS, none were selected for further consideration in the site-specific Deerfield EIS. As explained in Appendix I, the large majority of those 37 sites are small areas that would most likely only be considered suitable for residence-scale or small community/cooperative development, or could perhaps be considered by smaller wind companies that may view these areas as marginally economically viable (given that utility-scale might be determined differently by smaller companies). These sites would not meet the minimum size threshold defined in Appendix I for utility-scale development. Only three sites passed this first level, size-based screening criteria. These sites were given a more thorough review and evaluated in the second level of this screening that included looking at land use and wind power efficiency factors. Two of these sites were eliminated as described in Appendix I. Only one site, Site #35, passed the screening criteria and could therefore be compared with the proposed Deerfield Project site in more detail, with particular focus on environmental factors and significant issues.

As stated in Appendix I, any site deemed worthy of further consideration as an off-site alternative of NFS lands must compare favorably to the proposed site. Considering an off-site alternative in more detail would only be reasonable if it appeared that site (1) clearly had the potential to result in substantially less overall impacts than what would be anticipated at the proposed site, and (2) potentially could more effectively define and address the significant issues in order to provide the decision maker a clear choice among options (alternatives). Site #35 was thoroughly evaluated and compared to the Deerfield site using a number of environmental factors. These sites were then compared in regards to how they addressed each significant issue. They were also compared in regards to proximity to infrastructure. Finally, their locations were compared in relation to proximity to population centers, towns, and local residences as a way to relate environmental concerns with potential local social concerns.

It was concluded that Site #35 has very similar characteristics to the proposed Deerfield site, and therefore would be duplicative within the existing range of alternatives already considered for detailed analysis. As such, Site #35 would not more effectively address the significant issues, nor would it substantially avoid or reduce potential environmental, economic, or social impacts when compared to the proposed site. Similar levels of adverse and beneficial impacts would be expected at both sites. Therefore, it would not be reasonable to consider in detail an alternative at Site #35.

2.4 Brief Description of the Alternatives

Based on the above analysis, the following four final alternatives have been selected for detailed evaluation in the FEIS. Each one is a viable alternative that can be selected by the Responsible Official for implementation.

1. The Proposed Action as submitted in the Applicant's proposal for land use authorization.
2. Alternative 1: No Action
3. Alternative 2: Reduced Turbines in Western Project Site (Reduced West)
4. Alternative 3: Turbines in Eastern Project Site Only (East Side Only)

For ease of reference, the abbreviated alternative names, Reduced West and East Side Only, may be found in use in this document.

During the analysis, it was determined that in order for the Proposed Action to be consistent with the GMNF Forest Plan, it would be necessary to modify standard S-2 for soil, water and riparian area protection and restoration for this Project. See Section 3.8.2.1.4 for further details. It is anticipated that this Forest Plan amendment would apply to any action alternative.

2.4.1 Proposed Action

A full description of the Proposed Action is found in Section 1.4. In brief, the Proposed Action consists of the construction and operation of 17 wind turbines in the 2.0 MW class with a combined nameplate capacity of 34 MW of electricity along with the necessary ancillary facilities on two ridgelines east and west of Route 8, on NFS lands on the Manchester Ranger District of the GMNF in the Towns of Searsburg and Readsboro, Vermont. Seven turbines would be sited in the Eastern Project site, east of Route 8, and 10 turbines would be sited in the Western Project site, west of Route 8.

The access road to the Western Project site would be from the north via private land along Putnam Road. The access road to the Eastern Project site would be from an extension of the existing Searsburg Wind Facility access road. The substation would lie along the western access road on NFS lands, adjacent to the existing 69 kV transmission line. The O&M building and temporary construction laydown areas would lie on private land at an existing clearing at the terminus of Putnam Road (the western access road). Each Project site would include one LIDAR site as part of the turbine string to collect wind data. These LIDAR sites would be used in lieu of meteorological (met) towers. Electrical collection lines along the eastern array would be underground, rising to overhead lines to join the existing GMP line that runs from the east ridge to Route 8, and would cross Route 8 overhead and proceed overhead up to the western ridge. The line would then continue underground along the western array and access road to the substation. The location and Project components are shown on Figure 1-3.

Seventeen Gamesa G80 turbines would be used for the Proposed Action. Each blade of the Gamesa G80 is approximately 128 feet (39 meters) in length, resulting in a total rotor diameter of about 263 feet (80 meters) and maximum blade tip height from the ground surface of up to about 387 feet (118 meters). Each turbine would be capable of generating 2.0 MW of electricity, with a capacity factor of 33.5%. The Project would supply up to 34 MW of new wind energy to Vermont consumers and the New England electric grid. Co-location of the Proposed Action with the existing 11-turbine Searsburg facility on private land adjacent to Forest Service lands would allow shared use of some of the existing infrastructure.

2.4.2 Alternative 1: No Action

NEPA regulations, 40 CFR 1502.14(d), require that the alternatives analysis in an EIS include the No Action alternative. In this case "No Action" means the proposed activity would not take place. Therefore, the environmental effects resulting from taking no action are compared to the effects of permitting the Proposed Action and alternatives to the Proposed Action. Under the No Action alternative, no turbines, access roads, or other ancillary facilities would be constructed at this time. The Project site would remain available for any and all uses allowed in the Diverse Forest Use Management Area. This alternative provides a baseline for comparison with the action alternatives.

2.4.3 Alternative 2: Reduced Turbines in Western Project Site

The Reduced West alternative was the only one of the four alternatives selected for detailed evaluation in the DEIS that was changed in the SDEIS. This alternative was modified to be consistent with the 15-turbine layout approved by the PSB, and is being carried forward through the FEIS as such. The Reduced West alternative was developed in order to potentially mitigate impacts and address one or more of the significant issues, including issues related to black bears and bear habitat, avian and bat mortality, and to a lesser extent, issues related to visual concerns.

When compared to the Proposed Action, the seven turbines proposed for the Eastern Project site would not be altered. However, the three most southerly turbines along the western turbine array would be eliminated from the Project for this alternative. An additional turbine would be included toward the northern end of the western array, and the locations of all eight turbines re-configured into a more compact array. The access road to the Western Project site would also be shortened as compared to the Proposed Action, and re-routed slightly to service the shifted turbine locations.

The turbines selected for removal on the western array were identified in an effort to reduce impacts to the relatively dense stands of bear-scarred beech (BSB) within the southern reaches of the Western Project site. Removal of other turbines was considered in lieu of these three, but would not yield as much reduction in impacts. The spacing of these turbines is such that, by eliminating them from the proposal, a larger area of beech habitat could be maintained when compared to eliminating other combinations of turbines. Also, this area is adjacent to other valuable black bear habitat, such as wetlands and apple trees. Very minor turbine shifts (all less than 100 feet) may continue to be made during final engineering to further reduce impacts, particularly related to on BSB.

Rather than convert to an overhead collection line at the site of the southern-most turbine, as is the case for the Proposed Action, for this alternative the collection line would remain underground and would be located to avoid beech habitat as much as possible. It would transition to an overhead line at the location of where turbine W10 would be located for the Proposed Action (where beech habitat is greatly diminished) and stay overhead down the ridge toward and across Route 8. Project components for the Reduced West alternative are shown on Figure 2-2. All other infrastructure of this alternative, such as the location of the substation, LIDAR units, O&M building, and temporary construction laydown areas, would essentially remain the same as for the Proposed Action.

Alternative 2 would use five 2.0 MW Gamesa G80 turbines and ten 2.0 MW Gamesa G87 turbines. The G87 turbines have a slightly longer blade resulting in a total rotor diameter of about 286 feet (87 meters). These turbines would have a maximum blade tip height about 12 feet (3.6 meters) taller, at 401 feet (122.2 meters), than the 389-foot tall G80 turbines. Such a small difference in rotor diameter and height is not anticipated to produce any change to the impacts disclosed in Sections 3.10 (Avian), 3.11 (Bats), and 3.5 (Visual Quality). The Forest Service is unaware of any studies that differentiate mortality according to turbine blade length.

The reduction from 17 to 15 2.0 MW turbines totaling up to 30 MW of power would reduce the nameplate capacity of the Project by approximately 12% when compared to the Proposed Action. Because the G87 sweeps a slightly greater area, it efficiently captures more wind energy and thus, the combination of G80 and G87 turbines would operate at a slightly higher 35.2% capacity factor when compared to the 33.5% for the Proposed Action. As for the Proposed Action, co-location of the Proposed Action with the existing Searsburg facility on adjacent private land would allow shared use of some of the existing infrastructure.

2.4.4 Alternative 3: Turbines in Eastern Project Site Only

The East Side Only alternative addresses all four of the significant issues to some extent and also potentially mitigates impacts when compared to the Proposed Action. This configuration, shown in

Figure 2-3, consists of the construction and operation of the seven turbines proposed for the Eastern Project site, but no turbine construction in the Western Project site. Only the O&M building and the temporary laydown areas would remain on private land at an existing clearing at the terminus of Putnam Road (the western access road). The substation would be located on the Eastern Project site adjacent to the existing Searsburg Wind Facility substation. The LIDAR site for the eastern ridge would remain as planned, but there would be no second unit in the Western Project site. The access road to the east side turbines would remain as for the Proposed Action. The only construction for the western access road would be improvements to the existing Putnam Road down a short distance of approximately 0.1 mile to the location of the O&M building and the laydown areas. There would be no access road, turbines, or collection lines along the western ridge.

The collection lines for the eastern turbine array would remain the same as in the Proposed Action but would terminate at the new substation location. The existing 69 kV line, owned by GMP to service the Searsburg Wind Facility, parallels Sleepy Hollow Road within an existing 100-foot (60 feet cleared) right-of-way (ROW). The line is constructed with single wood poles, approximately 50 feet in height above grade and spaced at a maximum span of approximately 350 feet. To accommodate the East Side Only alternative, this transmission line would need to be upgraded. The pole spacing would remain the same but sturdier poles would need to be placed approximately 15 feet from the base of existing poles and reconductored. The existing line would be removed after the new line was constructed. The pole appearance would be nearly identical with height remaining the same.

This alternative would essentially eliminate most of the impacts of the Western Project site due to the elimination of the 10 western turbines. Likewise, due to the smaller footprint of the entire Project site, impacts from overhead and underground lines and service roads would be reduced. Alternative 3 would use five Gamesa G80 and two G87 turbines, in a configuration identical to the portion of the Reduced West alternative located in the Eastern Project site. Therefore, any impacts associated with turbine height or blade length (rotor diameter) would be the same as for the Reduced West alternative. The reduction from 17 to 7 2.0 MW turbines totaling up to 14 MW of power would reduce the nameplate capacity of the Project by approximately 59% when compared to the Proposed Action. Due to the combination of G80 and G87 turbines, these turbines would operate with a 34.2% capacity factor, higher than for the Proposed Action, but lower than for the Reduced West alternative (because the larger G87 turbines would comprise a smaller proportion of the total Project capacity).

2.5 Comparative Evaluation of the Alternatives

The Purpose and Need (Section 1.3) and significant issues (Section 1.8.2) were two primary factors used in developing the range of alternatives selected for detailed evaluation in the EIS. The degree to which each of the proposed alternatives would meet the Purpose and Need of working toward implementing the GMNF Forest Plan goals, in particular, goals 11, 5, and 17, provided an important part of the framework to develop alternatives. The proposed activities also relate to other Forest Plan goals, including goals 2, 3, 4, 6, and 15. The degree to which the proposed activities are guided by all these goals, and how the proposed activities work toward achieving the desired future condition that these Forest Plan goals describe, can be determined by comparing the impacts of the alternatives, as disclosed below. Each one of the four alternatives analyzed in detail is a viable alternative that can be selected by the Responsible

Official for implementation. Each alternative varies in the way it meets the Purpose and Need, and in its environmental effects.

NEPA regulations (40 CRF 1502.14) require the comparative evaluation of alternatives in an EIS in order to sharply define the significant issues and disclose the significant environmental differences among alternatives based on those issues. This comparative evaluation begins with an overview of the impacts in terms of the Purpose and Need and four significant issues identified for the Project, presented below in Table 2.5-1. The following sections compare the environmental consequences of each alternative. To facilitate this comparative analysis, this section is organized by the level of difference in impact between various alternatives by:

1) Purpose and Need and significant issues for which the impacts are substantially different when comparing alternatives, Section 2.5.1 and Table 2.5-1;

2) Significant issues for which the impacts are not substantially different when comparing alternatives, Section 2.5.2 and Table 2.5-1; and

3) Other substantive issues evaluated in the FEIS, Section 2.5.3 and Table 2.5-2.

Table 2.5-1: Primary Differences Among Alternatives

Issue	Related Forest Plan Goal	Proposed Action	No Action	Reduced West Alternative	East Side Only Alternative
Ability to Produce Renewable Wind Energy (Project Purpose and Need)	11, 5, & 17	Total nameplate capacity 34 MW (17 2.0 MW Gamesa G80 turbines). 33.5% capacity factor; total annual production approximately 99,776 MWh. Enough energy to power approximately 14,024 homes annually[7].	There would be no production of renewable wind energy. Project area available for uses according to Diverse Forest MA.	Total nameplate capacity 30 MW (five 2.0 MW Gamesa G80 turbines and ten 2.0 MW Gamesa G87 turbines). 35.2% capacity factor; total annual production approximately 92,506 MWh. Enough energy to power approximately 13,267 homes annually[1].	Total nameplate capacity 14 MW (five 2.0 MW Gamesa G80 turbines and two 2.0 MW Gamesa G87 turbines). 34.2% capacity factor; total annual production approximately 41,943 MWh. Enough energy to power 6,016 homes annually[1].
Soil and Water Resources (Significant Issue 1)	3, 4, & 6	Clearing and grading approx. 87.4 acres (approx. 0.9% of 9,523-acre Project area). Access roads cross 4 streams; collection lines span 2 streams. Total direct wetland impacts 4,905 square feet: 2,855 square feet of permanent impact, 1,332 square feet of secondary impact, and 718 square feet of temporary impact. Potential impacts to protective strip (requires Forest Plan amendment) and/or 100-foot buffers of 12 wetlands.	No land would be cleared or graded. No streams crossed by access roads, collection lines, or transmission lines. No impacts to wetlands, protective strips, or wetland buffers.	Clearing and grading approx. 85.4 acres (approx. 0.9% of 9,523-acre Project area, slightly less than the Proposed Action). Access roads cross 4 streams; collection lines span 3 streams. Total direct wetland impacts 3,652 square feet: 1,929 square feet of permanent impact, 1,218 square feet of secondary impact, and 505 square feet of temporary impact. Potential impacts to protective strip (requires Forest Plan amendment) and/or 100-foot buffers of 13 wetlands.	Clearing and grading approx. 49.6 acres (approx. 0.5% of 9,523-acre Project area). Access roads cross 4 streams; substation construction impacts 1 stream; transmission line upgrade spans 17 streams and 13 wetlands. Total direct wetland impacts 6,192 square feet: 1,966 square feet of permanent impact, 1,218 square feet of secondary impact, and 3,008 square feet of temporary impact. Potential impacts to protective strip (requires Forest Plan amendment) and/or 100-foot buffers of 7 wetlands.

[7] Based on average annual electricity consumption in Vermont of 6,972 kWh (EIA, 2010).

Issue	Related Forest Plan Goal	Proposed Action	No Action	Reduced West Alternative	East Side Only Alternative
Avian and Bat Mortality (Significant Issue 2)	2	Estimated range of mortality due to collision or barotraumas would be the greatest among action alternatives.	There would be no mortality from collision or barotrauma.	Estimated range of mortality would be slightly less than that of the Proposed Action.	Estimated range of mortality would be substantially less than the Proposed Action and Alternative 2.
Black Bear Habitat (Significant Issue 3)	2	Clearing and grading 87.4 acres would remove 460 to 470 BSB trees, approx. 1.7% of all BSB estimated within Project area. Highest risk of undue adverse impacts, both direct (removal of important habitat, BSB) and indirect (disturbance and displacement).	No BSB trees would be removed. No creation of open areas to improve diversity of bear foraging habitat. No additional risk of displacement of bears.	Clearing and grading 85.4 acres would remove 350 to 360 BSB trees, approx. 1.3% of all BSB estimated within Project area. Moderate risk of undue adverse impacts, both direct (removal of important habitat, BSB) and indirect (disturbance and displacement).	Clearing and grading 49.6 acres would remove 55 to 60 BSB trees, approx. 0.2% of all BSB estimated within Project area. Lowest risk of undue adverse impacts, both direct (removal of important habitat, BSB) and indirect (disturbance and displacement).
Visual Resources (Significant Issue 4)	15	Viewshed would include Project and Searsburg facility. Project located at considerable distance from viewpoints along Appalachian Trail. Limited viewing opportunities from parks and recreation areas. Direct vantage points from state and local roadways.	There would be no change from existing conditions. Searsburg facility would remain as a prominent feature in Viewshed.	Viewshed would include Project and Searsburg facility. Reduction of three turbines would only result in minor reductions of visual impacts, when compared to Proposed Action.	Viewshed would include Project and Searsburg facility. Only modest reductions in overall visual impacts, when compared to the Proposed Action. Turbines on Eastern Project site most visible in all alternatives.

2.5.1 Purpose and Need and Significant Issues that are Substantially Different Between Alternatives

The alternatives differ substantially in how they meet the important component of the Purpose and Need of working toward implementing the Forest Plan goals and objectives of providing opportunities for renewable energy development on GMNF lands, while looking to meet the direction of the National Energy Policy. The difference lies in their ability to generate renewable energy and further Forest Plan goals 11, 5, and 17, which relate to providing opportunities for renewable energy use and development; maintaining or improving air quality; and supporting regional and local economies through resource use, production, and protection. The No Action alternative would generate no renewable energy and would not further any of those goals. The East Side Only alternative would have the potential to generate less than half as much renewable energy (14 MW) compared to the other action alternatives, and from the Applicant's perspective, would not likely be economically sustainable because of its small size; it would be difficult to produce sufficient revenue to offset construction, maintenance, and infrastructure costs. The Proposed Action and the Reduced West alternative would be comparable in potential renewable energy production (34 and 30 MW nameplate capacity, respectively) and in furthering goals 11, 5, and 17.

Of the four significant issues identified during the scoping process, only for Issue 3 do the alternatives under consideration differ substantially in their relative level of impact.

Issue 3: People are concerned that the Proposed Action will adversely impact black bears by removing critical beech habitat, particularly in the western expansion area.

Habitat impacts resulting from the proposed activities relate to Forest Plan Goal 2: "maintain and restore quality, amount, and distribution of habitats to produce viable and sustainable populations of native and desirable non-native plants and animals." As described in detail in Section 3.12 of the FEIS, the Proposed Action, because it would result in the largest area of physical disturbance and include the most turbines, has the greatest potential for direct and indirect impact to black bears and their habitat. This alternative would result in the removal of approximately 460 to 470 bear scarred beech (BSB), an important source or fat and nutrition for black bears as they prepare for hibernation. The BSB stand on the western ridge is reported by the Vermont Agency of Natural Resources (ANR) to be one of the largest documented in the state, and of regional significance to black bear populations in southern Vermont. Some expert biologists believe that the loss of BSB along the ridgeline would reduce the availability of an important food resource and could result in reduced winter survival and cub production among local bears. However, there is not consensus among bear biologists regarding the magnitude of this impact and the degree to which it may be off-set by the increased diversity of forage opportunities resulting from the creation of successional habitat on the Project site, and by the availability of other BSB in the Project area and surrounding vicinity.

The Vermont Public Service Board, in its April 2009 Order and Certificate of Public Good, states that the removal of BSB in the stand on the western ridge may be mitigated by protecting other similar habitat. Condition #11 of the CPG requires the Applicant to conserve (through purchase, easement, or protective covenant) four times the amount of BSB acreage that would be removed (i.e., a four-to-one ratio). These lands would need to be comparable to the remote, high elevation area of concentrated beech stands in the Project site. The amount of lands conserved would vary by alternative according to the amount of BSB acreage removed. For the Proposed Action, 42 acres of BSB would be removed and therefore 168 acres would need to be conserved. For the Reduced West alternative, 36 acres of BSB would be removed and 144 acres conserved, and for the East Side Only alternative, 10 acres of BSB would be removed and 40 acres would need to be conserved.

Indirect impacts (disturbance and displacement) to bears would also be greater under the Proposed Action than the other alternatives. The larger number of turbines and area of disturbance, and the proportionally greater level of human activity associated with construction and maintenance of the turbines would potentially result in slightly more area and amount of human disturbance than for the Reduced West alternative and much more potential disturbance than for the East Side Only alternative. As acknowledged in Section 3.12, bear biologists disagree on the magnitude of this impact, and the extent to which bears may habituate to human disturbance.

The No Action alternative (Alternative 1) would not cause impacts to black bears and their habitat. Potential beneficial impacts associated with the creation of openings/early successional habitat and an associated increase in the diversity of food sources available to bears would also not be implemented under this alternative. As there are no known Forest Service proposals for other uses of this area, any impacts to black bears and their habitat from future uses are uncertain at this time.

The Reduced West alternative (Alternative 2) would reduce potential impacts to bears on the western ridge when compared to the Proposed Action. By eliminating the three southern-most turbines on the western ridge and adding another near the north end of the array, the total number of BSB to be removed would be reduced from 460 to 470 for the Proposed Action, to 350 to 360. This represents a 24% decrease in direct impact when compared to the Proposed Action. Removing less BSB would result in more beech being available as a food source for use by bears. However, because of its smaller footprint, this alternative would slightly reduce beneficial impacts associated with the creation of early successional habitat. As noted above, the area and amount of disturbance would also be somewhat decreased due to the reconfiguration to a more compact 15-turbine array and a reduction in access road length, resulting in lesser indirect impacts than would be expected from the Proposed Action. Also, dropping the three southern-most turbines would provide an area of beneficial habitat relatively free from disturbance, as explained in Section 3.12.2.3.

The East Side Only alternative (Alternative 3) would result in the least impact to black bears and their habitat by eliminating turbines from the western ridge. This alternative has value in that offers an alternative for selection that would result in much less overall environmental impacts. As such, it provides the Responsible Official with a comparison between alternatives with greater impacts, particularly to bears and bear habitat (the Proposed Action and Alternative 2), and one with little impact to bears (Alternative 3). Also very important, the Vermont ANR suggested that this alternative be evaluated. The ANR has stated in both the PSB review and the Forest Service NEPA process that they would prefer a conservative approach to development. They believe the East Side Only alternative represents the least risk to bears. They also believe that this alternative, despite the considerable difference in habitat including the amount of BSB, would offer an opportunity to study the impacts of wind facility development on bears before potentially moving forward with development on the Western Project site. Construction of the East Side Only alternative would result in the loss of approximately 55 to 60 BSB. This is a reduction of 88% when compared to the Proposed Action and 85% when compared to the Reduced West alternative. There would also be no increase in forage diversity through the creation of early successional habitat on the western ridge. The area and amount of disturbance responsible for potential indirect impacts would be substantially reduced under this alternative. With only the temporary laydown area and O&M building proposed for the north end of the west ridge, there would be very little disturbance or displacement of bears using the Western Project site.

Although the alternatives under consideration differ in their potential level of impact on black bears and bear habitat, none of the alternatives would result in what would likely be an undue or unacceptable adverse impact to bears when examined in a context of the larger Project area. This assessment is based on the following:

1. Pre-construction studies indicate that the Proposed Action would remove approximately 1.7% of the 28,000 BSB that are estimated to occur in the Project area (direct impact). The Reduced West alternative would impact slightly less BSB and would maintain an important area of habitat on the southern end of the western string that would continue to be available for use by bears. The East Side Only alternative would impact little BSB on the eastern ridge and essentially impact none of the western ridge, and as such, offers a good comparison of the level of impacts between alternatives to help define Issue 3. For each alternative, the very large majority of beech habitat and BSB estimated to lie within the Project area (over 98%) would remain available to bears over the short- and long-term (Section 3.12.2).

2. With strict limitations on access and use of the Project site, and with the design criteria and mitigations that would be required under any alternative, indirect impacts would likely be short-term, as most bears would likely adapt to the presence of the facility without major behavioral changes (see Section 3.12). This takes into consideration the conditions and mitigations required by the PSB in their Certificate of Public Good, which include, but are not necessarily limited to, gating of Project access roads, developing measures to prohibit and deter illegal ATV access and other unauthorized access, limiting human activity on site during critical periods of bear use, limiting ground lighting through the use of motion sensor lights, utilizing remote cameras, and finding and preserving any specific bear crossings. The CPG also calls for the Applicant to conduct a multi-year study of the impact of the Project on bears and develop a detailed proposal describing how indirect impacts will be minimized (Sections 3.12.2 and 3.12.4).

The Vermont PSB, in their April 2009 Order accompanying the CPG that approved the 15-turbine Project on both ridges, essentially reached the same conclusion, that the Project, when appropriately mitigated, would not result in an undue adverse impact to the environment. The Order recognized that the "higher-altitude bear habitat is significant; removal of these trees and general impairment of the habitat would represent an undue adverse effect upon the environment, if not mitigated through appropriate conditions" (PSB Order 4/16/2009, p. 5). The mitigation measures set forth in the Order that reduce the impact to acceptable levels are: (1) Deerfield (the Applicant) would conserve comparable bear habitat in the southern Vermont region on a four-to-one ratio through conservation easements, and (2) Deerfield would engage in studies of the effects of the Project on bear populations to help address some of the uncertainty as to the degree to which the population would be disrupted and displaced. The PSB Order supports the science-based analysis and determination in the DEIS, SDEIS, and FEIS, namely, that although there is some agreement, there is uncertainty (i.e. no definitive consensus amongst consulted bear biologists) regarding the direct and indirect impact of the proposal on bears. The PSB Order states that the "Project will have an impact on bear habitat; however, with sufficient mitigation, the impacts to the bear population will not outweigh the benefits of clean, renewable energy that this Project will provide" (PSB Order 4/16/2009, p. 78).

Post-construction monitoring and research would be needed to reduce the scientific uncertainty over the impact of the Project on bears and bear habitat, regardless of the alternative selected. Further discussions between the Applicant and the Vermont ANR were conducted in an attempt to get consensus on a suite of studies to help determine the impacts to bears and to reduce scientific uncertainties regarding these impacts. This led to the development of a Stipulation document agreed to by those parties that laid the conceptual groundwork for post-construction studies. As such, the Stipulation calls for the continuation of the hair-snag study and requires a "GPS-based bear study to evaluate the Project's indirect impact on bear use of habitat adjacent to the facility". At the time of this writing, the stipulated study has begun, with field work completed for the fall of 2011. Work will resume in the spring of 2012. Specific elements of the monitoring and research effort are described in Section 3.12.4 of this FEIS. Results of post-construction monitoring could be used to influence management of the Project over time to minimize adverse impacts on bears. Additional detail on what such management might entail is also provided in Section 3.12.4.

The analysis in Section 3.12.2 concludes that the action alternatives are unlikely to adversely affect the continued existence of a viable population of black bears in the Project area and in the surrounding region. Bears are a hunted species in Vermont and their populations are monitored by the ANR. The introductory paragraphs of Section 3.12 state that population and hunting data suggest a stable, if not increasing (between 1997 and 2005), bear population. Biologists agree that construction of the access roads and potential increased levels of human activity during the more critical seasons for bears (spring, summer, fall) pose the greatest threat of adverse impact to bears. However, with strict limitations on access and use of the immediate Project site, and with the design criteria and mitigations described in Section 3.12.2, those impacts would be short-term as most bears would likely adapt to the presence of the facility without major behavioral changes. Assuming that hunting pressure would not increase dramatically, and that road closures and enforcement are successful in neutralizing motorized access and additional human uses, the operation of the Project is not expected to displace most bears from the area.

The analysis of effects of the Project on bears and bear habitat disclosed in Section 3.12 takes into consideration all of the scientific information which has been presented to the Forest Service. The agency compiled available published literature and consulted with biologists within and outside the Forest Service. The best available scientific information has been used to assess the potential effects on black bears, including the substantial record developed during the PSB process. Biologists have visited the site and conducted field work and studies to evaluate potential effects and verify scientific information. Some studies are still ongoing. No credible scientific information or evidence available to the Forest Service has been overlooked or ignored. It has been acknowledged that determining the long- and short-term effects of a wind facility on bears is a matter of considerable scientific complexity, and that there is scientific uncertainty and a variety of diverse opinions as to the significance of potential impacts. All of the diverse scientific opinions were considered.

2.5.2 Significant Issues that are Not Substantially Different Between Alternatives

The remaining three significant issues identified for the Project are unlikely to be differentially affected by the alternatives under consideration. A summary of the relative impact of each alternative on each of these issues is presented below.

Issue 1: People are concerned that the Proposed Action will adversely impact soil and water resources resulting in unacceptable sedimentation, erosion, and loss of wetlands.

Soil and water impacts resulting from the proposed activities relate to Forest Plan Goals 3, 4, and 6, which pertain to the maintenance or restoration of the natural ecological processes and functions of soil, aquatic, fisheries, riparian, stream channel, and wetland resources. As described in detail in Section 3.2 of the FEIS, the Proposed Action, being the largest of the alternatives, would result in the largest area of land disturbance for Project construction, and therefore have the greatest potential for soil erosion, loss of soil productivity, stream sedimentation, and degradation of surface waters. Clearing and grading for this alternative would impact approximately 87.4 acres, 73.1 acres of National Forest Service Lands and 14.3 acres of private lands. The Proposed Action would disturb 24.8 acres of steep slopes (over 15% grade). As described in Section 3.8.2, it would also result in direct impacts to a total of 4,905 square feet of wetlands, with 2,855 square feet of permanent impact (i.e., grading and filling), 1,332 of secondary impact (i.e., bridge spanning), and 718 square feet of temporary impact (i.e., clearing, not filled). Of this, 2,502 square feet of total disturbance would be on GMNF lands and 2,403 square feet on private land. Access roads would cross four streams and collection lines would span two streams. No other water resources would be directly affected.

Alternative 1 would have no impact on soil and water resources. It would present no risk of increase soil erosion, loss of soil productivity, or degradation of surface water resources. In terms of indirect impacts, the area would remain available for other diverse forest uses and allowable development.

Alternative 2, the Reduced West alternative, would disturb approximately 85.4 acres of land; approximately 2% less than the Proposed Action. The reduction in acres disturbed would occur on the western ridge; disturbance on the eastern ridge would be very similar as for the Proposed Action. This alternative would result in the disturbance of 28.6 acres of steep slopes. Direct impacts to wetlands would total 3,652 square feet, with 1,929 square feet of permanent impact, 1,218 square feet of secondary impact, and 505 square feet of temporary impact. Access roads would cross four streams and collection lines would span three streams. The Reduced West alternative, given its similar amount of disturbance compared to the Proposed Action, would only slightly reduce the potential for soil erosion, loss of soil productivity, stream sedimentation, and degradation of surface waters.

Alternative 3, the East Side Only alternative, would result in an area of disturbance totaling 49.6 acres; 43% less than the Proposed Action, and 42% less than the Reduced West alternative. Most of the disturbance associated with this alternative would be confined to the eastern ridge, but it also includes a temporary laydown area and O&M building along Putnam Road, and a new substation location adjacent to the GMP substation off of Sleepy Hollow Road. The East Side Only alternative would result in a similar impact to steep slopes (23.1 acres) when compared to the other action alternatives. Direct impacts to wetlands would total 6,192 square feet, with 1,966 square feet of permanent impact, 1,218 square feet of secondary impact, and 3,008 square feet of temporary impact. Access roads would cross four streams and substation construction would impact one additional stream. Permanent wetland impacts would be similar to the Reduced West alternative, but less than the Proposed Action. Temporary wetland impacts would be substantially greater under the East Side Only alternative than for the Proposed Action or Reduced West alternative. The additional wetland disturbance would occur as a result of substation construction and reconstruction of the existing 69 kV transmission line required under this alternative. The transmission line route includes 13 wetland and 17 stream crossings, some of which could experience minor filling and/or temporary disturbance due to transmission line reconstruction. Thus, although potential for soil erosion and reduction of soil productivity are minimized under this action alternative due its smaller total area of soil disturbance, additional direct disturbance/degradation of surface water resources could occur.

Despite the fact that the alternatives vary in their potential impact to soil and water resources, none would result in substantially different long-term impacts. This is due to the following:

1. Water resources on and adjacent to the Project site are very limited.

2. The Proposed Action, with the largest area of disturbance at about 87 acres, would impact less than 1% of the 9,523 acre Project area (0.9%); the Reduced West alternative would impact overall about 2 acres less than the Proposed Action, while the East Side Only would impact about 37 acres less than the Proposed Action (about ½ of 1% of the Project area).

3. Most of the soil disturbance and associated impacts to soil and water resources are temporary, i.e., limited to the period of Project construction and site restoration. This is not anticipated to exceed nine to twelve months.

4. Best management practices, Forest Plan standards and guidelines, and appropriate design criteria and mitigation measures (see Section 3.2.2) would be used to control erosion and sedimentation. All of the action alternatives would employ such measures, and each would be built in accordance with a stormwater management plan that would control short and long-term impacts associated with stormwater runoff from the site.

<u>Issue 2: People are concerned that the Proposed Action will result in unacceptable mortality to avian and bat species, including migrating and local populations, due to collision with turbines and turbine blades.</u>

Although mortality rather than effects to habitat are the concern here, this issue relates to some extent to Forest Plan Goal 2: "maintain and restore quality, amount, and distribution of habitats to produce viable and sustainable populations of native and desirable non-native plants and animals".. As described in Sections 3.10 and 3.11 of the FEIS, potential mortality of avian and bat species due to collision with turbines or barotrauma is generally a direct function of the number of turbines proposed. Studies at operating wind energy facilities indicate no correlation between mortality and specific turbine design and siting features (e.g., proximity to water, lighting, adjacent habitat, etc.). The most likely assumption is that bird and bat mortality at the proposed Deerfield site would be on a scale and species composition similar to that observed at ecologically similar sites on forested ridgelines in northern New England. Estimates of average mortality would likely be in the range of 0.44 to 6.75 birds and 0.17 to 7.13 bats per turbine per year (see Avian Sections 3.10.1.3 and 3.10.2.1.1, and Bat Sections 3.11.1.2 and 3.11.2.1.1). Consequently, the Proposed Action, which would involve construction and operation of the most turbines, has the highest risk of avian and bat mortality. Using the lowest and highest estimates of morality from similar New England facilities would result in total annual mortality of approximately 8 to 115 birds and 3 to 122 bats for the 17-turbine Proposed Action.

Alternative 1, the No Action alternative, would result in no additional mortality. Alternative 2, the Reduced West alternative, proposes 15 turbines, 12% fewer than the Proposed Action. Consequently, the predicted annual mortality of 7 to 102 birds and 3 to 107 bats for this alternative is approximately 12% less than the Proposed Action. The 7-turbine East Side Only alternative is 59% smaller than the Proposed Action, and therefore the predicted annual mortality of 3 to 48 birds and 2 to 50 bats annually is approximately 59% less when compared to the Proposed Action.

Although the predicted avian and bat mortality rates vary by alternative, the relatively small size of all of the action alternatives would limit the significance of this impact. It is anticipated that due to the small size of the Project and the relatively low use of the site by migrating species, potential mortality would only impact a relatively small portion of the overall population of the affected species. As stated in Section 3.10.3 for avian species, it is understood that calculating avian mortality from all sources, including human-related source, is extremely difficult to do. The level of risk of cumulative avian mortality from implementation of the Proposed Action or Alternatives 2 or 3 would be expected to be low to moderate, with Alternative 3 (East Side Only) estimated to result in substantially lower cumulative mortality due to the reduction in turbines. It is believed that this predicted mortality would add very little to the overall cumulative mortality of avian species.

The potential cumulative impacts of the proposed Project on resident bats cannot be evaluated without consideration of the extremely high mortality from white-nose syndrome (WNS) for several species in the region. Mortality of resident bat species is typically low at wind facilities, compared to that of the migratory bat species. If mortality is assumed to be directly proportional to the level of local populations, risk of mortality likely would be reduced in the wake of WNS, as would the potential cumulative impacts of the proposed Project on these species. If mortality of resident bat species from the Project operation is higher than anticipated, impacts of the Project could result in a substantially greater incremental cumulative impact when added to those from WNS, although this is not anticipated. It is even more challenging to assess cumulative impacts for migratory bats. Although these species appear to be unaffected by WNS, they do suffer some mortality at utility-scale wind facilities across their range. Migratory bats that pass through Vermont also might be exposed to the sites listed above for the locally-hibernating bats, as well as some combination of the many utility-scale facilities operating, under construction, or planned from eastern Canada and Maine through New York and Pennsylvania to West Virginia and Tennessee.

Section 3.11.3 discusses cumulative mortality for bats and concludes that it is extremely difficult to estimate the total cumulative impacts to bat mortality from all sources. Increasingly sophisticated sampling and analysis techniques provide estimates of bat mortality at individual wind facilities, but few attempt to estimate total bat mortality across large regions or the entire range of individual species or populations (e.g., Kunz et al., 2007; NRC, 2007). Assessment of cumulative impacts to populations requires knowledge of population size, total mortality, fecundity, and other demographic parameters, most of which are not available in sufficient detail for bat species that occur in the Northeast. Consequently, assessment of cumulative impacts is largely an estimation of relative levels of risk associated with each alternative when taken cumulatively with all other impacts. The highest risk would be associated with the Proposed Action, followed closely by the Reduced West Alternative. A substantially lower level of risk of cumulative impacts would be expected from the East Side Only alternative.

A number of factors discussed in detail in Sections 3.10 and 3.11 suggest that avian and bat mortality would be a relatively minor impact under any of the Deerfield Project alternatives:

1. Preconstruction studies indicate a general lack of listed threatened and endangered species or GMNF Regional Forester Sensitive Species (RFSS) that could be subject to mortality at the proposed Project site. Results from summer mist-net and acoustic surveys conducted by the Vermont ANR, the Forest Service, and other collaborators during 2010 and 2011 suggest that the four bat species listed or proposed for listing as RFSS and/or under the ESA are almost completely absent from the Vermont landscape after recent population declines caused by WNS.

2. The numbers of birds flying over the site were similar or less than numbers reported from other inland locations in New England and fewer than reported in many studies conducted farther to the south. Thus, it is believed that avian activity levels may be low at the Deerfield site, therefore lowering risk of mortality.

3. The activity level of bats observed in the Project area during the early stages of the analysis was similar to or lower than rates observed at other sites across the Northeast during the same time periods, using the same methodology and type of equipment. Again, this may imply that the risk of mortality may be similar to or lower than what could be seen at comparable facilities in the Northeast. Results from summer mist-net and acoustic surveys conducted by the Vermont ANR, the Forest Service, and other collaborators during 2010 and 2011 suggest that in the wake of WNS, many bat species are now almost completely absent from the Vermont landscape. Acoustic monitoring during 2011 detected the occurrence of bats in the Project area from mid-April through mid-October. Although direct comparison is complicated by a variety of factors, results from 2011 are similar to and consistent with results from 2005 and 2006.

4. Populations of cave- and mine-hibernating bats in the northeastern U.S. are experiencing unprecedented mortality due to WNS. Mortality estimates range from 75% to 100% in affected hibernacula in New York and Vermont. WNS primarily impacts resident, cave- and

mine-hibernating, non-migratory bat species. The risk of mortality at wind facilities for these resident bat species is typically lower than the risk to migratory species.

5. The overall objective would be to limit mortality to the lowest possible level, and thus minimize cumulative impacts. Required post-construction monitoring and adaptive management of the Project, as explained in Sections 3.10.3 and 3.11.4, and Appendix H, would be required under any approved action alternative, and the results would be used to mitigate mortality to the extent possible.

<u>Issue 4: People are concerned that the Proposed Action will adversely affect the visual resources of the area, especially those important to the character of the ridgelines.</u>

Visual impacts resulting from the proposed activities relate to Forest Plan Goal 15, which is to "maintain and enhance visual resources such as viewsheds, vistas, overlooks and special features." As discussed in detail in Section 3.5 of the FEIS, visual impacts of the Proposed Action and the alternatives under consideration were evaluated in a comprehensive visual impact assessment (VIA). The Project VIA identified visually sensitive resources, visual quality, and viewer sensitivity within a 10-mile radius around the turbines. Visual quality and viewer sensitivity within this area are variable but were generally determined to be moderate. Based on the Recreation Opportunity Spectrum (ROS) of the MA on which the Project site is located, the "Modification" Visual Quality Objective (VQO) would apply to the Project in evaluating foreground, mid-ground, and background visual impacts. As described in Section 3.5, the "Partial Retention" VQO would apply to the Project for evaluating the viewshed as seen from the Appalachian/Long Trail, consistent with Forest Plan standards.

The VIA concluded that the Project area is visually appropriate for the facilities because the ridges are not visually distinct focal points in the surrounding landscape and wind turbines from the existing Searsburg Wind Facility already occur along the eastern ridge. Although the existing Searsburg Wind Facility is not within the GMNF, the boundary is not something that can be perceived by the average viewer. The Proposed Action would be similar in form, color, and scale to the existing Searsburg facility, so that it would repeat an existing pattern in the landscape. There are no significant or documented scenic resources in the area that would be affected, and the Project would be located at a considerable distance from the few open viewpoints that occur along the Appalachian Trail. The VIA concluded that the Proposed Action and all of the action alternatives would be in compliance with the VQOs outlined in the Forest Plan.

No turbines, access roads, or other Project components would be constructed under the No Action alternative. Therefore, Alternative 1 would not have any current adverse effects on visual resources because the existing conditions in the Project area would remain unchanged until other uses were approved and implemented.

Under Alternative 2, the three southern-most turbines on the western turbine string would be eliminated. The ridge proposed for the Western Project site is generally less visible than the ridge proposed for the Eastern Project site, and the southern-most turbines of the western ridge would have the least visibility of all of the turbines in the Proposed Action. Therefore, when compared to the Proposed Action, this alternative would most likely not result in any meaningful reduction in visual impacts in the majority of the study area.

When compared to the Proposed Action, development of the East Side Only alternative would result in only modest reduction in overall visual impacts because, of the two ridges proposed for the Project site, the eastern ridge is more visible. The only area from which the appearance of the landscape would not change would be approximately 2.5 miles of Route 9 between Woodford State Park and Route 8. From other viewpoints in the affected environment, where the eastern and western turbines are seen in combination, this alternative would result in a slightly reduced overall visual impact. Construction of this alternative would result in some additional trade-offs in visual impacts compared to the Proposed Action. Under the East Side Only alternative, the 34.5 kV collector line crossing Route 8 would be eliminated, thereby slightly reducing visual impacts. However, this alternative would require placing a new substation adjacent to the existing substation now serving the Searsburg Wind Facility, which would likely result in increased visual impacts at this location.

In summary, the visual impacts of all of the action alternatives are similar because elimination of turbines on the Western Project site would not result in a large reduction of visual impacts. The most populated areas within the viewshed, and those where vegetative openings (such as farm meadows) permit distant views, are primarily east of the Project site. Areas west and north of the ridges proposed for the Project site are generally wooded, thus offering little opportunity for views towards the Project. Moreover, the primary recreation areas from which views of the Project would be possible are also to the east, most notably Harriman Reservoir.

2.5.3 Other Substantive Issues Evaluated in the FEIS

Other substantive issues were included in the evaluation of impacts for the alternatives in the various resource sections of Chapter 3.0 of the FEIS including: Land Use, Climate and Air Quality, Noise, Cultural and Heritage Resources, Ecological Resources, Recreation, Socioeconomics, Transportation and Roads, Telecommunications, Safety and Security, and Environmental Justice. The impacts of the three action alternatives do not differ substantially for these other environmental issues. Impacts to these resources are summarized below in Table 2.5-2, and are not repeated here to avoid redundant discussion. Please note that potential impacts for each of these resources are fully analyzed within the various sections of Chapter 3.0 (as referenced in Table 2.5-2).

In some respects, all of the resource impacts, as well as the significant issues discussed above, relate to land use, because the proposal involves use and management of public lands under an existing NFS land and resource management plan. The goals of the Forest Plan include sustainability, stewardship, and conservation of the multiple use resource values of the national forest. All of the alternatives, to some extent, would work toward these overall sustainability, stewardship, and conservation goals as embodied in the Forest Plan, although the No Action alternative would not meet Goal 11. The No Action alternative would conserve existing conditions to the greatest degree, but would not further the goal of encouraging renewable wind energy compared with the other alternatives.

All of the action alternatives involve clearing of some existing habitat and impacts to individual plant and animals, but also promote sustainability through development of a renewable energy source, consistent with the diverse forest use management area direction. In addition, future use and management of the site for other purposes would not be precluded, as the turbines could be required to be removed and the site restored at the end of the Project's useful life under any alternative. Consequently, individual or cumulative impacts associated with all of the action alternatives do not preclude options for future generations' use of the Project site.

Table 2.5-2: Direct and Indirect Impacts to Other Substantive Issues Evaluated in the FEIS

Resource Area	Section No.	Proposed Action	No Action	Reduced Turbines in Western Project Site	Turbines in Eastern Project Site Only
Land Use	3.1	Clearing and grading approx. 87.4 acres: 73.1 acres of NFS lands and 14.3 acres of private land; approx. 0.9% of the 9,523-acre Project area. Change use of 73.1 (or actual permitted) acres of Diverse Forest Use MA to a dedicated use as wind facility.	No land would be cleared or graded. NFS lands would continue to be managed under directives for Diverse Forest Use, as outlined in Forest Plan.	Clearing and grading approx. 85.4 acres: 66.5 acres of NFS lands and 18.9 acres of private land; approx. 0.9% of the 9,523-acre Project area. Change use of 66.5 (or actual permitted) acres of Diverse Forest Use MA to a dedicated use as wind facility.	Clearing and grading approx. 49.6 acres: 29.7 acres of NFS lands and 19.9 acres of private land; approx. 0.5% of the 9,523-acre Project area. Change use of 29.7 (or actual permitted) acres of Diverse Forest Use MA to a dedicated use as wind facility.
Climate and Air Quality	3.3	Generation of up to 34 MW of emission free power. Short-term CO_2 emissions reductions of approx. 70,292 tons per year. Long-term reduction (Year 8 and beyond) of approx. 51,595 tons per year. Greatest potential for air quality benefits.	There would be no generation of emission free power, no reduction of harmful emissions. No potential for increased air quality benefits.	Generation of up to 30 MW of emission free power. Short-term CO_2 emissions reductions of approx. 65,154 tons per year. Long-term reduction (Year 8 and beyond) of approx. 47,820 tons per year. Slightly less potential for air quality benefits.	Generation of up to 14 MW of emission free power. Short-term CO_2 emissions reductions of approx. 29,505 tons per year. Long-term reduction (Year 8 and beyond) of approx. 21,646 tons per year. Least potential for air quality benefits.
Noise	3.4	Most short-term noise impacts from construction. No change in noise levels at any residence. An increase of sound levels by 3 and 4 dBA over background conditions at Lamb Brook Area and Aiken Wilderness, respectively.	No short-term noise impacts from construction. No change in noise levels at any residence. No increase in sound levels in Lamb Brook Area or the Aiken Wilderness.	No negligible difference in short-term construction noise impacts compared to Proposed Action. No change in noise levels at any residence. An increase of sound levels by 4 and 7 dBA over background conditions at Lamb Brook Area and Aiken Wilderness, respectively.	Least short-term noise impacts from construction. No change in noise levels at any residence. An increase of sound levels by 3 dBA over background conditions at Lamb Brook Area; no increase at Aiken Wilderness.

Resource Area	Section No.	Proposed Action	No Action	Reduced Turbines in Western Project Site	Turbines in Eastern Project Site Only
Cultural and Heritage Resources	3.6	No impact to any known historic or archaeological sites. Would not change character of landscape as seen from designated historic architectural structures. Most risk for disturbing unidentified archaeological resources.	No impact to any known historic or archaeological sites. There would be no construction or soil disturbing activities in the Project area.	No impacts to any known historic or prehistoric archaeological sites. Would not change the character of the landscape as seen from designated historic architectural structures. Slightly less risk for disturbing unidentified archaeological resources.	No impacts to any known historic or prehistoric archaeological sites. Would not change the character of the landscape as seen from designated historic architectural structures. Least risk for disturbing unidentified archaeological resources.
Ecological Resources	3.9	Vegetation impacts to Northern Hardwood Forest, Montane Yellow Birch-Red Spruce Forest, and Open Uplands on approx. 87.4 acres. No undue adverse impacts are anticipated for Management Indicator Species, Reptiles and Amphibians, Fish, Mammals, Threatened and Endangered Species, Animal Regional Forester Sensitive Species, or Plant Regional Forester Sensitive Species. Greatest risk for spread of NNIS.	There would be no clearing of vegetation. No undue adverse impacts to Management Indicator Species, Reptiles and Amphibians, Fish, Mammals, Threatened and Endangered Species, Animal Regional Forester Sensitive Species, or Plant Regional Forester Sensitive Species. No additional risk of spread of NNIS.	Vegetation impacts to Northern Hardwood Forest, Montane Yellow Birch-Red Spruce Forest, and Open Uplands on approx. 85.4 acres. No undue adverse impacts are anticipated for Management Indicator Species, Reptiles and Amphibians, Fish, Mammals, Threatened and Endangered Species, Animal Regional Forester Sensitive Species, or Plant Regional Forester Sensitive Species. Risk for spread of NNIS essentially the same as Proposed Action.	Vegetation impacts to Northern Hardwood Forest, and Montane Yellow Birch-Red Spruce Forest on approx. 49.6 acres. No undue adverse impacts are anticipated for Management Indicator Species, Reptiles and Amphibians, Fish, Mammals, Threatened and Endangered Species, Animal Regional Forester Sensitive Species, or Plant Regional Forester Sensitive Species. Least risk for spread of NNIS.

Resource Area	Section No.	Proposed Action	No Action	Reduced Turbines in Western Project Site	Turbines in Eastern Project Site Only
Recreation	3.13	No direct impacts to developed recreation sites. No undue visual and noise impacts to dispersed recreational users, including those using Aiken Wilderness, Lamb Brook Area.	No impacts to developed or dispersed recreational sites or opportunities.	No direct impacts to developed recreation sites. No undue visual and noise impacts to dispersed recreational users, including those using Aiken Wilderness, Lamb Brook Area.	No direct impacts to developed recreation sites. No undue visual and noise impacts to dispersed recreational users, including those using Aiken Wilderness, Lamb Brook Area.
Socioeconomics	3.14	Require approx. 250 jobs during construction and approx. 2.5 employees during operation. Purchase of local goods and services. Tax revenue and direct municipal payments combine for minimum of $240,000 per year to Town of Searsburg and $154,000 to Town of Readsboro.	No temporary construction jobs or full-time employment opportunities would be created. No purchase of local goods and services. No tax revenue or direct municipal payments to Towns of Searsburg and Readsboro.	Require approx. 250 jobs during construction and approx. 2.5 employees during operation. Slightly less purchase of local goods and services. Tax revenue and direct municipal payments combine for minimum of $240,000 per year to Town of Searsburg and $154,000 to Town of Readsboro.	Require fewer jobs during construction period and fewer employees during operation. Much less purchase of local goods and services. Tax revenue and direct municipal payments combine for minimum of $154,000 to Town of Readsboro. No tax revenue or direct municipal payments to Town of Searsburg.
Transportation and Roads	3.15	Estimated 136 total trips to deliver turbine components. Modification to certain portions of existing highways necessary. Greatest level of disturbance to local residences and drivers.	No impacts to roadways, and local residences and drivers.	Estimated 120 total trips to deliver turbine components. Modification to certain portions of existing highways necessary. Very similar level of disturbance to local residences and drivers as for Proposed Action.	Estimated 56 total trips to deliver turbine components. Modification to certain portions of existing highways necessary. Reduced level of disturbance to local residences and drivers when compared to Proposed Action.
Telecommunications	3.16	No undue adverse impacts to telecommunications are anticipated.	No undue adverse impacts to telecommunications are anticipated.	No undue adverse impacts to telecommunications are anticipated.	No undue adverse impacts to telecommunications are anticipated.

Resource Area	Section No.	Proposed Action	No Action	Reduced Turbines in Western Project Site	Turbines in Eastern Project Site Only
Safety and Security	3.17	Impacts (risk) from ice shedding, tower collapse and blade failure, stray voltage, fire, lightning strikes, and EMF anticipated to be minimal.	There would be no impacts and risks from ice shedding, tower collapse and blade failure, stray voltage, fire, lightning strikes, or EMF.	Impacts (risk) from ice shedding, tower collapse and blade failure, stray voltage, fire, lightning strikes, and EMF are anticipated to be minimal. Slightly less risk than Proposed Action.	Impacts (risk) from ice shedding, tower collapse and blade failure, stray voltage, fire, lightning strikes, and EMF are anticipated to be minimal. Considerably less risk than Proposed Action.
Environmental Justice	3.22	No adverse impacts to minority or low-income populations.	No adverse impacts to minority or low-income populations.	No adverse impacts to minority or low-income populations.	No adverse impacts to minority or low-income populations.

2.6 Identification of a Preferred Alternative

Section 1502.14(e) of the Council of Environmental Quality implementing regulations for the NEPA requires that the Forest Service identify the Preferred Alternative in the Draft EIS if one or more exist. The identified Preferred Alternative may or may not be the same as the Proposed Action. Identification of the Preferred Alternative by the Responsible Official in any DEIS should not be construed as pre-decisional. The intent is to provide the reader with a sense of the direction the Forest Service is leaning at the time the DEIS is released. However, the comments received during the public comment period for an EIS are a very important part of the decision making process. Therefore, whether or not a Preferred Alternative is identified, the final decision on which alternative to implement, either as described in the EIS or modified due to comments received, will be made and disclosed in the Record of Decision.

No Preferred Alternative was identified in the DEIS. Since the State review was still on-going, the Responsible Official did not have a preferred course of action at that time. After the State review was complete, the Responsible Official identified Alternative 2 as the Preferred Alternative. Alternative 2, or the Reduced West alternative, was originally a 14-turbine configuration in the DEIS. It was very similar to the 15-turbine configuration approved by the Public Service Board and was been modified in the SDEIS to match that configuration. The Reduced West alternative remains the Preferred Alternative in this FEIS.

CHAPTER 3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter discusses environmental and social resources including areas such as infrastructure and economics that may be affected by the Deerfield Wind Project, and describes the environmental consequences (direct, indirect, and cumulative impacts) of the Proposed Action and other feasible alternatives. The discussion of these topics under each resource section is structured into the main subsections described below.

Affected Environment: In each resource section, this subsection describes the existing conditions within the Project area specific to that resource, or defines other areas of interest to establish the base condition. As noted in Chapter 1.0, the Project site corresponds to the footprint of the proposed facilities, while the Project area encompasses all NFS and private lands in GMNF management compartments 121, 122, 123, and 124. A generalized description of the affected environment for the proposed Project is detailed in this introduction to Chapter 3.0. More specialized information on the affected environment as it pertains to each resource area is located at the beginning of each separate resource section within this chapter.

The Project area is located on two ridges within the Southern Green Mountain biophysical region of south-central/western Vermont. The Southern Green Mountains are a combination of high peaks, high plateaus, an escarpment on its western border, and low foothills to the east (Thompson & Sorenson, 2005). The mountaintops are slightly higher than 3,000 feet. Deeper valleys near the Project area are several hundred feet lower in elevation than the mountaintops. The sides of the mountains are relatively steep in many places.

As illustrated on Figure 3.9-1, the Project area encompasses three forest types and is composed of 76% northern hardwood forest, 22% montane yellow birch-red spruce forest, and 2% upland brush. The upland brush community at the Project site is confined to an existing transmission line ROW area in the northern reaches of the Western Project site where vegetation is actively managed to limit canopy re-growth.

Deciduous trees within the dominant northern hardwood forest community include sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), American beech (*Fagus grandifolia*), black cherry (*Prunus serotina*), yellow birch (*Betula alleghaniensis*), a few paper birch (*Betula papyrifera*), striped maple (*Acer pensylvanicum*), and mountain ash (*Sorbus decora*). Small patches of coniferous species are interspersed throughout the Project area and Project site, and include balsam fir (*Abies balsamea*), red spruce (*Picea rubens*), and isolated eastern hemlock (*Tsuga canadensis)*. Most of the forest has been subject to some level of timber harvest during the past 40 to 50 years, as evidenced by large stumps on the forest floor (Kerlinger, 2006a).

National Wetland Inventory (NWI) mapping indicates that there are 58 wetlands within the Project area, totaling 163.3 acres (United Sates Fish and Wildlife Service [USFWS], 2008). Field inventories in areas proposed for disturbance identified an additional 40 wetlands, totaling 13.1 acres (Arrowwood Environmental, 2006a,b, 2007, 2008a, 2011). Based on field review, wetlands in the Project area are one of the following community types: spruce-fir-tamarack swamp, seepage, red maple-black ash, shallow emergent marsh, old field, shrub swamp, beaver wetland complex, and conifer swamp.

Elevation in the Project site ranges from approximately 2,401 feet AMSL near the intersection of Route 8 and the Putnam Road access to approximately 3,110 feet AMSL along the eastern ridgeline, south of the existing Searsburg Wind Facility. The existing turbines of the Searsburg Wind Facility are located north of and at slightly lower elevations (from 2,700 to 2,900 feet above AMSL) than those proposed in the Eastern Project site, as the eastern ridge climbs in elevation to the south.

Although nearly 12 miles of designated snowmobile trails lie within the Project area, none of these trails cross the Project site. The snowmobile trails closest to the proposed Project are located approximately 0.5 mile from the Western Project site and approximately 0.8 mile from the Eastern Project site. No developed recreational sites occur in the Project area. However, dispersed recreational activities such as hunting, hiking, cross-country and backcountry glade skiing, snowshoeing, peakbagging, and primitive camping occur in the Project area, and several unmarked trails traverse the Project area and vicinity.

Direct and Indirect Impacts Presented by Alternative: In each resource section, this subsection discusses the issues and concerns identified through the scoping and public comment process and the Forest Service review process. Issues statements and the indicators used to focus the discussion of impacts addressing those issues are described. Potential direct and indirect effects of the proposed activities are then discussed for the Proposed Action and each of the alternatives described in Chapter 2.0.

5. *Direct effects* are those effects "…which are caused by the action and occur at the same time and place." (40 CFR 1508.8(a)). Examples include soil or vegetation disturbance due to clearing and grading activities associated with Project construction.

6. *Indirect effects* are those effects "…which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on water and air and other natural systems, including ecosystems." (40 CFR 1508.8(b)). Examples include off-site sedimentation into waterbodies or displacement of wildlife due to construction activities.

Cumulative Impacts: This subsection concludes the discussion of impacts. Cumulative impacts are "impacts on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions" (40 CFR 1508.7). Examples include collective impacts from nearby construction projects or timber harvesting activities.

Following the last resource section, formatted into the subsections as described above, this chapter also includes sections that address Short-term Uses and Long-term Productivity, Unavoidable Adverse Effects, Irreversible and Irretrievable Commitments of Resources, Overall Cumulative Impacts for the Project, and Environmental Justice.

3.1 Land Use

This section summarizes the existing conditions and potential impacts in regard to land use that may result from the proposed Project. It also discusses town and regional plans and the implications of the proposed Project on those plans.

3.1.1 Affected Environment

The proposed Project is located in the Towns of Searsburg and Readsboro in Bennington County, Vermont. Bennington County is bordered by New York State to the west, Massachusetts to the south, Windham County to the east, Windsor County to the northeast, and Rutland County to the north. Both towns are located along the eastern edge of Bennington County This area is characterized by a high plateau with mountain peaks, and is bordered by a dramatic escarpment on the west and rolling foothills to the east.

3.1.1.1 Historic Land Use

Population densities have historically been low in this region, with Native American and early European settlers concentrating primarily in Vermont's river valleys (Thompson & Sorenson, 2000). English settlement of this area began in the mid-18th century and flourished after the Revolution. Land use in the 19th century included subsistence farming, grazing, and orchard operations, but was shaped largely by extractive industries like logging and mining. By the early 20th century, visitors to Vermont began considering the mountains a source of beauty and recreation opportunities (USDA Forest Service, 2006a).

Most of the forestland was cleared by the early 1900s, and although the forests of the southern Green Mountains have largely grown back, there have likely been significant changes in forest structure and composition. During the latter half of the 20th century, downhill ski areas and associated residential and commercial development have substantially increased human influences in the region (Thompson & Sorenson, 2000). Much of the Southern Green Mountain Biophysical Region is owned and managed by the GMNF. Established in 1932, the GMNF is one of only two National Forests in New England. Located entirely within the state of Vermont, the Forest now comprises more than 400,000 acres inside the 821,000-acre Forest Proclamation Boundary (USDA Forest Service, 2006a).

3.1.1.2 Current Land Use

The Town of Searsburg encompasses approximately 13,700 acres, or 21.4 square miles. With a population of 96, settlement is rural and dispersed (U.S. Census Bureau, 2000a). The Town of Readsboro is somewhat larger, with 809 residents (U.S. Census Bureau, 2000b) across 23,000 acres, or 36 square miles.

As shown in Figure 1-2, the Project area encompasses GMNF management compartments 121, 122, 123, and 124, an area totaling 9,523 acres. NFS lands comprise 6,942 acres (73%) of the Project area. Managed forestland is the dominant land use in the Project area, on both NFS and private lands. Existing built features include public roads, private residences, the existing Searsburg Wind Facility, a substation, and a 69 kV transmission line. In both towns, areas of development are concentrated in small hamlets and villages along the existing network of state, county, and local roads.

The Multi-Resolution Land Characteristics Consortium is a nationwide partnership of federal agencies that formed to purchase Landsat 7 imagery from 2001, and coordinated to produce a comprehensive land cover database for the nation called the National Land Cover Database (NLCD 2001). The goal of this partnership was to provide the Nation with complete, current, and consistent public domain information on its land use and land cover (Homer et. al., 2007). Table 3.1.1-1 summarizes the land cover in the Project area according to the NLCD 2001.

Table 3.1.1-1: Land Cover and Land Use in the Project Area

Land Cover/Land Use[1]	Acres	Percent
Deciduous Forest	6,451	67.74
Evergreen Forest	862	9.05
Mixed Forest	1,464	15.37
Shrub/Scrub	100	1.05
Grassland/Herbaceous	44	0.46
Emergent Wetlands	15	0.16
Woody Wetlands	234	2.46
Open Water	12	0.13
Pasture/Hay	41	0.43
Cultivated Crops	2	0.02
Developed, Open Space	223	2.34
Developed, Low Intensity	68	0.71
Developed, Medium Intensity	7	0.07
Total	9,523	100

[1] NLCD, 2001 (Homer et. al., 2007).

3.1.1.3 Regional & Local Land Use Plans

In Vermont, land use planning occurs at multiple layers of government. Towns, regional commissions, and the state are responsible for creating land use plans that are compatible. Town government is responsible for zoning, but the State also has a Land Use and Development Law (Act 250) that regulates development on projects of a certain size. All regional planning commissions in the area have regional plans, and most of the towns in the area have adopted town plans. Goals and objectives in regional and town plans are a good indication of community values and attitudes (USDA Forest Service, 2006a).

The Towns of both Searsburg and Readsboro fall within the greater Windham region, and are included in the Windham Regional Plan that was adopted October 24, 2006. The Windham Regional Commission (WRC) was formed in 1965, and was subsequently constituted by the State

Legislature. It now operates under the Vermont Municipal and Regional Planning and Development Act (24 VSA Chapter 117) to assist the 27 member towns in providing guidance for change in the Windham Region. The Windham Regional Plan is intended to create a framework for decisions related to growth and development throughout the region, recognizing existing settlement patterns; availability of existing and planned public infrastructure; and land use policies established in existing town plans. The Windham Regional Plan designates six types of land use: downtowns and villages, high intensity mixed use, resort centers, rural residential lands, productive rural lands, and resource lands (WRC, 2006).

The Project is located in an area designated as resource lands on the Windham Regional Plan's Proposed Land Use map. The resource lands category is dominated by lands requiring special consideration due to the uniqueness, irreplaceable or fragile nature, or important ecological function of the lands. Resource lands include fish and wildlife habitats; areas hosting federally identified endangered or threatened species; areas hosting significant natural plants, animals and communities as designated by the Vermont Nongame and Natural Heritage Program (NNHP); unique and fragile natural areas; riparian buffers, wetlands, shores, floodplains, and aquifer recharge areas; steep slopes; lands over 2,500 feet in elevation; ridgelines; undeveloped forestlands having limited access to improved public roads; and regionally significant scenic corridors and areas. According to the Windham Regional Plan, "it is important to limit and manage human interventions in resource areas. The most appropriate land uses for resource lands are conservation and management of natural resources and low impact, very low-density rural uses." The Plan also specifies that any development or land use in these areas should be designed to have a minimal impact on natural resources (WRC, 2006).

The importance of planning for energy was identified as the number one regional priority when developing the Windham Regional Plan (WRC, 2006). The Plan discusses energy use, energy sources, energy demand, electricity demand, current issues, and energy policies. In the Introduction to Chapter 4, the Plan identifies five areas needing significant progress:

1. *Greater diversification* of energy sources, in order to reduce dependence on foreign sources and to increase stability in the event of supply interruptions or cost fluctuations;
2. *Reduced environmental impacts*, especially regarding air quality and subsequent water quality;
3. *Increased conservation and efficiency* in all energy uses in order to reduce costs and environmental impacts, and to reduce the region's vulnerability to energy disruptions;
4. *Ongoing public education* regarding the region's energy future and what individuals and Towns can do to influence it; and
5. *Enhanced local self-sufficiency* in all public policy areas so that the region's quality of life will be resilient to potential supply disruptions or significant cost increases (WRC, 2006).

In addition, the Windham Regional Plan identifies 15 energy policies. According to the Plan, the policies found in each chapter "form the core of the Plan and state the WRC's position and intent." Many of the energy policies are unrelated to wind energy or the proposed Project (e.g., policies pertaining to net metering, public transportation, and landfills). However, energy policies 4, 5, and 6 apply to energy generation, transmission, and distribution projects.

Zoning within the Project area varies according to municipality. The Town of Searsburg has no town plan or zoning ordinance. The Town of Readsboro has a Zoning Bylaw that was adopted on March 28, 2006 and a Town Plan that was approved on September 1, 2010. The Plan for the Town of Readsboro is intended to provide planning policies to assure that decisions made at the local, regional, and state levels are in harmony with the objectives and policies of the Town. The future land use section of the Plan represents a vision for the use and development of the lands in the Town of Readsboro, and a means to realize this vision (Town of Readsboro, 2010). The Readsboro Zoning Bylaw designates six zoning districts: village, hamlet, rural residential, rural residential alpenwald, watershed, and conservation. The Town of Readsboro includes all GMNF lands in their conservation district, which is defined as undeveloped forestland with little access to improved public roads, utilities, and services. Other lands included in this category include upland wildlife habitats, multiple resource areas, ponds, watercourses, and elevations above 2,500 feet. Private development in conservation districts is restricted through a requirement for a Conditional Use Permit for most types of land uses, including wind turbines (Town of Readsboro, 2006). However, according to Vermont state law, the Section 248 process for energy generation facilities preempts all local zoning. Therefore, developers who use the Section 248 process through the Vermont Public Service Board are not required to obtain a separate Conditional Use Permit.

3.1.1.4 Forest Service Land Use Directives

The 2006 Forest Plan guides all natural resource management activities for the GMNF. It describes Forest-wide goals and objectives, MA desired resource conditions, S&Gs for implementation of projects, levels of resource production and management, and the availability of suitable land for resource management. The purpose of the Forest Plan is to provide management direction to ensure that ecosystems are capable of providing a sustainable flow of beneficial goods and services to the public. S&Gs are designed to achieve the desired conditions, goals, and objectives, while minimizing or negating the effects of a management action or land use. Please see the Forest Plan for more specific information on Plan goals, objectives, management direction, and S&Gs.

Goal 11 of the 22 goals listed in the Forest Plan is to "*provide opportunities for renewable energy use and development*." There are two associated objectives, to "*increase opportunities for renewable energy use and development*," and to "*reduce the amount of energy needed to operate Forest facilities by employing state-of-the-art conservation practices and alternate heat and electricity sources when constructing new facilities or when modifying existing facilities as necessitated for other reasons*."

The Project site is located in the Diverse Forest Use MA, which emphasizes a variety of forest uses. Vegetation management emphasis is placed on production of high quality sawtimber and other timber products on a sustained yield basis. Management actions emphasize a mix of habitats for wildlife species, including deer wintering habitat. Public use is managed to provide a full range of recreation opportunities, from motorized and non-motorized trails to dispersed campsites and developed campgrounds. The mix of vegetation conditions and recreation opportunities across the landscape provides a mosaic of landscape conditions that strives to be visually attractive to people visiting the Forest. There are several additional MA specific guidelines pertaining to mineral exploration/extraction and prescribed burns, both of which are permitted in the Diverse Forest Use MA (USDA Forest Service, 2006a).

The 2006 Forest Plan specifically provides for the consideration of wind energy development in the Diverse Forest Use MA through the non-recreation Special Use permit process (USDA Forest Service, 2006a). Existing non-recreation Special Use permits on the GMNF include communication facilities; state, town, and private roads; a liquid waste disposal facility; water systems and reservoirs; telephone lines; electric lines; and agricultural uses, such as maple tapping and cultivated fields (USDA Forest Service, 2006c).

The land use authorization specific to this non-recreation Special Use would be in the form of a Special Use permit issued in accordance with FSH 2709.11, Chapter 10, Exhibit 3. The permit would be issued for a term of 30 years. All relevant Forest Service mitigation measures and any terms and conditions required by the State issued Certificate of Public Good would be included in the permit.

3.1.1.5 Future Land Use

Other than the proposed Project, future land use patterns in the area are anticipated to remain largely unchanged for the foreseeable future. Current regional land use patterns in the Towns of Searsburg and Readsboro are expected to remain, with a future emphasis on those uses defined in the regional and local plans, as described above. Timber harvesting activities would continue on private lands adjacent to the Project site (Fice, 2008).

On NFS lands, the Project area would continue to be managed as a Diverse Forest Use MA, until such a time that management of this area was changed by Forest Plan amendment or revision. A brief description of the desired future condition for Diverse Forest Use MAs is presented here. See the Forest Plan for more information. This desired condition would be a landscape characterized by a mix of deciduous and coniferous forest stands of various types. The stands would vary in size, shape, height, and tree species. Forest communities that would naturally be present, such as northern hardwoods, aspen, and oak, would be retained and enhanced where feasible. Silvicultural practices, including both even-aged and uneven-aged systems, would be used to meet timber, wildlife, ecological, visual, and recreation objectives (USDA Forest Service, 2006a).

Suitable habitat would be provided for a variety of wildlife and plant species, including a mix of young and mature forests. Permanent and temporary upland openings would occur in shapes and sizes consistent with visual objectives in the area. Views, ecological processes, and management practices would be interpreted at some vista sites. Recreation opportunities would be diverse in this MA, with pockets of semi-primitive motorized ROS class to the more common roaded natural ROS class. Recreation management would be towards the desired ROS class of Roaded Natural. Trail opportunities would be diverse, ranging from hiking and bicycling to snowmobiling. Impacts from recreation use would be evident, and wind energy development could occur through issuance of a land use authorization (USDA Forest Service, 2006a).

3.1.2 Direct and Indirect Impacts Presented by Alternative

No significant issues related to land use were identified during scoping. Indicators used to focus the discussion of impacts to land use include consistency with local, regional, and state plans and review processes, as well as disruptions and alterations to land use resulting from the proposed activities.

3.1.2.1 Proposed Action

Development of wind energy facilities would be compatible with the Forest Plan management direction for the Diverse Forest Use MA. By providing an alternate electricity source derived from renewable energy, the proposed Project would help the GMNF achieve goal 11 as stated in the Forest Plan. Furthermore, the proposed Project is not in conflict with any of the other Forest-wide goals or objectives. Since Deerfield Wind, LLC (the Applicant) received a Certificate of Public Good from the Vermont PSB, the proposed Project would not require a Conditional Use Permit from the Town of Readsboro. As explained below, the Deerfield Wind Project appears consistent with the energy policy described in the Windham Regional Plan. The Project also appears consistent with the energy policies outlined in the Readsboro Municipal Plan. Both of these documents specify that development on high elevation ridges should be designed to have a minimal impact on natural resources. These impacts, including the careful site design and proposed design criteria that would minimize such impacts, are described in the various resource sections of this FEIS.

Implementation of the Proposed Action appears to be consistent with the five energy goals stated in the Windham Regional Plan. Energy currently used in the region is primarily from petroleum products, hydropower, and nuclear power. Construction of additional wind energy facilities would diversify the available supply of energy. Compared to many other energy sources, wind energy is clean and safe. Wind facilities generally have a beneficial effect on air quality, by producing emission free energy, and thereby offsetting the need to produce equivalent energy from other sources. The Project includes an educational component in the form of a planned public information area. Locally produced wind energy could also increase local self-sufficiency.

Although Section 1.5 of the Windham Regional Plan identifies energy as the number one regional priority and the Proposed Action appears to be consistent with the stated energy goals, Section 4.2 of the Plan contains cautionary language about wind energy: "Wind power is clean and renewable, but turbine placement can be difficult and controversial because of natural resource impacts, aesthetics, and the need for turbine placement elevations between 2,500-3,300 feet which in Vermont often means in sensitive areas with thin soils and steep slopes." This FEIS evaluates the site-specific environmental and social resources that may be affected by the Deerfield Wind Project, and describes the environmental consequences of each alternative in various resource effects sections.

The Proposed Action also appears to be consistent with the stated energy policies of the Windham Regional Plan. As specified by energy policy #4, thorough studies and analyses of all anticipated socioeconomic and environmental impacts have been conducted. These studies are summarized in the various resource sections of this FEIS, and are included in the Project Record. Should a land use authorization be approved and a Special Use permit be issued for construction of a wind facility, the Forest Service would require the Applicant to adhere to a high environmental standard, avoiding adverse environmental impacts to the extent possible and mitigating unavoidable impacts. Energy policy #5 pertains to "new or improved energy transmission or distribution facilities," while energy policy #6 addresses the "extension of energy transmission or distribution facilities." The Proposed Action would construct a new substation, to be located adjacent to the existing 69 kV transmission corridor, which would be utilized rather than create new corridors. Aside from the substation, which minimizes impact through co-location with existing facilities, no new transmission or distribution facilities would be created, and no existing transmission or distribution facilities would be extended.

Despite apparent consistency with the Plan's stated energy goals and policies, the Proposed Action may not be entirely compatible with the intent of the Windham Regional Plan. Although none of the energy policies specifically pertaining to generation facilities mention avoiding resource lands, the Plan states, "It is important to limit and manage human interventions in resource areas." However, the Plan also states, "Any development or land use in these areas should be designed to have a minimal impact on the natural resource." The Proposed Action appears to comply with this guidance. Careful facility design, application of Forest Plan S&Gs, and implementation of design criteria and mitigation measures (see Appendix A) required by the Forest Service along with the conditions in the Vermont Public Service Board's CPG (see Appendix G) would all serve to minimize impacts to natural resources.

Chapter 8 of the 2010 Readsboro Town Plan addresses energy resources, including wind energy. From page 50, *"Ridgelines in and near Readsboro are capable of economic commercial-scale wind energy production. The potential economic and environmental benefits of wind as a clean and local energy supply must be balanced by analysis and mitigation of possible locally adverse impacts of large-scale installations in undeveloped areas of the Town*." The use of on-site or locally obtainable renewable energy resources is encouraged, as long as its implementation is consistent with resource conservation policies outlined in the Plan. In the Town Plan, the Town of Readsboro (2010) specifies the most important local issues to consider in the planning and design of wind energy facilities in the community:

- Economic Benefit to the Town – The concern is for the potential impact on local tax revenues, along with local employment and business opportunities. For a more detailed analysis of socioeconomics, refer to Section 3.14 of this FEIS.
- Aesthetic – The concern is for the potential impact on scenic views and rural landscape character. For a more detailed analysis of visual quality, refer to Section 3.5 of this FEIS.
- Environmental – The concern is over impacts of ridgeline development, and possible detriment to important wildlife habitat and migration routes. This issue has been examined through numerous independent studies and environmental assessments, and through consultations with state and federal agencies. The FEIS addresses ecological, avian, bat, and bear resources in Sections 3.9, 3.10, 3.11, and 3.12 respectively.

- Operational and safety – This category summarizes a range of safety concerns, including blade breakage, ice throw, automatic braking devices, trajectory of falling objects, and noise. Turbine noise and associated impacts are addressed in Section 3.4 of this FEIS, while potential public safety issues are addressed in Section 3.17.

As explained in Chapter 1.0, the Deerfield Wind Project has also undergone review at the state level by the PSB. In its deliberations on whether or not to issue a Certificate of Public Good that would allow a project to proceed, the PSB considers land use (as well as a number of other environmental and social issues) and overall benefits to the ratepayer. The PSB found that construction of the Deerfield Wind Project would "promote the general good of the State of Vermont," and issued a CPG on April 16, 2009. An amended final CPG was issued on July 17, 2009.

During Project construction, there would likely be some impacts to land use, mostly temporary and short-term. Disruptions to nearby forest management and timber harvest activities, and some recreational activities, can be expected. Movement of equipment and materials could temporarily block forest access roads and provide disruption to local travel on Routes 8 and 9. Construction would result in the clearing and grading of approximately 73.1 acres of NFS lands and 14.3 acres of private land, a total of 87.4 acres, thereby altering the use of approximately 0.9% of the 9,523-acre Project area. Should the land use authorization be approved, the issuance of a Special Use permit, would permanently alter the land use of those acres as long as the facility remains in operation and the permit remains in effect. This would include the NFS lands used to site the substation on the northern edge of the Western Project site. Some adjacent private land use along Putnam Road in this area would also be altered by the construction and operation of the O&M building and modifications to Putnam Road. This also would be evident for as long as the facility remains in operation.

During Project operation, land use impacts on surrounding forestland would be minimal. The proposed facility would not interfere with forest management operations or recreational opportunities on nearby lands. However, there could be a perceived change in land use in some areas. The remote or rural character of the area could be impacted in those locations where a number of the proposed turbines would be seen, or where the turbines could be viewed from foreground distances (i.e., under 0.5 mile). The character of the area affected is included in the discussion of visual quality in Section 3.5 of this FEIS.

All impacts associated with these disruptions and alterations are fully disclosed in the various resource sections of Chapter 3.0.

3.1.2.2 Alternative 1: No Action

Implementation of Alternative 1 would have no impact on land use within the Project area, or within the greater region. There would be no land cleared and no facilities constructed. Current land use patterns and Forest Service management practices in the area would likely remain unchanged for the foreseeable future.

3.1.2.3 Alternative 2: Reduced Turbines in the Western Project Site

Impacts to land use under Alternative 2 would be very similar to those described for the Proposed Action, except two fewer turbines would be visible from some locations (see Section 3.5). Construction under the Reduced West alternative would result in the clearing and grading of approximately 66.5 acres of NFS lands and 18.9 acres of private land, a total of 85.4 acres, thereby altering the use of approximately 0.9% of the 9,523-acre Project area, about the same as for the Proposed Action, thus permanently altering the land use of those acres as long as the facility remains in operation. The amount of acreage permitted for this Alternative would be the same or very close to that which would be issued for the Proposed Action. Alterations to private land use along Putnam Road would be the same as for the Proposed Action.

3.1.2.4 Alternative 3: Turbines in the Eastern Project Site Only

Impacts to land use under Alternative 3 would be similar to, but less than, those described for the Proposed Action. Although fewer turbines would be visible from some locations, the proposed substation for this alternative would be located adjacent to the existing GMP substation at the base of the eastern ridge, and therefore, more visible to travelers on Route 8 (see Section 3.5). Construction under the East Side Only alternative would result in the clearing and grading of approximately 29.7 acres of NFS lands and 19.9 acres of private land, a total of 49.6 acres, thereby altering the use of approximately 0.5% of the 9,523-acre Project area. This impact would be considerably less than that for the Proposed Action or Reduced West alternative. The types of disruptions described for the Proposed Action would also occur under the East Side Only alternative, but to a lesser degree, as construction would require less time. Land use on the Western Project site would only be slightly altered as no road or turbine construction would take place along the ridgeline, nor would the substation be located in this area. However, the temporary laydown area and O&M building would still be located on private land along Putnam Road, so those minor land use alterations would still exist. The acreage permitted under Alternative 3 would be expected to be substantially less (estimate approximately 30 acres) than the permitted acres for the Proposed Action and Alternative 2, since the Western Project site would not be used.

3.1.3 Cumulative Impacts

The analysis area for cumulative impacts to land use consists of the Project area, including both NFS and private lands, considering a timeframe of approximately 5 to 10 years for past and future actions. References to the life of the Project imply a span of 30 years, the expected term of any Special Use permit issued, or until the permit is no longer in effect. Past, present, and reasonably foreseeable future actions in the analysis area are discussed below.

Some of the past actions that have occurred over the last 5 to 10 years include timber harvesting on nearby private lands, small maintenance projects on local roads, and the existing Searsburg facility, which began operation in 1997 (slightly beyond the 5 to 10 year period). Construction of the existing Searsburg facility altered the use of approximately 35 acres of private land. Timber harvesting activities and road maintenance are in line with expected land use actions and therefore do not contribute any incremental impacts to existing land use.

Foreseeable future actions for the next 5 to 10 years could include Forest Service timber harvesting on nearby lands, although none is planned at this time. A landscape-scale planning effort for NFS lands south and west of the Project area is expected to begin in 2011. This planning effort might include additional GMNF lands south of Route 9 and east of the Project area as well. It would be at least one to two years beyond 2011 before any definite proposals would be analyzed. No specific proposals are known at this time. Timber harvesting on private lands in the Project area is expected to continue, but there is no record keeping nor advanced planning for future harvests on most of the private land in the Project vicinity (Fice, 2008). Similarly, no known road improvement projects (beyond those needed for the Deerfield Wind Project), or major land developments are currently proposed on Project area lands, although these could also occur within the life of the Project. Any private land development would need to be consistent with local Plans and regulations. These activities would be consistent with management direction for the area and therefore, these impacts would not be considered changes in land use. Development of the Deerfield Wind Project would permanently alter between approximately 30 and 80 acres of NFS lands, at least through the life of the facility. When combined with the alterations produced by the Searsburg Wind Facility, this would produce a minimal cumulative impact on land use in the Project area.

3.2 Geology and Soils

This section describes the existing geologic conditions in the Project area and the potential impacts at the Project site from the proposed Deerfield Wind Project. The information, including physiography, bedrock and surficial geology and soils, was compiled from available maps, reports and observations from the site-specific wetlands analysis and reconnaissance-level observations of the Project area. As further detailed below, the physiography, geology and soils are generally consistent throughout the Project area.

3.2.1 Affected Environment

The affected environment used to focus discussion of geology and soils impacts is the Project area. The area most affected would be the actual footprint of the Project at the Western Project site and the Eastern Project site.

3.2.1.1 Physiography and Bedrock Geology

The Project area lies within the Green Mountain physiographic region of Vermont, a primarily north-south trending mountain range that extends from northern Massachusetts into southern Quebec. The range is approximately 35 miles wide at the southern Vermont border, thinning to approximately 20 miles wide at the northern Vermont border with Canada. Its dominant structure is the massive Green Mountain north-south-trending anticline (upfold), which contains a core of hard gray Precambrian metamorphic gneiss overlain or flanked by Cambrian schists (Ratcliffe, 1994; Van Diver, 1987). The folding was caused long ago by tectonic compression and deformation, as an early proto-Atlantic Ocean closed during the Paleozoic Acadian orogeny. The Precambrian and Cambrian strata were pushed westerly, creating massive folds such as the Green Mountain anticline. Strata were also thrust westerly along a series of low angle thrust faults (Van Diver, 1987).

A series of mainly northeasterly trending thrust faults is mapped close to and parallel to Route 8, which bisects the Project area (Ratcliffe, 1994). Rocks to the east of the fault system (essentially at Route 8) are mapped as Cambrian-age schists, while west of the fault are the older Precambrian gneisses that form the core of the Green Mountain anticline. The Cambrian schists originally overlaid the Precambrian gneisses, but were eroded off the crest of the anticline and are now found only along its eastern and western flanks in southern Vermont (Doll, 1970).

Faulted rocks are more subject to erosion than intact rocks. The thrust fault system may have caused preferential erosion, creating the valley between the topographic highs to the west and east. Route 8 was constructed within the valley along the fault system. No other bedrock faults are mapped as having surface or near surface expression within the Project area, with the exception of a northeast-trending thrust fault that just clips the southeast corner of the eastern Project area south and east of Route 8 (Ratcliffe, 1994).

Despite the presence of these ancient fault traces, there are no active faults confirmed in Vermont (Ebel et al., 1995).

The proposed turbines would occupy ridgelines on either side of the valley along Route 8. The topographic elevations at the bases of the proposed turbines on the west side of Route 8 range from 2,750 to 2,900 feet above AMSL. Access to the Western Project site would be over the existing Putnam Road off Route 8, onto an existing unpaved Forest Service road. These access roads climb the northern nose of this ridgeline from an approximate base elevation of 2,500 feet, rising to 2,900 feet above AMSL.

On the east side of Route 8, the base elevations of the proposed turbines are higher, ranging from 2,900 to 3,100 feet above AMSL along the ridge. The existing access road to the Searsburg Wind Facility turbines would be utilized to construct the additional turbines in the Eastern Project site. The elevations along this access road range from 2,450 to 2,900 feet above AMSL.

Bedrock is mapped as exposed in a small area near the intersection of Putnam Road (the proposed northern access road) and Route 8 (Shilts, 1966). In other locations in the Project area, bedrock is covered by a thin mantle of glacial till, as discussed below. Based upon general soil characteristics and mapping by the National Resource Conservation Service (NRCS), depth to bedrock is estimated at less than 40 inches through much of the Eastern and Western Project site (NRCS, 2005).

On the ridgelines, bedrock can be expected from 2 to 40 inches below the ground surface, with slightly more soil cover typically found along the ridge flanks and within the valley near Route 8. In the valley, bedrock is anticipated at more than 60 inches below the ground surface. Numerical soil units mapped by NRCS in the Project area are shown on Figure 3.2-1. Table 3.2.1.1-1 includes the estimated depth to bedrock of each of the specific soil units shown on Figure 3.2-1, as well as other characteristics identified by NRCS that are pertinent to construction.

Table 3.2.1.1-1: Characteristics of Soils in Project Area

Map Unit Symbol	Map Unit Name	Agricultural Value[1]	Forest Value[2]	Potential Frost Action	Flooding Frequency	Highly Erodible Land Classification	Hydric Soils	Parent Material	Range of Depth to Bedrock (inches)	Range of Slopes (%)	Range of Seasonal High Water Table (feet)
003715D	Houghtonville-Rawsonville association, hilly, rocky	10	63	moderate	none	highly erodible	N	Glacial Till	greater than 20	8 to 35	greater than 6.0
003903C	Mundal-Wilmington association, rolling, very stony	10	63	moderate	none	highly erodible[3]	Y	Dense Till	greater than 60	3 to 25	0 to 2.5
003702E	Rawsonville-Hogback association, very hilly, very rocky	11	31	moderate	none	highly erodible	N	Glacial Till	10 to 40	25 to 60	greater than 6.0
003703C	Mundal-Houghtonville association, rolling, very stony	10	74	moderate	none	highly erodible	N	DT/GT[4]	greater than 60	8 to 15	greater than 1.0
00310E	Glebe-Stratton-Londonderry complex, very rocky	11	0	high	none	highly erodible	N	Glacial Till	2 to 40	25 to 60	greater than 6.0
003913E	Glebe-Stratton association, very hilly, very rocky	11	0	high	none	highly erodible	N	Glacial Till	10 to 40	25 to 60	greater than 6.0
00310D	Glebe-Stratton-Londonderry complex, very rocky	11	0	high	none	highly erodible	N	Glacial Till	2 to 40	15 to 25	greater than 6.0
003112D	Rawsonville-Hogback complex, very rocky	10	51	moderate	none	highly erodible	N	Glacial Till	10 to 40	15 to 25	greater than 6.0

Notes:

- From the report "Farmland Classification Systems for Vermont Soils", April, 2003. Groups 9 to 12 are considered to be unsuitable for crop production.
- The relative forest value of the map unit on a scale of 1 to 100, with 100 denoting the highest forest value.
- Soil map unit 003903C is defined as being potentially highly erodible.
- DT/GT is Dense Till/Glacial Till.

3.2.1.2 Surficial Geology

With the exception of limited areas of exposed bedrock (see above), a thin veneer of glacial till is mapped over the entire Project area (Shilts, 1966). Based upon NRCS soil maps, the till is up to 3 feet thick in the uplands, with thicker sequences in the valley along Route 8 (NRCS, 2005).

No metallic resources, such as iron, gold, uranium or lead, have been mapped in or near the Project area as of 1986 (McBean, 1986a). No non-metallic resources, such as sand and gravel, have been mapped in or near the Project area (Vermont Geological Survey, 1993; McBean, 1986b). The soils in the Project area are considered poor potential sources of sand and gravel (NRCS, 2005). A wetland area (Wetland S) with disturbed sandy soils just west of Route 8 and north of a possible southern access road (previously under consideration but since eliminated) may have been the result of sand or gravel removal (see Section 3.8.1.1), but its small size is indicative of non-commercial activity.

3.2.1.3 Soils

Soil types mapped by the NRCS within and adjacent to the Project area and their characteristics were obtained from a CD of Vermont soils issued by the Vermont Center for Geographic Information (VCGI) and the NRCS (NRCS, 2005, 2006). Soils within the Project area were downloaded onto a Geographic Information Systems (GIS) map overlaying proposed Project components.

A total of eight soil unit associations and complexes are mapped within the Project area; these are shown by numerical soil units on Figure 3.2-1. Characteristics of these soils relating to potential construction limitations were obtained from the NRCS database (NRCS, 2005) and are presented in Table 3.2.1.1-1. Glacial till and dense glacial till derived from granite and schist are the parent materials of all soils in the Project area, which are noted as very rocky. The soils are typically well drained on glaciated uplands, and none are identified as subject to flooding.

Soil types mapped in the Project area are indicative of those that form over steep slopes, ranging from 8 to a maximum of 60% from the horizontal plane. Soils that typically form on slopes greater than 40% are mapped along the subject ridgelines on both sides of Route 8. As expected due to the slopes, virtually all soils are considered highly erodible in the Project area, as shown on Figure 3.2-2. More detailed soil descriptions are available from the Vermont Center for Geographic Information and NRCS (NRCS, 2005, 2006).

Areas with slopes greater than 15%, and therefore susceptible to erosion, are color-coded on Figure 3.2-3. These areas are largely limited to the proposed transmission line linking the turbines in the Western Project site with the Searsburg Wind Facility transmission line, and the existing access road to the Searsburg Wind Facility turbines, which would be extended to access the Eastern Project site.

Steeply sloped areas within the Project site have the potential for land or rock slides, debris flows or mud slides, especially when vegetative cover is removed during construction and during heavy rainstorms (see Section 3.2.2).

Only one soil mapped by NRCS in the Project area (Mundal-Wilmington association, rolling, very stony) has a hydric (wetland) soil component. The Wilmington soil component is a hydric soil formed from poorly drained glacial till. The Wilmington hydric soil component of the association comprises approximately 15% of the association map unit. Moderately well-drained Mundal soils comprise approximately 70% of the map unit, while other non-hydric soils comprise the remaining 15% of the association (NRCS, 2008).

Three turbines would be constructed just within or immediately adjacent to these associated soils in the northwestern portion of the Western Project site. Site-specific soil types were identified in wetlands delineated within the Project area, as discussed in Section 3.8. Wetland soil types ranged from deep (greater than 4 feet) organic peats in spruce-fir-tamarack swamps to shallow peat soils in seepage wetlands. Peat-rich soils over silt-loam and over rock, and gleyed (indicative of excessive moisture) sandy soils were also encountered in individual wetlands.

No prime farmland soils and no soils of statewide importance have been designated by NRCS in the Project area. The agricultural values assigned for the mapped soils indicate all are unsuitable for crops production (NRCS, 2005). This is consistent with the lack of agricultural fields in the Project area. The relative forest values of the soil units assigned by NRCS range from 0 to 74 on a scale of 0 to 100, with 100 denoting the highest forest value (see Table 3.2.1.1-1).

Potential frost action was noted as moderate to high in all soils, the latter in the Glebe-Stratton soil association and complexes along the southernmost ridge of the turbines proposed east of Route 8.

3.2.2 Direct and Indirect Impacts Presented by Alternative

One significant issue was identified during Project scoping relating to soil resources. People were concerned that the Proposed Action would adversely impact soil and water resources, resulting in unacceptable sedimentation, erosion, and loss of wetlands. The soil resources component of this issue will be discussed in this section. Potential impacts to water resources and water quality and to wetlands and floodplains are assessed in Sections 3.7 and 3.8, respectively.

Indicators were selected to help define and compare how proposed activities for each alternative would impact soils and geology. The first indicator is the percentage of affected area where slopes exceed 15%. Soils disturbed during construction on steep slopes are at increased risk of eroding during rain events through fluvial transport of sediment downgradient into low areas, streams, and wetlands. The second indicator is the acres of permanently reduced soil productivity resulting from the proposed activities. Soil productivity would be reduced in areas where topsoils are permanently removed, where soils are compacted and permanently devegetated (such as roads) and occupied by structures. Soil productivity, or its capacity to sustain native vegetation, is used here as a measure of the quality of the soil resource.

Table 3.2.2-1 presents a summary of the anticipated impacts to soils and geology from the Proposed Action and each alternative, organized by the indicators: steep slopes and loss of soil productivity. Note that the land area affected by construction exceeds the anticipated operational impacts for the Proposed Action and each action alternative. This is because construction impacts include all areas of operational impacts, in addition to those areas to be temporarily cleared of vegetation during construction, such as laydown areas, turbine workspaces, and the edges of access roads. Since vegetation in these areas would be allowed to revegetate following construction, impacts to such areas are considered temporary, and are not included as operational impacts. Operational impacts consist of those areas converted to built facilities (e.g., access roads, substation, turbine bases, and the O&M facility), and those areas subject to grading that would not be restored during Project operation (e.g., the fill is required to support access roads or other built facilities).

The Proposed Action and alternatives under consideration would not result in any impacts to prime farmland or agricultural soils, as none have been identified in the vicinity of the Project area. No protected unique geological features, economic minerals and sediments, or active agricultural farmlands have been identified in the Project area, and therefore none would be affected by the proposed Project.

Table 3.2.2-1: Comparison of Soils Issues and Indicators by Alternative

Issue	Indicator	Proposed Action	Alternative 1: No Action	Alternative 2: Reduced West	Alternative 3: East Only
Potential for Soil Erosion and Sedimentation into Wetland	*Total Construction Disturbance*	87.4 acres	None	85.4 acres	49.6 acres
	Affected Area with Slopes greater than 15%	24.8 acres (28%)	None	28.6 acres (33%)	23.1 acres (47%)
Loss of Soil Productivity	*Operational Disturbance*	61.5 acres	None	56.5 acres	36.1 acres

3.2.2.1 Proposed Action

The Proposed Action would require clearing and grading of approximately 87.4 acres during construction. Approximately 30% of the area disturbed during construction (25.9 acres) would be stabilized, revegetated, and restored following construction.

The presence or absence of certain geologic conditions could pose construction limitations. These include steep and/or unstable slopes, terrain with the potential for rock or mudslides, and shallow bedrock that may require blasting. Direct and indirect impacts addressed in this section are those typical of disturbance to soil and rock during a construction project.

3.2.2.1.1 Erosion

Construction of the Project would require site preparation, including both clearing and grading. Existing vegetation would be cleared and removed from work areas, increasing the risk of erosion. Work areas are associated with installation of new access roads, temporary widening of existing access roads, site preparation and construction of turbine pads, assembly and installation of the turbines themselves, construction of the O&M building and the substation, the electrical collection system, and the temporary laydown areas. Once vegetation is removed in the work areas, soils would be excavated to achieve necessary grades. During construction, the gravel surface of the access roads would be 22 feet wide over most sections, reduced from the 35-foot nominal width described in the DEIS. Where necessary, the gravel surface would be wider (up to 36 feet) to allow large construction equipment to navigate sharp turns. Grading would typically extend approximately 5 to 10 feet to either side of the gravel road surface, and clearing approximately 20 to 30 feet to either side. The total construction disturbance area, presented above in Table 3.2.2-1, includes all grading and clearing. Where possible, the gravel surface of the access roads would be reduced to approximately 16 feet wide after completion of construction, with the margins revegetated to reduce erosion. However, in order to maintain a stable road surface, the cut and/or fill required to support the road would not be re-graded during Project operation.

As shown on Figure 3.2-2, all soils in the Project area are considered by NRCS to be highly erodible. Because disturbed soils on slopes are particularly prone to erosion, slopes greater than 15% within work areas were identified as indicators of erosion risk. As shown on Figure 3.2-3, the proposed turbine locations along the crests of the east and west ridgelines are generally on slopes of less than 15%. Slopes greater than 15% are found on either side of Route 8 where the existing Searsburg Wind Facility access road and substation are located. About 24.8 acres of slopes greater than 15% would be disturbed to construct the Proposed Action (28% of the 87.4-acre construction area, as reported on Table 3.2.2-1).

Erosion would also be possible due to alteration of surface drainage patterns. The grading that occurs during and after construction, if done without regard for surface drainage runoff patterns, can cause ponding and erosion, and impact vegetative cover. Grading would be designed to manage runoff and achieve long-term stabilization of both restored temporary work areas and areas with permanent Project components.

Construction plans and permits would include a stormwater management plan detailing structures such as ditches, water bars, culverts, temporary sediment basins, and other such features that would effectively minimize erosion. Final grading would be designed and implemented to minimize drainage problems that may result in erosion of soils and sedimentation into water bodies. Drainage structures would be kept in working order, in compliance with Forest Plan standard S-6 for soil, water, and riparian area protection and restoration. Section 3.7 Water Quality and Water Resources discusses the amount of impervious surfaces that would result from the construction of roads and turbine pads, and how these would affect soils and water resources. The Proposed Action would not result in wide-scale conversion of land to impervious surfaces. With proper application of design criteria, mitigation measures, and Forest Plan S&Gs, adverse impacts to soils from stormwater runoff are anticipated to be negligible.

A number of design criteria and mitigation measures would be implemented to minimize erosion risks. For example, to meet requirements of the CPG issued by the Vermont PSB, VHB Pioneer (2008) prepared a preliminary Project-specific Erosion Prevention and Sediment Control Plan (EPSCP). The exact details of the EPSCP, and its "operational phase stormwater permit" would be expected to continue evolving through preparation of this FEIS, but will be finalized "prior to creation any impervious surfaces at the site" (Condition #18 of the CPG). The Final EPSCP would be compliant with the Forest Plan's applicable S&Gs, particularly those for soil, water, and riparian area protection and restoration, including standards S-2, S-3, and S-4, and guidelines G-3, G-5, G-6, G-7, and G-10. The EPSCP would also be compliant with Vermont Acceptable Management Practices (AMPs), the Stormwater Management Rule, and the Vermont Standards and Specifications for Erosion Prevention and Sediment Control. All soil protection and restoration measures would be shown on proposed Project plans and documentation, copies of which would be provided to the general contractor and all subcontractors.

Prior to the start of work, all wetlands, surface water bodies and identified sensitive resources within and adjacent to construction activities would be shown on plans. Erosion control measures would be placed in the field in accordance with the plans. Such measures would include staked hay bales, siltation fencing, temporary siltation basins, temporary slope breakers, temporary earthen berms, sand bags and other appropriate materials. Blocking of existing surface water drainage and subsurface drainage features would be avoided during road construction or stockpiling of soils. Any damage to drainage features would be repaired or replaced. Restoration and revegetation would be performed as soon as possible to avoid exposed areas that would be sources of erosion or sedimentation. Disturbed areas would be reseeded with appropriate temporary or permanent seed mix of native species following backfilling and final grading. Follow-up inspections of all disturbed areas would be done after the first and second growing seasons to determine the success of revegetation, and to correct problems as needed.

During preparation of the conceptual EPSCP prepared for the PSB review, extensive field review was conducted at the Project site to assess proposed construction sites and delineate sub-watersheds. Preliminary stormwater treatment designs and practices were subsequently developed for both construction and operation of the proposed Project, consistent with the Forest Plan and the Vermont Stormwater Management Manual. The EPSCP narrative details the expected sequence of construction activities, and includes examples of the types of measures that would be implemented during each activity to reduce stormwater impacts. According to the EPSCP, construction would proceed in a phased approach that would ultimately limit the extent of exposed soil at any one time, and would require temporary or permanent stabilization of exposed areas as soon as practicable. Specific EPSCP measures that could be implemented during construction include, but are not limited to, up-slope diversion of run-off; limits of disturbance barrier fence and flagging; silt fencing, both with and without reinforcement; grass- and stone-lined swales; stone check dams; temporary and permanent stream crossings; rock sandwiches; temporary and permanent stabilization with seed, mulching/matting, and/or wood chips; temporary sediment basins; level spreaders; and the use of vegetative buffers (VHB Pioneer, 2008).

The conceptual EPSCP also addresses operational stormwater management facilities through associated maps, tables, and site plans. The following five criteria were applied to the development of operational stormwater treatment plans: water quality, channel protection, recharge, overbank flood, and extreme storm. The goal(s) of each of these criteria are described below.

- Water Quality Goals: to provide for reliable pollutant removal for runoff from impervious surfaces, to capture 90% of the annual storm events, and to remove 80% of average annual total suspended solids load.

- Channel Protection Goal: to control the quantity of stormwater in order to protect the channel stability of receiving waters.

- Recharge Goal: to maintain existing ground water levels and the average annual recharge rate by allowing infiltration of a specific quantity of stormwater on a developed site.

- Overbank Flood (Q10) and Extreme Storm (Q100) Goals: to reduce downstream flooding potential during major storm events by controlling post-development peak discharge rates so that the pre-development peak discharge rate is not exceeded.

Wet ponds, in conjunction with other treatment measures, are proposed to meet the water quality, channel protection, overbank flood, and extreme storm criteria, while grass channels are proposed to meet the recharge standard in areas of existing low slope. Opportunities for supplement swales to provide additional recharge and infiltration are also under consideration for areas where site conditions would facilitate such practices. Maps associated with the conceptual EPSCP depict the locations of sub-watersheds, along with potential locations for retention basins, receiving waters, and discharge points. Final treatment measures and their locations will be identified in the final EPSCP and associated maps, which would be included in the Deerfield Wind Project Record, and incorporated as necessary into any Special Use permit or construction permits issued by the Forest Service. See also Sections 3.7 and 3.8 for further discussion of the EPSCP.

3.2.2.1.2 Sedimentation of Streams and Wetlands

Erosion from disturbed soils can indirectly cause sedimentation of downgradient streams and wetlands adjacent to work areas. Sections 3.7 Water Quality and Water Resources and 3.8 Wetlands and Floodplains fully disclose potential impacts to these resources. Implementation of erosion control and sediment management measures, as described above, would result in little or no risk of sedimentation of disturbed soils into streams and wetlands.

3.2.2.1.3 Soil Displacement

Areas of cut and fill are likely within the Project area, and would be identified by design engineers during final design. In cut areas where grades need to be lowered, soils would be excavated and removed to achieve finished grade. These areas could include access roads, which need to achieve certain grades, and building the turbine foundations, which may need leveling of the ground surface during site preparation. Soils would be directly displaced by these activities, and would be used as fill to build up grades in other locations, if appropriate. Soils would also be displaced if blasting occurs.

On steep slopes, mud slides that would result in soil displacement can be initiated by blasting vibrations, as well as failure due to loading, especially when soils are wet and contain clay.

Sloped areas would be monitored and activities that could cause slides on unconsolidated slopes, such as stockpiles and use of heavy equipment, would be avoided in vulnerable areas.

3.2.2.1.4 Soil Productivity

Loss of soil productivity is a direct impact to soil primarily due to vegetation removal, excavation, and overall disturbance to the soil structure. Soil productivity can also be reduced due to compaction. The Forest Service defines soil productivity as the inherent capacity of a soil to support the growth of specified plants, plant communities, or a sequence of communities. It may be expressed in terms of volume or weight per unit per area per year, or another measure of biomass accumulation (USDA Forest Service, 2006a).

Because soil productivity is expected to recover in areas where vegetation would be cleared to construct the Proposed Action and then allowed to revegetate during operation, reduction in soil productivity would occur primarily on the footprints of the substation, O&M building, foundation pads at each wind turbine, and roads needed for Project operation. Where possible, the gravel surface of the access roads would be reduced to approximately 16 feet wide after construction. However, in order to maintain a stable road surface, the cut and/or fill required to support the road would not be re-graded during Project operation. Therefore, all areas subject to grading during Project construction could experience a loss of soil productivity, and the impacts described herein and presented above in Table 3.2.2-1 include all areas that would be graded.

The Proposed Action would utilize 1.03 miles of roads now servicing the Searsburg Wind Facility, and would require the construction of 5.07 miles of new access roads. The estimated total acreage of which soil productivity would be directly impacted is 61.5 acres.

3.2.2.1.5 Accidental Release of Oil or Hazardous Materials

Use of heavy equipment can lead to inadvertent spills or releases of oil and hazardous materials. Release of oil or hazardous materials into soils and/or bedrock, if not discovered and remediated, can result in contamination of these resources, and, if the release is substantial, to downgradient water resources. However, the risk of adverse impacts from the release of oil or hazardous materials would be minimized or eliminated through proper application of design criteria and mitigation (see Appendix A) and relevant Forest Plan S&Gs for soil, water, and riparian area protection and restoration, including S-2 and S-4. To comply with S-2, soil-disturbing activities would be separated as much as possible (subject to any necessary project-specific amendments to S-2; see Section 3.8.2.1.4) from water sources by a protective strip of predominantly undisturbed soil with plant and/or organic matter cover. The purpose of the protective strip would be to protect the soil's infiltration capacity, and to filter out sediment and pollutants. S-4 would limit the locations in which vehicles and other construction equipment could be serviced and refueled. Such activities would be located outside the protective strip, in a location approved by a Forest Officer. Any fuel leaks from such equipment would be repaired immediately, and a supply of acceptable absorbent materials would be kept on the Project site for use in the event of a hazardous fluid spill.

Design criteria include development of a Spill Prevention, Control, and Countermeasures Plan (SPCCP) to describe the procedures that would be used to prevent oil pollution during Project construction and operation, and the response measures that would be implemented should a spill occur. CH2M HILL (2008b) prepared a draft SPCCP for the proposed Project in accordance with 40 CFR 112 and associated United Stated Environmental Protection Agency (USEPA) regulations. This report is included in the Project Record. The hierarchical objectives of the SPCC Plan are as follows: (1) to prevent spills from occurring, (2) to prepare for potential spills, and (3) to respond quickly and appropriately if a spill does occur. The SPCCP provides an inventory of all oil-filled equipment and oil storage containers to be located at the Project site, including storage containers at the O&M facility, lubricating and hydraulic oils in the turbine towers/nacelles, and mineral oil at the substation. Storage specifications and inspection standards described in the SPCCP would reduce the likelihood of spills. Any releases of oil or hazardous materials would be addressed immediately upon detection, using the procedures and equipment described in the SPCCP, and reported in accordance with all applicable laws and regulations. See also Sections 3.7 and 3.8 for further discussion of the SPCCP.

3.2.2.1.6 Blasting

Blasting of bedrock may be required at the turbine locations to install the foundation to design depth. Blasting can cause indirect impacts due to vibrations transmitted through rock. Vibrations in the immediate vicinity of the blast can alter local fracture patterns and resulting groundwater flow in bedrock aquifers. Drinking water for users along Route 8 near the Project area is supplied by private groundwater wells. The nearest drinking water well to a turbine location is located approximately 0.5 mile from the perimeter of the Project, at the closest house, a distance that is not expected to result in any impacts to the well (see also Section 3.7). Nonetheless, identification and protection of area groundwater wells, particularly those tapping bedrock aquifers, would be addressed and safeguarded by compliance with measures contained in a Blasting Plan, to be prepared following receipt of permits.

The Applicant would be required to develop a Blasting Plan prior to performing any blasting for the Project. The Blasting Plan would include pre- and post-blast surveys of wells and structures in the surrounding area. Pursuant to the Certificate of Public Good (CPG) issued by the PSB, the Applicant would be required to arrange for a public information session with surrounding landowners to address concerns related to blasting. The Blasting Plan would be prepared by a licensed professional engineer, and all blasting activities would be carried out by licensed and certified blasting technicians. The blasting contractor would have all necessary certifications, e.g., from the Vermont Department of Public Safety. The Plan would detail pre- and post-blasting inspections, safety measures, notification procedures, hours of operation, fly rock control, and other steps to be taken to ensure blasting is conducted properly. Furthermore, the Blasting Plan would require all blasting activities be conducted in accordance with applicable laws and regulations, including the CPG for the Project; the Blasting Guidance Manual issued by the U.S. Department of Interior Office of Surface Mining, Reclamation, and Enforcement; and the U.S. Department of Interior Rules 816.61-68 and 817.61-68.

In the event that any nearby landowner reports adverse impacts from blasting on their wells or other structures, the Applicant would be required to perform a post-blasting evaluation to determine if blasting-related damages have occurred. If the post-blast inspections show damage in comparison with the pre-blast surveys, the Applicant would be required to remediate any such damages.

3.2.2.1.7 Summary Of Proposed Action

Approximately 87.4 acres of surface soils would be disturbed during construction of the Proposed Action. This includes all areas that would be cleared and/or graded to construct the Project, both during construction and operation (for life of Project). Approximately 28% (24.8 acres) of this area would be on slopes greater than 15%. Approximately 30% (25.9 acres) of the ground surface area disturbed during construction would be stabilized, revegetated, and restored following construction. Areas to be restored would include temporary laydown areas and access road margins, which would be reduced from widths needed for construction equipment to approximately 16 feet for facility operation, as described in Section 3.2.2.1.1. Approximately 61.5 acres of land surface would be permanently occupied by the Proposed Action, at least through the life of the Project. These 61.5 acres would therefore be considered the land area where soil productivity would be permanently reduced.

The Proposed Action would result in direct impact to soils, including disturbance, compaction, loss of productivity, displacement, and the potential for erosion and sedimentation into down-gradient wetlands and water bodies. The application of Forest Plan S&Gs and the design criteria and mitigation described in Appendix A would minimize these impacts to the extent possible. However, it must be acknowledged that any recovery of lost soil productivity after the life of the Project would be a long-term process. Construction would be compliant with all state and federal permits, site-specific plans detailing construction methodologies, and sediment and erosion control plans. The Applicant and the Forest Service would employ one or more individuals to provide oversight during construction to ensure compliance with all plans and permit conditions and that design criteria, mitigation measures, and Forest Plan S&Gs are properly implemented. Upon completion of construction, a Forest Service Special Use permit administrator would oversee the terms and conditions of the Special Use permit during Project operation, including any required Project operation monitoring. All these compliance features would equally apply to activities that effect water resources and wetlands, as described in Sections 3.7 and 3.8, respectively.

3.2.2.2 Alternative 1: No Action

No turbines, access roads, or other Project components would be constructed under the No Action alternative, and therefore no direct, indirect, or cumulative impacts to soils or geology would be anticipated other than those associated with continuing and on-going Forest Service and private land management activities and natural processes within the Project area. Soils and geology would continue to be managed under the directives outlined in the Forest Plan for the assigned Diverse Forest Use MA.

3.2.2.3 Alternative 2: Reduced Turbines in Western Project Site

Approximately 85.4 acres of surface soils would be disturbed during construction of the 15 turbines and associated facilities that comprise this alternative, as shown in Table 3.2.2-1. Approximately 33% of this area (28.6 acres) would be on slopes greater than 15%, which is similar to, but somewhat greater than, the percentage of sloped areas in the Proposed Action (28%). Given this, the erosion potential indicated by the amount of activities on slopes greater than 15% would be similar to that of the Proposed Action.

Approximately 34% (29.0 acres) of temporarily disturbed surface area (for example, road edges and laydown areas) would be stabilized, revegetated, and restored following construction. The Reduced West alternative would utilize 1.03 miles of roads now servicing the Searsburg Wind Facility, and would require the construction of 4.45 miles of new access roads. The estimated total acreage in which soil productivity would be directly impacted is 56.5 acres.

The same design criteria and mitigation would be applied for this alternative as for the Proposed Action. Given the slightly reduced area of construction for the Reduced West alternative, this alternative would result in minimal impacts in regard to soil resources, slightly less than those for the Proposed Action.

3.2.2.4 Alternative 3: Turbines in Eastern Project Site Only

Approximately 49.6 acres of surface soils would be disturbed during construction of the seven turbines and associated facilities, including the east side substation, the O&M building and temporary laydown areas, that comprise this alternative, as shown on Table 3.2.2-1. Approximately 47% of this area (23.1 acres) would be on slopes greater than 15%, which is higher than the percentage of sloped areas in the Proposed Action (28%) or Reduced West alternative (33%). Given this, the erosion potential indicated by the amount of activities on slopes greater than 15% would be slightly less in terms of acreage, but a higher proportion than that of the other action alternatives.

Approximately 27% (13.5 acres) of temporarily disturbed surface area (for example, road edges and laydown areas) would be stabilized, revegetated, and restored following construction. The East Side Only alternative would utilize 1.03 miles of roads now servicing the Searsburg Wind Facility, and would require the construction of 1.92 miles of new access roads. The estimated total acreage in which soil productivity would be directly impacted is 36.1 acres. This would be approximately 59% of the area anticipated for the Proposed Action. Soil and rock disturbance would not occur on the western ridge under this alternative with the exception of disturbance for construction the O&M building and the temporary laydown area.

The same design criteria and mitigation would be applied for this alternative as for the Proposed Action. Given the substantially reduced area of construction for the East Side Only alternative, this alternative would result in minimal impacts in regard to soil resources, much less than those for the Proposed Action or Alternative 2.

3.2.3 Cumulative Impacts

The area for the cumulative impacts analysis of soils and geology is the Project area, with particular attention given to the actual construction work areas and blasting areas.

The only past activities that have occurred within the cumulative effects analysis area in the last 5 to 10 years was the operation and maintenance of the Searsburg Wind Facility which began operations in 1997 (slightly beyond the 5 to 10 year period), routine road maintenance, and small timber sales on private lands. There is no evidence of long-term adverse impacts from these activities. Although the Searsburg Wind Facility resulted in some loss of soil productivity where access roads, turbines and other components are in place over the life of that project, soil and geologic conditions temporarily disturbed during construction have revegetated and stabilized. The geology and physiology of the area, including drainage features and streams, have recovered and are functioning properly.

Reasonably foreseeable future actions that could affect soils and geology in the Project area include Forest Service timber harvesting, road improvement projects, and large scale developments on adjacent private lands, such as residential subdivisions and commercial or industrial projects. Although no timber sales or other large scale ground disturbance activities are currently planned by the Forest Service within the cumulative impact analysis area for the foreseeable future, if they do occur these activities would be conducted in compliance with Forest Plan S&Gs to minimize impacts. A landscape-scale planning effort for NFS lands south and west of the Project area is expected to begin in 2011. This planning effort might include additional GMNF lands south of Route 9 and east of the Project area, as well. It would be at least one to two years beyond 2011 before any definite proposals would be analyzed. No specific proposals are known at this time.

No known road improvement projects or major land developments are proposed or anticipated in the next 5 to 10 years. Large projects on private lands would likely be subject to review by town and possibly state and/or federal agencies. Any approvals by regulatory bodies would be conditioned to require compliance with best management practices, to minimize environmental impacts such as erosion of soils and sedimentation into wetlands and water bodies. Very little private land lies within the Project area.

Blasting of rock could occur as part of site preparation for these types of projects. Blasting would be expected to be conducted using best management practices by qualified blasting contractors, would occur only in the localized construction area and for limited time periods as need given the specifics of the Project.

Although the Proposed Action and Alternatives 2 and 3 would most likely result in some potential for soil erosion, sedimentation, displacement, and loss of soil productivity, these impacts are anticipated to be minor and would likely add little to the overall potential cumulative impacts. Combined with little or no past and foreseeable future impacts, there would be little or no cumulative impacts to geology and soil resources.

3.3 Climate And Air Quality

This chapter describes the existing climate and air quality in the Project area and the potential impacts to climate and air quality that may result from the proposed Project.

3.3.1 Affected Environment

The affected environment for climate and air quality discussions will focus primarily on the Project area and surrounding vicinity, using precipitation and temperature to characterize climate. The air quality discussion will also include conditions in areas beyond the Project vicinity, and will include air quality monitoring data from various nearby and statewide stations, and a regional perspective as applicable.

3.3.1.1 Precipitation and Temperature

The NRCS of the USDA maintains and monitors National Water and Climate Centers (NWCCs) in numerous locations throughout the United States, including two in Bennington County, Vermont. Both Bennington County substations have complete data for precipitation only, not temperature; therefore available data from adjacent counties in Vermont, Massachusetts, and New York were examined for their relevance to the Project area.

Data collected at the NWCC substation in Heath, MA, the nearest substation most relevant to the Deerfield Project area, shows that the 30-year average precipitation for the period of 1971 to 2000 at Heath is 51.36 inches per year. June, with an average precipitation of 4.90 inches, is historically the wettest month of the year, and February, with 3.33 inches, is historically the driest. The 30-year average snowfall recorded at Heath is 80.7 inches per year. December and January are historically the snowiest months of the year, with annual averages of 16.5 and 21.1 inches, respectively. The average annual precipitation has decreased approximately 2 inches over this time period.

A minority of the 17 NWCC substations in the seven-county area examined collect temperature data. Due to their elevations and locations, no single temperature substation is representative of the Project area. This being the case, data from the two nearest substations is presented in the table below as providing the best available information for the region. Based on the data in the table below for the period of 1971 to 2000, the average annual daily maximum temperature is 54.3° to 55.4° Fahrenheit (F), and the average annual daily minimum temperature is 31.7° to 36.0° F. Historically, January is the coldest month, with an average daily temperature of 17.3° to 20.3° F and July is the warmest, with an average daily temperature of 67.8° to 68.2° F. NWCC substations do not provide annual summary statistics for temperature. Available annual maximum, mean, and minimum temperatures were obtained from Weather Underground (http://www.wunderground.com) for 1999 to 2007 from the nearest airport weather station, William H. Morse State Airport in Bennington, Vermont. Average annual temperature from this time period is 46.75° and there was no discernible trend over time.

Table 3.3.1-1: Project Area Temperature Data

NWCC	Elevation (Feet AMSL)	Estimated Distance from Project Site	Avg. Daily Max Temp	Avg. Daily Min Temp	Coldest Month	Avg. Daily Temp	Warmest Month	Avg. Daily Temp.
Cavendish, VT	800	38 miles north-northeast	55.4° F	31.7° F	January	17.3° F	July	67.8° F
Grafton, NY	1,560	24 miles west	54.3° F	36.0° F	January	20.3° F	July	68.2° F

3.3.1.2 Air Quality

Air quality data for Vermont are published annually by the Vermont Department of Environmental Conservation (VTDEC) Air Pollution Control Division. The most recent summary of air quality data available for the state, as verified in June 2011, is the *2005 Annual Report on Air Quality* (VTDEC, 2005). Included in this report are ambient air quality data through 2004, as well as long-term monitoring trends in air quality that were collected and compiled from monitoring stations across the state. The data presented indicate that the air quality at all monitoring stations is in compliance with the National Ambient Air Quality Standards (NAAQS) for ozone (O_3), particulate matter (PM) less than 2.5 microns in diameter ($PM_{2.5}$), PM less than 10 microns in diameter (PM_{10}), carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2). Vermont is not required to measure ambient lead concentrations and is presumed to be in compliance with the NAAQS for lead. While technically in compliance with the NAAQS, the concentrations at the two O_3 monitoring sites were both equal to 100% of the eight-hour average O_3 NAAQS during 2004.

The EPA Green Book (USEPA, 2010a) lists Currently Designated Nonattainment Areas for All Criteria Pollutants by county for the entire United States. As of its last update on January 6, 2010, the entire State of Vermont is designated as in attainment of the NAAQS for all criteria pollutants (CO, NO_2, O_3, lead, PM_{10}, $PM_{2.5}$, and SO_2).

Air emissions originating in the Project area are related primarily to vehicular travel and forestry activities. Vehicles traveling area roads produce exhaust emissions, along with dust from unpaved road surfaces.

Federally mandated air emissions standards and regulations (e.g., the Clean Air Act Amendments of 1990) have been enacted in an attempt to reduce air emissions from fossil fuel burning power plants, which are seen as primary acid rain sources. Many studies and reports have noted the effects of acid deposition in the Northeast, including the Adirondack Mountains and the Green Mountains (Jenkins et al., 2005; Campbell et al., 1997; Matteson, 2005). Several programs monitor and track acid deposition. As detailed in Jenkins et al. (2005), the monitoring systems are coordinated by the National Acid Precipitation Assessment Program, a cooperative program among many United States government agencies and Departments. Much of the actual monitoring is conducted by the National Trends Network (NTN), a network of 145 member institutions.

The VTDEC has monitored precipitation events through the Vermont Acid Precipitation Monitoring Program (VAPMP) at several sites in Vermont since 1980, with Underhill and Mt. Mansfield being the two stations most recently in operation (Pembroke, 1999). The National Atmospheric Deposition Program/National Trends Network (NADP/NTN) operates a nation-wide network of precipitation monitoring stations, one of which is located in and operated by the City of Bennington and the State of Vermont (National Atmospheric Deposition Program, *Undated*).

There is also a Clean Air Status and Trends Network station located in Bennington County south of the Kelley Stand Road near Lye Brook Wilderness that is operated by the USEPA. Meteorological parameters, wet and dry deposition, and O_3 are measured at the site (USEPA, 2010b).

In addition, there is an Interagency Monitoring of Protected Visual Environments station located on Mt. Equinox in Manchester, Vermont. This station monitors for air particulates and is operated by the Forest Service in cooperation with the EPA. This station is part of a nation-wide network of sites, and data is used to characterize national, regional, and statewide trends in air particulates (Interagency Monitoring of Protected Visual Environments, 2008).

According to the website of the VTDEC Water Quality Division, VTDEC has been monitoring the chemistry of acid-sensitive lakes since 1980. In 1983, the Vermont Long-Term Monitoring Project (VLTM) was initiated within National Acid Precipitation Assessment Program and has since been conducted in cooperation with the USEPA to monitor the chemistry of 11 lakes (VTDEC, 2003). Monitoring of stream water chemistry has also been conducted to assess the impacts of acid deposition (Campbell et al., 1997). Stream water chemistry at high elevation ponds in southern Vermont has dramatically changed since the passage of the Clean Air Act Amendments to reduce acid rain in 1990. Since that time, sulfur levels at high altitude lakes have declined approximately 40%, while nitrogen levels have remained relatively stable. Likewise, acidity levels (pH) have remained fairly stable since 1990, despite the reduction in sulfur levels presumably due to the concurrent depletion of base cations in the soil (Kellogg, 2008).

3.3.2 Direct and Indirect Impacts Presented by Alternative

No significant issues related to climate and air quality were identified during the scoping process. Various comments received from the public suggest that a discussion highlighting the benefits to air quality from the use of alternatives to fossil fuels (green power) should be included in the EIS, along with identification of the potential reductions in air emissions that could result from Project operation.

Two indicators, changes in precipitation and changes in average temperatures, will be discussed briefly in regard to effects on local and regional climate. A number of indicators will serve to focus the discussion on air quality, including discussion of climate change and global warming. These indicators include dust, vehicle emissions, CO_2 emissions, and emissions of PM, NO_X, and SO_2. Since it is difficult to separate direct and indirect impacts to air quality, no attempt will be made to distinguish between the two.

3.3.2.1 Proposed Action

All the proposed activities, including the harvesting of trees to clear roads and turbine areas, and the actual construction of the facility would occur in a rather finite space and over a relatively short time (one construction season). As such, the proposed Project would have no measurable direct or indirect impacts on local and regional precipitation and temperature. Trends in precipitation and temperature would not be expected to vary from those over the recent past as a result of only the proposed Project activities.

During the site preparation and construction phases of the proposed Project, temporary minor adverse impacts to air quality would result from the operation of construction equipment and vehicles. Impacts would occur as a result of emissions from engine exhaust and the generation of dust during earth-moving and forestry activities, and travel on unpaved roads. Dust could cause annoyance and potentially impact property through dust depositing on surfaces at certain locations or residences located adjacent to unpaved town roads or Project access roads. These impacts would be expected to be short-term and localized.

Several design criteria would be implemented to minimize the amount of dust generated by construction activities. The extent of exposed or disturbed areas on the Project site at any one time would be minimized, and those areas would be restored or stabilized as soon as practicable. Construction crews would be limited to traffic speeds of 25 mph or less on unpaved access roads to minimize generation of dust. Disturbed areas would be re-planted or graveled to reduce wind-blown dust. Construction activities and traffic would be monitored for dust problems. Water and other dust abatement materials would be used to wet down dusty roads (public roads, as well as Project access roads) during the duration of construction activities. Section 3.15 on Transportation and Roads also discusses dust abatement measures.

In addition, car-pooling among construction workers would be encouraged to minimize construction-related traffic and associated emissions. All vehicles used during construction would comply with applicable Federal and state air quality regulations. Operational measures such as limiting engine idling time and shutting down equipment when not in use would be implemented.

Electricity generated by this Project would directly displace the generation of energy at existing conventional power plants, and would thereby displace pollutants emitted by these facilities. This conclusion is supported by a 2008 U.S. Department of Energy (USDOE), National Renewable Energy Laboratory report that states, "Wind energy generation results in reductions in air emissions because of the way the electric power system works. Wind energy is a preferred power source on an economic basis, because the operating costs to run the turbines are very low and there are no fuel costs. Thus, when the wind turbines produce power, this power source will displace generation at fossil fueled plants, which have higher operating and fuel costs." Air quality benefits occur when wind generated power reduces the combustion of fossil fuels at existing power plants (Jacobsen & High, 2008).

According to ISO New England Inc.'s 2010 Regional Profile, electricity in the region is generated from the following sources: natural gas (41%), oil (1.5%), nuclear (29%), coal (15%), and hydroelectric/other renewables (14%). Natural gas and oil are the marginal fuel units in New England's power pool, or those that are turned on or off as the load fluctuates; electricity generated by the proposed Project would not displace hydroelectric or nuclear power (ISO-NE, 2009). When the proposed Project is generating power, electricity generation from natural gas and oil would be reduced within the region. However, because the proposed Project would not always be producing power (i.e., the wind is not always blowing sufficiently to generate electricity), it is recognized that these sources would not experience a constant reduction in use.

Once in operation, the Project would produce 99,776 MWh of electricity annually (accounting for the 33.5% capacity factor, or the fact that the Project would not always be generating energy). After considering the effects from loss of carbon sequestration and the emissions from construction and road building, the Project would result in a beneficial impact on air quality by producing electricity without any emissions to the atmosphere. The annual production of wind energy by the Project would reduce CO_2 emissions, which contribute to global warming, by an amount equivalent to removing about 11,000 to 13,000 cars from the road in the near-term (calculated using USEPA Greenhouse Gas Calculator, 2001).

Synapse conducted a study for the Deerfield Wind Project to assess the effects of the Project in reducing air emissions (Hausman et al., 2006). The analysis projected considerable reductions in contaminants resulting from the Project's power generation. The estimated emission reductions that would result from the Proposed Action are presented in Table 3.3.2-1 below. The near-term analysis is based on the current mix of power generating facilities in the Northeast United States and which generating units would be the marginal units that would be displaced were the Deerfield Project to be constructed. The shifting of the marginal fuel units as loads shift during each day and over the course of the seasons is accounted for. The long-term analysis accounts for the expected change in the mix of power generating facilities in the Northeast United States in Year 8 and beyond, as well as the expected growth in power demand. The intermediate- or mid-term analysis accounts for the transition in mix of power generating facilities in the Northeast United States and uses displaced emission factors intermediate between the short- and long-term values. The forecasted emission displacements provided below for the Proposed Action assume a total nameplate capacity of 34 MW, consisting of 17 Gamesa G80 wind turbines operating at a 33.5% capacity factor (or 99,776 MWh annually).

In the case of CO_2, the emissions reductions listed below would be partially offset during the first year by certain construction activities, including the permanent removal of existing tree cover from the Project area and access road construction. As described in Section 3.9.2.1.1, it is estimated that approximately 87.4 acres would be cleared of tree cover for the Proposed Action.

The longest running direct measurement of carbon uptake by a northern hardwood forest is at the Harvard Forest in western Massachusetts. The mean annual carbon uptake, measured during 1993 to 2000, is 2.0 plus or minus 0.4 Mega-grams Carbon per hectare per year, or 0.89 tons of carbon per acre per year. The Harvard Forest was significantly damaged (75% loss of crown cover) by a hurricane in 1938, and is still regrowing after that event (Barford et al., 2001). This carbon uptake rate sequesters approximately 3.3 tons of CO_2 per acre per year. By comparison, a mature spruce-fir forest (approximately 90 years old) in Maine (the Howland Forest) has a mean annual carbon uptake, measured during 1996 to 2002, of 1.74 plus or minus 0.46 Mega-grams Carbon per hectare per year, or 0.78 tons of carbon per acre per year (Hollinger et al., 2004). This carbon uptake rate sequesters approximately 2.8 tons of CO_2 per acre per year.

Age makes a big difference, with younger forests taking up carbon at a faster rate than older forests. Site productivity, disturbance, and other factors that affect growth rates may also be important. The rates cited above are comparable to the values used for estimating the carbon budget of United States forests, for the specific forest types and ages represented by these two sites.

The most conservative approach to assessing the loss of CO_2 sequestration potential assumes that 87.4 acres of forest would be removed, that no vegetation of any sort would regrow on those 87.4 acres (which would not be the case, depending upon the amount of acreage allowed to revegetate as roads narrow back down), and that the higher of the two rates cited in the studies described applies (3.3 tons of CO_2 per acre per year). This would result in a maximum lost sequestration potential estimated to be 288 tons of CO_2 per year. When this lost sequestration potential is compared to the Total Annual Reductions at 99,776 MWh in Table 3.3.2-1, it is found to reduce predicted reduction in CO_2 by only 0.4% in Years 1 to 4 and only 0.6% in Years 8 and beyond. These changes to predicted CO_2 reduction, while real, are most likely less than the margin of error for the predictions in Table 3.3.2-1, and therefore are negligible in the current analysis.

A worst-case scenario of emissions that would be created by access road construction can be approximated based on published estimates for highway construction of 1,400 to 2,300 tons of CO_2 per mile. These estimates account for the manufacturing of steel, concrete, and other construction materials used to build paved roads, and includes fuel consumed by construction equipment (Williams-Derry, 2007). Note that in areas of steep embankments or sharp turns, guardrails would likely be constructed for the safety of long-term operations and maintenance personnel, but materials used for the guardrails would be minimal compared to paving materials included in the published estimates. The Proposed Action would create 5.07 miles of new roadway, and upgrade 1.03 miles of existing roadway to accommodate widths needed for construction. The most conservative approach to assessing CO_2 emissions from access road construction assumes that road upgrades would emit the same amount of CO_2 as new construction, and uses the highest value of 2,300 tons of CO_2 per mile. This would result in an estimated 14,030 tons of CO_2 emitted from access road construction. When compared to the estimated annual reduction presented in Table 3.3.2-1, this would diminish predicted CO_2 reductions by 20% in the first year of operation, but would not change emission displacements in subsequent years. However, it is important to note that the access roads for the Proposed Action would be narrower than a typical highway, and would be surfaced with gravel rather than paved, (i.e., no concrete or steel construction materials would be used). Therefore, the actual CO_2 emissions generated by construction of Project access roads would likely be substantially less than those presented below in Table 3.3.2-1. No information is available as to the emissions produced by construction of gravel roads.

Table 3.3.2-1: Estimated Emissions Reductions Resulting from the Proposed Action

Compound	Annual Reduction (tons per year)	Annual Reduction (tons per year)	Annual Reduction (tons per year)	Annual Reduction (tons per year)
	Year 1	Near-term, Years 2 to 4	Mid-term, Years 5 to 7	Long-term, Years 8+
NO_X[1]	99.1	99.1	67.5	34.9
SO_2[1]	271.2	271.2	147.9	25
CO_2[1]	70,580	70,580	61,231	51,883
CO_2 Offsets[2]	288/14,030	288	288	288
Total CO_2 Reductions	**56,262**	**70,292**	**60,943**	**51,595**

[1] Based on data presented in Hausman et al. (2006), adjusted for 33.5% capacity factor (Zimmerman, 2007b).
[2] Estimated CO_2 offsets of 288 tons for tree removal and 14,030 tons for access road construction based on data presented in Barford et al. (2001) and Williams-Derry (2007), respectively.

As described above, the Proposed Action would be expected to reduce current emissions from existing fossil fuel-fired power plants, and delay increased use of fossil fuels over the long term. Fossil fuel-fired power plants are major emitters of CO_2, which contributes to global warming as the primary greenhouse gas. According to the VTDEC Air Pollution Control Division website, "there is a growing scientific consensus that increased anthropogenic emissions of CO_2 are enhancing the natural greenhouse effect, resulting in changes in the earth's climate. Climate change poses serious potential risks to human health and ecosystems globally, regionally, and in Vermont. Capping CO_2 emissions from fossil fuel-fired electricity generation… will create an incentive for the creation and deployment of more efficient fuel burning technologies, renewable resources, and end-use efficiency resources and is expected to lead to lower dependence on imported fossil fuels in the region" (VTDEC, 2007).

As indicated above in Table 3.3.2-1, relatively large CO_2 reductions, totaling up to 70,292 tons per year for Years 2 through 4, would positively contribute to efforts to address climate change and lessen the region's dependence on imported fossil fuels. In addition, this reduction in emissions would contribute to improving the health of ecosystems globally, regionally, and in Vermont. A corresponding long-term benefit (Year 8 and beyond) would also be produced.

The Project would also reduce the emissions of oxides of nitrogen and sulfur, which contribute to acid rain, thereby reducing deposition of sulfates and nitrates, which contribute to the acidification of soil. Other pollutants from coal combustion not quantified in the Synapse report include PM, carbon monoxide (CO), volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs), dioxins, hydrochloric acid, and hydrofluoric acid, as well as elements such as mercury, arsenic, silicon, calcium, chlorine, lead, sodium, aluminum, iron, lead, magnesium, titanium, boron, and chromium, and the radioactive elements potassium-40, uranium, and thorium (USEPA, 1995; Gabbard, 2001). In addition, the primary component of natural gas is methane, which is itself a greenhouse gas with a global warming potential 21 times that of CO_2 (USEPA, 2002). Some unburned methane is emitted from the combustion process (USEPA, 1995) and other methane escapes into the atmosphere from its production at the wellhead to its final use. The EPA estimated that in 1997, 32.9 million metric tons of carbon equivalent or 18% of U.S. methane emissions were emitted in this way (USEPA, 1999). Though very difficult to quantify, any development of energy from wind power such as the Deerfield Wind Project could reduce pollutants produced from natural gas combustion as the need for energy from this source is reduced.

If the displaced power production were to result from wood combustion, rather than coal or natural gas combustion, CO_2 would not be an important issue because the carbon in wood is already part of the biosphere, not newly released from fossil fuels. However, there would still be displacement of emissions of the criteria pollutants $PM_{2.5}$, PM_{10}, CO, NO_2, and SO_2, as well as VOCs, PAHs, and trace elements (USEPA, 1993). In addition, concentrations of radioactive cesium in some wood ash in the Northeast (resulting from atomic weapons testing in the 1950s and 1960s) have been shown to be on the order of 100 times the concentration allowed to be released in nuclear power plant sludge (Science News, 1991).

Due to the absence of air emissions from combustion processes, the Project would not be subject to the Regional Greenhouse Gas Initiative (RGGI). The RGGI caps CO_2 emissions from fossil fuel fired power plants 25 MW and larger, and is the first mandatory, market-based effort in the United States to reduce greenhouse gas emissions. From 2009 to 2014, CO_2 emissions from fossil fuel-fired power plants in RGGI participating states (Vermont and nine other New England and mid-Atlantic states) are capped at 188 million tons of CO_2 per year. Beginning in 2015, the cap will decrease by 2.5% per year, for a total reduction of 10% by 2018. Under the RGGI cap-and-trade program, participating states issue one "allowance" for each ton of CO_2 emissions covered by the state's cap. Nearly all CO_2 allowances are distributed through quarterly CO_2 allowance auctions. At the end of each three-year control period, regulated power plants must submit one CO_2 allowance for each ton of CO_2 emitted over the preceding three years (RGGI, 2010). As described above, when the proposed Project is generating power, electricity generation from natural gas and oil would be reduced within the region. By displacing CO_2-emitting power sources, the proposed Project would decrease the demand for emissions allowances, thereby lowering costs throughout the State of Vermont and the RGGI region (Hausman, 2007).

3.3.2.2 Alternative 1: No Action

No new turbines, access roads, or other Project components would be constructed under the No Action alternative, and therefore there would be no direct or indirect impacts to local and regional climate factors of precipitation and temperature. Trends for these local and regional factors would be expected to continue as in the recent past.

There would be no further direct or indirect impacts, beneficial or adverse, to air quality in the Project area beyond those associated with maintaining the status quo. There would be no impacts from construction activities, and since the entire State of Vermont is designated as in attainment of the NAAQS for all criteria pollutants (CO, NO_2, O_3, lead, PM_{10}, $PM_{2.5}$, and SO_2), this would continue to be the case under the No Action alternative.

Since no permanent tree removal would be occurring under No Action, trees would continue to provide the beneficial impact of sequestering carbon at the rates discussed above. However, the tradeoff would be that this impact would not match the beneficial impact on air quality from the production of 34 MW of electricity without any emissions to the atmosphere. The overall reduction of CO_2 emissions, which contribute to global warming, by an amount equivalent to removing about 11,000 to 13,000 cars from the road in the near-term as shown for the Proposed Action would not be realized. In addition, under the No Action alternative, risks to human health and ecosystems associated with climate change and dependence on imported fossil fuels would not be decreased.

3.3.2.3 Alternative 2: Reduced Turbines in Western Project Site

Reducing the number of turbines by two for this alternative would produce no direct or indirect impacts to the local and regional climate factors of precipitation and temperature. The spatial distribution would remain the same as for the Proposed Action and the length of time to implement the proposed activities would be slightly shorter. Trends for these local and regional factors would be expected to continue as in the recent past.

Removal of two turbines from the Western Project site would result in a very slight reduction of temporary air quality impacts from construction related to dust and vehicle emissions compared to those anticipated for the Proposed Action.

The 15-turbine Reduced West alternative would have a nameplate capacity of 30 MW (less than the 34 MW capacity of the Proposed Action), but due to the combination of G87 and G80 turbine models, would achieve a comparably higher capacity factor of 35.2%. Given that, emission reductions from displaced fossil fuel generation would be very similar to those identified above in Tables 3.3.2-1. As shown in Table 3.3.2-2 below, there would still be a considerable net air quality benefit of reduced emissions from the Reduced West alternative. Though these CO_2 emission reductions are slightly less than those that would be realized under the Proposed Action, they would nevertheless contribute to a decrease in health and ecosystem risks associated with climate change and the dependence on imported fossil fuels. The forecasted emission displacements provided below for the Reduced West alternative assume a total nameplate capacity of 30 MW, consisting of five Gamesa G80 and ten Gamesa G87 wind turbines, operating at a 35.2% capacity factor (92,506 MWh annually).

As described in Section 3.9.2.3, approximately 85.4 acres of forest would be cleared under the Reduced West alternative. Using the most conservative approach to assessing the loss of CO_2 sequestration from forest clearing, as described above in Section 3.3.2.1, a maximum lost sequestration potential is estimated to be 282 tons of CO_2 per year. When this lost sequestration potential is compared to the total annual emissions reductions in Table 3.3.2-2, the forest clearing associated with the Reduced West alternative would reduce predicted CO_2 displacements by only 0.4% in Years 1 to 4 and only 0.6% in Years 8 and beyond, which would essentially be the same as for the Proposed Action.

The Reduced West alternative would create 4.45 miles of new access roads, and upgrade 1.03 miles of existing roadway to accommodate widths needed for construction. Using the most conservative approach to assessing CO_2 emissions from access road construction described above in Section 3.3.2.1, the Reduced West alternative would result in an estimated 12,604 tons of CO_2 emitted from access road construction. When compared to the estimated annual reduction presented in Table 3.3.2-2, this would diminish predicted CO_2 reductions by 19% in the first year of operation, but would not change emission displacements in subsequent years.

Table 3.3.2-2: Estimated Emissions Reductions Resulting from the Reduced West Alternative

Compound	**Annual Reduction** (tons per year)	**Annual Reduction** (tons per year)	**Annual Reduction** (tons per year)	**Annual Reduction** (tons per year)
	Year 1	Near-term, Years 2 to 4	Mid-term, Years 5 to 7	Long-term, Years 8+
NO_X[1]	92	92	63	32
SO_2[1]	251	251	137	23
CO_2[1]	65,436	65,436	56,770	48,102
CO_2 Offsets[2]	282/12,604	282	282	282
Total CO_2 Reductions	**52,550**	**65,154**	**56,488**	**47,820**

[1] Based on data presented in Hausman (2008), adjusted for 35.2% capacity factor (PSB, 2009).
[2] Estimated CO_2 offsets of 282 tons for tree removal and 12,604 tons for access road construction based on data presented in Barford et al. (2001) and Williams-Derry (2007), respectively.

3.3.2.4 Alternative 3: Turbines in Eastern Project Site Only

This alternative would eliminate most activities on the Western Project site and thus result in a smaller project implemented over a shorter time. However, it would still occur within one construction season. As such, there would be no direct or indirect impacts to the local and regional climate factors of precipitation and temperature. Trends for these local and regional factors would also be expected to continue as in the recent past.

If no turbines were constructed in the Western Project site, there would be a further reduction of temporary air quality impacts related to dust and vehicle emissions from those anticipated for the Proposed Action. Alternative 3 would eliminate any of the construction related temporary impacts to air quality on the Western Project site as described above, and the construction period would be shorter.

The 7-turbine East Side Only alternative would have a nameplate capacity of 14 MW, less than half of that of the Proposed Action. Given that, emission reductions from displaced fossil fuel generation would be appreciably less than those identified above in Tables 3.3.2-1 and 3.3.2-2. As shown in Table 3.3.2-3 below, there would still be a net air quality benefit of reduced emissions from the East Side Only alternative. This benefit would be substantially reduced when compared to the Proposed Action and the Reduced West alternative. Though these CO_2 emission reductions are much less than those under other action alternatives, these reductions would still contribute to a decrease in health and ecosystem risks associated with climate change and the dependence on imported fossil fuels. The forecasted emission displacements provided for the East Side Only alternative assume a total nameplate capacity of 14 MW, consisting of five Gamesa G80 and two Gamesa G87 wind turbines operating at a 34.2% capacity factor (41,943 MWh annually).

As described in Section 3.9.2.4, approximately 49.6 acres of forest would be cleared under the East Side Only alternative. Using the most conservative approach to assessing the loss of CO_2 sequestration from forest clearing, as described above in Section 3.3.2.1, a maximum lost sequestration potential estimated to be 164 tons of CO_2 per year. When this lost sequestration potential is compared to the total annual emissions reductions in Table 3.3.2-3, the forest clearing associated with the East Side Only alternative would reduce predicted CO_2 displacements by only 0.6% in Years 1 to 4 and only 0.8% in Years 8 and beyond.

The East Side Only alternative would create 1.92 miles of new access roads, and upgrade 1.03 miles of existing roadway to accommodate widths needed for construction. Using the most conservative approach to assessing CO_2 emissions from access road construction, as described above in Section 3.3.2.1, the East Side Only alternative would result in an estimated 6,785 tons of CO_2 emitted from access road construction. When compared to the estimated annual reduction presented in Table 3.3.2-3, this would diminish predicted CO_2 reductions by approximately 23% in the first year of operation, but would not change emission displacements in subsequent years.

Table 3.3.2-3: Estimated Emissions Reductions Resulting from the East Side Only Alternative

Compound	**Annual Reduction** (tons per year)	**Annual Reduction** (tons per year)	**Annual Reduction** (tons per year)	**Annual Reduction** (tons per year)
	Year 1	Near-term, Years 2 to 4	Mid-term, Years 5 to 7	Long-term, Years 8+
NO_X[1]	41.7	41.7	28.4	14.7
SO_2[1]	114.0	114.0	62.2	10.5
CO_2[1]	29,669	29,669	25,740	21,810
CO_2 Offsets[2]	164/6,785	164	164	164
Total CO_2 Reductions	**22,720**	**29,505**	**25,576**	**21,646**

[1] Based on data presented in Hausman et al. (2006), adjusted for 34.2% capacity factor.
[2] Estimated CO_2 offsets of 164 tons for tree removal and 6,785 tons for access road construction based on data presented in Barford et al. (2001) and Williams-Derry (2007), respectively.

3.3.3 Cumulative Impacts

The Project area would serve as the cumulative impact analysis area for impacts related to weather factors and air quality. Past projects from the last 5 to 10 years and foreseeable future projects for the next 5 to 10 years would be appropriately considered.

Since there would be no direct or indirect impacts to local and regional precipitation and temperature expected from the Project, there would be no additive impacts on these weather factors in regard to past or foreseeable future trends. Therefore no measurable cumulative impacts to these weather factors would be anticipated.

During Project construction, there would be a slight adverse cumulative impact in general air quality over the Project area, mainly temporary and relatively short-term, due to vehicle and equipment emissions. Over the past 5 to 10 years, impacts to air quality over the Project area, though not quantifiable over this period, have generally been minimal and mostly associated with local vehicle traffic and perhaps a small amount of timber harvesting on private land. There have been no major construction activities of the magnitude of the Proposed Action in the Project area. Construction of the Searsburg Wind Facility was completed in 1997 (slightly beyond the 5 to 10 year period of past activities considered for cumulative impacts discussions). Beyond the additive impacts of the Proposed Action, no additional large-scale construction on private or public lands is anticipated in the future 5 to 10 year period. No large-scale timber harvesting is planned in the Project area on NFS lands in the next 5 to 10 years. A landscape-scale planning effort for NFS lands south and west of the Project area is expected to begin in 2011. This planning effort might include additional GMNF lands south of Route 9 and east of the Project area, as well. It would be at least one to two years beyond 2011 before any definite proposals would be analyzed. No specific proposals are known at this time. Even if any large projects were to be implemented, the incremental amount of adverse impact to air quality would be minimal and short-lived.

Impacts to air quality, particularly carbon emissions, are also considered for the effect they have on the global climate situation. In order to adequately discuss cumulative impacts as they exist for the global climate situation, the affected environment will be the global atmosphere. It should be recognized though, that global climate change and global warming has been affected and will continue to be affected for a longer period of time than the cumulative 10 to 20 years (before and after) used to characterize impacts for this Project. More importantly, relevant research on this topic has just recently been developing and will continue to develop at a rapid pace.

This research is showing that adverse impacts from global warming and climate change are already being exhibited worldwide due to emissions of methane, carbon, SO_2, and NO_X. Direct impacts to air quality to be considered in the following discussion of cumulative impacts for the Deerfield Project include those from vehicle and equipment emissions, changes in carbon sequestration, and offsets in emissions due to the production of emissions-free wind energy, including the existing Searsburg facility and the Proposed Action. Indirect impacts to be considered would be in regard to the effects the overall changes these emissions would have on global warming and climate change.

The Searsburg Wind Facility is a 6 MW project that generated 11,486 MWh of electrical power in 2005 (from EIA/DOE Form 906/920). Weighted average emission factors indicate the amount of emission reductions per MWh. According to the Synapse report, these values will vary in the near, intermediate, and long-term futures, based on the mix of fuels anticipated to be utilized in each timeframe. Using weighted average emission factors from the Synapse report, estimated emissions reductions from the Searsburg Wind Facility were calculated based on the actual 2005 generation data. These values are presented in the Table 3.3.3-1 below.

Table 3.3.3-1: Estimated Emissions Reductions Due to the Existing Searsburg Wind Facility

Compound	Annual Reduction (tons per year)	Annual Reduction (tons per year)	Annual Reduction (tons per year)
	Near-term, Years 1 to 4	Mid-term, Years 5 to 7	Long-term, Years 8+
NO_X	11	7	4
SO_2	31	17	3
CO_2	8,126	7,047	5,973

Note: Timeframes represent operational years of the Proposed Deerfield Project. Based on Searsburg generation data from 2005, and weighted emission factors presented in Hausman et al., 2006.

The cumulative impacts of the proposed Project and the existing Searsburg Wind Facility would include the reductions in emissions shown above for the existing Searsburg facility, as well as those quantified in Section 3.3.2 above for the proposed Project. Just as there would be a beneficial direct cumulative impact to air quality from reductions in NO_x, SO_2, and CO_2, so would there be a beneficial direct cumulative impact from reductions of the many other pollutants listed in Section 3.3.2 above, including those associated with coal and natural gas combustion, and pollutants associated with acid rain.

Any adverse impact from vehicle and equipment emissions and from loss of carbon sequestration due to tree removal would be offset by long-term reductions in carbon, sulfur, and nitrogen oxides emissions from the Proposed Action and Reduced West alternative, and to a lesser extent from the East Side Only alternative. Therefore, in each of these cases, a beneficial net cumulative impact to air quality would result. No additional cumulative impact would result from the No Action alternative.

Electricity generated by this Project would directly displace the generation of energy at existing conventional power plants, and would thereby displace pollutants emitted by these facilities. Because the operating costs to run the turbines are very low and there are no fuel costs, wind energy is a preferred power source on an economic basis. Since air quality benefits occur when wind generated power reduces the combustion of fossil fuels at existing power plants (Jacobsen & High, 2008), adding more wind energy facilities in the eastern U.S. would further reduce the amount of energy and associated emissions produced by fossil fuel facilities.

At this time, it is expected that two or three additional wind facilities could be permitted in Vermont within the next 5 to 10 years. Also, the 30 MW Hoosac Wind Power Project in northern Massachusetts, south of the Deerfield Project, has recently been approved and construction is currently underway. It is speculative as to the number of other emissions free electric generating facilities that may come on line in this future period that could further reduce emissions and improve air quality. It can be anticipated that each of these future facilities would also result in a beneficial net cumulative impact to air quality. This net improvement to air quality worldwide should indirectly affect the global warming and climate change situation but, from a global perspective, the small amount of decrease in emissions and subsequent improvements in air quality from the Deerfield Wind Project and foreseeable future projects in this area cannot effectively be modeled at this time. Therefore, although beneficial, the cumulative impact overall to global warming and climate change is not yet measurable.

3.4 Noise

This section summarizes the existing sound environment in the vicinity of the Project area, and potential impacts that could occur from noise produced during construction and operation of the proposed Deerfield Wind Project. The information presented within this Section is largely based on site-specific noise studies prepared by Resource Systems Group, Inc. (RSG) of White River Junction, Vermont. RSG is a member of the National Council of Acoustical Consultants, and the RSG engineer who prepared the studies is board certified by the Institute of Noise Control Engineering.

3.4.1 Affected Environment

The Affected Environment used to describe potential noise impacts for the Proposed Action and alternatives includes the Project area and surrounding vicinity, including as far north as parts of Route 9, west into the George D. Aiken Wilderness, and south and east into portions of the Lamb Brook Area. Background sound in this area would include noise produced by the existing Searsburg facility. RSG has conducted several noise studies over the course of Project planning, both to document existing sound levels in the Project area and to model anticipated sound levels during Project construction and operation. Each of these studies is described briefly below, and can be found in full in the Project Record.

- RSG prepared a *Noise Primer* dated March 23, 2006 that provides an overview of basic sound principles, including the properties of sound and how sound propagates in the environment. The primer also discusses how noise is measured, modeled, and mitigated, and includes a glossary to assist the reader in understanding the specialized terms used in noise monitoring and assessment. The *Noise Primer* is attached as Appendix B of this FEIS.
- RSG conducted fieldwork in the Project area during November and December of 2005. Using that data and the initial Project configuration of 24 turbines, RSG prepared *Noise Impact Study for Deerfield Wind, LLC, Searsburg/Readsboro, Vermont*, dated December 28, 2006.
- In 2007, the Applicant modified the Project layout, reducing the number of proposed turbines from 24 to 17, and RSG re-ran the noise modeling for the revised Project configuration, issuing an updated *Noise Impact Study for Deerfield Wind, LLC, Searsburg/Readsboro, Vermont* dated September 13, 2007.
- The Applicant subsequently determined that the Gamesa G80 turbine model would be better suited to the Project site than the models previously considered. Therefore, RSG re-ran the noise modeling for the Project using the new turbine, and issuing a *Revised Noise Impact Study for Deerfield Wind, LLC, Searsburg/Readsboro, Vermont* dated November 28, 2007.
- On April 3, 2008, the GMNF Responsible Official finalized the range of alternatives to be analyzed in full detail in the EIS. This range of alternatives has been reviewed during analysis of comments on both the DEIS and the SDEIS, and remains intact as first approved. RSG subsequently re-assessed potential noise impacts for the Proposed Action and each of the three Alternatives described in the DEIS: No Action, Reduced Turbines in Western Project

Site, and Turbines in Eastern Project Site Only. The findings of this analysis are summarized in a memo dated May 5, 2008.

- To reduce Project impacts to bear habitat, the Applicant again modified their application to the Vermont PSB, to a 15-turbine layout that closely resembles the Reduced West Alternative analyzed in the DEIS. This layout would include 10 Gamesa G87 turbines, and five Gamesa G80 turbines. Accordingly, RSG re-ran the noise model for the revised layout, summarizing the results in a memo dated July 1, 2008.
- The Vermont PSB Certificate of Public Good conditions contained noise standards, measured in dBA(exterior)(Leq)(1 hr), as described below in Section 3.4.1.2. Therefore, RSG issued the noise figures in these units in a memo dated June 3, 2010.

The noise studies listed above were prepared according to procedures for modeling sound as specified in the International Standards Organization (ISO) standard ISO 9613-2, dated 1996, entitled *Acoustics—Attenuation of Sound During Propagation Outdoors—Part 2: General Method of Calculation*. The methodology and findings of these studies are presented in the Sections below.

3.4.1.1 Selected Noise Primer Terms

To aid the reader in interpreting results presented in the following sections, definitions of selected terms are summarized here from the *Noise Primer* (Appendix B). The Primer was prepared by RSG (2006) to assist the reader in understanding the specialized terms used in noise monitoring and assessment.

Noise is a sound of any kind, especially with a connotation of unwanted or undesired sound. To understand noise, RSG suggests that one must first understand sound. The sound we experience every day is the rapid vibration of air that we sense with our ears. Sound propagates through air as a compression wave, and can also travel through solids and liquids. The effect perceived by the ear as sound is a very small and rapid change in air pressure. The pressure ratio is expressed on a logarithmic scale in decibel (dB) units. Approximate levels of commonly experienced sounds include 50 dB for a typical quiet office, 60 dB for ordinary conversational speech, 75 dB inside a vehicle traveling at 65 mph with the windows up, and 90 dB for a heavy truck at 50 feet.

Sound can be measured in many different ways. An instantaneous measurement gives the sound pressure level at that exact moment in time. The level could be 62 dB, but a split second later it could be 57 dB, as sound pressure levels are constantly changing. Therefore, noise and sound are generally described in terms of time. One of the most common ways of describing noise levels is in terms of the continuous equivalent sound level (Leq) over a monitoring period. The Leq is the average of the sound pressure over an entire monitoring period, which could be any defined amount of time. The one-hour Leq is noted as Leq(1); the Leq over 24 hours is written as Leq(24). Since the Leq is the average sound pressure, loud and infrequent noises have a greater effect on the resulting level than quieter and more frequent noises. For example, the Leq average of 60 dB and 40 dB is 57 dB. Because it weights higher sound levels, and is representative of sound that takes place over time, the Leq is the most commonly used descriptor in noise standards and regulations. The day-night sound level (Ldn) is similar to the Leq, but applies a 10 dB penalty to the nighttime Leq between 10 pm and 7 am.

Statistical sound levels, such as L_{10}, L_{50} and L_{90}, give information about the distribution of sound levels over time. The L_{50} is the sound level that is exceeded 50% of the time, or the median level; it is usually lower than the Leq level. The L_{90} is the sound level that is exceeded 90% of the time, and filters out sporadic, short-duration noise events, thereby capturing the quiet periods between such events. The L_{90} can be thought of as the quietest 10% of a time period, and since it generally excludes transient sound events, and is a relative base level which most sound exceeds.

Since sound pressure levels are measured on a logarithmic scale, they cannot be arithmetically added or subtracted to determine the total sound pressure of all noise sources in an area. Sound pressure levels in decibels must first be converted back to standard pressure values, then added or subtracted, and then converted back to the logarithmic scale. An easier method is shown below in Table 3.4-1.

Table 3.4-1. Decibel Addition

If Two Sources Differ By	Add to the Higher Level
0-1 dB	3 dB
2-4 dB	2 dB
5-9 dB	1 dB
>9 dB	0 dB

Source: RSG, 2006.

This method requires no conversion; only the difference between the two sound levels is required. For example, to calculate the combined sound level for two separate sources with levels of 70 and 75 dB, one need only determine the difference between the two sound levels, and then consult Table 3.4-1. Because the difference between 75 and 70 dB is 5 dB, 1 dB must be added to the higher of the two levels. Therefore, the sum of 70 dB and 75 dB is 76 dB.

The human ear is capable of perceiving a wide range of sounds, from the high-pitched sounds of a bird song to the low-pitched sound of a bass guitar. Sounds are perceived based on their loudness (i.e., volume or sound pressure level, measured in dB) and pitch (i.e., tonal or frequency content). The standard unit used to describe the tonal or frequency content of sound is the Hertz (Hz), measured in cycles per second. A young, healthy human ear can typically perceive sounds ranging from 20 Hz to 20,000 Hz. However, the human ear is not equally sensitive to all frequencies. Despite being the same decibel level as each other, mid-range frequencies seem louder than high or low frequencies. For example, a 500 Hz tone at 80 dB sounds significantly louder than a 63 Hz tone at 80 dB. For this reason, acousticians apply frequency "weightings" to sound levels. The most common weighting scale used in environmental noise analyses is the A-weight (dBA), because it most accurately represents the sensitivity of the human ear (RSG, 2006; Colby et al., 2009).

Wind turbine sound can originate from mechanical or aerodynamic mechanisms. Mechanical sound originates from the gearbox and control apparatus, and is effectively controlled by standard noise control techniques. Aerodynamic sound, often described as "swishing," is produced by the rotation of the rotor blades through the air, and is typically the dominant source of noise from modern wind turbines. Aerodynamic sound is generated at the highest levels during the downward motion of the rotor blade, resulting in a periodic rise in sound level, referred to as amplitude modulation. This modulation occurs approximately once per second, and the frequency content of this fluctuating sound is typically between 500 Hz and 1,000 Hz (Colby et al., 2009).

3.4.1.2 Noise Standards

RSG completed a review of noise regulations at the federal, state, and local levels. There are no quantitative noise standards in the Towns of Searsburg or Readsboro. In addition, there are no state statutes or regulations that establish quantitative noise standards that would apply to the Project. Some federal agencies have adopted standards for exterior noise that apply to other types of projects (such as transportation), while other federal agencies have developed noise guidelines for wind turbines operating on jurisdictional lands. However, there are no federal standards that apply to wind turbines. Therefore, RSG (2007b) also reviewed guidelines issued by the Bureau of Land Management (BLM), the Environmental Protection Agency (EPA), and the World Health Organization (WHO). These standards and guidelines are summarized below in Table 3.4-2.

Based on review of the standards and guidelines presented below in Table 3.4-2, RSG recommended that the Project meet a nighttime guideline for protection against sleep disturbance of 45 dBA, averaged over an eight-hour night, and a daytime guideline for protection against annoyance of 50 dBA, averaged over the remaining 16 hours. This is written as 45 dBA Leq (night) and 50 dBA Leq (day), and is equivalent to a day-night average level of 52 dB Ldn. This standard would be applicable to outdoor areas receiving frequent human use, including homes, yards and porches, but would not be applicable to areas of transient uses, such as driveways, trails and parking areas. The 45 dBA nighttime goal is consistent with the WHO community noise guideline to protect against sleep disturbance, and like the WHO guideline, assumes that a bedroom window would be open, and that sound levels inside the house would be reduced by 15 dBA due to the attenuating effect of the building. If a bedroom window were shut, an additional attenuation of 10 dBA would result. RSG recommended this standard for the Project because it is more stringent than any of the federal standards reviewed, and would be well below the level that can cause hearing impairment. This noise limit is protective of human health, and below the threshold of annoyance and sleep disturbance. Therefore, implementation of this standard in the Project area would prevent quality of life concerns for residents, i.e., would not result in an undue adverse effect to the aesthetics of the area (RSG, 2007b).

Table 3.4-2. Summary of Standards and Guidelines for Exterior Noise

	Agency/ Organization	Applicable to	Sound Level
Standards	Federal Highway Administration and Vermont Agency of Transportation	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.	57 dBA Leq(1) or 60 dBA L10(1)
		Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, hotels, motels, schools, libraries, churches, and hospitals.	67 dBA Leq(1) or 70 dBA L10(1)
		All other areas.	increase over background cannot exceed 18 dBA
	Federal Energy Regulatory Commission	Compressor facilities under FERC jurisdiction	55 dB Ldn
Guidelines	Environmental Protection Agency	To protect public health and welfare with an adequate margin of safety	55 dB Ldn
	Bureau of Land Management	For the development of wind turbines on federal lands managed by BLM. Refers to EPA guideline.	55 dB Ldn
	World Health Organization	For community noise. Designed to protect against moderate annoyance during the day, and against sleep disturbance at night.	50 dBA Leq (day) and 45 dBA Leq (night)
		For nighttime noise. Designed to protect vulnerable groups against health effects of night noise exposure.	40 dB Lnight,outside[1]

[1] Lnight,outside, as defined by the European Union Directive 2002/49/EC, is the A-weighted yearly average of night noise outside the dwelling (WHO, 2009). Project consistency with this guideline is addressed in Section 3.4.2.

Pursuant to 30 V.S.A. § 248, the Vermont PSB issued an Amended Certificate of Public Good on July 17, 2009. Condition #28 of the Certificate specifically addressed noise standards, establishing enforceable noise limits for the Project. These limits appear to be based on the WHO community noise guidelines, but are more protective, since the outdoor threshold of 45 dBA must be calculated over the span of any given one-hour period instead of over the entire eight-hour night. "Deerfield shall construct and operate the Project so that the turbines emit no prominent discrete tones pursuant to ANSI [American National Standards Institute] standards at the receptor locations; and Project related sound levels at any existing surrounding residences do not exceed 45 dBA(exterior)(Leq)(1 hr) or 30 dBA(interior bedrooms)(Leq)(1 hr)" (PSB, 2009). Should the Responsible Official decide to issue a land use authorization for the Proposed Action or one of the action alternatives, the Forest Service permit would require compliance with the terms and conditions of the CPG. Noise monitoring/modeling of interior sound levels would require access to the bedrooms of private residences near the Project site, which would be overly intrusive to area residents. Therefore, the Forest Service analysis has adopted the noise standard of 45 dBA(exterior)(Leq)(1 hr) for the Project.

3.4.1.3 Methodology of Background Sound Level Monitoring

To determine background sound levels in the Project vicinity, continuous sound level monitoring was completed in 2005 at seven sound monitoring locations selected by RSG within five discrete noise zones in and around the Project site. Background sound monitoring locations are depicted in Figure 3.4-1. The five discrete noise zones and associated monitoring sites are:

6. The Aiken Wilderness (Site MB1).
7. Other MAs of the GMNF (Sites B3 and MB3).
8. Homes along Route 8, which has an average daily traffic volume of approximately 720 vehicles per day (vpd) (Site B2).
9. Homes along Route 9, which has an average daily traffic volume of approximately 4,400 vpd (Site MB2 and B1).
10. The existing Searsburg facility turbines, adjacent to the proposed Eastern Project site (Site B4).

All seven background sound monitoring locations were monitored with ANSI Type 1 Cesva SC310 integrating sound level meters set to log average, 90th percentile, 50th percentile, and full octave band sound levels every 10 seconds. The microphones were placed 0.8 to 1.4 meters above the ground. Each sound level meter was calibrated before and after the measurements and fitted with a windscreen to reduce the self-noise created by wind passing over the meter's microphone.

The sound level monitoring was completed over two different four- and five-day periods. Sites MB2, B2, and MB3 were monitored from Friday November 18 to Wednesday November 23, 2005. Sites MB1, B1, B3, and B4 were monitored from Thursday December 1 to Monday December 5, 2005.

3.4.1.4 Results of Background Sound Level Monitoring

A number of statistical sound levels were measured over the two different four- and five-day periods described above. Background sound levels in the Project area are largely a function of wind speed, i.e., the stronger the winds, the louder the resulting background sound. Each background sound monitoring location is described briefly below, and depicted in Figure 3.4-1.

- Site MB1 is located along the eastern border of the Aiken Wilderness, at the end of Forest Road 74 (Aiken Road) in the Town of Woodford. The road is part of the Vermont Association of Snow Travelers, Inc. (VAST) Corridor 7A snowmobile trail network. The snowmobile season had not opened at the time the monitoring occurred. Monitoring indicated that background sound levels were similar for days and nights, indicating that there was not a lot of traffic or infrequent and relatively loud events. The sound levels tended to rise and fall along with the ridge top wind speeds.

- Site MB2 is located south of Old Route 9, east of Bishop Hill Road, and south of Route 9 in the Town of Searsburg. Monitoring indicated a more diurnal (daily) pattern in the background sound levels. Sound levels were highest during the day and lowest during the night, suggesting that traffic patterns heavily influence noise in this area.

- Site B1 is located between a cemetery and the intersection of Routes 8 and 9 in the Town of Searsburg. Monitoring indicated a diurnal pattern of background sound levels, similar to Site MB2. However this site also showed a rise in sound levels during the night of December 3. It was reported that this night experienced high wind speeds (above 25 mph) at the ridgeline, which resulted in wind noise at this location. It should be noted that the existing wind turbines were not readily audible at this site.

- Site MB3: a forest trail in the Lamb Brook Area in the Town of Readsboro. The trail is part of the VAST Corridor 9 regional snowmobile trail. With the exception of a rainy period during the early morning of November 22, background sound levels at Site MB3 were closely correlated with wind speed. The sound levels were relatively low during the night, especially during calm winds. Again, the snowmobile season had not yet opened during the monitoring period.

- Site B2 is located at the intersection of Route 8 and the existing overhead transmission lines in the Town of Searsburg. Monitoring of background sound levels indicated a clear difference between the Leq values, which followed a diurnal pattern, and the L_{90} and L_{50} levels, which were more stable. The difference was due to the relatively low traffic volumes on Route 8, i.e., there were not enough vehicles on Route 8 to affect the percentile levels, but the peaks from the vehicle pass-bys affected the Leq. The rise in the L_{90} and L_{50} levels during the night of November 23 was due to a short period of rain.

- Site B3 is located north of Sleepy Hollow Road on Route 8 in the Town of Searsburg. Monitoring indicated sound level patterns similar to that at Site B2. The L_{90} and L_{50} levels correlated with the ridge top wind speeds.

- Site B4 is located just south of the existing Searsburg facility turbines. Due to proximity to the existing wind turbines, it was assumed that the wind turbines generated all of the background sound at this location. The sound levels were closely correlated to wind speed, except during the evening of the December 2 when the wind turbine blades were pitched back to prevent damage by high winds. It is also important to note that the Leq, L_{90} and L_{50} levels were nearly identical at night, indicating that the sound levels during each of these hourly periods were very constant.

The results of the background sound monitoring are summarized in Table 3.4-3, including the distance to the closest turbine at the existing Searsburg facility. Measurements are provided in three different levels: Leq, L_{50}, and L_{90}. The RSG reports included in the Project Record contain full details on the monitoring results.

Table 3.4-3: Summary of Overall Background Monitoring Results by Site

Background Monitoring Location	Distance to Existing Turbines (meters)	Day (dBA)			Night (dBA)		
		Leq	L50	L90	Leq	L50	L90
Site MB1	4,500	45	33	32	39	29	28
Site MB2	4,350	50	45	43	46	38	37
Site B1	3,550	56	49	46	52	39	38
Site MB3	2,750	51	29	28	49	33	32
Site B2	2,350	56	41	40	51	41	40
Site B3	800	57	42	42	50	43	42
Site B4	20	63	56	55	62	62	61

Source: RSG, 2007b.

The existing Searsburg facility turbines contribute to the background noise in a portion of the geographic area, particularly in and around the Eastern Project site. The existing turbines, which have been in operation since mid-1997, have a single rotational speed that revolves at approximately 29 revolutions per minute above a certain minimum wind speed. Each wind turbine begins to generate power in winds above 10 mph and has a rated output of 550 kilowatt (kW) in winds of 30 to 65 mph. Above the 65 mph, the wind turbines are programmed to shut down either by pitching their blades or yawing parallel to the wind direction.

It was determined during the study period of December 1-5, 2005 that the sound emissions from two existing Searsburg facility turbines (Turbines 8 and 9) gradually increased by 2.4 dBA for every m/s (2.2 mph) increase in wind speed, up to a maximum sound level of approximately 66 dBA at wind speeds of 10 to 11 m/s (22.4 to 24.6 mph). However, the sound levels were found to be relatively constant (around 63 dBA) between 6 to 17 m/s (13.4 and 38 mph). Above 17 m/s (38 mph), the turbine blades started to pitch to prevent damage. It was determined that since the turbines operate at a single rotational speed, sound levels from the existing turbines are relatively constant. Most of the sound was created by air turbulence around the blades, the yaw motors, and the generator. Incidents of malfunctions that created unusual sounds have occasionally occurred since the existing turbines have been in operation, but these were fixed soon after reports were made.

3.4.2 Direct and Indirect Impacts Presented by Alternative

Although noise impacts were not identified during public scoping as a significant issue, a number of noise-related issues and concerns were raised by the public. Specifically, people are concerned about the noise levels of the turbines and the extent this noise would be disruptive to their residences and while recreating in the Project area. People are also concerned that the Proposed Action would adversely affect the solitude and wildland attributes of the nearby Lamb Brook Area and the Aiken Wilderness. In addition, a number of public comments received on the SDEIS raised concerns about reported impacts to human health from wind turbines. In response to those comments, a new appendix has been added to this FEIS. See Appendix K for a summary of potential health effects turbines and turbine noise. This section addresses potential noise-related direct and indirect impacts due to the construction and operation of the Proposed Action. The Project impacts are in addition to the existing noise already generated by the existing Searsburg facility turbines. The indicator used to focus the discussion of noise impacts is the evaluation of the potential magnitude of sounds for facility construction and operation. As described above, potential noise impacts were assessed from seven monitoring sites in five discrete noise zones, with focus on nearby residences and along two designated GMNF trails, one in the Lamb Brook Area and one at the nearest edge of the George D. Aiken Wilderness Area. Potential noise impacts to wildlife that may be using the Project area are also considered based upon wildlife observed using the area around the existing Searsburg facility turbines over the last 10 years.

3.4.2.1 Proposed Action

The disclosure of impacts begins with a discussion of the impacts of Project construction. This is followed by discussion of the impacts of Project operation, including a description of the modeling used to describe anticipated potential impacts.

3.4.2.1.1 Potential Impacts of Construction

Noise from temporary construction-related activities would be generated and experienced at nearby homes. Construction of the Proposed Action would include the following activities over the planned nine-month construction period:

- Site and Right of Way Clearing
- Construction of Access Roads
- Movement of Vehicles
- Foundation Excavation and Construction
- Wind Turbine Structure Erection
- Underground Electrical Collection System Installation
- Substation Installation
- Site Cleanup and Restoration

Blasting may also be required, depending on subsurface conditions. If blasting activities are necessary, they would likely be limited in nature and would be conducted in strict compliance with safety and public notification/warning requirements, in accordance with applicable federal and state regulations. Refer to Section 3.2.2.1.6 for additional information about blasting.

Design criteria to minimize temporary construction-related noise would include various measures for noise abatement, such as ensuring all engines have functional mufflers in good condition, minimizing equipment idling, and limiting hours of construction from 7 a.m. to 7 p.m. (except for possible extended concrete pours and similar events, and other minor construction activities that may need to extend earlier or later). Construction noise would be produced primarily by diesel engines that power construction equipment and by the operation of rock drills, jackhammers, and compactors. Generally, engine noise would dominate the noise produced by diesel and gasoline engine-powered equipment.

Table 3.4-4 presents an estimate of the maximum noise levels from construction equipment at various distances. A distance of 2,600 feet represents the typical distance construction activities would take place from residences, while 2.2 and 4.6 miles represent the distances from the Project site to Woodford State Park and Atherton Meadows State Wildlife Management Area, respectively. Sound levels are likely to be further reduced due to intervening dense vegetation and topography. As a general rule, not all equipment listed would be employed during each phase of construction, and the equipment is typically operated intermittently during a work shift.

Table 3.4-4: Maximum Sound Levels (dBA) from Construction Equipment at Various Distances

Equipment	50 feet	2,600 feet	2.2 Miles	4.6 Miles
M-250 Liftcrane	83	42	24	10
2250 S3 Liftcrane	78	37	19	5
Excavator	83	44	29	21
Dump truck being loaded	86	49	35	27
Dump truck at 25 mph accelerating	76	37	17	7
Tractor trailer at 25 mph accelerating	80	42	23	13
Concrete truck	81	40	22	8
Bulldozer	85	44	26	12
Rock drill	100	54	13	17
Loader	80	38	19	5
Backhoe	80	39	19	7
Chipper	96	58	40	26

Note: Table assumes hard ground around construction site, and ISO 9614-2 propagation with no vegetation reduction. Actual sound levels will likely be lower given the prevalence of dense vegetation and soft ground around the Project site. Sources: RSG, 2007b, 2010.

The noise levels expected from Project construction activities would be similar to that caused by road construction or logging activities. It is anticipated that work would be undertaken at several locations across the Project site simultaneously, to construct the Project as efficiently as possible. Aside from access road construction near Route 8, Project construction would occur well away from the nearest residences (a minimum of 0.5 mile for turbines locations) and thus would have a minimal impact on noise levels at those locations. Area landowners also would be notified in advance about certain types of construction noise, e.g., blasting, should it be necessary. Furthermore, in the event of an unusual or disturbing noise from the Project, neighbors would be able to contact a site supervisor to report noises. In collaboration with the Forest Service, the site supervisor would work closely with the Towns and local residents to address construction noise complaints to the extent possible.

Due to the setbacks proposed for the Project and the limited duration and timing of construction activities, construction noise would likely produce only temporary, short-term adverse impacts on nearby residences, recreational users of the GMNF, and wildlife. Sound levels from Project construction would be considerably less than background noise levels at_nearby state facilities

(RSG, 2010), and therefore recreational users of these facilities would not be affected. These temporary impacts should not pose an undue burden on the local community.

3.4.2.1.2 Potential Impacts of Site Operation

Sound levels from wind turbines are a function of wind speed. Background sound is also a function of wind speed, i.e., the stronger the winds, the louder the resulting background sound. In areas that are covered by trees and bushes, such as the Project area, this effect is amplified. Combined with the fact that the frequency spectrum from wind is very similar to the frequency spectrum from a wind turbine, the sound from a wind turbine is generally masked by wind noise at downwind receivers. An exception can occur when winds are blowing on top of the ridge where the turbines are located, despite little or no wind at ground level in the valleys, where most receptors are located. This can occur because winds tend to be lighter on the leeward side of a ridge, and because the "roughness" of forest cover slows surface winds. To evaluate this phenomenon, RSG (2007b) compared wind speed on the ridge with sound levels at various measurement sites. In each case, sound levels in the valley were correlated with wind speed on the ridge. However, ambient sound levels in the valley did not start to rise until the wind speeds on the ridge reach 5 to 7 m/s (11 to 16 mph). The turbines would not be running or producing noise at wind speeds below 4 m/s (9 mph), which is the cut-in speed for power generation. Therefore, for receptors in the valley, the wind turbines would be most audible when winds are blowing with relatively low speeds (4 to 7 m/s or 9 to 16 mph) on the ridge, but not in the valley. When generating in such low wind conditions, the turbines would be operating at low speeds and would have proportionally lower sound emissions.

Various meteorological conditions can also affect sound propagation, primarily wind shear and temperature lapse. Wind shear is the difference in wind speeds by elevation, and temperature lapse rate is the temperature gradient by elevation. Under conditions with high wind shear (large gradient), sound levels upwind from the source tend to decrease, while sound levels downwind tend to increase. With temperature lapse, when ground surface temperatures are higher than those aloft, sound levels on the ground will decrease. The opposite is true when ground temperatures are lower than those aloft (an inversion condition). In general, sound transmits furthest under stable conditions with a strong inversion, such as during a clear night with low winds. In those situations, sound levels produced by the wind turbines would be at their lowest. Under very stable conditions, wind speeds are generally too low to generate electricity, and thus, the wind turbines would produce little or no noise. As a result, worst-case conditions for wind turbine noise emissions tend to be under more moderate nighttime inversions. A full range of meteorological conditions was accounted for in the Project noise models, as described below.

The different noise generating characteristics of turbines models were considered during turbine selection. Only turbines with maximum sound power levels of 107.5 dBA or less were considered for the Project to ensure that noise generated by the Proposed Action would not exceed the noise standard adopted for the Project of 45 dBA(exterior)(Leq)(1 hr). In addition, the Project would be constructed and operated so that the turbines would emit no prominent discrete tones, pursuant to ANSI standards, at nearby residences. These limits are consistent with WHO community noise guidelines to protect against sleep disturbance and annoyance.

Since turbine selection for the Proposed Action was not final at the time of the original noise studies, RSG evaluated potential sound levels from two different models, the Gamesa G87 and Suzlon S88, using the S88 for modeling purposes so as to present the worst-case scenario. The Applicant subsequently determined that the Gamesa G80 turbine would be better suited to the Project site, and RGG (2007b) issued a *Revised Noise Impact Study* to evaluate potential impacts from that specific turbine model. The Gamesa G80 has a maximum sound power level of 105 dBA, which is roughly equivalent to a maximum sound pressure level of 55 dBA 90 meters (295 feet) from the turbine base.

Noise Model

To determine the predicted noise impact from the Proposed Action, modeling was performed using the Cadna A acoustical modeling software, an internationally accepted acoustical model with a high level of reliability. The model follows methods specified by the International Standards Organization, as noted in Section 3.4.1. This method predicts dBA under meteorological conditions favorable to sound propagation from sound sources, including downwind propagation. The model also takes into account source sound power levels, surface reflection and absorption, atmospheric absorption, geometric divergence, meteorological conditions, walls, barriers, berms, and terrain.

Sound attenuation from the existing forest cover in and around the Project site was excluded from the model in order to present a conservative, worst-case scenario. A 25 meter by 25 meter grid of modeled receivers was set up at locations within 12,900 acres (20 square miles) around the Project site; discrete receivers were also placed at all residential homes within this area, using the Vermont Emergency 911 database. A receiver is the point on the ground at which the computer model can calculate anticipated sound levels. Figures 3.4-1 through 3.4-8 shows selected discrete receivers as yellow and black circles. These receivers include the closest homes to the project, other representative residences, and backcountry areas to the west and south of the Project. In order to provide an accurate comparison to existing conditions, three of the modeled receivers are located at background sound monitoring locations (MB1, MB2 and MB3) described above in Section 3.4.1.

Wind Turbine Noise Levels Used in Modeling

Wind turbine manufacturers test their turbines using two international standards:

- International Electrotechnical Commission standard IEC 61400-11:2002(E), "Wind Turbine Generator Systems – Part 11: Acoustic Noise Measurement Techniques"
- International Electrotechnical Commission standard IEC 61400-14:2005(E), "Wind Turbine Generator Systems – Part 14: Declaration of Apparent Sound Power Level and Tonality Values"

These standards provide sound power emission levels from a turbine, by wind speed and frequency, and also provide confidence intervals under typical operation. In addition to the sound levels, the manufacturers publish information quantifying pure tones, if any, from the turbines.

Results of Noise Modeling Under Maximum Rated Sound Power

Noise impacts from the existing Searsburg facility turbines (and substation) and the 17 proposed turbines (and proposed substation) were modeled using their maximum rated sound power levels. It is important to note that the modeled sound levels represent worst-case conditions, as they are based on the maximum sound output from the wind turbines (i.e., the mean reference sound power level plus the confidence interval provided by the manufacturers), and assume a moderate nighttime inversion with winds blowing from each turbine to each receiver. All Project-related sound levels are mapped in dBA(exterior)(Leq)(1 hr), the units in which the Vermont PSB set standards for the Project. The following scenarios were modeled to quantify sound levels anticipated from the Project:

- Project-related noise from the Proposed Action, assuming 17 Gamesa G80 turbines operating at their highest rated sound power (Figure 3.4-2).
- The No Action alternative, consisting of 24-hour background traffic noise and the existing Searsburg facility turbines, operating under the highest sound emissions derived from the recent monitoring data (Figure 3.4-3).
- The difference between Project-related noise from the Proposed Action and the No Action alternative (Figure 3.4-4).

As shown on Figure 3.4-2, modeling indicates that the highest Project-related noise level that would occur at a residence from operation of the Proposed Action is 39 dBA(exterior)(Leq)(1 hr), which is well below the noise standard of 45 dBA(exterior)(Leq)(1 hr). Similarly, sound levels at all other residential locations are also below the noise standard of 45 dBA(exterior)(Leq)(1 hr).

As shown on Figure 3.4-3, existing noise levels at the residence that would receive the highest levels of Project-related noise are currently 58 dBA(exterior)(Leq)(24). When the sound levels between Project-related noise from the Proposed Action and the No Action alternative are compared, the modeling indicates that there would be no change in Leq(24) noise levels at any residence (Figure 3.4-4). The greatest modeled difference between Project-related noise from the Proposed Action and the No Action alternative would occur at Site MB1 near the eastern border of the Aiken Wilderness, at the end of Forest Road 74 in Woodford (Figure 3.4-4). At this location, Project-related sound levels would reach 29 dBA(exterior)(Leq)(1 hr), while existing noise levels are currently just 25 dBA(exterior)(Leq)(24). Therefore, a net increase of 4 dBA would occur at this site. This location, west of the Western Project site, is also a VAST snowmobile trail, and experiences varying amounts of engine noise during the winter months, not accounted for in the monitoring results for the No Action alternative. Therefore, during snowmobile season, existing noise sources may be louder than indicated on Figure 3.4-3, and the net increase in sound levels may be somewhat less.

The second greatest modeled difference between Project-related noise from the Proposed Action and the No Action alternative would occur at Site MB3 in the Lamb Brook Area. At this location, Project-related sound levels would reach 32 dBA(exterior)(Leq)(1 hr), while existing noise levels are currently 29 dBA(exterior)(Leq)(24). Therefore, a net increase of 3 dBA would occur at this site. This location, south of the Eastern Project site, is also a VAST snowmobile trail (the regional east-west Corridor 9 trail), and also experiences varying amounts of engine noise during the winter months.

Additional Model Scenario Using Meteorological Data

Because wind turbines operate at all types of wind speeds and directions, not just those assumed in the ISO Standard (see Section 3.4.1), one year of hourly wind speed and direction data was obtained from the ridge top meteorological towers in Searsburg. The data was initially used in conjunction with varying parameters and algorithms to evaluate the likelihood of sound levels exceeding the WHO community noise guideline of 45 dBA Leq(night). That analysis concluded that there would be no period during which the average 8-hour nighttime sound level for the existing Searsburg facility and proposed Deerfield turbines would exceed 41 dBA at the nearest residence (RSG, 2007b). This data was subsequently re-analyzed to assess compliance with the Project standard of 45 dBA(exterior)(Leq)(1 hr) at the nearest home. The data analysis using 8,760 hours of meteorological data showed the worst-case impacts would occur when winds with a stability class of F or G, which occur at night, blow from the south. Results indicated that the maximum modeled sound level under these conditions would be less than 45 dBA(exterior)(Leq)(1 hr) at the nearest home (RSG, 2010).

The year of meteorological data can also be used to determine consistency with the WHO night noise guidelines. The combined Lnight,outside from the Proposed Action and existing Searsburg turbines would be 37 dB at the Shea residence (RSG, 2011b), below the 40 dB Lnight,outside limit recommended in the night noise guidelines (WHO, 2009). These results are confirmed by a recent paper that showed that annual average sound levels are likely to be at least 5 dB lower than their one-hour maximum level (Kaliski & Duncan, 2010). The difference between the maximum and annual impacts is due to the fact that the maximum level occurs when winds are blowing from the source to the receiver or during moderate nighttime inversions, and simultaneously, the wind speeds at hub height are high enough to operate the wind turbine at its maximum sound output. However, in reality, the wind direction constantly shifts, meteorological conditions change, and the wind is not always strong enough to generate the maximum sound power from a wind turbine.

Potential Impacts to Nearby Residences

The area around the Project site is relatively sparsely populated, with mature forests on rolling to rugged topography. No residences are located on GMNF lands for many miles to the west of the Project site. GMNF lands in the Lamb Brook Area extend to the south, to the hamlet of Heartwellville. The closest residence there is located approximately 2 miles south of the southernmost Searsburg Wind Facility turbine, and 1.4 miles south of the closest proposed turbine, the southernmost in the Eastern Project site. To the east, GMNF and other undeveloped lands extend east approximately 2 miles to the Harriman Reservoir. Scattered residences are located along Route 8, Sleepy Hollow Road, and Route 9 to the northeast, north and northwest of the Project sites. The closest residence to the existing Searsburg facility and the proposed turbines is located on the east side of Route 8, 0.7 mile northwest of the northernmost Searsburg

Wind Facility turbine. This residence would be 0.5 mile (approximately 805 meters) northeast of the closest proposed turbine (Turbine W8, in the Western Project site).

Although sound generally travels best on calm nights, these conditions are typically unfavorable for wind turbine operation, and as such, wind turbine sound levels are generally low. In addition, the presence of forest vegetation and topography would reduce the proposed modeled noise levels, which did not incorporate the sound-masking effects of vegetation. During the warmer months when the leaves are out, windows at the closest residences may be open. The sounds from the wind turbines would be partially masked by the intervening forest cover. Background sound also increases with increasing wind speeds, particularly at locations covered by mature trees and shrub vegetation, such as within and around the Project sites, further masking the increase in Project sound levels under windy conditions.

Noise conditions measured at Site B3 in December 2005 are considered representative of background conditions at this residence. As described in Section 3.4.1, background noise was influenced by the occasional car on Route 8 and ridge top wind speeds, which increased noise from trees and operational noise from the existing Searsburg facility. Modeling results indicate this residence experiences an A-weighted existing noise level of 41.8 dBA, the highest of the residences in the vicinity of the Project site. This is considered a faint noise level characteristic of a suburban area (see Figure 2 in RSG Noise Primer in Appendix B).

The highest Project-related noise level (i.e., without consideration of the masking effect of existing noise conditions) from operation of the Proposed Action that would occur at a residence is 39 dBA(exterior)(Leq)(1 hr), which is well below the Project noise standard of 45 dBA(exterior)(Leq)(1 hr). Once noise generated by traffic conditions, the Searsburg Wind Facility and other sources is taken into consideration, noise modeling indicates that the addition of the 17 Gamesa G80 turbines and the substation would not result in an increase in noise levels at any nearby residence (Figure 3.4-4). Background noise levels would mask Project-related sound at residences primarily located along Routes 8 and 9. Route 9 receives an average daily traffic volume of approximately 4,400 vehicles per day. While homes along Route 8 experience noise from only an occasional vehicle (average daily traffic volume of about 720 vehicles per day), background noise levels already include low levels of sound from the existing Searsburg facility and winds.

To assess potential impacts from low frequency noise at residences, RSG (2007b) calculated the un-weighted sound pressure levels (dB) anticipated outside nearby residences. At the residence with the highest overall low frequency noise levels from the turbines, the sound level would not exceed 60 dB at a frequency of 31.5 Hz, or 55 dB at a frequency of 63 Hz. These levels, anticipated to occur at the *exterior* of residences, are well below the interior low frequency noise threshold of 65 to 70 dB that could result in moderately perceptible building vibrations at those frequencies.

As described in Section 3.4.1.2, Condition #28 of the CPG established noise standards for the PSB-approved 15-turbine Project of 45 dBA(exterior)(Leq)(1 hr) or 30 dBA(interior bedrooms)(Leq)(1 hr). These requirements would also apply to selection of either the Proposed

Action or East Side Only alternative. Conditions #29 and #30 provide assurances for noise monitoring and enforcement of noise standards. In the event that noise from Project operation were to exceed the maximum allowable levels, the PSB would require the Applicant to take all remedial steps necessary to bring the sound levels produced by the turbine(s) into compliance with allowable levels, including modification or cessation of turbine(s) operation. Furthermore, the Applicant would be required to implement a PSB-approved Noise Monitoring Plan during the first full year of operation. This Plan would establish a monitoring program to confirm compliance with the maximum allowable sound levels under a variety of seasonal and climatic conditions. The plan would also specify protocols to be followed should complaints be received about the Project exceeding noise limits (including monitoring at the affected locations, as appropriate). The Applicant would then be required to submit any such monitoring results to the PSB for review.

Should the Responsible Official decide to issue a land use authorization for the Proposed Action, the Forest Service permit would require compliance with the terms and conditions of the CPG, as noted above. The noise monitoring and compliance requirements contained therein would be intended to protect local residents from turbine noise that could result in sleep disturbance, and provide recourse in the event that turbine noise was to exceed allowable limits.

Potential Impacts to Lamb Brook Area

The turbines in the Eastern Project site are located in the northwestern-most portion of what was previously known as the Lamb Brook Area in the GMNF, on the same ridgeline that contains the existing Searsburg facility turbines. Three management areas are now found in the Lamb Brook Area, Diverse Forest Use, Remote Wildlife, and Remote Backcountry. There are no Forest Plan sound or noise restrictions in the area. Recreational use of the Lamb Brook Area is relatively low, except during the hunting and snowmobile seasons, as described in Section 3.13.1. Access to the Lamb Brook Area is difficult, with no open road access, designated parking areas, signage, developed recreational sites, or posted information. The area is rimmed by hills and ridges. Some undesignated trails cross the area and ascend the relatively low topographic high points. The east-west VAST Corridor 9 snowmobile trail is also used for hiking and can be accessed from Route 8 or from the remnants of former Forest Road 266 which is gated at its entry point on Route 100 just south and east of Heartwellville.

Noise modeling indicated that sound levels above 40 dBA from the existing Searsburg facility turbines are limited to the northern border of the Lamb Brook Area. To measure background sound levels indicative of what most recreational visitors to the Lamb Brook Area would experience, monitoring Site MB3 was located on a trail approximately 1 mile southeast of the closest (southernmost) proposed turbine in the Eastern Project site. Background sounds levels measured at Site MB3 in November 2005 were closely correlated with wind speed and were relatively low during the night, especially during calm winds. As depicted in Figure 3.4-3, the existing sound level at Site MB3 is 29 dBA Leq(24).

Noise modeling indicated that Project-related noise from the Proposed Action would be 32 dBA(exterior)(Leq)(1 hr) at Site MB3, without considering the masking effects of vegetation, background noise due to winds in the forest, and intervening topography. This represents an increase of 3 dBA from the 29 dBA recorded in November 2005. However, the leaves in the forest during the warmer months should help muffle Project noise. In the winter, the trail is a designated snowmobile trail, part of the heavily used regional east-west VAST Corridor 9 (see Section 3.13.1). The snowmobile season typically opens around December 15 (after the November 2005 background sound level monitoring occurred) and ends in early April, depending on snow cover. Therefore, the sounds of motorized snowmobiles were not part of the background sound levels measured at Site MB3.

Operation of snowmobiles would create more noise in winter in much of the Lamb Brook Area than the proposed turbines. Project operations noise would be anticipated to cause no quality of life concerns in this large GMNF area, which should still retain its solitude and wildlife attributes, especially outside of snowmobile season and when the trees are in full leaf.

<u>Potential Impacts to George D. Aiken Wilderness Area</u>

The 5,060-acre congressionally designated Aiken Wilderness is located approximately 1.5 miles west of the Western Project site at its closest point. Background sound levels measured at Site MB1 on Aiken Road (also called Forest Road 74) near the eastern border of the Wilderness Area rose and fell with ridge top wind speeds during the monitoring period in early December 2005. There were few indications of traffic or infrequent loud events, as would be expected at this location in the GMNF at approximately 1.4 miles south of Route 9. As depicted in Figure 3.4-3, the existing sound level at Site MB1 is 25 dBA Leq(24).

Noise modeling indicates that Project-related noise from the Proposed Action would be 29 dBA(exterior)(Leq)(1 hr) at Site MB1, without considering the masking effects of vegetation, background noise due to winds in the forest, or intervening topography. While these conservative assumptions were intentionally used in the noise modeling to ensure analysis of worst-case impacts, the result is that Project-related increase would likely be less than the noted 4 dBA difference much of the time. This is partially due to the leaves in the forest, which would help muffle or mask Project noise during the warmer months, as would insect (e.g., crickets chirping) and birdcalls. Also, Forest Road 74 is a designated snowmobile trail (VAST Corridor 7A), as described in Section 3.13.1. The snowmobile season typically opens around December 15 and ends in early April, depending on snow cover. As indicated in Section 3.4.1.3, background sound monitoring was conducted in late November and early December, before snowmobile season began. Operation of snowmobiles would create far more noise along the eastern border of the Aiken Wilderness than turbines located a minimum of 1.5 miles away, thereby providing wintertime masking of Project-related noise. Furthermore, because snowmobile noise is part of the existing wintertime noise environment (yet was not included in the background sound monitoring), the measured background sound levels are lower than those actually experienced at this site during much of the winter. Therefore, the modeled maximum difference of 4 dBA would be most likely to occur in early spring and late fall.

There are no Forest Plan sound or noise restrictions within or adjacent to the wilderness area. There is no expectation that visitors to any part of the Aiken Wilderness would not hear sounds related to human development and use. The area was designated as Wilderness in 1984, well after the local state highway system was established. As described in Section 3.13.1.3, visitation and use of the Wilderness is light. To represent the maximum Project-related noise levels that would be experienced in the Wilderness area, Site MB1 was located on the eastern edge of the Aiken Wilderness, closest to the proposed facility. As visitors go deeper into the Wilderness area, lesser, or conceivably no, potential Project noise impacts would be expected. The middle of the Wilderness area is approximately 3 miles from the closest proposed turbine. The heavy vegetation during summer months and ambient sound from year-round traffic on Route 9, occasional snowmobile noise in the winter, and other existing sources would further mask any Project noise for visitors into the deep interior of the Wilderness (i.e., further away from the Project than monitoring Site MB1). In comparison, the middle of the Wilderness area is approximately 2.1 miles from Route 9, closer than to the Project. Any noise impacts would most likely result first from traffic on Route 9, particularly from large trucks that routinely travel this route.

Potential Impacts to Wildlife

Wildlife movement at and near the Searsburg Wind Facility was documented by a remote camera in October 2005 (typically the month of highest bear activity in the area) and between April and November 2006. Moose, bear, red fox, coyote, deer, fisher, raccoon, songbirds, and turkey were photo-documented in the immediate vicinity of Searsburg Wind Facility's Turbine 7. Seventy-eight percent of the wildlife observations in 2005 and 57% of those in 2006 were made when Turbine 7 was generating and thus creating noise (Wallin, 2005b, 2006b).

Noise modeling demonstrated that Project noise would be generally uniform in magnitude and that sound levels over the entire Project area would often be dominated by and uniformly dependent on the speed of the wind. In deciduous forests, it is likely that higher background noise levels could be expected under windy conditions in the spring and summer due to leaf rustle. Because turbine noise levels generally drop in parallel with the level of masking noise, impacts during most low wind situations would not be notably different than those experienced during high wind conditions, when the turbines generate maximum sound levels.

This information suggests that wildlife do not completely avoid noise generated by wind turbines, but continue to use areas immediately around these structures, at least to some extent. It should be noted that the older generation Searsburg facility turbines generate more noise than would be expected from the newer models, and yet wildlife have continued to use the area around the Searsburg facility. Turbine noise in general is fairly steady, relatively modest in volume and tone, and not sudden or sharp. These types of noises generally do not elicit an avoidance response from many of the wildlife species observed in the Project area, particularly as wildlife acclimate to the sounds of turbines, and as they move further away from the turbines. Therefore, only minimal noise impacts to wildlife would be expected from the Proposed Action.

Potential Impacts to Nearby State Facilities

RSG (2010) extended the sound model to include Woodford State Park and Atherton Meadows State Wildlife Management Area. The new receivers were modeled using the same parameters described above. None of the roadways near Atherton Meadows State Wildlife Management Area were included in the model, so a default background sound level of 20 dBA was assumed for the No Action alternative. For reference, this level is lower than the quietest sound levels monitored in the Aiken Wilderness. The model assumes favorable propagation conditions to each receiver.

At Woodford State Park, Project-related sound levels were modeled at two locations: on top of the 2,414 foot (735 meter) peak to the east of the Adams Reservoir, and at the Contact Station just north of the Reservoir. The distance from these modeled receivers to the nearest proposed turbines is 2.2 miles (3.5 km) and 2.4 miles (3.9 km), respectively.

At Atherton Meadow State Wildlife Management Area, a receiver was placed at Atherton Meadow, and a second was placed at the northeast corner of the management area, closest to the proposed wind turbines. These receivers are 5.5 miles (8.9 km) and 4.6 miles (7.4 km) away, respectively, from the closest proposed wind turbine.

Table 3.4-5: Modeling Results for Receivers at State Facilities.

Modeled Receiver	Background Noise Leq(24)	Project- Related Noise, dBA Leq(1-hour).		
		Proposed Action	Reduced West Alternative	East Side Only Alternative
Woodford Peak	45	24	27	15
Woodford Contact Station	46	22	25	13
Atherton Meadows	20	8	9	8
Atherton NW	20	11	12	11

Source: RSG, 2010.

As indicated in Table 3.4-5, Project-related sound levels would be considerably less than background noise levels under the Proposed Action (RSG, 2010).

<u>Other Potential Impacts of Site Operation</u>

Other potential noises associated with operation of the Proposed Action include noise from transformers, transmission lines, and O&M activities. Each of these potential noise sources is discussed below:

- Transformers – Each turbine would contain a transformer to step the voltage up to 34.5 kV, and the proposed Project substation would also contain transformers. Transformer noise emissions are subject to National Electrical Manufacturers Association (NEMA) TR-1 standards. Furthermore, transformer noise has been included in the noise propagation model. As previously discussed, the combined Project-related noise from the proposed turbines and the substation would be less than 45 dBA Leq(1 hr) outside all area residences.
- Transmission Lines – The transmission lines associated with the Project would be 34.5 kV and 69 kV. The voltage of these lines is too low to generate any significant corona noise, and would likely be inaudible next to the lines (RSG, 2007b).

- Operations and Maintenance – The anticipated maintenance and operations schedule predicts that two round trips each day via a pickup truck or off-road vehicle in adverse conditions may be required. This level of increased traffic would not result in any adverse noise impact to nearby residences, considering the proximity of Routes 8 and 9. Routine maintenance at turbine transformers and at the substation would create little if any adverse noise impacts.

In addition, there are some circumstances in winter where ice can form on a wind turbine blade, creating higher levels of turbulence noise. However, these events are expected to occur infrequently, be of short duration, and occur in the winter when most people are indoors.

Summary of Proposed Action Impacts

As described above, any adverse noise impacts from construction would be short-term and intermittent, with most activities taking place away from the immediate vicinity of residences. Design criteria and mitigation measures would be implemented to minimize impacts to the extent possible.

Operational impacts have been fully described above. As depicted in Figure 3.4-4, Project-related noise from the Proposed Action would result in no change to the sound levels at any area residences when compared to existing sound levels (which include the existing Searsburg facility and background traffic levels). Increases in sound levels from existing conditions due to the Proposed Action would occur at Site MB1 near the eastern border of the Aiken Wilderness and Site MB3 in the Lamb Brook Area. It is important to note that these areas are generally isolated, forested locations, with no residences nearby (within 1 mile).

As described in Section 3.4.1.2, the Project noise standard is based on the Vermont Public Service Board requirement, which states "Deerfield shall construct and operate the Project so that the turbines emit no prominent discrete tones pursuant to ANSI standards at the receptor locations; and Project related sound levels at any existing surrounding residences do not exceed 45 dBA(exterior)(Leq)(1 hr) or 30 dBA(interior bedrooms)(Leq)(1 hr)" (PSB, 2009). In order to protect the privacy of nearby residents, no monitoring or modeling of interior sound levels was conducted inside homes in the vicinity of the Project area. As shown on Figure 3.4-2, Project-related noise would not exceed 39 dBA(Leq)(1 hr) at the exterior of any home in the Project area, and the Project would be in compliance with all applicable laws and standards.

Conditions #29 and #30 of the CPG provide assurances for noise monitoring and enforcement of PSB noise standards. The Applicant would be required to implement a PSB-approved Noise Monitoring Plan during the first full year of operation. In the event that noise from Project operation were to exceed the maximum allowable exterior or interior levels[8], the PSB would require the Applicant to take all remedial steps necessary to bring the sound levels produced by the turbine(s) into compliance with allowable levels, including modification or cessation of

[8] It may be reasonable to install sound monitors inside bedrooms of private residences in response to specific complaints during facility operation, should the need arise.

turbine(s) operation. These monitoring and compliance requirements would protect local residents against sleep disturbance, and provide recourse in the event that turbine noise exceeds allowable limits.

3.4.2.2 No Action Alternative

No turbines, access roads, or other Project components would be constructed under the No Action Alternative, and therefore no direct, indirect, or cumulative noise impacts would be anticipated other than those associated with continuing and on-going Forest Service management activities and natural processes within the Project area. The No Action alternative would still include noise impacts now generated from the Searsburg Wind Facility, and from traffic noise. Existing background noise levels in the Project area are discussed in Section 3.4.1 above, and illustrated on Figure 3.4-3.

3.4.2.3 Reduced Turbines in Western Project Site

Results of noise modeling for the Reduced West alternative indicate sound levels slightly greater than those that would occur under the Proposed Action in some areas, as described below. For comparison, see Figures 3.4-5 and 3.4-2, which depict Project-related sound levels for the Reduced West alternative and the Proposed Action, respectively. This difference is primarily because this 15-turbine alternative includes 10 Gamesa G87 turbines, which have a maximum sound power level of 106.5 dBA, slightly higher than the 105 dBA maximum sound power level for the Gamesa G80 turbine. (The remaining 5 turbines in this alternative, and all 17 turbines in the Proposed Action, would be Gamesa G80 turbines.) Another contributing factor to the higher sound levels predicted for the Reduced West alternative is the more compact layout of the western turbine array as compared to the Proposed Action. The highest Project-related noise level (without consideration of existing noise conditions) from operation of the Reduced West alternative that would occur at a residence is 40 dBA(exterior)(Leq)(1 hr), which is well below the Project noise standard of 45 dBA(exterior)(Leq)(1 hr), and is 1 dBA greater than the highest Project-related noise level that would occur under the Proposed Action (which would occur at a residence along Route 8). This 40 dBA(exterior)(Leq)(1 hr) noise level would occur at a home along Putnam Road, while those residences along Routes 8 and 9 would experience Project-related sound levels of 36 to 38 dBA(exterior)(Leq)(1 hr).

Figure 3.4-6 shows the difference between Project-related noise from the Reduced West alternative and the No Action alternative. As depicted in Figure 3.4-6, no homes would experience a difference in sound levels when comparing Project-related noise from the Reduced West alternative to existing sound levels (i.e., the No Action Alternative), which include the Searsburg facility and monitored background traffic levels. Project-related noise at nearby homes would be consistent with both the 1999 WHO community noise guidelines and the 2009 WHO night noise guidelines (RSG, 2008, 2011a,b).

Increases in sound levels from existing conditions (i.e., the No Action Alternative) as a result of the Reduced West alternative would occur at Site MB1 near the eastern border of the Aiken Wilderness (7 dBA) and Site MB3 in the Lamb Brook Area (4 dBA)(RSG, 2011c).

When compared to the Proposed Action, removal of the three southern-most turbines and addition of one turbine in the northern section of the turbine string in the Western Project site would likely result in slightly reduced construction and operational sound levels along reaches of Route 8, in the vicinity of the overhead transmission line.

3.4.2.4 Turbines in Eastern Project Site Only

Noise modeling results for this alternative indicate that eliminating all turbines in the Western Project site would result in less noise at receptors located at residences along Route 8 and Putnam Road. The relocation of the substation to the east would also result in less noise impacts to residences in the northern reaches of the Western Project site. Figure 3.4-7 illustrates the Project-related sound levels that would be produced by the East Side Only alternative, consisting of five Gamesa G80 and two Gamesa G87 turbines. For comparison, see Figure 3.4-2, which depicts Project-related sound levels for the Proposed Action. The highest Project-related noise level that would occur at a residence from operation of the East Side Only alternative is 32 dBA(exterior)(Leq)(1 hr), which is well below the Project noise standard of 45 dBA(exterior)(Leq)(1 hr). This would occur at a home along Route 8. As shown on Figure 3.4-8, no homes would experience an increase in sound levels when comparing Project-related noise from the East Side Only alternative to existing sound levels (i.e., the No Action Alternative). Project-related noise at nearby homes would be consistent with both the 1999 WHO community noise guidelines and the 2009 WHO night noise guidelines (RSG, 2008, 2011a,b).

An increase in sound levels of 3 dBA from existing conditions as a result of the East Side Only alternative would occur at Site MB3 in the Lamb Brook Area. The East Side Only alternative would not cause any increase in sound levels at Site MB1 in the Aiken Wilderness.

When compared to the Proposed Action and Reduced West alternative, reduced construction and operational noise impacts would be experienced in northern and western portions of the Project area, including the Aiken Wilderness, due to the relatively smaller Project configuration and shorter construction period. The noise level at locations close to the Eastern Project site would remain similar to that of the other action alternatives.

3.4.3 Cumulative Impacts

The cumulative impact analysis area would be the same area as described for the affected environment in Section 3.4.1. Cumulative impacts consider potential noise-generating projects and activities that could occur in addition to the existing Searsburg facility and Proposed Action turbines. The operational noise of the Proposed Action and the Searsburg Wind Facility were evaluated together to determine the magnitude of noise effects, as assessed above. Cumulative impacts would also include noise from projects or sources that occurred in the recent past and those that could occur in the foreseeable future.

Modeling demonstrated that noise from the Proposed Action and the Searsburg Wind Facility would be generally uniform in magnitude and that sound levels over the entire Project area would often be dominated by and dependent on the speed of the wind. The aerodynamic noise generated from properly operating wind turbines is typically broadband, like fans. This broadband noise is generally continuous and has a similar spectrum to normal background noise, as opposed to engine and other man-made noise, which can contain discrete tones. Tonal noise is similar to individual notes on a piano, and can be more noticeable and annoying at the same relative loudness level than other types of noise, because it stands out against background noise. The introduction of construction noise sources to the Project area, such as intermittent blasting and engine sounds, could result in increased short-term disturbance to area receptors.

Other than the existing Searsburg facility (constructed slightly beyond the 5 to 10 year period of past activities considered for cumulative impacts discussion), there are no known projects or activities from the recent past (5 to 10 years) that are continuing to produce noise impacts. Short-term projects that previously occurred, such as logging and road construction, have since concluded. Other similar short-term activities can be expected to occur in the foreseeable future, and produce additive noise to that produced by the existing Searsburg facility along with the additive noise of the Proposed Action or alternatives. There are no known private land-based long-term projects or activities expected in the next 5 to 10 years that would produce a continuous additional noise impact. This would be expected given the remoteness and low population levels. Regarding activities on NFS lands, a landscape-scale planning effort for NFS lands south and west of the Project area is expected to begin in 2011. This planning effort might include additional GMNF lands south of Route 9 and east of the Project area, as well. It would be at least one to two years beyond 2011 before any definite proposals would be analyzed. No specific proposals are known at this time. Any noise producing activities resulting from this future analysis would generally produce short-term noise.

Therefore, the primary additive noise impacts to determine cumulative impacts would come from two sources. The first would be from construction activities for the Propose Action and alternatives, and this would be short-term and localized. The second source would be the additional noise impacts resulting from the long-term operation of any approved action alternative. These impacts have been fully described above. It is anticipated that this would result in minimal adverse cumulative impacts that would vary across the sites modeled, dependent on wind and other factors, and vary slightly by alternative.

3.5 Visual Quality

The visual resource goal in the Forest Plan is to "maintain or enhance visual resources such as viewsheds, vistas, overlooks, and special features" (USDA Forest Service, 2006a). Specific objectives identified under the visual goal include: complete a transition from the Visual Management System (VMS) to the Scenery Management System (SMS); maintain or enhance visual quality of special areas that contain scenic features; and maintain or enhance visual quality on the forest. Site-specific analysis is conducted at the project level, using S&Gs described in the Forest Plan, to establish visual quality objectives for the Project area and to determine effects of implementing projects.

The description of both the affected environment, as well as potential impacts of the Proposed Action and alternatives, is based primarily on data and analyses included in the Visual Impact Assessment (VIA) prepared by Jean Vissering and T.J. Boyle Associates (2008), which has been independently reviewed and approved by the Forest Service. The complete VIA may be found in the Project Record.

3.5.1 Affected Environment

This section will start off with a brief introduction to Forest Service management direction for visual resources, including definitions and terms to be used in the subsequent impact assessment. This section will also describe the existing conditions of the Project site and surrounding regional landscape, and provide assessments of the visual character, use, and viewer sensitivity for a variety of sites on both NFS lands and private lands in the Project vicinity.

The affected environment for visual resources is a 10-mile radius area around the Project site. This area was selected for analysis because wind turbines could potentially be visible at this distance. Although the visual impacts from turbines diminish with distance, both because they appear smaller and because they occupy a smaller portion of overall views, a 10-mile radius area provides a thorough evaluation of foreground, mid-ground, and background views from which the Project could potentially be seen.

3.5.1.1 Forest Service Management Direction

Although one of the specific goals of the Forest Plan is to transition from the VMS to the SMS, it is important to note that this conversion had not yet occurred at the time of the EIS preparation. Therefore, this visual evaluation was prepared using the VMS, a program that recognizes the visual landscape as a basic resource, to be treated as an essential part of, and receive equal consideration with, other basic resources of the land. The VMS provides the framework to inventory the visual resource, and to provide measurable standards for its management (Bacon, 1979), while the Forest Plan provides updated S&Gs to be used specifically when implementing the VMS and determining visual quality objectives on the GMNF.

Standards are non-discretionary management requirements that are applicable to all foreseeable circumstances. Guidelines are discretionary management requirements that are applicable to most situations, but can be modified at the Project level. The Forest Plan specifies three Forest-wide visual standards, and two Forest-wide visual guidelines, as outlined below.

3.5.1.1.1 Visual Standards

- S-1: Visual quality objectives shall be determined when implementing the Forest Plan in specific areas.
- S-2: Visual quality objectives shall be met for all activities.
- S-3: For the viewshed as seen from the Appalachian Trail and the Long Trail, but outside of the Appalachian Trail and Long Trail MAs, activities shall meet a visual quality objective of at least partial retention.

A Visual Quality Objective (VQO) is the degree of acceptable alteration of the landscape based on physical and sociological characteristics of an area. The five levels of VQO and four visual conditions defined for the GMNF by the Forest Plan are presented below in Table 3.5.1.1-1.

Table 3.5.1.1-1: GMNF Visual Quality Objectives / Visual Condition Standards

VQOs	Visual Condition Standards
Preservation	Alterations are caused by ecological changes only.
Retention	Alterations made by people are not visually evident
Partial Retention	Alterations made by people must appear subordinate within the surrounding natural appearing landscape.
Modification	Alterations may dominate the original surrounding landscape, but constructed facilities must be compatible with the landscape.
Maximum Modification	Alterations dominate the original surrounding landscape to a high degree, and do not relate completely to natural appearing form, line, color, or texture.
Permanent	A visual condition is being maintained over time.
Temporary	A visual condition in allowed to recover over time.
Enhancement	A visual condition is improved by increasing desirable variety in the landscape.
Rehabilitation	A visual condition is improved by removing existing visual impacts.

3.5.1.1.2 Visual Guidelines

- G-1: The Built Environment Image Guide should be used to develop the image, appearance, or architectural character of existing or proposed facilities when considering rehabilitation, expansion, replacement, or the addition of new improvements.
- G-2: Two tables provided in the Forest Plan should be used as guidelines to determine VQOs. One of the tables is tailored specifically for timber harvesting activities, and is not further discussed here. The other table provides guidelines for establishing VQOs for on-site and off-site views, based on the desired Recreational Opportunity Spectrum and viewer sensitivity, a portion of which is included as Table 3.5.1.1-3.

The intent of the Built Environment Image Guide is to improve the image, aesthetics, sustainability, and overall quality of Forest Service facilities consistent with the agency's role as a leader in land stewardship. The built environment includes administrative and recreation structures; landscape structures; site furnishings; structures on roads and trails; and signs. Since the guidelines apply to structures installed and operated by the Forest Service, along with its cooperators and permittees, the Built Environment Image Guide should be consulted for the Deerfield Project. The guide establishes architectural character types for eight provinces nationwide. The Northeast Province encompasses all of Vermont (USDA Forest Service, 2001a).

On the GMNF, VQOs are established for each project based on the combination of several elements, including the management area (MA), the Recreation Opportunity Spectrum (ROS), the Distance Zone, and the viewer sensitivity of the site. Each of these terms is defined below.

3.5.1.1.3 Management Area

MAs are areas of the National Forest designated in the Forest Plan as having similar management objectives. The proposed Project site is located in a MA designated as Diverse Forest Use, which emphasizes a variety of forest uses including timber management, wildlife habitat, and a range of recreational opportunities. The Forest Plan allows the development of wind energy facilities in Diverse Forest Use MAs through the land use authorization and Special Use permit process. Such authorization requires conformance with the GMNF visual S&Gs (see Tables 3.5.1.1-1 and 3.5.1.1-3).

3.5.1.1.4 Recreation Opportunity Spectrum

The Recreational Opportunity Spectrum is a formal Forest Service classification system designed to delineate, define, and integrate outdoor recreation opportunities in land and resource management planning. ROS classes are used to describe all recreation opportunity settings, from natural, undisturbed, and undeveloped to heavily used, modified and developed. ROS designations attempt to describe the kind of recreation experience one may expect to have in a given part of the Forest. ROS classes include primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, rural, and urban. For additional information on ROS classes, see Section 3.13 of this SDEIS.

The MA in which the Project site is located has a Roaded Natural ROS Classification. Roaded Natural settings consist of a predominately natural appearing environment, with moderate evidence of the sights and sounds of people. Interaction between users may be low to moderate, but with evidence of other users prevalent. Opportunities for both motorized and non-motorized forms of recreation are possible. Natural settings may have modifications that range from being easily noticed to strongly dominant. Roads and highways may be present, and structures are readily apparent (USDA Forest Service, 2006a).

3.5.1.1.5 Viewer Sensitivity

Viewer sensitivity provides some measure of the amount and expectation of viewers. The VMS process identifies categories of sensitivity levels, and provides broad guidelines for identifying the different levels. There are three categories of viewer sensitivity: high, moderate, and low.

Guidelines for identifying viewer sensitivity levels have been specifically defined by the GMNF for various areas inside and outside the National Forest, as indicated in Table 3.5.1.1-2.

Table 3.5.1.1-2: GMNF Viewer Sensitivity Levels

Highly Sensitive Locations The locations listed to the right are considered to be highly sensitive.	United States or State Highways
	Roads averaging at least 150 vehicles per day;
	Roads primarily providing access to highly sensitive recreation sites
	National Scenic or National Recreation Trails including side trails
	Heavily used seasonal trails through areas with recognized scenic attractions
	Eligible and designated Wild, Recreational, and Scenic Rivers that provide outstanding or substantial scenic values
	Riparian Areas with heavy fishing, boating, swimming, and other uses highly dependent on viewing scenery
	Wilderness
	Recreation Special Areas
	Ecological Special Areas with unique scenic features
	Town Centers or concentrations of residences
	Developed recreation sites except for trailheads within moderately sensitive locations
	White Rocks Cliffs and Ice Beds in the White Rocks NRA
	Observation sites along highly sensitive travelways
Moderately Sensitive Locations These locations do not qualify as highly sensitive but get more than twice as much use as general undeveloped areas that provide the same recreation opportunity.	Roads and trails shown on the National Forest recreation maps except those described as least sensitive;
	Concentrated use areas and observation sites along moderately sensitive travelways
	Eligible and designated Wild, Recreational and Scenic Rivers that provide locally common scenic values
	Riparian Areas receiving low to moderate use which is double that of adjacent undeveloped lands.
Least Sensitive Locations These are all locations not qualifying as having high or moderate sensitivity.	Travelways maintained primarily for non-recreation purposes such as timber access roads and utility line clearings
	Areas where use primarily has little dependence on scenic viewing. Examples are hunting or gathering of fuel wood and Christmas trees.

Every landscape is distinct in both its physical form and in the relationships people develop with those landscapes. Understanding local and user perceptions and values is essential in evaluating visual impacts. Public participation is integral to the GMNF review process, which includes public hearings. Informal interviews were conducted as part of the field assessment process, as described in the VIA.

3.5.1.1.6 Distance Zones

Distance zones are divisions of a particular landscape being viewed, and are used to describe the part of a characteristic landscape that is being inventoried or evaluated. The three categories of distance zones are foreground, mid-ground, and background. Views in which all three distances zones are visible are often those with the greatest scenic quality.

Foreground views (within 0.5 mile) are considered to be most sensitive due to the proximity to the viewer, and the ability to perceive detail. Mid-ground views extend from 0.5 mile to 5 miles[9] from the viewer, where one can perceive individual landscape features under clear conditions, but not in great detail. Background views extend beyond 5 miles, and generally consist of viewing conditions where only broad landforms are discernible and where atmospheric conditions may render the landscape an overall bluish color. In general, the scale and impact of a project is reduced the further it is seen from a viewer.

3.5.1.1.7 Project Area Visual Quality Objectives

Based on the Roaded Natural Area ROS classification of the MA on which the Project is located, and the management guidelines outlined in Table 3.5.1.1-3, the Permanent Modification VQO applies to the Project in evaluating both on-site (foreground) and off-site (mid-ground and background) visual impacts. The Modification VQO permits alterations to "dominate the original surrounding landscape, but constructed facilities must be compatible with the landscape." For mid-ground and background locations, the Visual Conditions Guidelines identifies two possible VQOs for the Roaded Natural ROS. It notes that "when viewing lands from a distance, some change may be apparent," and goes on to say that "on the upper part of the more noticeable peaks and ridges, changes may be seen but are subdued and subordinate to the surrounding natural appearing landscape." This is where the Partial Retention VQO applies. However, in "other locations changes may be more noticeable and even begin to dominate the view but should be in harmony as are most private pastures and croplands (Modification)." Tables 3.5.1.1-1 and 3.5.1.1-3 illustrate the S&Gs as listed in the Forest Plan.

[9]The VMS uses 3 to 5 miles for mid-ground views while the SMS uses 4 miles. In the VIA the more inclusive 5 miles was used in order to represent a "worst case" condition, and because of the size of wind turbines which increases their visibility for mid-ground areas.

Table 3.5.1.1-3: GMNF Visual Condition Guidelines for the Roaded Natural Area ROS

Recreational Opportunity Spectrum (ROS)	Viewer Sensitivity	Visual Condition on-Site (within 0.5 mile) and Distribution per Mile (50 Acres) of Travel Corridor or per 1000 Acres of Other Lands	Visual Condition as Seen from off-Site at more than 0.5 mile
ROADED NATURAL	High	Up to 10% of travel corridor may be **PERMANENT MODIFICATION.** At least 90% would be **RETENTION.**	When viewing these lands from a distance, some change may be apparent. On the upper part of the more noticeable peaks and ridges, changes may be seen but are subdued and subordinate to the surrounding natural appearing landscape. (PARTIAL RETENTION) On other locations, changes may be more noticeable and even begin to dominate the view but must be in harmony as are most private pastures and croplands. (MODIFICATION)
	Moderate	Up to 10% of travel corridor may be **PERMANENT MODIFICATION**. Up to 15% of the travel corridor may be **TEMPORARY PARTIAL RETENTION.** At least 85% of the travel corridor must be **RETENTION**.	
	Low	Up to 1% per 1000 acres may be **PERMANENT MODIFICATION.** Up to 10% per 1000 acres may be **TEMPORARY MODIFICATION**	

The guidelines are primarily intended for evaluating timber management practices and can be difficult to apply to non-timber management activities, such as the Project proposed here. The Forest Plan outlines few guidelines specifically for wind turbine projects, especially for interpreting the achievement of VQOs. The VIA made the following determinations based on conversations with GMNF representatives:

- Distinctions are made for locations on "noticeable peaks and ridges". The VIA interpretation of this statement is that certain mountains or hills within a region are noticeable elements in the landscape due to their height, shape, or other distinctive features. Such peaks and ridges are important visual focal points. By contrast, the horizontal ridges upon which the Project would be sited do not stand out in this landscape. They are neither named nor visually identifiable to the average viewer from most view locations. In a few instances when seen at close range they may be among the more "visible" peaks and the VIA recognizes this fact in its assessment.

- Since the Project ridges are not among the "more noticeable peaks and ridges" within the affected environment, the Modification VQO would be the guideline that applies to the Project.
- The Partial Retention VQO does apply unequivocally to views from the Appalachian Trail and Long Trail.
- The VIA identifies two characteristic situations where Partial Retention is the appropriate descriptor, based on the phrase "subordinate to the surrounding natural appearing landscape." In many of the more distant viewing locations, especially those in which only portions of the Project are visible along with the existing GMP Searsburg Wind Facility, the Project would both borrow from existing landscape characteristics and also occupy a very small part of the overall view. The natural appearing landscape would continue to be the dominant visual characteristic as seen from these viewpoints. These situations would meet the Partial Retention VQO. A second situation where the Project would meet the Partial Retention definition are viewing locations which are entirely wooded but from which in winter the Project ridges are visible through numerous tree branches (note, however, that the Modification VQO is still technically the guideline that would apply in many of these instances). The VIA interprets this condition to be one in which the Project would be subordinate due to the fact that 1) the foreground trees and forest are a far more visually dominant feature in the views, 2) the turbines are seen (appear to be) well below the height of foreground trees, and 3) their vertical forms and color are unlikely to appear to be noticeable seen beyond numerous vertical tree trunks and branches.

In many cases, mid-ground and background viewing areas are located on the GMNF in different MAs, some with more restrictive VQOs. However, the VQOs of the MA where the Project is located are the VQOs applicable to the Project. For sites that are outside the GMNF, the Modification VQO relevant to the Roaded Natural Area ROS would apply where there are views of the Project.

3.5.1.2 Description of the Affected Environment

The assessment of visual impacts began by collecting basic objective information about the components of the proposed Project, the character of the surrounding area, and how the Project would be seen within its surrounding context. The analysis for assessing visual impacts of wind turbines on the Forest focused on examination of the affected environment, defined as a 10-mile radius around the Project site, including both Forest Service and private lands.

Within the affected environment, development of a computer generated viewshed analysis was the first step in analyzing potential visibility of the Project from surrounding areas. Viewshed maps assume that no trees exist, so they are very accurate in showing where visibility would <u>not</u> occur due to topographic interference, but less accurate in predicting areas from which the Project would be visible. Dense vegetation, evergreen trees, and buildings can limit or eliminate visibility in areas indicated as having potential visibility. Consequently, as a follow-up to viewshed mapping, field analysis (on the ground) was used to determine whether or not the Project would be seen, how much of the Project would be seen, and the context or scenic quality of the area from which it would be seen.

Field assessment performed as part of the VIA included both GMNF land and public viewing areas outside the Forest. Trips into surrounding GMNF lands were made on snowshoes, skis, and by snowmobile over the course of two months and at least five separate visits. Visits focused on the Aiken Wilderness, the Remote Backcountry and Remote Wildlife MAs (also referred to as "Lamb Brook"), Forest Roads 73 and 74, and the snowmobile corridors near the Project site. Red Mill Campground was also visited; however, that campground has since been closed to the public and will remain closed for an undetermined length of time. Although these landscapes are almost entirely forested, they were considered to have the highest potential for public use within relatively proximate areas of the GMNF (distances extend up to 5.5 miles away). They are described in detail in the VIA. Field visits were also made to more distant areas within the GMNF including portions of the Appalachian/Long Trail and Mount Snow.

Views outside the GMNF were inventoried over several months including the summer, fall and winter of 2003 and 2004. This included state and local roads; parks including Molly Stark State Park, Woodford State Park, and Whitingham Park; lakes and ponds and their associated beaches and boat launch areas such as Harriman and Somerset Reservoir, and views from the Haystack Golf Course. Views from residential areas were not inventoried, but potential visibility is evaluated in the VIA report. Local, state, and federal officials provided recommendations for inventory locations. Table 3.5.1.2-1 lists the location of representative viewpoints identified and evaluated in the VIA and discussed below. Figure 3.5-1 shows the location of these selected viewpoints.

Table 3.5.1.2-1: Deerfield Wind Project Viewpoints

Viewpoint #	Location	Town
1	Route 9 East of Wilmington	Wilmington
2	Stowe Hill Road	Wilmington
3	White Road	Wilmington
4	Ray Hill Road	Wilmington
5	Brown Road/Haynes Road	Wilmington
6	Boyd Hill Road	Wilmington
7	Route 9 West of Wilmington Village	Wilmington
8	Route 9 West of Project	Searsburg and Woodford
9A	Route 8 from Route 9 to Crozier Cemetery	Searsburg
9B	Route 8 from Crozier Cemetery to Heartwellville	Searsburg
10	Route 8 at Crozier Cemetery	Searsburg
11	Route 100 Heartwellville Village	Readsboro

Viewpoint #	Location	Town
12	Route 100 South of Heartwellville	Stamford and Readsboro
13	Town Hill Road	Whitingham
14	Glastenbury Mountain Fire Tower	Glastenbury
15	Molly Stark State Park Fire Tower	Wilmington
16	Woodford State Park	Woodford
17	Harriman Reservoir: Mountain Mills Boat Launch	Wilmington
18	Harriman Reservoir: Castle Hill Boat Launch	Wilmington
19	Harriman Reservoir: Ward's Beach and Picnic Area	Wilmington
20	Harriman Reservoir (water)	Wilmington
21	Somerset Reservoir	Somerset
22	Sadawga Lake	Whitingham
23	Whitingham Park and Brigham Young Monument	Whitingham
24	Mount Snow Summit	Dover
25	Haystack Golf Club	Wilmington
26	Davis Road	Monroe, MA

3.5.1.3 Description of the Project Area

The Deerfield Wind Project is proposed for the tops of two unnamed ridges on either side of Route 8. The two ridges are generally horizontal in form across the tops but drop off fairly steeply to the west and east. Both ridges are completely wooded, with the exception of the very northern portion of the Eastern Project site, which is in private ownership and contains turbines and access roads for the existing GMP Searsburg Wind Facility. The Western Project site (and surrounding area) is comprised primarily of second growth hardwoods, while the Eastern Project site (and surrounding area) contains a greater mixture of softwoods, especially at the northern end. Other than the Searsburg wind turbines, neither ridge contains any distinct visual features which make them focal points in the landscape or which draw the eye. Private lands are located to the north and east of the Western Project site and to the north of the Eastern Project site.

Due to the rugged terrain and predominance of forest vegetation, the Searsburg Wind Facility is not visible from many locations. However, where openings occur, the existing turbines can be seen. The Searsburg facility has a total of 11 turbines, each 198 feet tall, with a white tubular steel tower and three black blades. At some point during the DEIS/SDEIS analysis, one of the Searsburg towers was damaged and removed. However, Green Mountain Power, owner of the site, has since replaced the turbine, bringing the number back to 11 turbines. The turbines are well established, but distinct, elements in the landscape. Most often they are seen as a small part of this varied landscape in which other higher or more prominent hills and ridges dominate. These turbines require no night lighting.

There are no formally designated hiking trails within or close to the Project site. There are very few unnamed trails close to the site, parts of which have been in existence since the 1980's. These trails were used to erect wind measurement towers at the Searsburg Wind Facility, and are still used to maintain these towers. Occasional hikers and hunters explore the two ridges that make up the Project site. Hikers have been known to bushwhack up to the high point at the southern end of the Eastern Project site, which is known informally as Cemetery Peak. There are no obvious signs of use in the GMNF in either area.

About 1.5 miles of Route 8 runs between the two ridges and is within 0.5 mile of the Project site. It includes the intersection with Sleepy Hollow Road near the entrance to the Searsburg Wind Facility. There is a pullout on Route 8 near this point where people stop to look at and take photographs of the existing wind turbines. No other sensitive resources occur within 0.5 mile of the Project site.

To the west of the Western Project site is an area designated as a Diverse Backcountry MA, which separates the Project site from the George D. Aiken Wilderness. Land under the Diverse Backcountry designation emphasizes relatively large landscapes that provide a mix of backcountry recreational experiences, from low use foot trails to motorized use trails. To the east of the Eastern Project site is an area commonly known as the Lamb Brook Area. Most of the Lamb Brook Area is designated as a Remote Backcountry MA, with some of the higher elevation ridges and knolls south of the Project area designated as a Remote Wildlife Habitat MA.

Under the Forest Plan, the entire Project site is classified as Roaded Natural Area ROS.

3.5.1.4 Surrounding Regional Landscape

As previously outlined, the affected environment for visual resources encompasses both private and public lands within a 10-mile radius of the Project site. This section describes the general character of the regional landscape, and then proceeds to describe specific visual resources within the affected environment. For each visual resource with views of the proposed Project, factors affecting the visual impact of the Project are discussed.

The proposed Deerfield Wind Project is located in the southern foothills of the Green Mountains, a physiographic region running north-south the entire length of the state of Vermont. The Project is located south of Route 9, one of a few east-west highways that run through the Green Mountains. North of Route 9, the mountains are generally higher and more prominent. The most visually distinct mountains in the area are Mount Snow and Haystack in the Town of Dover, both of which have been developed as ski areas. These mountains are noticeable because of their larger size and the presence of ski trails, which are particularly prominent in winter. Haystack's pyramidal shape makes it particularly distinct, and a visual focal point in this region.

Glastenbury Mountain to the north, in the Town of Glastenbury, is also one of the area's higher peaks. However, it is more rounded in form than Haystack and Mount Snow, and is difficult to see from many places. Around the Project site, the landscape is complex with numerous lower and higher hills and smaller mountains. The ridges where the Project is proposed are relatively horizontal in form, in contrast to many of the more rounded hills that surround them. These ridges range in height from 2,740 to 3,110 feet AMSL. Most of the hills/ridges within the affected environment are largely undeveloped. Therefore, built structures and night lighting are largely restricted to valley areas where human settlement is concentrated. However, there is an existing communication tower on Prospect Mountain that can be viewed from various locations within the affected environment. Valleys within the affected environment also include major water features, such as the Deerfield River, Harriman Reservoir, and Somerset Reservoir. The reservoirs are part of the Deerfield River Hydroelectric System, owned and operated by an affiliate of National Energy & Gas Transmission, Inc. Along with power generation, these water bodies are used for a variety of water-based recreational activities, including swimming, boating, and fishing.

The Towns of Searsburg, Woodford, Whitingham, Readsboro, Somerset, Glastenbury, Dover and Stamford surround the Project site. Concentrations of human settlement occur in Readsboro, Heartwellville, Whitingham, Jacksonville, Bennington, Wilmington, and West Dover. Elsewhere, widely scattered rural residences (seasonal and year-round) occur along the local road system. Commercial land use is concentrated in the villages and along the state highways but also occurs in the vicinity of developed ski resorts. Routes 8, 9, and 100 are the major roadways through the area, all located in the valleys between hills and mountains. The existing Vermont Electric Power Company (VELCO) 69 kV transmission line runs through the north end of the Western Project site. This line is made up of wooden H-frame structures averaging approximately 55 feet in height. These structures occur within a cleared shrub-dominated right-of-way approximately 100 feet wide.

3.5.1.5 Foreground Visual Character, Use, and Viewer Sensitivity

The Forest Plan S&Gs for visual resources G-2 provides very detailed visual condition guidelines for on-site and off-site views. As shown in Table 3.5.1.1-3, different VQOs would be required for on-site and off-site views, depending on ROS. As defined in the Forest Plan, on-site views would include those within 0.5 mile of the Project site, which are also called foreground views. The Forest Plan defines off-site views as those from distances greater than 0.5 mile, which would encompass both mid-ground and background views. Mid-ground and background views of the Project site are addressed in Section 3.5.1.6 for NFS lands, and in Section 3.5.1.7 for lands outside the GMNF.

The affected environment for foreground visual conditions would include about 1.5 miles of Route 8, Crozier Cemetery, about half of the Searsburg Wind Facility including the access road and substation, and portions of the eastern and western ridges. No residences are located within this zone. The area is predominantly wooded with a mixture of both evergreen and deciduous trees. Most of the site is within the GMNF except for the eastern flank of the western ridge and the northern end of the eastern ridge.

3.5.1.5.1 Visual Character

The foreground affected environment is characterized by moderate scenic quality. This assessment is based on the fact that the low forested ridges that dominate the area are common or normally present throughout the region. The Crozier Cemetery and the Searsburg Wind Facility are the most significant focal points at the present time. The most scenic portion of Route 8 is through a wooded ravine to the south. A small roadside stream enhances this stretch of road. A small portion of the Remote Backcountry MA to the east may extend into foreground areas of the Project. However, due to the topography and angle of view there is no visibility of the Project site from these areas.

3.5.1.5.2 Use and Viewer Sensitivity Levels

Route 8 is the only portion of the site receiving significant use. As a state road it would have high sensitivity levels according to the Forest Plan. It includes the intersection with Sleepy Hollow Road near the entrance to the Searsburg Wind Facility. One of several pullouts on Route 8 is located within the foreground area across from the cemetery. As indicated previously, it is a popular point to stop, view, and take photographs of the existing wind turbines. Visitors also pull in to the parking area by the cemetery to read information about the Searsburg Wind Facility or to visit the cemetery.

The remainder of the foreground affected environment is considered to be of low sensitivity. There are no public trails, though occasional hikers and hunters explore these two ridges. There are no obvious signs of use in either area. The Searsburg Wind Facility receives regular inspections and maintenance of the turbines as well as tours by groups interested in seeing and learning about wind generation.[10]

3.5.1.6 Mid-ground and Background Visual Character, Use, and Viewer Sensitivity within the GMNF

This section addresses visual character, use and viewer sensitivity in mid-ground and background areas within the GMNF (areas greater than 0.5 mile away). The areas discussed in this section include the Lamb Brook Area, other adjacent GMNF MAs, the George D. Aiken Wilderness, the Long/Appalachian Trail, and Mount Snow. The location of these sites is indicated on Figure 3.5-1. The following discussion is generally organized in order of proximity to the Project.

3.5.1.6.1 The Lamb Brook Area

The Lamb Brook Area lies east of the Eastern Project site. The Forest Plan places the northern portions into a Remote Backcountry MA and the southern portions into a Remote Wildlife Habitat MA.[11] The Remote Backcountry MA emphasizes "large expanses of relatively natural landscapes…" "Public use is managed at a scale and intensity that …has minimal effect on the area's integrity." "Non-motorized trail recreational opportunities will be available." "Recreational impacts will be managed to … minimize visual disturbance, and to preserve a sense of wildness."

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[10] The author of the VIA has interviewed people who have stopped to look at the existing wind turbines. All reactions to the project have been positive. People have said that their reactions to a communications facility would be negative while they view the wind turbines positively.

[11] Two areas of the Remote Backcountry MA extend east up the slopes of the Eastern Project Ridge. These may extend to within ½ mile of the Project site. There would, however be no visibility from these areas due to the topography and angle of view.

Visual Character

The southern portions of Lamb Brook, including the Old Stage Road, are in a Remote Wildlife Habitat MA. The emphasis of this area is "to provide a mix of different-aged forest habitats…" "Recreation uses are de-emphasized to minimize continuing disturbance to wildlife." While the ROS class is Semi-Primitive Non-Motorized, motorized uses are permitted in winter allowing the Old Stage Road (part of the Albany to Boston Stage Road) to continue to be used as part of the VAST snowmobile trail system.

This area is entirely wooded. It is accessible via a forest road, which is gated just off Route 100 near Heartwellville. The road ends at a second gate at the junction with the Old Stage Road. The historic Old Stage Road, also the VAST Corridor 9 snowmobile trail, runs west to east and eventually toward Harriman Reservoir. Two informal or undesignated trails (also used as secondary VAST snowmobile trails) intersect with the Old Stage Road, one circling north to join a former forest road, and another south over "the Dome", a prominent landform within Lamb Brook and a hiking destination for some due to its accessibility. The summit of "the Dome" is covered with dense wind swept beeches, but just below the summit is a small opening where one can look north toward the Eastern Project site. The openings are not along the trail and are difficult to find. The existing Searsburg facility turbines are visible. The management recommendations for this area generally discourage recreational use, so it is unclear whether this trail would be maintained. None of the trails in this area are marked or noted in any guidebooks.

The northern portion of the Remote Backcountry MA is occasionally accessed from Route 9 via a steep road on private land that services a surge tank and penstock associated with the Deerfield Valley Electrical Project. There are no trails however, and no obvious evidence of use was noted during fieldwork conducted for the VIA.

The terrain is moderately steep throughout this area. The ridge proposed for the Eastern Project site encloses the interior of this area to the west. "The Dome" and a series of unnamed rocky ledges form the eastern edge of the area. Hardwoods predominate, though there are several areas of softwoods along drainage ways and in wetter areas. Higher elevations tend to be covered in either softwoods or beech trees. Strong winds near the tops of many of these hills make the beeches dwarfed and stunted. Lamb Brook, Wilder Brook and an unnamed brook are small but important focal points in this landscape.

The northern half of the area has several points of interest. The Medbury Branch is a scenic brook with steep softwood-covered banks. Halfway up the valley it divides into two smaller brooks emerging from the flanks of the ridge proposed for the Eastern Project site. At one point, along the flank, the Medbury Branch becomes a series of cascades known by some as the "Devil's Staircase". There are also a number of quite large trees within this northern area.

Use and Viewer Sensitivity Levels

Access to Lamb Brook is difficult. Forest Road 266 is gated near Route 100 requiring a 1.5-mile walk up the road into Lamb Brook itself. There are no signs providing directions or information. Most use occurs in the southern portions of Lamb Brook especially along the Stage Road. "The

Dome" may be one of the more common destinations due to trail access. There is evidence that off-trail explorers occasionally visit the ledges and the cascades at the top of the Medbury Branch.[12] While no data exists for actual forest use, by far the heaviest use occurs during the winter months along the Old Stage Road, which is part of a snowmobile trail extending between Bennington and Brattleboro.[13] Viewer sensitivity levels are considered to be high in the Remote Backcountry MA but are unrated in the Remote Wildlife Habitat MA since recreational use is discouraged.

3.5.1.6.2 Other Adjacent GMNF Management Areas

This section is focused primarily on the area between the Western Project site and the George D. Aiken Wilderness. A Diverse Backcountry MA covers the area to the west of the Western Project site. This MA emphasizes backcountry recreational experiences including motorized use trails.

Visual Character

Northern hardwoods predominate throughout this area along higher terrain, with softwoods being concentrated around the numerous wetlands and streams. Generally the terrain is less steep than along the hills to the east and west. The ridges proposed for the Project site are seen as two of many similar hills within the area. It is an area of moderate scenic quality with no notable scenic resources. Forest Road 74 runs just east of the Aiken Wilderness providing access to semi-primitive campsites, and serves as a VAST snowmobile trail during the winter months. The road once continued south but was rerouted to the east to avoid numerous wetlands associated with Yaw Pond Brook. Forest Road 73 enters the GMNF from Route 100 south of Heartwellville and also provides access to semi-primitive campsites. It is gated in the vicinity of an in-holding called Camp Casino, but a trail (a secondary snowmobile corridor in winter) continues along the southern border of the Aiken Wilderness heading to Woodford.

Use and Viewer Sensitivity Levels

Forest Access Roads 73 and 74 run just outside portions of the eastern and southern boundaries of the Aiken Wilderness, and are open to vehicular use. Campers, hikers, hunters, fishermen and other recreationalists use the Forest access roads in summer and fall. The heaviest winter use of the area is by snowmobile riders using the VAST trails.

3.5.1.6.3 George D. Aiken Wilderness

The 5,060-acre Aiken Wilderness was designated in 1984, and is one of eight wilderness areas on the GMNF. It is a complex of streams and wetlands surrounded by higher hills along its eastern and western edges. Numerous wetland ecosystems include forested and shrub swamps, open water, marshes, and boggy areas. The West Branch of the Deerfield River is the major drainage.

[12] Information regarding off trail areas here and elsewhere came from a member of a loosely knit group of off-trail explorers (sometimes called "peakbaggers") who maintain informal maps and registers on tops of untrailed summits of hills and mountains. There is an informal register at the top of the Dome, (the last entries recorded as of February 2004 were by hunters in November describing deer sightings), and allegedly one on "Cemetery Peak" at the southern end of the Eastern ridge.

[13] The Woodford Snowbusters is the largest snowmobile club in the United States with over 5,000 members. Wilmington's Deerfield Valley Stumpjumpers are the third largest club in Vermont with over 2,500 members.

This divides into about four branches comprised of sequences of streams and wetlands. A branch of Yaw Pond Brook emerges from the eastern portions of the Wilderness and branches of Red Mill Pond Brook have their source in the northern portions of the Wilderness. The entire area is a high plateau, most of which is over 2,300 feet in elevation.

Visual Character

The terrain in the Aiken Wilderness is hilly and complex and the vegetation varied. In places the vegetation is thick and barely penetrable, and in others, the hardwood forests are more open. Low areas tend to be wet in summer, while in winter it is possible to traverse frozen ponds, swamps and marshlands on skis or snowshoes. The Aiken Wilderness is almost entirely surrounded by State or National Forest lands (Woodford State Park is to the north).

The combination of numerous open wetlands and diverse vegetation and topography, creates a visually interesting and varied landscape. As described in the VIA, it is an intimate landscape rather than a dramatic one. There are few distant views and no open mountain summits. The watercourses and especially the numerous ponds are the scenic focal points of this area. The diversity of habitats and opportunity to view wildlife in a remote and wild landscape are important parts of the area's aesthetic appeal.

Use and Viewer Sensitivity Levels

The areas surrounding the Aiken Wilderness receive moderate recreational use, but only a few venture into the Wilderness itself. Aiken Wilderness is known for its abundant insects and wetness in spring and summer, and there are no official trails in this area. Consequently, most users visit this area during the fall and winter. The area is popular with bear hunters who set up camp along the forest access roads in the fall. In addition, a few dedicated explorers like to climb the various hills within Aiken Wilderness, and ski or snowshoe across the numerous wetlands in winter. Backcountry skiers and snowshoers occasionally come into Aiken Wilderness from Woodford State Park. Most follow the drainage ways through numerous semi-open ponds and wetlands, as well as the remains of old logging or camp roads. The Green Mountain Club sponsors an annual backcountry ski trip crossing the Wilderness from Route 9 to the snowmobile trail emerging near Heartwellville.

3.5.1.6.4 The Long/Appalachian Trail

The Long/Appalachian Trail runs over the spine of Glastenbury Mountain at the northern end of the affected environment, and continues south to the Massachusetts border.

Visual Character

Most of the trail in this area is densely wooded with limited views. The fire tower on Glastenbury Mountain is one of the few places where there are extensive views of the surrounding area from the Appalachian Trail. Glastenbury Peak is reached over a gently curving spine with almost continuous mixed forest cover. The trail descends to Route 9 and goes over one smaller knob known as Porcupine Lookout that provides filtered views from east to almost south, including toward the Project ridges and the existing Searsburg Wind Facility. The stretch from Route 9 to the Massachusetts border ascends a series of lower ridges. There is only a limited viewpoint west of the Aiken Wilderness on Harmon Hill (approximately 7.1 miles away).

Views from the summit of Glastenbury Peak are the most extensive, and include mountains and largely undeveloped land for many miles in all directions. The panorama includes Mount Greylock in Massachusetts, Mount Snow, Haystack Mountain, and Equinox in Manchester among the more notable peaks. Somerset Reservoir is also a focal point and lies just to the east. This view constitutes viewpoint (VP) #14 on Figure 3.5-1. There are human elements visible in the landscape as well, though none dominate the view. The existing Searsburg facility turbines and transmission line ROW can be seen to the south. The communications tower on top of Prospect Mountain is also faintly visible, as are a few ski trails along the west side of Mount Snow. West of Glastenbury Mountain there is a privately owned in-holding where considerable timber harvesting has occurred in foreground views.

Porcupine Lookout is a secondary viewpoint reached along the ascent to Glastenbury Mountain. Camping is not permitted here. The Project ridges are visible to the southeast with Haystack Mountain visible to the east and a lower GMNF ridgeline viewed looking more to the south. The existing Searsburg turbines are visible or partially visible at 7 miles or greater distance.

Use and Viewer Sensitivity Levels

The Long/Appalachian Trail is a National Scenic Trail and considered to be a highly sensitive hiking corridor. Use of this stretch of corridor may be somewhat less than sections with major peaks that are easily accessible in a day's hike. The summit of Glastenbury Mountain, which offers the most dramatic views along this stretch, is about 10 miles from a trailhead in either direction. But this characteristic also makes Glastenbury Mountain a worthy challenge, as well as increasing its value as a remote and wild place.

3.5.1.6.5 Mount Snow

Mount Snow is one of three alpine ski areas and year-round sports centers located in part on GMNF land.[14] Lifts, trails, roads, and summit structures are within the GMNF. Lifts to the summit are open during the winter months for skiing and snowboarding, and during the summer months for sightseeing and hiking around and down from the summit.

Visual Character

Views from the summit are panoramic but include abundant foreground ski area development. From the observation deck of the summit lodge there are 360° views that include the existing Searsburg facility turbines to the south. Ski areas are dependent on high mountains. In Southern Vermont, such mountains occur primarily within the GMNF. Although they result in a highly modified landscape, ski areas are found on private and public lands in various locations across Vermont and New England. Facilities and activities on NFS lands are administered under a Special

[14] The others are Bromley and Sugarbush.

Use permit with appropriate terms and conditions. Approximately 37% of the land occupied by Mount Snow is NFS lands, including all of the top portions (peaks) of the ski area.

Visual quality standards for ski areas have been specifically addressed in Agriculture Handbook 617, National Forest Landscape Management, Volume 2, Chapter 7 (USDA Forest Service, 1984). Ski areas are guided by the Rural ROS, which permits a VQO of Permanent Maximum Modification within foreground areas but are encouraged to comply with the Modification VQO for mid-ground and background views. Modification allows alterations to dominate the original surrounding landscape, but constructed facilities must be compatible with the landscape. The Forest Plan notes that ski areas may "under-achieve" these objectives.

Use and Viewer Sensitivity Levels

Ski areas are heavily used in a manner that is not typical of the majority of uses within the GMNF. As such they require a Special Use permit that specifies the activities permitted, and required resource protection measures. Viewer sensitivity levels are high due to the high number of users.

3.5.1.7 Mid-ground and Background Visual Character, Use, and Viewer Sensitivity from Outside the GMNF

This section will examine visual character, use, and viewer sensitivity in the following areas: state and local roads, recreation areas and water bodies, and private residences.

3.5.1.7.1 State and Local Roads

Three state highways traverse the affected environment, and several local roads offer views toward the Project site.

Visual Character

State highways within the affected environment include Routes 100, 9, and 8, while the local roads include White, Stowe Hill, Ray Hill, and Boyd Hill Roads in Wilmington, and Town Hill Road in Whitingham. Roads within the GMNF are discussed above, and roads in State Parks are discussed below in the Recreation Areas and Water Bodies section.

- **Vermont Route 8** – Route 8 serves as a connector between Route 9 in Searsburg and Route 100 in Heartwellville, where it joins Route 100 heading south. It is a multi-state north-south highway in New England, running though Connecticut, Massachusetts, and 13.3 miles of Vermont, terminating at the intersection with Route 9 in Searsburg. The northern part of the route offers a few foreground views of the Searsburg Wind Facility. There are several pull-offs along the road where people stop to take photographs of the existing turbines. Viewpoints 9A, 9B, and 10 represent views from various locations along Route 8.

- **Vermont Route 9** – Route 9 is a designated Vermont Scenic Byway known as the "Molly Stark Trail". It serves as an important east – west travel route, spanning 48 miles across southern Vermont between Bennington and Brattleboro, along the same route Revolutionary War general John Stark led his troops to victory against the British in the Battle of

Bennington. In 1936, the highway was dedicated to Molly Stark, who is remembered for her success as a medic during a smallpox epidemic and for opening her home as a hospital. From the agricultural landscape of the lower valley of western Vermont, the Molly Stark Trail ascends nearly 2,000 feet into the GMNF. After passing through the scenic mountain towns of Woodford and Searsburg, the byway drops down into the Deerfield River Valley, home to the Harriman and Somerset Reservoirs, and the historic town of Wilmington. Continuing to the east, the highway passes Molly Stark State Park and then reaches a scenic overlook at Hogback Mountain. A final winding descent out of the mountains leads through the hill farms and forest of Marlboro and into Brattleboro, where the Molly Stark Trail meets the Connecticut River Byway. About 30 miles of Route 9 occur within a 10-mile radius of the Project site. Open views toward the site are available for a total of about 3.1 miles. Viewpoints 1, 7, and 8 represent views from various locations along Route 9.

- **Vermont Route 100** – Route 100 is heavily used by tourists, and its scenic character is an important consideration. In this region, Route 100 winds its way in a north-south direction through the numerous hills that characterize the area. Within the affected environment, Route 100 runs for about 52 miles through the Villages of West Dover, Wilmington, Jacksonville, Whitingham, Readsboro, and Stamford. Due to the rugged terrain in this area, open views toward the Project site are limited to relatively small areas that total about 2.5 linear miles. Viewpoints 11 and 12 represent views from various locations along Route 100.

- **Secondary Roads** – Numerous secondary roads with open fields providing views toward the existing Searsburg facility and Project area were identified. These include:

    - Boyd Hill Road – Wilmington (VP#6)
    - Ray Hill Road – Wilmington (VP#4)
    - White Road – Wilmington (VP#3)
    - Stowe Hill Road – Wilmington (VP#2)
    - Town Hill Road – Whitingham (VP#13)

- **Other Roads –** Other miscellaneous roads with potential view opportunities include Brown Road in Wilmington (VP#5) and Davis Road in Monroe, MA (VP#26). Sections of the Mohawk Trail (Route 2) located within the affected environment in Massachusetts were also reviewed.

<u>Use and Viewer Sensitivity Levels</u>

As a popular recreation and tourism destination, the scenic attributes of the Wilmington area are highly valued. Route 100 is often recognized as a scenic highway in Vermont and Route 9 has been designated as a Scenic Byway by the State of Vermont. All state roads are considered to be highly sensitive travelways. Local roads in the area are of moderate sensitivity because they are generally used by fewer than 150 vehicles per day. It is possible that on occasional summer weekends Town Hill Road in Whitingham would receive this level of traffic when a ball game or other community event is taking place at the Whitingham Park, but averages are likely to be below this level.

3.5.1.7.2 Recreation Areas and Water Bodies

This section describes recreation areas and water bodies outside the GMNF.

Visual Character

Because there are no open views toward the Project site from the Red Mill Campground in the GMNF (now closed to the public), from campsites along the Long/Appalachian Trail, from eligible Recreation Rivers, or from recreation areas within Massachusetts (i.e., Clarksburg State Park or the Monroe State Forest), these areas are not addressed. In addition, Prospect Mountain Sports Center is located west of the Aiken Wilderness, about 4 miles from the proposed Project. It is a former downhill ski area that is now used for cross-country skiing. Views of the Project from this area are also considered unlikely, and therefore not addressed in this discussion. The visual character of the remainder of the region's important recreational resources is summarized below:

- **Molly Stark State Park**, established in 1960, consists of 150 acres of lawns and woodland, used for picnicking, camping, and hiking. Located at the base of Mount Olga, the area has long attracted visitors. During the 1930s, the Civilian Conservation Corps constructed fireplaces and a toilet building. There are two campground loops, with 23 tent/trailer sites and 11 lean-tos. The trails and campsites are surrounded by forest, so there are no open views toward the Project site from these portions of the park. One trail leads to a fire tower on Mt. Olga from which long-distance panoramic views are available (VP#15). The views include the existing Searsburg facility turbines and the Project site to the west, about 8 miles away.

- **Woodford State Park** is a 398-acre, generally forested park that includes a sizeable lake, which is the visual and recreational focal point of the park. At an elevation of 2,400 feet, Woodford is Vermont highest State Park. Campsites surround the lake, and trails in the park are used for hiking, natural observation, cross-country skiing, and snowshoeing. With the exception of one glimpse through dense trees during the winter months along a trail at the northeastern boundary of the park, there are no open views of the existing Searsburg facility turbines or the proposed Project site.

- **Harriman Reservoir** is a large body of water that snakes along the valley of the Deerfield River. Its shoreline is relatively undeveloped except for the northern end near Route 9, and three developed boat launch, picnic, and swimming areas. It is used for motor boating, canoeing, kayaking, and jet-skiing in summer. There are no campsites at Harriman Reservoir. Mountain Mills is the most actively used area for launching larger boats (VP#17). Castle Hill Boat launch (VP#18) is small and better suited for canoes and kayaks. Ward's Beach (VP#20) is most popular for swimming and has an attractive picnic area. A small marina is located to the south. The existing Searsburg facility turbines can be seen from Ward's Beach, and portions of the Mountain Mills Boat Launch area (the most heavily used and developed recreation area).

- **Somerset Reservoir** (VP#21) is part of a series of flood control and electricity producing reservoirs that occur throughout the Deerfield valley. It is a relatively large body of water that is remote and accessible only to canoes, kayaks and low horsepower motorboats. There are primitive campsites, but the shoreline is largely undeveloped. A few trails and the summit structures can be seen on Mount Snow to the east, and the existing turbines are visible from a small portion of the reservoir. Somerset Reservoir is enjoyed for canoeing, kayaking, swimming, camping and fishing. Approaching the Reservoir, the massive dam is readily visible, but on the reservoir itself a natural setting predominates.

- **Lake Raponda**, located in Wilmington, is a 121-acre lake with many private camps and homes along its shoreline. There is a small beach for Wilmington residents on the eastern shore, and a boat launch at the northern end of the lake. A ridge to the west of the lake blocks views to the Project site.

- **Sadawga Pond** is in Whitingham and has a public boat launch (VP#22). There are no beaches or picnic facilities. This lake is at the edge of Whitingham village with camps around the eastern and southwestern shoreline. Much of the shoreline is undeveloped and there is a floating bog in the middle of the lake. The existing Searsburg facility turbines are visible from portions of the lake.

- **Whitingham Recreation Area** (VP#23) is located on Town Hill Road. There is a picnic area, play equipment, and ball field located on a fairly open hilltop. The Brigham Young Monument is located in the southeast corner of the park. There are scenic views to the west and southwest, and the existing Searsburg facility turbines, about 6.4 miles away, can be seen from the far edge of the open field just south of the Monument.

- **Haystack Golf Club** (VP#25) is in private ownership, but is popular with area residents. It offers dramatic views from the Clubhouse and many of the greens with Haystack prominent to the northwest and a broad panorama to the south and southwest that includes the existing Searsburg facility turbines.

Use and Viewer Sensitivity Levels

All public recreation areas are considered to have high viewer sensitivity levels. None of the recreation areas described above are located in settings for which there is a clear expectation of an entirely natural landscape free of motorized uses, nor are they documented as having exceptional scenic values. All could be considered to have settings of relatively moderate to heavy use, and all contribute to the scenic quality of the regional landscape.

3.5.1.7.3 Private Residences

The emphasis of the Project VIA was on the public landscape. In general, public views are of greater importance since they are enjoyed by a greater number of people. However, views from private residences are fixed and prolonged, so that there is a much greater duration of impact. If a particular ridgeline is seen as an important focal point in the view, or if a large part of the view is altered for a large number of people, the impacts could be substantial.

There are approximately two homes or camps within 0.5 mile of the Project site, approximately 51 homes or camps within 1 mile, and 144 homes or camps within 3 miles. Very few of these homes and camps have views of the proposed Project site. Visibility is most likely from a few homes along Route 8, from which the existing Searsburg facility turbines and portions of the Eastern Project site are visible; from several homes along Route 9, from which the Western Project site is visible; and from about 8 homes in Heartwellville, from which the Eastern Project site is visible. A few homes or second homes in Alpenwald Village, a private development near Heartwellville, are able to see portions of the Project site through deciduous trees in winter (2.5 to 3 miles away).

Farther away, there are a number of homes located along or off of Ray Hill Road, and Boyd Hill Road in Wilmington. These roads are both located about 4.5 miles away from the Project site, along ridges running parallel with the ridges that include the Eastern and Western Project sites. Forest cover and topography block most views of the Project site from homes in these areas, but there are some open views across the valley to the Project site. The existing Searsburg facility turbines are present in all views from the east. The Chimney Hill development in Wilmington is another densely developed area, but the homes are surrounded by woodlands and have limited views toward the Project site. Farther away there are concentrations of homes along White and Stowe Hill Roads in Wilmington (4.8 to 6 miles away) and on Town Hill, Poverty Row, and Streeter Hill Roads in Whitingham at distances of 6 miles or more away. Some homes at higher elevations west of Lake Raponda Road may also be able to see the Project site, though this hillside is forested.

3.5.2 Direct and Indirect Impacts Presented by Alternative

During the scoping process, one significant issue was identified relating to visual resources. People are concerned that the Proposed Action would adversely affect the visual resources of the area, especially those important to the character of the ridgelines. Two indicators have been developed to address this issue. The first is change to the character of the seen area for the proposed facility from key viewpoints related to private residences, historic resources, recreational areas, wilderness/wildland areas, waterways/river corridors, and other areas of public use. The second indicator is the degree to which the proposed wind facility would meet Forest Plan visual quality objectives and standards.

Any wind energy facility would generally result in some impacts to visual resources. This section will evaluate the existing character and amount of the area from which the Project facilities would be visible, including historic resources, scenic resources (particularly ridgelines), recreational areas, wilderness/wildland areas, waterways/river corridors, highways and roads, and other areas of public use. The degree to which the Project would meet Forest Plan visual quality objectives and standards will also be addressed. While the Forest Plan provides guidelines for evaluation of visual impacts, few guidelines are designed specifically for wind turbine projects, especially for interpreting the achievement of VQOs. The VIA for the Deerfield Wind Project was based on guidance provided by the

Forest Plan, the Visual Management System, and other related documents.[15] For evaluating visual impacts related to wind energy projects, the VIA also referred to the recommendations in the National Academy of Science publication, *Environmental Impacts of Wind Energy Projects* (NRC, 2007).

Landscape Related Factors

The degree or amount of visibility of a project is important, but the quality and sensitivity of the views is also very relevant. Landscape related factors influence relative scenic quality and viewer sensitivity, and include landscape variety/diversity; focal point; intactness/order; constituent analysis/concern level; distance zones; duration of view; and documentation of scenic resources or recreational importance. Project related factors influence the degree of contrast of a proposed project (in this case related to wind energy projects), and include project scale; visual clutter; form, line, color, and texture; movement; lighting; noise; and shadow flicker. Each of these factors is discussed in detail below.

- **Landscape Variety/Diversity:** As a general rule, diverse natural landscapes are more scenic. Diversity may result from varied topography and/or diverse vegetative types producing a range of textures and colors, or from the presence of notable features such as water features or rock outcrops.
- **Focal Point:** Certain landscape or cultural features stand out and are particularly noticeable as a result of their physical characteristics. Focal points often contrast with their surroundings in color, form (shape) and sometimes texture, and often enhance scenic quality. Examples include mountains that are higher than surrounding mountains or of a distinct shape, noticeable rock outcrops, and significant water features such as lakes, ponds, waterfalls or rivers. Cultural features, such as a steeple or dome can also be focal points. Built elements should not detract from important existing focal points.
- **Intactness/Order:** Natural landscapes have an inherent underlying order determined by natural processes. Discordant elements in the landscape may detract from scenic quality. Order in the built environment is often expressed by retaining traditional patterns of development, by locating objects in places where there is some logic to their placement, and in the repetition of form line, colors, and texture existing in the surrounding built or natural environment.
- **Constituent Analysis/Concern Level:** Every landscape is distinct in both its physical form and in the relationships people develop with those landscapes. Understanding local and user perceptions and values is essential in evaluating visual impacts. Public participation is integral to the GMNF review process and includes numerous public meetings and hearings. The authors of this visual assessment participated in several public meetings and conducted informal interviews as part of the field assessment process.

[15] These documents include National Forest Landscape Management Volume 1 (Handbook #434) and National Forest Landscape Management Volume 2, Chapters 1 (The Visual Management System), and Chapters 2-7 focusing on the visual management of specific uses from timber, to roads, to ski areas.

- **Distance Zones:** As mentioned previously, foreground views (up to 0.5 mile) are considered to be most sensitive due to the proximity to the viewer, and the ability to perceive detail such as leaves. Mid-ground views extend from 0.5 mile to 5 miles from the viewer, where one can perceive individual trees in clear conditions but not great detail. Background is beyond 5 miles and generally consists of viewing conditions where only broad landforms are discernible and where atmospheric conditions may render the landscape an overall bluish color. In general the scale and impact of a project is reduced the further it is seen from a viewer. Views in which all three distant zones are visible are often those with greatest scenic quality.

- **Duration of View:** Some views are seen as quick glimpses while driving along a roadway or hiking a trail, others are seen for a more extended duration. When there are extended views, especially from important scenic areas, visual impacts may be exacerbated. Examples include hiking trails with views extending over open rocky ridges with highly scenic distant views; or where there are numerous documented highly scenic and sensitive viewpoints throughout a region.

- **Documentation of Scenic Resources or Recreational Importance:** When there is public documentation of particular scenic or recreational resources, especially in local, regional or state planning documents, it is an indication of broad public consensus of the value of a particular resource. Documentation that also specifies particular characteristics of the resource that contribute to its scenic or recreational value is especially useful in evaluating significance.

- **Project Scale:** This refers to both the apparent height and extent of the proposed Project in relation to its surroundings. The perceptions are likely to vary depending on the number of turbines seen from particular viewpoints, the distance from which they are seen, and other contextual factors.

- **Visual Clutter:** Numerous disparate built elements occurring within a view can exacerbate visual impacts.

- **Form, Line, Color, and Texture:** This refers to three visual properties of the Project and the extent to which they are similar to or contrast with the characteristics of other elements within the view.

- **Movement:** The movement of turbine blades can make them more noticeable, but has been shown to also make them appear more visually attractive.

- **Lighting:** The extent to which lights would be seen from critical viewing areas and their prominence.

- **Noise:** While not analyzed from a technical standpoint in this section, the area in which noise may be perceptible and the quality of the noise may influence the aesthetic context of sensitive areas. For analysis of noise in the Project area, refer to Section 3.4 of this FEIS.

- **Shadow Flicker:** This can be a problem when residences or public use areas occur in close proximity to wind turbines. Due to the distance between the proposed turbines and the nearest residences, unacceptable adverse impacts from shadow flicker are not expected (AWS Truewind, 2006), and will not be further discussed in this section. See Appendix K for additional discussion of shadow flicker.

Project Simulations

As part of the Project VIA, simulations were prepared for 11 viewpoint locations around the region. Simulation locations were selected to represent a range of distances and viewing angles, to illustrate views from some of the more visually sensitive viewing locations, and to provide a variety of viewing environments. Recommendations for simulation locations were made by local officials and by GMNF representatives. Table 3.5.2-1 lists the simulations that were prepared for each alternative, in order of distance from Project.

Table 3.5.2-1: Simulation Locations

Viewpoint #	Location	Distance To Nearest Turbine
9A	Route 8 to Western Project site, Searsburg	0.6
9B	Route 8 to Eastern Project site, Searsburg	1.3
8	Route 9 West of Route 8, Woodford	1.7
11	Route 100 Heartwellville, Readsboro	1.8
18	Harriman Reservoir, Castle Hill Boat Launch, Wilmington	4.0
20	Harriman Reservoir, North of Ward's Beach, Wilmington	4.0
4	Ray Hill Road, Wilmington	4.3
6	Boyd Hill Road, Wilmington	4.6
13	Town Hill Road, Whitingham	6.0
3	White Road, Wilmington	6.1
14	Glastenbury Mountain Fire Tower, Long Trail/Appalachian Trail, Glastenbury	7.3

These simulations were revised for the FEIS to illustrate minor turbine shifts (less than 100 feet), and to illustrate roads and clearings where they may be visible from viewpoints (Vissering, 2011). The updated simulations are found in Appendix C, and illustrate the Proposed Action, the No Action alternative, and the other two action alternatives. The simulations were used to determine overall compliance with the Forest Plan based on degree of visual prominence and degradation of views from viewpoints within the GMNF, the surrounding area, and within the region as a whole. Because open, unobstructed views of the proposed turbines would generally be limited to areas outside the Forest, the majority of the simulations were prepared from viewpoints located outside the GMNF. Also, the simulations depict the 11 turbines at the existing Searsburg facility.

3.5.2.1 Proposed Action

This section evaluates the potential direct and indirect impacts to visual resources that would result from implementation of the Proposed Action. Considered will be visual impacts and compliance with the Forest Plan, specifically (1) visual impacts on foreground areas; (2) visual impacts on mid-ground and background areas located within the GMNF; and (3) visual impacts on mid-ground and background areas located on private lands.

3.5.2.1.1 Foreground Visual Impacts and Compliance with the Forest Plan

This section addresses the visual impact of the Proposed Action on the foreground affected environment (locations within 0.5 mile of the Project site), and compliance with the Visual Condition Guidelines for these areas, as defined in the Forest Plan. The areas discussed in this section are the same as those described in Section 3.5.1.3.

Project Visibility

For drivers heading south on Route 8, the eastern turbines would be seen intermittently with views opening up near the intersection with Sleepy Hollow Road (VP#10). The eastern turbines would be seen beyond the existing Searsburg facility turbines from most vantage points. The western turbines would unlikely to be visible while heading south on Route 8 within foreground locations. For drivers heading north on Route 8, there would be occasional glimpses of the tops of a few of the western turbines through the ravine. As one reaches the height of land, the western turbines would no longer be visible, but the eastern turbines would be seen looking sharply right. Beyond the cemetery, the proposed Project would no longer be visible heading in a northerly direction.

Travelers would also briefly see the crossing of the 34.5 kV collection line connecting the Eastern and Western Project sites. This would be located just south of the cemetery. Existing trees would screen most of the line, but poles nearest the roadside, as well as the approximately 30-foot wide cleared ROW, would be visible as one drives by. During the winter months it is possible to see small portions of the existing Searsburg Wind Facility substation, and occasional collection poles along the access road. Occasional glimpses of the upgraded Project access road may be also possible shortly after construction, especially near the base of the hill. The road would be widened approximately 3 feet but would appear similar to the Searsburg Wind Facility access road.

Visual Impacts and Compliance with Forest Plan

The on-site condition standards differ for areas of low and high visual sensitivity, both of which occur in the Project area. The only area of high sensitivity is the portion of Route 8 at VP#10, as described above. The recommended foreground visual conditions permit up to 10% of the travel corridor to be Permanent Modification with the remaining 90% in Retention. Permanent Modification allows alterations to dominate the original surrounding landscape, but constructed facilities must also be compatible with the landscape. The Forest Plan does not define "compatible" but an interpretation found in other Forest Service documents suggest this to mean that structures must borrow from the form, line, color, and texture evident in the surrounding landscape which may include both natural and built elements.[16] As noted above the primary visual features along Route 8 at the present time are the forested slopes of the two ridges, the existing Searsburg facility turbines, and to a lesser extent the cemetery.

While heading south on Route 8, approximately five additional turbines would be visible in the Eastern Project site, beyond the existing Searsburg facility turbines. The 34.5 kV transmission line crossing would also be an additional element that is briefly visible. A portion of the views would be "permanently modified" with the addition of new turbines that contrast with the existing natural landform and vegetation. The Project would, however, repeat the form, line, color, texture, and pattern characteristics of the existing Searsburg turbines. The remainder of the Project area would remain entirely forested and the turbines would appear to be rising above an undisturbed forest, just as the existing Searsburg facility turbines do. Less than half of the Deerfield Wind Project would be visible within foreground areas. Although the pale off-white metal forms of the proposed Deerfield turbines would most likely result in a higher degree of contrast within an entirely undeveloped context, on this site, the presence of wind turbines on the same ridgeline would make the turbines visually compatible with their surrounding landscape. The additional turbines would occupy a relatively limited portion of the view. The undeveloped portions of the Project area would meet the Retention VQO.

In limiting the Modification to 10%, this could refer to views seen as a percentage of miles driven, or the land area covered. Approximately 1.5 miles of Route 8 are within 0.5 mile of the Project. The only location where Project infrastructure would be located immediately adjacent to the road corridor would be at the collection line crossing. The 30-foot wide cleared ROW would be visible briefly, due to the terrain and surrounding vegetation. Visibility of the proposed Project from Route 8 would be intermittent with foreground trees blocking views along much of the 1.5 miles. There may be a brief view of the western turbines heading north, but most views would be limited to a southbound direction of travel. Nearly all views would include the existing Searsburg turbines. The Project would not occupy more than 10% of the land area viewed along this stretch even within the foreground areas.

The remainder of the foreground affected environment would have low viewer sensitivity levels. Recommended visual conditions are for up to 1% per 1,000 acres of the area to be "Permanent Modification" and up to 10% per 1,000 acres to be in "Temporary Modification". Permanent modification would include roads, turbine pads, and the cleared collection line ROW, all of which would be eliminated from traditional forest use.[17] The actual footprint of the turbines and power poles would be relatively small. The margins of the wider roads required during installation of the turbines would be revegetated and constitute "temporary modification". Construction for the Proposed Action would result in the clearing and grading of a total of approximately 87.4 acres,

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[16] The *Visual Management System Handbook*, USDA Forest Service (1974) and associated documents discussed these concepts in detail. The Forest Plan (page 37) refers to a Forest Service document entitled *The Built Environment Image Guide* (FS 710 December 2001). This publication is oriented almost exclusively to buildings rather than other types of facilities, but does note the importance of "sustainable design."

[17] Although the access road would be gated, no one would be prevented from using the surrounding forest areas for non-motorized uses, unless area closures were implemented at a later date. The site could be utilized for other uses such as educational tours of the wind facility.

73.1acres of NFS lands and 14.3 acres of private land, thereby altering the appearance of a total of approximately 0.9% of the 9,523-acre Project area.

Views of the Project within the low sensitivity foreground areas would be limited since these areas are almost entirely wooded. Except within the cleared areas of the Project itself, views would be relatively minimal, and therefore compatible. The direct views toward the portions of the site that is developed would result in the greatest contrast with the existing site conditions. The road would be consistent in character with typical forest roads, but the wind turbines themselves would contrast with the surrounding forest cover in scale, color, and materials. However, other factors would make the proposed turbines appear reasonably compatible, including: 1) the logical visual connection of the new turbines with the existing Searsburg Wind Facility on land immediately adjacent making them appear to be clustered together, 2) the turbines would borrow form, line, color, and texture from the Searsburg turbines which are part of the surrounding landscape, 3) the limited recreational use of the ridges proposed for the Project site, 4) the lack of any documented visual resources or existing views along the ridges proposed for the Project site, 5) the relatively small area of site disturbance and surrounding areas remaining in continuous forest cover, and 6) the existing visitor expectation of seeing wind turbines within views.

3.5.2.1.2 Mid-ground and Background Visual Impacts on Areas within the GMNF

This section addresses the visual impact of the Proposed Action on mid-ground and background areas within the GMNF, and compliance with the Visual Condition Guidelines for these areas, as defined in the Forest Plan. The areas discussed in this section are the same as those described in Section 3.5.1.6.

Lamb Brook Area

The focus of discussion regarding the Lamb Brook Area will be on views from trails within this area during leaf-off periods. Due to extensive forest cover, there would be little or no visibility during leaf-on periods.

Project Visibility

There are a few areas from which the seven turbines located in the Eastern Project site would be seen through numerous foreground trees. The existing Searsburg facility turbines can be similarly seen from several of the winter viewpoints. The Western Project site turbines would not be visible at any time of the year. In general the trail locations from which the Project would be visible include the eastern sections of the Old Stage Road and portions of the undesignated trail leading to "the Dome." Visibility would most likely be where there is a predominance of hardwoods and relatively steep slopes. Where slopes flatten out, distant views disappear due to the density of foreground trees.

Approaching Lamb Brook walking along Forest Road 266, there may be limited views of the tops of some of the proposed turbines from the southernmost section of the Eastern Project site at a distance of about 1.5 miles. The terrain is steep and there are abundant softwoods along this stretch. From the second gate, heading northeast along the Forest Road, there would be no visibility of the turbines. Along the Old Stage Road west of and including Lamb Brook, there would be no visibility of the turbines in either direction for approximately 0.6 mile due to the dense softwood cover. After crossing Lamb Brook, the road heads up a steep hill where hardwoods become more predominant and the ridge proposed for the Eastern Project site comes into view through foreground trees. The turbines along the ridge proposed for the Eastern Project site would be seen at just over 1 mile to about 2 miles away from the Old Stage Road. Heading east on the Old Stage Road, "the Dome" dominates the view, but heading west, the ridge proposed for the Eastern Project site can be seen.

Heading north on the undesignated trail leading to "the Dome", the ridge proposed for the Eastern Project site is partially visible intermittently through trees. As noted in Section 3.5.2.4, there are a few small openings with limited views to the north toward Mount Snow, Haystack Mountain, and the ridge proposed for the Eastern Project site. These openings are not at the summit, nor are they on the trail and can be difficult to find. The existing Searsburg facility turbines can be seen from these openings, as well as from other points along the trail.

A secondary trail connects the Old Stage Road just east of Lamb Brook with Forest Road 266. At the junction, the Forest Road becomes very overgrown. The ridge proposed for the Eastern Project site is seen briefly at the southern end of the connector trail, but is not seen at all from other sections of either the Forest Road or the connector trails.

There are no trails in the northern portions of Lamb Brook, but there are a few locations where the turbines in the Eastern Project site would be visible to bushwhackers in the winter. From the northeastern edge of Lamb Brook along the upper portions of gently sloping hillside east of the Medbury Branch, the turbines in the Eastern Project site would be visible through foreground trees, and from a few small openings along the unnamed ledges near "the Dome" at about 1.75 miles away. The existing Searsburg facility turbines are also included in this view, directly across the valley. The summits of the unnamed ledges are covered with evergreen trees, which would screen views of the Project from this area. There are views to the north from a few places, and Route 9 can be seen along with more distant mountain ridges from a few points. The turbines in the Western Project site would most likely not be visible. Views during the summer months would be highly restricted.

Visual Impacts and Compliance with Forest Plan

The ridge proposed for the Eastern Project site is one of three surrounding landforms within the area. The extensive forest cover prevents high visibility of the ridge at any time of the year but especially during leaf-on periods. Consequently, at no time of the year would the turbines be likely to appear as visually dominant elements within the area. The heaviest recreational use occurs along the Old Stage Road, which is used as a snowmobile corridor in the winter. Backcountry users would also be able to see the proposed turbines in the Eastern Project site, along with the existing Searsburg facility turbines, from a few steeper hillside locations in this area. There would be no distant views from the summits of the surrounding hills in the Lamb

Brook Area. For these reasons, the views from this area would meet the Modification VQO as well as the more restrictive Partial Retention VQO.

Within the context of the Lamb Brook Area, the ridge proposed for the Eastern Project site may be considered one of the more visible ridges. However, even during winter, when it is most evident, it is still not a strong visual feature. Even if the Partial Retention VQO were applied from these viewpoints, the proposed Project would meet that standard.

The turbines would not be dominant elements in any views from the Lamb Brook Area. During the summer months they would be nearly impossible to see, especially from any of the trails within the area. During leaf-off periods, the numerous tree trunks and branches within the views would tend to diminish Project visibility, especially to the casual forest visitor. Their vertical form and light color would make the turbines much harder to see than the darker horizontal ridge. The moving blades may be noticeable but are more narrow and difficult to perceive than the vertical towers. For the few who do reach the off-trail openings on "the Dome," or the unnamed ledges nearby, views of the proposed eastern turbines, along with the existing Searsburg facility turbines, would be possible. These turbines would present contrast with the existing vegetation in terms of line, form, color, and scale. Although larger than the existing turbines, the proposed turbines would be consistent in line, color, and form with these existing structures, and would appear to be small in relation to the massiveness of the ridge proposed for the Eastern Project site.

The seven proposed eastern turbines would be unlikely to dominate or detract from the existing user activities and visual resources of the area: the ability to explore relatively wild hills, many without trails, and to appreciate the diverse natural features of the area (streams, diverse vegetation, rocky ledges, wildlife, and wind-stunted beech forests on many hill summits). Few visit the area for distant scenic views, and where limited views exist, the views already include wind turbines. Nowhere would the Project be a prominent visual focal point within Lamb Brook. During the summer months its visibility would be almost nonexistent.

Turbine lighting may be one of the more substantial changes within this area. As mentioned in Section 1.4.1.5, current Federal Aviation Administration (FAA) guidelines call for lighting the turbines at each end of a ridgeline array, and those turbines approximately 0.5 mile apart within the array, with a single red flashing light atop the nacelle. At the Eastern Project site, three turbines would be lit. Lighting would be limited to a single pulsing red light on the nacelle, which would be operated only during nighttime hours. These lights would contrast with the dark skies that currently characterize the area. The area contains no designated campsites or other sites likely to receive nighttime use. Due to the extensive tree cover, lights would be unlikely to be visible at night during the summer months. During the winter, the lights would only be visible through trees along the steeper slopes facing the Project. Steeper slopes would not likely be sites selected for winter camping. Near streams or along the hill summits, where such camping is more likely, the density of trees and greater softwood cover would help to reduce any impacts. Lights are currently visible from several winter viewing areas, since many look out beyond the boundaries of the GMNF to areas where lighted structures and automobile headlights may be visible. One view from the unnamed ledges near "the Dome" looks out to Route 9. However, more distant lights would have a different presence than those seen at close range. The actual numbers of people who would experience these impacts is likely to be extremely small, but flashing lights would alter the sense of remoteness that now exists.

Other Adjacent GMNF Management Areas

As described in Section 3.5.1.6, this section is focused primarily on the area between the Western Project site and the George D. Aiken Wilderness.

Project Visibility

Visibility of the Project from adjacent GMNF MAs would be minimal during the summer months due to heavy forest cover over the entire area. During the winter months, the western turbines and to some extent the eastern turbines would be intermittently visible through deciduous trees from several areas. From Forest Road 74, the ridge proposed for the Western Project site is approximately 1.3 miles away at its closest point. Snowmobilers and fall hunters are the primary users during leaf-off periods and the most likely users to see the turbines. Some fall and winter hikers and snowshoers occasionally access Aiken Wilderness via Forest Road 74. Most go in via Woodford State Park in order to avoid the snowmobile trail. The turbines would be seen primarily along the northern part of Forest Road 74. Due to terrain, vegetative cover, and angles of view, the turbines become less visible heading east over the VAST trail. From Forest Road 73, just south of the Aiken Wilderness, views would be quite limited at any time of year due to terrain and abundant softwood cover.

Views of the Project would most likely be from northern portions of this MA, and primarily toward the Western Project site (10 turbines). However, views toward the Eastern Project site (seven turbines) would also be possible in the southern portions of this area. The most likely observers would be hunters using campsites along Forest Road 74 during leaf-off periods and snowmobilers traveling the VAST trail in winter. The existing Searsburg facility turbines are not visible from this area.

Visual Impacts and Compliance with Forest Plan

Due to the dense forest cover that occurs throughout this area, the visible portions of the turbines would be subordinate elements in the landscape, and unlikely to be noticeable to casual forest visitors. Snowmobiling, the most predominant winter use in the area and one of the few that also occurs at night, involves rapid movement. Snowmobilers may catch glimpses of the turbines as they move along (most often through trees and tree branches), but the dominant visual impressions would remain as they are now, of a trail winding through a varied forest landscape. The ridges proposed for the Project site are among several that would be seen within this MA. Given the minimal visibility within the area, the lack of highly sensitive recreational uses, and the lack of prominence of these ridges within views of the area, the Partial Retention VQO would be met.

<u>George D. Aiken Wilderness</u>

Inventorying potential views of the proposed Project from within the Aiken Wilderness was limited during the VIA due to the area's large size, lack of trails, complex topography, and varied vegetation. Field visits focused on areas most likely to be visited or to have potential views of the proposed Project. These visits covered about seven of the hills within the Aiken Wilderness, as well as a route through the interior along frozen drainage ways, ponds, and an abandoned road. All visits were made during the winter months, the only time when there would be potential views of the proposed Project.

Project Visibility

There are not any defined or recognized viewpoints associated with designated trails or other features within the Wilderness. In general the area's complex topography and diverse vegetation would make the Project difficult to see from most areas within the Aiken Wilderness, even during the winter months. The Project would be most visible from several of the steeper hardwood-covered hillsides especially along the eastern edge of the Wilderness. From the typically rounded hilltops, however, dense trees block visibility. The Project would also be visible from two small hillsides along the southwestern edge of the Wilderness, but not along the flanks of Prospect Mountain within the Wilderness boundary. Views of the Project would likely be fully or substantially screened from the open wetlands in this area due to their low elevation and surrounding hills. Winter views would be through tree trunks and branches, and views of the Project during the summer months would be unlikely anywhere within the Aiken Wilderness for most users as explained below.

The following paragraphs provide a detailed discussion of potential Project visibility, and an assessment of the visual impacts, from four areas within the Aiken Wilderness. The four areas are: the northern portions near Woodford State Park, the hills along the eastern boundary, the central wetlands and hills, and the hills along the western boundary.

- **Northern Areas near Woodford State Park**: There are limited views from the northern portions of the Aiken Wilderness due to intervening topography and dense vegetation with a strong softwood component. Any views would be limited to winter months. A view of the ridge proposed for the Western Project site can be seen near the eastern boundary of Woodford State Park where the terrain is relatively high in elevation. The terrain descends quickly, however, and the ridge is soon out of sight. Just south of Woodford State Park there are numerous hills and wetlands. Larger hills to the east block views of the Project site from most areas in the park. One of the higher hills in this area (over 2,500 feet) was noted on the viewshed maps as having potential visibility. However, the mix of evergreen and deciduous trees, as well as the density of trees on the relatively flat hilltops, would prevent any visibility from even the higher hills in this area.

- **Eastern Perimeter Hills**: There are several hills along the eastern boundary of the Aiken Wilderness that are most easily reached from Forest Road 74. These hills are high enough to block nearly all views of the ridges proposed for the Project site from the northern interior portions of the Wilderness. The vegetation in this portion of the Wilderness is predominantly hardwood, possibly permitting limited views in winter through trees along the steeper east-facing slopes, toward the Western Project site. On the flatter hill summits however, the density of trees tends to restrict visibility. One hill (elevation 2,618) has a very steep drop-off on the east side near the top permitting views through trees toward the Project site. The existing turbines are also visible from this location. The Western Project site is about 2 miles away, while the Eastern Project site is about 3.5 miles away.

One of the only unobstructed views within the Aiken Wilderness would be from a high hill in the interior which has a small opening at the top oriented to the south, toward Mount Greylock in Massachusetts. Views toward the proposed Project would also be possible along the steeper east-facing slopes, but would be seen through foreground trees. Such views would also include the Searsburg Wind Facility.

- **Interior Portions of the Aiken Wilderness**: One of the most common winter routes used by backcountry skiers runs from north to south following wetlands, drainages, and an old camp road through the central interior of the Aiken Wilderness, and then on to Forest Road 73. The eastern hills within Aiken Wilderness block views along all of the northern portions of this route, but there are occasional views to the south toward Dutch Hill, and to the west toward Prospect Mountain. The communications tower on Prospect Mountain can be seen through the trees. The ridges proposed for the Project site are not visible from this route, or from any of the open wetlands along the route. However, the ridge proposed for the Eastern Project site, about 4 miles away, can be viewed through trees if one ascends the small hills surrounding the wetlands. As elsewhere, there are no views from the flatter summits of surrounding hills. The ridge proposed for the Western Project site is difficult to see due to intervening ridges.

- **Hills Along the Southern and Western Boundaries of Aiken Wilderness**: Visibility of the Project site would likely be relatively minimal from the low hills along the southern boundary of the Aiken Wilderness due to the mixed evergreen and deciduous forest vegetation in much of this area, the intervening hills, and the orientation of steeper slopes to the north rather than to the east. The ridge proposed for the Eastern Project site is visible from two of the hills on the southwestern edge of the Wilderness (approximate elevation 2,560 feet) at a distance of 5.5 miles. The existing Searsburg facility turbines can also be seen. Farther north, the elevation of the western boundary of Aiken Wilderness, combined with the presence of intervening hills, would eliminate any visibility of the proposed Project site .[18]

Visual Impacts and Compliance with Forest Plan

During summer months, the proposed Project would be unlikely to be visible from anywhere in the Aiken Wilderness due to the density of tree cover. Recreational use is more likely to occur during the fall and winter, and use is relatively light. There would be minimal to no visibility along

[18] According to the owner of Prospect Mountain Ski Touring Center, the ridges cannot be seen from any of the eastern slopes of Prospect Mountain once one descends low enough to be within the Wilderness area.

one of the most scenic and well-used routes along the frozen wetlands, drainage ways, and old roads in this area. For those few that may explore the hills above the wetlands and streams, there are areas from which some turbines would be seen in winter. These are the steeper, east-facing slopes. The turbines would be seen at distances ranging from about 1.5 miles at the closest point to over 5 miles away from western portions of the Wilderness, all of which are mid-ground views and seen through numerous tree trunks.

Overall visibility, even in the winter months, would be limited. Although the turbines would present some level of line, color, form, and scale contrast, in no case would the Project be a focal point or dominate views. Most wilderness users would likely be unaware that the turbines were there. In many places from which the proposed turbines would be seen, the existing Searsburg facility turbines can now be seen, thus limiting the contrast presented by the proposed Project. While it is possible that nighttime use could occur during the late fall and winter months, camping would likely take place on flatter slopes where visibility of Project lights would be difficult.

The Aiken Wilderness is not a place people visit for distant views, but rather for the diversity of vegetation, wetlands, and the possibility of glimpsing the wildlife this area supports. The occasional filtered views of the Project are unlikely to diminish the experience of users of this area. Due to the abundance of foreground vegetation, and the varied landforms that limit viewing opportunities, the turbines would appear as a minor and subordinate part of the natural landscape. For these reasons, the views from the Aiken Wilderness would meet the Partial Retention VQO in the few areas where glimpses of the turbines would be visible, as well as the more restrictive Retention VQO in the remaining majority of the area where there would be no visibility.

<u>The Long/Appalachian Trail</u>

Project Visibility

The most open view of the proposed Project from the Appalachian Trail is available on Glastenbury Mountain. The Searsburg facility turbines are not readily visible from that section of the trail or nearby campsites, however, they are visible from the fire tower on Glastenbury Mountain (VP#14). From this vantage point, approximately 9.7 miles away, the turbines appear as small vertical masts. The turbines proposed along the Eastern Project site would be located just behind the existing Searsburg turbines, while the turbines proposed along the Western Project site would be slightly closer, ranging from 7.7 miles to about 9.2 miles away. They would appear to be a related cluster of white vertical lines extending above the ridgetop. While presenting some line and color contrast, perceived scale contrast would be reduced at this distance, and the turbines would occupy a very small part of the panoramic views available from this location. Due to the viewer's higher elevation, site clearing for roads and turbine construction could possibly be visible from the Glastenbury Mountain fire tower, but would not be a significant element in the landscape. The effects of distance would substantially reduce the visibility of tree clearing and ground disturbance.

Background views from Porcupine Lookout to the south of Glastenbury Mountain are narrower occupying about 100 degrees of view with some of the existing Searsburg turbines fully or partially visible from here. From this point, all or portions of the proposed turbines would also be visible. The western turbines would be approximately 5.1 to 6.3 miles away, while the eastern turbines would be approximately 7.1 to 7.6 miles away. The visual impact and factors mitigating the impact are similar from this viewpoint to those described above for Glastenbury Mountain. The simple vertical lines presented by the turbines along with their perceived informal placement or pattern in the landscape, would also help to mitigate the visual impact of these features.

From Harmon Hill, there is a small opening from which it may be possible to see the proposed turbines along with the existing Searsburg facility turbines at distances ranging from 7.5 to 8.5 miles away. At these distances, the turbines would appear as a very small part of a much larger landscape.

Visual Impacts and Compliance with Forest Plan

The Forest Plan requires that all views from the Appalachian Trail meet at least the Partial Retention VQO. From the limited vantage points along the Appalachian Trail, the ridges proposed for the Project site would not be among the "more noticeable peaks and ridges". Haystack Mountain, Mount Snow, Mount Greylock and Mount Equinox are much more distinctive landforms among the many that are visible from the identified vantage points. At these distances, the existing turbines are small elements of the landscape. The cluster of new turbines along these ridges would be slightly more prominent than the existing Searsburg facility turbines now appear, primarily on the east ridge where they would be viewed against the sky, but would continue to occupy a minor part of the views. From Glastenbury Mountain, turbines on the west ridge would be viewed against landform rather than sky. The proposed Deerfield turbines would appear as a cluster of vertical white lines that repeat the form, line and color of the existing turbines. The turbines would not interfere with any views of prominent mountains or regional focal points. Views of the Project along this section of trail would not be extended views along open alpine summits.

From the Porcupine Lookout viewpoint, the proposed turbines would appear as new man-made elements of the landscape. Although they may be perceived as small, they would appear larger than the existing turbines, but would not be substantially out of scale due to the viewing distance. Several additional factors would reduce their overall prominence and contrast from this view. Other hills and mountains are visible within the view, including the much higher and more prominent Haystack Mountain to the east. The Project ridges are also seen beyond a more prominent foreground ridge making the Project ridge appear to be at a greater distance, reinforcing its background position. The turbines would repeat the line, color, and form of the existing turbines and occur within the same general location. The effect of distance and atmospheric perspective (bluing and hazing) would also reduce turbine contrast with the surrounding landscape.

FAA obstruction lighting would be visible at night from the viewpoints described above. These flashing lights would contrast with the existing dark skies that characterize nighttime views from this site, and would attract viewer attention. However, they would not create sky glow or interfere with views of the night sky overhead (star-gazing). In addition, the lights would not be visible from designated camping areas and thus will be seen by relatively few viewers. To the extent that it receives nighttime use, other lights at similar distances would also likely be visible within views from the Glastenbury Mountain fire tower. Porcupine Lookout is not likely to receive substantial nighttime use.

At the distances from which the turbines would be seen along the Appalachian Trail, they would be subordinate within the surrounding landscape during the daytime. The existing naturally occurring landscape would continue to dominate the view, thus meeting the Partial Retention Standard. The nighttime landscape would be seen by relatively few people, and would also meet the Partial Retention VQO, since the lights would be positioned low on the horizon from Glastenbury Mountain, occupy a very small part of this overall landscape, and appear subordinate to the vast expanse of stars overhead.

Mount Snow

Project Visibility

At the summit of Mount Snow (VP#24), the proposed Project would be visible from upper lifts, the summit restaurant decks, and along the upper portions of several ski trails at a distance of approximately 6 miles away. The existing Searsburg facility turbines are currently visible from these locations.

Visual Impacts and Compliance with Forest Plan

The Project would be seen from a strongly altered foreground setting that includes buildings, ski lifts, signs and vegetation clearing. The Project would be viewed at a considerable distance (6 miles) and appear within the context of the existing Searsburg facility turbines. It would occupy a small part of the overall views from the summit. The proposed Project would therefore meet the Modification VQO as well as the Partial Retention VQO.

3.5.2.1.3 Mid-ground and Background Visual Impacts from Areas Outside the GMNF

This section evaluates the Project's visual impact on state and local roads, recreation areas and water bodies, and private residences. The areas discussed in this section are the same as those described in Section 3.5.1.7. This evaluation is based on visual simulations from the viewpoints listed in Table 3.5.1.2-1. The simulations were used as one tool in assessing the visual impacts of the proposed Project as viewed from key viewpoints. By comparing the simulations with photographs of existing conditions, the following Project characteristics could be evaluated: the relative size (horizontal and vertical scale) of the turbines in relation to their surroundings, including the existing Searsburg facility turbines; the number of turbines visible; the extent to which surrounding landforms partially obscured or diminished the relative scale of the Project; and the overall degree of prominence of the Project in terms of its proximity to the viewer and its contrast surrounding natural and built landscape elements.

State and Local Roads

Project Visibility

Open meadows are less frequent in this region than in other parts of Vermont, so distant views from roads are more limited. Numerous intervening hills also make the ridges proposed for the Project site difficult to see from many locations or for extended periods of time while driving. Views from State and local roads are described below.

- **Route 8**: The Project would be most visible along the northern half of Route 8, with some visibility near the intersection with Route 100 at Heartwellville. Heading south on Route 8 there would be several views with the existing Searsburg Wind Facility and the eastern turbines seen directly ahead (VP#9B). From a few locations some of the western turbines would also be visible (VP#9A). Views extend approximately 0.8 mile with an additional 0.5 mile of intermittent visibility. Near the Crozier Cemetery, the Project would be seen in the foreground (within 0.5 mile) (VP#10). In all views, the existing Searsburg Wind Facility is currently a dominant element. The most scenic portion of Route 8 is the narrow ravine between the Crozier Cemetery and Heartwellville. This section of road would remain largely unchanged with no views of the Project, except for occasional brief views toward a few of the western turbines while traveling north. The 34.5 kV collection line crossing would be visible briefly, though in general it would be well screened from view.

- **Route 9**: There would be no views of the Project from the scenic pullout at Hogback Mountain. Heading east after passing over the height of land, the Eastern Project site would come into view for 0.6 mile near Molly Stark State Park (VP#1), then disappear, but be visible only intermittently for 2.5 miles just east of Wilmington Village. Foreground trees and buildings would make it difficult to see. The Eastern Project site would be visible west of the village intermittently for about 1 mile near Harriman Reservoir (VP#7). Heading east from Woodford, the western turbines of the proposed Project would be seen near Woodford State Park and continuing intermittently for about 2 to 3 miles (VP#8). From three to seven of the western turbines would be seen directly ahead in some views. The existing Searsburg facility turbines are also seen briefly near Woodford State Park.

- **Route 100**: Views along Route 100 are limited. The Project would be visible occasionally between Stamford and Heartwellville (VP#12) with the most open views extending about 0.7 mile near Heartwellville (VP#11), primarily of the Eastern Project site. The Western Project site would be seen briefly near the VTrans garage by Dutch Hill. There may also be a brief view of the Eastern Project site from Whitingham Village. There would be no views between Wilmington and Whitingham, between Whitingham and Heartwellville, or between Wilmington and Dover.

- **Mohawk Trail (Route 2, Massachusetts)**: This is a noted scenic highway in Massachusetts, and portions are within the affected environment. There would be no views from this highway.

- **Secondary Roads**: Secondary roads with open fields providing views toward the existing Searsburg Wind Facility and Project area were identified. Descriptions are provided below for VPs from Boyd Hill Road, Ray Hill Road, White Road, and Town Hill Road. Other viewpoints along local roads are for the most part quick views such as on Brown Road in Wilmington (VP#5), and on Davis Road in Monroe, MA (VP#26). Aside from VP#26, there would be no other views of the proposed Project from roads in Massachusetts.

  - Boyd Hill Road (VP#6): There is a scenic viewpoint along this road where foreground meadows provide open views toward the Eastern Project site. The Project would be visible for approximately 0.4 mile with some additional intermittent visibility in leaf off periods. The existing Searsburg facility turbines are visible in the view. This viewpoint is 4.6 miles from the nearest proposed turbine.

  - Ray Hill Road (VP#4): Ray Hill Road rises up from Wilmington Village with intermittent views looking west toward the Eastern and Western Project sites. The existing Searsburg facility turbines can be seen, along with the ridge proposed for Eastern Project site. Most of the ridge proposed for the Western Project site is also visible, at distances of about 4.6 miles away. Although foreground buildings and trees would make the proposed Project less prominent from the road itself, there would likely be a number of residences from which the Project would be visible.

  - White Road (VP#3): Open meadows near the intersection of White Road and Stowe Hill Road (VP#2) northeast of Wilmington Village provide scenic panoramas looking from southwest to northwest. The ridges proposed for the Project site are visible, along with the existing Searsburg facility turbines, at distances of about 6.5 to 7.5 miles away. Views would be available for about 0.8 mile along the two roads, with an additional 0.7 miles of intermittent visibility.

  - Town Hill Road (VP#13): Town Hill Road extends from Whitingham Village to Whitingham Park and the Brigham Young Monument at the height of land. Descending this road there are scenic views toward the Eastern Project site, as well as to the south toward Harriman Reservoir. The views continue for about 0.6 mile, and the Project would be seen at a distance of about 5.8 miles.

Visual Impacts and Compliance with Forest Plan

The perception of the ridges proposed for the Project site varies depending on the vantage point, but as outlined previously, these ridgelines are not among the "more noticeable peaks and ridges" in the region. Their horizontal form makes them part of the background of a diverse landscape with numerous rounded hills with other distinct mountains that are strong focal points. Mount Snow and Haystack are the dominant focal points within this region, and are higher in elevation. Thus the Modification VQO is the appropriate standard of review. The turbines would begin to dominate some views along state roads, especially those in which it is seen at relatively close range or directly ahead in views. Examples would include the view from Heartwellville looking toward the Eastern Project site, which is seen from about 0.8 to 1.5 miles away. Views from Route 9 heading east from Woodford State Park look toward the Western Project site at distances ranging from 0.7 to 3.2 miles away. Neither of these views currently includes the existing Searsburg facility turbines (except very briefly near the entrance to Woodford State Park), so the change in the landscape would be more substantial. Views of the Project from Route 8 would be equally proximate, but the Searsburg turbines are currently a dominant feature within these views. None of the views described above involve unique or documented scenic resources. In both the Route 9 and the Heartwellville locations, views include numerous other hills and ridges that would remain undeveloped. The ridges proposed for the Project site do not appear as a significant feature in any views. Along Route 9, Haystack Mountain can be seen and is an important focal point to the northeast. All three viewpoints are within evolving cultural landscapes that include foreground development.

From other viewpoints along roadways, distance would make the Project appear to be a relatively small part of a much larger landscape. Of the views from local roads, the views from Ray Hill Road would be the most prominent, due to distance and the visibility of both ridges proposed for the Project site. Views from the road itself, however, are intermittent due to foreground houses and trees, and are likely to be more prominent from some of the homes (see discussion of residential areas below). From Boyd Hill Road, only the eastern turbines would be visible, and they would be partially obscured by foreground hills. From White Road in Wilmington and Town Hill Road in Whitingham, the distance and breadth of the view makes the Project appear to be a relatively small part of a broad panorama. The Project would be noticeable but not prominent within views from White Road, Town Hill Road, Boyd Hill Road or Ray Hill Road. In all four cases, the Project would appear visually connected with the existing Searsburg Wind Facility, which is visible in nearly all views from local roads. Equally important is the fact that there are a relatively limited number of viewpoints throughout the region, and all are of relatively short duration. Therefore, the proposed Project would meet the required Modification VQO, and many areas would achieve the more restrictive Partial Retention VQO as well.

Recreation Areas and Water Bodies

Project Visibility

Viewed from the various recreational areas throughout the region, the proposed Project would contrast with the surrounding natural landscape and would be a noticeable element where it is visible. However, it is unlikely to be a dominant visual element from most viewing areas.

- **State Parks –** The proposed Project would not be visible from the two State Parks in the region, except for occupying a very small part of the 360° view from the Molly Stark State Park fire tower at a distance of 8.0 miles away.

- **Harriman Reservoir –** From Harriman Reservoir, the views are complex and intermittent with foreground hills interrupting many views and appearing more dominant. Harriman Reservoir would be one of the more proximate developed recreation areas to the Project at 3.6 to 4.8 miles away. The greatest change would be most likely to occur at the Castle Hill Boat Launch area, where the existing Searsburg facility turbines are not visible. Only three or four of the proposed turbines would be visible from this location, but these turbines would present strong contrast in line, color, texture, form and scale when compared to the existing vegetation and landform. However, the reservoir is not a place where there are expectations of an entirely natural setting. While the natural landscape predominates, it is a cultural setting with a few buildings and some developed recreation sites visible along with a variety of watercraft, including motorboats, on the water. Turbine lighting would alter the nighttime landscape, but would not be the only lights visible. There are no camping areas around the reservoir, and other nighttime use of the reservoir is minimal. Frequent foreground hills would also minimize views, ensuring that the natural landscape would continue to be a dominant element of all views. In most locations only a few of the turbines would be visible.

- **Somerset Reservoir –** The Project would not be visible from the campsites near the boat access area on Somerset Reservoir (VP#21), but would be visible from the southern open water portions of the reservoir. However, the Project would be seen at a considerable distance (7.2 to 10 miles) and occupy a small part of the overall view. While views are predominantly natural, the summit restaurant on Mount Snow can also be seen from this area. The Project would not be visible from the more remote northern end of the reservoir. Lights would not be visible from designated campsites but would be visible from at least one of the informal picnic sites around the reservoir. The Project would be somewhat more noticeable than the existing Searsburg Wind Facility, but due to its distance from viewers and the screening provided by surrounding landforms that would limit some views, would not be a prominent feature in views from the reservoir. The surrounding natural landscape would continue to be the dominant part of the recreational experience.

- **Lake Raponda** – A large ridge west of the lake blocks views towards the Project area, and neither the existing Searsburg Wind Facility nor the proposed Deerfield Project would be visible from Lake Raponda or its immediate shoreline.

- **Sadawga Pond** – The turbines at the existing Searsburg Wind Facility cannot be seen from the boat launch, but can be seen from a few points on the water. The turbines proposed for the Eastern Project site would be visible from eastern and southern portions of the lake, approximately 5.6 miles northwest. Because they would be closer, they would appear more prominent than the existing turbines, but would echo the color, line, and form of the existing facility, and would be a small part of the overall views from the lake.

- **Whitingham Recreation Area** – The turbines at the existing Searsburg Wind Facility and the ridge proposed for the Eastern Project site are only visible at a considerable distance (6.4 miles) from the far edge of the open field just south of the Monument. The eastern turbines would be visible, but difficult to see due to intervening vegetation in the area. It may be possible to see the tips of some western turbine blades as well.

- **Haystack Golf Club** – The Clubhouse and many of the greens offer dramatic views with Haystack prominent to the northwest, and a broad panorama to the south and southwest that includes the turbines at the existing Searsburg Wind Facility. The turbines proposed for both the Eastern and Western Project sites would also be visible, beyond the existing turbines.

Visual Impacts and Compliance with Forest Plan

From nearly all recreation areas the visual impact of the Project would be limited due to the following factors:

- Substantial screening of the Project by topography and forest vegetation
- Relatively small number of turbines seen at one time
- Distance from which the turbines are seen
- Presence of the existing Searsburg facility turbines in most views
- No documentation of exceptional scenic value
- No documentation of an undisturbed natural setting being critical for the recreational experience.

To some people, from certain locations, the Project may appear to dominate the view, but would still be in harmony with the existing Searsburg facility, which is a well-established part of the surrounding landscape. Therefore, the Project would meet the Modification VQO. In addition, the turbines, when seen, would be viewed as rising above the forested landscape, with no apparent alternation of the forest itself. From most locations, the Project would be viewed at substantial distances. It would be a visible background feature, but not a dominant element within the surrounding landscape. Thus the Project would generally appear subordinate to the broad expanse of natural appearing landscape, and would meet the more restrictive Partial Retention VQO.

<u>Private Residences</u>

Views from private residences are likely to be similar to views discussed under state and local roads. There are no residences that would experience foreground views (within 0.5 mile) of the proposed Project. There are approximately 144 homes or camps within 3 miles (mid-ground) of the Project along Routes 8, 9, and 100 in Heartwellville. Field assessment suggests that few would have direct views of the proposed Project. There are two homes located near the proposed access road to the Western Project site. Construction to realign and improve this road would result in visual impacts during construction. The only concentration of homes in proximity to the Project occurs in Heartwellville (1 mile) and in a subdivision south of Heartwellville called Alpenwald Village (2.4 miles). Most homes in Alpenwald appear to be surrounded by woods.

More distant residential areas with potential views to the Project occur on Ray Hill (VP#4), Boyd Hill (VP#6), Stowe Hill and White Roads (VP#3) in Wilmington (4 to 6 miles away), and the Town Hill Road (VP#13), Poverty Row, Streeter Hill and Kentfield Road area in Whitingham (6 miles away). The homes in the Chimney Hill development in Wilmington are about 3.5 miles away, but most are not oriented toward the Project site. The simulations for Heartwellville, Ray Hill Road, Boyd Hill Road, White Road, Town Hill Road provide an illustration of how the Project would appear from nearby residential areas (see Appendix C).

For any homes within 3 miles of the Project with a direct view of the Project site, the proposed Project may reach the Permanent Modification condition (see Table 3.5.1.1-3). In this complex landscape however, it is likely that views would also include many other undeveloped hills. The

Project is unlikely to be located directly in front of distant landscape focal points. Some views in the area include the more distinctive Haystack Mountain to the north, but the ridges proposed for the Project site are generally seen as relatively undistinguished horizontal landforms. From residences at distances greater than 3 miles, the Project would be more likely to appear as a smaller part of a wider panorama of hills and mountains.

For residents who would view the Deerfield Wind Project, night lighting may be the chief concern and would alter the character of the landscape. The flashing red lights on the turbines would contrast with the generally dark skies that characterize most rural residential areas. However, in more developed settings, other light sources would already disrupt views of the night sky from private homes. For residences relatively close to the Project, only a few lights are likely to be visible. In addition, lighting intensity on wind turbines is significantly less when seen at angles below 1° of horizontal. FAA obstruction warning lights are designed to be visible to aircraft but not to light up the general area. They do not contribute to sky glow. Lights would be visible at greater distances in clear weather conditions but would appear less prominent. At distances over 3 miles, lights are likely to occupy a relatively small portion of views and of the night sky, and would occur on the horizon where they would not disrupt views of stars overhead.

3.5.2.1.4 Design Criteria and Mitigation Measures

The following design criteria and mitigation measures would be applied to reduce adverse impacts to the visual resource:

- Keep aviation obstruction warning lights to the minimum allowed by the FAA. As mentioned in Section 1.4.1.5, this would involve lighting seven turbines (three on the Eastern Project site and four at the Western Project site) with red flashing lights at night.
- Utilize a white/off-white turbine color that blends well with the background sky and makes them more visible to aircraft, thus avoiding the need for daytime FAA warning lights. Off-white has been selected for the Deerfield turbines which may mute the brightness somewhat.
- Submit and adhere to a revegetation and landscaping plan for areas disturbed by construction of access roads, substation, LIDAR sites, and transmission line infrastructure to minimize any visual impacts associated with tree clearing during construction.
- Limit clearing for the overhead electrical line crossing of Route 8 to a 30-foot wide corridor, and orient the corridor so as to avoid direct views up the cleared ROW from Route 8.
- Limit ground-level lighting to the use of motion-sensor lights at the substation.
- Locate turbines as far as reasonably possible from adjacent residences to minimize potential shadow flicker impacts.
- File a protocol to implement if the Project receives any complaints regarding excessive shadow flicker.

3.5.2.1.5 Summary of Impacts from Proposed Action

The proposed Deerfield Wind Project would introduce large new man-made structures that present line, form, color and scale contrast with the existing vegetation and topography. However, the fact that the ridges proposed for the Project site are not visually distinct focal points in the surrounding landscape, and the fact that wind turbines from the existing Searsburg Wind Facility already occur along the eastern ridge, combine to make the Project area visually appropriate for the Proposed Action. Although the existing Searsburg Wind Facility is not within the GMNF, the boundary is not something that can be perceived by the average viewer. The proposed Project would be similar in form, color, and scale to the existing Searsburg Wind Facility, so that it would repeat an existing pattern in the landscape. This repetition of existing visual characteristics helps to prevent visual clutter, and results in a logical setting for the Deerfield Wind Project. There are no significant or documented scenic resources that would be affected in the area, and the Project would be located at a considerable distance from viewpoints along the Appalachian Trail. There are only a few open vantage points that would offer views of the Project from the Appalachian/Long Trail, all of which are over 5 miles from the nearest proposed turbine. In all of these views, the turbines would be viewed along with the existing Searsburg turbines and would appear as relatively small background features that remain subordinate to the surrounding natural landscape. Furthermore, as described in Section 3.5.2.1.1, the Proposed Action would be in compliance with the VQOs outlined in the Forest Plan.

3.5.2.2 Alternative 1: No Action

No turbines, access roads, or other Project components would be constructed under the No Action alternative. Therefore, Alternative 1 is not anticipated to have any adverse effects on visual resources, since the existing conditions in the Project area would be remain unchanged.

This alternative would provide the greatest reduction of visual impacts compared to the Proposed Action, particularly in locations where the proposed Project would introduce an entirely new visual element into the viewshed (i.e. those locations from which the existing Searsburg facility turbines are not currently visible, but from which the proposed Project would be visible). These locations would include portions of Route 9 between Woodford State Park and Route 8 (VP#8); portions of Route 100 between Stamford and Heartwellville (VP#11 and VP#12); and from the Castle Hill Boat Launch area, where two to three turbines would be visible (VP#18).

It should be noted that the Proposed Action would not be visible from the majority of the affected environment. From such areas, the No Action alternative would have the same visual impacts compared to the other alternatives.

3.5.2.3 Alternative 2: Reduced Turbines in Western Project Site

Under Alternative 2, the three southernmost turbines on the western turbine array would be dropped from consideration and a turbine would be added to the northern portion of the string, for a total of eight turbines on the Western Project site and seven turbines on the Eastern Project site. All other access and infrastructure needs would remain as in the Proposed Action, with one exception. At the southern end of the Western Project site (eighth and last turbine in this alternative), the electrical collection line would be routed and buried to minimize removal of BSB trees. As the collection line passes the location of what is proposed as the tenth and southernmost turbine in the Proposed Action, the collection line would transition to above ground as it does for the Proposed Action, and be carried as an overhead line down the ridge and across Route 8 to connect with the east side collection system (see the full description of the Proposed Action in Section 1.4 for more information). Construction for Alternative 2 would result in the clearing and grading of a total of approximately 85.4 acres, 66.5 acres of NFS lands and 18.9 acres of private land, thereby altering a total of approximately 0.9% of the 9,523-acre Project area.

This alternative would result in minor reductions of visual impacts, as compared to the Proposed Action. The ridge proposed for the Western Project site is generally less visible than the ridge proposed for the Eastern Project site, and the southernmost turbines of the western ridge would have the least visibility of all of the turbines in the Proposed Action. There would be some amelioration of views along Route 8 (VP#9A) where the southernmost turbines along the Western Project site would be seen briefly heading south and north. The more visible eastern turbines would remain (VP#9B and VP#10).

There would also be a slight reduction in impacts along Route 9 between Woodford State Park and the intersection with Route 8 (VP#8). The northernmost turbines at the Western Project site are primarily in view along this stretch of Route 9, with the southernmost sometimes blocked by foreground trees or landforms and always the furthest away from the viewer. From limited locations 8 instead of 10 turbines would be visible. However, this alternative is unlikely to result in any meaningful reductions in visual impacts along this section of Route 9. The removal of the three southernmost turbines would result in minor visual mitigation from other locations. From Ray Hill Road (VP#4) and White Road (VP#3) there would be an overall reduction of three out of the 17 visible turbines, but the overall breadth (horizontal scale) of the Project would remain the same.

This alternative would show no difference in views from Harriman Reservoir. The northernmost turbines at the Western Project site would be seen from Castle Hill (VP#18) and Mountain Mills Boat Launch (VP#17) areas, while from Ward's Beach (VP#19 and VP#20) only the eastern turbines would be visible. Similarly from Boyd Hill Road (VP#6), Town Hill Road VP#13), Sadawga Lake (VP#22), and Whitingham Park (VP#23) only the eastern turbines would be visible. Differences in views from the VAST trail and Aiken Wilderness on GMNF land west of the proposed Project would be minor since views are extremely limited in any case. There would be no effect on the limited views within the Lamb Brook Area, but views from Glastenbury Mountain and Porcupine Ridge on the Appalachian Trail would be altered somewhat. A reduction from 10 to eight turbines at the Western Project site would result in a minor reduction in visual impacts when compared to the Proposed Action.

Alternative 2 would be in compliance with the recommended VQOs outlined in the Forest Plan. All applicable design criteria and mitigation as described for the Proposed Action would also be applied for this alternative. Compared to the Proposed Action, the Reduced West alternative would result in minor reductions of visual impacts. Visual impacts would be greater under this alternative when compared to the No Action alternative.

3.5.2.4 Alternative 3: Turbines in the Eastern Project Site Only

This alternative proposes construction of the seven turbines on the Eastern Project site, as with the Proposed Action, but eliminates the western turbine array entirely. The seven turbines at the Eastern Project site would be constructed in the same locations as in the Proposed Action. The collection lines of the eastern turbine array would also remain the same as in the Proposed Action, but would terminate at a new substation that would be located to the east of the existing GMP substation off of Sleepy Hollow Road. A new ring bus would need to be constructed at the substation, and the 69 kV transmission line that runs south along Sleepy Hollow Road would require an upgrade. New poles would be constructed within the existing ROW, set off approximately 15 feet from the existing poles, which would be removed following construction of the new line. The new poles would be the same height, and use the same spacing as the existing lines. However, the poles would be sturdier, as each would support three conductors on each side as opposed to the one conductor per side on the existing poles. No additional ROW clearing would be required along this line. The O&M building and temporary construction laydown areas would remain located on Putnam Road as in the Proposed Action. Construction for Alternative 3 would result in the clearing and grading of a total of approximately 49.6 acres, 29.7 acres of NFS lands and 19.9 acres of private land, thereby altering the appearance of a total of approximately 0.5% of the 9,523-acre Project area.

Development of the East Side Only alternative would result in modest reductions in overall visual impacts throughout the region. Of the two ridges proposed for the Project site, the eastern ridge is more visible. The only area from which visual impacts would be eliminated entirely would be the western portions (for approximately 2.5 miles) of Route 9 between Woodford State Park and Route (VP#8), whereas up to 10 turbines would be visible in the Proposed Action from this location. The existing Searsburg facility turbines are seen very briefly along this portion of Route 9, but this alternative would eliminate views of the turbines in the Western Project site, which would have been visible directly ahead and at about 0.6 mile at their closest point. Views of the eastern turbines would remain along sections of Route 9 east of Wilmington.

From other viewpoints in the affected environment, where the eastern and western turbines are seen in combination, this alternative would also result in a somewhat reduced overall visual impact. Views along White Road (VP#3) and Ray Hill Road (VP#4) would include seven rather than 17 (Proposed Action) or 15 (Alternative 2) new turbines, along with the existing Searsburg facility turbines. Similar reductions in Project scale would be visible from Mount Snow (VP#24), Somerset Reservoir (VP#21), and the Glastenbury Mountain (VP#14) and Molly Stark fire towers (VP#15). Due to the long distance of these locations from the Project site (7 to 10 miles), the Project would appear to be relatively small in all cases.

There would be less impacts for views from Castle Hill Boat Launch (VP#18) and a few other northern locations along Harriman Reservoir (VP#17), from which a few of the northernmost turbines in the Western Project site would be visible under in the Proposed Action and Alternative

2, but would not be visible for this alternative. There would be similarly less impacts along Route 8 (VP#9A) and Route 100 where views of the western array would be missing from a few locations (VP#12) under Alternative 3. Likewise, Alternative 3 would also offer a reduction of impacts in the few places in the Aiken Wilderness and VAST snowmobile trail from which the western turbines may be visible in the Proposed Action and Alternative 2, but would not be visible for this alternative.

Nearly all other views would remain unaffected. Views from Lamb Brook, most of Route 8 (VP#9B and #10) and Route 100 (VP#11 and #12), the eastern portions of Route 9 (VP#1) coming into Wilmington, Heartwellville (VP#11), Boyd Hill Road (VP#6), Ward's Beach and nearby areas on Harriman Reservoir (VP#19 and #20), Town Hill Road (VP#13), Whitingham Village, Sadawga Pond (VP#22), and most of Harriman Reservoir would remain unchanged.

Construction of this alternative would result in some additional trade-offs in visual impacts compared to the 17-turbine Proposed Action. For example, the extent of visual impacts along Route 8 would be different. Under the East Side Only alternative, the 34.5 kV collection line crossing Route 8 south of the Cemetery would be eliminated, thereby reducing visual impacts. However, this alternative would require placing a new substation adjacent to the existing substation now serving the Searsburg Wind Facility, which would result in increased visual impacts at this location. The existing substation at the intersection of Sleepy Hollow Road and Route 8 would appear to double in size. Under other action alternatives, the Project substation would be located at the northern end of the Western Project site on Putnam Road, and would not be immediately visible from public roads. This alternative would still require improvements to Putnam Road, including the intersection with Route 8, in order to utilize private land for a storage/laydown area and the O&M building.

Alternative 3 would be in compliance with the recommended VQOs outlined in the Forest Plan. All applicable design criteria and mitigation as described for the Proposed Action would also be applied for this alternative. Visual impacts would be greater under this alternative when compared to the No Action alternative. Compared to the Proposed Action and Reduced West alternative, the East Side Only alternative would result in reductions of visual impacts. However, the elimination of turbines in the Western Project site would not result in a large reduction of visual impacts. This is because turbines in the Eastern Project site would be the most visible from sensitive viewing areas within the affected environment. The most populated areas within the viewshed, and those where vegetative openings (such as farm meadows) permit distant views, are primarily east of the Project site. Areas west and north of the ridges proposed for the Project site are generally wooded, thus offering little opportunity for views towards the Project. Moreover, the primary recreation areas from which views of the Project would be possible are also to the east, most notably Harriman Reservoir.

3.5.3 Cumulative Impacts

Cumulative visual impacts can potentially occur when a proposed activity incrementally adds to or subtracts from the overall impacts when combined with past actions and reasonably foreseeable future actions. This section addresses the potential cumulative visual impacts that may arise from interactions between the impacts of the proposed Deerfield Wind Project and the impacts of other projects, past, current, or future. The cumulative impact analysis area for the Deerfield Project is the same as the affected environment: a 10-mile radius around the Project site.

The only project with visual impacts similar to the Proposed Action that has occurred in the relatively recent past is the Searsburg Wind Facility, which went on-line in mid-1997 (slightly beyond the 5 to 10 year period of past activities considered for cumulative impacts discussion but still showing a visual impact). The proposed Project would lie adjacent to this existing 11-turbine facility, which is now a well-established part of the existing landscape. While addition of the proposed Deerfield turbines would add to the overall visual impact in the analysis area, both the existing and proposed facilities are relatively small, and even when considered together (i.e., a total of 28 turbines for the Proposed Action, 26 turbines for Alternative 2, and 18 turbines for Alternative 3), constitute what would generally be considered a small commercial wind facility. Although the new turbines would be larger, the proposed Project would be consistent with the existing Searsburg Wind Facility in terms of line, color, texture, and form. The impacts for the Proposed Action and alternatives, taken in consideration with the impacts of the existing Searsburg Wind Facility, have been fully described in preceding sections.

Other existing and proposed projects in the area that could contribute to cumulative visual impact include timber sales, residential subdivisions, and commercial development (businesses, ski areas, etc.). Although all of these development activities could contribute to cumulative impact, the character and location of their visual impact are largely different than those of the proposed Project. In addition, such activities are not proposed at this time within the area, or would occur at a scale and magnitude that would not have a substantial effect on the visual environment, especially within lands of the GMNF. Consequently, cumulative visual impacts associated with other non-wind energy projects are not anticipated.

Construction has been started on the Hoosac Wind Power Project in the Towns of Monroe and Florida, MA, which is located approximately 8 to 10 miles south of the proposed Deerfield Project site. Due to the area's mountainous topography and forested cover, simultaneous views of both these projects would not be available in the vast majority of the analysis area. However, open, unobstructed views of both projects under optimum viewing conditions would most likely be available from a few open mountain top viewpoints (e.g., Glastenbury Mountain fire tower). Where such views would be available, they would be distant. The distance of the projects from the viewer would reduce their visibility (especially under overcast or hazy conditions), and when seen, the projects would appear as small background features on the horizon. Furthermore, views of the two projects would not typically coincide in a single view, and together would never make up more than a small percentage of the total field of view from these panoramic viewpoints. Although a few other wind facility projects are being considered in the State of Vermont, all are located in central or northern Vermont, far from the Deerfield Project area, and pose no additional cumulative impact.

Therefore, any cumulative visual impact associated with the Proposed Action and Alternatives 2 and 3, when considered along with the existing Searsburg Wind Facility and the Hoosac facility as the most likely foreseeable future project, would be minor. There would be no cumulative impact associated with the No Action alternative.

3.6 Cultural and Heritage Resources

This section will discuss the impacts of the proposed activities on the cultural and heritage resources present in the Project area. The term heritage resources will be used in this chapter; note that the term 'cultural resources' is also commonly used in the vernacular. The Forest Plan defines heritage resources as: "historic landscapes, archaeological sites, buildings, structures, features, artifacts, Native American Traditional Heritage properties, and/or related clusters of these" (referred to as "districts"). They are deemed "significant" if they meet, or may meet, National Register of Historic Places (NRHP) Criteria for Evaluation (36 CFR 60.4; NPS, 1998):

> "The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and: (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or (b) that are associated with the lives of persons significant in our past; or (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or (d) that have yielded, or may be likely to yield, information important in prehistory or history".

Any heritage resource that is considered significant (NRHP-eligible) may be referred to as a "historic property". Section 2.3.15 of the Forest Plan (USDA Forest Service, 2006a), under Forest-Wide Management Direction, requires the following:

> "All proposed undertakings must take into account the effect on any NRHP-listed, NRHP-eligible or unevaluated heritage resource within the [undertaking's] Area of Potential Effect (APE) prior to implementation. The Forest Service must protect and manage properties found to be eligible for the NRHP, or which remain unevaluated, as if they were listed on the NRHP."

Studies have been conducted to comply with the above requirements and Section 106 of the National Historic Preservation Act of 1966 (as amended). If a heritage resource is identified within the Project's APE, and if that resource is deemed significant as defined above, then efforts would be made to avoid, minimize or mitigate those effects, in consultation with the applicable regulatory agencies.

3.6.1 Affected Environment

Construction and operation of the proposed Project may cause two types of potential effects (impacts) to heritage resources. One would be the potential for direct physical disturbance to archaeological sites and historic properties, if any exist, within the limits of proposed Project construction. The Project site, within which the construction would occur, is the affected environment or APE for direct effects.

The second type of potential effect would be an indirect effect. Effects due to visual intrusion or noise are considered indirect effects, and either could affect the setting of an aboveground heritage resource, such as a historic structure. A visual effect would be found if the proposed introduction of visual elements (the turbines or ancillary facilities) to the character and setting of the historic structure would diminish the integrity of the significant features that qualified the historic structure for inclusion in the National Register. The affected environment, or APE, for indirect visual effects is considered to be the area within 10 miles of the limits of the Project's highest aboveground structures (the turbines). For simplicity, the APE for Project noise is considered the same as the visual APE.

Multiple studies have been conducted to identify known and potential heritage resources within the Project's APE and assess impacts; these are described below. The assessment of Project visibility and overall visual impacts are described in Section 3.5.

3.6.1.1 Phase IA Archaeological Survey and Historic Resource Screening Study

As the first step to comply with the Forest Plan and Section 106 regarding heritage resources, a *Phase IA Archaeological Survey and Historic Resource Screening Study: Deerfield Wind Project* (Phase IA) was conducted by The Louis Berger Group, Inc. (Berger). A copy of the February 2006 Phase IA report may be found in the Project Record. The Phase 1A report was prepared in accordance with the *Vermont State Historic Preservation Office's Guidelines for Conducting Archaeological Surveys in Vermont* issued by the Vermont Department of Historic Preservation (VTDHP) in July 2002.

The Phase IA study identified known heritage sites and assessed the potential for previously unidentified heritage sites to be located within the APE for direct physical disturbance. The Phase IA included background research to 1) determine local chronological sequences for pre-European Contact (also called prehistoric) Native American lifeways; 2) characterize the distribution and type of known archaeological sites in and around the Project site; 3) summarize environmental characteristics of the Project area to aid in predicting locations of potential prehistoric and historic archaeological sites; 4) outline the history of the Project area; and 5) design research issues to assist in the prediction of potential prehistoric and historic archaeological sites (sensitivity assessment) within the proposed Project's APE for ground disturbance (LBG, 2006).

The Phase IA research and archaeological sensitivity assessment (LBG, 2006) included the following tasks:

- Examination of available archaeological site files, maps and Cultural Resource Management reports within approximately 5 miles of the Project site at the VTDHP;
- Examination of NRCS soil maps and surface geology maps of the land in and around the Project site;
- Consultation with the Forest Service Archaeologist for the Green Mountain and Finger Lakes National Forests, who provided GIS mapping of known and potential archaeological sites;
- Consultation with the Tribal Historic Preservation Offices (THPOs) of the Stockbridge-Munsee Community Band of Mohican Indians and the Mississquoi Band of the Abenaki Nation, to inform them of the Project and request comments;

- Completion of the VTDHP's form entitled *Environmental Predictive Model for Locating Precontact Archaeological Sites* (VTDHP, 2002b), to assist in assigning prehistoric archaeological sensitivities within the Project site;

- Site visits and field inspections of the Project site and vicinity to assess conditions and note areas of potential sensitivity for heritage resources.

The Phase 1A report included a historic resource screening study to identify known aboveground architectural historic resources, (i.e. historic properties) such as individual structures and historic districts, which may be visually affected by the introduction of the proposed turbines into the existing landscape. The study included background research to compile a list of all structures listed or previously determined eligible for listing on the State and National Registers within the Project's 10-mile radial viewshed. The research was followed by a vehicular reconnaissance in November 2005 to assess the types of historic period aboveground resources within the viewshed. This study was supplemented by a more detailed historic architectural investigation in 2007 (see Section 3.6.1.3, below).

3.6.1.1.1 History of the Project Vicinity

A chronology of prehistoric Native American adaptations and settlement patterns in Vermont is described in the Phase IA report. In summary, known prehistoric occupations and sites in Vermont range from those associated with Paleo-Indian hunter-gatherers (circa 9500 to 8000 BC), who followed the retreating glaciers, to stone artifacts dated from the Archaic Period (circa 8000 to 1000 BC), when deciduous forests spread northward, to the Woodland Period (circa 1000 BC to AD 1600), when ceramics were consistently used to cook and store food, enabling longer term settlements.

At the time of European contact in the 17th century (the Contact Period is considered circa AD 1600 to 1750), the descendants of Late Woodland groups inhabiting the Connecticut River Valley of Vermont included the Western Abenaki. The Western Abenaki were organized into several major bands, each occupying its own village site. Crops were grown and foodstuffs stored at the villages, while smaller groups dispersed periodically, primarily to hunt.

Trappers and hunters were the first Euro-Americans to travel into the remote region in southern Vermont. The Town of Searsburg was chartered in 1781, but was not settled immediately, possibly due to a boundary dispute with the Town of Readsboro, to the south. Located along the Massachusetts border, Readsboro was settled earlier and was the more industrial of the two. Early settlement of Searsburg may also have been delayed due to the rugged topography of the region.

Joseph Crosier, recognized as Searsburg's first permanent colonial settler, emigrated from Colrain, MA to the southeastern portion of town with his family in 1824. By 1831, Crosier had 1,302 acres of land in Searsburg and the family developed productive farms focusing on beef cattle, sheep and wool production, dairy, butter and cheese. A possible Crosier homestead was previously identified on the west side of Route 8, across from the cemetery at the intersection of Route 8 and Sleepy Hollow Road.

Others began to settle in the area, and as of 1850, just over 200 people lived in Searsburg, particularly in the northern part of the town. In addition to farming, a primary economic pursuit was lumbering, with a number of sawmills operating in the mid-19th century. The population of Searsburg increased to its peak of 263 in 1860, and then gradually declined. The Towns of Searsburg and Readsboro remain small rural mountain towns with dispersed settlement patterns and large areas of land within the GMNF.

3.6.1.1.2 Prehistoric Archaeological Sensitivity

Following a review of previous archaeological work in the Project vicinity, assessment of the environmental setting and paleogeography of the area, and completion of the VTDHP's *Environmental Predictive Model for Locating Precontact Archaeological Sites* (VTDHP, 2002b), Berger (LBG, 2006) found that both the Eastern and Western Project sites possess areas of varying sensitivities for prehistoric archaeological resources. Areas of higher probability for prehistoric resources included peaks, vistas and small wind-protected flat areas or saddles.

No prehistoric archaeological sites were found along the ridgelines during the 1995 Phase IB field survey of the nearby Searsburg Wind Facility area, although two prehistoric flakes were found at the site of the possible Crosier farmstead. The site was avoided during construction of the Searsburg Wind Facility and would be avoided by the Project as well (see Section 3.6.2).

3.6.1.1.3 Historic Archaeological Sensitivity

Results of the Phase IA research indicated the likelihood of encountering historic archaeological resources was high in the Western Project site and low in the Eastern Project site.

Western Project Site

Sensitivity for the presence of previously unidentified historic archaeological sites in the Western Project site was initially considered to be high, prior to the Phase IB field survey. The VTDHP archaeological site files contained 22 historic archaeological sites within a 4-mile radius of the Western Project site, with six historic sites within a 1-mile radius. Two of the six are kilns and the remaining four are homestead/farmsteads.

NFS GIS maps identified five additional historic archaeological sites in or near the Western Project site, some of which were close to an alternative southern access road, which was subsequently dropped from the Proposed Action and replaced by the Putnam Road access on the north end of the Western Project site. Other revisions were also made to the Project layout to avoid sites in the APE for ground disturbance in the Western Project site.

Eastern Project Site

The historic archaeological sensitivity assigned to the Eastern Project site was low. The proposed turbine alignment would be along a ridge, well away from the historic settlement pattern along watercourses and roads in the region's valleys. Subsurface testing was previously conducted along the same ridge in 1995 (LBG, 1995), immediately north of the proposed wind turbine array. One isolated bottle fragment was found, and was not considered significant.

A Phase IB field survey was recommended and conducted in these areas, as described under the Phase IB Archaeological Survey (see Section 3.1.6.2, below).

A supplemental Phase 1A was conducted in May 2008 in a limited area considered for the proposed substation in the East Side Only alternative (LBG, 2008a). The 350- by 175-foot area immediately east of the existing Searsburg Wind Facility's substation was examined by Project and Forest Service archaeologists. The purpose of this supplemental Phase 1A walkover was to determine the presence or absence of observable aboveground heritage resources and to assess the prehistoric and historic archaeological sensitivities of the alternative location.

Based upon excessive slopes and lack of fresh water, the area was considered not sensitive for potential prehistoric resources. A dry-laid stone wall, reminiscent of early farming activity, and a second rock wall just upslope and outside of the APE near an existing trail, were observed. As a result of these cultural features, the Project archaeologist assigned a moderate sensitivity for historical archaeological resources and recommended avoidance of these aboveground structural remnants. If avoidance was found not feasible, the archaeologists recommended mapping and photographing these features prior to disturbance, which should be minimized to the extent possible.

3.6.1.2 Phase IB Archaeological Survey

In September 2007, a field inspection and sensitivity study of the Project's APE was conducted to update the Phase IA Survey and develop the scope for the Phase IB Survey. The Phase IB scope (LBG, 2007a), entitled *Archaeological Resource Assessment and Scope of Work* dated October 2007, was submitted to the VTDHP. The Phase IB was designed to assess the presence/absence of archaeological deposits at 12 locations identified as archaeologically sensitive during the Phase IA field walkover, within areas anticipated for ground disturbance at the Project site. Five locations were within the Western Project site and seven were within the Eastern Project site.

A Phase IB field survey was conducted between October 29 and November 9, 2007. The cultural resources specialists who conducted the Phase IB meet the Secretary of the Interior's Professional Qualifications standards as specified in 36 CFR 66.3(6)(2). Test pits were excavated and the recovered materials were logged, screened and examined for cultural materials. No archaeological deposits were encountered in any of the 115 shovel test pits excavated during the Phase IB survey and no additional work was recommended. Methodology and results of the Phase IB were submitted to the VTDHP in an end-of-field letter dated November 26, 2007 (Luhman, 2007).

Based upon review of the end-of-field letter (Luhman, 2007), the VTDHP requested additional information about the Phase IB archaeological field-testing methods in a letter dated December 7, 2007 (Kessler, 2007). The requested archaeological information (summarized below) was provided in the report submitted to VTDHP entitled *Phase IB Archaeological Survey: Deerfield Wind Project, Towns of Searsburg and Readsboro, Bennington County, Vermont*, dated December 18, 2007 (LBG, 2007b).

The proposed scope for the Phase IB survey (LBG, 2007a) estimated the number of shovel test pits to be excavated at 175. The number of shovel tests actually excavated during the Phase 1B survey was 115. The December 2007 *Phase 1B Archaeological Survey* report (LBG, 2007b:6) reviewed field conditions that resulted in fewer shovel tests being excavated than was originally proposed at the 12 areas identified as archaeologically sensitive. Conditions that reduced the estimated number of shovel tests included shallow bedrock outcrops or boulders, excessive slopes, hummocky or wet areas, and a decrease in the originally estimated size of several potentially sensitive areas, due to increased visibility of the terrain during the field-testing (after the leaves had dropped) as compared with conditions during the walkover in September. During the field program, shovel test pits were placed judgmentally at intervals of 33 feet (10 meters), except where micro-topography prevented pits at such intervals. Adjusting site survey protocol to address site-specific restrictions encountered in the field during a survey is standard practice in the industry and is consistent with the VTDHP's *Guidelines for Conducting Archeology in Vermont* (VTDHP, 2002a).

To further satisfy VTDHP's concerns about the reduced scope of work accomplished during the October-November 2007 Phase 1B survey, Berger conducted additional archaeological survey work during May 2008. The supplemental archeological work is described in a report entitled *Revised Phase IB Archaeological Survey: Deerfield Wind Project* dated June 13, 2008. The supplemental 1B survey work included the excavation of 61 additional shovel tests, bringing the total number of shovel tests excavated for the Project to 176 (LBG, 2008b). No artifacts were recovered and no archeological sites were identified during the supplemental survey work.

The Applicant's proposal before the Vermont PSB was subsequently modified to a 15-turbine configuration as described in Section 1.1. To determine whether the revised layout would have any effect on archaeological resources, Berger conducted an additional Phase 1B field investigation in June 2008, the results of which are described in a report entitled *Addendum Report, Phase IB Archaeological Survey: Deerfield Wind Project* dated July 1, 2008 (LBG, 2008c). This addendum Phase 1B survey included a pedestrian reconnaissance of the entire Project area, and excavated a total of 29 additional shovel test pits at four of the 12 originally identified archeologically sensitive areas. No artifacts were recovered and no archeological sites were identified during the addendum Phase 1B survey work.

3.6.1.3 Historical Architectural Investigations and Determinations of Eligibility

As part of the process to assess the Project's potential visual impacts on aboveground historic properties, the *Phase IA Archaeological Survey and Historic Resource Screening Study* (LBG, 2006) described above that was conducted in 2005 also compiled a list of all known historic buildings, structures and districts that were included or had previously been determined eligible for inclusion in the State and National Registers within 10 miles of the limits of the Project's highest visible structures (the turbines). This area, considered the viewshed of the Project as described in Section 3.5 for Visual Resources, constitutes the APE for potential visual effects to aboveground historic architectural resources.

The 2005 study was supplemented in 2007 by a more comprehensive architectural investigation (LBG, 2007c), which also included documentation of previously unidentified structures within the visual APE that appeared to meet criteria for eligibility for inclusion on the National Register. The 2007 report, entitled *Historical Architectural Investigations and Determinations of Eligibility: Deerfield Wind Project* (LBG, 2007c), may be found in the Project Record. Findings are summarized below.

Results of the original review in 2005 at the VTDHP found no aboveground historic architectural structures listed on the State or National Registers within the Towns of Searsburg and Readsboro, within which the Project area lies. One aboveground historic site in Searsburg has been determined eligible for listing on the National Register. This is the Deerfield River Hydroelectric Project system, which includes a 1924 dam and associated structures located northeast, east and southeast of the Project site, in the towns of Searsburg, Somerset, Readsboro and Whitingham.

Two National Register historic districts were found to be located within the 10-mile visual APE: the Wilmington Village Historic District and the West Dover Village Historic District. The geographic area also includes four individually listed National Register historic sites: the Crow's Nest and Medburyville Bridge in Wilmington, the District No. 1 Schoolhouse in Somerset, and the Tudor House in Stamford. In addition, there are 51 individually listed State Register historic structures and an additional 15 State Register-listed structures within or near the National Register-listed historic districts in Wilmington and West Dover.

Of these structures already designated historic, the visual studies found no potential visibility of the Proposed Action at the Crow's Nest and Medburyville Bridge in Wilmington; the West Dover Village Historic District in Dover; the National Register-eligible 1922 dam project structures in Searsburg and adjacent towns; the Old Wesleyan Methodist Church in Readsboro; and none of the designated properties in Woodford and Jacksonville.

Very limited potential visibility of the Proposed Action was found at a number of other designated historic structures, due to screening provided by intervening vegetation, topography, and/or structures, as detailed in Section 3.5. In summary, those structures are the Wilmington Village Historic District and several other structures individually listed on the State Register; the Old Coach Inn and Methodist Church in Readsboro; one of two historic structures in Somerset; several structures in Whitingham (approximately 5 miles away) and some structures within the village of Stamford and along hillsides outside the village (approximately 7 miles away).

A field reconnaissance to verify the continued existence of the recorded historic sites, and photo-document and assess previously undesignated aboveground historic architectural structures for potential eligibility was conducted in the summer of 2007. The historical architectural assessments were done in accordance with National Park Service (NPS) guidance and to comply with Act 250 (Title 10 of Vermont Statues Annotated, Chapter 151) and 30 VSA Chapter 5, Section 248 (Public Service Board's Certificate of Public Good review).

The historic architectural resources identified in both the 2005 and 2007 surveys (LBG, 2006, 2007c) located within the 10-mile visual APE are listed Tables 1 and 2 of the 2007 *Historical Architectural Investigations and Determinations of Eligibility: Deerfield Wind Project* report (LBG, 2007c). A total of 114 previously unevaluated historic and/or architectural properties were identified in the 2007 historic resources survey within the 10-mile APE that are 50 years or older, as the 50-year age minimum is a guideline for eligibility for listing in the National Register. Of those, Berger noted that 17 properties satisfied one or more of the NRHP eligibility criteria (36 CFR 60.4; NPS, 1998; see Section 3.6). The State Historic Preservation Office (the VTDHP) reviews NRHP eligibility recommendations. In review correspondence dated December 7, 2007 (Kessler, 2007) concerning the 2007 *Historical Architectural Investigations and Determinations of Eligibility* report, VTDHP requested additional information, including photographic views of 25 properties included in the report. Berger provided additional photographs of the 25 specific properties and one streetscape requested by the VTDHP (Luhman, 2008). Based on the review of the requested information, VTDHP determined that they concurred with 57 of Berger's NRHP-eligibility recommendations, but also determined that an additional 51 of the identified properties satisfied NRHP-eligibility criteria (Luhman, 2008).

Berger and VTDHP developed an agreed-upon protocol, which included application of the *Criteria for Evaluating the Effect of Proposed Telecommunications Facilities, Transmission Lines, and Wind Power Facilities on Historic Resources* (VTDHP, 2007), for assessing potential impacts of the Project on historic properties (Luhman, 2008). Berger prepared a report entitled *Assessment of Effects, Deerfield Wind Project: Towns of Searsburg and Readsboro, Bennington County, Vermont* dated June 23, 2008 (LBG, 2008d), which was submitted to VTDHP on July 2, 2008 (Luhman, 2008). This report included evaluations of the potential effects of the Project on all of the properties that were 50 years or older identified within the 10-mile APE, including the 51 properties determined to be NRHP-eligible by VTDHP (Luhman, 2008). Review of a viewshed analysis and site visits determined that the Project would not be visible from most of the historic resources in the study area.

The Applicant's proposal reviewed by the Vermont PSB was modified from a 17-turbine to a 15-turbine configuration as described in Section 1.1. To determine whether this revised layout would have any effect on historic resources, the Applicant was required to conduct further architectural survey fieldwork in June 2008, the results of which are described in a report entitled *Addendum Report, Historic Architectural Investigations: Deerfield Wind Project* dated June 27, 2008 (LBG, 2008e). The addendum survey work identified 11 additional NRHP-eligible properties within the revised 10-mile APE associated with the 15-turbine layout. Review of the revised viewshed analysis associated with the 15-turbine configuration and site visits determined that the Project would not be visible from any of the 11 historic resources identified during the additional survey.

3.6.1.4 Consultation with Native American Tribes

In compliance with the Forest Plan (USDA Forest Service, 2006a), the Tribal Historic Preservation Officer (THPO) of the Stockbridge-Munsee Band of the Mohican Nation and the Chief of the St Francis/Sokoki Band of the Abenaki Nation were notified by letter dated November 30, 2005 (Luhman, 2005) about the proposed Project, and asked to identify any areas of concern in the

Project area. Correspondence dated December 22, 2005 from the Stockbridge-Munsee Tribal Historic Preservation Office stated "…the proposed ground disturbing activity of this project does not appear to be in a region of archaeological interest to the Stockbridge-Munsee Tribe." (White, 2005). Concerns about potential human remains and associated funerary objects were raised in the letter. None have been identified to date during surveys in the Project's construction footprint. No correspondence was received from the Abenaki Nation at that time.

Additional (email) contacts with both Tribes were made by the GMNF's archaeologist in November 2007 (Lacy, 2007a, 2007b), to inform them of the changes made to the Proposed Action. Both tribes responded that they had no further concerns with these changes.

3.6.2 Direct and Indirect Impacts Presented by Alternative

No significant issues were raised specifically regarding heritage resources. One significant issue may be associated with the Project's potential visual impacts on heritage resources. Other issues and concerns raised were those typically stated for a ground disturbing proposal, for instance, that all required compliance measures be met and that appropriate surveys and evaluations be done to assure protection of heritage resources.

Risk to physically damaging archaeological sites is the indicator used to focus discussion on direct impacts to heritage resources. Additionally, two indicators are used to focus discussion of the Proposed Action's visual impacts (indirect) on aboveground historic architectural resources (i.e., historic properties or structures). The first is change to the character of the seen area for these structures from key viewpoints. The second indicator is the degree to which the facility would meet Forest Plan Visual Quality Objectives and standards.

3.6.2.1 Proposed Action

The Phase IA and IB archaeological surveys identified one potential archaeological site in the Project area: the possible remains of the historic-period Crosier farmstead on the west side of Route 8. Although not within the footprint of the Western Project site, this site was within the APE of the once proposed southern access road into the Western Project site. As previously noted, access from the south has been dropped and replaced with access along Putnam Road in the northern portion of the Western Project site, and therefore, there would be no direct impact to this potential archaeological site. Although NFS GIS maps identified five historic archaeological sites located within or near the Western Project site, no archaeological sites were identified within the APE for physical disturbance (the construction footprint) of the Project. Therefore, there would be no direct impacts to known historic or prehistoric archaeological sites.

The Final Order dated April 16, 2009 that accompanied the Vermont PSB's Certificate of Public Good for the Project addresses "Historic Sites" in Findings 246-249. Finding 246 states "the Project will not have an undue adverse impact on historic or archaeological resources" (PSB, 2009:67). VTDHP reviewed all of the archeological studies undertaken for the Project. The Amended Petition to the Vermont PSB included an agreement entitled *Stipulation Between Deerfield Wind and the Vermont Division for Historic Preservation* (VTDHP, 2008), which summarizes VTDHP's evaluation of the Project's potential impacts on archaeological sites. The stipulation states "Based on the Division's [VTDHP's] review of the information identified [above], the Division is able to concur with Berger's conclusion... that the Project will not have an undue adverse impact on archaeological resources in the APE" (VTDHP, 2008:3).

One design criteria used to avoid or minimize impacts would be the development of an Unanticipated Discoveries Plan. Direct impacts during construction that could affect unidentified archaeological resources would be minimized by contractor compliance with procedures outlined in the Unanticipated Discoveries Plan. The plan, which would include notification to the Forest Service archaeologist to inspect the discovery in consultation with the VTDHP, would be prepared following receipt of permits and prior to the start of Project construction.

Other direct impacts could include off-site erosion from soils disturbed during Project construction and operation that could affect nearby archaeological sites, particularly those with surface expression. To reduce the risk of construction vehicles or activity physically disturbing identified nearby offsite archaeological deposits, such as the possible Crosier farmstead and the stone structural remnants near the existing Searsburg Wind Facility substation, a design criteria would be developed to clearly delineate the limits of Project work on plans and in the field, either by erosion controls measures, fencing, staking and/or flagging. The two sites noted above would be fully surrounded by appropriate marking, such as temporary fencing, and the areas would be identified as No Access areas in the field and on Project plans. Monitoring of these areas would continue during construction.

Aboveground historic architectural resources either listed in the National Register, determined eligible or recommended as eligible for listing in the National Register, or listed on the State Register were identified within the 10-mile radial viewshed of the Project, to determine whether they would have potential views of the Project, and if so, whether the introduction of the Project's visual elements (the turbines) would alter the character and setting of that specific historic structure. The VIA prepared for the Proposed Action (see Section 3.5; Vissering & Boyle, 2008) found that in most mid-ground and background locations within the overall 10-mile radial viewshed, simulated views of Project turbines would appear as a logical continuation of the existing Searsburg Wind Facility turbines. The simulations indicate the proposed turbines are clustered around an existing project (the Searsburg Wind Facility) with similar form, scale, color and texture, with the surrounding landscape remaining undisturbed. The VIA also found that because the Project would be located on two separate ridges, from most viewpoints only a few of the proposed turbines would be visible from one location. Substantial visual screening provided by the abundant forest cover, complex topography and intervening structures would also tend to minimize impacts to aboveground historic architectural resources.

As such, the Proposed Action would not change the character of the landscape as seen from designated historic architectural structures. In addition, the VIA (Vissering & Boyle, 2008) concluded that the analysis of the visual impacts of the proposed Project would comply with the guidelines of the Forest Plan, including the Visual Quality Objectives and standards applicable to all alternatives. Construction and operation of the Proposed Action would therefore have minimal indirect visual impacts to designated aboveground historic architectural resources. In regard to the impacts of noise on historic architectural structures, the results of the Noise Impact Studies

(RSG, 2007a, 2007b) prepared for the Project found that operational noise and sound vibrations generated by the Project would have little or no impact on the nearest residence, or on any aboveground historic architectural resources (see Section 3.4). Therefore, no indirect noise impacts to heritage resources due to the proposed Project would be anticipated.

Based on the results of the historic-architectural surveys, eligibility evaluations, and impact analyses conducted for the Project, Berger concluded that the Project would not be visible from most of the historic resources in the study area and would not have an adverse impact on historic resources (LBG, 2008d,e; Luhman, 2008). Furthermore, as noted in the agreement reached as part of the final PSB section 248 review, *The Stipulation Between Deerfield Wind and the Vermont Division for Historic Preservation* states that "Based on the Division's [VTDHP's] review of the information identified [above], the Division concurs with the Petitioner's assessment that the Project will not have an undue adverse impact on historic buildings and structures" (VTDHP, 2008:2). In correspondence dated April 2, 2010, the Forest Service requested the concurrence of the VTDHP that the Forest Service has met their obligation under Section 106 of the NHPA in regard to the Project and that the Project will not have any undue adverse effect on historic properties or archeological resources (Marr, 2010). The State Historic Preservation Officer signed the letter on April 23, 2010, indicating that VTDHP concurred with the Forest Service finding of no adverse effect on historic resources.

Therefore, after dependent review of the findings of the Berger studies and the PSB, the Proposed Action would not result in any undue adverse impacts to any archaeological resources or historic buildings and structures.

3.6.2.2 Alternative 1: No Action

No turbines, access roads, or other Project components would be constructed under the No Action alternative, and therefore no direct, indirect, or cumulative impacts to heritage resources would be anticipated. There would be no change to any existing heritage resources, including historic properties, other than what would naturally occur due to existing public use and Forest Service management of the site.

3.6.2.3 Alternative 2: Reduced Number of Turbines in Western Project Site

As is the case for the Proposed Action, a reduction of two turbines in the Western Project site would have no direct impacts to known historic or prehistoric archaeological sites. The possible Crosier farmstead and the stone structural remnants near the existing Searsburg Wind Facility substation, both outside the actual construction footprint, would be protected as noted in the Proposed Action.

A reduced number of turbines would slightly lessen any potential for unanticipated discovery of archaeological resources as well as indirect visual effects to those historic architectural resources that may exist within the APE for the Proposed Action. Also, as for the Proposed Action, there would be no indirect noise impacts to heritage resources resulting from this alternative.

3.6.2.4 Alternative 3: Turbines in Eastern Project Site Only

Dropping all turbines in the Western Project site would also result in no direct impacts to known historic or prehistoric archaeological sites. The possible Crosier farmstead would not be affected by construction on only the Eastern Project site. The stone structural remnants near the existing Searsburg Wind Facility substation, outside the actual construction footprint, would be protected as noted in the Proposed Action.

Dropping 10 of 17 Project turbines for this alternative would reduce the potential for unanticipated discoveries and lessen overall indirect visual impacts to historic architectural resources within the APE for the Proposed Action. However, when compared to the visual impacts disclosed for the Proposed Action, this alternative most likely would not offer any substantial reduction in impacts, as discussed in Section 3.5. Also, as with the Proposed Action, there would be no indirect noise impacts to heritage resources for this alternative.

3.6.3 Cumulative Impacts

The cumulative impacts analysis area for direct effects on heritage resources is the overall area of ground disturbance required for construction of the Project (the construction footprint). There are no identified archaeological sites or historic architectural structures within the Project site. The possible Crosier farmstead and the stone structural remnants near the existing Searsburg Wind Facility substation, although close to the Project site, would be protected as described above. Given the relative undeveloped nature of the Project vicinity, the only major development close to the Project site in the past 5 to 10 years is operation and maintenance of the Searsburg Wind Facility (constructed slightly beyond the 5 to 10 year period), which has produced no known disturbance to heritage resources. No other known projects are planned for the foreseeable future that would involve ground disturbance within or close to the Project site. A landscape-scale planning effort for NFS lands south and west of the Project area is expected to begin in 2011. This planning effort might include additional GMNF lands south of Route 9 and east of the Project area, as well. It would be at least one to two years beyond 2011 before any definite proposals would be analyzed. No specific proposals are known at this time. Any projects resulting from this planning effort would not impact the Deerfield Project area. Therefore, there would be no direct cumulative impacts from the Proposed Action or any of the alternatives.

The cumulative impacts analysis area for indirect visual and noise effects would be the same APE as previously described, that being the area within 10 miles of the limits of the Project's turbines. The existing Searsburg Wind Facility was constructed in 1997 and is now part of the visual landscape. No other known projects of similar nature, with similar visual impacts (structures that extend well above the tree heights), are planned on NFS lands in the analysis area in the next 5 to 10 years that would add to the visual effects of the proposed Project and the existing Searsburg Wind Facility. Any projects resulting from landscape-scale planning effort described above would not add any incremental cumulative impact to the Deerfield Project.

Other projects may be proposed on private land. These could include additional overhead transmission lines, telecommunications towers, additional wind turbines, or industrial plants with stacks. However, much of the land surrounding the Project area is relatively remote, undeveloped, and/or included within the National Forest, which limits the potential for future large-scale development. Little private land exists within the Project area. Visibility in the area is also limited by complex topography and dense forest in many areas. The relatively minimal indirect visual impacts of past and reasonably foreseeable future actions, when combined with the minimal impacts disclosed above for the Proposed Action and alternatives, would produce little adverse cumulative impacts to aboveground historic architectural resources.

3.7 Water Quality and Water Resources

The section describes the groundwater and surface water resources within the Project area, including headwaters, streams, shorelines, outstanding resource waters, groundwater, and water source protection areas, and the impacts to those resources that would result from implementation of the Proposed Action or one of the alternatives to the Proposed Action. Between 2003 and the present, Arrowwood Environmental completed numerous field surveys of the Project area, generating a report entitled *Environmental Assessment of the Deerfield Wind Project* (2006b), along with several other related documents. These reports are included in the Project Record. The Arrowwood surveys and definitions, many of which are derived from Vermont's Act 250 statute, form the basis for the following discussion.

3.7.1 Affected Environment

The affected environment is the Project area, as located in the Deerfield River drainage basin, United States Geologic Survey (USGS) Hydrologic Unit Code (HUC) 01080203. This watershed drains to the south, towards the Connecticut River, and eventually the Atlantic Ocean. Portions of three sub-watersheds fall within the Project area: the Deerfield River, from the headwaters to the East Branch (HUC 01080203-0101); the West Branch of the Deerfield River (HUC 01080203-0104); and the Deerfield River, from East Branch to Sherman Dam (HUC 01080203-0105).

3.7.1.1 Headwaters

The State of Vermont's Act 250 statute defines headwaters as lands that meet any of the following criteria: (i) headwaters or watersheds characterized by steep slopes and shallow soils; or (ii) drainage area of 20 square miles or less; or (iii) above 1,500 feet elevation; or (iv) watersheds of public water supplies designated by the Vermont Department of Health; or (v) areas supplying significant amounts of recharge waters to aquifers. This definition is consistent with the Forest Plan and the GMNF concept of headwaters and serves to guide discussion of impacts as needed. The Project area qualifies as headwaters under these criteria. The majority of the soils mapped within the Project area are classified as steep slopes, and the entire Project area is above 1,500 feet in elevation.

3.7.1.2 Streams

The Forest Plan glossary defines three types of streams, including perennial, intermittent, and ephemeral (USDA Forest Service, 2006a). Similarly, under Act 250, a stream is defined as any current of water located at an elevation of 1,500 feet AMSL or higher, or one which flows at any time at a rate of less than 1.5 cubic feet per second. The Vermont Hydrography Dataset (VCGI, 2007), which is similar to the National Hydrography Dataset used to map streams for the Forest Plan, was used for an initial remote assessment evaluation of streams in the Project area. This data was then field checked. Additional streams not appearing in the dataset were identified and mapped (Arrowwood Environmental, 2006b, 2008a, 2011). Table 3.7.1-1 summarizes attributes of delineated streams in the Project area, with streams identified as tributaries of named creeks where possible. However, most streams within the Project area are small and unnamed, and as such, are also identified and mapped by "stream ID". It should be clear that the delineated streams listed in Table 3.7.1-1 do not represent all streams in the Project area: only those areas in the vicinity of proposed disturbance were surveyed. Figure 3.7-1 depicts mapped and delineated streams within the Project area.

Table 3.7.1-1: Delineated Streams within the Project Area

Stream ID[1]	Hydrological Connection	Flow Regime[1]	Substrate[1]	Width[1]
1	Tributary of Stream 4	Intermittent	Soil/Pebble/Rock	1 to 2 feet
2	Tributary of Stream 4	Ephemeral	Muck	1 to 2 feet
3	Unnamed[2]	Intermittent	Rock	1 foot
4	Unnamed[2]	Intermittent	Sand/Gravel/Silt	1.5 to 4 feet
5	Tributary of Medbury Brook	Intermittent	Silt/Gravel	1 to 2 feet
6	Tributary of Stream 5	Intermittent	Gravel	1 to 2 feet
7	Tributary of Bond Brook	Perennial	Rock/Sand	3 to 4 feet
9	Upstream Portion of Stream 2	Ephemeral	Silt/Gravel	1 to 2 feet
10	Unnamed[2]	Ephemeral	Silt/Cobble	0.5 to 1 foot
11	Unnamed[2]	Intermittent	Cobble/Rock	0.5 to 1 foot
12	Tributary of Stream 19	Ephemeral	Rock	2 to 4 feet
13	Tributary of Stream 19	Perennial	Rock	2 to 4 feet
14	Upstream Portion of Stream 7	Perennial	Gravel/Rock	2 to 4 feet
15	Tributary of Bond Brook	Ephemeral	Organic (Detritus)	Diffuse
16	Tributary of Stream 19	Ephemeral	Old Skidder Trail	1 foot
17	Tributary of Stream 16	Ephemeral	Old Skidder Trail	1 foot
18	Tributary of Stream 12	Ephemeral	Silt/Cobble	1 foot
19	Tributary of Rake Branch	Intermittent	Cobble/Rock	1 foot
20	Tributary of Stream 21	Perennial	Cobble/Rock	1 to 3 feet
21	Tributary of Stream 19	Perennial	Cobble/Rock	1 to 3 feet
22	Unnamed[2]	Perennial/Ephemeral	Cobble	2 feet
23	Tributary of Stream 5	Ephemeral	Gravel	1 to 3 feet
24	Unnamed[2]	Ephemeral	Cobble/Silt	1.5 feet
S-1	Unnamed[3]	Intermittent	Gravel/Cobble	5 feet

Stream ID[1]	Hydrological Connection	Flow Regime[1]	Substrate[1]	Width[1]
S-2	Unnamed[3]	Intermittent	Cobble	1.5 feet
S-3	Unnamed[3]	Intermittent	Gravel	1 foot
S-4	Unnamed[3]	Intermittent	Cobble/Gravel	1 foot
S-5	Unnamed[3]	Intermittent	Cobble/Boulder	1 foot
S-6	Unnamed[3]	Intermittent	Gravel	20 feet
S-7	Unnamed[3]	Intermittent	Boulder/Cobble	12 feet
S-8	Unnamed[3]	Intermittent	Gravel/Cobble	2 feet
S-9	Unnamed[3]	Intermittent	Gravel/Cobble	2 feet
S-10	Unnamed[3]	Intermittent	Gravel/Cobble	1.5 feet
S-11	Unnamed[3]	Intermittent	Gravel/Cobble	2 feet
S-12	Unnamed[3]	Intermittent	Cobble	6 feet
S-13	Unnamed[3]	Intermittent	Cobble	5 feet
S-14	Unnamed[3]	Intermittent	Gravel	1 foot
S-15	Unnamed[3]	Intermittent	Gravel/Cobble	1.5 feet
S-16	Unnamed[3]	Intermittent	Gravel	1.5 feet
S-17	Unnamed[3]	Intermittent	Cobble	1 foot

[1] (Arrowwood Environmental, 2006b, 2008a, 2011).
[2] These small streams drain into a larger unnamed stream that runs south parallel to Route 8, and is a tributary of the West Branch of the Deerfield River.
[3] These small streams flow into a larger unnamed stream that runs northeast parallel to Sleepy Hollow Road. The larger unnamed stream drains into Bond Brook approximately 0.2 mile upstream of the Deerfield River.

Intermittent streams flow only part of the time such as after a rainstorm, during wet weather, or during part of the year (generally less than 50% of the time), while ephemeral streams have shallow channels above the water table, and only flow for short periods in response to precipitation. Perennial streams flow year-round. As shown in Table 3.7.1-1, most streams in the Project area are intermittent or ephemeral.

The Vermont Water Quality Standards (VWQS) establish classifications for Vermont streams and require that such waters be managed in order to maintain those classifications. Within the Deerfield River Basin, waters at elevations above 2,500 feet AMSL are generally designated as Class A1, while waters at elevations below 2,500 feet AMSL are generally designated as Class B. Class A1 waters are also known as "ecological waters" and must be managed to maintain these resources in a natural condition, compatible with aquatic biota, wildlife and aquatic habitat, aesthetics, and swimming, boating, fishing and other recreation. Class B waters must be managed to be compatible with aquatic biota, wildlife and aquatic habitat, aesthetics, and swimming, boating, fishing and other recreation, and also to support use for public water supply and crop irrigation (Vermont Natural Resources Board, 2008).

3.7.1.3 Shorelines

A shoreline, while not defined specifically in the Forest Plan, is defined in Act 250 as the "the land adjacent to the waters of lakes, ponds, reservoirs, and rivers." The Deerfield River flows southeast along the northeast edge of compartment 123, and as such, the shoreline falls within the Project area. In addition, there are numerous unnamed beaver ponds scattered throughout Compartments 121 and 122. The land adjacent to these ponds would also be considered shorelines.

In the Biological Evaluation (BE) for the revised Forest Plan, the Forest Service defined shore habitats as "the land adjacent to lakes, ponds, rivers, and streams that is influenced by water" (USDA Forest Service, 2006c). Using this slightly broader definition, shorelines include the Deerfield River and beaver ponds as described above, but also occur throughout the Project area along the banks of the streams listed above in Table 3.7.1-1 and depicted in Figure 3.7-1.

3.7.1.4 Outstanding Resource Waters

Under 10 V.S.A. 1424a, the Water Resources Panel of the Natural Resources Board has the authority to designate certain waters as outstanding resource waters (ORWs). Where the Panel designates such waters because of their water quality values, their existing quality shall, at a minimum, be protected and maintained (Vermont Natural Resources Board, 2008). There are no designated ORWs in the Project area. Furthermore, surface waters present within the Project area do not meet criteria for listing as ORWs (Arrowwood Environmental, 2006b; VHB, 2011).

3.7.1.5 Groundwater

According to the USGS Ground Water Atlas of the United States, the Project area is located over the New England Crystalline Rock Aquifer (USGS, 1995). Crystalline rock structures are geologically complex, containing primarily igneous and metamorphic rocks, along with some sedimentary rock formations with similar hydraulic characteristics. Rock type has little or no effect on groundwater flow, since virtually all movement of water in crystalline rocks is through secondary openings such as fractures and joints. Fracture permeability is the result of the cooling of igneous rocks, the deformation of igneous and metamorphic rocks, faulting, jointing, and weathering. Openings in rocks are more frequently located near the land surface, and decrease in number and size with depth.

Fracture permeability in the upper part of most crystalline rocks is sufficient to support groundwater flow systems. Water from precipitation recharges the fracture system directly at outcrops, or indirectly through overlying glacial deposits. Recharge occurs primarily in upland areas, with water moving down a hydraulic gradient to stream valleys where it is discharged to streams or other surface waters. The volume of water in storage in crystalline rock fracture systems is usually small, and wells often yield only a few gallons per minute. However, the concentration of dissolved solids is typically moderate to low, and water from crystalline aquifers is generally suitable for most purposes, including human consumption. Many rural domestic and small community water systems in Vermont obtain water from wells (USGS, 1995).

3.7.1.6 Water Source Protection Areas

In order to protect public drinking water supplies, public water systems in Vermont are required to develop Water Source Protection Areas (WSPAs), and subsequently Source Protection Plans once the State Water Supply Division has approved the WSPA. There are two types of WSPAs: groundwater and surface water. Groundwater SPAs include the land area beneath which groundwater flows to a well, spring, or infiltration gallery, while surface water SPAs are the watershed areas contributing surface water and groundwater flow to the drinking water intake (VTDEC, 2008). Although there are no WSPAs in the Project area, there are several in the Project vicinity. Chimney Hill WSPA is approximately 1.25 miles northeast of the Project area, and Wilmington Water District is approximately 2.0 miles northeast of the Project area (VT ANR, 2008).

3.7.2 Direct and Indirect Impacts Presented by Alternative

During the scoping process, one significant issue was identified relating to soil and water resources. People are concerned that the Proposed Action will adversely impact soil and water resources resulting in unacceptable sedimentation, erosion, and loss of wetlands. The water resources component of this issue will be discussed here, particularly as it relates to streams. Soil and wetland resources are discussed separately in Sections 3.2 and 3.8, respectively. In order to address the water resources component of the significant issue related to unacceptable erosion and sedimentation, the following indicators will be used to focus the discussion of impacts. The first indicator is the length of streams potentially affected by sedimentation, measured in linear feet. The second indicator is the amount of acreage that would potentially be converted to impervious surfaces that could negatively affect groundwater discharge.

The analysis area for the evaluation of direct and indirect impacts to water resources is defined as the three sub-watersheds that fall within the Project area. As described in Section 3.7.1, these watersheds consist of the Deerfield River from the headwaters to the East Branch, the Deerfield River from the East Branch to Sherman Dam, and the West Branch of the Deerfield River.

3.7.2.1 Proposed Action

Implementation of the soil disturbing activities included within the Proposed Action, such as clearing of vegetation, excavating, grading, construction and upgrade of roads, and burying of interconnect cables could potentially impact water resources. Since there are no ORWs or WSPAs in the Project area, water resource impacts will be focused on surface waters (streams and shorelines) and groundwater.

Potential impacts to water resources would occur primarily during Project construction. Therefore, discussion of impacts below focuses on construction activities. Routine facility O&M procedures would not include regular soil disturbance, and would not be anticipated to result in substantial adverse impacts. However, minor and isolated incidences of impact from O&M procedures may occur, which could result in a minimal impact to stream, shorelines, or groundwater in the Project area. Isolated events that could cause operational impacts include maintenance of buried transmission lines, access road washouts, replacement or maintenance of culverts, and accidental fuel or chemical spills.

3.7.2.1.1 Stream Crossings

Although the Proposed Action has been designed to avoid surface water resources to the greatest extent possible, both indirect and direct impacts to streams may occur as a result of Project construction. Access roads would have to cross four streams (Stream ID#s 1 to 4). Three of the streams are in the Eastern Project site (Stream ID#s 1, 2, and 4) and one in the Western Project site (Stream ID#3). Stream ID#s 1, 3, and 4 are intermittent, while Stream ID#2 is ephemeral. Streams ID#s 1 and 2 are both tributaries of Stream ID#4, which along with Stream ID#3, are tributaries of the unnamed creek that runs parallel to Route 8, eventually draining into the West Branch of the Deerfield River.

Potential direct impacts to the four intermittent/ephemeral streams would result from the installation of access roads and associated permanent crossings (e.g., appropriately sized culverts or other crossing structures). Direct impacts would total approximately 488 linear feet. The impacted lengths quantify the portions of the streams that would be subject to construction activities, including access road crossings and associated clearing and grading. No direct impacts to perennial streams would occur. Indirect impacts to streams in the proximity of Project access road construction could total up to approximately 17,034 linear feet (3.23 miles) as a result of potential sedimentation. This is a conservative estimate and includes the total lengths of Stream ID#s 1 to 4 downstream of the proposed access road crossings. Due to the intermittent character and low flow/velocity of these streams, it is highly unlikely that unacceptable levels of sedimentation would occur very far from the initial source. Table 3.7.2-1 summarizes potential direct and indirect impacts that would occur to streams under the Proposed Action.

Table 3.7.2-1: Summary of Impacts to Streams under the Proposed Action

Stream ID[1]	Flow Regime[1]	Direct Impact (linear feet)	Potential Indirect Impact (linear feet)
1	Intermittent	102	347
2	Ephemeral	209	2,164
3	Intermittent	61	7,719
4	Intermittent	116	6,804
Total		488	17,034

[1] (Arrowwood Environmental, 2006b, 2008a, 2011).

In addition, electrical collection lines would cross two streams (Stream ID#s 10 and 22). Both streams are located within 200 feet of the western edge of Route 8. Stream ID#10 is ephemeral, while that segment of Stream ID#22 is perennial. Stream ID#22 drains into Stream ID#10, which runs parallel to Route 8, and eventually drains into the West Branch of the Deerfield River. The electrical interconnect would be an overhead line in this section, and therefore no direct impacts are anticipated to Stream ID#s 10 or 22. Minor indirect impacts could occur as a result of the clearing of overstory vegetation adjacent to these streams. The overhead transmission lines would span over streams, and no poles would be installed in stream corridors. Clearing within stream corridors would be minimized to the extent possible.

Where road crossings would result in direct and indirect impacts to Stream ID#s 1 to 4, appropriate erosion prevention and sediment control measures would be implemented to prevent discharge into water resources. These stream crossings (both permanent and any temporary measures that may be erected during construction) would be designed to enable passage of streamflow, bedload, and aquatic organisms, and would consist of small wooden bridges, pipe arches, open bottom culverts, or other similar structures. Traditional pipe culverts would be avoided. Stream crossing designs would comply with the VTDEC Regulatory Requirements for Stream Crossing Structures, and the S&Gs outlined for stream crossings in the Forest Plan. Direct impacts to streams and shorelines from these crossings would be minimized by compliance with Forest Plan S&Gs for soil, water, and riparian area protection and restoration. Existing or narrow stream crossing locations would be utilized whenever possible (standard S-7), and to meet the intent of guideline G-1, clearing of vegetation along stream banks would be kept to a minimum. In accordance with S-5, all permanent stream crossings would be sized to allow for the passage of aquatic organisms, along with water and debris from storm events, and the design, location, structure type, and size of all permanent and temporary stream crossings would require review and approval by a Forest engineer.

Except where crossed by access roads and electrical collection lines, any soil disturbing activities would be separated from streams and shorelines to the extent possible by a protective strip of predominantly undisturbed soil, having vegetative or organic matter cover. Soil disturbance in protective strips as a result of stream crossings is allowable, provided other appropriate Forest Plan S&Gs are followed, in particular, S-5 and S-7.

A number of design criteria and mitigation measures would be utilized as needed to further reduce adverse impacts. Such measures would include using special crossing techniques, equipment restrictions, herbicide use restrictions, and erosion and sedimentation control measures. Specific design criteria and mitigation measures for protecting surface water resources would not only apply to the stream crossings discussions above, but also would be applicable to the discussions below on impervious surfaces, runoff, drainage, and groundwater.

One design criterion would be the development of a Spill Prevention, Containment, and Countermeasures Plan (SPCCP) that outlines procedures to be implemented to prevent the release of hazardous substances into the environment. Section 3.2, Geology and Soils, notes the details proposed in the Project SPCCP, prepared by CH2M HILL and included in the Project Record. The hierarchical objectives of the SPCCP are as follows: (1) to prevent spills from occurring, (2) to prepare for potential spills, and (3) to respond quickly and appropriately if a spill does occur. Storage specifications and inspection standards described in the SPCCP would reduce the likelihood of spills. Any releases of oil or hazardous materials would be addressed immediately upon detection, using the procedures and equipment described in the SPCCP, and reported in accordance with all applicable laws and regulations (CH2M HILL, 2008b).

In addition, the SPCCP would not allow refueling of construction equipment within 100 feet of any stream, wetland, infiltration basin, or proposed turbine location. Sites for servicing and refueling construction equipment would be located outside any protective strip in compliance with Forest Plan S&Gs for soil, water, and riparian area protection and restoration (S-4). Furthermore, all contractors would be required to keep materials on hand to control and contain a petroleum spill. These materials would include a shovel, tank patch kit, and oil-absorbent materials that have been manufactured specifically for the containment and cleanup of hazardous materials (USDA Forest Service, 2006a). Any fuel leaks from construction equipment would be repaired immediately.

Another design criterion would identify "No Equipment Access Areas". Except where crossed by permitted access roads, wetlands, shorelines, and surface waters would be designated "No Equipment Access", thus prohibiting the use of motorized equipment in these areas.

Restricted Activities Areas would be identified and a buffer zone of 100 feet would be established where appropriate around streams, wetlands, and infiltration basins. "Restricted Activities Area" would be noted on the construction drawings and marked in the field during Project construction. Restricted activities would include:

- No deposition of slash within or adjacent to a surface water or wetland.
- No accumulation of construction debris within the area.
- Herbicide restrictions within 100 feet of a stream or wetland (or as required per manufacturer's instructions).
- No degradation of stream banks.
- No equipment washing or refueling within the area.
- No storage of any petroleum or chemical material.

A design criterion that calls for the development of an Erosion Prevention and Sediment Control Plan (EPSCP) would be part of the construction process, and would function in cooperation with any stormwater management permit terms and conditions. Section 3.2, Geology and Soils, also provides details of the preliminary Project-specific EPSCP, prepared by VHB Pioneer (2008) for PSB review. During preparation of the conceptual EPSCP, VHB Pioneer conducted extensive field review at the Project site, assessing all proposed construction sites and delineating all sub-watersheds. The exact final details of the EPSCP, and its "operational phase stormwater permit" would be finalized "prior to creation any impervious surfaces at the site" (Condition #18 of the CPG). The EPSCP would be compliant with Forest Plan S&Gs for soil, water, and riparian area protection and restoration, the Vermont Acceptable Management Practices (AMPs), the Stormwater Management Rule, the Vermont Standards and Specifications for Erosion Prevention and Sediment Control, and the CPG issued by the Public Service Board. Specific EPSCP measures could include, but are not limited to, up-slope diversion of run-off; limits of disturbance barrier fence and flagging; silt fencing, both with and without reinforcement; grass- and stone-lined swales; stone check dams; temporary and permanent stream crossings; rock sandwiches; temporary and permanent stabilization with seed, mulching/matting, and/or wood chips; temporary sediment basins; level spreaders; and the use of vegetative buffers. The location of these features would be indicated on final construction drawings and reviewed by Forest Service personnel and contractors prior to construction. These features would be inspected to assure that they function properly throughout the period of construction, and until completion of all restoration work. The final EPSCP and associated maps would be included in the Deerfield Wind Project Record, and incorporated as necessary into any Special Use permit or construction permits issued by the Forest Service.

All four of the streams that would be directly impacted by installation of access road crossings are located at elevations above 2,500 feet AMSL. These streams are therefore designated as Class A1, or ecological streams by the Vermont Water Quality Standards. According to the Individual Stormwater Discharge Permit Application submitted to the Vermont Department of Environmental Conservation Water Quality Division, the operational phase stormwater discharges proposed for the Project would conform with the Interim Anti-Degradation Implementation Procedure signed October 12, 2010, which implements the anti-degradation policy of the Vermont Water Quality Standards (VHB, 2011).

3.7.2.1.2 Impervious Surfaces, Runoff, and Drainage

The Proposed Action would not result in wide-scale conversion of land to built/impervious surfaces. Approximately 61.5 acres would be graded for the installation of tower bases, crane pads, access roads, substation, and the O&M building. This would represent a conversion of approximately 0.6% of the 9,523-acre Project area. Consequently, no significant changes to the rate or volume of stormwater runoff are anticipated. However, the installation of permanent Project components could result in minor localized changes to runoff/drainage patterns. For example, the impervious surface of the access roads and crane pads could increase stormwater runoff to nearby streams, thereby increasing the flow of water through the Project area sub-watersheds. Buried transmission lines could facilitate groundwater migration along trench backfill in areas of shallow groundwater.

Any increase in stormwater runoff would be negligible, as Project construction would result in limited addition of impervious surfaces. Nevertheless, specific means of avoiding or minimizing stormwater-related adverse impacts during construction and operation of the Project include adhering to a detailed Project-specific EPSCP as described above. The EPSCP describes implementation of construction in a phased approach that would ultimately limit the extent of exposed soil at any one time, and would require temporary or permanent stabilization of exposed areas as soon as practicable (VHB Pioneer, 2008). If drainage problems develop during or after construction, Forest Plan standard S-6 calls for immediate corrective actions to restore the drainage structures to working order. For example, should an unforeseen large storm event result in sudden failure of a drainage feature, action would be taken immediately to repair the feature and/or construct new drainage feature(s), as needed. Efforts would be made to address the impact, i.e. repair a section of washed out road to prevent further erosion. These measures are typical responses to these situations on large private land projects as well as projects on NFS or other public lands, and have been shown to be effective in addressing these types of situations.

Operational stormwater treatment plans would be designed to achieve the following criteria: water quality, channel protection, recharge, overbank flood, and extreme storm. See Section 3.2.2.1.1 for a description of the goal(s) of each criterion. Wet ponds are proposed to meet the water quality, channel protection, overbank flood, and extreme storm criteria, while grass channels are proposed to meet the recharge standard in areas of existing low slope. Opportunities for supplemental swales to provide additional recharge and infiltration are also under consideration for areas where site conditions would facilitate such practices. Maps associated with the EPSCP depict the locations of sub-watersheds, along with proposed retention basins, receiving waters, discharge points, and other key features of the stormwater management plan.

3.7.2.1.3 Groundwater

As previously mentioned, the Proposed Action would add only small areas of impervious surface, which would be dispersed throughout the Project area, and would most likely have a negligible effect on groundwater recharge. However, construction of the proposed Project could result in certain localized impacts to groundwater. These impacts could include:

- Minor localized disruption of groundwater flows downgradient of proposed turbine foundations.
- Minor modification to surface runoff or stream-flow, thereby affecting groundwater recharge characteristics.
- Minor degradation of groundwater chemical quality from installation of concrete foundations.
- Impacts to groundwater recharge areas (wetlands). See Section 3.8 for evaluation of potential impacts to wetland resources.

Installation of turbine foundations has the greatest potential for impacts to groundwater. If blasting is necessary, it can generate ground vibration, fracture bedrock, and impact groundwater levels. However, since the nearest proposed turbine would be located at a minimum distance of 0.5 mile from existing private water supply wells, it is highly unlikely that any necessary blasting would physically damage the individual wells, or affect the groundwater flow to these wells or the well yields.

The proposed construction activity would occur at relatively high elevations (greater than 2,400 feet AMSL) rather than in valleys, where groundwater resources are typically concentrated. However, as described in Section 3.2, bedrock in the Project area is relatively shallow, 2 inches to 40 inches along the ridgelines proposed for turbine construction. Therefore, blasting of bedrock could be required at the proposed turbine locations in order to install the foundations. Any necessary blasting would be done in compliance with a Blasting Plan designed with appropriate charge weights and delays to localize bedrock fracturing to the proposed foundation area, minimizing the chance of impacting water levels. Details of the Blasting Plan are described in Section 3.2. The construction footprint would be minimized by defining the work area in the field prior to construction, and adhering to work area limits during construction, thereby limiting the potential impacts of soil compaction on normal infiltration rates. In addition, a Dewatering Plan would be prepared to outline the procedure for infiltrating the pumped water back into the ground in the event that water table penetration occurs during construction. The Dewatering Plan would outline the required capacity, substrate, and location of the infiltration basins.

In areas where excavation (or blasting) occurs below the water table, the construction process could impact groundwater flow paths. It is not unusual for routine construction projects to penetrate the water table. The potential for such an occurrence is dependent upon the depth of the construction and the depth to groundwater. Typically, such construction is not of concern to the quantity or quality of the groundwater resource, with the possible exception of wastewater disposal systems (Epsilon, 2006). Since wind energy facilities do not discharge any wastewater, this concern is not relevant to the proposed Project. Encountering groundwater during any construction project poses logistical challenges to the construction effort. Construction excavations must be kept dry to prevent erosion and sedimentation, to provide adequate working conditions, and to ensure stability of the excavation. Should groundwater infiltrate into the excavation holes, removal by pumping may be required, which could have a temporary effect on the elevation of the water table. However, this groundwater would be pumped to the surface and allowed to infiltrate back into the water table, using infiltration basins, with negligible loss of volume due to evaporation. Therefore, any effect would be localized and temporary.

Construction of the turbine foundations would require placement of large volumes of concrete. During the concrete curing process, it is possible that the groundwater quality in proximity to the concrete mass could experience a rise in pH value. However, this effect would be short-lived, with natural surface water infiltration restoring normal pH levels in a relatively short period of time. This effect would not extend beyond the immediate area of the foundation, and would not adversely affect groundwater quality (Haley & Aldrich, 2006).

In addition to impacts to groundwater due to turbine foundation installation, minor impacts could result from other Project activities. As mentioned above, construction of access roads would likely result in minor increases in storm water runoff that otherwise would have infiltrated into the ground. Buried transmission lines may facilitate groundwater migration along trench backfill in areas of shallow groundwater. Construction that occurs close to or crosses wetlands may also have an impact on groundwater as many wetlands serve as groundwater recharge areas. As described in Section 3.8.2, five small wetlands would be directly impacted under the Proposed Action, for a total of 4,905 square feet (2,855 square feet of permanent impact, 1,332 of secondary impact, and 718 square feet of temporary impact). However, there would be no impacts to most wetlands in the Project area, and overall impacts to groundwater recharge areas would be negligible.

A final potential impact to groundwater is the introduction of pollutants to groundwater. This is unlikely, but could occur if the water table is penetrated from excavation or blasting. As described above, should this occur, groundwater would be pumped to the surface and allowed to infiltrate back into the water table, using infiltration basins. If there were an accidental discharge of petroleum or other chemicals from construction equipment into an active infiltration basin, groundwater could become contaminated. It should be noted that infiltration basins are often constructed for the purpose of removing pollutants from stormwater. Pollutant removal is achieved through filtration of the runoff through the soil, as well by biological and chemical activity within the soil (NJ DEP, 2004). Furthermore, implementation of Forest Plan S&Gs, along with Project-specific design criteria and mitigation measures, would reduce this potential threat to groundwater. For example, the Project-specific SPCCP would restrict activities in a buffer zone around all infiltration basins. The refueling or washing of construction equipment, use of herbicides, and storage of construction debris, petroleum, or chemicals would be prohibited within 100 feet of any infiltration basin. Storage specifications and inspection standards described in the SPCCP would reduce the likelihood of spills. Any releases of oil or hazardous materials would be addressed immediately upon detection, using the procedures and equipment described in the SPCCP, and reported in accordance with all applicable laws and regulations (VHB Pioneer, 2008). Therefore, little, if any, adverse impacts to groundwater would be anticipated.

3.7.2.1.4 Summary for Proposed Action

As noted, access roads would have to cross four streams, one in the Western Project site and three in the Eastern Project site. Installation of these access roads would directly impact up to 488 linear feet of intermittent and ephemeral stream channels. In addition, a total of approximately 17,034 linear feet (3.23 miles) of these streams could be indirectly impacted by sedimentation due to construction activities. Overhead electrical connection lines would span over two streams close to Route 8, but no poles would be installed in stream corridors. Therefore, there would be no direct impact to these streams. The creation of impervious surfaces, although small in proportion to the total acreage of the Project area (approximately 0.6% of the 9,523-acre Project area) and dispersed throughout the area, could produce an adverse effect on groundwater recharge. However, with the proper implementation of Forest Plan S&Gs, mitigation measures, and design criteria developed specifically for this proposal, no undue long-term adverse impacts to water resources are anticipated.

To minimize any adverse impact and assure compliance with design criteria, mitigation measures, and Forest Plan S&Gs during construction and operation, a number of compliance measures would be applied. The measures would include requiring the Applicant to provide copies of all permits and plans, assuring that the contractor adhere to any special conditions of the permits issued, and requiring the Applicant, in coordination with the Forest Service, to employ one or more individuals to provide oversight during construction. Likewise, upon completion of construction, a Forest Service Special Use permit administrator would oversee the terms and conditions of the Special Use permit during Project operation, including any required Project operation monitoring.

3.7.2.2 Alternative 1: No Action

No turbines, access roads, or other Project components would be constructed under the No Action alternative. Therefore, Alternative 1 is not anticipated to have any adverse effects on water resources, since there would be no ground disturbing activities, no crossing of surface waters, and no impacts to groundwater, beyond those associated with ongoing public use and Forest Service maintenance of the area.

3.7.2.3 Alternative 2: Reduced Turbines in the Western Project Site

This alternative would drop the three southern-most turbines in the Western Project site and add one additional turbine in the northern area of the turbine array, and therefore slightly reduce the amount of construction. Construction on the Eastern Project site would remain very similar to the Proposed Action.

Direct and indirect impacts to Stream ID#s 1, 2, and 4 would be similar to those described for the Proposed Action, since these streams are located in the Eastern Project site and would still be crossed under Alternative 2. In addition, overhead electrical collection lines would cross two streams (Stream ID#s 10 and 22), located within 200 feet of the western edge of Route 8, in the same way as described for the Proposed Action.

Impacts to Stream ID#3 and its shoreline would be different under the Reduced West alternative when compared to the Proposed Action. This is due to the fact that Stream ID#3 is located in the Western Project site, south of the proposed site for Turbine W7, the southern-most turbine for this alternative. Under Alternative 2, the access road in the Western Project site would terminate at Turbine W7, and would not cross Stream ID#3. The electrical interconnect would be buried underground along the ridgetop, to reduce clearing impacts to BSB. This electrical collection line would need to cross Stream ID#3, either through directional boring under the stream or through an overhead span. Because the final method of crossing has not yet been engineered, it will be assumed that there would be the potential for direct and indirect impacts due to this crossing. However, the limits of clearing and soil disturbance would be much narrower for electrical interconnect crossings than for road crossings, so potential direct impacts would be reduced in comparison to the Proposed Action when appropriate S&Gs and design criteria are employed.

Alternative 2 would also directly impact approximately 72 linear feet of Stream 9 for installation of the access road to turbine E4. This impact is the result of turbine shifts designed to optimize wind resources for the G87 turbine model, and would not occur under the Proposed Action.

Potential indirect (sedimentation) impacts could occur along an additional 305 feet of stream and shoreline when compared to the Proposed Action. Table 3.7.2-2 summarizes potential direct and indirect impacts that would occur to streams under the Reduced West alternative.

Table 3.7.2-2: Summary of Impacts to Streams under the Reduced West Alternative

Stream ID[1]	Flow Regime[1]	Direct Impact (linear feet)	Potential Indirect Impact (linear feet)
1	Intermittent	97	348
2	Ephemeral	157	2,325
3	Intermittent	31	7,754
4	Intermittent	149	6,784
9	Ephemeral	72	128
Total		506	17,339

[1] (Arrowwood Environmental, 2006b, 2008a, 2011).

Stream crossings would directly impact up to 506 linear feet of intermittent and ephemeral stream channels. In addition, a total of approximately 17,339 linear feet (3.28 miles) could be affected by sedimentation, virtually the same as described above for the Proposed Action. All stream crossing designs would comply with the VTDEC Regulatory Requirements for Stream Crossing Structures, the S&Gs outlined for stream crossings in the Forest Plan, and design criteria and mitigation measures described for the Proposed Action. These measures would prevent undue adverse effects to the streams and shorelines.

Alternative 2 includes two fewer turbines and a shorter length of access roads, so there would be less conversion of land to impervious surfaces than under the Proposed Action. Approximately 56.5 acres would be graded for the installation of tower bases, crane pads, access roads, substation, and the O&M building. This would represent a conversion of approximately 0.6% of the 9,523-acre Project area. Consequently, no significant changes to the rate or volume of stormwater runoff are anticipated. However, the same types of minor, localized changes to stormwater runoff described for the Proposed Action could also occur under Alternative 2. Impacts to groundwater would be anticipated to be minimal.

In summary, the Reduced West alternative would require three access road stream crossings and three electrical interconnect stream crossings. Impacts to streams, shorelines, and groundwater (including groundwater recharge areas in or near wetland disturbance) from Alternative 2 would be very similar to those described for the Proposed Action. With the proper implementation of Forest Plan S&Gs, along with the Project-specific design criteria and mitigation measures described above, no undue long-term adverse impacts to water resources would be anticipated.

3.7.2.4 Alternative 3: Turbines in the Eastern Project Site Only

This alternative would eliminate all construction in the Western Project site except for the O&M building and the temporary laydown area, and therefore would substantially reduce the total amount of construction. Turbine and road construction on the Eastern Project site be very similar to the Proposed Action. The East Side Only alternative would also include construction of a new substation and an upgrade to the 69 kV transmission line along Sleepy Hollow Road.

Under Alternative 3, there would be no impacts to Stream ID#s 3, 10, or 22, since no turbines, access roads, or electrical collection lines would be constructed in the vicinity of those resources. Direct and indirect impacts to Streams ID#s 1, 2, and 4 would be similar to those described for the Proposed Action, since the streams are located in the Eastern Project site and would still be crossed under Alternative 3. Direct and indirect impacts to Stream 9 would be identical to those described above for the Reduced West alternative. Alternative 3 would also directly impact approximately 5 linear feet of Stream S-17 for installation of the substation. This impact would not occur under either the Proposed Action or Reduced West alternative, both of which would install the substation on the Western Project site. Table 3.7.2-3 summarizes potential direct and indirect impacts that would occur to streams under the East Side Only alternative.

Table 3.7.2-3: Summary of Impacts to Streams under the East Side Only Alternative

Stream ID[1]	Flow Regime[1]	Direct Impact (linear feet)	Potential Indirect Impact (linear feet)
1	Intermittent	97	348
2	Ephemeral	157	2,325
4	Intermittent	149	6,784
9	Ephemeral	72	128
S-17	Intermittent	5	34
Total		480	9,619

[1] (Arrowwood Environmental, 2006b, 2008a, 2011).

Approximately 9,619 linear feet (1.82 miles) could be affected by sedimentation downstream of the crossings. Since there would be less soil disturbance under the East Side Only alternative, the potential for erosion and sedimentation would likewise be less than that possible under the Proposed Action or the Reduced West alternative. As with any of the action alternatives, all stream crossing designs would comply with the VTDEC Regulatory Requirements for Stream Crossing Structures, the S&Gs outlined for stream crossings in the Forest Plan, the terms and conditions of applicable Project permits, and design criteria and mitigation measures described for the Proposed Action. These measures would prevent undue adverse effects to the streams and shorelines.

Alternative 3 includes fewer turbines and a shorter length of access roads, so there would be less conversion of land to impervious surfaces than for the Proposed Action. Approximately 36.1 acres would be graded for the installation of tower bases, crane pads, access roads, substation, and the O&M building. This would represent a conversion of approximately 0.4% of the 9,523-acre Project area. The same types of minor, localized changes to stormwater runoff described for the Proposed Action could also occur under Alternative 3, but to a lesser extent. Likewise, the potential for impacts to groundwater and groundwater recharge areas would be less than that possible for the Proposed Action or Reduced West alternative, and any impacts would be anticipated to be minimal.

The substation for the East Side Only alternative would be located adjacent to the existing GMP substation, on private land near the intersection of Route 8 and Sleepy Hollow Road. The impacts anticipated from construction of the substation would include clearing and grading of approximately 4 acres. No streams occur at the proposed site for this substation, and therefore no streams or shorelines would be impacted by its construction. Forest Plan S&Gs, along with the design criteria previously described, would be implemented to minimize construction impacts in the same manner as for construction of the substation on the Western Project site for the Proposed Action or Reduced West alternative.

The existing 69 kV transmission line along Sleepy Hollow Road would require design upgrades that would involve replacing existing poles with sturdier poles of the same height, with current pole spacing maintained. Arrowwood Environmental (2008a) delineated 17 intermittent streams (Stream ID#s S1-S17) in the existing transmission ROW. Because the transmission line is already used and maintained by GMP, no additional impacts are anticipated from the planned upgrade. The overhead transmission lines would span over streams, and no replacement poles would be installed in stream corridors. Erosion and sedimentation control measures previously described would be implemented to protect these streams and shorelines during replacement of the power poles.

In summary, the East Side Only alternative would require three access road stream crossings, the similar construction of a substation but in a different location, and the upgrade of the overhead transmission line along Sleepy Hollow Road that would span 17 streams. Due to the reduced amount of area impacted by construction, potential impacts to streams, shorelines, and groundwater from this alternative would be reduced substantially from those described for the Proposed Action and Reduced West alternative. With the proper implementation of Forest Plan S&Gs, along with the Project-specific design criteria and mitigation measures, no undue adverse impacts to water resources would be anticipated.

3.7.3 Cumulative Impacts

The analysis area for cumulative impacts to water resources consists of drainages in the Deerfield River watershed within the Project area, including both NFS and private lands, over a timeframe of approximately 5 to 10 years. Past, present, and reasonably foreseeable future actions in the analysis area are discussed below.

Some of the past actions that have occurred over the last 5 to 10 years include timber harvesting on nearby private lands, small maintenance projects on local roads, and the development of the Searsburg Wind Facility, which began operation in mid-1997 (slightly beyond the 5 to 10 year period). Routine maintenance activities on local roads have been ongoing. Impacts to streams, shorelines, and groundwater from any of these activities (i.e., stream crossings for timber sales, the construction of the Searsburg Wind Facility, and small construction and maintenance projects) have been similar in character to those described for the Proposed Action. However, overall impacts from construction of the Searsburg Wind Facility were likely less than those anticipated from this Proposed Action, due to the existing facility's smaller size. Occasional large rain events could also have resulted in erosion and sedimentation. However, field surveys and inventories conducted for the Deerfield Project indicate that streams and shorelines currently are in good condition. There is no evidence of any extensive erosion or sedimentation concerns, and no evidence of on-going adverse impacts to streams, shorelines, or groundwater as a result of construction and operation of the Searsburg Wind Facility.

Foreseeable future actions for the next 5 to 10 years could include Forest Service timber harvesting on nearby lands, although none is planned at this time. A landscape-scale planning effort for NFS lands south and west of the Project area is expected to begin in 2011. This planning effort might include additional GMNF lands south of Route 9 and east of the Project area, as well. It would be at least one to two years beyond 2011 before any definite proposals would be analyzed. No specific proposals are known at this time. Any such activities that do occur would be conducted in compliance with Forest Plan S&Gs to minimize impacts such as soil erosion, sedimentation, and accidental releases of oil and hazardous materials. Timber harvesting on private lands in the Project area is expected to continue, but there is no record keeping nor advanced planning for future harvests on most of the private land in the Project vicinity (Fice, 2008). Vermont Acceptable Management Practices (AMPs) would be implemented to minimize impacts.

Similarly, no known road improvement projects (beyond those that would be needed for the Deerfield Wind Project) or major land developments are currently proposed in the Project area, although these could also occur within the life of the Project. Large projects on private lands would likely be subject to review by town and possibly state and/or federal agencies. Any approvals by regulatory bodies would be conditioned to require compliance with Vermont's AMPs to minimize environmental impacts.

Therefore, the incremental amount of minimal impacts to streams, shorelines, and groundwater anticipated from the Proposed Action and alternatives, when added to impacts from past and foreseeable future activities, would result in little or no cumulative effects to water resources beyond the direct and indirect effects disclosed above.

3.8 Wetlands and Floodplains

This section summarizes the existing conditions of wetland and floodplain resources in the Project area, and potential impacts that could result from the proposed Project. Refer also to Section 3.7, which discloses impacts related to other water resources, primarily streams, shorelines, and groundwater.

3.8.1 Affected Environment

As shown in Figure 1-2, the Project area encompasses Compartments 121, 122, 123, and 124, an area totaling 9,523 acres. The Project area will serve as the affected environment for discussion of wetland related impacts. The environmental review process began with remote assessment. The Project area was examined through review of digital orthophotos, topographic maps, National Wetland Inventory (NWI) Maps, Vermont Significant Wetlands Inventory (VSWI) Maps, and Federal

Emergency Management Agency (FEMA) Flood Insurance Rate Maps (Arrowwood Environmental 2006b).

3.8.1.1 Wetlands

Federal jurisdiction over wetlands begins with the US Army Corp of Engineers (USACOE). The USACOE has jurisdiction over all wetlands regardless of size and whether they lie on private land or federal lands. A Corps of Engineers permit is required under Section 404 of the Clean Water Act for those activities involving the discharge of dredged or fill material in all waters of the United States, including not only navigable waters of the United States but also inland rivers, lakes, streams, and wetlands. The term "discharge" in this context may include the re-depositing of wetlands soils such as occurs during mechanized land clearing activities, including grubbing, grading, and excavation.

The term "wetlands", used above, is defined by Federal regulations to mean "...those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions..." (33 CFR Part 328.3(b), as published in the November 13, 1986 Federal Register). Wetlands generally include swamps, marshes, bogs, and other similar areas. The term "fill material" is defined by Federal regulations to mean "...any material used for the primary purpose of replacing an aquatic area with dry land or of changing the bottom elevation of a waterbody. The term does not include any pollutant discharged into the water primarily to dispose of waste..." (33 CFR Part 323.2(b), as published in the November 13, 1986 Federal Register).

Therefore, it is up to the USACOE to determine the need for a 404 permit should any wetland need to be filled. Likewise, the USACOE would advise as to whether the loss of wetlands would need to be replaced in-kind.

There are a number of wetlands in the Project area, on both private land and the NFS lands of the GMNF. Those lying on NFS lands would be identified as such, and are subject to Forest Plan direction and S&Gs. Those lying on private lands are not subject to S&Gs.

Review of NWI mapping indicates that there are 58 mapped wetlands within the Project area, totaling 163.3 acres (see Figure 3.8-1). These wetlands consist of 29 freshwater forested wetlands, totaling 75.1 acres; 18 freshwater scrub-shrub wetlands, totaling 71.6 acres; and 11 freshwater emergent marshes, totaling 16.6 acres. Of the 58 NWI wetlands mapped within the Project area, 52 wetlands totaling 151.3 acres occur on NFS lands, with the remainder found on private lands. There are no NWI wetlands mapped within the Project site. However, pursuant to Executive Order #11990 for Protection of Wetlands, all wetlands on NFS lands are wetlands subject to Federal protection, regardless of size or quality. This includes small vernal pools and seeps that may not be mapped as part of the NWI or state wetland inventories.

The Vermont Wetland Rules protect "significant" wetlands and wetland buffer zones throughout the state. Only wetlands classified as Class I or Class II are considered significant and receive protection under the Vermont Wetland Rules. Class I wetlands have each been specifically determined by the Water Resources Board as exceptional and irreplaceable, and are thus afforded the highest level of protection. A 100-foot buffer zone is designated adjacent to all Class I wetlands. There are no VSWI Class I wetlands in the Project area. Most palustrine wetlands mapped on the NWI are considered Class II wetlands by the Vermont Wetlands Rules. Any wetland that is contiguous to a Class II wetland is also considered a Class II wetland, even if it is not mapped on the NWI. A 50-foot buffer zone is designated adjacent to all Class II wetlands. As shown on Figure 3.8-2, there are 52 VSWI Class II wetlands within the Project area, totaling 172.5 acres.

VSWI Class III wetlands do not occur on NWI maps and are not contiguous to Class II wetlands. These wetlands are not considered significant under the Vermont Wetland Rules, and are not under the jurisdiction of the Vermont Agency of Natural Resources (ANR). However, as mentioned above, all wetlands are under federal jurisdiction (USACOE), and in addition, Class III wetlands on NFS lands are subject to the same protections as all other classes of wetlands occurring on NFS lands (i.e., Executive Order #11990, Forest Plan direction, and S&Gs).

Ecologists from Arrowwood Environmental conducted on-site wetland delineations at the Project area and Project site starting in 2005, as part of the fieldwork for the reports entitled *Existing Natural Resource Conditions at the Proposed Deerfield Wind Project* (2006a) and *Environmental Assessment of the Deerfield Wind Project* (2006b). Additional surveys were conducted in 2006 for the *Environmental Assessment of the Deerfield Wind Project: Supplemental Assessment of the Putnam Road Access Route, the Proposed Transmission Line Corridor, and the Existing Wind Facility Access Road* (2007), in 2008 for the *Environmental Assessment of the Deerfield Wind Project: Assessment of the East Only Transmission Line Corridor and Substation Alternative* (2008a), and for the *2011 Wetland Delineation Update* (2011). According to the Vermont Wetlands Office and the USACOE, wetland delineations in Vermont are only valid for a period of five years. The 2011 re-evaluation consisted of wetland boundary confirmation through delineation and documentation of wetland value and function, and used the new standard for determination of hydric soils, adopted by the Vermont and the USACOE in 2009. This new methodology resulted in additional areas now meeting the criteria for jurisdictional wetlands, and resulted in changes to the boundaries of several additional wetlands. All of these reports are included in the Deerfield Wind Project Record.

Initial field assessments consisted of walking the proposed Project site and a 100-foot radius from proposed disturbance areas, including several possible access routes for the Western Project site. More detailed assessments were made where sensitive resources such as wetlands were located. On-site delineations were conducted in accordance with the USACOE Wetlands Delineation Manual (Environmental Laboratory, 1987), with fieldwork generally conducted during summer and fall seasons. Wetland boundary flags were hung in the field, and surveyed using Trimble GeoXT Global Positioning System technology, data from which was post-processed to achieve sub-meter accuracy. It should be clear that the wetlands described in this section do not represent all wetlands in the Project area: only those areas in the vicinity of proposed disturbance were surveyed. It is likely that the Project area contains many additional wetlands that should be unaffected by the proposed activities.

The initial delineation effort in 2005 identified and mapped 21 Class III wetlands within the Project area in the vicinity of proposed disturbance. Seven additional Class III wetlands were mapped during the 2006 supplemental inventory, 13 additional Class III wetlands were mapped during the 2008 supplemental inventory, and seven additional Class III wetlands were mapped during the 2011 re-evaluation. As shown on Figure 3.8-3, six wetlands occur in or adjacent to the Eastern Project site (A, B, C, D, E, and AJ); three adjacent to the Western Project site (AL, BA, and BD); five along the Putnam Road access route (F, G, H, AH, and AK); five along the proposed electrical collection line that would connect the Eastern and Western Project sites (WW, XX, YY, ZZ, and BB-2); three along the existing wind facility access road (AA, BB, and BC); one in the Western Project site near the proposed substation (AB); 13 along the existing transmission line that parallels Sleepy Hollow Road (W-1 through W-13); and 12 along alternate access routes that have since been eliminated from consideration (J, and P-Z). Table 3.8.1-1 summarizes characteristics of delineated wetlands in the Project area.

Table 3.8.1-1: Delineated Wetlands in the Project Area

Wetland ID[1]	Size (Acres)	Community Type	Associated Stream ID#s[2]	Ownership	Subject to Forest Plan S&Gs?
A	0.1342	Spruce-Fir-Tamarack Swamp	1	NFS	Yes
B	0.2357	Spruce-Fir-Tamarack Swamp	2 & 9	NFS	Yes
C	0.4494	Spruce-Fir-Tamarack Swamp	4 & 5	NFS	Yes
D	0.0367	Seepage	None	NFS	Yes
E	0.0230	Seepage	5 &6	NFS	Yes
F	0.0066	Seepage	None	Private	No
G	0.5352	Red Maple-Black Ash Swamp	14	Private	No
H	0.1699	Seepage	7 & 14	Private	No
J	0.0686	Seepage	11	NFS	Yes
P	0.1111	Old Field	None	NFS	Yes
Q	4.6822	Beaver Wetland Complex	13, 19 & 21	NFS	Yes
R	0.0514	Seepage	None	NFS	Yes
S	0.0582	Old Field	None	NFS	Yes
T	0.5444	Conifer Swamp	None	NFS	Yes
U	0.2095	Seepage	None	NFS	Yes
V	0.4902	Shrub Swamp	None	NFS	Yes
W	1.8475	Shallow Emergent Marsh	12	NFS	Yes
W-1	0.014	Seepage	None	Private	No
W-2	0.0744	Seepage	None	Private	No
W-3	0.0328	Seepage	None	Private	No

Wetland ID[1]	Size (Acres)	Community Type	Associated Stream ID#s[2]	Ownership	Subject to Forest Plan S&Gs?
W-4	0.0371	Seepage	None	Private	No
W-5	0.0157	Seepage	None	Private	No
W-6	0.0349	Seepage	None	Private	No
W-7	0.0593	Seepage	None	Private	No
W-8	0.0248	Seepage	None	Private	No
W-9	0.0456	Seepage	S-14	Private	No
W-10	0.0078	Seepage	S-15	Private	No
W-11	.0275	Seepage	S-16	Private	No
W-12	0.0583	Seepage	None	Private	No
W-13	0.5405	Seepage	S-1	Private	No
X	0.2184	Seepage	None	NFS	Yes
Y	0.1073	Seepage	None	NFS	Yes
Z	0.0221	Seepage	None	NFS	Yes
AA	0.1196	Seepage	None	NFS	Yes
AB	0.1865	Seepage	None	NFS	Yes
AH	0.043	Seepage	None	Private	No
AJ	0.0269	Seepage	9	NFS	Yes
AK	0.1305	Seepage	14	NFS	Yes
AL	0.1748	Seepage	None	NFS	Yes
BA	0.0713	Seepage	None	NFS	Yes
BB	0.3263	Shallow Emergent Marsh	None	Private	No
BB-2	0.0071	Seepage	None	Private	No
BC	0.3362	Shallow Emergent Marsh	None	Private	No
BD	0.4193	Seepage	3	NFS & Private	Yes
WW	0.0417	Seepage	None	NFS	Yes
XX	0.0867	Seepage	22	NFS	Yes
YY	0.0727	Seepage	None	NFS	Yes
ZZ	0.0837	Shallow Emergent Marsh	24	Private	No

[1] As inventoried by Arrowwood Environmental (2006a,b, 2007, 2008a, 2011).
[2] As inventoried by Arrowwood Environmental (2006a,b, 2008a). See Section 3.7 for more information on streams.

Based on field review, wetlands in the Project area are one of the following community types: spruce-fir-tamarack swamp, seepage, red maple-black ash, shallow emergent marsh, old field, shrub swamp, beaver wetland complex, and conifer swamp. Descriptions of each of these communities are presented below. A complete list of plant species observed on-site, including scientific names, is included in the Project Record.

Spruce-fir-tamarack swamp: Three relatively small wetlands of this type were identified in the Eastern Project site (Wetlands A, B, and C). They sit in topographic bowls that collect water from the surrounding uplands. The hydrology is largely driven by ground water seepage, although there are also small surface water inputs. All three wetlands drain into small streams. Hummocks and hollows from peat moss form a varied micro-topography, with standing water common in the hollows. The soils consist of deep (greater than 4 feet) organic peats. The species composition of tree and shrub species is similar to that in surrounding uplands, but canopy cover and shrub abundance are lower in the swamps. Woody vegetation is characterized by an open canopy of balsam fir and yellow birch, with a sparse shrub layer consisting of hobblebush and balsam saplings. Hydrophytic plants such as gynandrous sedge, goldthread, and three-seeded sedge dominate the herbaceous layer.

Seep wetlands: Numerous open (non-treed) seepage wetlands have been delineated at the Project site. Wetlands D and E are located on the eastern slope of the ridge east of Route 8, and form the headwaters of a small brook (Stream 5) which drains northeast. Standing water collects seasonally in these small wetlands. Wetland AJ is a small isolated seepage located along the eastern ridgeline, with shallow organic soils over bedrock. Wetlands F and AH are located near the junction of Route 8 and Putnam Road. During wet periods, these wetlands drain into the ditch along Route 8. Wetlands WW, XX, YY, and BB-2 are located west of Route 8, near the proposed electrical collection line connecting the Eastern and Western Project sites under the Proposed Action and Reduced West alternative. Wetland WW is located on a steep slope south of Route 9, and is characterized by a small amount of ground water discharge that forms shallow peat soils. Wetlands XX and YY occur along the banks of stream 22, and may be significant for erosion control and sedimentation. Soils are saturated and consist of a thick layer of organic soils intermixed with lenses of fine sand and gravel. Wetland AA is located east of Route 8, north of the access road to the existing Searsburg Wind Facility. There is an ephemeral or intermittent stream associated with this wetland that originates in a roadside ditch and flows off-site. Wetland AB is located in the Western Project site along the existing transmission line. Wetland H is located east of Route 8, near the intersection with Putnam Road. Wetland R is located west of Route 8, near the access road to the existing Searsburg facility. Wetlands J, U, X, Y, and Z are located in the Western Project site along an alternate access route that is no longer under consideration. Wetland AL is southeast of turbine W-5. Wetlands BA and BD are located east of turbine W-7; Wetland BD forms the headwaters of Stream 3. Wetlands W-1 through W-13 are seep wetlands located along the existing transmission line that parallels Sleepy Hollow Road; Wetland W-12 is located at the proposed site of the substation for the East Side Only alternative. Herbaceous vegetation is characterized by manna grass, rough sedge, sensitive fern, bladder sedge, New York fern, umbellate aster, rough goldenrod, delicate-stemmed sedge, spotted touch-me-not, slender manna grass, fringed sedge, and purple-stemmed aster. Meadowsweet and steeplebush shrubs occur in low densities.

Red maple-black ash swamp: One wetland of this type was identified in the Western Project site (Wetland G), approximately 450 feet north of the Putnam Road access route, near Route 8. This wetland receives surface water from stream 14, and may also be fed by groundwater. The soils consist of 18 inches of hemic peat over rock. The canopy in this wetland consists of red maple and yellow birch, with a shrub layer comprised of red maple saplings. Herbaceous vegetation is dominated by ferns such as cinnamon fern, with scattered hummocks of peat moss also common.

Shallow emergent marsh: Four wetlands of this type were identified in the Project area. Wetland W is located in the Western Project site along an alternate access route that is no longer under consideration. Wetland ZZ is located near the proposed electrical collection line corridor, east of Route 8, between an old field and a montane yellow birch-red spruce forest. It forms the headwaters to a small drainage that empties into a roadside ditch along Route 8. Soils consist of a 13-inch thick horizon of peat over dense silt loams. Vegetation is dominated by meadowsweet, umbellate aster, rough goldenrod, and gynandrous sedge. Wetland BB is located directly adjacent to the current road to the existing Searsburg Wind Facility. It appears some portion of the wetland was filled during construction of the existing road. This wetland forms the headwaters to a small stream draining to the southeast. Open standing water is common among the tussocks of vegetation and standing dead trees. Vegetation is dominated by cattails, common rush, bladder sedge, and wool grass. Wetland BC is located between Route 8 and the access road to the existing Searsburg facility.

Old field: Two wetlands of this type were identified in the Project area. Wetland S is located on the west side of Route 8, across from the access road to the existing Searsburg Wind Facility. The disturbed soils, shape of the wetland, location, and surrounding topography suggest that this wetland may have been the site of historic disturbance such as gravel mining. The soils are gleyed course sandy loams. The vegetation consists of dense growth of meadowsweet, and hydrophytic sedges such as gynandrous sedge. Wetland P is located just south of Route 9 along an alternate access route that is no longer under consideration.

Beaver wetlands: Beaver wetlands are generally considered to be a combination of multiple natural communities that occur together on the landscape. The extent of a particular community often changes over time as beaver populations fluctuate. Located along the existing 69kV transmission line west of Route 8 and south of Route 9, Wetland Q is a combination of shallow emergent marsh and areas of open water. Some small areas of deep broadleaf marsh are present in the areas of open water. The shallow emergent marsh community is dominated by graminoids such as blue joint grass, woolgrass, bur-reed, and tussock sedge. While the areas of deep broadleaf marsh are mostly open water and therefore sparsely vegetated, plants observed include yellow water lily, cattail, and bur-reed. Some localized areas dominated by shrubs such as speckled alder occur on the periphery of the beaver wetland complex.

Shrub swamp: There was one shrub swamp identified in the field inventory. Wetland V sits in a narrow basin surrounded by upland forest. Dense growth of speckled alder dominates the shrub layer, occupying approximately 70% of the wetland. Areas of open water and herbaceous wetland vegetation comprise the remaining 30% of the wetland, which is dominated by rice cut-grass and tussock sedge.

Conifer swamp: There was one small conifer swamp identified in the field inventory. Wetland T occurs as a narrow wetland depression within a red spruce-northern hardwood forest matrix. The transition between the upland and wetland communities at this site is subtle. Canopy trees of red spruce and balsam fir are the same in both upland and wetland communities; the difference occurs in the understory. Hummocks and hollows of sphagnum moss characterize the microtopography in the wetland, with three-seeded sedge, dwarf raspberry, and goldthread as dominant herbs. Small areas of standing water are present in the hollows.

3.8.1.2 Floodplains

The GMNF Forest Plan defines Flood Plain as a lowland adjoining a watercourse, and at a minimum, the area is subject to a 1% or greater chance of flooding in a given year. The Vermont Statute 10 § 6001 (6) defines a floodway as a "channel of a watercourse which is expected to flood on an average of at least once every 100 years and the adjacent land areas which are required to carry and discharge the flood of the watercourse, as determined by the secretary of natural resources with full consideration given to upstream impoundments and flood control projects." Floodplain data was obtained from the FEMA Flood Insurance Rate Maps. Within the Project area, there are several floodplains designated as Zone A, or areas of 100-year flood. In the Town of Searsburg, floodplains are mapped along the Deerfield River, near the northeast edge of Compartment 123 (FEMA, 1974). In the Town of Readsboro, floodplains are mapped along Yaw Pond, near the western edge of Compartment 122; along an unnamed tributary of Yaw Pond Brook and in the adjacent VSWI Class II wetlands in Compartment 122 (portions of Stands 060, 061, and 105); and for approximately 800 linear feet along the unnamed tributary of the West Branch of the Deerfield River that runs parallel to Route 8, at the very southeast edge of Compartment 122 (FEMA, 1985).

To supplement the review of FEMA Flood Insurance Maps, topography was examined on 1:24,000 Unites States Geological Service (USGS) maps, as flat areas mapped along streams and rivers can be susceptible to flooding. One additional floodplain area was identified in the Project area, at the southwestern corner of Compartment 124. The headwaters of an unnamed creek forms along the ridge line in the Eastern Project area, and flows generally southwest, draining much of Compartment 124. This stream eventually drains into the West Branch of the Deerfield River just south of Heartwellville, after merging with the unnamed creek that flows south parallel to Route 8. In the section of this unnamed creek that flows through Heartwellville, approximately 800 linear feet of this unnamed creek appear to be at risk of flooding. No additional floodplains were identified in the Project area. There are no floodplains within the Project site.

3.8.2 Direct and Indirect Impacts Presented by Alternative

During the scoping process, one significant issue was identified relating to soil and water resources. People are concerned that the Proposed Action would adversely impact soil and water resources resulting in unacceptable sedimentation, erosion, and loss of wetlands. The wetland resources component of this issue will be discussed here. Soil and water resources are discussed separately in

Sections 3.2 and 3.7, respectively. The indicator used to focus the discussion of direct and indirect impacts to wetlands will be the area of wetlands (in acres) affected and/or lost due to proposed activities.

The analysis area for the evaluation of direct and indirect impacts to wetlands and floodplains is defined as the three sub-watersheds that fall within the Project area. As described in Section 3.7.1, these drainages consist of the Deerfield River from the headwaters to the East Branch, the Deerfield River from the East Branch to Sherman Dam, and the West Branch of the Deerfield River.

3.8.2.1 Proposed Action

3.8.2.1.1 Direct and Indirect Impacts to Floodplains

As described in Section 3.8.1, there are no floodplains in the Project site. All Project construction would occur a minimum of 1 to 1.5 miles from Project area floodplains, and therefore, no direct impacts are anticipated. Indirect impacts to floodplains could result from soil sedimentation caused by construction activities such as soil disturbance and the removal of vegetation. However, given the distance that floodplains lie from the proposed activities, and with the implementation of design criteria, mitigation measures, and Forest Plan S&Gs that have proven effective at keeping soil sedimentation at very low levels (USDA Forest Service, 1999, 2003a), no adverse impacts to floodways are anticipated. See also Section 3.7 for further discussion of design criteria and mitigation specific to streams that would minimize soil sedimentation.

3.8.2.1.2 Direct Impacts to Wetlands

Impacts to wetlands would occur primarily during Project construction. Operation of the constructed facility is not anticipated to have any undue adverse impacts to wetlands. Vehicular access to the turbines, substation, and O&M facility would be completely established during Project construction, and routine O&M procedures are not anticipated to result in adverse impacts. However, minor incidences from routine O&M procedures could have a minimal impact to wetlands in the Project area. Isolated incidences that could potentially cause minor impacts to wetlands include maintenance of buried electrical collection lines, access road washouts, replacement or maintenance of culverts, and accidental fuel or chemical spills. Monitoring and permit administration of post construction facility operations would identify any of these events, and action would be taken to correct any unforeseen impacts. Hence, the discussion below will focus on construction related impacts.

Due diligence was performed to avoid impacting wetlands. Forest Plan S&Gs for soil, water, and riparian area protection and restoration G-11 states that "crossing wetlands with roads or trails should be avoided whenever possible." (USDA Forest Service, 2006a). Forest Plan directives for wetland management are consistent with the 1977 Executive Order 11990, which states in section 2(a), "each agency, to the extent permitted by law, shall avoid undertaking or providing assistance for new construction located in wetlands unless the head of the agency finds (1) that there is no practicable alternative to such construction, and (2) that the Proposed Action includes all practicable measures to minimize harm to wetlands which may result from such use." To comply with G-11, careful planning and site design focused on avoidance of impacts to wetlands.

During construction, soil disturbing activities included in the Proposed Action (such as clearing of vegetation, excavating, grading, construction and upgrade of roads, and the installation of aboveground or buried electrical collection lines) could potentially impact wetland resources. Direct impacts to most wetlands would be avoided, with the exception of five small wetlands. The re-construction and widening of a corner of the existing access road at the intersection of Route 8 and Putnam Road would impact Wetlands F and AH, and re-construction and widening of a corner of the existing access road at the intersection of Route 8 and Sleepy Hollow Road would impact Wetland AA. These intersections would need to be modified in order to accommodate the large turning radii required for oversize construction vehicles to be able to execute the turns from Route 8 onto Putnam and Sleepy Hollow Roads. In addition, Wetlands AJ and BB, located on the Eastern Project site, would be impacted by access road construction. Table 3.8.2-1 quantifies the direct impacts to wetlands from the Proposed Action.

Table 3.8.2-1: Direct Impacts to Wetlands under the Proposed Action

Wetland ID	Wetland on NFS Land	Direct Permanent Impacts[1] Sq. Feet (Acres)	Direct Secondary Impacts[2] Sq. Feet (Acres)	Direct Temporary Impacts[3] Sq. Feet (Acres)	Total Sq. Feet (Acres)
F	No	123 (0.0028)	0 (0)	166 (0.0038)	289 (0.0066)
AH	No	1,873 (0.043)	0 (0)	0 (0)	1,873 (0.043)
AA	Yes	0 (0)	1,332 (0.0306)	223 (0.0051)	1,555 (0.0357)
AJ	Yes	618 (0.0142)	0 (0)	329 (0.0075)	947 (0.0217)
BB	No	241 (0.0055)	0 (0)	0 (0)	241 (0.0055)
Total		2,855 (0.0655)	1,332 (0.0306)	718 (.0164)	4,905 (0.1125)

[1] Direct permanent impacts consist of wetland areas subject to grading activities.
[2] Direct secondary impacts consist of wetland areas proposed to be spanned by a bridge.
[3] Direct temporary impacts consist of wetland areas subject to clearing activities.

Wetlands F, AH, AA, AJ, and BB are all Class III wetlands. According to the Vermont Wetland Evaluation Forms, these wetlands are not significant for any functions and values (Arrowwood Environmental, 2006b, 2007, 2011). However, the impacts would be considered a connected action under federal jurisdiction (USACOE), and could be determined to be subject to the federal "no net loss" policy. This policy calls for the creation of in-kind replacement wetland, at a size ratio of 1.5 to 1 (mitigation to impact). Since direct wetland impacts exceed 0.1 acre, it is expected that the USACOE would require such compensatory mitigation. Should the Responsible Official decide to issue a land use authorization for the Proposed Action, the Forest Service permit would require compliance with the terms and conditions of the 404 permit, including any compensatory mitigation. Any wetland replacement project would be developed in consultation with the USACOE and the Wetlands Office of the Vermont ANR.

In addition to the direct impacts to wetlands described above, there would be direct impacts to the protective strips and wetland buffers of some additional wetlands. The Forest Plan S&G for soil, water, and riparian area protection and restoration, S-2, specifies that any soil disturbing activities would be separated from wetlands by a protective strip of predominantly undisturbed soil, having vegetative or organic matter cover. The purpose of the protective strip would be to protect the soil's infiltration capacity, and to filter out sediment (USDA Forest Service, 2006a). According to the Forest Plan, the required width of protective strips is variable, based on the slope between the soil disturbing activity and the water source (see Forest Plan, Table 2.3-1, page 20). The minimum allowable width for protective strips is 50 feet, acceptable only where slopes are less than 10%; an additional 20 feet in width is required for each additional 10% of slope. Any soil disturbing activities occurring at a distance less than the variable width specified by S&G S-2 would be considered a direct impact to the prescribed protective strip. Furthermore, the Forest Plan S&G for soil, water, and riparian area protection and restoration G-10 states, "within 100 feet of wetlands and seasonal pools, activities should be limited to those that protect, manage, and improve the condition of these resources. Acceptable activities should be approved on a case-by-case basis." Any soil disturbing activities occurring at a distance less than the 100 feet specified by G-10 would be considered a direct impact to the prescribed wetland buffer.

Due to steep topography, the variable width protective strip and 100-foot buffer would be unattainable in certain locations. The primary activity that would impact protective strips and buffers would be associated with road building. Road building activities would include clearing road widths, excavating (as needed), grading, and graveling road bases. Road locations were adjusted early in the design process to keep back from wetland areas as much as possible. However, the steep topography would not allow further relocation, and constructing roads on the sides of these steep areas would result in much greater impacts. Table 3.8.2-2 summarizes direct impacts to protective strips and wetland buffers under the Proposed Action. A discussion of each impacted wetland follows.

Table 3.8.2-2: Impacts to Protective Strips and Wetland Buffers under the Proposed Action

Wetland ID	Distance to Disturbance[1] (feet)	Slope[2]	Width of Protective Strip Required Under S-2[3] (feet)	Impact to S-2 Protective Strip/ G-10 Buffer[4]
A	52	10-14%	70	Yes/Yes
B	50	14-18%	70	Yes/Yes
C	19	4-10%	50	Yes/Yes
D	42	12-16%	70	Yes/Yes
S	32	14%	70	Yes/Yes
AA	0	10-12%	70	Yes/Yes
AB	54	10-12%	70	Yes/Yes
AJ	0	10-14%	70	Yes/Yes
BA	63	6-10%	50	No/Yes
BD	91	8-12%	70	No/Yes
WW	TBD[5]	24%	90	TBD[5]
XX	TBD[5]	8-12%	70	TBD[5]

[1] Distance in feet measured between edge of delineated wetland and limits of disturbance from construction plans.
[2] Percent slope of land between delineated wetland and area of disturbance (VCGI, 2002).
[3] Forest Plan S&Gs for soil, water, and riparian area protection and restoration (S-2) requires a protective strip around all federal wetlands. The width of the protective strip is variable based on slope. See Forest Plan, Table 2.3-1, page 20 (USDA Forest Service, 2006a).
[4] Forest Plan S&Gs for soil, water, and riparian area protection and restoration (G-10) establishes a 100-foot buffer around all federal wetlands (USDA Forest Service, 2006a).
[5] These wetlands occur within 100 feet of the proposed clearing for the overhead electrical collection line. Although utility poles would be placed in upland areas so as to avoid direct impacts to these wetlands, exact configuration of utility poles is to be determined. Therefore an accurate measure of the distance between the edge of the wetland and the nearest soil disturbance (pole installation) is not available.

Wetlands A, B, C, D, and AJ: Wetlands A, B, C, D, and AJ are part of a complex of small wetlands and headwater streams that occurs in the Eastern Project area between the proposed sites for turbines E-3 and E-4. This wetland complex occurs along the narrow top of the ridge, where the topography is relatively level. Immediately to both sides of the ridge top, elevation drops steeply, making road construction impracticable. As shown in Table 3.8.2-1, the access road to turbine E-4 would impact a total of 947 square feet (0.0217 acre) of Wetland AJ, consisting of 329 square feet (0.0075 acre) of temporary impact due to clearing, and 618 square feet (0.0142 acre) of permanent impact due to grading. In addition, as shown in Table 3.8.2-2, the Proposed Action would impact the protective strips (standard S-2), and the 100-foot buffer (guideline G-10) of Wetlands A, B, C, and D. The original proposed location for turbine E-4 was shifted slightly to the current location after wetland delineation was completed, to avoid impacting Wetlands A and B. Turbine E-4 would be 170 feet from the nearest wetland. However, impacts to the protective strips and 100-foot buffers could not be avoided. The soil disturbing activity near these wetlands would consist of construction of the facility access road. There are no alternate routes to access the ridgeline that would not result in greater environmental impacts.

Wetland F and AH: As described above, these seep wetlands on private land would be cleared and graded during construction of the Putnam Road access route. Construction activities would result in 166 square feet (0.0038 acre) of temporary impact due to clearing, and 123 square feet (0.0028 acre) of permanent impact due to grading and filling to Wetland F. Construction would also result in 223 square feet (0.0051 acre) of temporary impact and 1,332 square feet (0.0306) acres of permanent impact to Wetland AH. Due diligence was performed to avoid directly impacting wetlands in this area, with several possible alternate access routes investigated. There are no alternate routes to the Western Project site that would not result in greater environmental impacts.

Wetland S: Wetland S is located approximately 5 feet west of Route 8, just north of the intersection of Sleepy Hollow Road. The protective strip and 100-foot buffer for this wetland contain approximately 225 linear feet of Route 8, including the intersection with Sleepy Hollow Road, which runs east from Route 8. Improvements to this intersection would include grading and widening the north side of Sleepy Hollow Road (see Section 3.15). As shown in Table 3.8.2-2, the Proposed Action would impact both the protective strip and the 100-foot buffer of Wetland S. However, all activities to improve the existing roads would occur on the east side of Route 8, with Route 8 serving as a barrier between the wetland and the construction activity. There are no alternate routes to transport turbine components to the Eastern Project site that would not result in greater environmental impacts.

Wetland AA: Wetland AA is located on the north side of Sleepy Hollow Road, across from the entrance to the existing GMP substation. The edge of this wetland is currently approximately 10 feet from the northern edge of Sleepy Hollow Road. The 100-foot buffer for this wetland includes approximately 325 linear feet of Sleepy Hollow Road. As described above, Wetland AA would be partially cleared during construction of the access route, and spanned with a bridge, resulting in a total of 1,555 square feet (0.0357 acre) of impact, consisting of 223 square feet (0.0051 acre) of temporary impact, and 1,332 square feet (0.0306 acre) of secondary impact. Although road improvements would impact Wetland AA under the Proposed Action, any alternate access routes to avoid this wetland would incur greater environmental impacts.

Wetland AB: Wetland AB is located in the Western Project area, under the existing 69 kV transmission line, north of the proposed location for turbine W-1. As shown in Table 3.8.2-2, the Proposed Action would impact both the protective strip and the 100-foot buffer of Wetland AB. Due diligence was performed to avoid directly impacting wetlands in this area. Electrical engineering constraints require that the substation be located adjacent to a transmission line. In order to avoid the environmental impacts that would result from construction of a new transmission corridor, potential sites for the substation were assessed along the existing ROW. Any alternate location for the proposed substation would incur greater environmental impacts.

Wetland BB: Wetland BB is located on private land, directly adjacent to the current road to the existing Searsburg Wind facility. As shown in Table 3.8.2-1, road improvements would result in

241 square feet (0.0217 acre) of permanent impact due to grading. There are no alternate routes to access the ridgeline that would not result in greater environmental impacts.

Wetlands BA and BD: Wetlands BA and BD are located in the Western Project area, north of the access road between turbines W-7 and W-8. These wetland occurs along the narrow top of the ridge, where the topography is relatively level. Immediately to both sides of the ridge top, elevation drops steeply, making road construction impracticable. As shown in Table 3.8.2-2, the Proposed Action would impact the 100-foot buffers of Wetlands BA and BD, but not the protective strips. There are no alternate routes to access the ridgeline that would not result in greater environmental impacts.

Wetlands WW and XX: Wetlands WW and XX are located immediately west of Route 8, south of Sleepy Hollow Road. Under the Proposed Action, the overhead electrical collection line connecting the Eastern and Western Project sites would pass west of Wetland WW, and south of Wetlands XX. No poles would be placed within these wetlands and no clearing would occur within these wetlands. The closest edge of the cleared right-of-way would be approximately 95 feet and 42 feet from Wetlands WW and XX, respectively. Therefore, no direct impacts to these wetlands are anticipated. However, engineering constraints could require the placement of poles within the 100-foot buffer, in which case the protective strips and 100-foot buffers would be impacted.

3.8.2.1.3 Application of Guideline G-10

Forest Plan S&Gs were considered during siting of Project components. In all cases, guideline G-10 was first considered when siting roads, turbines, and facilities. Each potentially affected wetland was looked at several times on a case-by-case basis for compliance with G-10. With the application of appropriate S&Gs and design criteria, it was determined that activities within the 100-foot guideline would be allowable without undue adverse impacts and the integrity of the wetlands would be maintained. As described above, some components including roads and turbine pads were relocated during the initial site design to minimize impacts, especially to wetland areas. As also noted above, any additional relocation would incur greater environmental impacts. Similar review by Vermont State ANR wetlands specialists further concurred that activities proposed within the 100-foot wetland buffer would be acceptable, and that no "undue adverse impact to wetland resources" are expected from the Project (Metz, 2008).

3.8.2.1.4 Project-specific Forest Plan Amendment

As shown in Table 3.8.2-1, soil disturbance within the protective strip S-2 would occur at Wetlands A, B, C, D, S, AA, AB, and AJ, and could also potentially occur at Wetlands WW and XX. According to the Forest Plan, S-2 currently allows for soil disturbance by heavy construction equipment in a protective strip under just three specific circumstances. An assessment of the applicability of each of the allowable conditions for soil disturbance within a protective strip is provided below for the Proposed Action.

1. When soils are dry, frozen or covered with sufficient snow.

   Construction of the Proposed Action would most likely need to occur in the summer months and in a limited timeframe due to the logistics of receiving, stockpiling, moving, and assembling the turbine parts. Depending on the timing of any decision to approve construction of the facility, some clearing activities (primarily for road building) could possibly occur during frozen ground conditions. However, it should be anticipated that the Proposed Action would not meet this condition.

2. When measures can be taken to assure compliance with FSM 2526.03.2 and .5.

   FSM 2526.03.2 provides the following direction: "*Manage riparian areas*[19] *under the principles of multiple-use and sustained-yield, while emphasizing protection and improvement of soil, water, and vegetation, particularly because of their effects upon aquatic and wildlife resources. Give preferential consideration to riparian-dependent resources when conflicts among land use activities occur*," while FSM 2526.03.5 directs: "*Give special attention to land and vegetation for approximately 100 feet from the edges of all perennial streams, lakes, and other bodies of water. This distance shall correspond to at least the recognizable area dominated by the riparian vegetation (36 CFR 219.27e). Give special attention to adjacent terrestrial areas to ensure adequate protection for the riparian-dependent resources*."

   As noted above, preferential consideration of riparian-dependent resources has resulted in changes to the proposed layout of roads and turbines to avoid wetlands; all facilities have been moved back away from wetlands as much as reasonably possible. However, any further attempt to relocate facilities away from wetlands would result in greater environmental impacts (cut and fill; steep slope issues with greater potential for runoff, erosion, and sedimentation). Therefore, given that turbine placement and other activities would impact buffer strips, it can be assumed that the Proposed Action would not fully meet this condition.

3. When local topography eliminates the risk of stream sedimentation associated with ground disturbance (for example, if a natural berm in the protective strip separates a stream/wetland from soil-disturbing activity).

   Local topographic features separating the wetland from the soil-disturbing activity are not present at each of the wetlands for which the protective strip would potentially be impacted, i.e., at Wetlands A, B, C, D, S, AA, AB, AJ, WW, and XX. Therefore, the Proposed Action would not meet this condition.

Since the Proposed Action does not meet any of the conditions that would allow use of heavy construction equipment within the protective strips, it would be necessary to amend standard S-2 for the Project in order to provide the necessary full compliance with Forest Plan standards for

[19] According to FSM 2526, riparian areas consist of "riparian ecosystems, aquatic ecosystems, and wetlands."

soil, water, and riparian area protection and restoration. This would be considered a site-specific amendment only for the Deerfield Wind Project, and would not apply to implementation of any other Forest project.

As previously noted, most of the potential impacts to protective strips occur along proposed access roads. In each case, alternate siting options have been considered and there are no alternate routes that would not result in potentially greater environmental impacts. In some cases, the wetlands for which the protective strip would be impacted lie adjacent to Route 8; intersections with this paved highway would need improvement and temporary widening in some locations near wetlands. It would not be possible for oversize construction vehicles to be able to execute the turns from Route 8 onto Putnam and Sleepy Hollow Roads without having to modify (widen in spots) the road. Also, in one case, Route 8 would lie between the soil disturbance and the wetland. Finally, there are no distinct topographical features that would impede effective application of appropriate S&Gs and design criteria to prevent or minimize the risk of soil sedimentation. In other words, other S&Gs and the specific design would assure the protection of the remaining protective strips and the integrity of affected wetlands.

Therefore, standard S-2 would be amended to allow soil disturbance within the protective strip of Wetlands A, B, C, D, S, AA, AB, AJ, WW, and XX provided:

1. Compliance with all other applicable standards for soil, water, and riparian area protection and restoration can be assured.

2. Adequate design criteria can be applied that would assure protection of the remaining protective strip and thus further assure that the integrity of the wetland can be maintained.

A number of specific design criteria and mitigation measures may be utilized as needed to further reduce potential adverse impacts to wetlands, and adhere to the amended S-2. Note again that there are no floodplains within the Project site, and hence, no need for design criteria specific to floodplains. Many of these criteria are the same as described in more detail in Sections 3.2 and 3.7. These include implementation of the Project-specific Spill Prevention, Containment, and Countermeasure Plan (SPCCP) that outlines procedures to be implemented to prevent the release of hazardous substances into the environment, and keeping materials on hand to control and contain potential petroleum spills. This plan would not allow refueling of construction equipment within 100 feet of any stream or wetland.

Another design criterion would identify No Equipment Access Areas, in which the use of motorized equipment would be prohibited. Also, Restricted Activities Areas would be identified in which a buffer zone of 100 feet would be established where appropriate around streams, wetlands, and infiltration basins. As noted in Section 3.7, restricted activities would include:

- No deposition of slash within or adjacent to a stream or wetland.

- No accumulation of construction debris within the area.

- Herbicide restrictions within 100 feet of a stream or wetland (or as required per manufacturer's instructions).
- No degradation of stream banks.
- No equipment washing or refueling within the area.
- No storage of any petroleum or chemical material.

Furthermore, as described in Sections 3.2 and 3.7, the Project-specific EPSCP would be implemented, and would function in cooperation with any stormwater management permit terms and conditions. Silt fences, hay bales, temporary siltation basins, and other erosion prevention features as noted for the EPSCP would be installed and maintained throughout Project construction, in compliance with Forest Plan guideline G-5 for soil, water, and riparian area protection and restoration. This plan would be an important part of efforts to assure effectiveness of amended S-2 and the protection of the remaining protective strips and the integrity of affected wetlands.

Based on guidance provided in the Forest Service Manual, the Project-specific Forest Plan amendment described above would be considered non-significant. According to FSM 1926.51, changes to the land management plan that are not significant can result from: (1) actions that do not significantly alter the multiple-use goals and objectives for long-term land and resource management, (2) adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term land and resource management, (3) minor changes in standards and guidelines, or (4) opportunities for additional projects or activities that will contribute to achievement of the management prescription. The Project-specific modification to S-2 would be considered a minor change in standards and guidelines, as per these criteria.

The proposed change to S-2 would be small and limited in application to ten specific wetlands at the Project site (Wetlands A, B, C, D, S, AA, AB, AJ, WW, and XX). Furthermore, there would be no change in goals, objectives, or outputs (goods and services) from the Forest. Multiple-use goals and objectives for long-term land and resource management would not be affected. There would be no adjustment of management area boundaries or management prescriptions. The location and size of the protective strips that would be affected by the change is very small in relation to the overall GMNF. Finally, allowing use of heavy construction equipment within the protective strips of ten specific wetlands would have no effect on any other management prescriptions.

3.8.2.1.5 Impervious Surfaces, Runoff, Drainage

The same situation in regard to the creation of impervious surfaces exists for wetlands as for streams and groundwater as described in Section 3.7. Any increase in stormwater runoff would be negligible, as Project construction would result in limited addition of impervious surface. Nevertheless, specific means of avoiding or minimizing stormwater-related adverse impacts during construction and operation of the Project include application of appropriate design criteria and mitigation measures.

To avoid localized drainage problems, ditches, water bars, culverts, temporary sediment retention basins, and other drainage features as determined by the final stormwater management plan would be located as needed at each road and tower site to prevent impacts to wetlands. The drainage control features would comply with Forest Plan S&Gs for soil, water, and riparian area protection and restoration (G-5), and would be noted on the construction drawings. If drainage problems develop during or after construction, standard S-6 calls for immediate corrective actions to restore the drainage structures to working order. See Section 3-7 for further details.

3.8.2.1.6 Indirect Impacts to Wetlands

Indirect secondary impacts may occur outside the footprint of the disturbance (i.e., beyond the limits of clearing and grading). These impacts could arise from or be associated with the direct discharge of dredged or fill materials, or could result from sedimentation and erosion caused by construction activities (e.g., removal of vegetation and soil disturbance could result in runoff into wetland areas). Indirect impacts could occur at wetlands that would be partially filled, or at wetlands adjacent to upland work areas, even if no direct wetland impacts are anticipated. Such areas may be found adjacent to the proposed access roads, electrical interconnects, turbine sites, staging area, and substation.

Public comments received on the SDEIS raised concerns that potential secondary impacts to wetlands associated with Project construction had not been fully addressed. In response to these concerns, analysis has been added to this FEIS to quantify the area of wetlands exposed to potential indirect effects to allow comparison of relative risk levels between alternatives. The Forest Plan contains numerous S&G to protect wetlands from the indirect effects of soil disturbing activities. The width of the protective strips prescribed by S-2 is variable, based on the slope between the soil disturbing activity and the water source. For the Proposed Action, S-2 would require protective strips of 50 to 90 feet. G-10 applies to areas within 100 feet of wetlands. Based on these thresholds, it is assumed for the purposes of this analysis that any wetland area outside the Project footprint but within 100 feet of the limits of proposed clearing or grading activities could be at risk of indirect secondary impacts. Table 3.8.2-3 summarizes potential indirect impacts to wetlands under the Proposed Action.

Table 3.8.2-3: Potential Indirect Impacts to Wetlands under the Proposed Action

Wetland ID	Ownership	Type of Direct Impact[1]	Potential Indirect Impact Square Feet (Acres)
A	NFS	S-2, G-10	1,322 (0.0304)
B	NFS	S-2, G-10	5,062 (0.1162)
C	NFS	S-2, G-10	2,864 (0.0658)
D	NFS	S-2, G-10	1,598 (0.0367)

Wetland ID	Ownership	Type of Direct Impact[1]	Potential Indirect Impact Square Feet (Acres)
S	NFS	S-2, G-10	2,506 (0.0575)
AA	NFS	Secondary, Temporary, S-2, G-10	3,655 (0.0839)
AB	NFS	S-2, G-10	3,794 (0.0871)
AJ	NFS	Permanent, Temporary, S-2, G-10	224 (0.0052)
BA	NFS	G-10	1,094 (0.0251)
BB	Private	Permanent	12,584 (0.2889)
BB-2	Private	None	170 (0.0039)
BC	Private	None	3,764 (0.0864)
BD	NFS	G-10	396 (0.0091)
WW	NFS	TBD[2]	141 (0.0032)
XX	NFS	TBD[2]	1,493 (0.0343)
ZZ	Private	None	854 (0.0196)
Total			41,521 (0.9533)

[1] Direct impacts to wetlands are described and quantified above. See Table 3.8.2-1 for permanent and temporary impacts and Table 3.8.2-2 for S-2 and G-10 impacts.
[2] There would be no permanent or temporary impacts to these wetlands. However, portions lie within 100 feet of the proposed clearing for the overhead electrical collection line. Although utility poles would be placed in upland areas so as to avoid permanent impacts to these wetlands, exact configuration of utility poles is to be determined. Since an accurate measure of the distance between the edge of the wetland and the nearest soil disturbance (pole installation) is not available, it cannot be determined whether S-2 or G-10 impacts would occur.

Application of Forest Plan S&Gs, along with the Project-specific design criteria and mitigation measures described above, would minimize these indirect impacts to wetlands. Included among the design criteria and mitigation are contingencies that, should any unforeseen adverse impact occur during construction, immediate action would be taken to remedy the situation. For example, should an unforeseen large storm event result in sudden failure of a drainage feature, action would be taken immediately to repair the feature and/or construct new drainage feature(s) as needed. Efforts would be made to address the cause of impact, e.g., repair a section of washed out road to prevent further erosion. These measures are typical responses to these situations on large private land projects as well as projects on NFS and other public lands, and have been shown to be effective in addressing these types of situations.

To minimize any adverse impact and assure compliance with design criteria, mitigation measures, and Forest Plan S&Gs during construction and operation, a number of compliance measures would be applied. Compliance measures would include requiring the Applicant to provide copies of all permits and plans, assuring that the contractor adhere to any special conditions of the permits issued, and requiring the Applicant and Forest Service to employ one or more individuals to provide oversight during construction. Likewise, upon completion of construction, a Forest Service Special Use permit administrator would oversee the terms and conditions of the Special Use permit during Project operation, including any required Project operation monitoring.

3.8.2.2 Alternative 1: No Action

No turbines, access roads, or other Project components would be constructed under the No Action alternative. Therefore, beyond impacts that would be associated with ongoing public use and Forest Service management of the area, Alternative 1 is not anticipated to have any adverse effects on wetland resources, since there would be no ground disturbing activities, no impacts to Wetlands F and AA, and no crossing of wetlands by overhead electrical collection lines.

3.8.2.3 Alternative 2: Reduced Turbines in Western Project Site

Alternative 2 would construct 15 turbines, dropping the three southern-most turbines in the Western Project site and adding one turbine near the northern end of that array. As such, there would be slightly less access road construction for this alternative. Impacts to floodplains from Alternative 2 would be the same as those described above for the Proposed Action. In addition, many of the same wetlands that would be impacted under the Proposed Action would also be impacted by the Reduced West alternative. This is because the turbines excluded from the Reduced West alternative occur in upland areas that would incur no wetland impacts under the Proposed Action. Delineated Wetlands F, AA, and AH would still be impacted, since they are located at the intersections of Route 8 with Putnam and Sleepy Hollow Roads, which would still require widening to provide access to the Western and Eastern Project sites, respectively. Construction of access roads in the Eastern Project site would still impact Wetland BB. However, the extent of impacts would be different for Alternative 2 than for the Proposed Action, due to the slight shifts in turbine locations and associated shifts in access roads, described in Section 2.4.3. These shifts would reduce impacts under the Reduced West alternative when compared to the Proposed Action by eliminating permanent and temporary impacts to Wetland AJ. Table 3.8.2-4 quantifies the direct impacts to wetlands from the Reduced West alternative.

Table 3.8.2-4: Direct Impacts to Wetlands under the Reduced West Alternative

Wetland ID	Wetland on NFS Land	Direct Permanent Impacts[1] Sq. Feet (Acres)	Direct Secondary Impacts[2] Sq. Feet (Acres)	Direct Temporary Impacts[3] Sq. Feet (Acres)	Total Sq. Feet (Acres)
F	No	0 (0)	0 (0)	6 (0.0001)	6 (0.0001)
AH	No	1,873 (0.043)	0 (0)	0 (0)	1,873 (0.043)
AA	Yes	0 (0)	1,218 (0.028)	499 (0.0114)	1,717 (0.0394)
BB	No	56 (0.0013)	0 (0)	0 (0)	56 (0.0013)
Total		1,929 (0.0442)	1,218 (0.028)	505 (0.0116)	3,652 (0.0838)

[1] Direct permanent impacts consist of wetland areas subject to grading activities.
[2] Direct secondary impacts consist of wetland areas proposed to be spanned by a bridge.
[3] Direct temporary impacts consist of wetland areas subject to clearing activities.

As described above in Section 3.8.2.1.2, the USACOE could require compensatory mitigation for wetland impacts. Should the Responsible Official decide to issue a land use authorization for the Reduced West alternative, the Forest Service permit would require compliance with the terms and conditions of the 404 permit, including any compensatory mitigation. Any wetland replacement project would be developed in consultation with the USACOE and the Wetlands Office of the Vermont ANR.

The need for amending standard S-2 would still exist under the Reduced West alternative. The construction activities that would impact the protective strips and buffers of certain wetland areas would still occur. Construction of access roads would impact the protective strip and/or 100-foot buffers of Wetlands A, B, C, D, S, and AA. Construction of a substation in the Western Project site would impact the 100-foot buffer of Wetland AB. Installation of the buried interconnect in the Western Project site would impact the protective strip and/or 100-foot buffer of Wetlands BA and BD. Clearing for overhead electrical collection lines connecting the Eastern and Western Project sites would occur within 100 feet of Wetlands WW and XX. In addition, the workspace around turbine W-6 would impact the protective strip and 100-foot buffers of Wetland AL, an impact that would not occur under the Proposed Action. The location for this turbine was shifted in the Reduced West alternative to avoid impacts to bear-scarred beech. Table 3.8.2-5 summarizes direct impacts to protective strips and wetland buffers under the Reduced West alternative.

Table 3.8.2-5: Impacts to Protective Strips and Wetland Buffers under Alternative 2

Wetland ID	Distance to Disturbance[1] (feet)	Slope[2]	Width of Protective Strip Required Under S-2[3] (feet)	Impact to S-2 Protective Strip/ G-10 Buffer[4]
A	60	10-14%	70	Yes/Yes
B	16	10-18%	70	Yes/Yes
C	9	6-10%	50	Yes/Yes
D	40	12-16%	70	Yes/Yes
S	42	12-14%	70	Yes/Yes
AA	0	10-12%	70	Yes/Yes
AB	68	10-14%	70	No/Yes
AJ	2	10-14%	70	Yes/Yes
AL	51	10-14%	70	Yes/Yes
BA	47	6-10%	50	Yes/Yes
BD	81	8-12%	70	No/Yes
WW	TBD[5]	24%	90	TBD[5]
XX	TBD[5]	8-12%	70	TBD[5]

[1] Distance in feet measured between edge of delineated wetland and limits of disturbance from construction plans.
[2] Percent slope of land between delineated wetland and area of disturbance (VCGI, 2002).
[3] Forest Plan S&Gs for soil, water, and riparian area protection and restoration (S-2) requires a protective strip around all federal wetlands. The width of the protective strip is variable based on slope. See Forest Plan, Table 2.3-1, page 20 (USDA Forest Service, 2006a).
[4] Forest Plan S&Gs for soil, water, and riparian area protection and restoration (G-10) establishes a 100-foot buffer around all federal wetlands (USDA Forest Service, 2006a).
[5] These wetlands occur within 100 feet of the proposed clearing for the overhead electrical collection line. Although utility poles would be placed in upland areas so as to avoid direct impacts to these wetlands, exact configuration of utility poles is to be determined. Therefore an accurate measure of the distance between the edge of the wetland and the nearest soil disturbance (pole installation) is not available.

All appropriate S&Gs, design criteria, and mitigation as described for the Proposed Action would be required. Given the shorter length of access roads (4.45 vs. 5.07 miles), there would be slightly less conversion of land to impervious surfaces than under the Proposed Action. However, as noted, the reduction in conversion to impervious surfaces would be in areas where no wetlands impacts would be anticipated. The potential for indirect or secondary impacts to wetlands from sedimentation and erosion would be somewhat greater when compared to the Proposed Action. Table 3.8.2-6 summarizes potential indirect impacts to wetlands under the Reduced West alternative.

Table 3.8.2-6: Potential Indirect Impacts to Wetlands under the Reduced West Alternative

Wetland ID	Ownership	Type of Direct Impact[1]	Potential Indirect Impact Square Feet (Acres)
A	NFS	S-2, G-10	1,024 (0.0235)
B	NFS	S-2, G-10	9,429 (0.2165)
C	NFS	S-2, G-10	3,003 (0.0689)
D	NFS	S-2, G-10	1,598 (0.0367)
F	Private	Temporary	283 (0.0065)
H	Private	None	85 (0.0019)
S	NFS	S-2, G-10	2,414 (0.0554)
AA	NFS	Secondary, Temporary, S-2, G-10	3,492 (0.0802)
AB	NFS	G-10	2,083 (0.0478)
AJ	NFS	S-2, G-10	1,172 (0.0269)
AL	NFS	S-2, G-10	1,596 (0.0366)
BA	NFS	S-2, G-10	2,697 (0.0619)
BB	Private	Permanent	12,820 (0.2943)
BB-2	Private	None	176 (0.004)
BC	Private	None	4,540 (0.1042)
BD	NFS	G-10	645 (0.0148)
WW	NFS	TBD[2]	141 (0.0032)
XX	NFS	TBD[2]	1,493 (0.0343)
ZZ	Private	None	856 (0.0197)
Total			49,547 (1.1373)

[1] Direct impacts to wetlands are described and quantified above. See Table 3.8.2-4 for permanent and temporary impacts and Table 3.8.2-5 for S-2 and G-10 impacts.
[2] There would be no permanent or temporary impacts to these wetlands. However, portions lie within 100 feet of the proposed clearing for the overhead electrical collection line. Although utility poles would be placed in upland areas so as to avoid permanent impacts to these wetlands, exact configuration of utility poles is to be determined. Since an accurate measure of the distance between the edge of the wetland and the nearest soil disturbance (pole installation) is not available, it cannot be determined whether S-2 or G-10 impacts would occur.

In summary, permanent and temporary impacts to wetlands would be substantially less for the Reduced West alternative when compared to the Proposed Action. However, an additional wetland (AL) would incur impacts to its protective strip and 100-foot wetland buffer. In addition, the potential for indirect impacts to wetlands would be somewhat greater under the Reduced West alternative than under the Proposed Action.

3.8.2.4 Alternative 3: Turbines in Eastern Project Site Only

Impacts to floodplains from Alternative 3 would be the same as those described above for the Proposed Action. In addition, many of the same wetlands that would be impacted under the Proposed Action would also be impacted by Alternative 3. Under the East Side Only alternative, no turbines would be constructed in the Western Project site, and no electrical collection system would be constructed between the Eastern and Western Project sites. Delineated Wetlands F, AA, and AH would still be impacted, since they are located at the intersections of Route 8 with Putnam and Sleepy Hollow Roads. These intersections would still require widening to provide access to the staging area and the Eastern Project sites, respectively. Construction of access roads in the Eastern Project site would still impact Wetland BB. In addition, a new substation would be constructed adjacent to the existing GMP substation on Sleepy Hollow Road, and the existing transmission line that runs northeast parallel to the road would be upgraded. Construction of the substation would impact Wetland W-12, a seep wetland located on private land, an impact that would not occur under either the Proposed Action or the Reduced West alternative. Although numerous seep wetlands (W-1 through W-11 and W-13) occur on private land under the existing overhead electrical collection line, utility poles would be placed in upland areas so as to avoid direct impacts to these wetlands. Table 3.8.2-7 quantifies anticipated direct impacts to wetlands from Alternative 3.

Table 3.8.2-7: Direct Impacts to Wetlands under the East Side Only Alternative

Wetland ID	Wetland on NFS Land	Direct Permanent Impacts[1] Sq. Feet (Acres)	Direct Secondary Impacts[2] Sq. Feet (Acres)	Direct Temporary Impacts[3] Sq. Feet (Acres)	Total Sq. Feet (Acres)
F	No	0 (0)	0 (0)	6 (0.0001)	6 (0.0001)
AH	No	1,873 (0.043)	0 (0)	0 (0)	1,873 (0.043)
AA	Yes	0 (0)	1,218 (0.028)	499 (0.0114)	1,717 (0.0394)
BB	No	56 (0.0013)	0 (0)	0 (0)	56 (0.0013)
W-12	No	37 (0.0009)	0 (0)	2,503 (0.0575)	2,540 (0.0584)
Total		1,966 (0.0452)	1,218 (0.028)	3,008 (0.0691)	6,192 (0.1423)

[1] Direct permanent impacts consist of wetland areas subject to grading activities.
[2] Direct secondary impacts consist of wetland areas proposed to be spanned by a bridge.
[3] Direct temporary impacts consist of wetland areas subject to clearing activities.

Since direct wetland impacts exceed 0.1 acre, it is expected that the USACOE would require such compensatory mitigation. Should the Responsible Official decide to issue a land use authorization for the East Side Only alternative, the Forest Service permit would require compliance with the terms and conditions of the 404 permit, including any compensatory mitigation. Any wetland replacement project would be developed in consultation with the USACOE and the Wetlands Office of the Vermont ANR.

The need for amending standard S-2 would still exist, although for fewer wetlands than under either the Proposed Action or Reduced West alternative. No turbines or substation would be constructed in the Western Project site, so there would be no impacts to the protective strip or

100-foot buffer of Wetlands AB, AL, BA, BD, WW, or XX. However, construction of access roads in the Eastern Project site would still impact the protective strip and 100-foot buffers of Wetlands A, B, C, D, and AJ, and road improvements would still impact the protective strip and 100-foot buffers of Wetlands S and AA. Table 3.8.2-8 summarizes direct impacts to protective strips and wetland buffers under the East Side Only alternative.

Table 3.8.2-8: Impacts to Protective Strips and Wetland Buffers under Alternative 3

Wetland ID	Distance to Disturbance (feet) [1]	Slope[2]	Width of Protective Strip Required Under S-2 (feet)[3]	Impact to S-2 Protective Strip/ G-10 Buffer[4]
A	60	10-14%	70	Yes/Yes
B	16	14-18%	70	Yes/Yes
C	9	6-10%	50	Yes/Yes
D	40	12-16%	70	Yes/Yes
S	42	12-14%	70	Yes/Yes
AA	0	10-12%	70	Yes/Yes
AJ	2	10-14%	70	Yes/Yes

[1] Distance in feet measured between edge of delineated wetland and limits of disturbance from construction plans.
[2] Percent slope of land between delineated wetland and area of disturbance (VCGI, 2002).
[3] Forest Plan S&Gs for soil, water, and riparian area protection and restoration (S-2) requires a protective strip around all federal wetlands. The width of the protective strip is variable based on slope. See Forest Plan, Table 2.3-1, page 20 (USDA Forest Service, 2006a).
[4] Forest Plan S&Gs for soil, water, and riparian area protection and restoration (G-10) establishes a 100-foot buffer around all federal wetlands (USDA Forest Service, 2006a).

Wetlands A, B, C, D, F, S, AA, AH, AJ and BB: Impacts to these wetlands would be as described above for the Proposed Action and Reduced West alternative. Even though most activities in the Western Project site would be eliminated, the temporary laydown area would still be used to stockpile turbine materials, so the corner of Route 8 and Putnam Road would still need modification, and hence, Wetlands F and AH would be directly impacted as previously described. Wetland AA would still be impacted during widening of the intersection of Route 8 and Sleepy Hollow Road. Construction of access roads in the Eastern Project site would still impact Wetlands AJ and BB. Please refer to the above impacts analysis for more details.

Wetlands W-12: This seep wetland is located in the cleared right-of-way under the existing GMP 69 kV transmission line that runs parallel to Sleepy Hollow Road. This existing transmission line would be upgraded under the East Side Only alternative, and a new substation constructed adjacent to the existing GMP substation. Wetland W-12 is located entirely within the limits of construction of the new substation, and therefore, the East Side Only alternative could result in a total of 2,540 square feet (0.0584 acre) of impact to Wetland W-12, 37 square feet (0.0009 acre) of permanent impact due to grading and 2,503 square feet (0.0575 acre due to clearing). However, because the seep wetland is located under an existing transmission line, it is already maintained in an open condition, and additional clearing would be anticipated to be minimal. Since this wetland is located on private land, Forest Plan S&Gs do not apply.

All appropriate S&Gs, design criteria, and mitigation measures as described for the Proposed Action would be required. Potential for indirect impacts to wetlands from sedimentation and erosion would only be slightly reduced from the Proposed Action because the reduction in construction would occur in areas away from wetlands. In other words, the amount of construction for Alternative 3 that could affect wetlands would be similar to that of the Proposed Action or Reduced West alternative. There would be a fairly substantial reduction in conversion to impervious surfaces compared to the Proposed Action due to the decrease in road construction (1.92 vs. 5.07 miles). However, this reduction would occur where no wetlands impacts would be anticipated, and therefore, not result in any further reduction of impacts. Table 3.8.2-9 summarizes potential indirect impacts to wetlands under the East Side Only alternative.

Table 3.8.2-9: Potential Indirect Impacts to Wetlands under the East Side Only Alternative

Wetland ID	Ownership	Type of Direct Impact[1]	Potential Indirect Impact Square Feet (Acres)
A	NFS	S-2, G-10	1,024 (0.0235)
B	NFS	S-2, G-10	9,429 (0.2165)
C	NFS	S-2, G-10	3,003 (0.0689)
D	NFS	S-2, G-10	1,598 (0.0367)
F	Private	Temporary	283 (0.0065)
H	Private	None	85 (0.0019)
S	NFS	S-2, G-10	2,414 (0.0554)
AA	NFS	Secondary, Temporary, S-2, G-10	3,492 (0.0802)
AJ	NFS	S-2, G-10	1,172 (0.0269)
BB	Private	Permanent	12,820 (0.2943)
BC	Private	None	4,540 (0.1042)
W-11	Private	None	1,199 (0.0275)
W-12	Private	Permanent, Temporary	0 (0)
Total			41,059 (0.9425)

[1] Direct impacts to wetlands are described and quantified above. See Table 3.8.2-7 for permanent and temporary impacts and Table 3.8.2-8 for S-2 and G-10 impacts.

In summary, direct permanent impacts to wetlands would be substantially less for the East Side Only alternative when compared to the Proposed Action, but somewhat greater when compared to the Reduced West alternative. Secondary direct impacts would be less for the East Side Only than for the Proposed Action, and identical when compared to the Reduced West alternative.

Direct temporary impacts would be substantially greater under the East Side Only alternative than under either the Proposed Action or Reduced West alternative. Fewer wetlands would incur impacts to protective strips and 100-foot wetland buffers for the East Side Only alternative than for the Proposed Action or Reduced West alternative. The potential for indirect impacts to wetlands would also be somewhat reduced under the East Side Only alternative.

3.8.3 Cumulative Impacts

The analysis area for cumulative impacts to wetlands and floodplains consists of the drainages in the Deerfield River watershed within the Project area, including both NFS and private lands. Some of the past actions that have occurred over the last 5 to 10 years include timber harvesting on nearby private lands, small maintenance projects on local roads, and the development of the existing Searsburg Wind Facility, which went online in mid-1997 (slightly beyond the 5 to 10 year period). Routine maintenance activities on local roads are ongoing. Although there may have been direct and indirect impacts to wetlands from these activities, the exact amount cannot be determined. All wetlands surveyed for the Deerfield Project appeared to be functioning well. No large loss of wetlands in the Project area over the last 5 to 10 years has been documented, including as a result of construction of the Searsburg facility).

No timber sales or other large scale ground disturbance activities are currently planned by the Forest Service in the Project area. A landscape-scale planning effort for NFS lands south and west of the Project area is expected to begin in 2011. This planning effort might include additional GMNF lands south of Route 9 and east of the Project area, as well. It would be at least one to two years beyond 2011 before any definite proposals would be analyzed. No specific proposals are known at this time. Any timber sales or other large scale ground disturbance activities that do occur would be conducted in compliance with Forest Plan S&Gs to minimize impacts such as soil erosion, sedimentation, and accidental releases of oil and hazardous materials.

Timber harvesting on private lands in the Project area would be expected to continue, but there is no record-keeping or advanced planning for future harvests on most of the private land in the Project vicinity (Fice, 2008). There is very little private land in the Project area. Similarly, no other known road improvement projects or major land developments are currently proposed on adjacent lands, although these also could occur within the life of the Project. Large projects on private lands would likely be subject to review by town and possibly state and/or federal agencies. Any approvals by regulatory bodies would be conditioned to require compliance with Vermont Acceptable Management Practices (AMPs) to minimize environmental impacts.

Therefore, the incremental amount of impacts to wetlands for all action alternatives, when added to impacts from past and foreseeable future activities, would likely result in some minor cumulative effects to wetlands beyond the direct and indirect effects disclosed above. The possible in-kind replacement of the permanently impacted portions of Wetlands F, AA, AH, AJ, BB, and/or W-12 (depending on alternative) described in Section 3.8.2, if undertaken, would mitigate most of this effect. No long-term effect to the overall function of the wetland areas within the Project area would be anticipated.

3.9 Ecological Resources

This section describes ecological resources including ecological communities, Non-Native Invasive Species (NNIS), Management Indicator Species (MIS), reptiles and amphibians, fish, mammals (other than American black bear and bats), Threatened and Endangered Species, and Regional Forester Sensitive Species (RFSS). Sections 3.10, 3.11, and 3.12 present separate discussions and analyses for birds, bats, and black bears, respectively.

3.9.1 Affected Environment

The affected environment for the discussion of impacts to ecological resources will be the Project area. As described in Section 3.0 and shown in Figure 1-2, the Project area encompasses all NFS and private lands in GMNF management compartments 121, 122, 123, and 124, an area totaling 9,523 acres. The Project area is located in the Southern Green Mountain biophysical region of Vermont. Temperatures are cool, precipitation is heavy, and natural communities with northern affinities dominate the region (Thompson & Sorenson, 2000). Elevation in the Project area ranges from approximately 1,510 feet (460 m) AMSL to approximately 3,110 feet (948 m) AMSL.

The Project site consists of the footprint of activity associated with the proposed Deerfield Wind Project, divided into the Eastern Project site and the Western Project site. Elevation in the Project site ranges from approximately 2,401 feet AMSL near the intersection of Route 8 and the Putnam Road access to approximately 3,110 feet AMSL along the eastern ridgeline, south of the existing Searsburg Wind Facility.

3.9.1.1 Vegetation

Plant species and communities found within the Project area were identified and characterized during field surveys conducted by Arrowwood Environmental during the summer of 2003 through 2005, with additional surveys conducted in 2006, 2008, and 2011. A total of 166 plant species were documented within the Project area during these field surveys. All of the plant species identified during the course of field surveys are common to the region and the State.

3.9.1.1.1 Ecological Communities

Both the Project area and the Project site are predominantly forested. As shown in Figure 3.9-1, northern hardwood forests and montane yellow birch-red spruce forests are the two most abundant communities in the Project site (Arrowwood Environmental, 2006a). These montane forest communities are typical of higher elevation areas in the Green Mountains. Northern hardwood forest is the most common community type in the Project site, occurring on both sides of Vermont Route 8. Other ecological communities present in the Project area include spruce-fir-tamarack swamp, seep wetland, red maple-black ash swamp, shallow emergent marsh, shrub swamp, conifer swamp, "old field" wetland, beaver wetland complex, streams/rivers, open uplands, and rocky outcrops. Each ecological community is described in detail below.

Northern Hardwood Forest

In the Project area east of Route 8, the northern hardwood forest canopy is characterized by beech (*Fagus grandifolia*), with lesser amounts of yellow birch (*Betula alleghaniensis*), red maple (*Acer rubrum*), and balsam fir (*Abies balsamea*). Total canopy cover is approximately 80%, but trees tend to be stunted compared to similar forests at lower elevations. Average diameter at breast height (DBH) of canopy trees is 6 to 9 inches, with occasional trees reaching 13 inches DBH. There are two distinct shrub layers: a tall shrub layer with approximately 15% cover, consisting mostly of beech, red maple, and balsam fir saplings; and a dense short shrub layer of hobblebush (*Viburnum alnifolium*) and beech. The herbaceous layer is sparse, and consists of intermediate wood fern (*Dryopteris intermedia*), shining clubmoss (*Lycopodium lucidulum*), and wood sorrel (*Oxalis acetosella*).

In the Project area west of Route 8, the northern hardwood forest canopy is characterized by beech, with lesser amounts of sugar maple (*Acer saccharum*) and yellow birch. Total canopy cover is 85%, with DBH ranging mostly from about 9 to 12 inches with some older, larger trees having DBHs greater than 12 inches. A sub-canopy layer of young beech and sugar maple trees is present, with DBHs ranging from 1.4 to 3 inches. There is also a fairly dense short shrub layer of hobblebush and beech. Herbaceous species include intermediate wood fern, mountain wood fern (*Dryopteris campyloptera*), whorled wood aster (*Aster divaricatus*), shining clubmoss, bladder sedge (*Carex intumescens*), and beechdrops (*Epifagus virginiana*).

Montane Yellow Birch-Red Spruce Forest

The second most abundant community type found in the Project area occurs along the mountain ridge east of Route 8, south of the existing turbines at the Searsburg Wind Facility. Best classified as montane yellow birch-red spruce forest, this forest forms a mosaic with the northern hardwood forests, generally occupying steeper knolls and ridges where soils are shallow. The canopy is dominated by balsam fir, with lesser amounts of yellow birch, red maple, and red spruce (*Picea rubens*). Canopy trees average 8 to 12 inches DBH, with occasional trees reaching 14 inches DBH. Although the canopy averages approximately 40 feet in height, occasional shorter sub-canopy trees are common. A sparse tall shrub layer is present, comprised of saplings of red maple and balsam fir, as is a dense short shrub layer dominated by hobblebush. Herbaceous species include intermediate wood fern, mountain wood fern, hay-scented fern (*Dennstaedtia punctilobula*), and partridgeberry (*Mitchella repens*).

Spruce-Fir-Tamarack Swamp

Three relatively small wetlands (Wetlands A, B, and C) of this type were delineated adjacent to the Eastern Project site, between the proposed locations for turbines E-3 and E-4. All three spruce-fir-tamarack swamps sit in topographic bowls that collect water from the surrounding uplands. Hydrology is largely driven by ground water seepage, although there are also small surface water inputs. All three wetlands drain into small streams. Hummocks and hollows from peat moss form a varied micro-topography, with standing water common in the hollows. The soils consist of deep (greater than 4 feet) organic peats. The species composition of tree and shrub species is similar to that in surrounding uplands, but canopy cover and shrub abundance are lower in the swamps. Woody vegetation is characterized by an open canopy of balsam fir and yellow birch, with a sparse shrub layer consisting of hobblebush and balsam saplings. Hydrophytic plants such as gynandrous sedge (*Carex gynandra*), goldthread (*Coptis trifolia*), and three-seeded sedge (*Carex trisperma*) dominate the herbaceous layer.

Seep Wetland

Numerous open, non-treed seepage wetlands have been delineated in the Project area. Wetlands D and E are located on the eastern slope of the ridge east of Route 8, and form the headwaters of a small brook which drains northeast. Standing water collects seasonally in these small wetlands. Wetland AJ is a small isolated seepage located along the eastern ridgeline, with shallow organic soils over bedrock. Wetland AL, BA, and BD are located on the western ridgeline, with Wetland AL southeast of turbine W-5, and Wetlands BA and BD east of turbine W-7; Wetland BD forms the headwaters of Stream 3. Wetlands F and AH are located near the junction of Route 8 and Putnam Road. During wet periods, small flows out of these wetlands drain into the ditch along Route 8. Wetland H is located east of Route 8, near the intersection with Putnam Road. Wetland R is located west of Route 8, near the access road to the existing Searsburg facility. Wetlands J, U, W, X, Y, and Z are located in the Western Project area along an alternate access route that is no longer under consideration. Wetlands BB-2, WW, XX, and YY are located west of Route 8, near the proposed electrical collection line connecting the east and west Project sites under the Proposed Action and Reduced West alternative. Wetland W is located on a steep slope south of Route 9, and is characterized by a small amount of ground water discharge that forms shallow peat soils. Wetlands XX and YY occur along the banks of Stream ID #22, and may be significant for erosion control and sedimentation. Soils are saturated and consist of a thick layer of organic soils intermixed with lenses of fine sand and gravel. Wetland AA is located east of Route 8, north of the access road to the existing Searsburg Wind Facility. There is an ephemeral or intermittent stream associated with this wetland that originates in a roadside ditch. Wetland AB is located in the Western Project site along the existing transmission line. Wetlands W-1 through W-13 are seep wetlands located along the existing transmission line that parallels Sleepy Hollow Road; Wetland W-12 is located at the proposed site of the substation for the East Side Only alternative. Herbaceous vegetation at Project area seep wetlands is characterized by rough sedge (*Carex scabrata*), sensitive fern (*Onoclea sensibilis*), bladder sedge, New York fern (*Thelypteris noveboracensis*), umbellate aster (*Aster umbellatus*), rough goldenrod (*Solidago rugosa*), delicate-stemmed sedge (*Carex leptalea*), spotted touch-me-not (*Impatiens capensis*), slender manna grass (*Glyceria melicaria*), and purple-stemmed aster (*Aster puniceus*).

Red Maple-Black Ash Swamp

One wetland of this type was delineated in the Project area, west of Route 8 and north of Putnam Road. Wetland G receives surface water from Stream ID #14, and may be fed by groundwater as well. The soils consist of 18 inches of hemic peat over rock. The canopy in this wetland consists of red maple and yellow birch, with a shrub layer comprised of red maple saplings. Herbaceous vegetation is dominated by ferns such as cinnamon fern (*Osmunda cinnamomea*), with scattered hummocks of peat moss also common.

Shallow Emergent Marsh

Four wetlands of this type were delineated in the Project area. Wetland W is located in the Western Project site along an alternate access route that is no longer under consideration. Wetland ZZ is located along the proposed transmission corridor, east of Route 8 and south of the access road to the existing Searsburg Wind Facility. It forms the headwaters to a small drainage that empties into a roadside ditch along Route 8. Soils consist of a thick horizon of peat over dense silt loams. Vegetation is dominated by meadowsweet (*Spiraea alba*), umbellate aster, rough goldenrod, and gynandrous sedge. Wetland BB is located directly adjacent the access road to the existing Searsburg Wind Facility and it appears that some portion of the wetland was filled during construction of that road. This wetland forms the headwaters to a small stream draining to the southeast. Open standing water is common among the tussocks of vegetation and standing dead trees. Vegetation is dominated by cattails (*Typha latifolia*), common rush (*Juncus effusus*), bladder sedge, and wool grass (*Scirpus cyperinus*). Wetland BC is located between Route 8 and the access road to the existing Searsburg facility.

Shrub Swamp

One shrub swamp was delineated in the Project area west of Route 8, near the junction of Route 9 and the existing 69 kV transmission line. Wetland V sits in a narrow basin surrounded by upland forest. Dense growth of speckled alder (*Alnus incana*) dominates the shrub layer, occupying approximately 70% of the wetland. Areas of open water and herbaceous wetland vegetation comprise the remainder of the wetland. Common herbaceous species include rice cut-grass (*Leersia oryzoides*) and tussock sedge (*Carex stricta*).

Conifer Swamp

There was one small conifer swamp delineated during the field inventory, located west of Route 8, near the junction of Route 9 and the existing 69 kV transmission line. Wetland T occurs as a narrow wetland depression within a montane yellow birch-red spruce forest matrix. The transition between the upland and wetland communities at this site is subtle. Canopy trees of red spruce and balsam fir are the same in both upland and wetland communities; the difference occurs in the understory. Hummocks and hollows of sphagnum moss characterize the microtopography in the wetland, with three-seeded sedge, dwarf raspberry (*Rubus pubescens*), and goldthread as dominant herbs. Small areas of standing water are present in the hollows.

"Old Field" Wetland

Two wetlands of this type were identified in the Project area. Wetland S is located on the west side of Route 8, north of the proposed electrical collection line that would link the Eastern and Western Project sites. The disturbed soils, shape of the wetland, location, and surrounding topography suggest that this wetland may have been the site of historic disturbance such as gravel mining. The soils are gleyed course sandy loams. The vegetation consists of dense growth of meadowsweet, and hydrophytic sedges such as gynandrous sedge. Wetland P is located just south of Route 9 along an alternate access route that is no longer under consideration.

Beaver Wetland Complex

Beaver wetlands are generally considered to be a combination of multiple natural communities that occur together on the landscape. The extent of a particular community often changes over time as beaver populations fluctuate. Located along the existing 69kV transmission line west of Route 8 and south of Route 9, wetland Q is a combination of shallow emergent marsh and areas of open water. Some small areas of deep broadleaf marsh are present in the areas of open water. The shallow emergent marsh community is dominated by graminoids such as blue joint grass (*Calamagrostis canadensis*), wool grass, bur-reed (*Sparganium chlorocarpum*), and tussock sedge. While the areas of deep broadleaf marsh are mostly open water and therefore sparsely vegetated, plants observed include yellow water lily (*Nuphar variegatum*), cattail, and bur-reed. Some localized areas dominated by shrubs such as speckled alder occur on the periphery of the beaver wetland complex.

Streams and Rivers

The main branch of the Deerfield River flows through compartment 123, near the northern-eastern edge of the Project area. Named creeks within the Project area include Lamb Brook, Medbury Brook, Rake Branch, Bond Brook, and Yaw Pond Brook. In addition, there are numerous small, unnamed streams within the Project area. Most streams within the Project site are hydrologically connected to wetlands. Intermittent streams flow less than 50% of the time, while ephemeral streams have shallow channels, and only flow for short periods following heavy rainfall or snowmelt. Perennial streams flow year-round. Jewelweed (*Impatiens capensis*) is a common species of Project site stream banks. For a more detailed analysis of streams in the Project area, refer to Section 3.7 of this FEIS.

Open Uplands

Natural openings are a rarity in the eastern deciduous forest, with permanent openings occurring primarily in areas with very thin soils (Thompson & Sorenson, 2000). Although there are no natural openings within the Project site, small areas of open upland habitats occur along roadsides and transmission corridors. Periodic mowing and other maintenance activities prevent woody encroachment. The Eastern Project site also includes three small cleared, shrubby areas (less than approximately 1.0 acre) associated with existing permitted meteorological towers (met towers) used to monitor wind conditions. These small open areas are dominated by various herbaceous species and scattered saplings. One or two older openings that previously held met towers may still exist but are mostly growing back in. The Western Project site also includes two small open areas (less than approximately 1.0 acre) that are maintained in a shrubby state to accommodate met towers. Maintenance of these openings/met tower sites occurs on an as needed basis, usually no more than once per year. There is also one upland opening south of the Western Project site that has been managed for apple production. These openings provide additional early successional habitat. Herbaceous species adapted to disturbance thrive in these areas. Common plants include ragweed (*Ambrosia artemisiifolia*), orchard grass (*Dactylis glomerata*), Queen Anne's lace (*Daucus carota*), orange hawkweed (*Hieracium aurantiacum*), St. John's-wort (*Hypericum perforatum*), timothy (*Phleum pratense*), and curly dock (*Rumex crispus*).

Rocky Outcrops

Arrowwood Environmental (2005) conducted a remote assessment to identify cliff and talus areas within 3 miles of the proposed turbines. One rocky outcrop was identified within the Project area, in Compartment 123, on a steep slope along the existing 69 kV transmission line corridor. Because the rocky outcrop is located approximately 1.4 miles from the nearest proposed turbine site, no rare plant or wetland surveys were conducted there. There is no rock/cliff habitat within the Project site.

3.9.1.1.2 Non-native Invasive Species

A non-native invasive species is an organism that has been purposefully or accidentally introduced outside its original geographic range, and is able to proliferate and aggressively alter its new environment, potentially causing harm to the economy, environment, or human health. Plant NNIS, of concern in this analysis, spread in a number of different ways. Dispersal mechanisms include wind, water, wildlife, vegetative reproduction, and human activity. Populations of NNIS typically establish most readily in places where the ground has been disturbed, exposing the soil. Ground disturbing management activities that are most conducive to spreading plant NNIS include timber harvest; trail and recreation facility development, use, and maintenance; utility corridor development and maintenance, including wind energy and communication sites; surface development for mineral exploration and extraction; road development and maintenance; and prescribed fire (USDA Forest Service, 2006b).

The revised Forest Plan includes S&Gs that require information on the status and threat of NNIS infestation to be incorporated as part of project development, to use standardized methods for determining risk, and to identify measures that can be undertaken to prevent and control the spread of NNIS during project implementation. The Plan also provides guidance regarding treating infestations, requires inclusion of NNIS prevention methods in contracts and permits, provides direction regarding seed mixes and mulch, and outlines an integrated pest management approach that includes methods of prioritizing prevention and control activities (USDA Forest Service, 2006b).

Table 3.9.1-1 provides a list of all plant NNIS tracked on the GMNF. This list contains all of the Class B Noxious Weeds on the Vermont State Quarantine list, along with giant hogweed, which is included on the US Animal and Plant Inspections Service list of federal noxious weeds (VDAFM, 2002; USDA APHIS, 2006) and 10 species from the Invasive Species Watch List from Vermont (available online at: http://www.vtinvasiveplants.org/pdfs/VIEPC_Invasive_Watch_List.pdf). This list of tracked species may change over time. Further surveys and preventive measures could be made as needed during implementation of any action alternative.

Table 3.9.1-1: Non-Native Invasive Plant Species Tracked by the GMNF

Common Name	Scientific Name	Habitat Type
Norway maple	*Acer platanoides*	Terrestrial
goutweed	*Aegopodium podagraria*	Terrestrial

Common Name	Scientific Name	Habitat Type
tree-of-heaven	*Ailanthus altissima*	Terrestrial
garlic mustard	*Alliaria petiolata*	Terrestrial
wild chervil	*Anthriscus sylvestris*	Terrestrial
Japanese barberry	*Berberis thunbergii*	Terrestrial
common barberry	*Berberis vulgaris*	Terrestrial
flowering rush	*Butomus umbellatus*	Aquatic
Oriental bittersweet	*Celastrus orbiculatus*	Terrestrial
spotted knapweed	*Centaurea biebersteinii* (= *C. maculosa*)	Terrestrial
Autumn olive	*Elaeagnus umbellata*	Terrestrial
Winged burning bush	*Euonymus alatus*	Terrestrial
giant hogweed	*Heracleum mantegazzianum*	Terrestrial
frogbit	*Hydrocharis morsus-ranae*	Aquatic
Yellow iris	*Iris pseudacorus*	Riparian
Shrubby honeysuckles (Amur, Morrow, Tatarian, & Bell's honeysuckles)	*L. maackii* *L. morrowii* *L. tatarica* *L. x bella*	Terrestrial
Japanese honeysuckle	*Lonicera japonica*	Terrestrial
purple loosestrife	*Lythrum salicaria*	Riparian
Eurasian watermilfoil	*Myriophyllum spicatum*	Aquatic
yellow floating heart	*Nymphoides peltata*	Aquatic
Wild parsnip	*Pastinaca sativa*	Terrestrial
common reed	*Phragmites australis*	Terrestrial/Riparian
Japanese knotweed	*Polygonum cuspidatum* = *Fallopia japonica*	Terrestrial/Riparian
curly leaf pondweed	*Potamogeton crispus*	Aquatic
common buckthorn	*Rhamnus cathartica*	Terrestrial
glossy buckthorn	*Rhamnus frangula* = *Frangula alnus*	Terrestrial
multiflora rose	*Rosa multiflora*	Terrestrial
water chestnut	*Trapa natans*	Aquatic
black swallow-wort	*Vincetoxicum nigrum* = *Cynanchum louiseae*	Terrestrial

In the fall of 2005, Arrowwood Environmental conducted an inventory of NNIS in the vicinity of the Project site. The purpose of the survey was to document the presence and extent of plant NNIS along the access road and cleared areas associated with the existing Searsburg Wind Facility. The Searsburg access road is entirely private, and not a Forest Service road. However, this area was identified for NNIS surveys for several reasons. Construction vehicles associated with the proposed Deerfield Project would use the existing access road, thereby risking spread of any NNIS populations that may occur along it. Furthermore, since road and utility corridor development and maintenance are management activities that create habitat conditions favorable to many NNIS (USDA Forest Service, 2006b), these areas are more likely to harbor NNIS than other less disturbed parts of the Project site.

As shown on Figure 1-3, the Searsburg access road starts on Sleepy Hollow Road, just east of Route 8, and heads up into the site; near the top, the road forks into north branch and a south branch. There are seven existing turbines along the north branch, and four along the south branch. Should any of the three action alternatives be implemented, the south branch of the existing Searsburg access road would be extended, and seven new turbines constructed along its extension. The main stem and south branch of the existing road would be used to transport turbine components to the proposed construction sites. Construction vehicles would use the north branch only as necessary.

Two small colonies of common reed were documented along the existing access road. Both colonies occur near the northern end of the north branch, with one colony to the south of each of the two northern-most existing Searsburg facility turbines. In addition, five small colonies of reed canary grass (*Phalaris arundinacea*) were recorded, three along the north branch, and two along the south branch. Although the GMNF does not currently track this grass on the NNIS List, reed canary grass is included on the Invasive Species Watch List for Vermont. The Invasive Species Watch List for Vermont is primarily comprised of species known to be invasive elsewhere, but with uncertain status in Vermont (Kart et al., 2005). The Invasive Plant Atlas of New England also includes reed canary grass on the official IPANE list (Mehrhoff et al., 2003). At the time of the survey, the amount of available roadside/open habitat occupied by common reed and reed canary grass was relatively small (Arrowwood Environmental, 2006a).

3.9.1.2 Wildlife and Wildlife Habitat

Approximately 83 species of wildlife have been documented in the Project area.

3.9.1.2.1 Management Indicator Species

MIS are vertebrate or invertebrate species utilized in monitoring habitat conditions on the Forest. Individual MIS are chosen because their population changes are believed to indicate the effects of management activities (USDA Forest Service, 2006a). The MIS selection process in the 2006 Forest Plan focused on habitats subject to active structural manipulation, such as the creation of temporary openings, regeneration of oak or aspen stands, or enhancement of riparian habitat. Habitat changes that occur by natural processes would be assessed separately through the Monitoring and Evaluation Program. Similarly, no MIS species were selected for habitats already receiving high levels of protection, such as wetlands. Table 3.9.1-2 lists the MIS identified in the Forest Plan for the GMNF.

Table 3.9.1-2: MIS on the GMNF

Common Name	Scientific Name	Representative Habitat/Resource Issue
Ruffed grouse	*Bonasa umbellus*	Aspen-birch
White-tailed deer	*Odocoileus virginianus*	Deer wintering habitat
Brook trout	*Salvelinus fontinalis*	Aquatic-riparian habitat
Gray squirrel	*Sciurus carolinensis*	Oak-pine
American woodcock	*Scolopax minor*	Early successional habitat

Ruffed Grouse/Aspen-Birch

While ruffed grouse are found in a wide range of forested habitats, optimal conditions occur in young dense forests, especially in aspen and birch stands. Aspen-birch habitat is a naturally short-lived community that is sensitive to vegetative management. These early successional forests often regenerate following clearcuts. Although this habitat type is common throughout Vermont and the northeast, aspen-birch forest does not occur in the Project site (Arrowwood Environmental, 2006a). However, aspen is scattered throughout some of the northern hardwood stands within the Project area, especially in the western part of the area. Ruffed grouse were documented along the ridgeline of the Western Project site during the on-site breeding bird survey (Kerlinger & Dowdell, 2003), and occasionally have been heard drumming or have been flushed during field surveys in recent years.

White-tailed Deer/Deer Wintering Habitat

White-tailed deer utilize a wide variety of habitats, including forests, forest edges, open fields, swamps, and woodland openings. In the winter, deer congregate (or "yard") in forests with dense conifer cover. The severity of winter temperature and snow depth can determine survivability into spring, so dense stands of mature conifers are crucial to the over-wintering success of deer in northern climes. This habitat type is common in Vermont and throughout the greater northeast. However, in the Green Mountains of Vermont, white-tailed deer have been reported to prefer protected valleys with southern or southeastern exposures that protect them from winter winds (Godin, 1977). Since the Project site is located along the tops of ridgelines at relatively high elevations (generally greater than 2,700 feet in elevation), it contains little potential deer wintering habitat.

There are no State mapped deer yards in the Project area. A field inventory focused on locating possible deer wintering habitat was undertaken in 2004. This survey included a 300-foot radius of turbine locations and access roads. A small stand (approximately 2 acres) of dense mature conifers was identified along the Putnam Road access route, but field assessment showed that this area received little winter use by white-tailed deer, likely due to the small size and high elevation. A larger mixed conifer and hardwood forest (approximately 51 acres) located to the south and southwest of the proposed site for turbine W-10 was also evaluated, but it also showed little signs of winter use by deer (Arrowwood Environmental, 2006a).

Brook Trout/Aquatic-Riparian Habitat

Brook trout is a native fish species that occurs in cold, clear, well-oxygenated streams with gravelly or rocky substrates. The species does poorly when water temperatures exceed 68° F (NatureServe, 2007). Brook trout are particularly good indicator species because susceptibility to water pollution, siltation, and temperature fluctuations restricts them to healthy stream ecosystems. Many of the perennial streams in the Project vicinity support wild brook trout populations, including Lamb, Medbury, Bond, Rake, and Yaw Pond Brooks. Arrowwood Environmental (2006a,b, 2007, 2008a, 2011) delineated six perennial streams within the Project area, Stream ID#s 7, 13-14, and 20-22. All of these perennial streams are headwater tributaries likely to provide habitat for brook trout and other cold water species. Furthermore, Forest Service surveys indicate above average brook trout populations (1000 to 2000 per mile) in Lamb, Medbury, and Yaw Pond Brooks, and in the unnamed perennial stream that runs parallel to Route 8 within the Project area. For a more detailed analysis of streams in the Project area, refer to Section 3.7 of this FEIS.

Gray Squirrel/Oak-Pine

The gray squirrel is used here as an indicator of mature oak/oak-pine forests. Oak forests are less common in Vermont than other hardwood types, and are restricted to the valleys of Lake Champlain and the Connecticut River. This habitat type does not occur in the Project area (Arrowwood Environmental, 2006a).

American Woodcock/Early Successional Habitat

American woodcock is generally considered an edge species. It is closely associated with young, second growth hardwoods and other early successional habitats. Ideal habitat consists of young forests and open abandoned farmland mixed with mature forestland (NatureServe, 2007). Although woodcock are found throughout Vermont and the greater northeast, none were documented during the on-site breeding bird survey (Kerlinger & Dowdell, 2003). Habitat within the Project area is quite limited. The only potential habitat is associated with three small clearings in the western side of the Project area: the areas cleared for construction of the meteorological towers, and a small opening managed for apple trees. The most likely habitat for American woodcock close to the Project site is a shrubby clearcut area on the western ridgeline, near the proposed sites for turbines 4-W and 5-W (Arrowwood Environmental, 2006a).

3.9.1.2.2 Reptiles and Amphibians

Wetland and upland habitats within the Project area were identified and characterized during field surveys conducted by Arrowwood Environmental during the summer of 2003 through the fall of 2005, with additional surveys conducted in 2006 and 2008. Based on these habitat conditions, along with documented species ranges, regional occurrence data, and habitat requirements, Arrowwood (2010) prepared a *Remote Assessment of Reptile and Amphibian Habitat at the Deerfield Wind Project*. In this study, available in the Project Record, likelihood of occurrence was assessed for each herptile species known from the State of Vermont, within both the Project area and the Project site. It is estimated that up to 23 reptilian and amphibian species could occur in the four compartment Project area, including American toad (*Bufo americanus*), wood frog (*Rana sylvatica*), pickerel frog (*Rana palustris*), spring peeper (*Pseudacris crucifer*), eastern red-backed salamander (*Plethodon cinereus*), eastern newt (*Notophthalmus viridescens*), spotted salamander (*Ambystoma maculatum*), painted turtle (*Chysemys picta*), snapping turtle (*Chelydra serpentina*), milk snake (*Lampropeltis triangulatum*), smooth green snake (*Opheodrys vernalis*), and common garter snake (*Thamnophis sirtalis*).

Section 3.9.1.1.1 of this FEIS describes the numerous ecological communities that occur within the 9,523-acre Project area. However, habitat diversity within the Project site, both for the Eastern and Western project sites, is much more limited. Many of the wetland communities that provide habitat to reptiles and amphibians within the Project area do not occur within the Project site, including spruce-fir tamarack swamp, red maple-black ash swamp, shrub swamp, conifer swamp, and beaver wetland complex. Therefore, species such as snapping turtle and painted turtle, which require deep water such as that found in Project area beaver wetland complexes, do not occur within the Project site. It is estimated that 10 reptilian and amphibian species could occur in the Project site, specifically common garter snake, red-bellied snake (*Storeria occipitomaculata*), ring-necked snake (*Diadophis puctatus*), smooth green snake, northern dusky salamander (*Desmognathus fuscus*), northern two-lined salamander (*Eurycea bislineata*), spring salamander (*Gyrinophilus porphyriticus*), eastern newt, eastern red-backed salamander, and American toad. Potential habitat for spring salamander within the Project site is limited to Stream #10. Northern two-lined and northern dusky salamanders likely occur in all streams in the Project site (Stream #s 1, 2, 3, 4, 9, 10, and 22). Common garter snake, red-bellied snake, ring-necked snake, smooth green snake, eastern newt, eastern red-backed salamander, and American toad utilize upland habitats within the Project site.

All of these species likely to occur within the Project site are relatively common and widely distributed throughout Vermont (Arrowwood Environmental, 2010; Andrews 2005). Wood turtle, Jefferson salamander, blue-spotted salamander, and four-toed salamander are State-listed species of concern, but as discussed in Section 3.9.1.3.2, are not likely to occur in the Project site (Arrowwood Environmental, 2010).

3.9.1.2.3 Fish

Ponds and streams in the Project vicinity likely support both warm water and cold water fish populations, both native and stocked. The Forest Service has conducted fish surveys in some of the perennial streams in the Project area. Although high elevation streams and their small tributaries on the GMNF generally support native brook trout populations, species diversity is often low. Medbury and Lamb Brooks support unusually high populations of trout (1000 to 2000 per mile), but are considered pure brook trout fisheries, with no other game or non-game species observed during monitoring. Yaw Pond Brook also supports very high populations of brook trout (1000 to 2000 per mile), along with creek chub (*Semotilus atromaculatus*). Beaver ponds and impoundments along Rake Brook release warmed surface waters downstream during the summer, resulting in warmer stream water and lower brook trout abundance (approximately 600 per mile). However, Forest Service surveys indicate that Rake Brook supports populations of blacknose dace (*Rhinichthys atratulus*) and longnose dace (*R. cataractae*). Macroinvertebrates, such as aquatic insects and crayfish, are common in many streams (USDA Forest Service, 2006b). For a more detailed analysis of streams and other aquatic habitats in the Project area, refer to Section 3.7 of this FEIS.

3.9.1.2.4 Mammals

Although specific data regarding mammal occurrences within the Project area is limited, the occurrence of mammalian species has been documented through evaluation of available habitat and the use of a remote sensing camera. This effort suggests that approximately 35 species of mammals could occur within the Project area. During October 2005 and from April through November 2006, a Reconyx Silent Image infrared digital camera was set up along an old logging road at the existing Searsburg Wind Facility. The camera was located in an opening adjacent to a small open water wetland, approximately 130 feet southeast the existing access road, and approximately 260 feet south of an operating turbine. Both the access road and the wind turbine were visible from the camera location. Mammal species recorded by the remote sensing camera include black bear *(Ursus americanus)*, red fox *(Vulpes vulpes)*, coyote *(Canis latrans)*, raccoon *(Procyon lotor)*, fisher *(Martes pennanti)*, moose *(Alces americanus)*, and white-tailed deer (Wallin, 2005b; Wallin, 2006b).

Arrowwood Environmental (2006a) evaluated moose habitat within the Project area, specifically focusing on wintering habitat. Although moose occur in a wide variety of forest types, balsam fir, aspen, and birch appear to be preferred in Vermont. During the summer they are often found near water foraging on the roots and tubers of aquatic plants. Fall and winter forages consist of young balsam fir, along with shrubs and hardwood saplings. Moose often browse in regenerating clearcuts, logged areas, and sites of natural disturbance; such areas usually harbor dense shrubs and sapling re-growth. Hemlock and other conifer cover types are important as winter habitat. Two forested areas dominated by coniferous species were assessed for signs of winter use (i.e., scat and browse). A red-spruce-hemlock stand west of Route 8, in the area through which the overhead collection line would pass in both the Proposed Action and Reduced West alternative, contained no moose scat, and is considered of limited value for wintering moose. In contrast, a stand of mature spruce-fir located on the eastern ridgeline (southeast of the proposed turbine sites in each action alternative) did show signs of winter use by moose.

Based on available habitat, other mammal species likely to occur within the Project area include snowshoe hare *(Lepus americanus)*, beaver *(Castor canadensis)*, gray squirrel, red squirrel *(Tamiasciurus hudsonicus)*, eastern chipmunk *(Tamias striatus)*, porcupine *(Erethizon dorsatum)*, opossum *(Didelphis virginiana)*, long-tailed weasel *(Mustela frenata)*, striped skunk *(Mephitis mephitis)*, bobcat *(Lynx rufus)*, southern red-backed vole *(Clethrionomys gapperi)*, meadow vole *(Microtus pennsylvanicus)*, star-nosed mole *(Condylura cristata)*, hairy-tailed mole *(Palascalops breweri)*, deer mouse *(Peromyscus maniculatus)*, woodland jumping mouse *(Napaeozapus insignis)*, masked shrew *(Sorex cinereus)*, and short-tailed shrew *(Blarina brevicauda)*. All of these species are common and widely distributed throughout Vermont (Godin, 1977).

For more detailed information on mammals of conservation concern, see Section 3.9.1.3.1 for descriptions of the gray wolf, eastern mountain lion, Canada lynx, and Indiana bat; and Section 3.9.1.3.2 for descriptions of the eastern small-footed bat. Also refer to Section 3.11 for analysis of bats in the Project area, and Section 3.12 for analysis of bears in the Project area.

3.9.1.2.5 Avian

Section 3.10 presents a detailed discussion of avian species in the Project area, and an analysis of the potential effects of the proposed Project. For more detailed information on birds of conservation concern, see Section 3.9.1.3.2 for descriptions of Bicknell's thrush, rusty blackbird, peregrine falcon, common loon, and bald eagle.

3.9.1.3 Threatened, Endangered, and Sensitive Species

This section describes on-site habitat conditions for federally threatened and endangered species, animal RFSS, and plant RFSS.

3.9.1.3.1 All Federally Threatened and Endangered Species

The Endangered Species Act (ESA) of 1973 requires federal agencies to implement a program to conserve fish, wildlife, and plants to ensure that their actions do not jeopardize the continued existence of any threatened or endangered species, or result in the destruction or adverse modification of critical habitat. Determination of eligible threatened and endangered species is the jurisdiction of the Secretary of the Interior. Species can be added to or removed from the list as their circumstances change. For example, the USFWS de-listed the bald eagle in August 2007 in response to observed population recovery. Table 3.9.1-3 shows all federally-listed threatened, endangered, and proposed species for the GMNF (USDA Forest Service, 2000).

Table 3.9.1-3: Federally-Listed Threatened and Endangered Species Tracked by the GMNF

Common Name	Scientific Name	Federal Status
Gray wolf	*Canis lupus*	Endangered
Eastern mountain lion	*Felis concolor couguar*	Endangered
Canada lynx	*Lynx canadensis*	Threatened
Indiana bat	*Myotis sodalis*	Endangered

The Center for Biological Diversity recently petitioned the Secretary of the Department of the Interior to list the eastern small-footed bat (*Myotis leibii*), northern long-eared bat (*Myotis septentrionalis*), and Bicknell's thrush (*Catharus bicknelli*) as threatened or endangered under the ESA (CBD, 2010a, 2010b). The Secretary of Interior has not listed any of these species, and they are addressed in Section 3.9.1.3.2 of this FEIS as RFSS.

A Biological Evaluation (BE) for the Deerfield Wind Project has been prepared in accordance with policy provided in FSM 2672.42 and Section 7 of the ESA. These policies are designed to avoid impacts that may cause loss of species viability or a trend toward listing of a species under the Endangered Species Act. The purpose of the BE is to determine the potential effects of the proposed Project, and its alternatives, on federally-listed threatened, endangered, and proposed (T&E) species, and RFSS, that may occur within the GMNF. The determinations made in the BE are summarized within this FEIS; the complete BE may be found in the Project Record.

As reported in the BE, the Project area includes some elements of suitable habitat for both gray wolf and eastern mountain lion, but there is no connectivity to existing populations or the core range. Potentially suitable habitat for Canada lynx is sparse, fragmented, and generally of low quality; there is also no connectivity to existing populations or core range. The Project area does not contain suitable habitat for Indiana bats: elevation is too high; it is too far removed from known maternity roost sites and hibernacula; it is too densely forested (greater than 80% forest cover); and Indiana bats are unlikely to be found on the east side of the Green Mountain spine.

There are no known occurrences of these T&E species in the Project area. Furthermore, no sign or evidence of these species was observed during field inventories conducted in 2003 to 2008 at the Project site by Arrowwood Environmental. Based on those facts, and on the lack of suitable habitat within the Project area, the BE concluded that it is unlikely that any federally-listed T&E species occur within the Project area.

Regarding T&E plants, as stated in the BE, no federally-listed threatened, endangered, or proposed plant species are known to occur on the GMNF.

3.9.1.3.2 Animal Regional Forester Sensitive Species

RFSS are those species for which population viability is of concern, based on significant current or predicted decline in either population numbers or density or in habitat capability (FSM 2670.5). The Forest Service gives special management consideration to these species to ensure their continued viability on the national forests and to ensure that Forest Service actions do not cause a trend towards federal listing. Species included on the RFSS list must occur on Forest Service land, or within the proclamation boundary of the Forest, and meet at least one of the following criteria: 1) are a candidate for federal listing under ESA; 2) have been de-listed under ESA within the last five years; 3) have a Global (G), National (N) or Trinomial (T) rank of 1, 2, or 3 from the Association of Biodiversity Information; or 4) are otherwise considered "at risk" on the Forest, with rationale documented in a Risk Evaluation (USDA Forest Service, 2006c). The GMNF is in the process of updating the RFSS list, but the proposed changes will not be approved before the release of the FEIS. To address the pending update, the BE included evaluation of all species currently listed as RFSS, along with those proposed to be added to the RFSS list. Table 3.9.1-4 shows the current animal RFSS for the GMNF (USDA Forest Service, 2006d). Also included are four species under consideration for addition as RFSS for Region 9.

Table 3.9.1-4: Regional Forester Sensitive Animal Species Tracked by the GMNF

Mammals	Scientific Name	State Conservation Rank[1] / Status[2]
Eastern small-footed bat	*Myotis leibii*	S1/Threatened
Little brown bat[3]	*Myotis lucifugus*	S1/Endangered
Northern long-eared bat[3]	*Myotis septentrionalis*	S1/Endangered

Tri-colored bat[3]	*Perimyotis subflavus*	S1/Proposed Endangered
Birds	**Scientific Name**	**State Conservation Rank[1] / Status[2]**
Bicknell's thrush	*Catharus bicknelli*	S2/Special Concern
Sedge wren[3]	*Cistothorus platensis*	S2/Endangered
Rusty blackbird	*Euphagus carolinus*	S3/Special Concern
Peregrine falcon	*Falco peregrinus anatum*	S3
Common loon	*Gavia immer*	S3
Bald eagle	*Haliaeetus leucocephalus*	S1/Endangered
Reptiles	**Scientific Name**	**State Conservation Rank[1] / Status[2]**
Wood turtle	*Clemmys insculpta*	S3/Special Concern
Amphibians	**Scientific Name**	**State Conservation Rank[1] / Status[2]**
Jefferson salamander	*Ambystoma jeffersonianum*	S2/Special Concern
Blue-spotted salamander	*Ambystoma laterale*	S3/Special Concern
Four-toed salamander	*Hemidactylium scutatum*	S2/Special Concern
Mollusks	**Scientific Name**	**State Conservation Rank[1] / Status[2]**
Brook floater	*Alasmidonta varicosa*	S1/Threatened
Creek heelsplitter	*Lasmigona compressa*	S2
Insects	**Scientific Name**	**State Conservation Rank[1] / Status[2]**
Boulder-beach tiger beetle	*Cicindela ancocisconensis*	S1
Harpoon clubtail	*Gomphus descriptus*	S3
Southern pygmy clubtail	*Lanthus vernalis*	S3
West Virginia white	*Pieris virginiensis*	S3S4/Special Concern
Forcipate emerald	*Somatochlora forcipata*	S2S3
Gray petaltail	*Tachopteryx thoreyi*	SU

[1] Conservation ranks provide an informational assessment of extinction risk based on factors such as abundance, distribution, population trends, and threats. State ranks are assigned by the Vermont Nongame and Natural Heritage Program (VNNHP) to reflect the rarity of the species within the State of Vermont. For avian species, the ranks apply to breeding status only. S1 = critically imperiled; S2 = imperiled; S3 = vulnerable to extirpation or extinction; S4 = apparently secure; S5 = demonstrably widespread, abundant, and secure; SU = status uncertain (VNNHP, 2011b; NatureServe, 2010).
[2] Vermont State Status has two categories afforded legal protection under the Vermont Endangered Species Law (10 V.S.A. Chapter 123), endangered and threatened. The additional informational category of special concern is not established by law, but used to track rare species (VNNHP, 2011a, 2011b).
[3] Little brown bat, northern long-eared bat, tri-colored bat, and sedge wren are under consideration for listing as RFSS.

As reported in the BE, potential habitat may be found within the Project area for nine animal species listed or proposed to be listed as RFSS: northern long-eared bat, little brown bat, tri-colored bat, rusty blackbird, creek heelsplitter, harpoon clubtail, southern pygmy clubtail, West

Virginiana white, and gray petaltail. Potential habitat for little brown bat occurs on north facing slopes, in the vicinity of wetlands, and along existing clearings and roads. Potential roosting and foraging habitat for northern long-eared bats occurs in forested areas throughout the Project area. Potential habitat for tri-colored bat occurs in the vicinity of wetlands and along existing clearings and roads. Potential habitat for rusty blackbird occurs in delineated Wetland Q. Potential habitat for creek heelsplitter occurs in six perennial streams delineated within the Project area. Potential habitat for harpoon clubtail and southern pygmy clubtail occur in delineated stream ID#s 7 and 14. Potential habitat for gray petaltail occurs in numerous seep wetlands throughout the Project area. Potential habitat for West Virginia white occurs in 19 stands with a site index of 60 or greater.

Due to a lack of suitable habitat, it is highly unlikely that the remaining RFSS occur in the Project area. Although Bicknell's thrush was observed in the Project area between 1994 and 1997, no occurrences were detected during surveys conducted in June 2003 (Kerlinger & Dowdell, 2003), June 2005 (Torres, 2005), June 2008 (Sease, 2008a), or June 2011 (Sease, 2011). See Section 3.10.1.2.5 for more information on these surveys. In addition, habitat exists in the Eastern Project site for Bicknell's thrush, but it is considered extremely marginal (Kerlinger, 2002; Torres, 2005; McFarland, 2011). Similarly, the Project area contains very limited summer roosting habitat for eastern small-footed bat. Accordingly, the BE determined that Bicknell's thrush and eastern small-footed bat are unlikely to occur in the Project area. Therefore, these species are is not subject to further analysis in this FEIS.

3.9.1.3.3 Plant Regional Forester Sensitive Species

As indicated above, the GMNF is in the process of updating the RFSS list, but the proposed changes will not be approved before the release of the FEIS. To address the pending update, the BE included evaluation of all species currently listed as RFSS, along with those proposed to be added to the RFSS list. Table 3.9.1-5 includes the current plant RFSS for the GMNF (USDA Forest Service, 2006d). Also included are 37 plant species proposed to be added as RFSS. Arrowwood Environmental conducted rare plant surveys in the Project area as part of their fieldwork. No plants on the RFSS list were discovered during the inventory (Arrowwood Environmental, 2006a). If any plant RFSS occur in the Project site, possible direct effects include equipment driving over them, and structures or roads being constructed over them. Possible indirect effects involve changes in habitat suitability due to Project activities. Because of the localized nature of these potential effects, the affected environment for the effects analysis is the Project site, along with those areas directly adjacent to the Project site.

Table 3.9.1-5: Regional Forester Sensitive Plant Species Tracked by the GMNF

Common Name	Scientific Name	State Conservation Rank[1] / Status[2]	Habitat
Vascular Plants			
Arctic bentgrass	*Agrostis mertensii*	S1	Alpine/subalpine Rock/cliff
Drummond's rock-cress[3]	*Arabis drummondii*	S1/Endangered	Rock/cliff Barrens/open uplands

Common Name	Scientific Name	State Conservation Rank[1] / Status[2]	Habitat
Eastern dwarf-mistletoe[3]	*Arceuthobium pusillum*	S2	Open wetlands
Poke milkweed	*Asclepias exaltata*	S3	Rich woods Barrens/open uplands
Fernleaf yellow false-foxglove	*Aureolaria pedicularia*	S1	Dry/warm forests
Hairy woodmint	*Blephilia hirsuta*	S1/Threatened	Open wetlands Forested wetlands Rich woods
Blunt-lobed grapefern[3]	*Botrychium oneidense*	S1	Forested wetlands Rich woods
New England northern reed grass	*Calamagrostis stricta ssp. inexpansa*	S1/Endangered	Rock/cliff
Small-flowered bittercress	*Cardamine parviflora*	S2S3	Rock/cliff Dry/warm forests
Summer sedge	*Carex aestivalis*	S1	Rich woods Dry/warm forests
Water sedge	*Carex aquatilis var. substricta*	S2S3	Shores Open wetlands
Hay sedge	*Carex argyrantha*	S2	Rock/cliff
Rocky Mountain sedge	*Carex backii*	S3	Rock/cliff Barrens/open uplands Dry/warm forests Rich woods
Bigelow sedge	*Carex bigelowii*	S1	Alpine/subalpine
Bronze sedge	*Carex foena*	S1S2/Endangered	Rock/cliff Barrens/open uplands
Cloud sedge	*Carex haydenii*	S1	Open wetlands Shores Forested wetlands
Shore sedge	*Carex lenticularis*	S2S3	Shores Open wetlands
Michaux sedge	*Carex michauxiana*	S3	Shores Open wetlands Forested wetlands
Few-seeded sedge[3]	*Carex oligosperma*	S2S3	Shores Open wetlands
Schweinitz's sedge	*Carex schweinitzii*	S2	Open wetlands Forested wetlands
Bulrush sedge	*Carex scirpoidea*	S2	Rock/cliff
Prickly hornwort	*Ceratophyllum echinatum*	S1	Aquatic
Purple clematis	*Clematis occidentalis var. occidentalis*	S3	Rock/cliff Dry/warm forests
Canada horse-balm	*Collinsonia canadensis*	S1	Rich woods
Squaw-root	*Conopholis americana*	S2S3	Dry/warm forests

Common Name	Scientific Name	State Conservation Rank[1] / Status[2]	Habitat
Steller's cliffbrake	*Cryptogramma stelleri*	S3	Rock/cliff
Northern wild comfrey	*Cynoglossum virginianum var. boreale*	S1/Threatened	Rich woods Dry/warm forests Conifer forests
Large yellow lady's-slipper	*Cypripedium parviflorum var. pubescens*	S3	Forested wetlands Rich woods
Showy lady's-slipper	*Cypripedium reginae*	S3	Open wetlands Forested wetlands
Narrow leaf tick-trefoil	*Desmodium paniculatum*	S3	Dry/warm forests
Perplexed tick-trefoil[3]	*Desmodium perplexum*	S2	Rich woods Barrens/open uplands
Glade fern	*Diplazium pycnocarpon*	S3	Rich woods
Rock Whitlow-grass	*Draba arabisans*	S2S3	Rock/cliff Dry/warm forests
Male fern	*Dryopteris filix-mas*	S2/Threatened	Rich woods
Matted spikerush	*Eleocharis intermedia*	S2S3	Shores Open wetlands
Capitate spikerush[3]	*Eleocharis olivacea*	S1	Shores Open wetlands
Ovate spikerush	*Eleocharis ovata*	S1	Shores Open wetlands
Meadow horsetail	*Equisetum pratense*	S3	Shores Forested wetlands
Sweet joe-pye weed	*Eupatorium purpureum*	S2	Rich woods Dry/warm forest
Boreal bedstraw	*Galium kamtschaticum*	S2S3	Forested wetlands
Rough avens[4]	*Geum laciniatum*	S2	Shores Open wetlands
Floating mannagrass[3]	*Glyceria septentrionalis*	S2	Open wetlands
Northern stickseed	*Hackelia deflexa var. americana*	S2S3/Threatened	Rock/cliff Dry/warm forests Rich woods
Harsh sunflower	*Helianthus strumosus*	S2S3/Threatened	Rock/cliff Barrens/open uplands Dry/warm forests
Rattlesnakeweed[3]	*Hieracium venosum*	S2	Dry/warm forests
Appalachian fir-clubmoss	*Huperzia appalachiana*	S2	Alpine/subalpine Rock/cliff
Large whorled pogonia	*Isotria verticillata*	S2/Threatened	Dry/warm forests
Butternut	*Juglans cinerea*	SU	Rich woods Forested wetlands
Highland rush	*Juncus trifidus*	S1	Alpine/subalpine Rock/cliff
Hairy bush-clover	*Lespedeza hirta*	S1/Threatened	Barrens/open uplands Dry/warm woods

Common Name	Scientific Name	State Conservation Rank[1]/Status[2]	Habitat
Violet bush-clover[3]	*Lespedeza violacea*	S2	Barrens/open uplands Dry/warm woods
American shore-grass	*Littorella uniflora*	S2	Aquatic Shores Open wetlands
Great blue lobelia[3]	*Lobelia siphilitica*	S1	Shores Forested wetlands
Musk flower[3]	*Mimulus moschatus*	S2S3	Shores Open wetlands
One-flowered muhly	*Muhlenbergia uniflora*	S2	Shores Open wetlands
Farwell's water-milfoil	*Myriophyllum farwellii*	S2	Aquatic
Three-leaved rattlesnake-root	*Nabalus trifoliatus*	S1	Dry/warm forests
Tupelo[3]	*Nyssa sylvatica*	S3	Shores Forested wetlands Rock/cliff
American ginseng	*Panax quinquefolius*	S2S3	Rich woods
Green arrow-arum	*Peltandra virginica*	S1	Shores Open wetlands
Broad beech fern	*Phegopteris hexagonoptera*	S2	Rich woods Dry/warm forests
Obedience plant[3]	*Physostegia virginiana*	S2/Threatened	Shores
Pitch pine	*Pinus rigida*	SU	Rock/cliff Barrens/open uplands Dry/warm forests
Large roundleaf orchid	*Platanthera orbiculata*	SU	Forested wetlands Rich woods Dry/warm forests Conifer forests
Jacob's ladder	*Polemonium vanbruntiae*	S2/Threatened	Shores Open wetlands Forested wetlands
Snail-seed pondweed	*Potamogeton bicupulatus*	S2	Aquatic Shores
Algae-like pondweed	*Potamogeton confervoides*	S2	Aquatic
Hill's pondweed	*Potamogeton hillii*	S3	Aquatic
Greenish-flowered wintergreen	*Pyrola chlorantha*	SU	Forested wetlands Dry/warm forests Conifer forests
Lesser wintergreen	*Pyrola minor*	S1/Endangered	Forested wetlands Rich woods Conifer forests
Chinquapin oak	*Quercus muehlenbergii*	S3	Dry/warm forests

Common Name	Scientific Name	State Conservation Rank[1] / Status[2]	Habitat
Pennsylvania buttercup[3]	*Ranunculus pensylvanicus*	S2S3	Shores Open wetlands
Roseroot stonecrop	*Rhodiola rosea*	S1/Threatened	Rock/cliff
Canadian black-snakeroot[3]	*Sanicula candensis var. grandis*	S2S3/Threatened	
Livelong saxifrage	*Saxifraga paniculata*	S1	Rock/cliff
American scheuchzeria	*Scheuchzeria palustris ssp. americana*	S1/Threatened	Shores Open wetlands
Meadow spike-moss[3]	*Selaginella apoda*	S3	Shores Open wetlands
Ledge spike-moss	*Selaginella rupestris*	S3	Rock/cliff
Pointed blue-eyed grass	*Sisyrinchium angustifolium*	S2	Barrens/open uplands Open wetlands
Eastern blue-eyed grass	*Sisyrinchium atlanticum*	SH	Barrens/open uplands Open wetlands
Roundleaf goldenrod	*Solidago patula*	S3	Open wetlands Forested wetlands
Rand's goldenrod[3]	*Solidago simplex spp. Randii var. monticola*	S2S3	Rock/cliff
Squarrose goldenrod	*Solidago squarrosa*	S2S3	Rock/cliff Barrens/open uplands Dry/warm forests
Bog chickweed	*Stellaria alsine*	S1	Shores Open wetlands Forested wetlands
Crooked-stem aster[3]	*Symphyotrichum prenanthoides*	SU	Shores Forested wetlands
Nodding trillium[3]	*Trillium cernuum*	S3	Forested wetlands
Northeastern bladderwort[4]	*Utricularia resupinata*	S1/Threatened	Aquatic Shores Open wetlands
Perfoliate bellwort	*Uvularia perfoliata*	S2	Rich woods Dry/warm forests
Alpine blueberry	*Vaccinium uliginosum*	S1	Alpine/subalpine
Smooth woodsia	*Woodsia glabella*	S2	Rock/cliff
Non-Vascular Plants			
Atrichum moss[3]	*Atrichum crispum*	S2S3	Shores
Racomitrium moss[3]	*Bucklandiella microcarpa*	S1	Rock/cliff
A liverwort[3]	*Cephaloziella elachista*	S1	Open wetlands
A liverwort[3]	*Frullania bolanderi*	S3	Rich woods Dry/warm forests Conifer forests
Hamatocaulis moss[3]	*Hamatocaulis vernicosus*	S2	Open wetlands
A liverwort[3]	*Harpanthus scutatus*	S1	Open wetlands

Common Name	Scientific Name	State Conservation Rank[1] / Status[2]	Habitat
Hygrohypnum moss[3]	*Hygrohypnum subeugyrium*	S1	Open wetlands
Isopterygiopsis moss[3]	*Isopterygiopsis pulchella*	S1	Rock/cliff Conifer forests Forested wetlands
Meesia moss[3]	*Meesia triquetra*	S2	Open wetlands
A liverwort[3]	*Metzgeria crassipilis*	S1	Rock/cliff Dry/warm forests
Pohlia moss[3]	*Pohlia annotina*	S2	Open wetlands
Pohlia moss[3]	*Pohlia bulbifera*	S1	Open wetlands Shores
Elongate pohlia moss[3]	*Pohlia elongate var. elongata*	SH	Rock/cliff Conifer forests
Pohlia moss[3]	*Pohlia sphagnicola*	SU	Open wetlands
Polytrichum moss[3]	*Polytrichastrum longisetum*	S1	Open wetlands
A liverwort[3]	*Scapania paludicola var. paludicola*	S1	Open wetlands
Maryland Sematophyllum moss[3]	*Sematophyllum marylandicum*	S1	Shores Rock/cliffs
Sphagnum[3]	*Sphagnum pulchrum*	S1	Open wetlands

[1] Conservation ranks provide an informational assessment of extinction risk based on factors such as abundance, distribution, population trends, and threats. State ranks are assigned by the Vermont Nongame and Natural Heritage Program (VNNHP) to reflect the rarity of the species within the State of Vermont. For bird species, the ranks apply to breeding status only. S1 = critically imperiled; S2 = imperiled; S3 = vulnerable to extirpation or extinction; S4 = apparently secure; S5 = demonstrably widespread, abundant, and secure; SU = status uncertain; SH = known from historical records only (VNNHP, 2011c; NatureServe, 2007).

[2] Vermont State Status has two categories afforded legal protection under the Vermont Endangered Species Law (10 V.S.A. Chapter 123). Endangered plants are in immediate danger of becoming extirpated in the State, and threatened plants have a high possibility of becoming endangered in the near future (VNNHP, 2011c).

[3] This species is proposed to be added to the RFSS list for the GMNF.

[4] This species is proposed to be removed from the RFSS list for the GMNF.

3.9.2 Direct and Indirect Impacts Presented by Alternative

No significant issues related to ecological resources were identified during scoping, although comments from the public expressed concerns about impacts to vegetation, wildlife, and rare species. Significant issues were identified pertaining to avian, bat, and bear resources. These resources are discussed separately in sections 3.10, 3.11, and 3.12 respectively.

3.9.2.1 Proposed Action

As described in Section 1.4, the Proposed Action would involve construction of 17 wind turbines and associated infrastructure.

3.9.2.1.1 Ecological Communities

Implementation of the Proposed Action would result in direct impacts to vegetation within the Project area. However, no plant species occurring in the Project area would be extirpated or significantly reduced in abundance as a result of construction activities. Under the Proposed Action, 87.4 acres would be cleared and/or graded during construction activities, 86.9 acres of forests and 0.5 acre of open uplands. Clearing of vegetation and construction activities would potentially result in a loss of wildlife food and cover, increased soil erosion and sedimentation, and a disruption of normal nutrient cycling. These activities would disturb and expose the soil, increasing vulnerability to encroachment by NNIS.

Impacts to ecological communities would result from Project construction activities, including both clearing and grading. Existing vegetation would be cleared and removed from work areas, increasing the risk of erosion. Work areas are associated with installation of new access roads; temporary widening of existing access roads; site preparation and construction of turbine pads; assembly and installation of the turbines themselves; and site preparation and construction of the LIDAR sites, the O&M building and substation, the electrical collection system, and the temporary laydown areas. Once vegetation is removed in the work areas, soils would be excavated to achieve necessary grades. During construction, the gravel surface of the access roads would be 22 feet wide over most sections, reduced from the 35-foot nominal width described in the DEIS. Where necessary, the gravel surface would be wider (up to 36 feet) to allow large construction equipment to navigate sharp turns. For access roads, grading would typically extend approximately 5 to 10 feet to either side of the gravel surface, and clearing approximately 20 to 30 feet to either side. For turbine workspaces, grading would typically extend approximately 5 to 10 feet to either side of the gravel surface, and clearing up to 100 feet beyond the gravel surface. The total impacts to vegetative communities, summarized above and presented below in Table 3.9.2-1, include all areas that would be subject to grading and clearing activities.

Where possible, the gravel surface of the access roads would be reduced to approximately 16 feet wide after completion of construction, with the margins loamed and revegetated to reduce erosion. However, in order to maintain a stable road surface, the cut and/or fill required to safely support the roads would not be re-graded during Project operation. Operational impacts to vegetation would generally be restricted to maintaining a 16-foot wide road and a 200-foot diameter workspace around the base of each turbine. Roads would need to be kept open and turbine pads kept clear of regenerating trees, resulting in the conversion of vegetative communities, e.g., from forestland to road base, and forestland to successional shrubland, brush, or old field. Similarly, vegetation would be brush-hogged in a 15-foot swath along buried electrical interconnect routes. Aside from minor disturbance associated with routine maintenance and occasional repair activities, other disturbance to plants and vegetative communities are not anticipated as a result of Project operation.

Implementation of the Proposed Action would result in direct impacts to vegetation on both NFS and private lands. Table 3.9.2-1 shows impacts to vegetative communities that would result from Project construction and operation under the Proposed Action.

Table 3.9.2-1: Impacts to Vegetative Communities from the Proposed Action

Vegetative Community	NFS Lands Impact (Acres)	Private Lands Impact (Acres)	Total Impact (Acres)
Northern Hardwood Forest	53.5	10.7	64.2
Montane Yellow Birch-Red Spruce Forest	19.1	3.6	22.7
Open Uplands	0.5	0.0	0.5
Total	73.1	14.3	87.4

3.9.2.1.2 Non-native Invasive Species

The Forest Plan includes S&Gs designed to minimize the spread of NNIS, and to aid in the control of existing occurrences and restoration of habitats on Forest Service lands. These S&Gs would be applied uniformly to all action alternatives, and would reduce the spread of NNIS within the GMNF, from GMNF lands to adjacent lands under private ownership, and vice versa. However, it is not possible to be 100% effective in prevention and control during management activities, nor is it possible to prevent the dispersal of NNIS that would occur naturally in the absence of management activities. Also, it is not possible to control activities on adjacent land under private management. Therefore, infestation of new sites, both on Forest Service lands and on adjacent properties, is likely to continue to some degree, regardless of the alternative implemented (USDA Forest Service, 2006b).

Populations of two NNIS were documented along the access road to the existing Searsburg Wind Facility. Patterns of infestation indicate that dispersal follows human travel corridors and other linear openings. These pathways can provide the combination of disturbed ground, increased light, and avenues for seed movement that can enable NNIS to become established in new areas (USDA Forest Service, 2006b). Surveys for NNIS in the Project area were restricted to the access road and cleared areas associated with the existing Searsburg Wind Facility, where they are most likely to be found. Other disturbed habitats, such as the ROWs along Route 8 and the existing 69kV transmission line, are likely to support populations of NNIS as well. Without measures to control dispersion, existing populations of NNIS within the Project area would be likely to continue spreading with implementation of the Proposed Action.

The following design criteria would be implemented to prevent the spread of plant NNIS within the Project area. These measures would apply to all action alternatives. If properly implemented, these measures should minimize the spread of NNIS.

1. Before entering the Project site, all construction equipment would be cleaned of dirt and debris that may contain NNIS seeds or propagules. The standard equipment cleaning clause would be followed (section BT6.35 of a standard timber sale contract).

2. Information regarding common reed infestations and control measures would be shared with the Towns of Searsburg and Readsboro and GMP, and applied as appropriate.

3.9.2.1.3 Management Indicator Species

MIS are fundamentally different from other resource elements relative to analysis of potential effects. Rather than analyze direct and indirect effects that the proposed management actions may have on MIS, this section analyzes effects that the proposed activities may have on five habitat types and, in turn, how each of the MIS may respond to these effects. Responses of MIS serve as proxy for the anticipated responses of other species that occur in the same habitats. Table 3.9.2-2 summarizes the likely impacts of the Proposed Action on MIS habitats in the Project area. A more detailed discussion of potential impacts to each species and its representative habitat or resource issue follows.

Table 3.9.2-2: Potential Impacts of the Proposed Action on MIS in the Project Area

MIS	Representative Habitat/ Resource Issue	Habitat in Project Area?	Potential Impact
Ruffed grouse	Aspen-birch	No	Limited Positive
White-tailed deer	Deer wintering habitat	Marginal	None
Brook trout	Aquatic-riparian habitat	Yes	None
Gray squirrel	Oak-pine	No	None
American woodcock	Early successional habitat	Scarce	Limited Positive

Ruffed Grouse/Aspen-Birch

There a single balsam fir/aspen/paper birch stand (type 11) mapped within the Project area. This stand of young saplings is 14.7 acres, and is located near the Western Project site, approximately 0.5 mile southwest of the proposed site for turbine W-10. In addition, there are small, unmapped inclusions of this habitat type within the northern hardwood stands throughout the Project area. Several ruffed grouse were documented during the on-site breeding bird survey. The Proposed Action would be anticipated to have little or no adverse effect on ruffed grouse or aspen-birch habitat. This habitat type may increase somewhat following construction, providing some beneficial impacts to grouse. Construction of the 22-foot wide access roads would require the clearing and grading of swaths of 50 to 70 feet in total width, extending up to 130 feet wide in some sections to allow large equipment to navigate sharp corners. Where possible, access roads would then be reduced and maintained to 16 feet wide following construction, with native vegetation allowed to revegetate along the edges. Aspen and birch are both early successional species that easily colonize recently disturbed sites, and as such, the regenerating roadside vegetation would likely include a component of aspen and/or birch.

White-tailed Deer/Deer Wintering Habitat

No State deer yards are mapped within the Project site or the Project area. The two closest mapped deer wintering areas are respectively located approximately 1.9 miles east of the proposed site for turbine E-7, and approximately 2.1 miles north of the proposed site for turbine W-1. As described in section 3.9.1.2.1, the field inventory recorded two potential stands that could provide deer wintering habitat, but neither received substantial winter use by white-tailed deer, likely because of the high elevation. The Proposed Action would likely result in the removal of a few trees from the edge of the 2-acre conifer stand along Putnam Road (Arrowwood Environmental, 2006a). This clearing may be required to widen the existing gravel road in order to accommodate cranes and other large construction vehicles. The Proposed Action would not impact the mixed forest stand west of Route 8 and south of the proposed site for turbine W-10. Therefore, the Proposed Action would have no effect on white-tailed deer or deer wintering habitat in the Project area.

Brook Trout/Aquatic-Riparian Habitat

Although the Proposed Action has been designed to avoid surface water resources to the greatest extent possible, access roads would have to cross four streams (Stream ID#s 1-4). Three of the streams are in the Eastern Project site (Stream ID#s 1, 2, and 4) and one in the Western Project site (Stream ID #3). Stream ID#s 1, 3, and 4 are intermittent, while Stream ID #2 is ephemeral. Stream ID#s 1 and 2 are both tributaries of Stream ID #4, which along with Stream ID #3, is a tributary of the unnamed creek that runs parallel to Route 8, eventually draining into the West Branch of the Deerfield River. Intermittent and ephemeral streams do not generally support brook trout and are not typically considered aquatic-riparian habitat. The Project area contains suitable cold water stream habitat for brook trout in six small perennial headwater streams (Stream ID#s 7, 13, 14, 20, 21, and 22). No perennial streams would be crossed by access roads under the Proposed Action, and accordingly, there would be no direct impacts to brook trout or cold water fisheries habitat.

Electrical collection lines would cross two streams (Stream ID#s 10 and 22). Both these streams are located within 200 feet of the western edge of Route 8. Stream 10 is ephemeral, while Stream ID #22 is perennial. The electrical collection lines would be an overhead line spanning the streams, and no poles would be installed in stream corridors. Therefore, no direct impacts would be anticipated to Stream ID#s 10 or 22.

Sedimentation or erosion caused by construction activities could result in indirect impacts to brook trout habitat. However, with implementation Forest Plan S&Gs, along with Project-specific design criteria and mitigation measures (see Appendix A), no unacceptable adverse indirect impacts would be anticipated. For a more detailed analysis of streams in the Project area, see Section 3.7 of this FEIS.

Gray Squirrel/Oak-Pine

The Project area lacks suitable oak-pine habitat for gray squirrel. The Proposed Action would not create oak-pine habitat, and therefore, would not impact the gray squirrel.

American Woodcock/Early Successional Habitat

Early successional habitat is quite limited within the Project area, and no American woodcock were observed during the on-site breeding bird survey. Through clearing of land and creation of open areas, the Proposed Action would increase early successional habitat. Approximately 25.9 acres of forestland would be cleared during Project construction that would not be subject to grading. These areas would be stabilized, revegetated, and restored following construction. In order to maintain a stable road surface, the cut and/or fill required to safely support the roads would not be re-graded during Project operation (i.e., compacted fill and gravel would not be removed). However, the margins of access roads and edges of turbine workspaces would be loamed so as to support revegetation (VHB Pioneer, 2008). This increase in early successional habitat would enhance habitat for the American woodcock and would provide a beneficial impact.

3.9.2.1.4 Reptiles and Amphibians

Construction activity and vehicular movement could adversely impact reptiles and amphibians within the Project site. Slow moving species such as American toad and various salamanders would be especially vulnerable to direct impacts, i.e., to mortality from moving vehicles during the clearing and grading phases of Project construction. Indirect impacts could also occur, in the form of habitat loss and alteration, and possible siltation or sedimentation of aquatic habitats.

As indicated in Section 3.9.2.1.1, construction of the Proposed Action would require clearing and grading of 86.9 acres of upland forested communities and 0.5 acre of open uplands. Areas converted to built facilities (i.e., access roads, turbine bases, substation, and O&M facility) would represent a loss of habitat over the life of the Project. Other areas (i.e., the margins of access roads, turbine workspaces, and the staging area) would be allowed to revegetate following construction. Habitat in such areas would be altered from forested to successional communities. This could benefit snake species within the Project site (i.e., common garter snake, red-bellied snake, ring-necked snake, and smooth green snake), which tend to prefer forest edges and woodland areas with canopy openings.

Although turbines have generally been sited away from wetlands and streams, access roads would cross Stream #s 1-4, while interconnect lines would cross over Stream #s 10 and 22. Also, five wetlands would be directly impacted by construction activities (Wetlands F, AA, AH, AJ, and BB), and the protective strips of about ten other wetlands would be impacted. See Section 3.8.2.1.2. Soil disturbance associated with access road construction and the installation of interconnect lines could potentially result in sedimentation and siltation impacts to aquatic habitat for amphibians. However, with the implementation of Forest Plan S&Gs, along with Project-specific design criteria and mitigation measures (see Appendix A), any adverse impacts anticipated to stream habitats or the salamanders that utilize such habitats would be minimized.

3.9.2.1.5 Fish

The Project area contains numerous small streams, including a number of perennial streams that could provide habitat to fish (Stream ID#s 7, 13, 14, 20, 21, and 22). As noted in the section above regarding Brook Trout/Aquatic-Riparian Habitat, access roads would have to cross four streams (Stream ID#s 1 to 4), and the overhead electrical collection lines would cross two additional streams. No poles would be installed in stream corridors.

No perennial streams would be directly impacted by the Proposed Action, and therefore, no direct impacts to fish species would be anticipated. Temporary indirect impacts to streams and fish species would potentially result from sedimentation and erosion caused by construction activities.

However, with implementation Forest Plan S&Gs, along with Project-specific design criteria and mitigation measures (see Appendix A), little or no adverse indirect impacts would be anticipated. For a more detailed analysis of streams in the Project area, see Section 3.7 of this FEIS.

3.9.2.1.6 Mammals

Impacts to bats and black bears are discussed in Sections 3.11 and 3.12, respectively. Direct and indirect impacts to mammals other than bats and black bears are expected to be limited to minor loss or alteration of habitat, and possibly some level of displacement. Habitat impacts would include 86.9 acres of forest and 0.5 acre of open uplands that would be cleared or graded, comprising an area of about 0.9% of the total Project area.

Some displacement of mammals would likely occur during construction, due to increased noise and human activity. The magnitude of this impact would vary by species and the seasonal timing of construction activities. Once construction is complete, mammalian species would be expected to re-occupy their territories in the vicinity of the turbines. In 2005 and 2006, a remote sensing camera was deployed approximately 260 feet away from an operational turbine at the existing Searsburg Wind Facility. As described in Section 3.9.1.2.4, seven different species of mammal were recorded on film: moose, deer, black bear, fisher, red fox, coyote, and raccoon. Although the photographs suggest that these mammal species can become habituated to the presence of wind turbines, the rate and degree of habituation is currently uncertain.

The winter moose habitat identified on the eastern ridgeline would not be directly impacted by the Proposed Action. A forested buffer would remain between the area cleared for the turbine workspaces and the moose habitat, which would offer some protection against indirect effects such as displacement. Moose were recorded by remote sensing cameras near the existing Searsburg facility, (Wallin, 2005b; Wallin, 2006b). However, as indicated above, the rate and degree of habituation is currently uncertain. Therefore, slight displacement of moose from this wintering habitat could occur (Arrowwood Environmental, 2006a).

3.9.2.1.7 All Threatened and Endangered Species

As described in the Biological Evaluation and in Section 3.9.1.3.1, above, gray wolf, eastern mountain lion, and Canada lynx are not known to occur on or in vicinity of the GMNF or in the Project area, and are unlikely to occur in these areas in the foreseeable future. Although some habitat components associated with these species may exist in the Project area, it includes no critical habitat. Indiana bats do occur on and near the GMNF, but the Project area does not contain suitable habitat because of its elevation, distance from known maternity roost sites and hibernacula, its heavily-forested condition, and location on the east side of the Green Mountain spine. For these reasons, the Biological Evaluation concluded that the Project and its alternatives would have No Effect on these threatened and endangered species.

No federally threatened or endangered plant species are known to occur on the GMNF. Therefore, the Project would have no direct, indirect, or cumulative effect on any federally threatened or endangered plants.

3.9.2.1.8 Animal Regional Forester Sensitive Species

Design criteria for sensitive species have focused on the avoidance of impacts. To ensure avoidance of direct impacts, numerous ecological studies, surveys, and inventories have been conducted. Furthermore, no signs or evidence of any of these species were observed during field inventories conducted at the Project site. As a result, the Proposed Action (along with all action alternatives) would not produce direct impacts to any species of viability concern on the GMNF. Indirect impacts to habitats would vary by species, with habitat for some species incurring limited adverse impacts, and habitat for others seeing no impact. There are no sensitive species for which adverse indirect impacts would lead towards loss of viability. Table 3.9.2-3 provides a summary of available habitat for Animal RFSS in the Project area, and a summary of the effects determinations from the BE. For those species with no habitat present in the Project area, neither direct nor indirect impacts would be anticipated, and they will receive no further analysis in this FEIS.

Table 3.9.2-3: Assessment of Available Habitat for Regional Forester Sensitive Animal Species in the Project Area, and Summary of BE Determination

Mammals	**Habitat in Project Area?**	**BE Determination**
Eastern small-footed bat	Very Limited	No Impact
Little brown bat	Yes	May Impact[1]
Northern long-eared bat	Yes	May Impact[1]
Tri-colored bat	Yes	May Impact[1]
Birds	**Habitat in Project Area?**	**BE Determination**
Bicknell's thrush	Marginal	No Impact
Sedge wren	No	No Impact
Rusty blackbird	Yes	May Impact[1]
Peregrine falcon	No	No Impact
Common loon	No	No Impact
Bald eagle	No	No Impact
Reptiles	**Habitat in Project Area?**	**BE Determination**
Wood turtle	No	No Impact
Amphibians	**Habitat in Project Area?**	**BE Determination**
Jefferson salamander	No	No Impact
Blue-spotted salamander	No	No Impact
Four-toed salamander	No	No Impact
Mollusks	**Habitat in Project Area?**	**BE Determination**
Brook floater	No	No Impact
Creek heelsplitter	Yes	May Impact[1]

Insects	Habitat in Project Area?	BE Determination
Boulder-beach tiger beetle	No	No Impact
Harpoon clubtail	Yes	May Impact[1]
Southern pygmy clubtail	Yes	May Impact[1]
West Virginia white	Yes	May Impact[1]
Forcipate emerald	No	No Impact
Gray petaltail	Yes	May Impact[1]

[1] May impact individuals but not likely to cause a trend towards federal listing as threatened or endangered under the Endangered Species Act, or loss of viability within the planning area.

A brief discussion is provided below for each RFSS that the BE concluded the Deerfield Wind Project and its alternatives may impact individuals but is not likely to cause a trend towards federal listing as threatened or endangered under the Endangered Species Act, or loss of viability within the planning area. Habitat for each of these species occurs within the Project area, although it may not be found within the Project site. The discussion below describes where habitat occurs for each species, along with the anticipated impacts from proposed Project activities.

Little Brown Bat

Suitable habitat occurs in the vicinity of wetlands, and along existing clearings and roads associated with an existing transmission line ROW and the existing Searsburg Wind Facility. However, results from summer mist-net and acoustic surveys conducted by the Vermont ANR, the Forest Service, and other collaborators during 2010 and 2011 suggest that little brown bats are almost completely absent from the Vermont landscape after recent population declines caused by WNS. Acoustic monitoring in the Project area from mid-April through mid-October 2011 detected the occurrence of *myotis* guild bats, which would include little brown bats, although identification of exact species was not possible. The frequency and number of *myotis* guild calls were lower than for migratory bats and big brown bats, suggesting lower abundance in the area (Stantec, 2011a). Additional information about the natural history of little brown bats can be found in Section 3.11.1 of this FEIS. Construction activities would potentially result in direct impacts to habitat through removal of roost trees, as well as indirect impacts in the form of shifting species distribution or habitat use. The Proposed Action would result in the clearing and grading of 73.1 acres of NFS lands and 14.3 acres of private lands. However, given the large amount of forested habitat that would remain in and around the Project area, many potential roost trees would continue to be available.

Bat mortality resulting from the proposed Project is anticipated to be comparable to that observed at other utility-scale wind projects located on forested ridgelines in northern New England, and probably less than the observed mortality at other sites in the Northeast (see Sections 3.11.1.2 and 3.11.2.1.1 in the FEIS for additional detail on estimation of mortality). Applying the average rate of mortality from wind facilities in New England similar to the Deerfield Project site (i.e., 3.14 bats/turbine/year), and the proportion of bat mortality estimated as little brown bats (i.e., approximately 10% of total bat mortality) for the Proposed Action would result in an annual mortality estimate of 6 little brown bats. Applying the same species composition ratio to the high-range mortality estimate would result in an annual mortality estimate of up to 13 little brown bats. It should be noted that the observations of little brown bat mortality in the northeastern U.S. were conducted in areas unaffected by WNS or before the onset of major population declines. Analyses are not available to assess mortality of little brown bats at utility-scale wind facilities in regions where populations have collapsed as a consequence of WNS. Numbers of little brown bats in Vermont are only a few percent of what they were prior to WNS. If mortality of little brown bats is directly correlated with their abundance on the landscape, mortality at the Deerfield site would be expected to be much lower than the range of 6 to 13 bats calculated above, perhaps approaching zero.

<u>Northern Long-eared Bat</u>

The Project area contains abundant forested habitat for foraging and summer roosting, and, northern long-eared bats likely occurred there before the onset of WNS. However, results from summer mist-net and acoustic surveys conducted by the Vermont ANR, the Forest Service, and other collaborators during 2010 and 2011 suggest that northern long-eared bats are almost completely absent from the Vermont landscape after recent population declines caused by WNS. Acoustic monitoring in the Project area from mid-April through mid-October 2011 detected the occurrence of *myotis* guild bats, which would include northern long-eared bats, although identification of exact species was not possible. The frequency and number of *myotis* guild calls were lower than for migratory bats and big brown bats, suggesting lower abundance in the area (Stantec, 2011a). Additional information about the natural history of northern long-eared brown bats can be found in Section 3.11.1 of this FEIS. Construction activities would potentially result in direct impacts to bat habitat through removal of roost trees, as well as indirect impacts in the form of shifting species distribution or habitat use. The Proposed Action would result in the clearing and grading of 73.1 acres of NFS lands and 14.3 acres of private lands. However, given the large amount of forested habitat that would remain in and around the Project area, many potential roost trees would continue to be available.

Bat mortality resulting from the proposed Project is anticipated to be comparable to that observed at other utility-scale wind projects located on forested ridgelines in northern New England, and probably less than the observed mortality at other sites in the Northeast (see Sections 3.11.1.2 and 3.11.2.1.1 in the FEIS for additional detail on estimation of mortality). Northern long-eared bats have accounted for about 1% of recorded and identified bat mortality in the northeastern U.S., although no mortalities have been observed at forested-ridge sites in New Hampshire or Maine (Fiedler, 2004; Kerns & Kerlinger, 2004; Kerns et al., 2005; Fiedler et al., 2007; Kunz et al., 2007; Arnett et al., 2008, 2009; Jain et al., 2007, 2009a,b,c,d,e 2010a,b; Stantec 2008, 2009a,b, 2010a,b; Young et al., 2009; Normandeau, 2010; Tidhar et al., 2010, 2011). Mortality recorded as unidentified bats or unidentified *Myotis* could include individuals of this species. Based on the highest observed rates of mortality at northeastern wind energy facilities, the Proposed Action could result in the death of up to two northern long-eared bats per year. It should be noted that studies suggesting that northern long-eared bats account for about 1% of identified bat mortality in the northeastern U.S. were conducted in areas unaffected by

WNS or before the onset of major population declines. Analyses are not available to assess mortality of northern long-eared bats at utility-scale wind facilities in regions where populations have collapsed as a consequence of WNS. As indicated above, northern long-eared bats are now virtually absent in Vermont. Since this data indicate that northern long-eared bats probably no longer occur within the Project area, mortality would not be expected.

Tri-colored Bat

The Project area provides foraging and summer roosting habitat for tri-colored bats, although they have never been considered common in Vermont or the Project area. Results from summer mist-net and acoustic surveys conducted by the Vermont ANR, the Forest Service, and other collaborators during 2010 and 2011 suggest that northern tri-colored bats are almost completely absent from the Vermont landscape after recent population declines caused by WNS. Acoustic monitoring was conducted in the Project area from mid-April through mid-October 2011. The red bat/tri-colored bat guild was the third most commonly detected, however most call sequences were further identified as red bats, and only one percent of the guild calls were identified as tri-colored bats (Stantec, 2011a). Additional information about the natural history of tri-colored bats can be found in Section 3.11.1 of this FEIS. Construction activities would potentially result in direct impacts to bat habitat through removal of roost trees, as well as indirect impacts in the form of shifting species distribution or habitat use. The Proposed Action would result in the clearing and grading of 73.1 acres of NFS lands and 14.3 acres of private lands. However, given the large amount of forested habitat that would remain in and around the Project area, many potential roost trees would continue to be available.

Tri-colored bats have accounted for about 10% of recorded and identified bat mortality in the northeastern U.S., although only one mortality has been observed in six years of study at forested-ridge sites in New Hampshire or Maine (Fiedler, 2004; Kerns & Kerlinger, 2004; Kerns et al., 2005; Fiedler et al., 2007; Kunz et al., 2007; Arnett et al., 2008, 2009; Jain et al., 2007, 2009a,b,c,d,e 2010a,b; Stantec 2008, 2009a,b, 2010a,b; Young et al., 2009; Normandeau, 2010; Tidhar et al., 2010, 2011). Should mortality be as high as 10%, as observed at other sites in the Northeast, estimated mortality could be similar to that reported above for little brown bats: six tri-colored bats for the Proposed Action, or using the high-range estimate, up to 13 bats per year. The more likely expectation is that mortality would be similar to other forested-ridge facilities in northern New England, or up to two tri-colored bats per year. The studies suggesting that tri-colored bats account for about 10% of identified bat mortality in the northeastern U.S. were conducted in areas outside Northern New England and in areas unaffected by WNS before the onset of major population declines. Analyses are not available to assess mortality of tri-colored bats at utility-scale wind facilities in regions where populations have collapsed as a consequence of WNS. As indicated above, tri-colored bats have never been common in Vermont and are now virtually absent; therefore extrapolated mortality as high as 10% does not seem likely. In any case, given the apparent low numbers of tri-colored bats in the region, mortality would not be expected.

Rusty Blackbird

The only likely breeding habitat for this species in the Project area is in delineated Wetland Q. This area was surveyed as a possible alternative access route that is no longer under consideration. The Proposed Action would have no impact on this site, as no Project components would be located there. There would be no direct or indirect impacts to rusty blackbird.

Creek Heelsplitter

The only likely habitat for this mollusk is in the six delineated perennial streams (Stream ID#s 7, 13, 14, 20, 21, and 22). As described in Section 3.7, these streams are tributaries of Rake Branch and Bond Brook. The Proposed Action would have no direct impact on habitat for creek heelsplitter, as no perennial streams would be crossed by access roads and the overhead electrical collection lines that would span streams would not place poles in the stream corridor, and thus, no direct impacts would be anticipated to this species. Temporary indirect impacts to streams and associated mollusk species could potentially result from sedimentation or erosion caused by construction activities. However, with implementation of Forest Plan S&Gs, along with Project-specific design criteria and mitigation measures (see Appendix A), no indirect impacts would be anticipated.

Harpoon Clubtail

Arrowwood Environmental identified possible habitat for this species along Stream ID#s 7 and 14, both perennial streams near Route 8. The Proposed Action would have no impact on habitat for this dragonfly, and likewise no direct or indirect impacts to this species, as the Putnam Road access route has been designed to avoid crossing these streams.

Southern Pygmy Clubtail

Arrowwood Environmental identified possible habitat for this species along Stream ID#s 7 and 14, both perennial streams near Route 8. The Proposed Action would have no impact on habitat for this dragonfly, and likewise no direct or indirect impacts to this species, as the Putnam Road access route has been designed to avoid crossing these streams.

West Virginia White

No direct impacts would be anticipated to this butterfly as a result of the Proposed Action, since a lack of extensive spring wildflower populations in the vicinity of proposed Project components makes occurrence unlikely. As discussed in section 3.9.1.3.2, the West Virginia white prefers rich northern hardwoods, which do not occur on the Project site. However, it may use the mixed forests of the Project area. This diminutive butterfly is a habitat specialist, requiring not just toothwort, but intact forests. The species is unusually sensitive to the creation of open areas, and seldom re-colonizes, since adults generally do not cross open areas of any kind (NatureServe 2007). The Proposed Action could have adverse indirect impacts on potential habitat for West Virginia white by increasing the amount of open areas at the Project site, which would limit potential movement of the species. As stated in the BE, any negative (adverse) indirect impacts would be anticipated to be quite limited in scope.

Gray Petaltail

There are a number of small seepage wetlands in the Project area that may provide suitable habitat for this dragonfly, including Wetlands D, E, F, J, R, U, W, X, Y, Z, AA, AH, AJ, AL, BA, BD, and W-1 through W-13. Implementation of the Proposed Action would have no effect on most of these wetlands, as no Project components would be located in their immediate vicinity. However, Wetlands F, AA, AH, and AJ would be impacted by the construction of access roads. Wetland AJ is located in the Eastern Project site. Wetlands F and AH are located on private land near the intersection of Route 8 and Putnam Road, while Wetland AA is located on NFS land near the intersection of Route 8 and Sleepy Hollow Road. Due to the large turning radii that would be required for over-sized construction vehicles, it would not be possible to re-design the placement of the access roads to avoid impacting these wetlands without incurring greater impacts elsewhere. Under the Proposed Action, Wetlands F and AH would be cleared and graded during construction of the Putnam Road access route, resulting in a combined 1,996 square feet (0.0458 acre) of permanent impact due to grading, and an additional 166 square feet (0.0038 acre) of temporary impact due to clearing. Wetland AA would be spanned by a bridge during construction of the access road to the Eastern Project site, resulting in 1,332 square feet (0.0306 acre) of direct secondary impact, with an additional 223 square feet (0.0051 acre) of temporary impact due to clearing. In addition, Wetland AJ would be cleared and graded during construction of the access road to turbine E-4, resulting in 618 square feet (0.0142 acre) of permanent impact due to grading and 329 square feet (0.0075 acre) of temporary impact due to clearing. Although no gray petaltail were observed at Wetlands F, AA, AH, or AJ during field surveys, any gray petaltail using these wetlands could be directly impacted. The permanent impacts to these wetlands would result in a loss of potential habitat for this species, and thus, have an adverse indirect impact. Given the small size of the impacts, and the extensive amount of remaining potential habitat, the Proposed Action would have minimal impact to gray petaltail habitat, and would not jeopardize the viability of this species.

3.9.2.1.9 Plant Regional Forester Sensitive Species

If any plant RFSS were to occur in the Project area, possible direct impacts include equipment driving over them, and structures or roads being constructed over them. Possible indirect impacts involve changes in habitat suitability due to Project activities. Because of the localized nature of these potential impacts, the affected environment for the impacts analysis includes the Project footprint (Project site), along with those areas directly adjacent to the Project site. For those species with no habitat present in the Project area, no direct or indirect impacts would occur and no further discussion is needed. Many plant RFSS have specific habitat requirements that further restrict distribution. Substrate chemistry and elevation are examples of two limiting factors that render habitats within the Project area unsuitable for many sensitive plants.

Determinations made in the BE dictate the level of analysis for each plant RFSS. The BE determined that the Proposed Action would have no direct or indirect impact to any species unlikely to occur in the Project area. Therefore, those species will not receive further analysis in this FEIS. As determined in the BE, there are 19 plant RFSS that may possibly occur in the Project area. These species all occur either in open wetland or open upland habitats. Table 3.9.2-

4 provides a summary of Plant RFSS that may possibly occur in the Project area, as determined by the BE, and identifies the habitats in which they could occur. Following the table is an evaluation of the direct and indirect effects the Proposed Action would have on each of those species, organized by habitats.

Table 3.9.2-4: Regional Forester Sensitive Plant Species that May Occur in the Project Area

Scientific Name	Common Name	Potential Habitat
Arabis drummondii *Carex foena* *Desmodium perplexum* *Lespedeza violacea* *Solidago squarrosa*	Drummond's rock-cress Bronze sedge Perplexed tick-trefoil Violet bush-clover Squarrose goldenrod	Open uplands
Carex aquatilis var. substricta *Carex haydenii* *Carex lenticularis* *Carex michauxiana* *Eleocharis intermedia* *Eleocharis ovata* *Littorella uniflora* *Mimulus moschatus* *Muhlenbergia uniflora* *Peltandra virginica* *Scheuchzeria palustris ssp. americana* *Utricularia resupinata*	Water sedge Cloud sedge Shore sedge Michaux sedge Matted spikerush Ovate spikerush American shore-grass Musk flower One-flowered muhly Green arrow-arum American scheuchzeria (Pod-grass) Northeastern bladderwort	Open wetlands
Sisyrinchium angustifolium *Sisyrinchium atlanticum*	Pointed blue-eyed grass Eastern blue-eyed grass	Open wetlands and open uplands

<u>RFSS of Open Upland Habitats</u>

The Project area contains potential habitat for the following plant RFSS that occur in open upland habitats: Drummond's rock-cress, bronze sedge, perplexed tick-trefoil, violet bush-clover, pointed blue-eyed grass, eastern blue-eyed grass, and squarrose goldenrod. This habitat type is present in the Project area, but is restricted to existing roadsides and utility corridors. These roadsides and utility corridors would most likely be kept open by ongoing maintenance.

There could potentially be direct adverse impacts to any sensitive plants growing in these open upland habitats, due to the needed widening and gravelling of the access road to the existing Searsburg Wind Facility: any plant RFSS growing in those areas could be killed by clearing and grading activities. However, rare plant surveys conducted by Arrowwood Environmental in 2003 to 2008 found no occurrence of these species in any areas proposed for disturbance under the Proposed Action. Therefore, no unacceptable adverse direct impacts would be anticipated to any plant RFSS that occur in open uplands.

There could be minor indirect impacts to the habitat for sensitive plants that occur in open upland habitats, due to Project activities that could result in changes in the suitability of habitat within the Project site. Clearing and grading associated with the proposed widening of the access road to the existing Searsburg Wind facility would represent an incremental loss of habitat for RFSS that grow in open uplands. However, this impact would be temporary, as the open upland habitat that would be removed would be replaced by similar open upland habitat along the same roadsides once construction is complete. Furthermore, additional areas of open uplands would be created and maintained under the turbines, along the sides of new access roads, and along the new electrical interconnect lines. The creation of these areas could increase available habitat for plants that occur in open upland habitats.

RFSS of Open Wetland Habitats

The Project area contains potential habitat for the following plant RFSS that occur in open wetland habitats: water sedge, cloud sedge, shore sedge, Michaux sedge, matted spikerush, ovate spikerush, American shore-grass, musk flower, one-flowered muhly, green arrow-arum, American scheuchzeria, pointed blue-eyed grass, eastern blue-eyed grass, and northeastern bladderwort. The Project area contains numerous open seep wetlands that could provide habitat for this group of RFSS.

The Proposed Action would have no direct effect on most of these seep wetlands, as no Project components would be located directly in their immediate vicinity. However, as noted above, Wetlands F, AA, AH, and AJ would be impacted by the construction of access roads under any of the action alternatives. Under the Proposed Action, direct impacts to seep wetlands would total 4,664 square feet (0.1071 acre), consisting of 123 square feet (0.0028 acre) of permanent impact and 166 square feet (0.0038 acre) of temporary impact to Wetland F; 1,332 square feet (0.0306 acre) of direct secondary impact and 223 square feet (0.0051 acre) of temporary impact to Wetland AA; 1,873 square feet (0.043 acre) of permanent impact to Wetland AH; and 618 square feet (0.0142 acre) of permanent impact and 329 square feet (0.0075 acre) of temporary impact to Wetland AJ. Rare plant surveys conducted by Arrowwood Environmental in 2003 to 2008 found no occurrence of RFSS in Wetlands F, AA, AH, or AJ, or anywhere in the Project area. Therefore, no direct impacts to these open wetland habitat RFSS would be anticipated.

Temporary indirect impacts to open wetlands could result from sedimentation or erosion caused by construction activities. This would include those wetlands for which the protective strips would incur disturbance (see Section 3.8.2.1). However, with implementation Forest Plan S&Gs, along with Project-specific design criteria and mitigation measures (see Appendix A), adverse indirect impacts would be minimized.

3.9.2.2 Alternative 1: No Action

As described in section 2.2.2, no turbines, access roads, or other Project components would be constructed under the No Action alternative. Since there would be no habitat disturbing activities, there would be no impacts to MIS, reptiles and amphibians, fish, mammals, T&E, or RFSS. Vegetative communities and NNIS control would continue to be managed under the directives outlined in the Forest Plan for the Diverse Forest Use MA.

3.9.2.3 Alternative 2: Reduced Turbines in Western Project Site

The Reduced West alternative would involve construction of 15 wind turbines and associated infrastructure. This alternative would result in direct impacts to vegetation at both the Eastern and Western Project sites. Table 3.9.2-5 shows impacts to vegetative communities that would result from construction and operation activities under the Reduced West alternative.

Table 3.9.2-5: Impacts to Vegetative Communities from the Reduced West Alternative

Vegetative Community	NFS Lands Impact (Acres)	Private Lands Impact (Acres)	Total Impact (Acres)
Northern Hardwood Forest	46.6	14.0	60.6
Montane Yellow Birch-Red Spruce Forest	19.4	4.9	24.3
Open Uplands	0.5	0.0	0.5
Total	66.5	18.9	85.4

Based on the Project layout and the engineered clearing and grading limits, the Reduced West alternative would result in a total disturbance to approximately 84.9 acres of forests and 0.5 acre of open uplands. The same risks of spreading NNIS described for the Proposed Action would also be present under Alternative 2.

Impacts to MIS under Alternative 2 would be similar to those described for the Proposed Action. The potential increase in early successional and aspen-birch habitat would be slightly less when compared to the Proposed Action, because the Reduced West alternative includes fewer turbines and slightly less access road construction, so beneficial impacts to ruffed grouse and American woodcock would also be slightly reduced. No perennial streams would be crossed by access roads, so there would be no impacts to brook trout or aquatic riparian habitat. There is no deer wintering habitat or oak-pine habitat in the Project area, so there would be no impact to these MIS.

Impacts to fish, reptiles, amphibians, and mammals would be very similar to those described for the Proposed Action, but habitat impacts would be reduced slightly because of the reduced amount of clearing for turbines and access roads.

There are no known occurrences of any federally threatened or endangered plant or animal species in the Project area, and no suitable habitat for these species occurs within the Project area. The Biological Evaluation concluded that the Project and its alternatives would have No Effect on T&E species. Therefore, no direct or indirect impacts to any federally-listed threatened or endangered species are anticipated from Alternative 2.

The BE concluded that the Reduced West alternative may impact individuals or habitat, but is not likely to lead to loss of viability on the Forest, and is not likely to cause a trend toward federal listing for the following species: little brown bat, northern long-eared bat, tri-colored bat, rusty blackbird, creek heelsplitter, harpoon clubtail, southern pygmy clubtail, West Virginia white, and gray petaltail. Impacts to the animal RFSS with a "May Impact" determination would be the same under the Reduced West alternative as those described for the Proposed Action. For the same reasons as noted for the Proposed Action, no direct or indirect impacts are anticipated to little brown bat, northern long-eared bat, tri-colored bat, rusty blackbird, creek heelsplitter, harpoon clubtail, and southern pygmy clubtail. Potential direct and indirect impacts to the gray petaltail dragonfly and West Virginia white butterfly would be the same as those described for the Proposed Action. The permanent impacts to Wetlands AA and AH would result in a small loss of potential habitat for the gray petaltail. These potential habitat impacts to the gray petaltail dragonfly would be slightly less for Alternative 2 than for the Proposed Action, with permanent impacts to Wetlands F and AJ avoided (see Section 3.8.2 for a full comparison of wetland impacts by alternative). The West Virginia white is unlikely to occur in the Project area, but could incur a minor adverse indirect impact to its potential habitat from the creation of open areas.

As determined in the BE, effects to plant RFSS would be the same under the Reduced West alternative as for the Proposed Action. No RFSS would incur impacts that could result in a loss of viability or a trend toward federal listing. For the 19 plant RFSS described in section 3.9.2.1.9, the BE concluded that Alternative 2 may impact individuals or habitat, but is not likely to lead to loss of viability on the Forest, and is not likely to cause a trend toward federal listing.

3.9.2.4 Alternative 3: Turbines in the Eastern Project Site Only

As described in section 2.2.4, the East Side Only alternative would involve construction of seven wind turbines and associated infrastructure. There would no turbines constructed on the Western Project site. Table 3.9.2-6 shows impacts to vegetative communities that would result from construction and operation activities under the East Side Only alternative.

Table 3.9.2-6: Impacts to Vegetative Communities from the East Side Only Alternative

Vegetative Community	NFS Lands Impact (Acres)	Private Lands Impact (Acres)	Total Impact (Acres)
Northern Hardwood Forest	10.9	15.1	26.0
Montane Yellow Birch-Red Spruce Forest	18.8	4.8	23.6
Total	29.7	19.9	49.6

Based on the Project layout and the engineered clearing and grading limits, the East Side Only alternative would result in a total disturbance to approximately 49.6 acres of forestland. The same risks of spreading NNIS described for the Proposed Action would also be present under Alternative 3, but to a lesser extent because of the reduced soil disturbance.

Impacts to most MIS under Alternative 3 would be similar to those described for the Proposed Action. The increase in open areas, early successional, and aspen-birch habitat would be substantially less when compared to the Proposed Action, because the East Side Only alternative includes fewer turbines and less access road construction. Beneficial impacts to ruffed grouse and American woodcock would be reduced. As for the Proposed Action, no perennial streams would be crossed by access roads, so there would be no impacts to brook trout or aquatic riparian habitat. There is no deer wintering habitat or oak-pine habitat in the Project area, so there would be no impact to these MIS under Alternative 3.

Impacts to fish, reptiles, amphibians, and mammals would be similar to those described the Proposed Action, but habitat impacts would be substantially reduced because of the reduced amount of clearing for turbines and access roads.

There are no known occurrences of any federally threatened or endangered plant or animal species in the Project area, and no suitable habitat for these species occurs within the Project area. The Biological Evaluation concluded that the Project and its alternatives would have No Effect on T&E species. Therefore, no direct or indirect impacts to any federally-listed threatened or endangered species are anticipated from the East Side Only alternative.

The BE concluded that the East Side Only alternative may impact individuals or habitat, but is not likely to lead to loss of viability on the Forest, and is not likely to cause a trend toward federal listing" for the following species: little brown bat, northern long-eared bat, tri-colored bat, rusty blackbird, creek heelsplitter, harpoon clubtail, southern pygmy clubtail, West Virginia white, and gray petaltail. Impacts to the animal RFSS with a "May Impact" determination would be similar under the East Side Only alternative as those described for the Proposed Action. For the same reasons as noted for the Proposed Action, no direct or indirect impacts would be anticipated to little brown bat, northern long-eared bat, tri-colored bat, rusty blackbird, creek heelsplitter, harpoon clubtail, and southern pygmy clubtail. Potential direct and indirect impacts to the West Virginia white butterfly would be the same as those described for the Proposed Action. The West Virginia white is unlikely to occur in the Project area, but could incur a minor adverse indirect impact to its potential habitat from the creation of open areas. That impact would be less than that of the Proposed Action and Alternative 2 since this alternative involves much less creation of open areas that would impede movement of the species. Potential direct and indirect impacts to the gray petaltail dragonfly would be slightly greater for Alternative 3 than for the Proposed Action and Alternative 2. Most direct wetland impacts would be the same as for Alternative 2, but for Alternative 3, one additional seep wetland would be impacted (see Section 3.8.2 for a full comparison of wetland impacts by alternative). Construction activities at Wetland W-12, which is located in the cleared right-of-way under the existing GMP 69 kV transmission line that runs parallel to Sleepy Hollow Road, would result in 37 square feet (0.0009 acre) of permanent impact and 2,503 square feet (0.0575 acre) of temporary impact. This disturbance to Wetland W-12 could directly affect any gray petaltail using the wetland, and would result in a small loss of potential habitat for the species.

The BE concluded that Alternative 3 would have similar impacts on the same 19 plant RFSS as described in Section 3.9.2.1.9: the Project and its alternatives may impact individuals or habitat, but are not likely to lead to loss of viability on the Forest, and are not likely to cause a trend toward federal listing.

Rare plant surveys were conducted on all areas on NFS lands proposed for disturbance under the East Side Only alternative. However, the substation and upgraded transmission line components of this alternative (which are proposed for private lands) were developed at a later date, and rare plant surveys have not yet been conducted in those areas. These areas contain open uplands and open wetlands that could provide habitat to RFSS. Therefore, a low to moderate risk of habitat loss would accompany the development of this alternative when compared to other the alternatives. However, rare plant surveys would be completed prior to implementation of any decision requiring construction in areas previously not surveyed. If any plant RFSS are found, mitigation would be used to avoid impacts. While little is known about the distance that these species' seeds are dispersed or pollen is moved, it is not suspected that there would be any interaction between plants at the known sites and any plants at this site, if any are present. For this reason, any change in plant RFSS at the Project site (if they are present) would be unlikely to impact the viability of these species on the GMNF or to contribute to a trend toward federal listing.

3.9.3 Cumulative Impacts

The analysis of cumulative impacts to ecological communities (i.e. loss or alteration of vegetation) and to wildlife and wildlife habitat (including MIS) is very similar and thus will be discussed together below in section 3.9.3.2.

3.9.3.1 NNIS

The affected environment for discussion of NNIS cumulative effects of the Proposed Action and alternatives is the Project area. The current model for NNIS risk assessment in Region 9 focuses on NNIS within seed dispersal distance from activities that could facilitate the spread of NNIS, and thus adversely impact other native plants (USDA Forest Service, 2006b). Any activity that involves ground disturbance or the movement of equipment from areas infested with NNIS to areas not yet infested has the potential to increase the chance of infestations developing on GMNF or adjacent lands. Construction and operation of both the proposed Deerfield Wind Project and the existing Searsburg Wind Facility would contribute to opportunities to spread NNIS. Since factors such as on-going maintenance are essentially timeless, no past or foreseeable future timeframe can be defined for the analysis; site access by permitted vehicles (mainly for maintenance) has been occurring for years past, since the Searsburg facility began operation, and would continue for future years. Therefore, the measureable additive component of the proposed activities of the Proposed Action and alternatives would primarily determine the level of overall cumulative impact.

As described, ground disturbance and travel in and out of the Project site during construction and operation would potentially result in the spread of NNIS that subsequently could adversely affect native plants. The greatest concern would be during construction due to the much higher level of disturbance and potential transport of seeds. The risk during construction would be for a relatively short period of time. During Project operation, the risk would be much lower due to the little amount of travel within the site (estimated at about two vehicle trips a day). NNIS may also be spread along private and State roadways in and close to the Project area, and further contribute to opportunities to spread NNIS. However, these opportunities would be very few since Project site access roads would be closed to public vehicle access.

Although unlikely, it is possible that there are more NNIS infestations in the Project area than were found during the surveys of existing access roads and cleared areas described in Section 3.9.1.1.2. Forest stands in the Project area are assumed to have a relatively low likelihood of NNIS infestations, and botanical surveys conducted throughout the Project site by Arrowwood Environmental did not identify any additional populations. As a general rule, the more extensive or widespread NNIS infestations are, the harder they are to control, which in turn increases the potential for impact on other resources. Given this, there would most likely be additional opportunities of NNIS spread from the Proposed Action and Alternatives 2 and 3, and thus a potentially adverse cumulative impact to native plants in the Project area. Project design criteria, mitigation measures, and Forest Plan S&Gs would effectively minimize the overall cumulative impact. For the No Action alternative, without the construction of additional access roads that could further facilitate the spread of NNIS into the Project area, no additive increase in this spread or potential impact to native plants would be expected beyond what may be occurring under the existing situation. Therefore, no cumulative impact would be expected from implementation of the No Action alternative.

3.9.3.2 Vegetation, Wildlife, and Wildlife Habitat

The affected environment for considering the cumulative effects of the loss or alteration of vegetation resulting from implementation of the Proposed Action or alternatives is the Project area. This discussion will also include cumulative impacts to the wildlife species and wildlife habitat discussed above. Cumulative impacts to birds, bats, and black bears are discussed separately in sections 3.10, 3.11, and 3.12, respectively. The cumulative effects analysis considers activities approximately 5 to 10 years past and 5 to 10 years into the future. These 10-year time frames were selected because 10 years represents the length of time after a stand is harvested when it is considered to be in the regeneration (0 to 9 years) stage, which provides early successional habitat for wildlife.

Some of the past actions that have occurred in the Project area and adjacent lands over the last 10 years include timber harvesting on nearby private lands, small maintenance projects on local roads, and development of the existing Searsburg Wind Facility in 1997 (slightly beyond the 5 to 10 year period for past activities). Approximately 35 acres of private land was cleared for construction of the Searsburg Wind Facility, with approximately 15 acres permanently cleared and the remaining 20 acres allowed to revegetate following construction completion (VERA, 1998; GMP, 2006). Foreseeable future actions for the next 5 to 10 years could include Forest Service timber harvesting on nearby lands, although none is planned at this time. A landscape-scale planning effort for NFS lands south and west of the Project area is expected to begin in 2011. This planning effort might include additional GMNF lands south of Route 9 and east of the Project area, as well. It would be at least one to two years beyond 2011 before any definite proposals would be analyzed. No specific proposals are known at this time. Timber harvesting on private lands in the Project area is expected to continue, but there is no record keeping nor advanced planning for future harvests on most of the private land in the Project vicinity (Fice, 2008). There is little private land in the Project area. Similarly, no known road improvement projects beyond those needed for the Deerfield Wind Project, or major land developments are currently proposed on Project area lands, although these could also occur within the life of the Project.

The loss or alteration of vegetation (also considered wildlife habitat) would range from 87.4 acres for the Proposed Action, to 85.4 acres for Alternative 2, and 49.6 acres for Alternative 3. The combined amount of vegetation that would be impacted by the Proposed Action and the existing Searsburg Wind Facility (35 acres) totals approximately 122 acres, or 1.3% of the Project area. Alternative 2 combined with the Searsburg Wind Facility would impact about 120 acres (1.3% of the Project area), while Alternative 3 combined with the Searsburg Wind Facility would alter about 85 acres (0.9% of the Project area). No major changes in age class structure would be anticipated. The No Action alternative would not alter any habitat. When combined with the past and foreseeable future alterations, and given the relatively small amount of alteration of habitat when compared to the size of the Project area, there would be little or no cumulative impact on vegetation and wildlife habitat in the Project area.

The past, present, and future actions on both private and NFS lands, combined with the effects potentially resulting from the Deerfield Wind Project action alternatives, could cause an increase in wildlife displacement. This is due to the additional noise and motorized traffic that would occur on private and NFS lands due to construction activities (short-term impact), as well as turbine operation and maintenance activities associated with the existing Searsburg Wind Facility and the proposed Deerfield Project (long-term impact). Construction impacts would be temporary and localized. As previously discussed, most or all wildlife would be expected to return to their habitats at some point after construction ends. There may be more displacement of certain amphibians, such as salamanders and wood frogs, caused by the construction activities around wetlands. However, no cumulative impact to the viability of these species would be anticipated, since the majority of wetland habitat within the Project area would not be impacted. Therefore, the overall cumulative impact in regard to wildlife displacement would be anticipated to be minimal.

For MIS with no direct or indirect impacts anticipated, no cumulative impacts would be expected. These MIS include white tailed deer/deer wintering habitat, brook trout/aquatic-riparian habitat, and gray squirrel/oak-pine habitat. For ruffed grouse/aspen-birch habitat and American woodcock/early successional habitat, limited positive impacts would be anticipated from all action alternatives. Although no timber harvests are planned at this time, certain silvicultural treatments (such as clearcuts and shelterwood cuts) are typically beneficial to both ruffed grouse/aspen-birch habitat and American woodcock/early successional habitat, at least in the short term. However, no major changes in habitat and age class structure are anticipated. Therefore, little or no cumulative impacts to MIS or MIS habitat would be anticipated.

In summary, cumulative impacts to vegetation and wildlife habitat would be similar under all action alternatives, with the differences in scale attributable to the different number of turbines and associated infrastructure (i.e., differing amount of disturbance and habitat change) proposed for each alternative. The cumulative impacts on wildlife and wildlife habitat would be slightly greater for the Proposed Action than for the Reduced West alternative, which would in turn be greater than for the East Side Only alternative. There would be no cumulative impact for the No Action alternative.

3.9.3.3 All Threatened, Endangered, and Sensitive Species

Direction provided in FSM 2670.22 requires the Forest Service to prevent the loss of viability of species on NFS lands and/or a trend toward federal listing. Therefore, the affected environment for cumulative effects on threatened, endangered, and sensitive species is defined as the entire GMNF. Consideration is also given to other lands immediately adjacent to the Project area. The determination of viability concerns for threatened, endangered, and sensitive species was derived from data gathered during Forest Plan revision, which included data through 2005. Therefore, the temporal context for this analysis is from that date forward for 10 years, which is the time frame that trees would start to provide shading after a regeneration cut.

As noted in section 3.9.1.3, no direct and indirect impacts to federally-listed threatened, endangered, or candidate species would be expected from implementation of the Proposed Action, or any of the alternatives to the Proposed Action. There are no known occurrences of gray wolf, eastern mountain lion, Canada lynx, and Indiana bat in the Project area, and little or no habitat components exist in the Project area. Likewise, there are no federally threatened or endangered plant species known to occur on the GMNF. Therefore, the Project would have no cumulative effect on any federally threatened or endangered animals or plants.

As analyzed in detail in the BE, the Proposed Action, or any of the alternatives to the Proposed Action, would have no impact on 13animal species listed or proposed to be listed as a RFSS. The Proposed Action or its alternatives could impact individuals of nine species listed as RFSS or under consideration for listing as RFSS, but are unlikely to cause a trend toward federal listing under the ESA or toward loss of viability in the Project area or the region. These species include little brown bat, northern long-eared bat, tri-colored bat, rusty blackbird, creek heelsplitter, West Virginia white butterfly, and three dragonflies: harpoon clubtail, southern pygmy clubtail, and gray petaltail. The West Virginia white is unlikely to occur in the Project area, but could incur a minor adverse indirect impact to its potential habitat from the creation of open areas. Minor direct and indirect impacts could occur to the gray petaltail dragonfly due to the disturbance to wetlands F, AA, AH, AJ, and W-12, as described above. The likelihood of impacts to other non-bat RFSS is negligible.

Results from summer mist-net and acoustic surveys conducted by the Vermont ANR, the Forest Service, and other collaborators during 2010 and 2011 suggest that little brown bats, northern long-eared bats, and tri-colored bats are almost completely absent from the Vermont landscape after recent population declines caused by WNS. Preliminary results of acoustic monitoring at the Project site during 2011 suggest low levels of activity for small bats: little brown, northern long-eared, or tricolored bats (Stantec, 2011a). If mortality of bats is correlated with their abundance on the landscape, then little or no mortality would be expected to occur at the Deerfield site, and thus there would be little additive component to overall cumulative impacts. The abundance, distribution, and future status of these species remains uncertain pending results from on-going acoustic surveys and other investigations, including post-construction monitoring for the Deerfield

Project and surveys of areas that have experienced severe bat population declines region-wide. See Section 3.11.3 for more discussion of cumulative impacts to various bat species. In summary, impacts from the Proposed Action or action alternatives would not be expected to contribute cumulatively towards a trend of listing as threatened or endangered under the ESA or to a loss of viability in the affected environment for any listed or proposed RFSS.

As analyzed in the BE and disclosed in Section 3.9.2.1.9, there would be no unacceptable adverse impacts anticipated for plant RFSS. However, when management activities occur at known sites for plant RFSS, cumulative impacts could result. Activities that could impact RFSS plants include habitat maintenance or restoration, road/trail maintenance or construction, timber harvest, habitat conversion, and land development. Some of these activities are currently occurring, or are planned into the foreseeable future at known sites for plant RFSS that grow in open upland or open wetland habitats on GMNF, but mitigation measures are being implemented to protect the populations. There is no way of knowing if these activities are occurring or are planned to occur at known sites on lands under other ownership. While little is known about the distance that these species' seeds are dispersed or pollen is moved, it is not suspected that there would be any interaction between plants at the known sites and any plants at this site, if any are present. For this reason, any change in plant RFSS or at the Project site (if they are present) would be unlikely to impact the viability of these species on the GMNF or to contribute to a trend toward federal listing. In summary, no additive cumulative effects are anticipated beyond the minor potential direct and indirect effects already described, because 1) there is not likely to be any interaction between RFSS plants at known sites and any RFSS plants that may occur in the Project area, and 2) no activities that would cumulatively impact these species are occurring or are planned at known sites.

3.10 Avian

This section describes existing avian resources and potential impacts to birds and bird habitat from the proposed Project. Information was obtained from literature reviews, agency consultations, and recent studies that specifically focus on the Project and its potential effects on resident and migrating birds. As appropriate, results from pre- and post-construction studies conducted from 1993 to 2002 at the Searsburg Wind Facility are included in the analyses and in the Project Record.

3.10.1 Affected Environment

The affected environment for the discussion of direct and indirect impacts to birds is the Project area, with a particular focus on the Project site. As described in Section 3.0 and shown in Figure 1-2, the Project area encompasses all NFS and private lands in GMNF management compartments 121, 122, 123, and 124, an area totaling 9,523 acres. Elevation in the Project area ranges from approximately 1,510 feet (460 m) AMSL to approximately 3,110 feet (948 m) AMSL. The Project site is the footprint of activity associated with the proposed Deerfield Wind Project, which includes the Eastern Project site and the Western Project site. Elevation in the Project site ranges from approximately 2,401 feet AMSL near the intersection of Route 8 and the Putnam Road access to approximately 3,110 feet AMSL along the eastern ridgeline, south of the existing Searsburg Wind Facility. The avian species that occur on the Project site, particularly the resident breeding birds, are influenced by the ecological conditions and topography of the site. Detailed information on the existing vegetation and ecological communities in the Project area is discussed in the introduction to the affected environment Chapter 3.0 and in Section 3.9. Information on climate may be found in Section 3.3. The following is a brief summary of the ecological setting.

The Project area is predominately forested, with scattered rocky outcroppings at the ridges and along the slopes (Kerlinger, 2006a). Vegetation on the Eastern Project site is similar to that of the Searsburg Wind Facility and includes northern hardwood forest (55%) and montane yellow birch-red spruce forest (45%) (Figure 3.9-1). The site includes small patches of balsam fir (less than 1 acre) that extend from the northernmost existing turbines to the southernmost proposed turbine locations. The Eastern Project site also includes three small (roughly less than 1.0 acre) cleared, shrubby areas associated with prior or existing meteorological towers (met towers) used to monitor wind conditions. These small open areas are dominated by various herbaceous species and scattered saplings. One or more of these openings are expected to become sites for proposed turbine placement. One or two older openings that previously held met towers may still exist but are mostly growing back in.

The Western Project site is vegetated primarily with northern hardwood forests (96%), with a small portion of upland brush (3%) and montane yellow birch-red spruce forest (1%) (Figure 3.9-1). American beech is the dominant species, with lesser amounts of sugar maple and yellow birch (Arrowwood Environmental, 2006a). Some low-lying patches of wet forest occur near the southern-most turbine sites on the Western Project site. The Western Project site also includes two small open areas (roughly less than 1.0 acre) that are maintained in a shrubby state to accommodate met towers as desired and permitted. These small open areas are vegetated with various herbaceous species and scattered saplings. Other open areas occur within the region, especially near the northern end of the Western Project site, and at the Fairington (Crosier) Cemetery, on Route 8 immediately adjacent to the Searsburg Wind Facility.

3.10.1.1 Summary of Avian Studies Conducted for the Searsburg Wind Facility

The Searsburg Wind Facility went on-line in 1997 with 11 turbines. Each turbine is situated on a cylindrical tower that offers no perching sites for birds. The nacelles that house the generators are smooth and offer no perching or nesting opportunities other than the top of the nacelle itself. The nacelles are approximately 131 feet (40 meters) above ground; height to the tip of the blades (12 o'clock position) is roughly 197 feet (60 meters). As of October 2010, 10 turbines were standing and in operation; replacement of the 11th turbine has been completed and it is expected to be operational by fall 2011.

From 1993 to 2002, 14 studies described avian resources and potential impacts at the facility. These studies include multi-year, site-specific work that spans pre- and post-construction of the existing wind energy project. Areas of focus included diurnal hawk migration, nocturnal migration of all species, breeding birds, and avian mortality at the wind facility (see Appendix D). Although the Searsburg site and turbines are substantially shorter than those proposed for the Deerfield Project, and therefore may affect avian species differently, these studies do provide insight regarding avian occurrence in the area and the general effects of an operating wind facility on avian activity.

Searches for nesting raptors, particularly northern goshawk (*Accipiter gentilis*), conducted in the spring of 1994 revealed no raptors nesting on or adjacent to the Searsburg Wind Facility. No evidence of raptors nesting on the site was found during breeding bird surveys conducted in 1996 and 1997, although two sightings of sharp-shinned hawks (*A. striatusa*) within 2.5 miles (4 kilometers) of the site suggest that this species nests nearby. Nesting by goshawks, in particular, appears to be unpredictable on the GMNF. During recent years, active nest sites and surrounding areas have not been used during following years (Sease, 2008b). Numbers of hawks migrating over the Searsburg Wind Facility in 1993, 1994, 1996, and 1997 were lower than, or similar to, most sites in New England, and two orders of magnitude lower than the counts taken at areas of concentration such as Cape May, NJ, Lighthouse Point, CT, and Hawk Mountain, PA (Kerlinger, 2002). After construction of the Searsburg Wind Facility, fewer hawks and songbirds flew over the site, suggesting that the turbines may have altered the migratory behavior of birds over the site. This deviation in flight pattern was considered unlikely to result in a significant increase in energetic costs of migration, navigational confusion, or any other adverse effect (Kerlinger, 2002).

Nocturnal migration of songbirds through the Searsburg site during the spring of 1994 and 1997 and the autumn of 1996 and 1997 suggested that the site is not a major migratory pathway. Numbers of birds flying over the site were the same as or less than the numbers reported from other inland locations in New England, and many fewer than reported in studies conducted farther south (e.g., Hawk Mountain, PA or Hook Mountain, NY). Fewer migrants were counted after construction of the turbines, perhaps indicating avoidance of the immediate turbine area by migrants (Kerlinger, 2002).

A five-month avian mortality survey (June 30 to October 18) at the Searsburg Facility in 1997 found no bird carcasses. Although this survey was less robust than current post-construction fatality monitoring protocols, the results suggests that large-scale mortality has not occurred at the existing Searsburg facility. This is further supported by the fact that scavenger rates were determined to be relatively low (Kerlinger, 2002).

Post-construction breeding bird surveys suggested a small decrease in the number of interior forest birds near the Searsburg Wind Facility but this change was not statistically significant. Concurrently, there was an increase of several edge species [blue jay (*Cyanocitta cristata*), American robin (*Turdus migratorius*), and yellow-rumped warbler (*Dendroica coronata*)] that normally do not reside in the forest interior. Kerlinger (2002) postulated that what he refers to as fragmentation due to the construction of the project could have moved breeding birds away from access roads and turbines, and provided habitat for the increased numbers of edge species.

In summary, Kerlinger (2002) examined all of the pre- and post-construction studies conducted at the Searsburg Wind Facility and concluded that overall impacts were minor, and were not likely to significantly affect bird populations on a regional scale.

3.10.1.2 Studies for the Deerfield Wind Facility

The Applicant and the Forest Service have undertaken a number of pre-construction avian studies to describe the avian resources at the proposed Deerfield Project site. These studies were conducted between 2003 and 2008 and include a Phase I Risk Assessment (Kerlinger, 2006a,b), breeding bird surveys (Kerlinger & Dowdell, 2003), Bicknell's thrush surveys (Casey, 2005; Torres, 2005; Sease, 2008a; Sease, 2011), hawk migration surveys (Woodlot, 2005a,b,c, 2006), and songbird migration studies using radar (Woodlot, 2005a,b,c, 2006; WEST, 2005a,b). Results from these studies are summarized below; each is included in the Project Record.

3.10.1.2.1 Breeding Bird Survey

During June and July 2003, Kerlinger and Dowdell (2003) identified 37 species of birds at point count locations along transects in the Eastern and Western Project sites (Figures 3.10-1A and 3.10-1B). Identified species included a combination of forest interior, forest edge, and, to a lesser extent, shrubland species, as well as a few species that typically occur in boreal forests. Almost all species detected are likely to nest in the Project area. Bicknell's thrush (*Catharus bicknelli*) was not detected during the surveys, nor were any federal- or Vermont-listed endangered, threatened, or species of concern.

Edge and shrubland species [e.g., American robin, common yellowthroat (*Geothlypis trichas*), chestnut-sided warbler (*Dendroica pensylvanica*)] occurred only on the Western Project site. Kerlinger and Dowdell (2003) believed that the presence of edge and shrubland species is due to past forest management activity and slightly greater habitat diversity in this portion of the Project area. No similar forest management occurred on the Eastern Project site during recent years. Species on the Eastern Project site were similar to those observed at the Searsburg Wind Facility, including those species associated with boreal forests [e.g., blackpoll warbler (*Dendroica striata*), yellow-rumped warbler, white-throated sparrow (*Zonotrichia albicollisa*)]. Few boreal species were found in the Western Project site. Presumably the presence or absence of boreal species was correlated with the presence of stands of balsam fir on the Eastern Project site, and lack of balsam fir on the Western Project site (Kerlinger & Dowdell, 2003).

3.10.1.2.2 Raptor Migration Studies

Woodlot Alternatives, Inc. (Woodlot) conducted raptor migration studies at the proposed Project site in fall 2004 and spring 2005, using daytime visual surveys. On the Eastern Project site, surveys were conducted at Turbine 8 of the Searsburg Wind Facility, which is near the southern end of the turbine array (Figures 3.10-2 and 3.10-3). This location provided a view of the ridges and valleys to the north, a view to the west over the Western Project site, and a view to the northeast of the seven northern turbines and across to Mount Snow and Haystack Mountain on clear days. Views to the east and south were limited by the topography and forest vegetation surrounding the observation point. On the Western Project site, surveys were conducted from the ground in a small clearing. Views were limited in all directions, although broken views over treetops were available to the south and east (Woodlot, 2005a,b).

During the fall of 2004 (September 16 to October 29), observers counted 872 raptors of 11 species. More raptors (n=725, 12.72 birds per hour) were observed at the Western Project site than at the exiting Searsburg Wind Facility (n=147, 2.45 birds per hour) in the Eastern Project site (Woodlot, 2005a). During the spring of 2005 (April 9 to April 29), observers counted 82 raptors of 11 species. Slightly more raptors were observed at the Western Project site (n=44, 1.05 birds per hour) than at the Searsburg Wind Facility (n=38, 0.90 birds per hour) in the Eastern Project site (Woodlot, 2005b). The most abundant raptor species were broad-winged hawks (*Buteo platypterus*), turkey vultures (*Cathartes aura*), red-tailed hawks (*Buteo jamaicensis*), and sharp-shinned hawks (Woodlot, 2005a,b).

Two Regional Forester Sensitive Species (RFSS), bald eagle and peregrine falcon, were observed at the Project site in the spring of 2005. The bald eagle was de-listed as threatened under the federal Endangered Species Act in 2007 and added as an RFSS by the Forest Service; the bald eagle (*Haliaeetus leucocephalus*) is listed as an endangered species by the State of Vermont. The peregrine falcon (*Falco peregrinus anatum*) was removed from the Vermont list of endangered species by the Vermont Fish and Wildlife Department (VTFWD) in 2005. Two Vermont Species of Special Concern were also observed: Cooper's hawk (*Accipiter cooperii*) and osprey (*Pandion haliaetusa*). The osprey also was de-listed by Vermont in 2005. The observers did not record any big migration pushes or large kettles of hawks, which are typically observed during fall hawk migration (Woodlot, 2005b).

During fall 2004, approximately 9% of observed raptors were flying less than 328 feet (100 meters) above the ground. During the spring of 2005, 82% of observed raptors were flying less than 410 feet (125 meters) above the ground[20]. Observers noted that more of the small species, such as accipiters and falcons, were consistently flying lower than the larger species. Some birds, primarily turkey vultures, were observed lifting up and directly over the tops of the existing Searsburg turbines, and then dropping back down on the opposite side of the moving turbine blades. Two sharp-shinned hawks were observed flying in between the turbines below the rotor swept zone and only a few feet above the treetops without colliding with the turbine blades (Woodlot, 2005a,b).

In general, migrating raptors flew over valleys and side slopes (Figures 3.10-2 and 3.10-3). One of the commonly followed routes, especially in the spring of 2005, was located along Route 8 in the valley between the Searsburg Wind Facility and Western Project site (Figure 3.10-3). The other frequented route was west of the proposed Western Project site. During both seasons, migrating raptors intersected the proposed turbine array on the Western Project site, but typically flew on either side of the Eastern Project site, not across it (Woodlot, 2005a,b). Overall numbers and species of raptors observed by Woodlot (2005a,b) for the proposed Project site were consistent with the earlier surveys done for the Searsburg Wind Facility.

During the fall of 2004, numbers of migrating raptors from other Northeastern survey sites (Putney Mountain, VT; Pack Monadnock, NH; Mount Wachusett, Barre Falls, and Little River

[20] Fall 2004 percentages are based on a turbine height of 328 feet (100 m) rather than 410 feet (125 m). These observations could not be re-analyzed for a turbine height 410 feet.

Lookout, MA) were 1.5 to 9.4 times greater than those documented at the Project site. In spring 2005, the difference was greater; observation rates from other Northeastern count sites (Braddock Bay, Hamburg, and Derby Hill, NY; Barre Fall, Blueberry Hill, MA; Bradbury Mountain, ME) were 8.7 to 70 times greater than at the Project site (Woodlot, 2005a,b; Roy & Erickson, 2007). The Project area does not appear to be a major raptor migration route because it is part of a series of discontinuous mountaintops of various heights, with relatively short, broken ridgelines that are orientated in a variety of directions. In addition, the Project area is not located near any major river system or coastlines, which tend to concentrate migratory hawks. Raptor migration survey results are summarized in Table 3.10.1-1.

Table 3.10.1-1: Summary of Raptor Migration Surveys for the Deerfield Wind Project

	Survey Site and Season					
	Fall 2004			Spring 2005		
	Existing Facility	Western Project Site	Total	Existing Facility	Western Project Site	Total
Number of Survey Days	10	10	20	7	7	14
Number of Species	9	15	15[1]	9	11	13
Number of Individuals	147	725	872	38	44	82
Number of Birds per Hour	2.45	12.72	7.45	0.45	0.52	0.98
Flying less than 328 feet (100 m) above ground[2]	13%	8%	9%	-	-	-
Flying less than 410 feet (125) above ground	-	-	-	68%	93%	82%[3]

[1] Eleven species were positively identified. In addition, several raptors were identified only to genus or just as "raptor".
[2] Fall 2004 percentages are based on an earlier turbine specification with a maximum turbine height of 328 feet (100 m). These observations could not be converted to 410 feet (125 m).
[3] Stantec (2008a) suggested that the relatively high percentage of raptors observed flying less than 410 feet above ground may have been a function of small sample size.
Sources: Woodlot, 2005a,b; Roy & Erickson, 2007

3.10.1.2.3 Nocturnal Songbird Migration (Avian Radar) Surveys

Woodlot (2005a,b,c, 2006) conducted four seasons of radar studies, in fall 2004, spring and fall 2005, and spring 2006, to characterize nocturnal migration in the Project area. In the fall of 2004, two radar units were used at three locations. One location in the Western Project site was surveyed each night. The remaining survey effort was split between the Eastern Project site and a low-elevation location (Figure 3.10-4). In subsequent surveys, one radar unit was used. During the spring of 2005, the radar unit was stationed near Turbine 8 at the Searsburg Wind Facility (Figure 3.10-5). In fall 2005, the radar unit was stationed at the meteorological tower in the Western Project site (Figure 3.10-6). In spring 2006, the radar unit was positioned near the northern meteorological tower at the Eastern Project site (Figure 3.10-7). Radar units were elevated approximately to the height of the surrounding tree canopy.

Passage rates for birds varied significantly among the four seasons of surveys. However, overall trends and patterns of migration and movement appeared similar between years and in comparison to other sites in the region. Woodlot (2005a,b,c, 2006) described bird migration in the Project area as a broad front, with no obvious areas of concentrated migration activity. Migration activity varied throughout any given season, but variability was largely attributable to weather conditions. The topography of the Project area does not appear to affect movement patterns of migrants through the Project area. Most birds flew at altitudes that would be above operating turbines; numbers of birds flying below 410 feet (125 meters) ranged from about 4% to 17% (Roy & Erickson, 2007). Data from these radar studies show variation and ranges comparable to those observed on other inland radar studies (Roy & Erickson, 2007). A summary of the surveys is presented in Table 3.10.1-2.

Table 3.10.1-2: Summary of Project Radar Surveys, 2004 through 2006

Location	Season[1]	Number of Survey Nights	Average Passage Rate[2]	Range in Nightly Passage Rates	Average Flight Direction	Average Flight Height (meters)[2]	% Targets less than Turbine Height[3]
Existing Facility	Fall 2004	14	175	7 to 519	194°	438	1%
Western Project Site	Fall 2004	28	193	8 to 1,121	223°	624	7%
Valley Location	Fall 2004	13	150	58 to 404	214°	503	1%
All three sites combined	Fall 2004	28	178	7 to 1,121	212°	611	4%
Existing Facility	Spring 2005	20	404	74 to 973	69°	523	6%
Western Project Site	Fall 2005	32	559	3 to 1,736	221°	395	17%
Eastern Project Site	Spring 2006	26	263	5 to 934	58°	435	11%

[1] Fall 2004 surveys were conducted between September 16 and October 29. Spring 2005 surveys were conducted between April 28 and May 29. Fall 2005 surveys were conducted between September 2 and November 1. Spring 2006 surveys were conducted between April 16 and June 9.

[2] See Appendix D for a more thorough presentation of the radar data, which displays the full distribution of passage rates and flight heights on a nightly basis.

[3] Data presented here has been re-analyzed to reflect percent of targets below 125 meters. The original reports presented percent of targets below 100 meters (Woodlot, 2005a,b,c, 2006).

Source: Roy & Erickson, 2007.

3.10.1.2.4 Comparison of the 2004 Fall Radar Survey with Other Radar Surveys

Western EcoSystems Technology, Inc. (WEST) (2005a) reviewed methods and data from the fall 2004 radar survey (Woodlot, 2005a), and compared them with 13 similar radar studies in the east and three from the western United States. WEST (2005a) concluded that the fall 2004 radar study was one of the largest and most comprehensive fall studies among those analyzed. Results from the Project were generally similar to those from the other sites. Average passage rate (targets per kilometer per hour) and proportion of targets below 410 feet (125 meters) were slightly lower at the Deerfield Project area and mean flight height above ground was slightly greater than those documented in other eastern studies (Table 3.10.1-3). WEST (2005a) identified only one study other than the Project, the large Stateline Oregon/Washington facility (300 MW), with more than one fall season of radar sampling.

Table 3.10.1-3: Summary of Passage Rate Estimates, Mean Flight Altitude, and Percentage of Target below 125 meters from 13 Fall Radar Studies (10 to 12 kW) at Wind Project Sites in the Eastern United States

Site	Survey Period	Topography	Mean Passage Rates (targets per kilometer per hour)	Mean Flight Height (meters)	Percentage of Targets less than 125 meters	Mean Flight Direction
Deerfield, VT	9/16–10/29/04	Mountaintop	178	556	4%[1]	203°
Sheffield, VT	Not available	Mountaintop	114[2]	566	1%	200°
Flat Rock, NY	8/5–10/3/04	Rolling Hills	158	415	8%	184°
Chatauqua, NY	9/2–10/10/03	Rolling Hills	238	532	5%	199°
Wetherfield, NY	9/2–10/6/98	Rolling Hills	168	—[3]	—	179°
Copenhagen, NY	9/2–10/1/98	Rolling Hills	225	—	—	184°
Martinsburg, NY	9/2–10/6/98	Rolling Hills	230	—	—	191°
Harrisburg, NY	9/2–10/1/98	Rolling Hills	122	—	—	181°
Martindale, PA	8/15–10/15/04	Disjunct Ridge	187	436	8%	188°
Casselman, PA	8/15–10/15/04	Disjunct Ridge	174	448	7%	219°
Mount Storm, WV	9/3–10/16/03	Straight Ridge	241	410	14.5%	184°
Jack Mountain, WV	Not available	Straight Ridge	229	583	8%	175°
Dans Mountain, MD	Not available	Straight Ridge	188	542	7%	193°
Average for Eastern Studies			183	498	7%	191°

[1] Woodlot (2005a) originally reported the percentage of targets below 328 feet (100 meters) as 3%. The data was subsequently re-analyzed to determine the percentage of targets below 410 feet (125 meters) based on current turbine design (Roy & Erickson, 2007).
[2] The mean passage rate reported was 91 targets per kilometer per hour, but the authors suggested that actual rates may be higher by up to 25% (114 = 91 x 1.25).
[3] The methods used in calculating flight heights at these sites were biased, and the authors requested that the estimates not be reported.
Source: West 2005a

In testimony to the Vermont PSB, Roy and Erickson (2007) summarized all radar survey results from the proposed Project and compared them to other migration studies using similar methods and equipment conducted in the Eastern U.S. during the same time period (2004-2006). Other studies evaluated include Sheffield, VT; Mars Hill, ME; Prattsburgh, Sheldon, Cohocton, Dairy Hills, Fairfield, Jordanville, Clinton County, and Churubusco, NY; and Franklin, WV. This comparison showed that there is a fair amount of variation in mean passage rates and mean flight heights between different sites. However, the rates and flight heights observed at the Project site are within the range observed at these other sites (Roy & Erickson, 2007).

3.10.1.2.5 Bicknell's Thrush Studies

Bicknell's thrush is not likely to occur near the Project area. Its preferred habitat is thick, stunted (less than 15 feet tall), conifer forest at elevations of 3,000 feet or more above sea level (Rimmer et al., 2001). Small patches of this habitat are present on the Eastern Project site near the Searsburg Wind Facility (eastern ridge), but at lower altitudes than the thrush's preferred habitat (Kerlinger, 2002). Bicknell's thrush was detected along the eastern ridgeline in surveys in 1994 (Capen & Coker, 1994), in 1996 and possibly in 1997 (Kerlinger, 1997b, 2002). Observers in 1997 heard what might have been a Bicknell's thrush, but the species identity was not confirmed. The possible presence of Bicknell's thrush was considered "surprising," considering the quality of habitat (Kerlinger, 2002: p.23). The ridgeline along the Eastern Project site was part of the annual Mountain Birdwatch conducted by the Vermont Institute of Natural Sciences (VINS, now the Vermont Center for Ecostudies). Bicknell's thrush was not detected during the VINS surveys, and VINS subsequently dropped this route because of the marginal habitat and absence of thrushes.

Bicknell's thrush was not encountered during surveys targeting the species in June and July 2003 (Kerlinger & Dowdell, 2003). Staff from the GMNF surveyed the eastern ridge in June 2005 and June 2008; Bicknell's thrush was not seen or heard during these surveys (Casey, 2005; Sease, 2008a). The Forest Service concluded in the DEIS and SDEIS that, given the poor and marginal habitat on the eastern ridge and lack of sightings or responses to playback of recorded calls during recent surveys, it is highly unlikely that Bicknell's thrush are using the eastern ridge as nesting habitat. The west ridge of the Project area does not contain Bicknell's thrush habitat, as the majority of the higher elevation area is in hardwoods. Bicknell's thrush that occurs on the Project site would most likely be transient birds (Torres, 2005).

According to models constructed by biologists with the Vermont Center for Ecostudies (VCE), acknowledged experts in the biology and ecology of Bicknell's thrush, there is no suitable habitat within the Deerfield Project area (McFarland, 2011). In August 2010, the Secretary of Interior received a petition to list Bicknell's thrush as endangered or threatened under the Endangered Species Act (CBD, 2010a). In light of possible ESA listing, and in consultation with biologists at VCE, the Forest Service conducted three additional Bicknell's thrush surveys during spring and early summer 2011. As before, no Bicknell's thrush was detected (Sease, 2011). The combined evidence is consistent with the conclusion that the likelihood of Bicknell's thrush occurring in the Project area is very low.

3.10.1.2.6 Phase I Avian Risk Assessment

Kerlinger (2006a,b) conducted a Phase I Avian Risk Assessment for the proposed Project. The assessment included a literature review, meetings with local and regional experts (agency staff, environmental organizations, and local birders), and multiple site visits conducted by an avian biologist. Together these sources of information provided an indication of the species and numbers of birds known or suspected to occur on the Project site or in the surrounding area. This information was then used to assess the degree of risk to birds from wind energy development at the site.

The Phase I Assessment concluded that birds present on the site are primarily forest-nesting species, although several edge species have been observed in the Western Project site, and on the Eastern Project site near the existing turbines (Kerlinger, 2006a). Few birds are likely to be present on the site during the winter due to the deep snow, cold temperatures, and strong winds. There is no information to suggest that the Project site is an important nesting or foraging area for federal- or state-listed endangered or threatened birds or GMNF RFSS. The habitat on the site does not appear to be suitable for any listed species or Vermont species of concern. Similarly, the site is unlikely to be a concentration site or an important stopover area for migrant species (Kerlinger, 2006a).

Kerlinger (2006b) supplemented the Phase I Avian Risk Assessment with updated avian and wind energy information, particularly the potential impacts of turbine lighting on avian mortality, and whether night-migrating birds follow ridges or valleys in the Northeastern and Appalachian regions of the U.S. Although certain kinds of lighting have been shown to attract birds and cause mortality, Kerlinger (2006b) concluded that there has not been a large-scale fatality event at a wind turbine lit exclusively with L-864 lights, the type that would be used at the proposed Deerfield Project. Furthermore, there was no difference in the rate of fatalities of night migrants at turbines with L-864 red flashing lights and turbines not equipped with FAA obstruction lighting. To determine whether night-migrating bird follow ridges, Kerlinger (2006b) analyzed five radar studies at four Appalachian ridge-top sites in Pennsylvania, Maryland, and West Virginia. Results showed that migrant birds tended to cross ridges at oblique angles rather than following ridgelines. Flight direction varied substantially from night to night, suggesting that migrant birds were not following ridges. The mean height of migration along the Appalachian ridges ranged between 1,345 to 1,902 feet (410 and 580 meters). Migrants following ridgelines would likely fly at much lower altitudes, i.e., less than 492 to 656 feet (150 to 200 meters). Less than 14% of birds flew below 400 feet (122 meters), the approximate height of the tallest turbines proposed for the Project site (Kerlinger, 2006b).

Results from the Project’s migration studies were comparable to those from the studies reviewed by Kerlinger (2006b). Night-time migration of birds at the Project site did not appear to follow ridges; rather it appeared more as a general, broad front, proceeding at relatively high altitudes during most of the night (Kerlinger, 2006b).

3.10.1.3 Avian Mortality at Wind Facilities

Erickson et al. (2005) examined avian mortality for eight wind facilities in the western United States, upper Midwest, and eastern United States. The average estimated avian mortality rate at these facilities was 2.11 birds/turbine/year, or 3.04 birds/MW/year. Based on these mortality rates, annual U.S. mortality outside of California at that time was approximately 9,200 birds and 195 raptors (Erickson et al., 2005). The National Research Council (NRC) Committee on Environmental Impacts of Wind-Energy Projects compiled the most recent overview of avian mortality at wind energy sites. This report compared mortality rates from the same sites as Erickson et al. (2005) plus three more (Combine Hills, OR; Top of Iowa; and Mountaineer, WV). The 14 sites included a total of 1,213 turbines with a total generating capacity of 908 MW. Data were collected over a minimum of one year and mortality methods were standardized (i.e., scavenging and searcher efficiency biases are incorporated into estimates). Using this larger data set, annual mortality rates for all bird species averaged 4.27 birds/turbine/year, or 2.96 birds/MW/year. For raptors, average mortality rates were 0.03 raptors/turbine/year, or 0.02 raptors/MW/year (NRC, 2007). For two operating wind energy facilities on forested ridgelines in the eastern United States, total avian mortality ranged from 4.04 birds/turbine/year at the Mountaineer, WV facility to 7.7 birds/turbine/year at the Buffalo Mountain, TN facility (National Academy of Sciences, 2007).

Three years of post-construction bird mortality study (2006 through 2008) currently are available for the Maple Ridge Wind Power Project (Maple Ridge) located just west of Lowville, New York (Jain et al., 2007, 2009a,b). Though geographically closer to the proposed Project area than other studies reviewed in the NRC (2007) report, Maple Ridge is significantly larger than the proposed Project, consisting of 195 wind turbines, each approximately 400 feet (122 meters) tall, constructed in a grid over 21,100 acres. In addition, Maple Ridge is also much different from the Deerfield site in that it is located largely on open agricultural land (crops and pasture), with only a small portion on forested lands. Results from the first year of monitoring were obtained from a survey of 50 out of the 120 operational turbine sites. Mortality during the first year of operation ranged from 3.13 to 9.59 birds per turbine, depending on survey frequency (Jain et al., 2007). The second year of monitoring in 2007 included weekly surveys at 64 turbines, for a total of 1,736 turbine searches. Avian mortality ranged from 3.87 to 4.61 birds per turbine (Jain et al., 2009a). The third year of monitoring in 2008 included weekly surveys at 64 turbines, totaling 1,882 turbine searches. Avian mortality in ranged from 3.42 to 3.72 birds per turbine (Jain et al., 2009b). Post-construction mortality studies at several other facilities across New York have produced similar results (Munnsville Wind Farm: Stantec 2009b; Cohocton and Dutch Hill Wind Farms: Stantec 2010a, 2011b; Noble Altona Windpark: Jain et al., 2011a; Noble Wethersfield Windpark: Jain et al., 2011b ; Noble Bliss Windpark: Jain et al., 2009c, 2010a; Noble Clinton Windpark: Jain et al., 2009d, 2010b; Noble Ellenburg Windpark: Jain et al., 2009e, 2010c).

The Lempster Wind Facility is located on a forested ridge in New Hampshire, approximately 45 to 50 miles (80 km) northeast of the Deerfield Project area. The 2.0 MW turbines at Lempster are of similar size and physical dimensions to those proposed for installation at the Deerfield Wind Project. Standardized mortality surveys were conducted during spring (April 15 to June 1) and fall (July 15 to October 31) of 2009 and 2010. A total of 13 bird fatalities were recorded in 2009, with the majority (71%) occurring during the fall migration season. Once corrected for removal of carcasses by scavengers and searcher efficiency, the overall fatality rate was 6.75 birds/turbine/year or 3.38 birds/MW/year (Tidhar et al., 2010). During 2010, a total of 11 birds were found, resulting in an estimated total mortality of 5.27 birds/turbine/year or 2.64 birds/MW/year. Only two birds were found during the spring in 2010; most (73%) were found in September and early October (Tidhar et al., 2011). The majority of observed bird mortality at Lempster was small songbirds typical of the largely-forested setting: e.g., blackpoll warbler, magnolia warbler (*Dendroica magnolia*), red-eyed vireo (Vireo olivaceus), golden-crowned kinglet (*Regulus satrapa*), and Swainson's thrush (*Catharus ustulatus*). No raptors were found in either year. The largest bird mortality was an American crow (*Corvus brachyrhynchos*) in 2010 (Tidhar et al., 2010, 2011).

The Mars Hill Wind Farm, located along a forested ridgeline in Aroostook County, ME, began operation in March 2007. Mortality surveys were conducted at each of the 28 turbines in the spring, summer, and fall of 2007 and 2008. Once corrected for removal of carcasses by scavengers and searcher efficiency, the overall avian fatality rate during 2007 and 2008 ranged from 0.44 to 2.65 birds/turbine/year or 0.29 to 1.77 birds/MW/year. Fatalities were dispersed throughout the survey period, and likely involved both resident and migrant songbirds. The majority of observed bird mortality at Mars Hill, like that at Lempster, was small songbirds typical of the largely-forested setting: Blackburnian warbler (*Dendroica fusca*), magnolia warbler, red-eyed vireo, and golden-crowned kinglet. Also found was one barred owl (*Strix varia*) and one ruffed grouse (*Bonasa umbellus*) in 2008 (Stantec, 2008b, 2009a).

The 38-turbine Stetson Mountain Wind Project (Stetson I) in eastern Maine began operation in January 2009. In April 2010, Stetson II began operation of another 17 turbines immediately to the north of Stetson I. The Stetson turbines are located about 50 miles south of the Mars Hill facility, and about 300 miles northeast of the proposed Deerfield Wind Project. All 55 Stetson turbines are 1.5 MW with a maximum height of 390 feet (119 meters) from the base to highest point of the rotor-swept zone. Stantec (2010b) conducted weekly mortality searches at Stetson I from April 20 through October 21, 2009. A total of 39 bird fatalities (9 were counted as incidental) were found including 23 different species. Mortality was largely flycatchers, warblers, vireos, and kinglets. The exceptions were two ruffed grouse, one chimney swift (*Chaetura pelagica*), one hermit thrush (*Catharus guttatus*), one ruby-throated hummingbird (*Archilochus colubris*), and one red-tailed hawk that was electrocuted, not struck by a turbine. The estimated total mortality from the 2009 study was 4.03 birds/turbine/year or 2.68 birds/MW/year (Stantec, 2010b). Normandeau (2010) conducted weekly searches at Stetson II from April 19 through October 31, 2010. A total of 11 bird carcasses were found: five warblers, three red-eyed vireos, one eastern wood pewee (*Contopus virens*), one red-breasted nuthatch (*Sitta canadensis*), and one American crow or raven (*Corvus corax*). The estimated total mortality from the 2010 study at Stetson II was 2.14 bird mortalities per turbine per year or 1.42 birds/MW/year (Normandeau, 2010).

There have been numerous other studies and reviews of avian impacts from wind energy sites of varying sizes in the United States, Canada, and Europe. Results from these studies vary and data continue to change as more wind energy sites are studied and individual sites are studied over longer periods of time. The NRC (2007) suggests that predicted levels of avian mortality resulting from wind facilities are unlikely to result in measurable impacts to migratory populations of most species. Small impacts could prove significant, however, for unstable populations when combined with existing threats of mortality, such as predation and large weather-related bird kills (NRC, 2007).

3.10.1.4 Factors Affecting Bird Mortality at Wind Facilities

3.10.1.4.1 Flight Altitude during Migration

The vast majority of nocturnally migrating passerines fly at altitudes well above the rotor-swept area of wind turbines (NRC, 2007). In a review of radar studies in the eastern United States, Kerlinger (1995) reported that nocturnal migration altitude for passerines is relatively high, but variable, and concluded that three-quarters of migrating individuals fly at altitudes between approximately 300 and 2,000 feet (91 and 610 meters) above ground level. Birds migrate at varying altitudes, although most stay within the following ranges (Smithsonian Migratory Bird Center, 2010):

- Songbirds: 500 to 6,000 feet (150 to 2,000 meters), 75% of songbirds between 500 and 2,000 feet (150 and 600 meters)
- Shorebirds: 1,000 to 13,000 feet (300 to 4,000 meters)
- Waterfowl: 200 to 4,000 feet (60 to 1,200 meters)
- Raptors: 700 to 4,000 feet (200 to 1,200 meters)

Comparisons of flight behavior show that migrating birds pass over areas with wind turbines at higher altitudes than over control areas without wind turbines (BirdLife, 2002). In a study in Tarifa, Spain, based on daytime observation of 72,000 migrating raptors, birds flew at higher average altitudes (greater than 100 meters versus 60 meters) over wind turbines than over two other observation areas without wind turbines (Janss, 2000).

3.10.1.4.2 Flying Near Turbines without Collision

Based on post-construction radar and visual studies, Christensen and Hounisen (2005) concluded that some birds exhibit avoidance behavior in the presence of wind turbines, reducing the chances of fatal collisions. European offshore wind energy facilities provide the most comprehensive comparison of pre- and post-construction avian surveys to date. Winkelman (1994) observed that 84% (43 of 51) of the birds passing through the rotor-swept zone of European turbines were not killed; 98.8% of birds flew safely past turbines. In Spain, low mortality has been observed at a very large wind facility (greater than 1,000 turbines) located in a major migratory flyway (BirdLife, 2003). Although it is an offshore facility, radar surveys at Horns Rev have shown that eiders primarily flew around the wind facility following construction and birds that flew through the turbine array flew in the center of the areas covered by turbines (Dong Energy, 2006).

When birds demonstrate avoidance behavior in response to a wind facility, it might be at some distance from a turbine array or upon approaching an individual turbine or an oncoming blade (Winkelman, 1992). Most birds change their flight behavior to avoid wind turbines (Dong Energy, 2006; Erickson et al., 2001; BirdLife, 2002; Sterner 2002). Avoidance behavior appears to be species-specific, but it is influenced by weather conditions and whether the facility is in operation (NRC, 2007). Resident breeding birds appear to be able to adjust to some degree to wind turbines by displacing their movements away from, or otherwise avoiding turbines, whereas migrants are not exposed to individual sites long enough to learn about them, possibly increasing their risk (NRC, 2007). Pre- and post-construction radar and visual surveys of migrating birds at the neighboring Searsburg Wind Facility reported a decrease in the number of birds flying over the wind facility following construction, suggesting that migratory songbirds and raptors are able to avoid wind turbines post-construction (Kerlinger, 2002; Woodlot, 2005a).

3.10.1.4.3 Turbine Design and Lighting

The majority of bird mortality at wind facilities is assumed to be caused by collisions with wind turbine blades (NRC, 2007). Various features of, or small variations in, turbine or tower design could result in substantial increases or decreases in avian mortality. Wind turbine design has been changed over time to accommodate the particular needs of specific projects, to respond to varying regional regulatory requirements, and to incorporate technological advances and innovations. Wind turbine design features that can affect avian mortality include height of the structure; size, speed, and design of rotor blades; guy wires; lattice structures; and structure lighting. Newer wind turbine and tower designs do not include guy wires or lattice towers, which reduces risk of avian mortality. The towers proposed for the Project do not have any lattice structures.

The Federal Aviation Administration (FAA) requires warning lights on structures over 200 feet above ground level. Lighting on buildings, bridges, towers, or other structures can attract birds, especially birds migrating at night, in bad weather, or during other conditions of poor visibility, which increases the likelihood of collision. Bright lights that continuously illuminate fog or precipitation are particularly dangerous, especially in combination with tall structures with guy wires. Birds may fly at lower altitudes during inclement weather and poor visibility, thus increasing the likelihood of collision. Steady-burning lights (e.g., sodium vapor lights) have been shown to attract night-migrating birds and have been associated with increased bird mortality at communication towers and other tall structures (Erickson et al., 2001; Manville, 2001; Kerns & Kerlinger; 2004, Gauthereaux & Belser, 2006; NRC, 2007). For these reasons, flood lighting of tall structures should be avoided, especially on nights with inclement weather. Use of flashing lights appears to greatly reduce attraction and risk of collision for birds (Richardson, 1998; Gehring et al., 2009).

Current FAA guidelines specify that minimum lighting for a ridgeline string of turbines requires that turbines at each end of the string, and at least one turbine every 0.5 mile in between, should be lit with one flashing strobe light atop the nacelle. Minimum lighting requirements are satisfied with lights (L-864) that flash at least 20 flashes per minute. Analyses at numerous sites in the United States show no difference in avian mortality rates between unlit turbines and turbines with red flashing FAA lights (Erickson et al., 2003; Johnson et al., 2003a; Kerlinger, 2003; Kerns & Kerlinger, 2004; American Bird Conservancy, 2005; Kerlinger & Guarnaccia, 2007; NRC, 2007; Horn et al., 2008a).

3.10.1.4.4 Weather

Bird flight patterns may vary in response to weather conditions, which can affect the risk of mortality. Winds at higher altitudes are generally stronger than winds closer to the earth's surface. Therefore, birds fly at higher altitudes when the wind is blowing in the direction in which they are migrating, and at lower altitudes when the wind is blowing in the opposite direction (Smithsonian Migratory Bird Center, 2010). Opposing winds aloft can force birds to fly at lower altitudes to reduce their energy costs, and that may increase the risk of collision with wind turbines or other tall structures.

Inclement weather has been identified as an important factor contributing to bird collisions with obstacles, including power lines, buildings, and communication towers (Estep, 1989; Howe et al., 1995). Low-lying clouds, rain, mist, and fog may also increase collision risk by reducing visibility (Percival, 2001; Day et al., 2004; NWCC, 2004). Although the risk of collision may be higher during periods of low visibility, migrating birds generally avoid flying in clouds or fog banks, preferring to stay either above or below them (Alerstam 1990, in Percival 2001; Christensen & Hounisen, 2005). The effect of weather, however, is confounded by the heights of structures, types of lighting, and whether towers are guyed or not (NRC, 2007). Although inclement weather can increase the risk of collision with structures, this increased risk is anticipated to be minor, and is likely to be mitigated in some measure by a reduction in numbers of birds that tend to migrate in these conditions (Day et al., 2004; Pettersson, 2005).

3.10.1.4.5 Topography

The effect of topography on avian migration and the risk of mortality at utility-scale wind facilities is not entirely clear due to the limited range of landscapes that have been studied (NRC, 2007). The literature suggests that the significance of topographic features such as mountain ridges or major waterways in determining migration patterns is species-specific. A more consistent observation with regard to migration patterns may be that species with limited breeding and winter ranges tend to have more restricted migration routes while species with widely dispersed breeding ranges typically display a broad-front migration pattern (NRC, 2007).

One migration pathway is the Atlantic Flyway, which is a series of migration routes that run north/south and is defined by the offshore waters of the Atlantic Coast to the east and the Appalachian Mountains to the west. Because many bird species use coastlines to aid in navigation during migration, the Atlantic coast is an integral route along the Atlantic flyway. There are no rivers, lakes, or ocean coastlines that would concentrate large number of birds near the proposed Project. Instead, the landscape is composed of hills and valleys that are variable in orientation and do not influence migration direction (Kerlinger, 2002).

In general, current studies indicate that passerines are relatively unaffected by topographic variability and migrate in broad fronts (NCR, 2007). Early studies by Lowery and Newman (1966) report little or no evidence that migrating birds were influenced by mountain ranges or major rivers in the eastern United States. Similarly, Mabee et al. (2006) concluded that over 90% of targets (n=952) detected in a radar survey did not alter flight paths while crossing a high mountain ridge in the Allegheny Front in West Virginia.

3.10.1.5 Relative Risk for Species or Species Groups at Wind Facilities

The average number of bird deaths per turbine or the total avian mortality caused by collisions with wind turbines is important, but does not represent the impact at a species level. As an extreme example, there is a great difference in the impact of mortality of 10,000 bald eagles compared to similar numbers of red-winged blackbirds (*Agelaius phoeniceus*) or American robins (*Turdus migratorius*), given the vastly larger populations numbers of the latter two species. Several bird species and species groups would need to be analyzed in detail with regard to potential impacts. These would be species that have been observed in the area of a proposed project, species that may breed in, travel through, or migrate over the area, or species that may be particularly vulnerable to impacts from wind turbines.

Data collected from post-construction avian mortality assessments indicate that different groupings of birds are disproportionately at risk from wind turbines. Species- or group-specific risk levels may be augmented or mitigated under some circumstances by other biological factors such as abundance, migration, regional distribution, and behavioral patterns can influence mortality rates for particular avian species or suites of species (NRC, 2007).

3.10.1.5.1 Raptors

Historically, raptor mortality has often been a primary focus of impact studies at wind facility sites. Compared to newer wind facilities, older wind facilities typically had shorter towers, faster rotor speeds, and lattice-type towers. These lattice towers provided attractive perch and nest sites for raptors, which drew them to the towers, increasing the risk of mortality. Turbines often were placed close together at older sites, leaving less room for birds to pass between blades. The relatively slow decomposition rate of raptor carcasses, and therefore the high likelihood of finding carcasses, may also have inflated estimated mortality of raptors compared to other bird species (NRC, 2007).

Raptors appear to have little difficulty avoiding turbines when flying or soaring near modern, utility-scale wind facilities, which tend to have fewer, larger, and more widely spaced turbines with slower rotor speeds (Orloff & Flannery, 1992; Morrison, 1998; Roy & Erickson, 2007). Newer towers are smooth cylinders that do not provide perch and nest sites. Raptors constitute approximately 6% of all reported avian mortality nationally, or 3% of all mortality in the eastern United States (NRC, 2007). Janss (2000) observed only two raptors killed during the passage of a minimum of 47,500 raptors during 1,000 hours of observation in Tarifa, Spain. At the Mountaineer facility (66 MW) in West Virginia, raptor mortality included only one red-tailed hawk and one turkey vulture in spring and fall searches in 2003 (Kerns & Kerlinger, 2004). The NRC (2007) estimates that annual raptor mortality from 14 sites in the United States is 0.03 raptors/turbine/year, or 0.02 raptors/MW/year. For wind facilities located on forested ridgelines in New Hampshire and Maine, mortality of raptors has been observed only rarely (see Section 3.10.1.3).

3.10.1.5.2 Songbirds

Songbirds (order Passeriformes) are the most abundant bird group in terrestrial ecosystems and are the most often reported as experiencing mortality at wind energy facilities (NRC, 2007). Songbirds may account for 75% of all avian mortality at wind facilities nationwide (NRC, 2007). Despite this large proportion of total mortality, the absolute number of songbirds killed varied considerably between sites in the eastern United States. The reported rate of all bird mortality ranged from zero per year (5 months of study) at the Searsburg Wind Facility (Kerlinger, 1997d) to 11.7 per MW per year from a site in Tennessee (Nicolson, 2003). For wind facilities located on forested ridgelines in New Hampshire and Maine, highest frequency of avian mortality has been small songbirds typical of the forested setting: flycatchers, wood warblers, vireos, and kinglets (see Section 3.10.1.3, above).

3.10.1.5.3 Migrants and Resident Breeding Birds

Wind turbines are thought to present a greater risk to migratory avian species in general than to resident avian species. Resident birds may continually fly near turbines, but they appear to become habituated to them, avoid flying close to them, and show less reaction to them (Winkelman, 1985; Janss, 2000, Percival, 2001). Migrant birds, by contrast, have a brief exposure period to particular wind turbines, and do not have an opportunity to habituate to the turbines.

3.10.1.5.4 Threatened and Endangered Species, Regional Forester Sensitive Species, and Species of Special Concern

The proposed Project site does not provide suitable habitat for any federal- or state-listed threatened or endangered species, or any avian RFSS for the GMNF, with the exception of a small amount of habitat for rusty blackbird (*Euphagus carolinus*). The only likely breeding habitat for this species in the Project area is in delineated Wetland Q. This area was surveyed as a possible alternative access route that is no longer under consideration. The Proposed Action would have no impact on this site, as no Project components would be located there (see Section 3.9). Bicknell’s thrush, an RFSS for the GMNF, was recorded on the eastern ridge in 1994, 1996, and possibly in 1997. The presence of this species has not been observed since, and lack of suitable habitat makes future occurrence in the Project Area unlikely (see Section 3.10.1.2.5,).

3.10.1.6 Loss and Alteration of Habitat

Alteration of habitat associated with wind projects in forested settings includes habitat fragmentation, creation of open areas, and removal of individual trees. Habitat fragmentation typically refers to the breaking up of larger contiguous tracts of habitat into smaller patches that are isolated from each other by areas of unsuitable or less suitable habitat. In this way, habitat fragmentation can create barriers that isolate population segments or impede movement of individual animals or plants between areas of suitable habitat. Depending on the scale and spatial distribution of changes, as well as the kinds of habitats involved, alteration of habitat might be fragmenting for some species and not for others (Franklin et al., 2002; USDA Forest Service, 2006a,c). Therefore, consequences of habitat alteration may be very different for the encroachment of housing developments into forested areas, conversion of forest to agricultural uses, change in habitat type through forest management, or construction of a linear wind project along a forested ridgeline. In addition, changes that make habitat unsuitable for some species may create conditions that increase the suitability of the site for other species or suites of species.

Forests that are divided into small blocks of different habitats (for example, creation of numerous openings in a thickly-forested landscape) contain edge habitat that may benefit some species, but adversely affect others as a result of increased opportunity for predation and exposure to nest parasitism. A right-of-way (ROW), for example, when maintained in shrubby or herbaceous early successional habitat, can provide greater diversity and number of birds than older forested habitats (Confer & Pascoe, 2003; Yahner et al., 2003). A long-term study of bird populations along a ROW in Pennsylvania found that the ROW not only provided food and habitat for early successional species, but also provided food and habitat for forest interior species. In addition, some of the forest interior species appeared to shift their home range to include a portion of the ROW (Yahner et al., 2002). Although early successional habitat does not provide nesting habitat for interior forest species (e.g., wood thrush and ovenbird), these species may forage extensively in early successional habitat, especially during the post-fledging period (Vega Rivera et al., 1998; Marshall et al., 2003; Hartley & Burger, 2004; Vitz & Rodewald, 2007; King, 2007).

It is acknowledged that the characteristics of the surrounding landscape and proportional amount of habitat change can influence the relative impact of forest clearing on interior species. Impacts to the overall viability of a forest species from clearing for a project the scale of a wind facility likely would be less within a landscape that is dominated by large blocks of contiguous forest, compared to a fragmented landscape with small or isolated forest stands (NRC, 2007). In addition, King and DeGraaf (2002) found that small, narrow, low-density, un-surfaced roads in extensively forested areas in New England do not reduce productivity of forest passerines, suggesting that such roads did not cause habitat fragmentation for these species.

3.10.1.6.1 Nest Predation / Parasitism

Creating openings in forested areas that result in narrow forest roads, ROWs, and edge habitats is believed to increase rates of nest predation and parasitism (Wilcove, 1985; Small & Hunter, 1988), and this relationship may be particularly evident in smaller habitat patches and at habitat edges (Paton, 1994; Andren, 1995). Incidence of parasitism or predation on nests of forest birds by species such as brown-headed cowbirds (*Molothrus ater*), blue jays, and American crows may increase with increased edge habitat. Nest parasitism by brown-headed cowbirds tends to be positively correlated with density of human habitat, however, and cowbird parasitism is not likely to become a problem in forested areas away from livestock (Tewksbury et al., 2006; Coker & Capen, 1995). During post-construction monitoring at the Searsburg Wind Facility, Kerlinger (1997d, 2002) did not observe increased numbers of brown-headed cowbirds.

3.10.1.6.2 Avoidance / Displacement

Disturbance during construction and operation of the wind turbines may displace some species, while others would likely continue to forage and nest in the Project area. Some species may become habituated to the presence of wind turbines within a few weeks, months, or years, but the rate (and degree) of habituation is currently uncertain because long-term studies have not been conducted. Evidence indicates that some grassland species do not respond favorably to the presence of tall structures in their habitat. Studies conducted at wind energy projects in southwest Minnesota and in Wyoming revealed that grassland nesting birds are found in reduced numbers as the proximity to wind turbines increases (Johnson et al., 2000; Leddy et al., 1999). Forest and forest edge birds may be less likely to be significantly disturbed by the presence of wind turbines because these species are familiar with tall features (i.e., trees) in their habitat (Kerlinger & Guarnaccia, 2007).

One of the few studies on disturbance and displacement impacts from wind turbines on forest-breeding birds is a post-construction study of the existing Searsburg facility. In that study, point count surveys for breeding birds conducted before and after turbine construction showed that some birds [such as blackpoll warbler, yellow-rumped warbler, white-throated sparrow, and dark-eyed junco (*Junco hyemalis*)] appeared to habituate to the turbines within a year of construction. The study did not document how close to the turbines these species nested, but it clearly demonstrated that forest-nesting birds foraged and sang within forest habitat about 100 feet (30 m) from the turbine bases. Other species found in pre-construction surveys, such as Swainson's thrush, were absent in the initial post-construction surveys and appear to have been displaced by the turbines (Kerlinger, 2002). However, a subsequent visit to the Searsburg site six years later revealed that Swainson's thrushes were singing (and likely nesting) within the forest adjacent to turbines, and many other species were present close to the turbines (Kerlinger & Guarnaccia, 2007). This suggests that different species may habituate to the presence of wind turbines at different rates. It should be noted that the existing Searsburg turbines are approximately half the height of the proposed Deerfield turbines, and generate a different sound level, generally louder than newer generation turbines (see Section 3.4).

A recent study examined the nesting success of boreal-forest songbirds at linear energy facilities, such as pipelines, seismic lines, and access roads, in mature mixed forests in Western Canada (Ball et al., 2009). Songbird abundance and nest productivity were compared at the edge of the corridor, 656 feet from the corridor edge, and 1,312 feet from the corridor edge. Success rates for ground nests increased near the corridor edge, contrary to predictions. Success of above-ground nests were unaffected by proximity to the corridor edge, as was productivity of ground and above-ground nests. Songbird abundance increased near the corridor edge. The ovenbird was the only species of 19 evaluated that was less abundant near the corridor edge. Although the authors caution that, "not all edges are created equal" and "results for linear features in remote boreal regions may not have the same effect as other anthropogenic edges created elsewhere," there are considerable similarities between the habitat conditions and species present at the Canadian boreal forest study site and the Deerfield Project site (Ball et al., 2009; Kerlinger & Dowdell, 2003). This suggests that the forest-breeding birds at the Project site might respond in a similar manner to the creation of access roads. Post-construction monitoring and research could potentially answer such questions (see Section 3.10.4).

3.10.2 Direct and Indirect Impacts Presented by Alternative

Public scoping identified one significant issue in regard to birds. People are concerned that the Proposed Action will result in unacceptable mortality to avian species, including migrating and local populations, due to collisions with turbines and turbine blades.

The analysis area for direct and indirect impacts to birds is the Project area, which includes GMNF Compartments 121, 122, 123, and 124 of the Manchester Ranger District. Potential direct impacts to birds associated with construction and operation of the proposed Project include risk of collision with turbines or towers and alteration of habitat. Potential indirect impacts include disturbance associated with the presence or activity of construction equipment and ongoing maintenance after construction; changes in movements of resident or migratory birds in response to the turbines, other structures, and altered habitat; and shifts in species composition in the Project area. Indicators used to analyze direct impacts to birds include numbers and species composition of birds that might be killed by collision with turbine blades, towers, or support structures (estimated level of risk of mortality), and the number of acres of mature forest habitat converted to other habitat types. Indicators of indirect impacts include changes in species composition or behavior of resident breeding birds at the Project site, and changes in species composition or flight patterns of birds migrating past the Project site.

3.10.2.1 Proposed Action

The Proposed Action would include installation and maintenance of 17 turbines, as well as access roads, electrical collection lines, a substation, and other associated support structures on the ridges to both the east and west of Vermont Route 8 in Searsburg and Readsboro. The discussion of potential impacts of the Proposed Action (and alternatives) focuses on the operation of the facility (operation-related impacts). Construction-related impacts to birds would be limited to incidental injury and mortality and disturbance/displacement due to construction activity and traffic over the anticipated nine-month construction period. These impacts would be short-term and minimal.

3.10.2.1.1 Direct Impacts

Potential direct impacts for the Proposed Action include collision impacts and habitat alteration impacts.

Collision Impacts

Operation of the Proposed Action would cause some mortality of birds from collision with turbine blades and turbine towers. A lack of long-running wind energy facilities in New England limits the availability of comprehensive data on avian mortality that might be applicable to the Deerfield Wind Project. The most likely assumption is that bird mortality at the proposed Deerfield site would be of a scale and species composition similar to that observed at ecologically similar sites on forested ridgelines in northern New England: Lempster, NH (a range of 5.27 to 6.75 birds/turbine/year in 2009 and 2010; Tidhar et al., 2010, 2011); Mars Hill, ME (a range of 0.44 to 2.65 birds/turbine/year in 2007 and 2008; Stantec, 2008b, 2009a); Stetson Mountain I, ME (4.03 birds/turbine/year in 2009; Stantec, 2010b); and Stetson II, ME (2.14 bird/turbine/year in 2010; Normandeau, 2010). The average mortality for the Lempster, Mars Hill, and Stetson facilities during six study years, weighted by the number of turbines, was 3.54 birds/turbine/year. This method estimates total avian mortality from collision at 60 birds per year for the entire 17-turbine Proposed Action. Using the lowest (0.44 birds/turbine/year) and highest (6.75 birds/turbine/year) estimated rates of mortality from these similar New England facilities results in a range of total estimated mortality of 8 to 115 birds per year for the 17-turbine Deerfield facility. Based on the observed species composition of avian mortality at sites located on forested ridgelines in northern New England (New Hampshire and Maine), the most likely assumption is that avian mortality at the proposed Deerfield site would be largely composed of flycatchers, wood warblers, vireos, and kinglets, with few or no raptors. See Section 3.10.1.3, above.

It is anticipated that avian mortality from the Proposed Action might be at the low end of this projected range. Pre-construction studies and analysis do not suggest any conditions likely to result in substantially higher mortality that at other sites in the region. Results from on-site surveys suggest that rate of passage for migratory songbirds at the Project site and over the hilltops of southern Vermont is generally low compared to other sites (Kerlinger, 1995, 1997a, 2006a; Woodlot, 2005a,b,c, 2006). Avian migration in the Project area generally occurs as a broad front; topography does not appear to funnel birds through the Project site. In addition, birds that migrate over the Project site usually do so at higher altitudes than the heights of proposed turbine rotors (Table 3.10.1-2). These average flight heights and percentages below turbine height are comparable to pre-construction surveys conducted at other sites in the Northeast (Roy & Erickson, 2007; Stantec, 2008a). The numbers of birds flying over the site were similar or less than numbers reported from other inland locations in New England and fewer than reported in many studies conducted farther south (Kerlinger, 1997a). Other Northeastern and New England sites included in the surveys noted above include Lempster, NH; Mars Hill, ME; Stetson Mountain I and II, ME; Franklin, WV; Fairfield, Jordanville, Prattsburgh, and Cohocton, NY. In addition, in pre- and post-construction migration studies at the Searsburg Wind Facility, fewer nocturnal migrants were counted after construction of the turbines, suggesting migrants may avoid turbines (Kerlinger, 2002).

Mortality of migratory raptors caused by the Proposed Action also is anticipated to be low, as it is at most recently-built wind facilities (NRC, 2007). The number of raptors flying past the Searsburg Wind Facility varied considerably during pre- and post-construction surveys (Kerlinger, 2002; Roy & Erickson, 2007), but overall numbers were relatively low. Studies at the Project site detected low numbers of migrating raptors compared to other sites in the region, and there is no evidence to suggest that the Project site is located within a major raptor migration corridor or that the topography of the site is channeling raptors over the Project area (Martin, 1993, 1994; Kerlinger, 1996, 1997c, 2006a; Roy & Erickson, 2007). In addition, data from post-construction mortality studies suggest that raptors are generally able to avoid colliding with turbines (Orloff & Flannery, 1992; Morrison, 1998; Roy & Erickson, 2007; NRC, 2007). For more detail, see Section 3.10.1.2.2, above.

According to the Vermont Bald Eagle Recover Plan (VTFWD, 2010a), the nearest nesting bald eagle is in the Town of Rockingham (in northeastern Windham County), approximately 30 miles from the Project site. This is beyond the 10-mile distance where assessment of potential risk and the need for an incidental take permit under the Bald and Golden Eagle Protection Act is typically required (USFWS, 2010c).

Mortality of resident nesting bird species due to the Proposed Action also is expected to be low, based on results from on-site surveys. Species that nest on and near the site typically fly below the forest canopy at heights that would not bring them into the rotor-swept zone (Kerlinger & Dowdell, 2003). As noted above, resident birds that live near wind turbines appear to become habituated to them, avoid flying close to them, and show less reaction to them (Winkelman, 1985; Janss, 2000; Percival, 2001).

For raptors and migrating songbirds, pre-construction avian surveys provide limited ability to predict mortality. Consequently, predicted levels of annual avian mortality for the proposed Project are speculative at best, pending empirical results from comprehensive, scientifically- and statistically-rigorous, post-construction monitoring. Such monitoring would be an integral component of any Special Use permit for construction and operation of the Proposed Action or any action alternatives (see Section 3.10.4).

Mitigation of Potential Collision Impacts

To mitigate avian collision impacts, the Applicant would be required to comply with the design criteria and mitigations stipulated by the Forest Service. This would include appropriate points of the Iberdrola Renewables Avian and Bat Protection Plan, which includes training operations personnel in the proper way to handle and report avian casualties and injuries (Iberdrola, 2008). This document has been independently reviewed by the Forest Service. In addition, the CPG issued by the PSB included the following conditions designed to avoid, minimize, and/or mitigate avian impacts:

- Deerfield (i.e. the Applicant) shall not undertake bulldozing, tree cutting, and blasting in areas proximate to breeding bird habitat during May and June to protect breeding birds. If Deerfield anticipates that construction will occur over the course to two seasons, Deerfield may propose that construction be allowed during May and June, but shall demonstrate that such permission will lessen the impact on breeding birds.
- Deerfield shall submit a post-construction bird and bat mortality study to the Board for review and approval, and shall obtain such approval prior to commencing commercial operation of the Project. The bird and bat mortality study plan shall at a minimum include the following elements:
    1. The study will be conducted for up to three years, with a minimum of two years.
    2. The studies will be performed by a qualified third party consultant;
    3. The study periods will cover spring, summer, and fall;
    4. Scavenging rates and searcher efficiency controls will be established for each period of study;

5. Scientifically and statistically valid survey protocols will be employed based on the best available scientific information;

6. Use of dogs on the project site will be limited to the extent absolutely necessary to design and test valid survey methods;

7. The methodology will be designed to minimize impacts on other natural resources within the Project area including bear and moose habitat; and

8. The Board and parties will have opportunity to review the study results at the end of each study year.

- Deerfield will engage with the Forest Service and ANR in a cooperative, team-based process to review bird and bat mortality data. If post-construction fatality monitoring demonstrates that the Project is having an undue adverse impact, (i.e., avian or bat fatality estimates over the two-year period exceed the most currently established threshold ranges for mortality at wind projects on northern forested ridges), Deerfield shall submit an adaptive management plan to ANR and the Board. The adaptive management plan will incorporate reasonable scientifically-proven measures to reduce fatality rates of the affected bird or bat species, and perform monitoring to evaluate the efficiency of the adaptive management measures. Actual measures to be taken will depend on the type and severity of impacts, and the likelihood of accomplishing the desired outcome. The Forest Service, in collaboration with the Public Service Board, shall retain final review and approval authority regarding the implementation of any adaptive management plan, and the need for a third year of morality studies.

The monitoring and research program would be enhanced by any additional requirements of the Forest Service (see Section 3.10.4). It would be designed to determine actual rates of mortality to the extent possible. As described in Section 3.10.4, the results from the monitoring program could be used to develop adaptive management plans or other forms of mitigation, as needed, to reduce the potential risk to avian species.

Habitat Alteration Impacts

Under the Proposed Action, 87.4 acres would be cleared and/or graded during construction activities, totaling 0.9% of the Project area. NFS lands account for 73.1 acres of proposed clearing and grading activities; the remaining 14.3 acres would occur on private lands. Impacts related to permanent alteration of forest habitat along the collection lines have been minimized, as described in Section 3.9. In addition, a vegetation management plan would be developed and implemented to promote growth of vegetation along roadsides and up to turbine bases to produce desired vegetation and habitat conditions.

Alteration of habitat due to the Proposed Action is expected to result in small decreases in abundance or spatial displacement of some forest interior nesting birds, such as Swainson's thrush, ovenbird (*Seiurus aurocapillus*), black-throated blue warbler (*Dendroica caerulescens*), and Canada warbler (*Wilsonia canadensis*) in the immediate area. At the same time, the Proposed Action would produce a beneficial direct impact for species that nest or forage in the forest edge and early successional habitat that will be created by clearing forest habitat for roads, turbine sites, and electrical connection lines. Species such as American woodcock, ruffed grouse, and several species of flycatchers, warblers, and sparrows would benefit from creation of early successional habitat in the Project site. As described above, several species that nest in interior forest may benefit to some degree from increased foraging opportunities in cleared forest areas around turbines and along roads, particularly during the post-fledging period.

Creation of edge habitat could increase numbers of American crows, blue jays, brown-headed cowbirds, and other nest predators around openings and edges created for turbines and along roads and connection lines. As noted above, cowbirds are unlikely to be a factor so far from livestock and human dwellings. Because mature forests are dominant in the regional landscape, impact to forest interior species from habitat loss or increased numbers of predators likely would be minor. Interior forest species, forest edge, and early successional species, including nest predators, already occur on the Project site (Kerlinger & Dowdell, 2003).

3.10.2.1.2 Indirect Impacts

Potential indirect impacts from clearing for the proposed turbines, electric lines, and roads include disturbance associated with the presence or activity of construction equipment and ongoing maintenance after construction; changes in movements of resident or migratory birds in response to the turbines, other structures, and altered habitat; and shifts in species composition in the Project area. The degree to which birds would be disturbed by construction activity is uncertain, but this disturbance would be short-term and the overall impact to resident and migratory birds would likely be minor. The same could be said for impacts of on-going operations and maintenance; any impacts would be short-term and intermittent and would produce minimal if any adverse impacts.

The impacts of habitat change should be low for most species. The amount of mature forest habitat that would be lost represents a small proportion of this habitat type in the region, which is dominated at a landscape level by mature forest. Impacts to interior forest species likely would be negligible. In contrast, availability of early successional habitat is limited across the regional landscape and small increases in this habitat can have a relatively greater impact. Thus, habitat change resulting from the Proposed Action likely would increase habitat diversity and provide relatively greater beneficial impacts to early successional species compared to the adverse impacts to interior forest species. It is acknowledged that creating habitat that attracts early successional species could put that species group slightly more at risk to mortality from collision impacts as described above in Section 3.10.2.1.1.

Neither disturbance from construction and operation and maintenance activities nor anticipated minor habitat alterations would be expected to adversely affect or result in unacceptable changes in species composition or behavior of resident breeding birds at the Project site, nor would it be expected to impact species composition or flight patterns of birds migrating past the Project site. Also, because of low likelihood of occurrence, there would be no anticipated indirect impacts on any state- or federally-listed threatened or endangered species, RFSS, or Vermont species of special concern.

3.10.2.1.3 Mitigation and Design Criteria for Reducing Impacts

Direct and indirect impacts related to the proposed Project would be minimized through site design, adherence to designated construction limits, avoidance of sensitive areas, and minimizing disturbance to the maximum extent practicable (see Section 3.10.2.1.1). Turbine technology and site design has evolved to eliminate or dramatically reduce the high rates of avian mortality observed at some early facilities, such as those in northern California where raptor mortality was documented. Turbines generally are placed farther apart than in older wind facilities and turbines are mounted on tubular towers rather than lattice structures to minimize likelihood of raptors or other birds perching and nesting on the towers. The proposed Deerfield Project incorporates these kinds of design elements. In addition, all electrical lines between the turbines would be buried and all aboveground segments of the 34.5 kV collection lines would adhere to all applicable guidelines for insulation and spacing recommended by the Avian Power Line Interaction Committee. See Section 1.4 for complete Project details.

Other design criteria would include installing aircraft safety lighting at the minimum number and brightness allowed by the FAA. Synchronous, red flashing lights would be mounted on the nacelles of those turbines at the ends and within each string in accordance with FAA guidelines. No daytime lighting would be required since the turbines are anticipated to be white or off-white in color. Lights at the substation and storage and maintenance facility would have cutoff luminaries that direct light toward the ground, eliminating light broadcast into the sky. Outdoor lighting would be controlled by manual switch or motion detectors that turn lights on only when necessary. Specific design criteria and mitigations are described in Appendix A.

Implementation of a rigorous, scientifically-based monitoring and research program used to develop adaptive management techniques based on monitoring results, would also be effective in reducing impacts. The overall objective of monitoring and of adaptive management would be to reduce and effectively minimize mortality. It is important to note that correlation between observed, pre-construction bird activity and post-construction impact is not definitive. The value of surveying pre-construction bird activity lies in estimating the level of potential risk to avian species likely to result from Project construction and operation. Actual impacts of the Project can be determined only through post-construction study and monitoring. See Section 3.10.4 below and Appendix H.

A standard condition of any Special Use Permit issued by the Forest Service is that the holder shall comply with all present and future laws and regulations. Should the Responsible Official decide to issue a land use authorization for the Proposed Action or one of the action alternatives, this condition would require compliance with the Migratory Bird Treaty Act of 1918 (MBTA), the Bald and Golden Eagle Protection Act, and the Endangered Species Act. Compliance with these Acts would require consultation between the Applicant and the USFWS. This permit condition, along with the required mitigation and design guidelines described above, would also enable compliance with Executive Order 13186 "Responsibilities of Federal Agencies to Protect Migratory Birds", which requires that all federal agencies follow practices that "prevent or abate the pollution or detrimental alteration of the environment for the benefit of migratory birds, as practicable." A Memorandum of Understanding (MOU) with the U.S. Fish and Wildlife Service provides guidance related to the NEPA process such as:

- Evaluate and balance long-term benefits of projects against any short or long term adverse effects.
- Pursue opportunities to restore or enhance the composition, structure, and juxtaposition of migratory bird habitats in project areas.
- Consider approaches for identifying and minimizing take that is incidental to otherwise lawful activities, including altering the season of activities to minimize disturbances during breeding season; retaining snags for nesting structures; and giving due consideration to key wintering areas, migration routes, and stopovers.
- For wind energy developments, use existing FS guidance and other relevant information for minimizing adverse effects to migratory birds and for monitoring.

The Deerfield Wind Project is consistent with the conditions in the MBTA. The USFWS has the authority to decide whether or not an agency is in compliance with the MBTA. The Forest Service (and the Applicant to the extent allowable) would work with the USFWS to address issues regarding compliance with the MBTA.

3.10.2.2 Alternative 1: No Action

No turbines, access roads, or other Project components would be constructed under the No Action Alternative, and therefore no direct, indirect, or cumulative impacts to birds would be anticipated. There would be no additional risk of mortality to birds from the No Action Alternative. Vegetative communities would continue to be managed under the directives outlined in the 2006 Forest Plan for the Diverse Forest Use Management Area. In the short term, landscape-level conditions would remain the same. Over the long term, forest stands would continue to mature, with existing young forest and openings, including openings currently used for meteorological towers (should they be removed), succeeding to older forest stands. The area would continue to provide uninterrupted nesting habitat for interior forest birds. Conversely, the increasing homogeneity of the mature-forest habitat structure over time and lack of introduced early successional habitats would provide less suitable habitat for bird species that nest or feed in them.

3.10.2.3 Alternative 2: Reduced Turbines in Western Project Site

Alternative 2 would reduce the number of turbines on the Western Project site from 10 to eight by removing three turbines from the southerly end of the Western Project site and adding one at the northern end, with an associated reduction in clearing for turbine pads and roads. The East side configuration of seven turbines would be the same as for the Proposed Action. The actual area of disturbance attributed to all construction for the Reduced West alternative is approximately 85.4 acres. The Reduced West alternative's 15-turbine configuration would use five 2.0 MW Gamesa G80 turbines and ten 2.0 MW Gamesa G87 turbines. The G87 turbines have a slightly longer blade resulting in a total rotor diameter of about 286 feet (87 meters). These turbines would have a maximum blade tip height about 11 feet (3.5 meters) taller, at 398 feet (121.3 meters), than the 387-foot tall G80 turbines. Such a small difference in rotor diameter and height is not anticipated to produce any change to the potential impacts. Overall impacts to birds under Alternative 2 likely would be somewhat lower than those described for the Proposed Action, proportional to the reduced number of turbines and the slightly lower habitat alteration.

The potential for direct impacts due to collisions would be slightly less than the Proposed Action due to the reduction in turbine numbers from 17 to 15. Using the same approach as for the Proposed Action above, the estimated total avian mortality would be 53 birds per year for the entire proposed 15-turbine Reduced West alternative based on the average mortality of 3.54 birds/turbine/year observed in recent years at New England facilities. Using a range of 0.44 to 6.75 birds/turbine/year as above, would generate a range of estimated total mortality of 7 to 102 birds per year. Based on the observed species composition of avian mortality at sites located on forested ridgelines in northern New England, avian mortality from Alternative 2 would likely be largely composed of flycatchers, wood warblers, vireos, and kinglets, with few or no raptors. As with the Proposed Action, avian mortality from Alternative 2 would be expected to be at the low end of this range. Another direct impact, the amount of mature forest habitat lost (altered), or conversely, the amount of early successional habitat created, would be slightly less that for the Proposed Action, and the potential adverse and beneficial impacts would be proportionally reduced, as well.

Despite the slight reduction in Project footprint under Alternative 2, indirect impacts would largely remain unchanged because this alternative still spans the entire Project area previously proposed, and because roads and electrical lines must still link the turbines. This alternative would still require an overhead electrical collection line and associated cleared ROW in order to link the Eastern and Western Project sites. Disturbance associated with construction and with operation and maintenance, and the anticipated minor habitat alterations, as for the Proposed Action, would not adversely affect or result in unacceptable changes in species composition or behavior of resident breeding birds at the Project site, nor would it impact species composition or flight patterns of birds migrating past the Project site. Likewise, there would be no anticipated indirect impacts on any state- or federally-listed threatened or endangered species, RFSS, or Vermont species of special concern.

The design criteria and mitigation described for the Proposed Action would also be applied for Alternative 2. The monitoring and research program for bird mortality would also be developed and applied under Alternative 2. The monitoring program would be designed to determine actual rates of mortality, which could be used to develop adaptive management plans or other forms of mitigation, if needed, to reduce the potential risk to avian species (see Section 3.10.4). Again, the overall objective would be minimizing mortality as much as possible.

3.10.2.4 Alternative 3: Turbines in Eastern Project Site Only

Alternative 3 would reduce the total number of turbines to seven, with an associated reduction in clearing for turbine pads and roads. Alternative 3 would result in a total area of disturbance of approximately 49.6 acres. Impacts to birds under Alternative 3 would be lower than those described for the Proposed Action and Alternative 2, approximately proportional to the reduced number of turbines. Removal of all turbines from the Western Project site would essentially eliminate all direct and indirect adverse and beneficial Project-related impacts to birds in this area. Roadways and electrical connectors in the Western Project site under the Proposed Action and Alternative 2 would not be constructed under this alternative. There also would be no electrical collection system constructed between the Eastern and Western Project sites under Alternative 3. The seven turbines built on the Eastern Project site would be the same as for the Proposed Action and Alternative 2. A new substation would be constructed adjacent to the existing GMP substation on Sleepy Hollow Road, and the existing transmission line that runs northeast parallel to the road would be upgraded, resulting in slightly greater impacts for these features.

The potential for direct impacts due to collisions would be considerably less than the Proposed Action and Alternative 2 due to the reduction in turbine numbers. Using the same approach to estimate bird mortality as for the Proposed Action above, the estimated total mortality would be 25 birds per year for the entire proposed seven-turbine East Side only alternative based on the average mortality of 3.54 birds/turbine/year observed in recent years at New England facilities. Using a range from 0.44 to 6.75 birds/turbine/year yields a range of estimated total mortality of 3 to 48 birds per year. Based on the observed species composition of avian mortality at sites located on forested ridgelines in northern New England, avian mortality from Alternative 2 likely would be largely composed of flycatchers, wood warblers, vireos, and kinglets, with few or no raptors.

Due to the general differences in habitat types between the Eastern and Western Project Sites, the relative numbers and species composition of resident birds exposed to the facility likely would be slightly different under this alternative compared to the Proposed Action or Alternative 2. Whether such differences would be reflected in avian mortality, or if mortality would vary for different turbines, would be determined only with post-construction monitoring. Another direct impact, the amount of mature forest habitat lost, or conversely, the amount of early successional habitat created, would be less than for the Proposed Action or Alternative 2, and the potential adverse and beneficial impacts would be proportionally reduced, as well.

Indirect impacts to birds from Alternative 3 would be expected to be reduced compared to the Proposed Action and Alternative 2, approximately proportional to the area of forest cleared. Lack of any Project activity on the Western Project site would eliminate all indirect effects from that area. Disturbance associated with construction and with operation and maintenance, and the anticipated minor habitat alterations would be less than that for the Proposed Action and Alternative 2, and likewise, would not adversely affect or result in unacceptable changes in species composition or behavior of resident breeding birds at the Project site, nor would it impact species composition or flight patterns of birds migrating past the Project site. Similarly, there would be no anticipated indirect impacts on any state- or federally-listed threatened or endangered species, RFSS, or Vermont species of special concern.

The design criteria and mitigation described for the Proposed Action would also be applied for Alternative 3, including development of a monitoring and research program for bird mortality.

The monitoring program would be designed to determine actual rates of mortality, which could be used to develop adaptive management plans or other forms of mitigation, if needed, to reduce the potential risk to avian species (see Section 3.10.4), with the overall objective of minimizing mortality as much as possible.

3.10.3 Cumulative Impacts

Cumulative impacts to birds would include both direct and indirect impacts resulting from the proposed Project, in combination with impacts from past, present, and reasonably foreseeable future actions. The analysis area for cumulative impacts to birds focuses on the affected environment for direct and indirect impacts, namely the Project area. In addition, this discussion acknowledges impacts from other sources within the normal range of movement for individuals of each species, including movement between summer and winter ranges. For migratory birds, impacts resulting from the proposed Project would be additive to mortality and other impacts from other sources encountered between summer and winter ranges. It is extremely difficult to estimate the total cumulative impacts to birds from all sources, and reliable data needed to do so is not available, including definitive data for population levels for many of the species potentially affected. Besides population size, assessment of cumulative impacts to populations requires knowledge of total mortality, fecundity, and other demographic parameters, most of which are not available in sufficient detail for bird species that occur in the Northeast. Consequently, assessment of cumulative impacts becomes largely an estimation of the relative level of risk associated with each alternative when evaluated cumulatively with all other impacts.

The cumulative impact analysis will consider past actions over the last 5 to 10 years, and reasonably foreseeable future actions in the next 5 to 10 years. The 10-year timeframe is effective because by 10 years after timber management or other vegetation-altering activities, regenerating stands have aged to the point when characteristics and ecological benefits of early successional habitat begin to diminish.

The only past activity that could cumulatively contribute to avian mortality is the operation of the Searsburg facility, which began operations in 1997, slightly before the beginning of the 5 to 10-year period for past activities. This facility represents a continuing potential source of avian mortality. Turbines at the Searsburg facility, however, are considerably smaller than those proposed for Deerfield; the blade tip is half as high above ground at its highest point and the rotor-swept zone of each turbine is approximately one quarter that of the larger proposed turbines. No avian mortality was reported during mortality searches in 1997 after the facility became operational. However, post-construction monitoring for the Searsburg facility was perhaps less sophisticated than current studies and therefore, care should be exercised in drawing comparisons from these results.

The Berkshire Wind Power Project is operational and was dedicated in May 2011. This 10-turbine facility, operated by a cooperative of non-profit public power entities, is located in the Town of Hancock in Berkshire County, MA, approximately 23 miles southwest of the Deerfield Project site. Each of the 1.5 MW turbines is slightly less than 400 feet tall from base to blade tip at its highest point. These turbines are located on a north-south forested ridge at elevations of about 2,500 to 2,700 feet. Although little information is available about this project, presumably the amount of clearing and construction of roads and turbine pads is proportional to that of the proposed Deerfield Project or the Hoosac facility (see below), based on the number of turbines.

Located about 45 to 50 miles northeast of the Deerfield Wind Project, the 12-turbine Lempster Wind Project began operation in November 2008. Like the proposed Deerfield Project, the Lempster facility turbines are situated along a forested ridge that is oriented approximately north-south. Clearings for turbines, access roads, and other infrastructure were cut from mostly a mixed hardwood-coniferous forest that contained some open areas. Each turbine is about 400 feet tall from base to blade tip at its highest point.

The Hoosac Wind Power Project is currently under construction, with operation anticipated to commence in 2012. The Hoosac facility will consist of two arrays of turbines, one of 11 turbines and one of 9 turbines, each with an approximate north-south orientation. Individual turbine sites range in elevation from approximately 2,300 to 2,800 feet. Each turbine would be about 340 feet tall from base to blade tip at its highest point (Arnett et al., 2007). Like the proposed Deerfield Wind Project, the Hoosac facility will create clearings along forested ridgelines for turbines, access roads, power lines, and other facilities. About 73 acres will be cleared for construction with about 15 acres being maintained long-term in a cleared condition. This project is located in towns of Florida and Monroe, MA, with most of the project lying about 8 to 10 miles south of the Deerfield site.

Other future activities that could affect bird habitat include timber harvesting and other resource management actions conducted by the Forest Service or private landowners. Such activities result in loss of mature forest habitat that is suitable for interior forest birds, but they create openings and regenerating forest stands that are essential habitat for early successional species and those that prefer forest edge. Although the Forest Service is not planning any timber sales or other large-scale habitat-altering activities within the Project area in the foreseeable future, a landscape-scale planning effort for NFS lands south and west of the Project area is expected to begin in 2011. This planning effort might include additional GMNF lands south of Route 9 and east of the Project area, as well. It would be at least one to two years beyond 2011 before any definite proposals would be analyzed. No specific proposals are known at this time. Timber harvesting on private lands in or near the Project area has occurred in the recent past and would be expected to continue. There is very little private land within the Project area. Regarding future harvests, there is no record-keeping or advanced planning on most of the private land in the Project vicinity (Fice, 2008). There are also no known road improvement projects or major subdivisions, housing developments, or other similar actions proposed on adjacent private lands. The remoteness of the area and abundance of public land in the region contributes to the lack of major developments. Thus the level of habitat-altering activities over the next 10 years is anticipated to be low and there would be little if any cumulative impact due to habitat fragmentation or other changes affecting bird nesting and foraging habitat.

The operating Searsburg and Berkshire facilities, the Hoosac facility that is under construction, and the proposed Deerfield site would likely pose similar risks of direct impacts on birds (collision with towers or blades). Applying the same average mortality estimate (i.e., 3.54 birds/turbine/year) used for each of the Deerfield alternatives, above, the cumulative estimated mortality of birds for all four facilities in southern Vermont and western Massachusetts (Deerfield, Searsburg, Berkshire, and Hoosac) would be 206 birds each year (249 if Lempster, NH is included) for the Proposed Action; 199

birds per year (242 birds if Lempster is included) for Alternative 2; and 171 birds per year (214 birds with Lempster) for Alternative 3. Alternatively, using the range of high and low observed rates (i.e., 0.44 to 6.75 birds/turbine/year), as above, yields total estimated cumulative mortality ranges of 27 to 393 birds per year for four facilities (33 to 474 if Lempster is included) for the Proposed Action; 26 to 380 birds per year (32 to 461 if Lempster is included) for Alternative 2; and 22 to 326 birds per year (28 to 407 if Lempster is included) for Alternative 3.

Indirect impacts to birds due to altered habitat conditions presumably would also be similar for these projects, and approximately proportional to the total acreage of cleared forestland. No direct or indirect cumulative impacts would be anticipated from the No Action alternative.

Overall, human-related sources have been estimated to kill from 500 million to one billion or more birds annually in the United States (Erickson et al., 2005; USFWS, 2002). Avian mortality at wind energy facilities probably represents from 0.01% to 0.02% of annual avian mortality from collision with man-made structures in the United States (Sagrillo, 2003). Even if wind energy facilities were more numerous (e.g., 1 million turbines), they would likely account for only a few percent of all avian collision mortality (Erickson et al., 2001, 2005). Turbines constructed at the Project site would contribute to an increase in wind energy facilities in the United States, contributing incrementally to an increase in the total birds killed by human-related sources.

Table 3.10.1-4: Estimated Annual Avian Mortality from Anthropogenic Causes in the United States.

Mortality Source	Estimated Annual Mortality	Citation
Collisions with Buildings	100 million to 1 billion	Klem, 1990, 2009.
Collisions with Power Lines	130 – 174 million	Koops, 1987 Erickson et al., 2005
Predation by Domestic Cats	100 million to 1 billion	Coleman & Temple, 1996 Dauphine & Cooper, 2009
Automobiles	80 million	Banks, 1979; Hodson & Snow, 1965
Pesticides	67 million	Pimentel et al., 1991
Communication Towers	4 - 50 million	USFWS, 2002
Oil Pits	1.5 – 2 million	USFWS, 2002
Wind Turbines	20,000 - 37,000	Erickson et al., 2005

In summary, it is understood that calculating avian mortality from all sources, including human-related sources that are estimated to kill millions of birds annually, is extremely difficult. The level of risk of avian mortality from implementation of the Proposed Action or Alternatives 2 or 3 would be expected to be low to moderate; predicted mortality would add very little to the overall cumulative mortality of avian species.

As noted above in the discussion of direct and indirect impacts, the correlation between observed, pre-construction bird activity and post-construction mortality is not definitive. Results from post-construction monitoring will be used to determine whether actual direct, indirect, and cumulative impacts are greater or less than predicted. With the overall objective of reducing or minimizing mortality, adaptive management procedures would be implemented, as necessary, based on post-construction monitoring results.

3.10.4 Scientific Monitoring and Research Study

Scientific uncertainty over the impacts of a development like the proposed Project can be analyzed and resolved only through continuing monitoring and research efforts. Although it would not be meaningful to conduct avian research during construction, research is proposed for several years of normal operation after construction as described in Appendix H. Sampling and analysis techniques for monitoring mortality of birds at wind facilities has become increasingly sophisticated and standardized to address factors such as probability of detecting carcasses, observer bias, removal of carcasses by scavengers, etc. (e.g., Anderson et al., 1999; Morrison, 2002; Arnett et al., 2005; Kunz et al., 2007; PA Game Commission, 2008; NYSDEC, 2009; OMNR, 2010). Specific elements of this monitoring and research program would be developed in consultation with an expert team of biologists including representatives of the Forest Service, Vermont ANR, USFWS, and experts in ecology and biology of birds in the Northeast. This comprehensive monitoring plan would have to be completed and approved by the GMNF Forest Supervisor prior to beginning of construction. It can also be expected that the monitoring plan may be adjusted over time as more is learned about the specific site and about appropriate techniques. Although all the exact details of the monitoring program are not known at this time, it is the intention of the Forest Service that this monitoring program would meet "state-of-the-art" scientific standards. A more detailed discussion of scientific monitoring and research is provided in Appendix H.

A post-construction bird and bat mortality study is a requirement of the Section 248 Certificate of Public Good issued by the Public Service Board. Specific requirements of this study are provided in Section 3.10.2.1.1. Required elements for the PSB monitoring plan are compatible with the criteria listed above.

Adaptive Management

Adaptive management of Project operations, based on post-construction monitoring results, would likely provide the most effective approach to minimizing avian mortality over time. The adaptive management plan would incorporate scientifically-proven measures to reduce mortality rates of affected bird species, and to monitor the effectiveness of the adaptive management measures. Actual measures to be taken would depend on the type and severity of impacts, and the likelihood of accomplishing the desired outcome. Monitoring results in combination with certain adaptive management techniques could possibly be used as a way to establish targeted reductions in mortality of species with unacceptably high mortality rates. It can also be expected that any techniques and triggers for implementing adaptive management, and any developed thresholds, may change during operations as more monitoring information becomes available and/or conditions change.

The Forest Service determined that operational controls on the Project would include curtailment of power production under certain conditions to minimize mortality of bats (see Section 3.11.4). Strategies specific to birds might include determining specific times of day or times of the year that should be emphasized or avoided for routine maintenance operations, administration of closures, use of deterrents, and locations and types of plantings in open areas that provide the greatest benefit and least disturbance to birds. Any Special Use permit issued for the Project would include such conditions, and would also require consideration of the conditions of the CPG issued by the PSB. Any adaptive management strategies would be developed, approved, and subsequently revised (if needed) by the Forest Service using the best available science, based on recommendations from a panel of technical and scientific experts, and observed results of on-site monitoring. This group would also define or revise thresholds, if possible, that would trigger adaptive management responses. See Appendix H for additional detail on research, monitoring, and adaptive management.

3.11 Bats

This chapter describes existing bat resources and potential impacts to bats and bat habitat from the proposed Deerfield Wind Project. Information used in this analysis was obtained from literature reviews, agency consultations, monitoring and research reports from existing wind facilities, and recent studies that specifically focus on the Deerfield Wind Project and its potential effects on local and migrating bats. As appropriate, results from pre- and post-construction studies conducted from 1993 to 2002 for the existing Searsburg Wind Facility are included in the analysis and in the Project Record.

3.11.1 Affected Environment

The affected environment for the discussion of direct and indirect impacts to bats is the Project area, with a particular focus on the Project site. As described in Section 3.0 and shown in Figure 1-2, the Project area encompasses all NFS and private lands in GMNF management compartments 121, 122, 123, and 124, an area totaling 9,523 acres. Elevation in the Project area ranges from approximately 1,510 feet (460 m) AMSL to approximately 3,110 feet (948 m) AMSL. The Project site is the footprint of activity associated with the proposed Deerfield Wind Project, which consists of the Eastern Project site and the Western Project site. Elevation in the Project site ranges from approximately 2,401 feet AMSL near the intersection of Route 8 and the Putnam Road access to approximately 3,110 feet AMSL along the eastern ridgeline, south of the existing Searsburg Wind Facility. Detailed information on the existing vegetation and ecological communities in the Project area is discussed in the introduction to the Affected Environment Section 3.0 (Affected Environment and Environmental Consequences) and in Section 3.9 (Ecological Resources). Information on climate may be found in Section 3.3 (Climate and Air Quality).

White-nose Syndrome and Bats

Populations of cave- and mine-hibernating bats in the northeastern U.S. are experiencing unprecedented mortality due to a disease condition identified as "white-nose syndrome" (WNS). The name derives from a white, dusty film that accumulates on the muzzles, ears, wings, and occasionally on other body parts of infected bats. The primary disease agent is *Geomyces destructans*, a psychrophilic (cold-loving) fungus (Blehert et al., 2009; Gargas et al., 2009), although additional research is necessary to determine if other disease agents are involved. WNS was first documented in eastern New York State during the winter of 2006, and quickly spread to Vermont, Massachusetts, and Connecticut. By May 2010, WNS was confirmed in hibernacula in New Hampshire, New Jersey, Pennsylvania, Maryland, Virginia, West Virginia, Tennessee, Missouri, Oklahoma, Quebec, and Ontario (BCM, 2010; USFWS, 2010a; USGS, 2010). WNS has continued to spread. By May 2011, confirmed occurrence of WNS included sites in Maine, Ohio, Indiana, North Carolina, Kentucky, Nova Scotia and New Brunswick, as well as new sites in Ontario and Quebec. Continually updated WNS information and links are available at USFWS (2011) and USGS (2011) websites.

WNS impacts bats through at least two different mechanisms. During hibernation, infected bats rouse from torpor more frequently than uninfected bats, prematurely depleting fat reserves. These bats either die of starvation in hibernacula or leave their hibernacula to search for food and perish in a winter landscape devoid of flying insects (Reichard & Kunz, 2009; USGS, 2010). During the winter and early spring of 2008 in New York and Vermont, bats were seen flying near affected sites during daylight hours and they were often found dead inside or near the entrances to hibernacula and on nearby structures. Reports of bats flying during daylight hours became more frequent and farther away from hibernacula during March and April 2008. The second pathway for WNS impact is scarring and necrosis of wing membranes on WNS-affected bats that survive hibernation. Damaged wings could compromise maneuverability and foraging success, which in turn would compromise reproduction and survival (Reichard & Kunz, 2009). Cryan et al. (2010) hypothesize a third impact whereby the fungal infection may cause mortality through catastrophic disruption of wing-dependent physiological functions. Mortality estimates range from 75% to 100% in affected hibernacula in New York and Vermont. The Vermont Fish and Wildlife Department estimates that as many as 400,000 bats may have died in Vermont hibernacula since WNS was first documented in 2008 (Smith, 2010). Estimated total mortality from WNS in the Northeast has exceeded 1 million bats from at least six species (WNS ESSM, 2009). Bat species known to be affected by WNS that occur in the Project area and in the central Vermont region are the little brown bat (*Myotis lucifugus*), northern long-eared bat (*M. septentrionalis*), Indiana bat (*M. sodalis*), eastern small-footed bat (*M. leibii*), tri-colored bat (*Perimyotis subflavus*, formerly named eastern pipistrelle, *Pipistrellus subflavus*), and big brown bat (*Eptesicus fuscus*) (Langwig et al., 2009; USFWS 2010a).

Observed population declines for bat species in the Northeast caused by WNS prompted the Center for Biological Diversity to petition the Secretary of Interior to list northern long-eared bats and eastern small-footed bats as endangered or threatened under the Endangered Species Act (CBD, 2010b). In June 2011, the USFWS determined that the Petition presented substantial scientific or commercial information indicating that listing of the eastern small-footed bat and the northern long-eared bat may be warranted. As a consequence, the USFWS concurrently announced initiation of status reviews of these species to determine if listing of either or both species is warranted. USFWS documents and statements are available online[21]. In December 2010, Kunz and Reichard (2010) completed a status review of little brown bats and concluded that ESA listing was scientifically warranted. The USFWS has yet to announce any action on behalf of little brown bats. The Indiana bat already is listed as an endangered species under the ESA.

[21] The USFWS website http://www.fws.gov/WhiteNoseSyndrome/ is continually updated to include the latest available information on white nose syndrome. The Forest Service has accessed this site throughout preparation of the SDEIS and FEIS.

The Forest Service is proposing addition of the little brown bat, northern long-eared bat, and tri-colored bat to the Region 9 (Northeastern U.S.) list of Regional Forester Sensitive Species (RFSS). RFSS are those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by a significant current or predicted downward trends in population numbers or density or in habitat capability that would reduce a species' existing distribution (FSM 2670.5). RFSS are subject to specific analysis and special consideration during project development and implementation. The eastern small-footed bat currently is listed as an RFSS in Region 9.

In a related action, the State of Vermont recently evaluated the statewide status of the little brown bat and northern long-eared bat. In July 2011, these species were added to the Vermont list of endangered species. The Indiana bat already was listed as endangered and the eastern small-footed bat already was listed as threatened by the Vermont ANR.

Species of Interest

Nine species of bats occur in Vermont, based upon their normal geographic range. These are the little brown bat, northern long-eared bat, Indiana bat, eastern small-footed bat, tri-colored bat, big brown bat, eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and silver-haired bat (*Lasionycteris noctivagans*) (Whitaker & Hamilton, 1998; VTFWD, 2008b).

Bats that occur in Vermont can be generally classified into two distinct ecological groups. Six of these species hibernate during the winter in caves or mines throughout the region. In spring, these cave-dwelling bats emerge and move to their summer range. Distances between hibernacula and summer range vary from a mile to a few hundred miles. The resident, cave-dwelling bats in Vermont are the little brown bat, northern long-eared bat, Indiana bat, eastern small-footed bat, tri-colored bat, and big brown bat. The other bats are long-distance migrants that solitarily roost in trees (migratory tree bats). These bats migrate out of the Northeast in late summer and early fall, spending the winter months in the southeastern United States or further south (Fleming & Eby, 2003). They then return to Vermont and the Northeast in late spring. Vermont's migratory tree bats include the eastern red bat, hoary bat, and the silver-haired bat.

Descriptions below highlight natural history characteristics of these species that are relevant to the proposed Deerfield Wind Project.

Little Brown Bat

Little brown bats hibernate in caves, hydroelectric dams, or abandoned mines where the temperatures remain between 35.6° and 41° F (2 to 5° C) and relative humidity remains high (above 85%). During active months, little brown bats typically roost near water bodies such as streams or marshes, or in valleys along high slopes. Pregnant females seek out warm dry places, such as attics and barns, where they form maternity colonies to bear and raise young. Males and non-pregnant females tend to roost either singly or in small groups away from the maternity colonies. Males use cooler daytime roosts in valleys near streams and marshes, and at higher slope positions in the mountains than females. Little brown bats forage over fresh water, such as marshes, lakes, or streams, in areas of forest regeneration, along forest roads or trails, and in other habitats where flying insects congregate (Fenton & Barclay, 1980; DeGraaf & Yamasaki, 2001). The Project area provides suitable habitat for this species, particularly in the vicinity of wetlands and along existing clearings and roads associated with an existing transmission line ROW and the existing Searsburg Wind Facility. As the Project would create new open areas, it may create additional foraging habitat for little brown bats. Although it has been hypothesized that wind turbines may attract bats, particularly migrating bats that are seeking tall roost trees (Kunz et al., 2007; Cryan & Barclay, 2009), a correlation between project-related habitat alteration that creates foraging habitat and increased risk of mortality has not been demonstrated.

Prior to WNS, little brown bats were common on the GMNF and surrounding areas, and in New England in general, ranked as "common" and "secure" in Vermont (VTFWD, 2008b). They were known to hibernate in large numbers in several mines and caves within 20 to 50 miles of the Project area. One certain repercussion of WNS is that little brown bats have suffered unprecedented, severe mortality in central Vermont since the winter of 2007/2008. Langwig et al. (2009) estimated mortality of little brown bats in WNS-infected hibernacula at 93%, but after an additional winter of exposure, mortality at these sites may be greater (VTFWD, unpublished data). Results from summer mist-net and acoustic surveys conducted by the Vermont ANR, the Forest Service, and other collaborators during 2010 and 2011 suggest that little brown bats are almost completely absent from the Vermont landscape. Acoustic monitoring in the Project area from mid-April through mid-October 2011 detected the occurrence of *myotis* guild bats, which would include little brown bats, although identification of exact species was not possible. The frequency and number of *myotis* guild calls were lower than for migratory bats and big brown bats, suggesting lower abundance in the area (Stantec, 2011a). As described above, after completing an evaluation of this species, the State of Vermont recently added the little brown bat to the Vermont list of endangered species. The Forest Service is proposing addition of the little brown bat and northern long-eared bat to the Region 9 list of RFSS. As mentioned previously, a status review of little brown bats (Kunz & Reichard, 2010) concluded that ESA listing was scientifically warranted, although the USFWS has yet to announce any action. Frick et al. (2010) concluded that the little brown bat could become regionally extinct across parts of its range within as few as 16 years. This conclusion was based on the virulence of WNS infection, the rapidity with which a healthy population of an abundant and widely-distributed species like the little brown bat could become at risk of regional extinction, and the rapid geographic spread of WNS since 2006.

Post-construction monitoring has demonstrated that little brown bats are susceptible to mortality from utility-scale wind projects. Little brown bats have accounted for as much as 10 to 20% of recorded and identified bat mortality at wind facilities in the northeastern U.S. (Fiedler, 2004; Kerns & Kerlinger, 2004; Kerns et al., 2005; Fiedler et al., 2007; Kunz et al., 2007; Arnett et al., 2005, 2008, 2009; Jain et al., 2007, 2009a,b,c,d,e, 2010a,b,c; Stantec 2008b, 2009a,b, 2010a,b; Young et al., 2009; Normandeau, 2010; Tidhar et al., 2010, 2011). In addition, many sites record considerable mortality of unidentified bats, or unidentified *Myotis* bats, many of which might be little brown bats. Consequently, estimates of mortality for this species are not precise. To date, results of analyses that assess mortality of little brown bats at utility-scale wind facilities in regions where bat populations have collapsed as a consequence of WNS are not available.

Northern Long-Eared Bat

Northern long-eared bats hibernate in caves, abandoned mines, or hydroelectric dams where temperatures remain between 35.6° and 44.6° F (2 to 7° C), humidity is high, and air flow is limited. Northern long-eared bats hibernate singly or in small groups usually tucked into small spaces. During active months, these bats typically roost in cavities in live or dead hardwood trees, such as beech, sugar maple, silver maple, green ash, and yellow birch, and under the loose bark of dead standing trees. Generally, roost trees are the larger ones in a given stand, and are more often hardwood, rather than softwood. This species tends to prefer roosting in tall, large-diameter hardwood trees that are in early stages of decay (Sasse & Perkins, 1996; DeGraaf & Yamasaki, 2001). Females tend to congregate in groups of up to 60 when forming maternity colonies, whereas males roost singly. Northern long-eared bats forage primarily in forested areas, below the tree canopy, in openings, and around water bodies where flying insects congregate (Caceres & Barclay, 2000; DeGraaf & Yamasaki, 2001). The Project area provides abundant suitable forage habitat for northern long-eared bats.

Prior to WNS, northern long-eared bats were irregularly distributed in New England, but relatively common across much of the GMNF. The State of Vermont ranked the northern long-eared bat as "common" to "locally common or scattered to uncommon, but not rare" (VFWD 2008b). They were known to hibernate in several mines and caves within 20 to 50 miles of the Project area. This species has suffered substantial and unprecedented mortality from WNS. Langwig et al. (2009) estimated mortality of northern long-eared bats in WNS-infected hibernacula at about 93%. Northern long-eared bats have been largely absent during hibernaculum surveys in New York and Vermont during the winter of 2009/2010, leading to speculation that mortality at these sites may be greater that originally estimated (VFWD, unpublished data). Results from summer mist-net and acoustic surveys conducted by the Vermont ANR, the Forest Service, and other collaborators during 2010 and 2011 suggest that northern long-eared bats are almost completely absent from the Vermont landscape. Acoustic monitoring in the Project area from mid-April through mid-October 2011 detected the occurrence of *myotis* guild bats, which would include northern long-eared bats, although identification of exact species was not possible. The frequency and number of *myotis* guild calls were lower than for migratory bats and big brown bats, suggesting lower abundance in the area (Stantec, 2011a). As described above, the Secretary of Interior has been petitioned to list northern long-eared bats as endangered or threatened under the Endangered Species Act (CBD, 2010b). The USFWS determined that the petition presented important information, and initiated a status review to determine if listing of is warranted. After completing an evaluation of this species, the State of Vermont recently added the northern long-eared bat to the Vermont list of endangered species. The Forest Service is proposing addition of the northern long-eared bat to the Region 9 list of RFSS.

Northern long-eared bats are susceptible to mortality from utility-scale wind projects, although the magnitude of losses appears to be low compared to other species. Northern long-eared bats have accounted for about 1% of recorded and identified bat mortality in the northeastern U.S. (Fiedler, 2004; Kerns & Kerlinger, 2004; Kerns et al., 2005; Fiedler et al., 2007; Kunz et al., 2007; Arnett et al., 2005, 2008, 2009; Jain et al., 2007, 2009a,b,c,d,e, 2010a,b,c; Stantec 2008b, 2009a,b, 2010a,b; Young et al., 2009; Normandeau, 2010; Tidhar et al., 2010, 2011). Mortality recorded as unidentified bats or unidentified *Myotis* could include additional individuals of this species. To date, results of analyses that assess mortality of northern long-eared bats at utility-scale wind facilities in regions where bat populations have collapsed as a consequence of WNS are not available.

Indiana Bat

Indiana bats hibernate during the winter in limestone caves or mines where temperatures are between 39° and 46° F (4 to 8° C). During active months, they roost in large diameter deciduous trees (dead and alive) with loose and peeling bark as maternity colony roost sites (Thomson, 1982; DeGraaf & Yamasaki, 2001). In the Champlain Valley of Vermont, and New York, the most important roost trees are shagbark hickory (*Carya ovata*) and black locust (*Robinia pseudoacacia*); other common roost trees include sugar maple, American elm (*Ulmus americana*), aspen (*Populus* spp.), eastern white pine (*Pinus strobus*), oaks (*Quercus* spp.), and butternut (Watrous et al., 2006). Elevation appears to be the most important factor associated with roost sites in this region, probably because Indiana bats avoid the cooler temperatures at higher elevation (Watrous et al., 2006). The 2006 GMNF Forest Plan (USDA Forest Service, 2006a) and the BE for Forest Plan revision (USDA Forest Service, 2006b) define potential Indiana bat maternity roost habitat as lands adjacent to the Champlain Valley and Valley of Vermont (along Route 7) at elevations below 800 feet. Optimal summer habitat for Indiana bats is a landscape-level patchwork of 20 to 60% forest cover that includes roost trees, abundant flying insects, and open water (Thomson, 1982; Rommé et al., 1995; Farmer et al., 1997; Kurta et al., 1993).

Two known Indiana bat hibernacula, including the largest known Indiana bat hibernaculum in Vermont, are located near Manchester, Vermont, 20 to 25 miles north of the Deerfield Project site (USDA Forest Service, 2006c). Pre-hibernation roosting and mating are most likely to occur close (primarily less than or equal to 5 miles) to hibernacula (Watrous et al., 2006; USDA Forest Service, 2006b). The lowest elevation in the Project area is approximately 2,400 feet, well above 800 feet. Thus, the Project site does not provide suitable habitat for Indiana bats because it is too high in elevation, too densely forested, too far from known hibernacula, and lies on the opposite side of the Green Mountain spine from where Indiana bats are likely to occur (Arrowwood Environmental, 2005; USDA Forest Service, 2006a,b).

The Indiana bat currently is federally-listed as endangered under the Endangered Species Act, as well as state-listed as endangered in Vermont (VTFWD, 2008a). Prior to WNS, it was considered rare and rarely encountered except at hibernacula or known summer roosting sites. Langwig et al. (2009) estimated mortality of eastern Indiana bats in WNS-infected hibernacula at 57%, but after an additional winter, mortality at these sites may be greater (VTFWD, unpublished data). Pending results from summer acoustic surveys and other investigations, the abundance, distribution, and future status of Indiana bats in the aftermath of WNS is uncertain, both in Vermont and in the Northeast in general.

To date, post-construction monitoring has not documented mortality of Indiana bats at utility-scale wind projects in the Northeast (Fiedler, 2004; Kerns & Kerlinger, 2004; Kerns et al., 2005; Fiedler et al., 2007; Kunz et al., 2007; Arnett et al., 2005, 2008, 2009; Jain et al., 2007, 2009a,b,c,d,e, 2010a,b,c; Stantec 2008b, 2009a,b, 2010a,b; Young et al., 2009; Normandeau, 2010; Tidhar et al., 2010, 2011). Range-wide, two dead Indiana bats have been found at a wind energy facility in the Midwest in 2009 and 2010 (USFWS, 2010b; Goland, 2011), as described below in Section 3.11.1.2.

However, mortality recorded as unidentified bats or unidentified *Myotis* could also include Indiana bats.

Eastern Small-Footed Bat

Eastern small-footed bats prefer cooler areas than most other myotid bats when roosting and hibernating. Hibernacula include drafty, dry locations below 39.2° F (4° C) such as the entrances to mines, mine tunnels, and caves. These bats hibernate singly or in small groups, and typically are the last to enter hibernation and the first to leave it. During active months, eastern small-footed bats roost in rocky crevices, in talus, under rocks, or in buildings. Pregnant females tend to cluster in small maternity colonies in rocky crevices on cliffs. Little is known about foraging habits (Best & Jennings, 1997; DeGraaf & Yamasaki, 2001).

Two known hibernacula are located near Manchester, Vermont, 20 to 25 miles north of the Deerfield Project site (J. Sease pers. communication, 2008b). Eastern small-footed bats are thought to travel up to 25 miles to summer habitat, therefore this species could occur in the Project area. The only known potentially-suitable summer roosting habitat within 3 miles of the Project area occurs on a south-facing cliff to the north of Route 9, approximately 2.1 miles from the closest proposed turbine site. If small-footed bats occur in the Project area, they are not likely to be found in high numbers (Tyburec, 2005; USDA Forest Service, 2005a).

As discussed in Section 3.9.1.3.2, the eastern small-footed bat is a Regional Forester Sensitive Species on the GMNF (USDA Forest Service, 2006a,b) and state-listed as threatened in Vermont (VTFWD, 2008a). Prior to WNS, this species was considered uncommon and rarely encountered during surveys. Consequently, little is known about it in Vermont. Langwig et al. (2009) estimated mortality of eastern small-footed bats in WNS-infected hibernacula at 78%, but mortality at these sites may be greater after an additional winter (VTFWD, unpublished data). As described above, the Secretary of Interior has been petitioned to list eastern small-footed bats as endangered or threatened under the Endangered Species Act (CBD, 2010b). The USFWS determined that that the petition presented important information, and initiated a status review to determine if listing of is warranted. Sample sizes of data for eastern small-footed bats are so limited that precise assessment of abundance, distribution, or population status in general, is not possible. To date, post-construction monitoring has not documented mortality of eastern small-footed bats at utility-scale wind projects in the Northeast (e.g., Kerns & Kerlinger, 2004; Kerns et al. 2005; Kunz et al., 2007; Arnett et al., 2008; Stantec, 2008b, 2009a, 2010b; Jain et al., 2007, 2009a,b; Normandeau 2010; Tidhar et al. 2010, 2011). Mortality recorded as unidentified bats or unidentified *Myotis* could include eastern small-footed bats.

Tri-Colored Bat

The tri-colored bat (formerly eastern pipistrelle) hibernates in abandoned mines, caves, and occasionally in hydroelectric dams that are relatively warm and the air is still (Fujita & Kunz, 1984; DeGraaf & Yamasaki, 2001). Tri-colored bats are unusual among the locally-hibernating bat species in that they tend to roost in trees among the foliage like migratory bats (see red, hoary, and silver-haired bats, below) (Carter & Menzel, 2007); other hibernating bats tend to roost under bark, in cavities or crevices in trees or rocks, etc. (DeGraaf & Yamasaki, 2001; Barclay & Kurta, 2007). The tri-colored bat typically forages in open areas, along the edge of high canopies surrounding fields, clearcuts, or rivers. These bats may forage at least as far away as 5 miles (8 kilometers) from a roosting site (Fujita & Kunz, 1984; DeGraaf & Yamasaki, 2001). The areas of the Project site near wetlands may provide additional habitat suitable for this species as well.

Tri-colored bats are considered uncommon to rare in New England and on the GMNF, listed as "rare" or "uncommon" by the State of Vermont (VTFWD, 2008b). They are known to hibernate in several mines and caves within 20 to 50 miles of the Project area. Tri-colored bats have been affected by WNS; Langwig et al. (2009) estimated mortality of tri-colored bats in WNS-infected hibernacula at 86%. After an additional winter, mortality at these sites may be greater (VTFWD, unpublished data). Sample sizes of data for tri-colored bats are so limited that precise assessment of abundance, distribution, or population status in general, is not possible.

Tri-colored bats are susceptible to mortality from utility-scale wind projects. Mortality varies by site, accounting for as much as 25% of recorded and identified bat mortality at some sites in the northeastern U.S. with no recorded mortality at other sites (Fiedler, 2004; Kerns & Kerlinger, 2004; Kerns et al., 2005; Fiedler et al., 2007; Kunz et al., 2007; Arnett et al., 2005, 2008, 2009; Jain et al., 2007, 2009a,b,c,d,e, 2010a,b,c; Stantec 2008b, 2009a,b, 2010a,b; Young et al., 2009; Normandeau, 2010; Tidhar et al., 2010, 2011). Mortality rates for tri-colored bats appear more comparable to those of the migratory bat species (with which they share foliage-roosting behavior), than to the rates of mortality apparent for other locally-hibernating bats, which tend to roost in crevices or cavities (Kunz et al., 2007; Arnett et al., 2008). Although scientists have made considerable progress during recent years to understand why some species of bats are disproportionately susceptible to mortality from commercial wind projects, the ultimate causes remain uncertain at this time (Kunz et al., 2007; Arnett et al., 2008; Cryan & Barclay, 2009). To date, results of analyses that assess mortality of tri-colored bats at utility-scale wind facilities in regions where bat populations have collapsed as a consequence of WNS are not available.

<u>Big Brown Bat</u>

Big brown bats tend to hibernate in dry cool locations such as caves, mines, and occasionally buildings where the temperature remains around 32° F (0° C). Night roosting sites during active months can be just about anywhere, including porches, behind shutters, in attics, and in trees. Daytime roosting areas tend to be cooler than those of other species, generally below 90° F (34° C). Maternity colonies can vary greatly from five to 700 individuals. Generally, big brown bats will not range more than 50 miles (80 kilometers) from their hibernaculum to a maternity site. The big brown bat forages and roosts in and around open fields, still water, roads, and regenerating hardwood forest areas (Kurta & Baker, 1990; DeGraaf & Yamasaki, 2001). Big brown bats are most abundant in agricultural landscapes, towns, and cities and least abundant in forested-dominated landscapes (Kurta & Baker, 1990; DeGraaf & Yamasaki, 2001). They are known to hibernate in several mines and caves within 20 to 50 miles of the Project area. The Project area is not considered ideal habitat for big brown bats at present. However, once portions of the hardwood forests atop the ridge have been cleared during construction, the area may become more attractive to big brown bats.

The big brown bat is ranked "locally common or widely scattered to uncommon, but not rare" by the State of Vermont (VTFWD, 2008b). The impact of WNS on big brown bats is uncertain. Langwig et al. (2009) estimated mortality of 56% at one hibernaculum, but only 7% at others, with an overall decline of 48% at all surveyed hibernacula. Other evidence suggests that the regional decline for big brown bats may be considerably lower, as many individuals may hibernate at sites other that the large hibernacula used by other species (Langwig et al., 2009). Results from summer acoustic surveys conducted by the Vermont ANR, the Forest Service, and other collaborators, during 2010 and 2011 suggest that big brown bats are the most common species across most of the Vermont landscape. No equivalent data were collected prior to WNS, however, so it is not possible to evaluate the impact of WNS from these surveys. Acoustic monitoring was conducted in the Project area from mid-April through mid-October 2011. The big brown bat/silver-haired bat guild was the second most commonly detected (after unknown); approximately 12 percent of the calls were further identified as big brown bats, and 19 percent as silver-haired bats (Stantec, 2011a).

Big brown bats are known to be susceptible to mortality from utility-scale wind projects, although the magnitude of losses appears to be lower than for many other species. Big brown bats have accounted for about 1% to 7% of recorded and identified bat mortality in the northeastern U.S. (Fiedler, 2004; Kerns & Kerlinger, 2004; Kerns et al., 2005; Fiedler et al., 2007; Kunz et al., 2007; Arnett et al., 2005, 2008, 2009; Jain et al., 2007, 2009a,b,c,d,e, 2010a,b,c; Stantec 2008b, 2009a,b, 2010a,b; Young et al., 2009; Normandeau, 2010; Tidhar et al., 2010, 2011). To date, results of analyses that assess mortality of big brown bats at utility-scale wind facilities in regions where bat populations have collapsed as a consequence of WNS are not available.

<u>Eastern Red Bat</u>

Eastern red bats migrate south of latitude 40° N for the winter; in Vermont they are summer residents only. During summer, red bats generally roost in the foliage of hardwood or softwood trees or tall shrubs, rarely in caves or buildings. Red bats forage in a variety of hardwood and softwood habitats, especially near still water, along roads and trails, and in regenerating and older class age forests. Generally, eastern red bats stay within 600 to 1,000 yards (546 to 910 meters) of daytime roost sites, emerging to begin foraging one to two hours after sunset (Shump & Shump, 1982a; DeGraaf & Yamasaki, 2001). The Project area is not considered ideal habitat for eastern red bats at present, although they likely pass through during migration. Once areas of hardwood forests atop the ridge have been cleared during construction, these sites may provide more suitable habitat. Acoustic monitoring was conducted in the Project area from mid-April through mid-October 2011. The red bat/tri-colored bat guild was the third most commonly detected (after unknown and big brown bat/silver-haired bat); most of the calls (84%) were further identified as red bats (Stantec, 2011a).

Red bats are considered uncommon to rare in New England (DeGraaf & Yamasaki, 2001). The State of Vermont ranks red bats as "locally common or widely scattered to uncommon, but not rare" (VTFWD, 2008b). Little is known about abundance, distribution, migration, and general ecology of red bats in Vermont. Because red bats migrate southward rather than hibernate in northern latitudes, they appear to be unaffected by WNS (Langwig et al., 2009; BCM, 2010; USFWS, 2010a; USGS, 2010).

Red bats are susceptible to high-level mortality from utility-scale wind projects throughout their range in North America, as are other migratory bat species. Red bats account for the greatest numbers of identified mortality at wind sites, ranging from 10% to as high as 60% of recorded mortality at some sites in the northeastern U.S. (Fiedler, 2004; Kerns & Kerlinger, 2004; Kerns et al., 2005; Fiedler et al., 2007; Kunz et al., 2007; Arnett et al., 2005, 2008, 2009; Jain et al., 2007, 2009a,b,c,d,e, 2010a,b,c; Stantec 2008b, 2009a,b, 2010a,b; Young et al., 2009; Normandeau, 2010; Tidhar et al., 2010, 2011). Although scientists have made considerable progress during recent years to understand why migratory bats are disproportionately susceptible to mortality from commercial wind projects, the ultimate causes remain uncertain at this time (see Kunz et al., 2007; Arnett et al., 2008; Cryan & Barclay, 2009).

Hoary Bat

Hoary bats migrate to warmer areas of the United States and Mexico during winter; in Vermont they are summer residents only. Summer roosts are in dense foliage of tree crowns. Males tend to roost singly and females roost in small family groups. Hoary bats typically forage in uncluttered, open areas over lakes, fields, and forest clearings. Hoary bats may forage a mile or more away from a chosen roosting site (Shump & Shump, 1982b; DeGraaf & Yamasaki, 2001). The Project area is not considered ideal habitat for hoary bats at present. However, once areas of hardwood forests atop the ridge have been cleared during construction, these sites may provide more suitable habitat. Hoary bats might pass by the proposed Project during migration, even through areas that do not provide suitable foraging habitat. Acoustic monitoring was conducted in the Project area from mid-April through mid-October 2011. The hoary bat guild was among the least commonly detected (along with the *myotis* guild (Stantec, 2011a).

Hoary bats are considered rare but may be more common than previously thought (DeGraaf & Yamasaki, 2001). The State of Vermont ranks hoary bats as "uncommon" (VTFWD, 2008b). Little is known about abundance, distribution, and ecology of hoary bats in Vermont. Because hoary bats migrate southward rather than hibernate in northern latitudes, they appear to be unaffected by WNS (Langwig et al., 2009; BCM, 2010; USFWS, 2010a; USGS, 2010).

Hoary bats are susceptible to high-level mortality from utility-scale wind projects throughout their range in North America, as are other migratory bat species. In the Northeast as a whole, hoary bats account for the second greatest numbers of identified mortality at wind sites after red bats, ranging from about 10 to 45% of identified species. At some northeastern wind sites, hoary bats are the most-commonly killed species (Fiedler, 2004; Kerns & Kerlinger, 2004; Kerns et al., 2005; Fiedler et al., 2007; Kunz et al., 2007; Arnett et al., 2005, 2008, 2009; Jain et al., 2007, 2009a,b,c,d,e, 2010a,b,c; Stantec 2008b, 2009a,b, 2010a,b; Young et al., 2009; Normandeau, 2010; Tidhar et al., 2010, 2011).

Silver-Haired Bat

Silver-haired bats do not hibernate in New England; they are summer residents only. Both males and females generally roost singly in areas of coniferous or mixed wood forests, near open water, tucked under loose bark and in tree cavities. Silver-haired bats typically forage in open areas, such as hardwood clearcuts, and near lakes, streams, and ponds in coniferous and deciduous forests (Kunz, 1982a; DeGraaf & Yamasaki, 2001). Wooded areas along streams and water bodies in the Project area may provide suitable habitat for this species. Silver-haired bats might pass by the proposed Project during migration, even through areas that do not provide suitable foraging habitat. Acoustic monitoring was conducted in the Project area from mid-April through mid-October 2011. The big brown bat/silver-haired bat guild was the second most commonly detected (after unknown);

approximately 19 percent of the calls were further identified as silver-haired bats, and 12 percent as big brown bats (Stantec, 2011a).

Although silver-haired bats were considered to be the most abundant species of bat in much of the Northeast 100 or more years ago, during recent decades they have been considerably less abundant (Kunz 1982a). The State of Vermont ranks silver-haired bats as "uncommon" (VTFWD, 2008b). Little is known about abundance, distribution, and ecology of silver-haired bats in Vermont. Because silver-haired bats migrate southward rather than hibernate in northern latitudes, they appear to be unaffected by WNS (Langwig et al., 2009; BCM, 2010; USFWS, 2010a; USGS, 2010).

Silver-haired bats are susceptible to mortality from utility-scale wind projects throughout their range in North America. Mortality of silver-haired bats has generally been considered to be much higher in western states (e.g., Kunz et al., 2007; Arnett et al., 2008) although they are killed at facilities in the Northeast (Fiedler, 2004; Kerns & Kerlinger, 2004; Kerns et al., 2005; Fiedler et al., 2007; Arnett et al., 2005, 2008, 2009; Jain et al., 2007, 2009a,b,c,d,e, 2010a,b,c; Stantec 2008b, 2009a,b, 2010a,b; Young et al., 2009; Normandeau, 2010; Tidhar et al., 2010, 2011). Silver-haired bats have accounted for as much as 20% to over 40% of recorded and identified bat mortality at forested ridgeline sites in New Hampshire and Maine (Stantec 2008b, 2009a, 2010b; Normandeau, 2010; Tidhar et al., 2010, 2011).

3.11.1.1 Deerfield Wind Project Bat Studies

A number of pre-construction bat studies have been completed to document the use and occurrence of resident and migrating bats near the Project site and to serve as a baseline from which to evaluate potential impacts of the Proposed Action and alternatives. Studies were conducted between 2004 and 2006, and include a bat habitat assessment (Arrowwood Environmental, 2005; USDA Forest Service, 2005a), as well as acoustic surveys and radar studies (Tyburec, 2005; Woodlot, 2005a,b, 2006, 2007a); see Section 3.10.1.2.3 for a discussion of the on-site radar surveys associated primarily with avian studies. Additionally, other studies were completed in the mid-1990s for development of the existing Searsburg Wind Facility. As applicable, information from those studies was included in the Deerfield Wind Project analysis and in the Project Record.

Woodlot Alternatives, Inc. (Woodlot) conducted acoustic monitoring surveys for bats at the Project site from spring through early fall in 2005 and 2006. (Note: In October 2007, Woodlot merged with another firm, Stantec Consulting [Stantec]). Table 3.11.1.1-1 summarizes the methods and sampling effort employed by Woodlot. Appendix E provides more detailed information on these studies. Locations of acoustic detectors are indicated on Figure 3.11-1A and 3.11-1B.

Table 3.11.1.1-1: Summary of Sampling Methods and Acoustic Bat Surveys

Season	Dates	Number Detector(s)	Number Detector Nights	Detector Height(s) (meters)	Detector Location(s)
Spring 2005[1]	April 19 – June 15	2	55	7 and 15 (23 and 49.2 feet)	Meteorological tower (existing Searsburg Wind Facility)
Summer/ Fall 2005[2]	July 7 – November 1	1 – 2	153	15 and 30 (49.2 and 98.4 feet)	Meteorological tower (Eastern Project site)
				15 and 30 (49.2 and 98.4 feet)	Meteorological tower (Western Project site)
				7 (23 feet)	Along tree line (Western Project site)
Spring 2006[3]	April 14 – June 13	4	194	10 and 20 (32.8 and 65.6 feet)	Meteorological tower (Eastern Project site)
				15 and 35 (49.2 and 114.9 feet)	Meteorological tower (Western Project site)
				7 (23 feet)	Along tree line (Western Project site)
Summer/ Fall 2006[4]	June 13 – October 27	5	421	10 and 20 (32.8 and 65.6 feet)	Meteorological tower (Eastern Project site)
				15 and 35 (49.2 and 98.4 feet)	Meteorological tower (Western Project site)
				7 (23 feet)	Along tree line (Western Project site)

Note: Detector-night is a sampling unit during which a single detector is deployed overnight. On nights when two detectors are deployed, the sampling effort equals two detector-nights.
Sources: [1] = Woodlot, 2005a; [2] = Woodlot, 2005b; [3] = Woodlot, 2006; [4] = Woodlot, 2007a.

Woodlot (2005a,b, 2007a) did not observe strong relationships of bat activity with weather conditions, perhaps due in part to the limited number of observations. In general, bat activity was directly correlated with temperature and inversely correlated with wind speed. Greater numbers of recorded call sequences were recorded on nights warmer than 50° F (10° C); relatively fewer call sequences were recorded on nights with the winds greater than 6.2 mph (2.8 m/s).

During 2005 studies, call sequences generally were identified to species. However, acoustic characteristics of calls from different bat species can include significant overlap, making specific identification difficult or impossible. Beginning in 2006, calls were classified into guilds of similar call characteristics (after Gannon et al., 2003). In addition, many recorded calls are too short or do not include sufficiently distinctive characteristics for positive identification. Woodlot grouped calls as follows:

- Myotid guild – all bats of the genus *Myotis*. Some general characteristics are believed to be distinctive for several of the species in this genus, but these characteristics do not occur consistently enough for any one species to be relied upon at all times. This guild includes the little brown bat, northern long-eared bat, Indiana bat, and eastern small-footed bat.

- Red bat/pipistrelle guild – eastern red bats and tri-colored bats can produce distinctive calls; however, there can be significant overlap in call characteristics making differentiation between these species problematic.
- Big Brown guild – includes big brown bat, silver-haired bat, and hoary bat. These species' call signatures commonly overlap, making species identification difficult.
- Unknown – all call sequences with too few pulses (fewer than seven) or of poor quality (such as indistinct pulse characteristics or background static) that cannot be identified to a species or guild.

The largest proportion of all calls could not be identified (n=269), followed by myotids (n=139), and the big brown bat guild (n=95). Call sequences attributable to the red bat/pipistrelle guild (n=22) were least common (Roy & Erickson, 2007). Although the nightly number of recorded call sequences varied considerably from night to night, the overall number of calls was low during spring and early summer, increasing in the latter half of July to a peak in early August, then consistently low through the first half of October. Red bats typically were detected in late summer (Woodlot, 2005a,b, 2006, 2007a). Numbers of calls at the Deerfield site were lower than for other sites in the Northeast. However, in general, species distribution was consistent with other recent studies in the Northeast. Documented species included all those that would be expected to occur in the Project area based on species' ranges and abundance. Survey results did not suggest anything particularly unique about migration activity of bats in the area (Woodlot, 2007a).

Over the two years of acoustic bat surveys, the number of call sequences recorded during each season varied, with fewer recorded call sequences during spring than during fall. Detection rates were 0.07 calls per detector-night for both spring surveys, 0.5 calls per detector-night in summer to fall 2005, and 0.9 calls per detector-night in summer to fall 2006 (Table 3.11.1.1-2). Based on combined survey data, bat activity for summer to fall, the seasons with higher activity, was 0.8 calls per detector-night (459 calls over 574 detector nights). Combining all acoustic surveys, observed bat activity was 0.58 calls per detector-night (478 bat calls over 823 detection nights).

Table 3.11.1.1-2: Comparison of Results from the 2005 and 2006 Acoustic Bat Surveys at the Proposed Project: Numbers of Identified Calls by Guild, Area, and Year

Year	2005			2006			
Season	Spring	Summer to Fall		Spring		Summer to Fall	
Guild	Eastern Project Site	Western Project Site	Eastern Project Site	Western Project Site	Eastern Project Site	Western Project Site	Eastern Project Site
Big Brown	0	18	14	5	0	28	30
Red bat/Pipistrelle	0	4	1	0	1	5	11
Myotid	4	7	10	3	2	50	63
Unknown	0	11	61	3	1	60	133
Total by Location	4	40	39	11	4	143	237
Number of Nights	55	119	34	87	107	216	205
Rate (Calls per Detector-night)	0.07	0.34	1.15	0.13	0.04	0.66	1.16
Rate/Season	0.07	0.5		0.7		0.9	

The activity level observed in the Project area was lower than rates observed by Woodlot (2005a,b, 2006; 2007a) at other sites across the Northeast during the same time periods, using the same methodology and type of equipment. This could indicate low levels of bat use of the Project site, due to habitat conditions or a lack of landscape-based concentrations in bat migration activity. Sampling effort, including both the number of deployed detectors, and the height and duration of deployment, can also affect the overall results of individual studies.

Acoustic detection equipment should ideally be deployed at the height of the rotor-swept zone to assess potential flight activity through the relevant airspace (NRC, 2007). Equipment at the Project sites was deployed at the maximum height practicable, limited by the availability of existing tall structures that could safely and reliably support field equipment. As detailed in Table 3.11.1.1-1, heights of acoustic detection equipment deployed at the Project sites ranged from 23 feet (7 meters) to 115 feet (35 meters) during the 2005 to 2006 seasons. The rotor-swept zone is expected to extend from 125 feet (38 meters) to 387 feet (118 meters). Consequently, studies at the Project site provided some measure of bat activity, but they likely missed some bat activity in the upper portions of the rotor-swept zone.

Technical complications can also influence bat activity levels observed during acoustic studies. The bat detectors deployed in the Project site generally operated well throughout the sampling periods. However, as is frequently the case with surveys that involve leaving equipment on-site for long periods, some data loss was experienced due to malfunctioning detectors, static readings, inclement weather, animal damage, and vandalism (Woodlot, 2005a,b, 2006, 2007a; see also Appendix E). Despite these limitations, acoustic data were successfully collected throughout different seasons from both the Eastern and Western Project sites, providing representative samples of bat activity in the affected environment.

Results of acoustic surveys must be interpreted with caution (Woodlot, 2007b,c). Identification of bats based upon acoustic call sequences requires some skill in interpretation and errors may occur. Use of guilds reduces the likelihood of identification errors at the expense of species-specific identification. Also, it is important to note that detection rates are not necessarily correlated with the actual numbers of bats in an area because it is not possible to differentiate between individual bats, and not all bats present in the area will be detected.

Studies of bat activity in the Project area, as described above, were conducted during 2005 and 2006, prior to the documented occurrence of WNS in Vermont. During discussions between the Forest Service, the ANR, and the USFWS in fall 2010, it was determined desirable to conduct further site-specific studies of bat activity in the Deerfield Project area up to and beyond the scheduled decision date for the Project. These additional acoustic studies would add to the body of knowledge regarding bat activity at the Project site by looking at post-WNS activity. The studies would also provide updated pre-construction data that could be compared to post-construction monitoring and research data. The protocols of the earlier 2005 and 2006 studies could be replicated, allowing comparison of bat activity data before the onset of WNS with this data collected after WNS began. Consequently, all parties, including the Applicant, agreed to move forward with additional acoustic studies from April through October 2011 to assess the current level of bat activity in the Project area. It was recognized that the data would not be available for or contribute to the Deerfield FEIS and the associated decision, but that these data would be very useful for the overall monitoring and research efforts and provide value during consideration of any post-construction adaptive management strategy.

Although direct comparison is complicated by a variety of factors, preliminary analysis of results from 2011 appear consistent with results from 2005 and 2006. Activity levels varied during the season, between each of four sampling sites, and between detectors at different heights above ground. Peak bat activity occurred at treetop level between mid-July and mid-September. Although many calls could not be identified (because of short duration or poor quality), most of the identifiable calls were from eastern red bats and bats belonging to the big brown bat/silver-haired bat guild. Calls from Myotis species and hoary bats were the least frequently identified. Additional details of this additional bat study may be found in Appendix E.

3.11.1.2 Sources of Potential Impacts to Bats from Wind Turbines

Some early studies of inland wind facilities recorded relatively few bat mortalities compared to the overall size of local bat populations (Howe et al., 2002). These early studies may have failed to identify mortality of bats because they were designed to measure mortality of birds (Kunz et al., 2007; Cryan & Barclay, 2009). Once the potential impact to bats was identified and monitoring programs were developed with appropriate methods to detect bat mortality, it became apparent that bat mortality can be substantial at some sites during particular times of year. Mortality rates for bats at wind turbine sites may exceed mortality for birds at some sites (Johnson, 2004). Reports frequently standardize mortality by calculating the number of bat fatalities per megawatt (MW) capacity or fatalities per 2,000 square meters of rotor-swept area for each facility (Arnett et al., 2008). Mortality typically falls within the range of about one to eight bats/MW/year in much of the western and Midwestern United States, and about 15 to 40 bats/MW/year in the Northeast (Kunz et al., 2007; NRC, 2007; Arnett et al., 2008). It is important to note that the topography, habitat conditions, populations of resident and migrating bats, and other factors can vary substantially from region to region or from facility to facility. In addition, seasonality and duration of sampling efforts often varies from study to study. Mortality studies are typically conducted during late summer and fall when mortality at wind facilities has been highest.

Factors Affecting Mortality of Bats

Studies that examined many individual wind facilities over wide geographic areas have detected some general patterns to bat mortality (Kunz et al. 2007; NRC, 2007; Arnett et al. 2008; Cryan & Barclay, 2009). For example, mortality appears greater for migrating, tree- or foliage-roosting bats (e.g., red bat or hoary bat) than for hibernating bats (e.g., little brown bat, northern long-eared bat, or big brown bat). Highest rates of bat mortality are consistently recorded during late summer and fall migration period. Mortality appears to be influenced by wind and weather conditions, and is generally higher at wind facilities located along forested ridge tops in the eastern United States than in relatively open landscapes in the mid-western and western states. Site-specific features, including design of turbines, towers, and other facilities, as well as distribution of various habitat conditions also may influence bat mortality. These factors are discussed below.

Relative Mortality of Different Bat Species and Species Groups

Migratory, tree-roosting bat species are most susceptible to direct impacts from wind energy facilities throughout North America. Approximately 75% of recorded mortality has been red bats, hoary bats, and silver-haired bats. Mortality of hoary bats may vary for some sites, but it is consistently high across all regions of North America. Mortality of red bats is highest in the east, where they account for about 35% of all recorded bat mortality. Mortality of silver-haired bats generally appear to be highest in the Pacific Northwest (Kunz et al., 2007; NRC, 2007; Arnett et al., 2008); mortality of silver-haired bats has also been high (e.g., 20% to 40% of observed mortality) during some years at some sites in New York, Pennsylvania, New Hampshire, and Maine (Stantec 2008b, 2009a, 2010b; Arnett et al., 2009; Jain et al., 2009d, 2010b; Normandeau, 2010; Tidhar et al., 2010, 2011). The reasons for the high mortality of migratory bats are not completely understood. Each of these species undergoes annual, long-distance, latitudinal migration. These migrations likely bring migratory bats into potential contact with more wind facilities than resident, hibernating bats. Highest rates of mortality take place during the late-summer and fall migration (see Seasonal and Weather Influences on Bat Mortality discussion below). Scientists speculate that bats may migrate at lower elevations above ground than birds, which would expose them to greater danger from tall wind turbines. Migrating bats also may mistake wind turbines for attractive roosting trees during migration. In addition, bats may not echolocate during migration (Gruver, 2002; Johnson, 2004), possibly reducing the likelihood of detecting obstructions (Crawford & Baker, 1981; Kunz et al., 2007; NRC, 2007; Barclay et al., 2007; Arnett et al., 2008).

Among the non-migratory species, tri-colored bats, which account for almost 20% of recorded mortality at eastern U.S. sites, appear more susceptible than little brown bats (8.7%), northern long-eared bats (0.6%), or big brown bats (2.5%) (Kunz et al., 2007; NRC, 2007; Arnett et al., 2008). Roosting behavior of tri-colored bats (in foliage) is more similar to the migrating bats than to the other hibernating bats. This behavior might explain higher rates of mortality for tri-colored bats, although this is speculation at present (Kunz et al., 2007; Cryan & Barclay, 2009).

In 2009, a dead Indiana bat was found at the Fowler Ridge I Wind Farm in Benton County, Indiana. Due to the time of year of the death, and a lack of both summer and winter habitat nearby, the bat is thought to have been a migratory individual (USFWS, 2010b). In response to the documented mortality, additional monitoring was conducted at the site in 2010, during which time a second Indiana bat carcass was found (Goland, 2011). No other incidences of mortality of federally-listed bat species have been reported in the United States. However, it is possible that additional mortality of endangered or threatened species occurred without being detected. Some mortality may have occurred during times when monitoring was not being done. Some mortality will be missed, with carcasses inadvertently overlooked by searchers or removed by scavengers, and some carcasses cannot be identified to species (NRC, 2007; Arnett et al., 2008).

Surveys at a proposed wind facility in northwest Massachusetts observed that bats echolocating with high frequency calls (greater than 35 kHz: mostly *Myotis* species and red bats) and those using low frequency calls (less than 35 kHz: mostly hoary bats and big brown bats) tended to fly at different heights and responded differently to changes in temperature, and to a lesser extent, to changes in wind speed (Arnett et al., 2007). Smaller, high-frequency bats were detected most frequently at 38.2 feet (10 meters) above the ground and appeared to increase their level of activity on warmer nights. Larger, low-frequency bats were detected most frequently at about 102 to 128 feet (31 to 39 meters) above the ground and appeared less influenced by temperature (Arnett et al., 2007). Although this remains conjecture at this time, the elevation above ground, and temperature ranges that influence when bats forage, may partially explain differential susceptibility to mortality at wind facilities.

Seasonal and Weather Influences on Bat Mortality

Highest rates of bat mortality at wind facilities consistently have been reported during late summer and fall. Although mortalities can be highly variable and periodic during any given season, a strong correlation with timing of migration seems apparent (Kunz et al., 2007; NRC, 2007; Arnett et al., 2008). Fewer bat mortalities are reported during the spring northward migration than during the fall. This may be a reflection of greater sampling effort during the fall, or there may be fundamental differences between the spring and fall migrations. For example, bats may fly at different elevation above the ground in spring, or in less-concentrated waves, or they may react differently to weather fronts (Kunz et al., 2007; NRC, 2007).

Local and regional weather conditions also affect bats' activity patterns. Wind direction and speed influence bat activity, for migration as well as for non-migrational foraging (Fiedler, 2004; Arnett et al., 2008). In general, highest mortality at wind sites takes place when wind speeds are below about 10 to 13 mph (5 to 6 meters/second [m/s]) (Kerns et al., 2005; Kunz et al., 2007; Arnett et al., 2008; Horn et al., 2008a; Arnett et al., 2009). Bat activity generally is correlated positively to temperature, with greater activity on warm evenings (Fiedler, 2004; Arnett et al., 2006, 2007; Redell et al., 2006; Reynolds, 2006). Bat mortality also may be higher during thermal inversions in the wake of storm fronts or during low cloud cover that causes bats to migrate at lower elevations above ground (Kunz et al., 2007; NRC, 2007). At various sites, bat mortality has been positively correlated to barometric pressure and negatively correlated with rainfall (Kerns et al., 2005; Arnett et al., 2008). These weather conditions also affect flying insects, which in turn, will influence activity of bats (Kunz et al., 2007).

Clearly, seasons, weather conditions, and bat activity levels, both during migration and during foraging, interact to influence mortality of bats at wind facilities. These interactions are complex, but they may provide opportunities for operational adjustment of wind facilities (adaptive management) to mitigate bat mortality (e.g., Arnett et al., 2009).

Topography, Forest Cover, and Other Site Characteristics

Reported mortality rates for bats generally are higher at wind facilities constructed along forested ridge tops in the northeastern United States than at other types of sites (Kunz et al., 2007; Arnett et al., 2008). Total bat mortality for a six-week period in the fall was estimated to be 400 to 660 bats for 20 turbines at the Meyersdale Wind Facility in Meyersdale, PA, and 1,364 to 1,980 for the 44 turbines at the Mountaineer Wind Facility in Tucker County, WV (Arnett et al., 2005). These estimated mortality figures were adjusted for searcher error and scavenging. The causes for these incidents of high mortality rate at Meyersdale and Mountaineer are unknown.

During the active season, bats are strongly associated with free water for roosting sites and for foraging areas (see species descriptions, above). These wet habitats typically support flying insects for forage, and also provide water for bats to drink. Jain et al. (2007) reported that bat mortalities appeared to be slightly greater at turbines close to wetland areas than at turbines located farther from wetlands at the Maple Ridge facility in New York, although this relationship has not been reported elsewhere (Arnett et al., 2008). At some sites, bat mortalities are clustered at the ends of turbine strings, or near the center of a string; at other sites mortality appears evenly distributed along the all turbines (Kerns et al., 2005; Fiedler et al., 2007; NRC, 2007; Arnett et al., 2008).

Design Features of Wind Turbines

Various hypotheses attempt to explain why bats are vulnerable to mortality at wind facilities. There is little evidence that bats regularly collide with non-moving objects (Arnett et al., 2005; Cryan & Barclay, 2009), suggesting that some aspect of moving, operational turbines increases the risk. Mortality of bats at wind turbines clearly is caused in part by collision of bats with blades, turbines, meteorological (met) towers, or support structures. Many of the recovered carcasses show evidence of physical trauma caused by impact (Johnson et al., 2003b; NRC, 2007; Baerwald et al., 2008; Horn et al., 2008a; Cryan & Barclay, 2009). Turbine blades deflect and dissipate bats' calls, making it more difficult for bats to detect the moving blades. This might increase the risk of collision with moving blades, especially when bats approach turbines laterally

(Long et al., 2009). In one study, however, almost half of the bats killed showed no external signs of trauma. Instead, these bats did show severe internal hemorrhaging consistent with "barotrauma," or exposure to rapid and extreme change in pressure. Rotating wind turbine blades produce vortices that can trap bats and pull them into the rotor-swept area, but they also create zones of low pressure as the air flows over them. Even if bats can detect and avoid contact with turbine blades, they may be killed by internal injuries caused by rapid pressure reductions they cannot detect or escape (Durr & Bach, 2004; Baerwald et al., 2008).

Modern wind turbines are typically white and they extend many meters above the surrounding forest canopies. These tall, white turbines may function as a visual beacon to bats and their insect prey, especially during nights with sufficient illuminating moonlight. Migratory, tree-roosting bats, in particular, tend to seek the tallest available trees for roosting. Monopole turbine towers may appear to bats to be very tall trees, and thus, desirable roost sites (Kunz et al., 2007; NRC, 2007). Wind turbines also may arouse bats' curiosity. Horn et al. (2008a) described exploratory flights around stationary or slow-moving turbine blades; on one occasion a bat landed briefly on the turbine blade. In other instances, bats appeared either to be chasing moving blade tips or drawn into the vortex.

Wind turbines may support rich assemblages of flying insects that are attracted by noises or other vibrations, heat, or some other feature of the immediate environment. These insects could attract foraging bats (Kunz et al., 2007). All wind turbines produce sound that can be detected by most humans, and presumably by bats as well. Some turbines likely also produce sounds within the range of ultrasonic frequencies used by bats for echolocation. These high-frequency sounds may attract bats and/or confuse them, potentially increasing their risk of injury (Kunz et al., 2007; NRC, 2007). Generation of complex electro-magnetic fields around turbine nacelles may attract or confuse bats, as well (Kunz et al., 2007). Additional research is needed to clarify whether these factors do in fact attract bats towards wind turbines.

Current FAA guidelines specify that for turbines, towers, or antennas with heights over 200 feet above ground level, turbines at each end of a string and at least one turbine every 0.5 mile in between must be lit with one red flashing strobe light atop the nacelle. The FAA requires red lights (L-864) with the minimum flash rate of 20 flashes per minute. Research suggests no clear evidence that obstruction lighting (flashing red strobes) attract birds or bats to turbines or towers, or that the presence of those lights cause large-scale mortality events at wind turbines. There is no apparent significant difference between the numbers of birds or bats killed at turbines with or without L-864 obstruction lights (Kerlinger, 2006a; Johnson et al., 2004; Jain et al., 2007; NRC, 2007; Horn et al., 2008a).

Height of the rotor-swept zone above the ground may become an increasingly important factor as wind turbines become larger. Barclay et al. (2007) demonstrated that although fatality rates for birds are not affected by tower height, bat fatalities increase exponentially as tower height increases, particularly when towers exceed about 213 feet (65 meters). This strongly suggests that migrating bats fly at lower altitudes than nocturnally migrating birds, and that towers over 200 feet in height likely extend into the airspace used by migrating bats (Barclay et al., 2007).

Alteration of Habitat

Alteration of habitat associated with wind projects in forested settings includes habitat fragmentation, creation of open areas, and removal of individual trees. Habitat fragmentation typically refers to the breaking up of larger contiguous tracts of habitat into smaller patches that are isolated from each other by areas of unsuitable or less suitable habitat. In this way, habitat fragmentation can create barriers that isolate population segments or impede movement of individual animals or plants between areas of suitable habitat. Depending on the scale and spatial distribution of changes, as well as the kinds of habitats involved, alteration of habitat might be fragmenting for some species and not for others (Franklin et al., 2002; USDA Forest Service, 2006a,c). Therefore, consequences of habitat alteration may be very different for the encroachment of housing developments into forested areas, conversion of forest to agricultural uses, change in habitat type through forest management, or construction of a linear wind project along a forested ridgeline. In addition, changes that make habitat unsuitable for some species may create conditions that increase the suitability of the site for other species or suites of species.

Bat species exhibit varying responses to habitat fragmentation. Some bat species respond negatively to fragmentation (Pavey, 1998; Law et al., 1999; Schulze et al., 2000), but for most species, increased area of edge and opening habitat will enhance foraging and general summer use (Grindal, 1996; Verboom et al., 1999; Fenton, 1990; Verboom & Spoelstra, 1999; Russo et al., 2002; Patriquin & Barclay, 2003; Hayes & Loeb, 2007; NRC, 2007; Horn et al., 2008a; Cryan & Barclay, 2009). Bats also use open and edge areas for echo orientation and protection from predators or wind (Verboom & Huitema, 1997; The Wildlife Society, 2007). Accordingly, clearing of forest habitat for construction of a wind facility in a generally forested habitat could attract bats into the area because of enhanced habitat conditions. This may, in fact, explain in part why mortality of bats is higher at wind facilities located on forested ridges that at those in open settings. However, it is difficult to demonstrate if habitat alteration for a wind facility would increase the numbers or species composition of bats foraging or roosting in the area, or if it would increase the risk of mortality from collision or barotrauma.

Forest clearing might remove actual or potential roost trees that could be used by many bats species (e.g., eastern red bats, big brown bats, hoary bats, and silver-haired bats) (NRC, 2007). Roosts provide many functions for bats including sites for resting, protection from weather and predators, rearing young, hibernation, digestion of food, mating, and social interactions (Kunz, 1982a,b,c; Kunz & Lumsden, 2003). In some settings, accessibility of suitable roost sites can be limiting habitat characteristic influencing the abundance and distribution of bats in some settings (Humphrey, 1975; Ports & Bradley, 1996; West & Swain, 1999).

Habitat disturbance could occur on smaller, more subtle scales as well. Clearing of forested sites could alter micro-climate habitat structure within the forest canopy due to changes in light and wind regimes, diurnal temperature patterns, soil moisture, and relative humidity. Such small-scale impacts could beneficially or adversely alter the quality of potential roosting sites (NRC, 2007).

Comparison of Deerfield Wind Project with Similar Sites

A lack of long-running wind energy facilities in New England limits the availability of comprehensive data on bat mortality that might be applicable to the Deerfield Wind Project. The Lempster Wind Facility began operation in New Hampshire in November 2008. This 12-turbine facility is located on a forested ridge approximately 45 to 50 miles (80 km) northeast of the Deerfield Project area. The 2.0 MW turbines at Lempster are of similar size and physical dimensions to those proposed for installation at the Deerfield Wind Project. Standardized mortality surveys were conducted during spring (April 15 to June 1) and fall (July 15 to October 31) of 2009 and 2010. A total of 10 bats were found during standardized searches in 2009: 4 silver-haired bats, 3 hoary bats, 2 big brown bats, and 1 little brown bat. A total of 14 bat fatalities were found during scheduled carcass searches in 2010: 8 hoary bats, 3 silver-haired bats, 2 eastern red bats, and 1 tricolored bat (formerly called eastern pipistrelle). In addition, 3 hoary bats and 2 silver-haired bats were recorded as incidental finds within the Lempster site. Once corrected for scavenger and searcher efficiency rates, overall estimated bat mortality rates were 6.21 bats/turbine/year in 2009 and 7.13 bats/turbine/year in 2010. During 2009, the majority of bat casualties occurred between August 13 and 23; only one bat was found during the spring period (Tidhar et al., 2010). In 2010, all bats were found during the fall, primarily during the August and September (Tidhar et al., 2011).

The Mars Hill Wind Farm, located along a forested ridgeline in Aroostook County, ME, began operation in March 2007. Weekly surveys were conducted at each of the 28 turbines in the spring, summer, and fall of 2007 and 2008. Twenty-four bat carcasses were found in 2007 and five bat carcasses were found in 2008. Once corrected for scavenger and searcher efficiency rates, the overall estimated bat mortality rates were 4.37 bats/turbine/year during in 2007 and 0.17 bats/turbine/year in 2008. Silver-haired bat, hoary bat, little brown bat, and eastern red bat accounted for 38%, 21%, 17%, and 13% of all detected bat fatalities, respectively, in 2007. In 2008, hoary bats and eastern red bats each accounted for 40% of mortalities, and silver-haired bats accounted for 20% (Stantec, 2008b, 2009a).

The 38-turbine Stetson Mountain Wind Project (Stetson I) in eastern Maine began operation in January 2009. In April 2010, Stetson II began operation of another 17 turbines immediately to the north of Stetson I. The Stetson turbines are located about 50 miles south of the Mars Hill facility, and about 300 miles northeast of the proposed Deerfield Wind Project. All 55 Stetson turbines are 1.5 MW machines with a maximum height of 390 feet (119 meters) from the base to highest point of the rotor-swept zone. Stantec (2010b) conducted weekly mortality searches at Stetson I from April 20 through October 21, 2009. A total of 5 bats were found: 1 little brown bat pup), 1 big brown bat, 2 hoary bats, and 1 silver-haired bat. The estimated total mortality of bats from the 2009 study was 2.11 bats/turbine/year (Stantec, 2010b). Normandeau (2010) conducted weekly searches at Stetson II from April 19 through October 31, 2010. A total of 14 bat carcasses were found: 1 little brown bat, 2 big brown bats, 5 hoary bats, and 6 silver-haired bats. The estimated total mortality of bats from the 2010 study at Stetson II was 2.48 bats/turbine/year (Normandeau, 2010).

The Maple Ridge Project, near Lowville, NY, is approximately 360 miles (580 km) to the west of the proposed Deerfield Project site. This project is significantly larger than the Deerfield Wind Project, consisting of 195 wind turbines, each about 400 feet (120 meters) tall, constructed in a grid layout over 21,100 acres. Site characteristics also are quite different from the Deerfield site; the majority of the Maple Ridge area is located on open agricultural fields (primarily hay, alfalfa, and corn) and pastures, with smaller areas of woodlots, wooded wetlands, and stream corridors. Some contiguous forest is located along the western portion of the project area. Jain et al. (2007) reported mortality of 326 bats from June 17 to November 15, 2006, the first operational year of Maple Ridge. This corresponds to 15.2 to 24.53 bats/turbine/year, with the range in mortality numbers calculated based on different survey intervals tested during the pilot study. Mortalities included five species (hoary bat, silver-haired bat, eastern red bat, little brown bat, and big brown bat). Bat mortalities peaked during the fall migration period; 69% of carcasses were found between July 1 and August 31. Also, bat mortalities appeared slightly greater at turbines located near wetlands, though no significant difference was detected between wooded and non-wooded turbine sites (Jain et al., 2007).

A second year of monitoring at Maple Ridge occurred in the spring, summer, and fall of 2007. Weekly surveys were conducted at 64 of 195 turbines, for a total of 1,736 turbine searches. Remains of 202 bats were found by searchers during standardized surveys, with an additional 81 carcasses discovered outside formal surveys. Once corrected for scavenger and searcher efficiency, the overall bat mortality rate (including incidental fatalities outside standardized surveys) was 13.87 bats/turbine/year. Species consisted of the same five identified in 2006. The greatest number of bat mortalities occurred during the fall migration period, with approximately 66% of bat carcasses found between July 1 and August 31 (Jain et al., 2009a). A third year of monitoring at Maple Ridge occurred in the spring, summer, and fall of 2008. Weekly surveys were conducted at 64 of 195 turbines, for a total of 1,882 turbine searches. Remains of 140 bats were found by searchers during standardized surveys, with an additional 76 carcasses discovered outside formal surveys. Once corrected for scavenger and searcher efficiency, the overall bat mortality rate (including incidental fatalities outside standardized surveys) was 8.92 bats/turbine/year. Species consisted of the same five identified in 2006 and 2007. As in previous years, the greatest number of bat mortalities occurred during the fall migration period, with approximately 81% of bat carcasses found between July 1 and September (Jain et al., 2009b).

The existing Searsburg Wind facility is located immediately north of the Eastern Project site. The Searsburg project, completed in 1997, includes 11 turbines along a forested ridge with a maximal blade height of about 200 feet (60 meters). Kerlinger (1997d) conducted avian mortality searches in 1997 (30 June to 18 October) and reported finding no bird carcasses under the turbines. It is difficult to make robust inference about possible bat mortality from this study, as it was not designed to monitor bats. As noted above, the first mortality studies at utility-scale wind facilities focused on birds and did not anticipate mortality of bats (Kunz et al., 2007; Cryan & Barclay, 2009). Based on his observations, Kerlinger (1997d) tentatively concluded that the Searsburg facility was not killing large numbers of birds. Presumably, had large-scale mortality of bats been observed, it would have been reported; none were reported. As noted above, however, risk to migrating bats appears to increase as the rotor-swept zone reaches higher above about 200 feet

(Barclay et al., 2007). Thus, the existing Searsburg turbines may not be representative of potential bat mortality from structures that are approaching or exceed twice their height.

Bat mortality has been high at forested ridgeline wind facilities in West Virginia and western Pennsylvania. The 44-turbine Mountaineer Wind Energy Center is located along a forested ridgeline in the Allegheny Mountains in northern West Virginia, about 450 miles southeast of the Deerfield site. Mountaineer went online in late 2002. Estimates of bat mortality at Mountaineer in 2003 and 2004 ranged from 31 to 48 bats/turbine/year (Kearns & Kerlinger, 2004; Arnett, 2005). The 20-turbine Meyersdale Wind Energy Center, located in the Allegheny Mountains in western Pennsylvania about 60 miles north of Mountaineer, began commercial operation in 2003. Although the facility is situated along a forested ridgeline, the surrounding area includes a greater proportion of open agricultural land than that around Mountaineer. Estimates of bat mortality at Meyersdale in 2004 ranged from 20 to 46 bats/turbine/year (Arnett, 2005).

In summary, bat mortality varies from facility to facility, with some general trends of relative risk by region. Reported mortality is the highest along Appalachian ridgelines, more moderate in New York State, and relatively lower in New England. Considering the similarity of ecological settings on forested ridgelines in northern New England, the proposed Deerfield Project would be expected to pose a risk for bat mortality similar to that at Lempster, NH, and Mars Hill and Stetson Mountain, ME.

Correlation of Pre-Construction Studies with Post-Construction Mortality

A consistent and reliable correlation between pre-construction bat activity and post-construction bat mortality, for resident bats or for migrating bats, may be difficult to identify. Roy and Erickson (2007) reported that mortality of bats generally is low at sites where pre-construction bat activity also was low, and mortality is high where pre-construction activity was observed to be high. Arnett et al. (2006, 2009) observed high levels of bat activity prior to construction, as well as relatively high levels of mortality after construction of the Casselman Wind Project in southwestern Pennsylvania. Relationships between pre-construction bat activity and post-construction mortality can be confounded by a variety of factors. For example, wind energy facilities cited by Roy and Erickson (2007) are widely divergent in their characteristics: large grid-like layouts in agricultural land versus strings of turbines on forested ridges; different facilities in different settings in Wyoming, Minnesota, Iowa, Tennessee, and West Virginia; and facilities with maximal rotor height varying from about 270 feet (82 meters) to 400 feet (120 meters). Reynolds (2006) observed low activity of bats at the Maple Ridge Wind Project during pre-construction surveys in the spring and summer. However, Jain et al. (2007, 2009a,b) observed relatively high mortality of bats, particularly migratory bats, in mid- to late summer and early fall.

Most researchers caution against citing low bat activity at rotor-height during pre-construction surveys as an indication that post-construction mortality of bats would be low. For example, bats may be attracted to a site once turbines are constructed (Ahlén, 2003; Kunz et al.; 2007; Arnett et al., 2008) due to changes in vegetation cover. In addition, conditions from pre- to post-construction may also affect the height at which bats fly, thus leading to more bats feeding, commuting, or migrating through an area, and potentially increasing exposure risk with turbine rotors (Kunz et al., 2007).

3.11.2 Direct and Indirect Impacts Presented by Alternative

Public scoping identified one significant issue in regard to bats. People are concerned that the Proposed Action would result in unacceptable mortality to bat species, including migrating and local resident populations, due to collisions with turbines and turbine blades.

The analysis area for direct and indirect impacts to bats is the 9,523-acre Project area, which includes GMNF Compartments 121, 122, 123, and 124 of the Manchester Ranger District. Potential direct impacts to bats associated with construction and operation of the proposed Deerfield Wind Project include (1) risk of collision and "barotrauma" (internal damage from rapid and dramatic pressure change) caused by operating turbines, and (2) alteration of habitat associated with construction of turbines and infrastructure. Potential indirect impacts include disturbances to bats associated with the presence or activity of construction equipment and on-going maintenance of the operating facility, and disturbance to habitat that could alter movements and behavior of bats. Indirect impacts associated with alteration of habitat include changes in habitat use and possible shifts in species composition, as forest clearing associated with the proposed activities would create new foraging opportunities and provide travel corridors.

Indicators used to analyze direct impacts to bats include numbers and species composition of bats that might be killed by collision with turbines, turbine blades, or other support structures, or by barotrauma (expressed as an estimated level of risk of mortality), and the number of acres of mature forest habitat converted to other habitat types. Indicators of indirect impacts include potential changes in species composition or behavior of resident breeding bats at the Project site, and possible changes in species composition or flight patterns of bats migrating past the Project site.

3.11.2.1 Proposed Action

The Proposed Action would consist of installation and maintenance of 17 wind turbines, with the associated construction/maintenance of roads, power lines, substation, and other support structures on the Eastern and Western Project sites along Route 8. The discussion of potential impacts of the Proposed Action (and alternatives) focuses on the operation of the facility (operation-related impacts). Construction-related impacts to bats would be limited to incidental injury and mortality and disturbance/displacement due to construction activity and traffic over the anticipated nine-month construction period. Construction-related impacts would be short-term and minimal.

3.11.2.1.1 Bat Mortality

The primary direct impact of utility-scale wind facilities on bats is mortality from collisions with turbines, turbine blades, met towers, or other support structures, and mortality from barotrauma, which results from exposure to rapid and extreme change in air pressure as a bat moves between moving rotor blades. The estimated level of risk of mortality is used to describe this impact. As described above, no reliable method exists for predicting bat mortality at wind facilities based on pre-construction assessment of bat activity.

Reported mortality of bats generally has been lower in New England than in New York, which in turn, has been lower than along Appalachian ridgelines in Pennsylvania and West Virginia (see Section 3.11.1.2, above). The most likely assumption is that bat mortality at the proposed Deerfield site would be at a scale similar to that observed at similar sites on forested ridgelines in northern New England: Lempster, NH (a range of 6.21 to 7.13 bats/turbine/year in 2009 and 2010; Tidhar et al., 2010, 2011); Mars Hill, ME (a range of 0.17 to 4.37 bats/turbine/year in 2007 and 2008; Stantec, 2008b, 2009a); Stetson Mountain I, ME (2.11 bats/turbine/year in 2009; Stantec, 2010b); and Stetson II, ME (2.48 bats/turbine/year in 2010; Normandeau, 2010). The average mortality for the Lempster, Mars Hill, and Stetson facilities during six study years, weighted by the number of turbines, was 3.14 bats/turbine/year. This method estimates total bat mortality from collision and barotrauma at 54 bats per year for the 17-turbine Proposed Action. Using the lowest (0.17 bats/turbine/year) and highest (7.13 bats/turbine/year) mortality figures from these similar New England facilities would result in an estimated total bat mortality in the range of 3 to 122 bats per year for the entire 17-turbine facility.

Bat mortality of a similar magnitude as that reported from Maple Ridge, NY (low and high range from those three years: 8.92 to 24.53 bats/turbine/year in 2006 to 2008; Jain et al., 2007, 2009a,b) would result in the death of an estimated 152 to 417 bats per year at the 17-turbine Deerfield site. As described in Section 3.11.1.2, it appears that the highest level (24.53) was reported in the first year of operation and was calculated from different surveys conducted during pilot studies. Mortality levels appeared to be decreasing from 2006 to 2008. Mortality of the scale observed at the Mountaineer and Meyersdale sites (a range of 20 to 48 bats/turbine/year in the years 2003 and 2004), results in estimates of 340 to slightly more than 800 bats per year at the Deerfield site. Mortality of the scale observed at Maple Ridge would not be expected at the Project site, because of lower pre-construction bat activity and substantial differences in site characteristics, and because bat mortality in the New England region has generally been lower. Extreme levels of mortality, such as those in West Virginia or western Pennsylvania in those early years are even less likely.

Based on observations at other facilities in the Northeast (Fiedler, 2004; Kerns & Kerlinger, 2004; Arnett et al., 2005, 2009; Kerns et al., 2005; Fiedler et al., 2007; Kunz et al., 2007; Jain et al., 2007, 2009a,b,c,d,e, 2010a,b,c; Stantec, 2008b, 2009a,b, 2010a,b; Young et al., 2009; Tidhar et al., 2010, 2011; Normandeau, 2010), the composition of bat mortality at the Project site would be expected to be about 70% or more migratory bat species (hoary, red, and silver-haired bats). The species composition of bat mortality at the three forested ridgeline sites in northern New England (Lempster, Mars Hill, and Stetson), however, has shown to be different from that for the Northeast as a whole, with a higher percentage of silver-haired bats. Based on six years of study at these three sites, the observed mortality was approximate 38% hoary bats, 35% silver-haired bats, 10% eastern red bats, 10% little brown bats, 7% big brown bats, and 1% tricolored bat (Stantec, 2008b, 2009a, 2010b; Normandeau, 2010; Tidhar et al., 2010, 2011). The first three species (hoary, silver-haired, and eastern red bats) represent migratory bats, which combine for

83% of the total observed mortality. The latter three species (little brown, big brown, and tri-colored bats) represent hibernating resident bats, which combine for 17% of the total observed mortality. Lacking empirical data, these are assumed to be the best prediction of species-specific mortality to be expected at the proposed Deerfield Wind Project. Applying this species ratio to an estimated total mortality of 54 bats, as calculated above, the species composition of annual mortality at the proposed 17-turbine Deerfield facility would be 21 hoary bats, 19 silver-haired bats, 6 red bats, 6 little brown bats, 4 big brown bats, and 1 tri-colored bat (all fractional estimates rounded up).

In the aftermath of WNS, populations of resident, hibernating bats in Vermont have declined substantially. At present, it is unknown if the risk of resident, hibernating bats' exposure to wind facilities is proportional to population size. WNS probably had no influence on observed post-construction mortality at the sites in Maine, and may have had little or no impact on bat mortality at Lempster, NH facility. Thus, 10% mortality of little brown bats observed at these sites may be representative for this species when it is one of the most abundant across the landscape, but might not be realistic for a site in Vermont. In general, variability in environmental setting, the level of resident and migratory bat populations present in the area, and other conditions preclude accurate prediction of bat mortality based on mortality observed at the other sites. Mortality at any given site also appears to be subject to annual variability. Curtailment of turbines at low wind speeds likely could significantly reduce mortality (see discussion in Section 3.11.2.1.5 and Appendix A). Any accurate prediction of annual bat mortality for the proposed Project, with or without curtailment, is speculative at best, and would depend upon empirical results of comprehensive, scientifically- and statistically-rigorous, post-construction monitoring. Such monitoring would be an integral component of any Special Use permit issued for construction and operation of the Project. Protocols and study design would follow established and accepted procedures for monitoring mortality at commercial wind facilities (see section 3.11.4, below).

3.11.2.1.2 Habitat Impacts

Alteration of habitat would potentially result in direct impacts to bats through removal of roost trees and creation of small open areas and edge that could provide foraging areas and travel corridors. Under the Proposed Action, an estimated 87.4 acres would be cleared and/or graded during construction activities, totaling 0.9% of the analysis area. NFS lands account for 73.1 acres of proposed clearing and grading activities; the remaining 14.3 acres would occur on private lands. Approximately 73% of this area is northern hardwoods, 26% is montane yellow birch-red spruce, and 1% is upland brush (see Figure 3.9-1, Forest Cover Types). Direct impacts from clearing forested habitat for turbines, electrical collection lines, and roads could result in removal of potential bat roost trees. Electrical connection lines between the turbines would mostly be buried, except for an aboveground segment that would run for approximately 0.5 mile, crossing Route 8; there would be a small risk of collision associated with this above-ground segment. Given the size of the area that would remain forested, many potential roost trees would continue to be available in the Project area. Clearing of forest associated with the Proposed Action would create new or enhanced foraging opportunities for some species of bats, potentially resulting in a beneficial impact. These impacts would be less for migrating bats that would only be passing through the area. It is not possible to predict whether Project-related increases of open and forest-edge habitats would increase the number of bats that frequent the area, or whether this altered habitat would result in increased likelihood of bat mortality. Should bats be attracted to the area due to increased forage areas, this could be considered an adverse impact if it were to put more bats at risk of mortality.

Alteration of habitat could also result in indirect impacts in the form of behavioral changes in habitat use and possible shifts in species composition. Changes in habitat use would most likely occur as described in the previous paragraph, i.e., as a result of creation of new forage areas and travel corridors. These changes in use would be expected to be minor given the relatively small amount of habitat alteration when compared to the vast amounts of contiguous forest that would remain. It is difficult to predict possible changes in species composition (if any) of bats that would use the Project area. Any changes in species composition would be minor, again, given the small amount of habitat alteration, and would most likely be associated with species that prefer the new open, edge habitat.

The Proposed Action would result in direct impacts to three small wetlands on private land (Wetlands F, AH, and BB), and two small wetlands on Forest Service land (Wetlands AA and AJ) for a total of 4,905 square feet. These impacts are fully described in see Section 3.8.2.1.2. To the extent possible, impacts to wetlands, waterways, and other quality habitat important to bats have been avoided. The impacts to these small wetlands would not be anticipated to adversely affect bat habitat.

3.11.2.1.3 Night Lighting Mortality

Lighting of the turbines (and other infrastructure) would be installed at the minimum number and brightness allowed by the FAA (e.g., using flashing lights with the longest permissible off cycle). Research has found no clear evidence that the required FAA lighting attracts bats. Therefore, proposed lighting for turbines would be expected to have little or no impact on bats.

3.11.2.1.4 Impacts to Indiana Bats and Eastern Small-footed Bats

There are no known records of Indiana or eastern small-footed bats in the Project area, and none was observed during on-site surveys. As described above (3.11.1 Affected Environment), Indiana bats are not likely to occur in the Project area; if eastern small-footed bats do occur in the Project area, they would be in very low numbers. Consequently, the likelihood of direct or indirect impacts on Indiana bats or on eastern small-footed bats is considered to be extremely low.

3.11.2.1.5 Mitigation and Design Criteria for Reducing Impact

Direct and indirect impacts related to the proposed Project would be minimized through site design, adherence to designated construction limits, avoidance of sensitive areas, and minimizing disturbance to the maximum extent practicable. Advances in turbine technology and site design that has dramatically reduced the high rates of avian mortality from that observed at some early facilities, would also be expected to help minimize bat mortality (see Section 3.10.1.4.3). Electrical connection lines between the turbines would mostly be buried, except for an aboveground segment that would run for approximately 0.5 mile, crossing Route 8. The aboveground segment of the electrical collection line would adhere to all applicable guidelines for insulation and spacing recommended by the Avian Power Line Interaction Committee. These guidelines were developed specifically for birds, and although not known definitively, it is anticipated that these practices would also benefit bats. See Section 1.4 for complete Project details.

Other design criteria would include installing aircraft safety lighting at the minimum number and brightness allowed by the FAA. Synchronous, red flashing lights would be mounted on the nacelles of those turbines at the ends and within each string in accordance with FAA guidelines. No daytime lighting would be required since the turbines would be white or off-white. Lights at the substation and storage and maintenance facility would have cutoff luminaries that direct light toward the ground, eliminating light broadcast into the sky. Outdoor lighting would be controlled by manual switch or motion detectors that turn lights on only when necessary. All specific design criteria and mitigations are described in Appendix A.

Curtailment of power production at low wind speeds may be one method of reducing bat mortality at utility-scale wind facilities because bats tend to be most active when wind speeds are low. "Cut-in speed" is the wind threshold at which turbines begin producing electricity. The cut-in speeds at which modern turbines begin producing power, 7.8 to 9.0 mph (3.5 to 4.0 m/sec), are relatively low, and represent conditions where bats are often still active. Increasing cut-in speed to 13.4 mph (6.0 m/sec), for example, shifts power production to periods when bats are less likely to be flying. Curtailment appears to be most effective during migration in summer and fall (Baerwald et al., 2009; Arnett et al., 2011).

Implementation of a rigorous, scientifically-based monitoring and research program, along with adaptive management techniques based on the results of monitoring, would also be effective in reducing impacts. The overall objective of monitoring and of adaptive management would be to minimize mortality as much as possible. Protocols and design for post-construction monitoring of bird and bat mortality, as well as adaptive management actions or mitigation measures to reduce mortality of bats and birds, would be developed and implemented in consultation with an expert team of biologists. These experts should be qualified to provide the best available science to the decision-making process (see Section 3.11.4 below).

3.11.2.1.6 Summary of Proposed Action

In summary, bat mortality resulting from the Proposed Action would be anticipated to be comparable to that observed at other utility-scale wind projects located on forested ridgelines in northern New England. It would most likely be less than the observed mortality at other sites in the Northeast and much lower than that found along Appalachian ridgelines in Pennsylvania and West Virginia. Applying the weighted average rate of mortality from wind facilities in New England similar to the Deerfield Project site (i.e., 3.14 bats/turbine/year) would result in a mortality estimate of 54 bats per year. Using the range of mortality observed at New England wind facilities (0.17 to 7.13 bats/turbine/year) would result in a range of 3 to 122 estimated bat fatalities per year for the 17-turbine facility. Habitat alterations would also result in negligible loss of roost trees and creation of a small amount of foraging habitat. Impacts related to habitat use and species composition of bats in areas of altered habitat conditions, including areas where foraging habitat may be created or enhanced, would be difficult to predict but most likely would be minor due to the relatively small amount of habitat altered in comparison to the amount of contiguous forest habitat that would remain. Impacts to wetlands would also be minimal, with little or no anticipated impact to bats and bat habitat. In addition, no adverse impacts would be anticipated to Indiana bat (federal- and state-listed as endangered) and eastern small-footed bat (RFSS and state-listed as threatened). Appropriate design criteria and mitigation measures described above would be applied to minimize overall impacts.

As noted, correlation between observed, pre-construction bat activity and post-construction mortality is not definitive, and no reliable method exists for predicting bat mortality at wind facilities. Actual mortality at the Deerfield Project would be determined through rigorous post-construction monitoring.

If needed, results from post-construction monitoring would be used to develop a program of adaptive management. As the impacts and consequences of WNS become more apparent, additional adaptive management strategies may need to be considered. While the exact components of any adaptive management strategy cannot be determined at this time, possible strategies could include selective operational changes such as curtailment of turbines at low wind speeds, deterrents to keep bats away from turbines, or on-site habitat manipulation (see Section 3.11.4, below).

3.11.2.2 Alternative 1: No Action

No turbines, access roads, or other Project components would be constructed under the No Action alternative, and therefore no direct, indirect, or cumulative impacts to bats would be anticipated. There would be no risk of mortality to bats from the No Action Alternative. Vegetative communities would continue to be managed under the directives outlined in the Forest Plan for the Diverse Forest Use Management Area. In the short term, landscape-level conditions, including bat habitat, would remain the same. Over the long term, forest stands would continue to mature, with existing young forest and openings succeeding to older forest stands. The lack of newly created openings from the proposed Project and maturation of existing openings in the area would minimize foraging areas for bats and travel paths would be diminished (USFWS, 2008).

3.11.2.3 Alternative 2: Reduced Turbines in Western Project Site

Alternative 2 would reduce the number of turbines on the Western Project site from 10 to eight by removing three turbines from the southerly end of the Western Project site, and adding one at the northern end, with an associated reduction in clearing for turbine pads and roads. The East side configuration of seven turbines would be the same as for the Proposed Action. The Reduced West alternative’s 15-turbine configuration would use five 2.0 MW Gamesa G80 turbines and ten 2.0 MW Gamesa G87 turbines. The G87 turbines have a slightly longer blade resulting in a total rotor diameter of about 286 feet (87 meters). These turbines would have a maximum blade tip height about 11 feet (3.5 meters) taller, at 398 feet (121.3 meters), than the 387-foot tall G80 turbines. Such a small difference in rotor diameter and height is not anticipated to produce any change to the potential impacts.

The area of disturbance attributed to all construction for the Reduced West alternative is approximately 85.4 acres. Direct and indirect impacts to bats, both beneficial and adverse, likely would be proportionally less for Alternative 2 than for the Proposed Action. Using the weighted average mortality rate documented at operating New England wind facilities (3.14 bats/turbine/year), the estimated total mortality from collision and barotrauma would be 48 bats per year for the 15-turbine facility. Alternatively, using the range of 0.17 to 7.13 bats/turbine/year as discussed above, would result in estimated total mortality ranging from 3 to 107 bats per year for the entire 15-turbine facility. Levels of mortality like those observed at Mountaineer or Meyersdale (a range of 20 to 48 bats/turbine/year) yields estimates ranging from 300 to 720 bats per year. As noted for the Proposed Action, mortality of the scale observed at Maple Ridge would not be expected at the Project site, because of lower pre-construction bat activity and substantial differences in site characteristics, and because bat mortality in the New England region has generally been lower. Extreme levels of mortality, such as those in West Virginia or western Pennsylvania in those early years are even less likely. Actual mortality could be greater or lower, and any accurate prediction of bat mortality for this alternative would be speculative, and likewise, would depend upon empirical results of post-construction monitoring. Such monitoring would be an integral component of any Special Use permit issued for construction and operation of the proposed Project (see section 3.11.4 below).

It is anticipated that relative mortality for species or species groups would be the same as for the Proposed Action. Assuming total mortality estimate of 48 bats and using the percentages ratios from Section 3.11.2.1.1 above, the species composition of annual mortality estimated for Reduced West alternative would be 19 hoary bats, 17 silver-haired bats, 5 red bats, 5 little brown bats, 4 big brown bats, and 1 tri-colored bat (all fractional estimates rounded up). As noted above for the Proposed Action, estimating that little brown bats might account for 10% mortality likely is unrealistic for a site in Vermont in the aftermath of WNS.

The small reduction in acres of clearing when compared to the Proposed Action would result in removal of slightly fewer potential roost trees and slightly less increase in forage habitat. As noted for the Proposed Action, the clearing that would produce more forage could be considered a beneficial impact; however, it could be considered an adverse impact if it attracts more bats and thus increases the risk of mortality. As noted, it is difficult to predict whether Project-related increases of open and forest-edge habitats would increase the number of bats that frequent the area, or whether this altered habitat would actually result in increased exposure of bats to mortality. The slightly less alteration of habitat for the Reduced West alternative would also result in an only slightly different behavioral response by bats to altered habitat conditions when compared to the Proposed Action (i.e., would only be a minor change). Likewise, these changes in habitat would most likely produce changes in species composition of bats using the area very similar to those described for the Proposed Action.

Electrical collection cables would be underground beneath the access roads in the vicinity of the wind turbines, as well as across the southern end of the western string where the three turbines would be dropped from this alternative. Underground cables should have no adverse impact on bats. There would be a small risk of collision associated with the above-ground portion of the electrical collection system along the ridge south from the Western Project site and across Route 8 similar to the Proposed Action.

Impacts to wetlands would also be minimal, with little or no anticipated impact to bats and bat habitat as described for the Proposed Action. No adverse impacts would be anticipated for Indiana bats or for eastern small-footed bats. As for the Proposed Action, appropriate design criteria and mitigation measures described above would be applied to minimize overall impacts. Because there would be no changes to the Eastern Project site configuration for this alternative, the impacts from activities on that site would be the same as for the Proposed Action.

In summary, Alternative 2 would result in a slight reduction in potential direct and indirect impacts compared to the Proposed Action, approximately proportional to the reduction in number of turbines and reduction in acres of forestland cleared. Impacts of Alternative 2 on the estimated level of risk of bat mortality from collision and barotrauma would be anticipated to be proportionally lower than for the Proposed Action. Any indirect impacts associated with Alternative 2 would be very similar to those of the Proposed Action.

3.11.2.4 Alternative 3: Turbines in Eastern Project Site Only

Alternative 3 would eliminate all turbines from the Western Project site and reduce the total number of turbines to seven, all on the Eastern Project site, with an approximately proportional reduction in clearing for turbine pads and roads. The actual area of disturbance attributed to all construction for Alternative 3 is approximately 49.6 acres, a considerable reduction from the 87.4 acres impacted under the Proposed Action and 85.4 acres impacted under Alternative 2. Pre-construction research at the Project site detected no difference in bat activity patterns on the Eastern and Western Project sites. Therefore, potential bat mortality from collision and barotrauma would be anticipated to be approximately proportional to the number of turbines. Using the average weighted mortality rate documented at operating New England wind facilities (3.14 bats/turbine/year), the estimated total mortality from collision and barotrauma would be 22 bats per year for the 7-turbine facility. Alternatively, using the range of 0.17 to 7.13 bats/turbine/year, as discussed above, would result in estimated total mortality ranging from 2 to 50 bats per year for the 7-turbine facility. Levels of mortality like those observed at Mountaineer or Meyersdale (a range of 20 to 48 bats/turbine/year) yields estimates ranging from 140 to 336 bats per year. As noted for the Proposed Action, mortality of the scale observed at Maple Ridge would not be expected at the Project site, because of lower pre-construction bat activity and substantial differences in site characteristics, and because bat mortality in the New England region has generally been lower. Extreme levels of mortality, such as those in West Virginia or western Pennsylvania in those early years are even less likely. Actual mortality could be greater or lower, and any accurate prediction of bat mortality for this alternative would be speculative, and likewise, would depend upon empirical results of post-construction monitoring. Such monitoring would be an integral component of any Special Use permit issued for construction and operation of the proposed Project (see Section 3.11.4 below).

It is anticipated that relative mortality for species or species groups would be the same as described for the Proposed Action or Alternative 2 (i.e., using the percentages ratios from Section 3.11.2.1.1 above). For total mortality estimate of 22 bats for the East Side Only alternative, the species composition of annual mortality would be approximately 9 hoary bats, 8 silver-haired bats, 3 red bats, 3 little brown bats, 2 big brown bats, and 1 or no tri-colored bats (all fractional estimates rounded up). As noted above for the Proposed Action and Alternative 2, estimating that little brown bats might account for 10% mortality likely is unrealistic for a site in Vermont in the aftermath of WNS.

The acreage proposed for clearing for the East Side Only alternative is only slightly more than half of what is proposed for the Proposed Action. This large reduction in acres cleared when compared to the Proposed Action, and also Alternative 2, would result in removal of a much lower number of potential roost trees and substantially less increase in forage habitat. The clearing that would produce more forage would be considered a beneficial impact; however, some people would consider it an adverse impact if it attracts more bats and thus increases the likelihood of mortality. As noted, it is difficult to predict whether Project-related increases of open and forest-edge habitats would increase the number of bats that frequent the area, or whether this altered habitat would actually result in increased exposure of bats to potential mortality. In addition, the small amount of habitat alteration for the East Side Only alternative (49.6 acres) would therefore most likely result in minor behavioral response by bats to altered habitat conditions, and would result in little or no changes in the species composition of bats using the area.

Little or no direct impacts would be anticipated from the construction of the eastern substation and improvements to the existing transmission line along Sleepy Hollow Road. Impacts to wetlands would be minimal, with little or no anticipated impact to bats and bat habitat as described for the Proposed Action and Alternative 2. No adverse impacts would be anticipated for Indiana bats or for eastern small-footed bats. As for the Proposed Action and Alternative 2, appropriate design criteria and mitigation measures described above would be applied to minimize overall impacts.

In summary, Alternative 3 would result in a substantial reduction in potential direct and indirect impacts compared to the Proposed Action and Alternative 2, approximately proportional to the reduction in number of turbines and reduction in acres of forestland cleared. Impacts of Alternative 3 on the estimated level of risk of bat mortality from collision and barotrauma would be anticipated to be low, most likely considerably lower than the Proposed Action and Alternative 2. Any indirect impacts associated with Alternative 3 would also be lower than those of the Proposed Action and Alternative 2.

3.11.3 Cumulative Impacts

It is extremely difficult to estimate the total cumulative impacts to bats from all sources, given the extremely large area of consideration (i.e., the migratory range of all species at risk). Increasingly sophisticated sampling and analysis techniques provide statistically robust estimates of bat mortality at individual wind facilities, but there have been few attempts to estimate total bat mortality across large regions or the entire range of individual species or populations (e.g., Kunz et al., 2007; NRC, 2007). Kunz et al. (2007) attempted to model cumulative impact based on projected development of wind power in the mid-Atlantic highlands (Maryland, Pennsylvania, Virginia, and West Virginia), estimating a total annual mortality of 20,000 to 76,000 migratory bats (hoary, eastern red, and silver-haired bats) by the year 2020. Attempts to reasonably assess cumulative mortality would require knowledge of migratory routes followed by these bats between summer and winter ranges, the wind facilities they would be exposed to, and the mortality rates for those facilities. Estimating cumulative impact is further complicated by the absence of reliable data on population size, total range-wide mortality from other sources, and other demographic parameters. Overall population levels of most or all bat species are largely unknown and very difficult to estimate. This is especially true in the Northeast, as so many cave-dwelling bat populations are affected by WNS. Consequently, assessment of cumulative impacts becomes largely an estimation of relative levels of risk associated with each alternative when considered cumulatively with all other possible impacts.

Cumulative impacts to bats would include both direct and indirect impacts resulting from the proposed Project or its alternatives, in combination with impacts from past, present, and reasonably foreseeable future actions. The cumulative impact analysis will consider past actions over the last 5 to 10 years, and reasonably foreseeable future actions in the next 5 to 10 years. The 10-year timeframe is effective because by 10 years after timber management or other vegetation-altering activities, regenerating stands have aged to the point when characteristics and ecological benefits of early successional habitat begin to diminish.

The analysis of direct and indirect impacts focuses on the Project area. However, it is vital that the analysis of cumulative impacts considers impacts from other sources located within the normal range of movement for individuals of each species, and that range includes areas well outside of the defined Project area. For resident bat species, this includes impacts encountered during movements on and between summer roosting and foraging areas and winter hibernacula, as well as consequences of WNS. For migratory bats, impacts resulting from the proposed Deerfield Project would be additive to mortality and other impacts from other sources encountered on summer and winter ranges and during migration.

Therefore, in order to consider meaningful impacts from sources located outside the Project area, the cumulative impacts analysis area has been expanded to include the area encompassing four other relatively nearby wind facilities that have been identified as potentially contributing to cumulative effects. They are the Searsburg Wind Facility, Berkshire facility in western Massachusetts, the Hoosac facility in northwestern Massachusetts, and the Lempster Wind facility in New Hampshire. Searsburg, Berkshire, and Lempster are operational, and Hoosac is currently under construction. The area of potential movement for resident, hibernating bats could include the Searsburg, Berkshire, Hoosac, and the proposed Deerfield facilities. The Lempster facility may also be within the normal range of movement of resident bats that occur in southern Vermont and western Massachusetts. All five facilities would be expected to experience levels of impacts to migratory bats. No other wind projects close to the Deerfield Project are anticipated in the reasonably foreseeable future.

Construction and operation of the existing Searsburg Wind Facility, which went on-line in mid-1997 (slightly beyond the 5 to 10 year period of past activities used to discuss cumulative impacts), is the only past activity likely to continue representing a continuing source of potential adverse impacts to bats that is close to the Project area. Mortality of bats has not been recorded for the Searsburg facility, although it must be noted that post-construction monitoring was not designed to search for bats. The Searsburg facility continues in operation. Two over-grown openings were cleared and two new 60-meter meteorological towers were installed in the Western Project area during the winter of 2009. Two new 60-meter met towers (along with one already in place) were also installed in re-cleared brushy openings in the Eastern Project area in the spring of 2010. Three of the four met towers placed in 2009 to 2010 were removed in the spring of 2011; one of the three 60-meter towers was replaced in-kind. The existing meteorological towers currently under permit would be expected to be removed if construction of the Project proceeds. No new met towers are proposed at this time. Existing evidence suggests that stationary objects such as meteorological towers do not present a threat to bats (Arnett et al., 2005; Cryan & Barclay, 2009).

Located about 45 to 50 miles northeast of the Deerfield Wind Project, the 12-turbine Lempster Wind facility began operation in November 2008. Like the proposed Deerfield Project, the Lempster facility turbines are situated along a forested ridge that is oriented approximately north-south. Clearings for turbines, access roads, and other infrastructure were cut from mostly a mixed hardwood-coniferous forest that contained some open areas. Each turbine is about 400 feet tall from base to blade tip at its highest point.

The Berkshire Wind Power Project was dedicated in May 2011. This 10-turbine facility, operated by a cooperative of non-profit public power entities, is located in the Town of Hancock in Berkshire County, MA, approximately 23 miles southwest of the Deerfield Project site. Each of the 1.5 MW turbines is slightly less than 400 feet tall from base to blade tip at its highest point. These turbines are located on a north-south oriented forested ridge at elevations of about 2,500 to 2,700 feet. Although little information is available about this project, presumably the amount of clearing and construction of roads and turbine pads is roughly proportional to that of the proposed Deerfield Project.

Another nearby development, the Hoosac Wind Power Project, is currently under construction, with operation anticipated to commence in 2012. The Hoosac facility will include two strings of turbines, one with 11 turbines and one with 9 turbines, with an approximate north-south orientation. Individual turbine sites range in elevation from approximately 2,300 to 2,800 feet. Each turbine will be about 340 feet tall from base to blade tip at its highest point (Arnett et al., 2007). Like the proposed Deerfield Project, the Hoosac facility will create clearings along forested ridgelines for turbines, access roads, power lines, and other facilities. About 73 acres will be cleared for construction with about 15 acres being maintained long-term in a cleared condition. This project is located in towns of Florida and Monroe, MA, with most of the project lying about 8 to 10 miles south of the Deerfield Project.

Presumably, the risk of direct impacts on bats (collision with towers or turbines or barotrauma caused by moving blades) is similar for most of these facilities, and perhaps less for the smaller-turbine Searsburg facility. As described in Section 3.11.2.1.1 for the Proposed Action, the species composition of bat mortality at three of these forested ridgeline sites in northern New England (Lempster, Mars Hill, and Stetson), provides the best prediction of species-specific mortality to be expected at the proposed Deerfield Wind Project. Based on six years of study at these three sites, the observed mortality was approximate 38% hoary bats, 35% silver-haired bats, 10% eastern red bats, 10% little brown bats, 7% big brown bats, and 1% tricolored bat (Stantec, 2008b, 2009a, 2010b; Normandeau, 2010; Tidhar et al., 2010, 2011). The first three specie groups, hoary bats, silver-haired bats, and eastern red bats, represent migratory species; percentage composition for these would be 83%. The latter three groups, little brown bats, big brown bats, and tricolored bats, represent resident species, with a percentage composition of 17%.

Section 3.11.2.1.1 describes how bat mortality at the proposed Deerfield site would be at a scale similar to that observed at similar sites that include Lempster, NH; Mars Hill, ME; and Stetson Mountain I and II, also in Maine. Six study years at these facilities resulted in a weighted average mortality of 3.14 bats/turbine/year. Applying this average to the four facilities used to estimate cumulative impacts (11 turbines at Searsburg, 20 turbines at Hoosac, 12 turbines at Lempster, and 10 turbines at Berkshire) and adding in the incremental impact estimated for the Deerfield Project would result in an average annual cumulative mortality of 220 bats per year for the Proposed Action, 214 bats per year for Alternative 2, and 189 bats per year for Alternative 3. The Lempster data has been included in this calculation even though it is uncertain that the facility is within the normal range of movement of resident bats that occur in southern Vermont and western Massachusetts. Applying the 17% figure representing locally-hibernating (residents) bats would result in an average annual cumulative mortality of 38 resident bats per year for the Proposed Action, 37 resident bats per year for Alternative 2, and 32 resident bats per year for Alternative 3.

The lowest (0.17 bats/turbine/year) and highest (7.13 bats/turbine/year) mortality figures from the studies conducted for the Lempster, Mars Hill, and Stetson I and II facilities can be used to disclose an estimated range of cumulative mortality. Applying these figures to the four facilities used to estimate cumulative impacts, and adding in the incremental impact estimated for the Deerfield Project, would result in an average annual cumulative mortality range of 13 to 502 bats per year for the Proposed Action, 13 to 487 bats per year for Alternative 2, and 12 to 430 bats per year for Alternative 3. Applying the 17% figure representing locally-hibernating (residents) bats would result in an average annual cumulative mortality range of 3 to 86 resident bats per year for the Proposed Action, 3 to 83 resident bats per year for Alternative 2, and 2 to 74 resident bats per year for Alternative 3 (all fractional estimates rounded up). The potential cumulative impacts of the proposed Project on resident bats cannot be evaluated without consideration of the extremely high mortality from WNS for several species in the region. As described above, mortality of resident bat species is typically low at wind facilities, compared to that of the migratory bat species. If mortality is assumed to be directly proportional to the level of local populations, risk of mortality likely would be reduced in the wake of WNS, as would the potential cumulative impacts of the proposed Project on these species. If mortality of resident bat species from the Project operation is higher than anticipated, impacts of the Project could result in a substantially greater incremental cumulative impact when added to those from WNS, although this is not anticipated. Whatever the resultant cumulative mortality (or lack thereof) of resident bats, the magnitude of any incremental impact from the Project would be greatest for the Proposed Action, slightly less for Alternative 2, and substantially less for Alternative 3. Pending results from on-going acoustic surveys and other investigations, the abundance, distribution, and future status of these species, as well as the potential cumulative impacts remains uncertain.

It is generally more difficult to assess cumulative impacts for migratory bats. Although these species appear to be unaffected by WNS, they do suffer some mortality at utility-scale wind facilities across their range. Migratory bats that pass through Vermont also might be exposed to the sites listed above for the locally-hibernating bats, as well as some combination of the many utility-scale facilities operating, under construction, or planned from eastern Canada and Maine through New York and Pennsylvania to West Virginia and Tennessee. As calculated above for the four facilities included in the analysis of cumulative impacts, and including the incremental mortality estimated for the Deerfield Project, the average annual total cumulative mortality estimates would be 220 bats per year for the Proposed Action, 214 bats per year for Alternative 2, and 189 bats per year for Alternative 3. Applying the 83% figure representing migratory bats would result in an average annual cumulative mortality of 183 migratory bats per year for the Proposed Action, 178 migratory bats per year for Alternative 2, and 157 migratory bats per year for Alternative 3. Using the lowest (0.17 bats/turbine/year) and highest (7.13 bats/turbine/year) mortality figures from the studies conducted for similar New England facilities, adding in the incremental impact estimated for the Deerfield Project, and applying the 83% figure representing migratory bats would result in an average annual cumulative mortality range 11 to 417 migratory bats per year for the Proposed Action, 11 to 405 migratory bats per year for Alternative 2, and 10 to 357 migratory bats per year for Alternative 3 (all fractional estimates rounded up).

Regarding habitat alteration, there has been little timber harvesting and clearing of forestland in the last 10 years that increased foraging habitat, or decreased roost trees in the Project area. Existing small openings containing meteorological towers have been subject to occasional maintenance and clearing, most recently in the past couple years, as described above. Future activities that could affect bat habitat include timber sales and other similar resource management actions on NFS or private land. No timber sales or other large scale habitat-altering activities are planned by the Forest Service within the Project area in the immediate future. The Forest Service conducts routine maintenance, including hand cutting of brush, mowing, and prescribed burning, in permanent upland openings across the GMNF. In some years this may include tens or hundreds of acres on the Manchester District. Timber harvesting on private lands in or near the Project area has occurred in the recent past and would be expected to continue. There is very little private land within the Project area. Regarding future harvests, there is no record-keeping or advanced planning on most of the private land in the Project vicinity (Fice, 2008). Also, the Forest Service is not aware of any major road improvement projects, large subdivisions, housing developments, or other activities proposed for private lands within the Project area that would adversely affect bat habitat. The remoteness of the area and abundance of public land in the region contributes to the lack of major developments.

A landscape-scale planning effort for NFS lands south and west of the Project area is expected to begin in 2011. This planning effort might include additional GMNF lands south of Route 9 and east of the Project area, as well. It would be at least one to two years beyond 2011 before any definite proposals would be analyzed. No specific proposals are known at this time. This analysis will most likely exclude the immediate Deerfield Project area (except for analysis of cumulative effects). It will commence with a landscape-scale assessment of resources: roads, trails, recreational activity, ecological resources, soil and water conditions, timber, wildlife habitat, archaeological and heritage sites, etc. After assessment, the Forest Service, in collaboration with local residents and other interested parties, will develop proposed actions and alternatives that will likely include timber management, habitat enhancement, improvements to trails and roads, and so on. Any resultant NEPA analysis will include full assessment of its potential impacts on bats and other resources. Thus, the level of habitat-altering activities over the next 10 years is anticipated to be low and widely distributed across the landscape.

In summary, the overall cumulative impact would be the greatest for the Proposed Action, slightly less for the Reduced West alternative, and much less for the East Side Only alternative. There would be little if any direct or indirect cumulative impact on bats due to habitat alteration affecting bat foraging habitat, the availability of roost trees, and the species composition of bats using the area for any of the action alternatives. Similarly, no cumulative impacts would be expected for threatened, endangered, or sensitive bat species from any of the alternatives discussed in detail due to lack of direct or indirect impacts to these species. Because direct and indirect impacts would be negligible under the No Action Alternative, no cumulative impacts would be anticipated.

3.11.4 Scientific Monitoring and Research Study

Scientific uncertainty over the impacts of a development like the proposed Project can be analyzed and resolved only through continuing monitoring and research efforts. Sampling and analysis techniques for monitoring mortality of bats at wind facilities has become increasingly sophisticated and standardized to address factors such as probability of detecting carcasses, observer bias, removal of carcasses by scavengers, etc. (e.g., Anderson et al., 1999; Morrison, 2002; Arnett et al., 2005; Kunz et al., 2007; PA Game Commission, 2008; NYSDEC, 2009; OMNR, 2010). The methodology and techniques of bat mortality monitoring are evolving. Similar to efforts to monitor impacts to avian species, the specific elements of this monitoring and research program would be developed in consultation with an expert team of biologists including representatives of the Forest Service, Vermont ANR, USFWS, and experts in ecology and biology of bats in the Northeast. This comprehensive monitoring plan would have to be completed and approved by the GMNF Forest Supervisor prior to beginning of construction. It can also be expected that the monitoring plan may be adjusted over time as more is learned about the specific site and about appropriate techniques. Although the exact details of the monitoring program are not known at this time, it is the intention of the Forest Service that this monitoring program would meet "state-of-the-art" scientific standards. A more detailed discussion of scientific monitoring and research is provided in Appendix H.

A post-construction bird and bat mortality study is a requirement of the Section 248 Certificate of Public Good issued by the Public Service Board. Specific requirements of this study are provided in Section 3.10.2.1.1. Required elements for the PSB monitoring plan are compatible with the criteria listed above.

Adaptive Management

As was noted for avian species, results from post-construction monitoring would be used for adaptive management strategies, or adjustment of facility operations, if necessary, to reduce mortality of bats. The Forest Service determined that operational controls on the Project would include curtailment of power production from June 1st through September 30th, from 30 minutes prior to sunset until sunrise, when air temperatures are greater than 50°F, and when wind speeds are less than or equal to 6 m/s (13.4 mph). Development of threshold numbers that would trigger or otherwise regulate operational adjustments is difficult, given the limited scientific information available (PSB, 2009). However, the Forest Service maintains that a threshold of zero bats is appropriate for federally- or state-listed threatened or endangered species. Setting thresholds for other species, if any, revision of threshold numbers, and revision or alteration of curtailment conditions and specifications would be determined based on recommendations from a panel of technical and scientific experts and the best available science.

On-going results from the scientific monitoring and research program, results from studies and monitoring efforts at other facilities, as well as updated information about the regional status of individual bat populations would be considered when revising adaptive management or operational adjustments. Any Special Use permit issued for the Project would include such conditions, and would also require consideration of the conditions of the CPG issued by the PSB. See Appendix H for additional detail on research, monitoring, and adaptive management.

3.12 Black Bears

The black bear (*Ursus americanus*) is the smallest of three bear species that occur in North America, and the only bear found in Vermont. The ideal habitat for black bears in Vermont is remote, forest-dominated landscape that includes complex structure (diverse species composition and age distribution) interspersed with wetlands and few to no roads. Because black bears are reclusive and require secure escape cover, densely-wooded habitat with variation in terrain is typically preferred. Proximity to water and the availability of coniferous trees that provide concealment and protection from severe weather are also important habitat elements. Black bears are capable of extensive movements and they may change the size of their home range in response to variations in fall mast production (Hammond, 2002). A black bear's home range can be quite extensive, in excess of 150 square miles for an adult male. Home range for an adult female in the northeastern U.S. is typically about 9 to 10 square miles (McLaughlin, 2008).

Black bears are omnivorous, feeding on a variety of plants and animals that are seasonally or opportunistically available. In spring, bears forage primarily on herbaceous plants, especially those that grow in and around wetlands such as grasses, sedges, skunk cabbage, but also on hard mast (acorns and beechnuts) that remain on the ground from the previous fall. Preferred summer foods include succulent plants such as jack-in-the-pulpit and jewelweed, various berries (e.g., raspberries, blueberries, and blackberries), as well as insects, grubs, small animals, and carrion. In late summer and autumn, bears seek foods high in nutritional value to sustain them through the winter. Preferred fall foods include beechnuts, acorns, cherries, apples, berries, and succulent plants. Bears also will forage on agricultural crops, such as corn (VTFWD, 2001).

Availability and quality of fall food supplies, including beech or oak mast, may be one of the most important factors affecting female bears' ability to produce healthy cubs, and the ability of those cubs to survive their first winter. If such foods are in low abundance or of poor quality prior to denning, and alternative sources of food are not available, the female may not have enough fat reserves to support fetal development and successful birth. Lack of adequate nutrition can also contribute to delayed first estrus, increased incidence of barren females, smaller litter size, longer intervals between litters, and increased cub mortality (Jonkel & Cowen, 1971; Alt, 1989; Elowe & Dodge, 1989). In most years, estimated cub mortality in Vermont is around 20%, but it may be as high as 50% during years of food scarcity (VTFWD, 2001).

The black bear population in Vermont is concentrated along the spine of the Green Mountains, from Massachusetts to Canada, and in the northeastern portion of the state (VTFWD, 2001, 2009). Biologists with the Vermont Fish and Wildlife Department estimated the bear population in Vermont to be approximately 3,000 to 3,500 animals in the late 1990s to 2000, which is higher than it had been in 200 years (VTFWD, 2001). By 2008, the statewide population estimate grew to 4,600 to 5,700 animals (VTFWD, 2008c, 2009). Bears are classified as a game species by the state, and have been managed through regulated harvest since 1941. Bear harvests in Vermont were the highest on record in 2003 and 2004, and harvests from southern Vermont have been consistent during recent years (Decker, 2004; VTFWD, 2007). Harvest numbers from Wildlife Management Unit P, which includes the Project area, "have been consistently high without large fluctuations in the age structure that might indicate problems with recruitment or harvest levels that are unsustainable" (Hammond, 2002: p. 22). Harvest data for management units P and Q for 2008 and 2009 (50 and 51 bears, respectively) were down slightly from 2003 and 2004 (55 and 59 bears, respectively), but up from 2005 and 2007 (38 bears each year). Annual harvest reports are available online at www.vtfishandwildlife.com. Overall, these data suggest a stable, if not increasing bear population between 1997 and 2009 (VTFWD, 2010b). Most recently, in a news release on Vermont.gov, the official state website, Vermont Agency of Natural Resources (ANR) biologist Forrest Hammond stated that the black bear population is now estimated at slightly more than 6,000 bears, higher than the objective of 4,500 to 6,000 bears listed in the state's Big Game management Plan for 2010-2020 (VTANR, 2011). Increases in population are thought to be at least partially attributable to the presence of public lands, which provide essential elements of black bear habitat, in the form of maturing oak and beech forests, and refuge from human activity, in the form of roadless or wilderness tracts on those lands (see Appendix F).

In the 1980s, the ANR, parent agency of the Vermont Fish and Wildlife Department, initiated a program to conserve black bear habitat under Vermont's Act 250 Land Use and Development Control Law (Title 10, Chapter 151, of the Vermont Statues). Criterion 8a of Section 6086 addresses wildlife concerns and authorizes protection for "necessary wildlife habitat decisive to the survival" of a species. Vermont ANR determined that three types of black bear habitat are critical and deserving of Act 250 protection: 1) stands of bear-scarred beech trees (BSB), 2) wetlands, and 3) travel corridors. In its current Black Bear Management Plan, the Vermont Fish and Wildlife Department (2008c: p. 1) proposes stabilizing and maintaining the statewide black bear population at current abundance (4,600 to 5,700 animals) and distribution, which would necessitate management strategies "to harvest surplus bears."

The proposed Project area and surrounding vicinity are used by black bears. The Project area, especially the Western Project site, includes areas of concentrated mature beech trees that show evidence of foraging by black bears (i.e., the bark has been scarred by the claws of bears climbing the tree trunks to reach beechnuts in the canopy). The Vermont ANR considers such areas of abundant and concentrated BSB to be necessary habitat for bears. The GMNF Forest Plan acknowledges the importance of mast-bearing trees in general, and BSB in particular, including an objective to increase or expand mast production where practical (USDA Forest Service, 2006a: p. 12). Guidelines in the Forest Plan provide that groups of BSB should be retained in favor of single BSB, and single BSB exhibiting repeated use should be retained where clumps are absent (USDA Forest Service, 2006a: p. 29). The Forest Plan does not specifically identify any individual BSB sites or other sites of special interest for bears.

3.12.1 Affected Environment

This section provides a description of existing habitat conditions for black bears in the Project area, including BSB stands, beech bark disease, and other habitat features. The affected environment for the discussion of direct and indirect impacts to black bears will be the four-compartment Project area. The Project area encompasses 9,523 acres of NFS and private lands, or a total of approximately 15 square miles, which is similar to (or slightly larger than) the home range of an adult female black bear in the northeastern U.S. While it is understood that adult male bears often range over a much wider area, the Project area would be most affected by the proposed activities. For assessing direct impacts, there will be a particular focus on the Project site, or footprint of proposed disturbance.

3.12.1.1 Existing Habitat Conditions

The portion of the Project area located on the ridge east of Vermont Route 8 (Eastern Project site) is covered primarily by mixed deciduous/coniferous forest, and dominated by mature beech, yellow birch, red maple, and balsam fir in the overstory. The understory contains a mix of shrubs, saplings, and herbaceous plant species, including hobblebush, intermediate wood fern, shining club moss, and wood sorrel. The Eastern Project site also includes three small (roughly less than 1.0 acre) cleared, shrubby areas associated with existing permitted meteorological towers (met towers) used to monitor wind conditions. These small open areas are dominated by various herbaceous species and scattered saplings. One or more of these openings are expected to become sites for proposed turbine placement. One or two older openings that previously held met towers may still exist but are mostly growing back in. The adjacent Searsburg Wind Facility also includes areas of shrubs, berry bushes, and regenerating trees along existing access roads and around the turbine sites.

The portion of the Project area located on the ridge west of Vermont Route 8 (Western Project site) is mature, northern hardwood forest, dominated by American beech, with lesser amounts of sugar maple and yellow birch. The slope leading southward toward Route 8 includes some conifer stands, as well as an old apple orchard that is managed by the Forest Service as a permanent upland opening for wildlife with productive apple trees. The Western Project site also includes two small open areas (roughly less than 1.0 acre) that are maintained in a shrubby state to accommodate existing permitted met towers. Maintenance of these openings/met tower sites, as well as those on the Eastern Project site, occurs on an as needed basis, usually no more than once per year.

Beech is a major component (≥20% of basal area) of several of the northern hardwood forest types that occur in the Project area and on GMNF lands across much of the Manchester Ranger District. As shown in Figure 3.9-1, northern hardwoods are the most common forest type in the Project area. On a larger scale, American beech is the third most dominant tree species in Vermont, after sugar maple and balsam fir, and it is increasing in abundance and basal area (Brooks et al., 1987; Wharton et al., 2003). The densest concentrations of beech occur in the four southern-most counties in Vermont (Bennington, Windham, Rutland, and Windsor), which encompass the Project area, and along the spine of the Green Mountains (Wharton et al., 2003).

The Forest Service conducted timber sales on GMNF lands within and around the Project area, although none more recently than 1993. Consequently, any regenerated stands have aged beyond early successional (herbaceous and shrubby) habitat into older stands of dense saplings and pole timber, primarily beech, which is typical of regenerating northern hardwood stands within the GMNF. The lack of early successional habitat can adversely affect certain species, including black bears, which use this habitat at different times of their life cycle.

3.12.1.1.1 Bear-scarred Beech Stands

Hard mast (acorns, beechnuts, and other nuts produced by trees and shrubs) is an important food source for many wildlife species, including black bears. In Vermont, American beech is a primary source of hard mast and an important source of fat and nutrition for bears as they prepare for hibernation. Bears may forage on fallen beechnuts in early spring when they are first exposed by melting snow, but the most important use of beech mast is in the fall. Bears may travel many miles to find productive beech stands, where they forage for several weeks on beechnuts that have fallen to the forest floor. If necessary, bears climb the trees, sit near the trunk, and pull branches toward them to feed on the nuts. These foraging sites have the appearance of a large bird nest. Evidence of this foraging activity is also found in the form of claw marks that leave scars on the trunks of beech trees.

Although beechnuts are an important food for black bears in Vermont, they are not reliably available on an annual basis. Beechnut production is cyclic across the region: an abundance of nuts produced some years, while during other years, the crops are small or nonexistent. In Maine, beech trees normally have good nut production in even-numbered years (Schooley, 1990). Similar dynamics have been observed in Adirondack forests, with greater than 390,000 seeds per hectare produced in even years, and near or total failure in odd years (McNulty & Masters, 2005). By most accounts, good beechnut production has been less frequent than every other year (VTFWD, 2010b). In bear populations that rely exclusively on beech as a source of fall mast, abundance of beechnuts has been linked positively to cub production during years following good mast production (McLaughlin et. al., 1994; Jakubas et al., 2005). In such populations, bears tend to produce cubs in good beech mast years, when they can meet their nutritional requirements, but would not produce cubs or would produce fewer or smaller cubs in poor beech mast years when they are unable to get the nutrition supplied by beechnuts.

However, this type of "synchronous reproduction", where cub production is correlated with good beech mast years, was not observed by Elowe and Dodge (1989), whose research was conducted in habitat immediately south of this Project area. Bears in this study experienced a greater ratio of cubs per sow during years when beech mast was scarce. Inferences about the importance of beech mast from Elowe and Dodge (1989), however, may be confounded by a greater diversity of fall food for bears in western Massachusetts compared to the Project area in southern Vermont. In particular, corn (a rich source of carbohydrate) and red oak (higher in carbohydrates and fat than beech), which are not readily available in the Project area, appeared to play an important role. It can also be noted that despite variable production of beech mast, the Vermont black bear population has grown consistently since the 1970s (VTFWD, 2010b), and is now estimated at slightly more than 6,000 bears, higher than the objective of 4,500 to 6,000 bears.

Regardless of the regularity or irregularity of beech mast production, mature, nut-bearing beech trees are an important habitat element for black bears in both the Eastern and Western Project sites and on surrounding GMNF lands. Hardwood stands in the region include numerous areas with concentrated BSB trees, demonstrating consistent, heavy use of the area by foraging bears. The Vermont ANR considers the BSB stands on and adjacent to the Project site to be "some of the most extensive and important in the state" (Hammond, 2007: p. 11), and of regional significance to black bear populations in southern Vermont. "The concentration and remoteness of these trees creates a unique setting that the scarring demonstrates have historically drawn generations of bears in large numbers to feed undisturbed on the highly nutritious beech nuts" (Hammond, 2008: p. 2). Consequently, research and survey work were deemed necessary to assess impacts that the existing Searsburg Wind Facility has had on black bear habitat, as well as the potential impacts of the proposed Deerfield Wind Project.

In work unrelated to the existing or proposed wind facilities, Wolfson (1992) identified high-quality black bear habitat in the area during development of a quantitative procedure for evaluating beech stands as black bear habitat. This statewide study included five stands in the eastern portion of GMNF Compartment 124 (part of the Project area), and two stands 8 to 10 miles west of the Project area in GMNF Compartment 148. One stand in Compartment 124 lies largely within 0.5 mile of the southern-most proposed turbine; the other stands are at least 0.5 mile away from proposed turbine sites. Using a Habitat Site Index scale of 0 to 1, Wolfson (1992) rated four of the five stands in Compartment 124 at 1.0 (highest quality) and one stand at 0.6. One of the stands 8 to 10 miles west of the Project area was rated 1.0, the other 0.0.

Studies specifically designed to evaluate bear habitat within and adjacent to the proposed Project began in 2003. Initial fieldwork assessed the extent and density of BSB in a 75-acre hardwood stand situated between 0.25 and 0.5 mile east of the existing Searsburg Wind Facility. A major objective of this study was field testing techniques for surveying and assessing abundance and density of BSB. Subsequent habitat surveys focused 1) on lands within the potential direct impact area on which the proposed turbines and access roads would lie, and 2) on lands outside the direct impact area but within the overall Project area (GMNF Compartments 121 through 124).

During November and December 2004, Wallin (2005a) surveyed BSB within 150 feet of the centerline of the proposed access roads in both the Eastern and Western Project sites. Additional studies during the spring and summer of 2006 included mapping of BSB in several areas that were not previously investigated due to Project changes that occurred since the original 2004 site assessment. Combined, these surveys cataloged 1,394 BSB within 150 feet of the proposed turbine array in the Western Project site. Within this 102-acre search area, density of BSB averaged approximately 14 BSB per acre. On the Eastern Project site, 138 BSB documented in the 50-acre area within 150 feet of the proposed turbine centerline represents an average density of approximately 3 BSB per acre (Wallin, 2007).

Wallin then conducted surveys to estimate the overall abundance of BSB on all NFS lands within the four-compartment Project area, exclusive of stands dominated by softwoods and all lands within 0.25 mile of Vermont Routes 8 and 9. The exclusion of these lands resulted in an area of 8 square miles that was estimated to include approximately 28,000 BSB. Although the four-compartment survey included only NFS lands, it is known that additional BSB occurs on adjacent private lands within the Project area, and on both NFS lands and private lands beyond the boundary of the Project area that were not surveyed. Wallin and Capen (2006) concluded that the density of large BSB generally is greater, and BSB are more evenly distributed across the landscape, in the area adjacent to the Eastern Project site (Compartments 123 and 124). In the area adjacent to the Western Project site (Compartments 121 and 122), the BSB is generally more broadly distributed, but at a lower density than in the Eastern Project site. This study was conducted to characterize the general distribution and density of BSB over NFS lands in the four-compartment area, and was not intended to describe the density of BSB at any specific location. Data was collected at 30 randomly selected sample points within each compartment, with statistical calculations used to extrapolate and compare estimates of BSB based on those sample points. It should be noted that some sample plots contained no BSB; when only plots actually containing BSB were included in the calculations, Compartment 122 had a 15.3 BSB per acre, the highest concentration among the four-compartment Project area (Wallin & Capen, 2006). Compartment 122 lies on the west side of Route 8, in the southwestern corner of the Project area, and encompasses a small section of the southernmost portion of the Western Project site turbine string.

Supplemental surveys conducted from April to May 2008 identified areas of concentrated BSB (rather than attempting to census individual trees) within 0.25 mile of the Project centerline and identified, delineated, and estimated BSB density in areas of concentrated BSB elsewhere in the four-compartment Project area. The objective was to look specifically for areas of concentrated, or high density, BSB rather than attempt the prohibitive task of tallying all BSB within a 0.25-mile zone each side of the Project centerline. The Forest Service defined a threshold of 8 BSB per acre for "stand-alone" areas of concentrated BSB, extending to include densities as low as 5 BSB per acre when contiguous to areas of 8 or more BSB per acre. These thresholds were selected based on discussions between the Forest Service, Vermont ANR, and Wallin (who had been conducting surveys in the area). Wallin (2008a) found that the density of BSB along the western ridgeline decreased with distance from the Project centerline. BSB density averaged 6.5 BSB per acre along the transect 0.125 mile from the centerline and 4.4 BSB per acre along the transect 0.25 mile from the centerline. BSB are scattered throughout the Project area west of Route 8 (Compartments 121 and 122) outside of 0.25 mile from the Project centerline, and six areas include BSB with a density of 8 BSB per acre or greater. As shown in Figure 3.12-1, two of these areas are extensions of larger clusters that are primarily within 0.25 mile of the centerline. The total area outside of 0.25 mile in the six sites is 86 acres with an average density of 8.5 BSB per acre (Wallin, 2008a).

In the Project area east of Route 8, Wallin (2008a) surveyed 121 acres within 13 transects and counted 794 BSB, for an average density of 6.6 BSB per acre. Interpolating from the 2008 transect data and earlier survey data (Wallin, 2003; Wallin & Capen, 2006; Wallin, 2008a), three areas of concentrated BSB were delineated within Compartments 123 and 124 (see Figure 3.12-1). The northernmost cluster is 204 acres with an average density of 10.5 BSB per acre. The center cluster measures 453 acres with an average density of 11.4 BSB per acre. The southernmost cluster measures 373 acres with an average density of 8.8 BSB per acre.

3.12.1.1.2 Beech Bark Disease

Many of the beech trees on and adjacent to the Project site are affected by beech bark disease. This disease is caused by the combination of the scale insect *Cryptococcus fagisuga* and pathogenic fungi of the genus *Neonectria*. The fungal infection typically produces cankering of the bark, which slows growth and may eventually cause the death of the trees, usually over a period of 10 years or more (Lovett et al., 2006). The impact of beech bark disease is greatest in stands where beech trees are dominant and larger in diameter. The initial "killing phase" of infection in a stand is characterized by high mortality (particularly of large trees), which are the trees least resistant to the disease. An "aftermath phase" is characterized by reduced vigor and premature mortality of chronically infected trees (Houston, 1994). The death of these trees is often followed by sprouting of multiple young stems from the roots. However, the disease also infects these stems as they mature. Most stands include a mix of beech trees that demonstrate a range of susceptibility or resistance to the disease, including some trees that show little or no overt sign of infection (Houston, 2006). In long-term study plots at Huntington Forest in the Adirondacks, trees as small as 4.49 inches DBH all had signs of beech bark disease by 2002, suggesting that smaller trees are increasingly affected in the aftermath forest (McNulty & Masters, 2005).

Lovett et al. (2006) report that the course of vegetation change can vary considerably after the death of overstory beech trees. In some areas the main effect has been a shift in the size and age structure of the beech stand, rather than a shift in the tree species composition. In other areas, beech decline appears to promote the growth of competing species such as hemlock or sugar maple. These researchers note that shifts to either lower dominance or smaller size structure of beech would result in reduced beechnut production and changes to the food web in affected areas.

Beech bark disease arrived in Vermont in or around 1960. Beech mortality in Vermont from beech bark disease was reported to be as high as 30% by the early 1980s, suggesting that beech mast availability in Vermont has been greatly reduced in the past several decades by the effects of this disease (Faisson & Houston, 2004). All of Vermont is considered to be an "Aftermath Forest"; that is, a forest that has experienced the first wave of beech mortality following infestation by beech bark disease (Hamelin, 2011). These stands are typically characterized by reduced abundance of beech scale, as compared to the initial stages of infestation. Most beech trees in an Aftermath Forest show evidence of Nectria infection, but some appear to have escaped infection, or are at least partially resistant to beech bark disease. Hamelin (2011) notes that while beechnut production in the Aftermath Forests of Vermont is probably significantly lower than it was prior to the arrival of beech bark disease, beech continue to supply a significant source of hard mast for bears and other wildlife species. Various studies have documented that seed production drops for trees infected by beech bark disease, especially after trees lose 25% or more of their crowns (Costello, 1992; Faison & Houston, 2004; Houston, 2005). However, guidelines developed by the Vermont ANR for optimizing mast yields from beech trees recommend retention of relatively healthy trees that are resistant to or tolerant of beech bark disease (as indicated by crown and bole condition), and those that show evidence of good mast production (as indicated by bearing scarring, i.e., BSB), even if they are infected by beech bark disease (Hamelin, 2011).

Beech bark disease has been present in the Project area, particularly on the western ridge, for many years. Wallin (2010b) has observed a relatively high incidence of the disease and probable mortality, much of it involving BSB, during visits to the Western Project site during several years of survey work through early summer 2010.

American beech continues to represent a substantial component of northern hardwood stands on the GMNF (USDA Forest Service, 2006a). In fact, the Forest Service estimates that the number of beech trees in Vermont that are 11 inches DBH or larger actually grew more than 50% between 1983 and 2003 (USDA Forest Service, 2003b). Research on this disease continues, but the short- and long-term impact of the disease on distribution, abundance, and age composition of beech trees, the production of mast, and resulting impacts on black bear ecology are unclear.

3.12.1.1.3 Other Bear Habitat Features

Softwood stands and mixed wood stands with a large conifer component in the Project area likely provide escape cover for bears. Cleared areas in the vicinity of the existing meteorological towers and at the adjacent Searsburg Wind Facility provide early successional habitat, which serves as an additional source of food for bears, including herbaceous vegetation, raspberries and blackberries, insects, birds, and small mammals. The Forest Service maintains a permanent upland opening for wildlife on the west side of Route 8. This opening includes productive apple trees, and shows evidence of use by foraging bears (Torres, 2007). Old apple trees are also scattered within and adjacent to the Project area, frequently associated with historic home sites, especially on the east side of Route 8 (Lamb Brook Area). Many of these apple trees have not been maintained recently, and are shaded by overstory trees (Torres, 2007). Wetlands within the Project area are predominantly small seeps that do not provide significant bear foraging habitat. Red oak does occur near the Project area. A 13-stand block, totaling about 1,000 acres, and another separate stand of about 50 acres, classified as red oak forest type, are located near Bennington, VT, 7 to 10 miles west of the Project area. These stands have not been surveyed in detail recently, but according to GMNF stand data, all except about 127 acres of these stands are mature and should be producing mast (acorns).

3.12.1.1.4 Current Use by Black Bears

As described above, evidence of black bear foraging in the Project area is provided by the presence of BSB, as well as by scattered tracks and scat. Scarred trees testify to historic and continuing foraging by bears in these beech stands. It should be noted, however, that BSB represent a conservative measure of the importance of beech mast or specific sites to bears. In years and areas with an abundance of other early fall foods, bears may delay foraging on beechnuts until after most of the nut crop has fallen to the forest floor. Therefore, many mature beech trees are likely to provide beechnuts for bear forage without showing scarring. Stated differently, BSB are not the only beech trees that are important for bears (McLaughlin, 2008). Evidence also has been found showing that bears have been foraging in the old apple orchard located along Vermont Route 8 between the Eastern and Western Project sites (Torres, 2007). There is no documentation of bears denning in or adjacent to the Project area. Based on public sightings, reports from bear hunters, and on-site surveys, Wallin (2006a) identified and mapped three suspected bear travel corridor locations in the area: the power line crossing, the cemetery crossing, and the Forest Service crossing. As illustrated on Figure 3.12-1, all three corridors occur within a mile of proposed turbine sites, and appear to link blocks of beech habitat located east and west of Vermont Route 8 (Wallin, 1998, 2006a).

From 1995 to 1997, Wallin (1998) conducted a study of bear movements in and around the existing Searsburg Wind Facility to evaluate potential effects that construction and operation of that facility might have on the use of travel corridors and adjacent habitat by bears. Results suggest that although bears largely avoided the site during construction, some bears returned to the area during the first year after construction was completed. This study did not identify the number of individual bears that passed through the area, or their age or sex (Wallin, 1998). In addition, Wallin (2007a) documented recent (post-construction) scarring of beech trees within 0.25 mile of the existing Searsburg facility turbines, and collected hairs from black bears from utility poles between the turbines and near the power substation (Wallin, 2005, 2007a).

Two remote camera studies at the existing Searsburg Wind Facility in 2005 and 2006 documented use of the area around operating wind turbines by wildlife (Wallin, 2005b and 2006b). An infrared camera was mounted adjacent to an old logging road/game trail approximately 40 meters from the access road and 80 meters from wind turbines from late September through November 2005, and from April through November 2006. One photograph from 2005 clearly shows a bear in the area; the turbines were operating and generating power at the time the photo was taken. Photographs from 2006 documented seven more bear occurrences, one of which included a female and cub. The closest turbine to the camera (Turbine 7) was operating on each of the days except one, when Turbines 6 and 8 (opposite sides of Turbine 7) were both operating.

Wallin (2008b) also investigated the presence of bears in and around the existing Searsburg facility by installing lines of barbed wire along the periphery of the Project. This low fence collected eight bear hair samples between October and early December of 2006, and 14 samples during May through August 2007. Seven separate bears were identified through genetic (DNA) analysis, including five males and two females. The sex and individuality of nine other samples could not be determined. Many of the samples were concentrated between Turbine 7 and Turbine 8, (1,000 feet separate the two turbines). Other hair snags were collected along the entire Searsburg project area, indicating that at least some black bears do move through the areas immediately adjacent to the existing Searsburg project.

Wallin (2010) began an additional hair-snag study on the Western Project site in 2009 to investigate bear use of the site. In conjunction with this study, Wallin also hung beechnut traps to investigate the level and quality of the beechnut crop in the Project area. The additional hair-snag study was initiated, in part, to address requirements of the Certificate of Public Good issued by the PSB, in particular conditions related to 1) evaluating access roads to identify any bear crossings, and 2) perhaps serving as part of a multi-year study on the Project's impact on bears. About 3.25 miles of barbed wire was strung along the proposed access road and along several strings extending 0.4 to 0.5 mile perpendicular to the main line across areas of concentrated BSB. From September to early December 2009 (fall study 2009), 102 snags (clumps of hair) were collected from the wires. Of the snags that were genetically identifiable from the fall study 2009 (49), 20 individual bears were identified including 13 males and 7 females. From May through August 2010 (spring/summer study 2010), 96 snags were collected. From the total of 198 samples collected during the fall study 2009 and the following spring/summer study 2010, 30 individuals were identified. Sixty-nine snags of the total of 198 were not genetically identifiable. The study continued in 2010 and 2011. Forty-two snags were collected during fall study 2010, and an additional 61 hair snags were collected so far during the spring/summer study 2011 (through mid-July). All snags collected since fall 2010 will be submitted for DNA analysis in September 2011 (Wallin, 2011). This hair-snag study is proposed to continue through the post-construction period.

To further describe bear use of the area, anecdotal reports by bear hunters indicate that the Project area is considered good for bear hunting, and bears continue to use the area despite fairly heavy hunting pressure by hunters and hounds (Torres, 2007). The ANR's Fish and Wildlife Department regulates bear hunting in Vermont. Bears may be harvested during a 2.5-month season that opens September 1, and closes the first Wednesday of the rifle deer season in November. Hunting bears over bait is prohibited. Hounds may be used to track bears with a permit, but no commercial guiding is allowed with bear dogs (VTFWD, 2008c).

3.12.2 Direct and Indirect Impacts Presented by Alternative

During the scoping process, one significant issue was identified relating to black bears. ANR biologists and members of the public expressed concern that the Proposed Action will adversely impact black bears by removing critical beech habitat, particularly in the western expansion area. The concern also includes the area adjacent to the Project sites based on belief that these areas may be avoided by bears (an indirect impact) due to the presence of turbines and human activity, despite the fact that they would still contain BSB (i.e., trees not removed as part of the direct impact).

The analysis area for assessing direct and indirect impacts on black bears is the 9,523-acre Project area, which includes GMNF Compartments 121, 122, 123, and 124 of the Manchester Ranger District. The area selected as the zone for evaluating potential direct impacts of the Project on black bears is the area directly affected by disturbance. In other words, this would be the land used for road construction, turbine placement, laydown areas, the substation and O&M building, and any other land disturbed for facility construction and operation. Direct impacts to black bears would include loss of BSB and other mature American beech trees that provide an important food resource. Potential indirect impacts include disturbance associated with the presence or activity of construction equipment, disturbance created by on-going maintenance of the operating facility, and disturbance to habitat or travel corridors that could alter movements and behavior of bears or displace them from preferred habitats.

The indicators used to analyze direct impacts to black bears are the number of BSB removed during construction and the area of forestland cleared and graded. The indicator used to analyze indirect impacts to black bears is the general amount of use by black bears of the Project site and surrounding areas. This relates to disturbance, and how bears may or may not adapt to changes on the site. Indirect impacts are likely to be different during construction than during normal operation of the completed facility. The zone for evaluating indirect impacts would the area surrounding the direct impact zone up to about 0.5 mile. For evaluating impacts of new developments such as ski area expansion and housing projects, the Vermont ANR typically assumes indirect impacts to black bears takes place in a zone out to a distance between 0.25 and 0.50 mile away from development activities (VT ANR, 2006; Hammond, 2007).

Little scientific information is available on impacts of utility-scale wind facility development on black bears. Direct impacts, i.e., the number of BSB removed from the site, can be measured, but the repercussions of that removal on bears are difficult to quantify. Indirect effects of displacement and of changed movements and behavior are difficult to measure as well, compounding the difficulty of assessing the overall impacts of these changes to individual bears, whether local or transient, or to the regional bear population as a whole. Research and monitoring has examined the impacts on bears from different kinds of development, notably construction of roads, ski resorts, or housing developments. The kind of development associated with the Proposed Action is different from projects that have been studied, however, and it is uncertain exactly how black bears in Vermont would respond to this Project. Although the Vermont ANR believes the Project could have substantial adverse direct and indirect impacts to bears, other biologists consulted during Project analysis are not in agreement about the impacts of the proposed Project. Consequently, analysis of potential impacts includes a degree of scientific uncertainty.

In response to this uncertainty and to ensure that every effort is made to use the best available science, the Forest Service consulted with a number of expert biologists for guidance and advice in identifying and assessing potential impacts that the Deerfield Wind Project might have on black bears. These biologists offered expertise in biology and management of black bears and/or in forest wildlife and wildlife habitat in New England. The Forest Service also sought comments and opinions on potential impacts from an independent Review Panel of three prominent bear biologists. This panel reviewed Project-related documents provided by the Forest Service including research and survey reports, testimony prepared for the Vermont Public Service Board, maps, and aerial photographs. The Forest Service also provided a list of questions and specifically requested each panelist's assessment of the relative levels of risk to black bears from each of the alternatives regarding direct, indirect, or cumulative effects of construction and operation of the proposed wind energy facility, not for a selection or preference of one alternative over another. The panel independently reviewed the material and provided their comments. The original statements and conclusions of the Bear Review Panel, and results of other consultations, are summarized in Appendix F.

In December 2008, after the September release of the DEIS, the Forest Service contacted the three Bear Review Panel members to ask 1) permission to make their comments public, 2) if the Forest Service had captured their comments correctly in the DEIS and in the summary in Appendix F, and 3) if they had any additional comments about the potential impact to black bears. At that time, the Forest Service also provided a transcript of the testimony given to the Vermont Public Service Board by Dr. William Kilpatrick of the University of Vermont. In his testimony, Kilpatrick (2008) raised concerns over impact that the Project might have on black bears, and provided critical comments about methods, sample sizes, and conclusions of pre-construction bear studies conducted at the Deerfield site.

All three panel members agreed to public release of their comments. Mr. Orff did not provide additional comments. Dr. Pelton generally agreed that the Forest Service captured his comments correctly in the DEIS and in Appendix F, although in his opinion, some of the language sounded like the DEIS and Appendix were justifying moving forward with the Project. Dr. Pelton also expressed concern that the Forest Service could not guarantee that future administrators would continue to provide protective management or enforce mitigation measures. He did not change any of his original thoughts and opinions after reading Kilpatrick's testimony. Dr. McLaughlin agreed that the Forest Service captured his comments correctly. He did not change his thoughts and opinions after reading Kilpatrick's testimony, but instead thought that on some points, Kilpatrick espoused an overly pessimistic view of the reproductive performance of American black bears in eastern habitats. Dr. McLaughlin also questioned the conjecture that the proposed Project would exacerbate genetic isolation of bears in southern Vermont. Appendix F of the FEIS provides further detail about the Forest Service's follow-up with the Bear Review Panel.

Given the degree of uncertainty and lack of agreement about the overall effects that the proposed Deerfield Wind Project might have on bears, the following analysis will disclose the areas of agreement and disagreement regarding these impacts and describe the degree of risk to bears, bear populations, and bear habitat presented by each alternative.

3.12.2.1 Proposed Action

The Proposed Action would include installation and maintenance of 17 turbines, as well as access roads, electrical collection lines, a substation, and other associated support structures on the ridges to both the east and west of Vermont Route 8 in Searsburg and Readsboro. Under the Proposed Action, 87.4 acres would be cleared and/or graded during construction activities, totaling 0.9% of the Project area. NFS lands account for 73.1 acres of proposed clearing and grading activities; the remaining 14.3 acres would occur on private lands. For the 17-turbine Proposed Action, approximately 5.07 miles of new access roads would be constructed. Clearing and grading of these areas would require removal of vegetation including mature beech trees, many of which provide an important source of food for bears. Portions of the proposed Project are located in areas identified by Vermont ANR as "necessary bear habitat", because of the number and density of BSB. Vermont ANR considers beech stands such as these as essential for the long-term survival, well-being, and reproductive success of black bears in Vermont (Vermont ANR, 2006; Austin, 2006; Hammond, 2007).

3.12.2.1.1 Direct Impacts on Bears and Bear Habitat

Direct impacts of the Proposed Action to black bears would result from the removal of mature beech trees, including BSB, and the resulting loss of available beech mast, as well as the potential beneficial impacts of creating early successional habitat in cleared areas. Only those BSB trees within the Project footprint would be removed. Direct impacts of the Proposed Action would be greatest in the Western Project site because of the abundance and density of mature beech and BSB on the western ridge. Wallin (2005a) identified 1,394 BSB within 150 feet of proposed Project components in the Western Project site, for an average density of approximately 14 BSB per acre. In the Eastern Project site, only 138 BSB lie within 150 feet of the Project centerline, an average density of approximately 3 BSB per acre. The Proposed Action would result in the direct loss of an estimated 460 to 470 BSB, which represent approximately 1.7% of all BSB (roughly 28,000) estimated to lie within the four-compartment Project area (Wallin & Capen, 2006). The number of BSB to be removed is derived from surveys that identified individual BSB trees by GPS location that would lie within the anticipated clearing and grading limits needed for construction of the Eastern and Western Project site roads, turbine pads, and ancillary facilities. Of the total, it is estimated that about 410 to 415 BSB would be removed from the Western Project site and 50 to 55 BSB would be removed from the Eastern Project site. Those removed from the Eastern Project site are all isolated trees; no areas of high density concentrated BSB would be impacted. The area estimated to contain the BSB trees that would be removed is approximately 42 acres; 32 acres would be impacted in the Western Project site and 10 acres in the Eastern Project site.

In draft guidelines for mitigation of development impacts on bear habitat, the Vermont ANR (2006) defines necessary black bear habitat as those stands with at least 15 to 25 BSB that exhibit scarring made within the past 10 years, although no area or density is specified. The ANR (Hammond, 2007) considers the removal of BSB for the proposed Deerfield Project an unacceptable loss of necessary bear habitat, especially when the scale of removal for this Project is compared to that for other approved development projects in Vermont. ANR views the area of BSB within the Project area to be among the most extensive and important in the State and significant to bears regionally. In ANR's view, this Project would potentially fragment this area of concentrated BSB, not only because of the direct loss of habitat, but also because of the indirect impacts of roads, and the human uses and activities they may bring (Hammond, 2007).

Wallin (2008b) disputes the claim that BSB in the Project area is regionally important. Hammond's 2002 Stratton Mountain black bear study (Hammond, 2002) demonstrated that beech is only of value when mast was produced, and that female bears did not travel widely during periods of good mast production. In those years, they used the mast in their home ranges. In poor mast years, female bears tended to migrate out of their home ranges to search for food sources other than beech. The Hammond (2002) study also documented that some female bears with home ranges within reach of the Deerfield Project area did not visit the Project area in good or poor mast years. Wallin (2008b) attributes that to the widespread availability of beech throughout the larger area surrounding the Project area. In their comments on the SDEIS, the ANR stated that this could also be attributable to the effect of heavily used roadways, such as Route 9, that could present a barrier to bear movements.

The Bear Review Panel, as well as other wildlife biologists and black bear experts consulted regarding this Project, acknowledged that removal of a large number of mature beech and BSB, and subsequent loss of potential mast production, would adversely impact black bear habitat. However, many of these biologists also considered that the overall impact of this loss might be reduced by the presence of other concentrated stands of BSB in the area, and by the large component of American beech that occurs within and around the Project area. During years of abundant beech mast production, beechnuts should be widely available. In years when the beechnut crop is poor, or fails completely, this same condition presumably would occur across the entire region, including the Project area. In some circumstances, areas of concentrated BSB might be relatively more important in years of low mast production if production from all the trees cumulatively provides sufficient quantity to benefit bears while being too scarce in less dense stands. Although the density of BSB within portions of the Western Project site is greater than that observed in much of the adjacent forest, stands of similar BSB density do occur in the Project area east of Route 8; no trees would be removed from these stands for the proposed Project. Other beech stands within the Project area may contain lower density BSB, but these stands appear to be well stocked with mature beech trees capable of producing beechnuts. BSB represent a conservative measure of the importance of beech mast to bears. Clearly, bears feed on nuts produced by BSB, but non-scarred, mature beech trees also produce nuts and provide forage for bears (McLaughlin, 2008).

Beech mast production in the Project area and vicinity has varied dramatically over the last 10 to 12 years. According to a report provided to the Forest Service since release of the SDEIS (VTFWD, 2010b), beech mast production from 2000 to 2009 appears to have been generally lower than the production measured from 1988 through 1999. In their comments to the SDEIS, the ANR stated that annual measurements of beech mast production throughout the state during the ten-year period of 2000 to 2009 found five years of generally fair to excellent production and five years of absent to poor production (VTFWD, 2010b). Wallin and Capen (2011) have been trapping beechnuts on the Western Project site in conjunction with the hair snag study described above. Over the fall period of September through early November 2009, 904 beechnuts were collected. Of the 904 nuts examined, only 63 (7%) contained endosperm and were considered a viable nut as a black bear food resource. For the fall 2010 period, 358 nuts were collected and only two nuts were considered viable, demonstrating a very poor nut crop for these two seasons.

During years of poor beechnut production, bears must seek other food sources (apples, grapes, herbaceous plants, corn, carrion, insects, grubs, etc.). Bears are very mobile, have large home ranges, and have demonstrated ability to travel great distances to take advantage of foraging opportunities. Their ability to seek out and survive on alternative food sources is demonstrated by the estimated 27% growth of the bear population over the last 10 years, despite the lack of good beechnut crops during most of this time period (Wallin, 2008b).

The proposed Project would produce some direct beneficial impacts on bear habitat. Clearings and edge habitat created around proposed turbine sites and along access roads and power lines would open the forest canopy and would create early successional habitat providing spring-summer-fall food sources for bears, including berry-producing plants. It would also attract insects, birds, and small mammals that would also serve as food sources. Hammond (2002) documented a substantial amount of bear use of similar habitats along power line ROWs and logging roads. Even during years of poor berry production, Hammond (2002) noted that bears use these areas to obtain insects from rotten logs and stumps.

The Bear Review Panel and other biologists consulted by the Forest Service agreed that creation of early successional habitat in the Project area would increase the diversity of forage opportunities for bears. This diversity would help compensate for years of poor beechnut production. As noted in Appendix F (McLaughlin), bears are opportunistic feeders and take advantage of a wide variety of vegetative foods. Roadways provide excellent early successional habitat, and maintenance of the bear food-producing plants that will grow along newly created roads would be beneficial to the area's bear population. In the long term, benefits of more diverse forage opportunities could partially compensate for the loss of some nut-bearing beech trees, and some consulted biologists thought there could be net benefit provided by more diverse forage for bears in the Project area (see Appendix F).

Wetlands provide important habitat for bears, especially in the spring, and therefore, any Project-related impacts to wetlands could potentially affect black bears. Loss of wetlands would represent a potential loss of food, while the construction of Project components near wetlands could result in displacement of bears from that habitat, in much the same manner that bears could be displaced from concentrated areas of BSB. As described in Section 3.8, wetland delineations were conducted in the Project area in the vicinity of all proposed disturbance. Vermont Wetland Evaluation Forms were completed for each delineated wetland, assessing the functions and values, including the value each wetland provides for wildlife. Numerous seeps occur in the vicinity of the Project site, but due to the small size and composition of the vegetation, none are considered important for bear use (Lew-Smith, 2007).

Impacts to wetlands would be avoided to the extent possible. Under the Proposed Action, direct impacts would total 4,905 square feet (0.1125 acre), with 2,855 square feet (0.0655 acre) of permanent impact, 1,332 square feet (0.0306 acre) of secondary impact, and 718 square feet (0.0164 acre) of temporary impact. These impacts would occur at four small seep wetlands (F, AA, AH, and AJ), and one shallow emergent marsh (BB). As explained in Section 3.8.2, the impacts of the Proposed Action on wetlands would be negligible, and therefore, wetland-related impacts on black bears would also be negligible. No wetlands that could provide future opportunities for spring foraging for black bears would be impacted by Project construction.

Design Criteria and Mitigation for Reducing Direct Impacts

A number of specific design criteria and mitigation measures would be applied as needed to reduce potential adverse direct impacts to black bears by increasing other types of forage within the Project area. One criterion for site restoration following construction would include redistributing some cleared logs and stumps within open areas or in forested edges around turbine sites and along access roads. This woody debris would provide habitat for insects, grubs, and small vertebrates that would in turn serve as a food source for bears for a period of time (20 to 30 years).

Another criterion would provide for sections of the permanently cleared areas around the proposed turbines and along the edges of Project access roads to be managed for berry-producing, early successional vegetation, such as blackberries and raspberries, either through natural reproduction or by planting where practical. This would increase foraging opportunities for black bears within the Project area and in the vicinity of road edges and turbines, thereby reducing displacement by inducing bears to become acclimated to and use the area. If combined with measures to reduce human disturbance so that bears could take advantage of these food sources, such design criteria would partially compensate for the adverse direct impacts of loss of BSB.

The PSB released its Amended Certificate of Public Good (CPG) in July 2009, after release of the DEIS. The CPG requires a number of conditions be met, including the use of a smaller crane for moving and installing turbine parts that would reduce the width needed to navigate most sections of the access roads. Originally, road widths during construction would have been a minimum of about 35 feet with a few sections on sharp corners being wider to accommodate machinery. The smaller crane would allow for a nominal road width of 22 feet during construction thus reducing the amount of forest clearing needed and the number of BSB that would need to be cut. The reduction in numbers of BSB to be removed is accounted for in the SDEIS and remains in this FEIS. There would still be sections on curves and switchbacks where the gravel surface would be wider (up to 36 feet) to allow large construction equipment to navigate sharp turns. Where possible, the gravel surface of the access roads would be reduced to approximately 16 feet wide after completion of construction, with the margins revegetated to reduce erosion. The Applicant also agreed to make small-scale adjustments to locations of turbines and roads prior to construction to further minimize impact to BSB.

Although the CPG applies to the approved configuration (Alternative 2 in the SDEIS and FEIS), the Forest Service would require all these conditions be met, as applicable, should any of the action alternatives be approved. These conditions apply to both direct and indirect impacts. To mitigate direct impacts, as required by CPG Condition #11, the Applicant would need to conserve (through purchase, easement, or protective covenant) four times the amount of BSB acreage that would be removed (a four-to-one ratio). These lands must be comparable to the remote, high elevation area of concentrated beech stands in the Project site. For the Proposed Action, 42 acres of BSB would be removed and therefore 168 acres would need to be conserved to mitigate this loss. Condition #10 also applies to direct impacts and would require the Applicant to identify and take action to preserve any bear crossings along the access roads. The CPG may be found in Appendix G.

Bear Review Panel: Direct Impacts

Please see Appendix F for details on Bear Review Panel comments regarding direct impacts. In summary, Pelton believes that direct impact to bear habitat due to loss of beech within the Project footprint likely would be minimal, particularly during good years of beechnut production, due to the overall abundance of beech in the region. However, in bad years the loss of beech trees along the affected corridor could have a negative effect on bears. Mitigation activities that enhance the availability of fall foods, such as apples or wild grapes, could benefit bears. Considering the general abundance of beech in the region, and assuming that the Project would increase the availability of early successional habitat in immediate area, McLaughlin suggests that in the long-term, the Proposed Action could result in a neutral or slightly positive net direct impact on bears through diversification of available foods. Orff believes that the removal of trees from an area of concentrated BSB like that in the Western Project site would affect regional bear densities.

Summary of Direct Impacts

In summary, based on the best available science and on the combined opinions of the Bear Review Panel and other consulted biologists, the Proposed Action of clearing and/or grading 87.4 acres of land and removing an estimated 460 to 470 BSB would likely result in an adverse direct impact to bears due to loss of habitat. Substantial mature beech and BSB habitat adjacent to the Project site and within the Project area would continue to be available in the short term. The long-term impact of beech bark disease on the abundance and density of mature beech trees, and on the availability of beech mast, is uncertain. The current density, abundance, and regeneration of beech within the Project area, however, suggest that beech will continue to be a major component of the region's forested habitats over the long term. Only 1.7% of the Project area's BSB would be removed for the Proposed Action. Adverse impacts from the removal of this small amount of habitat would be partially mitigated by the creation of other, more diverse forage opportunities provided by planting and/or maintaining early successional habitat in cleared areas and along forest edges, if human uses are such that these areas remain available to bears over time. Conservation of approximately 168 acres of comparable habitat as required by CPG Condition #11 would also partially mitigate the loss of beech habitat in the Project area.

Considering all of the above, the direct impacts of the proposed Project are unlikely to adversely affect the continued existence of a viable population of black bears in the Project area or in the surrounding region. Due to the uncertainty and inability of science to accurately quantify the impact of this loss to bears, and the apparent divergence of opinion among bear biologists and managers, and since the Proposed Action would impact the largest area, there is a moderate to high risk of greater impacts to bear habitat, bear use of the area, and bear populations associated with development of the Proposed Action than with development of the other alternatives.

3.12.2.1.2 Indirect Impacts on Bear Use

Indirect impacts include potential disturbance and displacement of bears from the Project area due to the direct loss of BSB habitat in combination with Project construction and operation activities in proximity to beech trees and other features of bear habitat. Other potential indirect impacts stem from altered behavior and movement patterns of bears in the area in response to the proposed Project and increased levels of human activity. Human activity, noise, and habitat alteration associated with the construction, operation, and maintenance of the proposed Project would likely displace bears from foraging in, and moving through, the immediate Project site, at least in the short term. No data are available that fully assess to what extent the activities associated with operation and routine maintenance of a commercial wind facility would discourage bears from accessing and utilizing suitable habitat in the area. The Vermont ANR acknowledges that no information is available to predict how black bears would be affected by a project like the Deerfield Wind Project. Lacking that specific information, ANR typically assumes a minimum indirect impact area of 0.25 mile beyond a project's footprint (Austin, 2006; Hammond, 2007). A smaller distance might apply to minor road crossings, while a larger distance (up to 0.5 mile or more) might apply to a BSB stand receiving consistent, intensive bear use (Hammond, 2002; 2007).

General Construction Impacts

Construction of the proposed Deerfield turbines, roads, electrical collection lines, and other supporting structures would include intense human and vehicular activity, presence of heavy construction equipment and trucks, and frequent loud, sharp noises. These are the kinds of activities and noises that have been documented to disturb and displace bears (Parsons, 2006). Most or all bears likely would be temporarily disturbed and displaced from areas of construction activity. This was true during construction of the existing Searsburg Wind Facility (Wallin, 1998). In the opinion of some of the experts consulted by the Forest Service, based on their experiences with black bears and various sources of disturbance, bears likely would be displaced to about 0.25 mile during periods of construction activity. However, this displacement might occur primarily during hours of construction; solitary adult or sub-adult bears might use the immediate area during quiet hours, e.g., during nighttime and weekends (see Appendix F). Construction of the Project is anticipated to occur over one typical construction season of about nine months. In the opinion of some of the consulted biologists, impacts would last up to a few weeks past the completion of the construction phase, and bears would likely return to the site quickly, once the noise and disturbance of continuous activity ceases (see Appendix F).

Roads

Habitat fragmentation typically refers to the breaking up of larger contiguous tracts of habitat into smaller patches that are isolated from each other by areas of unsuitable or less suitable habitat. In this way, habitat fragmentation can create barriers that isolate population segments or impede movement of individual animals or plants between areas of suitable habitat. Depending on the scale and spatial distribution of changes, as well as the kinds of habitats involved, alteration of habitat might be fragmenting for some species and not for others (Franklin et al., 2002; USDA Forest Service, 2006a,c). Therefore, consequences of habitat alteration may be very different for the encroachment of housing developments into forested areas, conversion of forest to agricultural uses, change in habitat type through forest management, or construction of a linear wind project along a forested ridgeline. In addition, changes that make habitat unsuitable for some species may create conditions that increase the suitability of the site for other species or suites of species.

Parsons (2006) researched peer-reviewed journals, magazine and newspaper articles, and Environmental Impact Statements for analyses of impacts that various types of development and activities have on black bears and on brown (grizzly) bears (*Ursus horribilis*). Parsons also interviewed bear experts from across North America, including state, provincial, and federal agencies. According to this review, the creation and use of roads is a major source of adverse impacts on black bears. Habitat fragmentation can occur when roads create barriers that limit bear movements and restrict access to food sources and preferred habitats.

Disturbance to bears caused by roads appears to be proportional to the size and density of roads, the volume of vehicular traffic, and the type of use the roads receive (Parsons, 2006). Avoidance behavior by bears (i.e., not crossing roads or avoiding habitat near roads) generally occurs only when traffic volumes are greater than 10 cars per day, and in many cases, hundreds of car per day (Parsons, 2006). Similar results have been reported in other studies of the indirect impact of human development on bears (Hammond, 2002). Reynolds-Hogland and Mitchell (2007) observed that, depending on the type and level of traffic and other human uses, gravel roads can create as great an adverse impact on habitat quality for black bears as paved roads. However, some of the gravel roads in that study were subject to heavy day and night use and included numerous campgrounds, as well as numerous remote campsites 0.25 mile or more from the gravel roads. Traffic volume on these gravel roads can exceed 1,000 cars per day during the summer and fall recreation period, the same time frame as the 2007 Reynolds-Hogland and Mitchell study (Stroup, 2008). Despite these high traffic levels, the Reynolds-Hogland and Mitchell study found a "positive relationship between annual productivity of hard mast and preference for areas near roads during fall for adults." In addition, gated roads on which motorized public access was successfully restricted produced no observable change in bears' movements and behavior (Reynolds-Hogland & Mitchell, 2007).

As stated above, approximately 5.07 miles of new roads would be constructed for the Proposed Action. Based on his review, Parsons (2006) concluded that by themselves, roads associated with the Deerfield Wind Project, during normal operation of the facility, would not be likely to create a barrier for black bears or prevent their use of the Project area. Project access roads would be narrow and unpaved. The road surface would be approximately 22 feet wide during construction over most sections with some sharp corners temporarily substantially wider, then reduced to about 16 feet wide for Project operation. The roadsides would revegetate naturally following construction. The degree of impact from roads would be dictated by the volume of traffic and levels of accompanying activity more than by the size or condition of the access roads.

Despite lack of specific studies or scientific information about the effects of wind turbines on bear habitat use, the potential impacts of roads and increased human use on bear habitat are not disputed. ANR's position is that roads and their use within the Project area could further impact the availability of forage resources, including BSB, adjacent to Project components, thus amplifying the impacts of the direct loss of BSB. In ANR's opinion, some individual bears may not return to the site after initial construction.

Bear Review Panel: Roads

The Bear Review Panel and other wildlife biologists consulted by the Forest Service unanimously agreed that construction of roads and their ensuing use represents perhaps the single-most serious risk to bears and bear habitat from the proposed Project. Orff (Appendix F) discussed his experience in an area with high human use (southern New Hampshire) and believes that construction of the Deerfield Project roads and turbines could produce similarly high levels of human use, opening the area to activities such mountain biking, hiking, and increased bear hunting pressure. This increased human activity likely would displace bears from the area and reduce their access to the BSB in the surrounding area.

Pelton (Appendix F) states that roads in many instances are "ribbons of risk" for bears. He notes a history of roads and human population growth leading to the disappearance of bears. He also states that "roads that receive very limited use can be a neutral factor, and in the best of circumstances, a positive factor as a travel lane and/or a feeding area." His concerns are long-term, given unknowns regarding the potential for the allowed uses of the roads to be changed, creating more human intrusion. He concludes that generally speaking, the less a road is used by humans the more bears will adapt to it.

McLaughlin (Appendix F) concluded that although roads are a potential source of human intrusion and fragmentation of black bear habitat, the construction of narrow, gated roads with extremely low traffic volumes could result in diversified food sources for bears. Construction of the Project would result in short-term disturbance of resident bears, but the minimal human presence on the site during facility operation would not create issues with attraction of bears or altering their behavior toward humans. Properly managed, such roads could have a net positive effect on the local bear population.

Bear Behavior

The behavioral reactions that bears would exhibit in response to the presence of a wind facility like the proposed Deerfield Wind Project, and to the site access activities associated with operation and maintenance, are uncertain. Bears' avoidance of houses and residential developments in Vermont has been documented (Hammond, 2002). However, inanimate objects, such as new buildings, typically illicit little or no response from bears in the absence of continuing or excessive human activity (Parsons, 2006). During normal operation under the Proposed Action, human presence in the Project area would be limited to occasional maintenance and monitoring. Noise from operating turbines typically is steady and modest in volume and tone; it does not include sudden, sharp, or potentially alarming noises. Additionally, turbine noise levels would be directly correlated with wind speed, thus turbine noises would be largely masked by the noise of wind moving through trees and other vegetation (RSG, 2007). If a bear's experience with a particular feature in its environment is favorable or neutral, its response is likely to be mild and any displacement behavior is likely to be minimal (Parsons, 2006).

Hammond (2002) suggested that bears feeding in hard mast stands in the fall may be particularly sensitive to disturbance from humans. Beech stands, especially mature ones, are comparatively open hardwood forests generally lacking in dense concealment cover. This lack of concealment cover is further compounded by the fact that bears forage in beech stands during the fall at the approximate time that leaves are falling, and in early spring prior to full leaf out, when the cover provided by beech trees may be limited. However, this effect has not been rigorously evaluated. There is abundant evidence indicating that bears can become habituated to human activities and structures when searching for food (e.g., raiding cabins, bird feeders, bee hives, etc.). Certainly, these kinds of bear-human interactions are not beneficial for wild black bear populations and they should not be encouraged. They do, however, illustrate that some black bears are able to cope with some degree of human disturbance. The Bear Review Panel and other consulted biologists who addressed adaptability agreed that resident black bears, defined as the resident females, their yearling-and-younger offspring, and males that use the site, adapt quickly to changes in their environment, including the presence of structures and occasional vehicles and other human activities. McLaughlin (Appendix F), for example, described black bears as an extremely adaptable species, thriving in the northeastern U.S. under conditions as diverse as forested suburban housing developments to expansive tracts of near-wilderness. In the opinion of these biologists, the structures and levels of activity associated with the Proposed Action, as described, would not be expected to create measurable changes in the behavior and movements of bears across the Project area.

Acclimation of black bears to the Project site might be facilitated or encouraged by an increased diversity of forage with the creation and maintenance of early successional habitat (see Section 3.12.2.1.1, also Appendix F). Transient bears and individual bears that are shyer of human activity might be more cautious around development of this scale, but they likely would adapt and behave normally throughout the area (see Appendix F). The ANR is concerned that the Proposed Action, and bears' continuing exposure to it, may gradually lead to a population of bears that are more habituated to human activity, thus an increased incidence of "problem bears." The ANR prefers to manage for and retain bears that are not easily habituated to human development. Accordingly, this alternative does present more risk to bears having to adapt and habituate their activities to humans than other alternatives.

Observations of bear activity at the adjacent Searsburg Wind Facility and studies conducted for the Deerfield Project have not demonstrated consistent or continuing avoidance of the Project area by bears. This is based on photo-documentation, scarring of beech trees, and bear hair snag studies, as well as evidence from tracks and scat. Although these observations demonstrate the continued use of this area by bears, it is acknowledged that they are not based on any type of scientific study; they are anecdotal sightings of bears near turbines showing use of the area by bears. They do not provide any information about behavioral responses of bears to the wind turbines, differential response by different age or sex groups (males, females, females with cubs, adults, juveniles, etc.), or bears' use of different habitat types. Section 3.12.1.1.4 on Current Use By Black Bears, above, fully describes instances of use of the area by bears.

Hunting Pressure

The Project area has traditionally received relatively heavy hunting pressure. Resident and out-of-state hunters come to this area specifically to hunt bears with hounds (Torres, 2007). Despite the disturbance and mortality that has resulted from this activity, bears have continued to use the area. The Vermont Fish and Wildlife Department tracks harvest data by Wildlife Management Unit and by Town, so exact estimates of the number of bears killed by hunters for the Project area are not available. However, recent harvest data for the Towns of Readsboro and Searsburg essentially support Hammond's (2002) report that harvest numbers from Wildlife Management Unit P (WMU P), which includes the Project area, "have been consistently high without large fluctuations in the age structure that might indicate problems with recruitment or harvest levels that are unsustainable." Combined harvest numbers for WMU P and the adjacent WMU Q were 55 bears in 2003, 59 bears in 2004, 38 bears each year in 2005 and 2007, 50 in 2008, and 51 in 2009 (annual harvest reports are available online at www.vtfishandwildlife.com).

Access and Closures

In order to address public comments raised in the DEIS, a proposal to close the area immediately surrounding the turbines and access roads has been dropped. Access to public lands adjacent to the Project site would not be restricted, except for gating the access roads and fencing some of the ancillary facilities. There is currently no plan to construct gates or fencing around the entire proposed wind facility or individual turbines. In the interest of public safety and site security, and to minimize motorized disturbance of black bears and other wildlife, a forest closure order would close the proposed facility access roads to public motorized traffic. The Public Service Board's CPG also stipulated that access roads must be gated to prevent motorized access by the general public.

Signs addressing public safety would be posted around the roads, turbines, and all ancillary facilities where necessary, in conformance with state and federal regulations and guidelines. Public use of the area would be monitored during the first one or two years of operation and, if desired for public safety and site security, an area closure could be implemented surrounding the access roads and turbines, with a setback of an appropriate number of feet from the edge of the facilities (roads and turbines). At the same time, the monitoring results will be looked at in terms of disturbance to black bears to determine if any closures are warranted. Safety and security is discussed further in Section 3.17.

Impacts Related to Unauthorized ATV Use

New roads, even though gated, could provide access for unauthorized use of all-terrain vehicles (ATV) or other off-highway vehicles (OHV). Such uses occur on the GMNF, despite the fact that they are not authorized in the Forest Plan (USDA Forest Service, 2006a). Unauthorized ATV use is a particular concern for remote areas such as the Project site. Section 3.13.1.3 characterizes unauthorized ATV use in the Project area. Sections 3.13.2.1.3 through 3.13.2.1.5 fully disclose the effects that constructing the access roads and turbines would have on opportunities for ATV use, with extensive discussion regarding the Lamb Brook area. These sections include discussion on the potential level and risk of unauthorized ATV and off-highway opportunities, the effectiveness of various deterrents, and a monitoring plan to measure progress in controlling unauthorized use in the Project area adjacent to both Project sites. There is also discussion on increasing law enforcement and monitoring by on-site personnel should other deterrents fail to achieve the desired results. The actual impacts of unauthorized off-highway vehicle use, including ATVs, are discussed as necessary under each resource section of the FEIS. The potential impacts of unauthorized off-highway vehicle use and ATVs on bears are discussed next.

As described in Section 3.13, there are opportunities for unauthorized ATV use on the Western Project site due to the existence of old, mostly overgrown skid trails from timber sales about 15 or more years ago. However, little or no evidence or sightings have been documented in recent years (Wallin, 2010a). There is no destination site or attraction that would draw ATV use to the area, and most of the site is rugged and not easily passable either by ATVs or off-highway vehicles such as 4-wheel drive trucks. On the Eastern Project site, there would be very little opportunity for ATV use and no realistic chance for 4-wheel drive or other off-highway vehicle use due to the thick, nearly impassable habitat along the access road. No illegal (unauthorized) trails exist off the access road and unauthorized ATV use has not been an issue at the existing Searsburg site (Staskus, 2010). Consequently, intrusions by ATVs or 4-wheel drive vehicles would not be expected into the Lamb Brook area from the Eastern Project site access road. Therefore, there would be no impacts from unauthorized ATV or 4-wheel drive access on black bears inhabiting the area, particularly those using the interior core of the Lamb Brook area (this was a primary concern in the Lamb Brook litigation). Any attempts to create illegal trails from the access road into the Lamb Brook area or any of the area surrounding the Project site would immediately be addressed.

For both the Western and Eastern Project sites, gating of the access roads, monitoring of public use to determine if closures are desired (as described above under Access and Closures), posting of signs, and quick response to any discovered activity would successfully deter unauthorized ATV and off-highway vehicle use. Most effective, however, would be the presence of operations and maintenance personnel and as needed, monitoring by Forest Service law enforcement personnel. Please see Section 3.13.2.1.3 for details on the effectiveness of the many measures in place to address unauthorized motor vehicle use. Therefore, adverse impacts on black bears from unauthorized ATV use in or adjacent to the Project site would not be anticipated.

Design Criteria and Mitigation for Reducing Indirect Impacts

A number of specific design criteria and mitigation measures would be applied as needed to further reduce potential adverse indirect impacts to black bears. To lessen effects of roads on the use of the area by bears, access roads would be gated and closed to public motorized access (see discussion above under Access and Closures). Minimum road widths would be maintained to present the least deterrent to crossing by bears and other wildlife. Mountain biking also would be prohibited on access roads. Future uses of the access roads would be tightly controlled by the terms and conditions of the Forest Service Special Use permit and by the conditions of the CPG.

Operational vehicular access would typically include no more than one or two trips per day, for routine maintenance and occasional administrative uses (access for monitoring surveys, etc.).

To further mitigate concerns, the CPG granted by the PSB requires that the Applicant file a detailed proposal describing how indirect impacts to bears will be minimized (CPG Condition #13). Although the CPG applies to the State-approved configuration (Alternative 2 in the FEIS), the Forest Service would require all these conditions be met, as applicable, should any of the action alternatives be approved. As stated, the proposal will address gating roads, utilizing remote cameras to deter illegal entry, patrols by law enforcement, limiting activity during certain times, and preserving bear crossings along the access roads. CPG Conditions #6 through #9 specifically state:

> (6) "Access roads will be gated and access to facility roads will be limited to authorized personnel only. The east-side access road will be double-gated with the existing gate at the end of the current Green Mountain Power Corporation access road (at the beginning of the Deerfield access road). The west-side access road will be gated at the beginning of the Deerfield access road and again after the transmission corridor. Deerfield will include measures to prohibit and deter illegal ATV access and other unauthorized access";
>
> (7) "Deerfield will prohibit major scheduled repairs and maintenance activities during fall periods when bears may be using beech trees";
>
> (8) "Deerfield personnel will be restricted from the site during the nighttime (sic) hours and during the crepuscular periods that have been shown to be important periods for bear activity (one hour before and after sunrise and sunset), except in emergency situations and during necessary wildlife study periods not otherwise avoidable."
>
> (9) "On-the-ground lighting at the facility will be limited to motion sensor lights at the substation."

These design criteria and mitigations would reduce potential adverse indirect impacts that could result in displacement of bears from the Project area.

Summary of Indirect Impacts

To summarize indirect impacts to black bears, based on the best available science and on the combined opinions of the Bear Review Panel and other consulted biologists as described above, black bears likely would be temporarily disturbed and displaced to some degree from areas of construction activity, by as much as 0.25 mile during the approximate nine-month construction period. ANR believes this impact could be substantial and persistent. However, those members of the Bear Review Panel and other consulted biologists who specifically addressed potential indirect impacts of the Project itself (as opposed to impacts resulting from increased human activity after a remote area becomes more accessible to the public; see below) concluded that after construction is completed, most bears would return to the area within a few days or weeks. The construction of the access roads and potential increased levels of human activity (facility operation and maintenance, hiking, biking, access by hunters, etc.) during the more critical seasons for bears (spring, summer, fall) pose the greatest threat of adverse impact to bears. However, with strict limitations on access and use of the immediate Project site, and with the design criteria and mitigations discussed above, those impacts would likely be short-term, as most bears would adapt to the presence of the facility without major behavioral changes. Assuming that hunting pressure would not increase dramatically, and that closures and enforcement are successful in neutralizing motorized access and additional human uses, the operation of the Project is not expected to displace most bears from the area and is unlikely to adversely affect the continued existence of a viable population of black bears in the Project area or in the surrounding region. If hunting pressure increases or proposed closures are not successful, there would be a higher risk that this alternative would indirectly affect the use of the Project area by bears when compared to other alternatives.

Conclusion: Summary of Indirect and Direct Impacts of the Proposed Action

Considering all findings regarding direct and indirect impacts of the Proposed Action, the activities proposed would be unlikely to adversely affect the continued existence of a viable population of black bears in the Project area or in the surrounding region. Since the Proposed Action would impact the largest area, there is a moderate to high risk of greater impacts to bear habitat, bear use of the area, and bear populations associated with development of the Proposed Action than with development of the other alternatives.

3.12.2.2 Alternative 1: No Action

No turbines, access roads, or other Project components would be constructed under the No Action alternative, no forestland would be cleared, and no BSB would be removed from the area. Therefore, no direct, indirect, or cumulative impacts to black bears would result from this alternative. Any changes that do occur in the area or the region would be those associated with on-going management activities and natural processes that would change habitat conditions. In the short term, bear habitat conditions would remain the same as described in Section 3.12.1. Over the long term, forest stands would continue to mature, although their species composition and age structure might change due to storm damage, disease, or other, unforeseeable events.

Various resource management activities, consistent with implementation of the Forest Plan, would continue on NFS lands in the area. Likewise, activities on private land would be expected to continue as has been infrequently occurring. These activities may include timber management, wildlife habitat management, and activities designed to enhance soil and water conditions, fisheries habitat, recreational opportunities, and so on. These activities could result in temporary displacement of bears. Hunting, hiking, and other recreational activities that could impact bears would be expected to continue at the current rate. Because there would be no clearing of forestland under the No Action alternative, no additional beneficial early successional habitat would be created to provide more diverse forage opportunities. The only opportunities for more early successional habitat would occur through natural events or future forest management activities.

3.12.2.3 Alternative 2: Reduced Turbines in Western Project Site

Alternative 2 was specifically designed to reduce the removal of BSB while retaining some development area for turbines on the west ridge. This alternative would reduce the footprint of the Western Project site by eliminating the three southernmost turbines and adding one additional turbine into the northern end of the western turbine string, closer to the existing transmission line. Turbine configuration on the Eastern Project site is the same as for the Proposed Action. Therefore, this alternative includes eight turbines on the western ridge and seven on the eastern ridge, for a total turbine count of 15. This 15-turbine layout, first identified in the SDEIS as the Forest Service's Preferred Alternative and carried forward to this FEIS, is the same configuration approved by the Vermont PSB under the State Section 248 process.

This alternative would result in a reduced adverse direct impact on bear habitat when compared to the Proposed Action. The total clearing and grading required for construction of Alternative 2 would be 85.4 acres, 66.5 acres of NFS lands and 18.9 acres of private lands. This is a reduction of about 2% from the Proposed Action (87.4 total acres). It is estimated that 350 to 360 BSB would be removed from the Project site under Alternative 2, a reduction of approximately 1.3% of the estimated BSB available (roughly 28,000) across the Project area. This compares to the 460 to 470 BSB that would be removed for the Proposed Action. Of the total BSB removed for the Reduced West alternative, 55 to 60 would be from the Eastern Project site, with the rest removed from the Western Project site. As noted in the final Order accompanying the CPG, a total of 36 acres would be impacted by the BSB removed (PSB, 2009: 71).

The three southern-most turbines eliminated from this alternative would have been located between the black bear road-crossing corridor near the cemetery on Route 8 and several small areas of concentrated BSB to the southwest. Although these three turbines would not be constructed, an electrical collection line and associated ROW would still be required through this area to connect the Eastern and Western Project sites. A design criterion would be developed so that this collection line would be placed to avoid beech habitat to the greatest extent possible, thus further reducing direct impacts. Rather than being installed overhead as normally would occur, this collection line would continue underground from the last turbine in the Alternative 2 string until it reaches the point where turbine W10 of the Proposed Action would be located. It would then transition to an above ground overhead line at the turbine W10 location, where beech habitat is greatly diminished, and stay overhead down the ridge toward and across Route 8 as described for the Proposed Action. The level of routine maintenance needed for the buried line would be very little compared to that required along a string of operating turbines. Approximately 4.2 acres of forestland would be converted to early successional habitat within the collection line corridor.

With the 15-turbine configuration, approximately 4.45 miles of new roads would be needed. Of that, approximately 2.72 miles of access road would be needed on the Western Project site, compared to the 3.38 miles for that portion of the Proposed Action. This would provide opportunity for growth of early successional habitat (a beneficial direct impact) in an amount similar to that found in the Proposed Action, including the additional small amount noted above related to growth along the connection line corridor.

As with the Proposed Action, no wetlands that could provide opportunities for spring foraging to black bears would be directly impacted by this alternative.

Reducing the Project footprint and number of proposed turbines in Alternative 2 would slightly reduce indirect impacts of the Project on bears when compared to the Proposed Action. Reducing disturbance in the southern portion of the western turbine array would allow bears relatively unimpeded access to other nearby important habitats, including wetland areas and apple trees located to the south and west of the sites where turbines are proposed for elimination in this alternative. This was a key factor in deciding which turbines to drop from the Proposed Action when developing this alternative. Because the Project still spans the entire development area analyzed for the Proposed Action, and because roads and electrical lines must still connect the turbines, indirect impacts during Project operation (disturbance/displacement of bears) would be only slightly less than those of the Proposed Action. Indirect impacts during construction would be essentially the same as for the Proposed Action.

To minimize direct and indirect impacts, the same design criteria and mitigation described for the Proposed Action would be implemented for Alternative 2 (see Section 3.12.2.1.1, paragraph entitled Design Criteria and Mitigation for Reducing Direct Impacts and Section 3.12.2.1.2, Design Criteria and Mitigation for Reducing Indirect Impacts). This would include among other things reducing the road width linking turbines on the western ridge from a 35-foot width to a 22-foot width to avoid BSB to the greatest extent practicable. To meet Condition #11 of the CPG, Alternative 2 would require the Applicant to conserve at least 144 acres of land that is comparable to the remote high-elevation area of concentrated beech stands to offset the PSB's calculated loss of 36 acres of BSB habitat.

Summary of Indirect and Direct Impacts of Alternative 2

In summary, the direct loss of beech habitat (approximately 350 to 360 BSB) would be less for Alternative 2 than for the Proposed Action. The amount of BSB removed would be approximately 1.3% of the estimated BSB available (roughly 28,000) across the Project area, as compared to 1.7% for the Proposed Action. The loss of beech habitat would be partially mitigated by the beneficial impacts of creating other types of diverse forage as would be found in openings and edge habitat, and, should monitoring dictate the need, by looking at future opportunities to enhance valuable habitat in other parts of the Project area. The loss of habitat would also be mitigated in part by the conservation of at least 144 acres of similar beech habitat, as required by the PSB. The direct impacts of Alternative 2 would be less than those of the Proposed Action, and the indirect impacts would be only slightly less than those of the Proposed Action. When compared to the East Side Only alternative, Alternative 2 would result in greater overall direct and indirect impacts, and thus more risk to black bear habitat, bear use of the area, and bear populations. Overall impacts of Alternative 2 would be more than for the No Action Alternative.

Given the reduction in the level of development and the reduction of direct and indirect impacts to bears for this alternative when compared to the Proposed Action, there would still be a moderate level of risk to bear habitat, bear use of the area, and bear populations. This is due to the degree of scientific uncertainty about the impacts of wind facility operations on bears and their use of surrounding habitats, as expressed by the divergent opinions among bear biologists. This is also due to the effects of removal of BSB and the degree that bears would adapt to the Project enough to utilize the remaining beech habitat and any newly created forage in the Project area. The combined direct and indirect impacts of Alternative 2 are unlikely to adversely affect the continued existence of a viable population of black bears in the Project area or in the surrounding region.

3.12.2.4 Alternative 3: Turbines in the Eastern Project Site Only

Alternative 3 would eliminate all turbines from the Western Project site, leaving a total development of seven turbines, all on the East Side. The total clearing and grading required for construction of Alternative 3 would be approximately 49.6 acres of forestland: 29.7 acres of NFS lands and 19.9 acres of private land. This is about 43% less cleared land than for the Proposed Action (87.4 total acres) and about 42% less than the 85.4 acres proposed for clearing in Alternative 2. Although the Project footprint for the East Side Only alternative does not intersect any areas of concentrated BSB, and thus no BSB would be cut from such clusters, an estimated 55 to 60 BSB would still be removed from the Project site during construction. This would represent 0.21% of the estimated 28,000 BSB in the Project area. This is an estimated reduction of about 405 to 415 BSB from the Proposed Action and about 295 to 305 BSB from Alternative 2. A total of approximately 10 acres would be impacted by the BSB removed for Alternative 3.

The East Side Only alternative would essentially eliminate all direct and indirect Project-related impacts to bears in the Western Project site, where the densest stands of BSB are located. There would be little or no adverse direct impact from cutting BSB on the Western Project site. The only Project-related development and human activity disturbance taking place on the Western Project site would be associated with construction of the laydown areas and the presence of the O&M building along Putnam Road. These activities would not be close to any areas of concentrated BSB. There would be very little disturbance or displacement of bears using the Western Project site. Alternative 3 would also eliminate potential beneficial impacts on the Western Project site associated with clearing areas to create more diverse foraging opportunities in early successional habitat.

On the Eastern Project site, the level of disturbance and displacement of bears anticipated from facility construction and operation would be about the same as for the Proposed Action. There would be slight increase in potential disturbance due to the presence of the substation associated with the East Side Only development. No wetlands that could provide future opportunities for spring foraging to black bears would be impacted by this alternative.

With the 7-turbine East Side Only configuration, approximately 1.92 miles of new access road would be constructed compared to the 5.07 miles for the Proposed Action and 4.45 miles for Alternative 2. Although not an important consideration due to lack of direct impact to BSB on the Western Project site, Alternative 3 would provide much less of an opportunity for growth of early successional habitat (a beneficial direct impact) when compared to the Proposed Action and Alternative 2.

Due to the scientific uncertainty associated with identifying the magnitude of impacts to black bears, the Vermont ANR has stated in both the PSB process and the Forest Service NEPA process that they would prefer a conservative approach to development. In their view, the East Side Only alternative represents the least risk to bears. Although the level of impacts to concentrated BSB would not be the same on the east ridge as those impacts on the west ridge, the ANR believes that this alternative offers an opportunity to study the impacts of wind facility development on bears before potentially moving forward with development on the Western Project site.

Where applicable, the same design criteria and mitigation measures described for the Proposed Action and Alternative 2 would be implemented for Alternative 3 (see Section 3.12.2.1.1, paragraph entitled Design Criteria for Reducing Direct Impacts and Section 3.12.2.1.2, Design Criteria for Reducing Indirect Impacts). Access roads would be 22 feet wide over most sections, reduced from the 35-foot nominal width described in the DEIS. Under this alternative, the Applicant would be required to conserve at least 40 acres of comparable land to offset the direct loss of 10 acres of BSB (four to one ratio), in the same manner as described for the Proposed Action and Reduced West alternative.

Summary of Indirect and Direct Impacts of Alternative 3

In summary, Alternative 3 would result in substantially less direct impact to BSB habitat than any of the other action alternatives, but more than the No Action alternative. This alternative would remove the smallest amount of BSB, approximately 50 to 60 BSB, or 0.21% of the BSB available in the Project area. Other nearby high concentrations of BSB east and south of the Eastern Project site would be unaffected. Bear use of those areas would be anticipated to continue unchanged. Similarly, potential indirect impacts from displacement, disturbance, and changed behavior and movement patterns associated with Alternative 3 would be much less than for the Proposed Action and Alternative 2, but more than for the No Action alternative. Little or no behavioral changes would be expected from bears using the western ridge. Therefore, when compared to the Proposed Action and Alternative 2, Alternative 3 would result in the lowest risk to bear habitat, bear use of the area, and bear populations. As with the other alternatives, the combined direct and indirect impacts of Alternative 3 are unlikely to adversely affect the continued existence of a viable population of black bears in the Project area or in the surrounding region.

3.12.3 Cumulative Impacts

Cumulative impacts to black bears would include both direct and indirect impacts resulting from the proposed Project, in combination with impacts from past, present, and reasonably foreseeable future actions. The affected environment for discussion of cumulative impacts on black bears includes all Forest Service and non-Forest Service lands within 10 miles of the proposed Project. This area includes more than 300 square miles, an area large enough to include the home ranges of many local bears, as well as movements and foraging of transient bears. In addition, the town of Bennington and Route 7, a major north-south highway, are approximately 10 miles west of the Project site. The cumulative impact analysis will consider past actions over the last 10 years, and reasonably foreseeable future actions in the next 10 years. The 10-year timeframe is effective because by 10 years after timber management or other vegetation-altering activities, regenerating stands have aged to the point where they no longer provide early successional habitat.

Past timber sales in the Project area and nearby NFS lands took place 15 to 20 years ago, and regenerated stands are no longer providing early successional habitat. Maintenance by the Forest Service of the permanent upland openings and productive apple trees has taken place within the past 10 years, and likely will be repeated during the next 10 years. According to the Forest Plan, and the current pace of projects, most Diverse Forest Use areas receive timber treatments approximately every 25 to 30 years. Projects planned for timber harvest generally utilize a combination of partial harvest, uneven age, and regeneration harvests to create a variety of habitats and forest structure/ages. Access for timber management is generally over existing roads. Creation of new roads is authorized in the GMNF Forest Plan, but it is rare. No further road development is planned in the Project area in the next 10 years.

The existing Searsburg Wind Facility was built over 10 years ago, but its on-going operation and maintenance continues to affect bear habitat in the area. Construction of the Searsburg facility resulted in loss of habitat and temporary displacement of bears during construction. However, no evidence is available to demonstrate conclusively one way or another whether this facility has caused any continuing adverse impact on black bears. Various studies and observations have demonstrated that bears continue to use the area around the existing Searsburg turbines, as well as other habitat in the Project area surrounding the turbines, although the age, sex, and number of individual bears moving and foraging near the site cannot be determined (Wallin, 1998; 2003; 2005b; 2006b).

Bear hunting has occurred frequently in the Project area in the past 10 years and would most likely continue at similar levels of hunting and harvest. Black bears are not listed as threatened or endangered. They are listed as a "medium priority" among Vermont's species of greatest conservation need, due to the impacts that development and fragmentation might have on important habitats, including mast stands, forested wetlands, and travel corridors (VTFWD, 2005). However, the statewide population has slowly increased over the last two decades (VTFWD, 2010b), and it is managed as a game species by the ANR in the State of Vermont. As such, the statewide population generates a sustainable surplus that can be harvested on an annual basis (VTFWD, 2008c). Most recently, as described in Section 3.12 above, the bear population is now estimated at slightly more than 6,000 bears, higher than the objective of 4,500 to 6,000 bears (VTANR, 2011).

No timber sales are anticipated in the Project area within the next 10 years. Currently, active timber harvest operations are proceeding in other areas of the Forest, although none are located near the Project area. Other vegetation management projects likely will be planned in other areas of the GMNF, possibly including lands within the cumulative impact analysis area. A landscape-scale planning effort for NFS lands south and west of the Project area is expected to begin in 2011. This planning effort might include additional GMNF lands south of Route 9 and east of the Project area, as well. It will be at least one to two years beyond 2011 before any definite proposals would be analyzed. No specific proposals are known at this time. As is generally the case, any proposed vegetation management would potentially result in both adverse impacts (due primarily to temporary disturbance and displacement) and beneficial impacts (due to creation of diverse habitat and forage opportunities). Forest Plan standards and guides related to vegetation management and management of habitat for wildlife, including beech management and protection of BSB, would be applied. The cumulative effects analysis of any proposals potentially affecting the Deerfield Project area would take into consideration any approved activities from the Deerfield Project

Timber harvesting on private lands in or near the Project area has occurred in the recent past and would be expected to continue. There is very little private land within the Project area. Regarding future harvests, there is no record-keeping or advanced planning on most of the private land in the Project vicinity (Fice, 2008). Although the impacts to BSB resulting from harvesting on private lands are largely unknown, it can be anticipated that the level of protection of BSB on private land is less than on NFS lands. It is worth noting that in 2003, the Forest Service estimated that an average of 5.3 million cubic feet of beech trees were removed from Vermont forests on an annual basis as part of timber harvesting activities (USDA Forest Service, 2003b). Similar levels of annual timber harvest over the past decade would equate to approximately 53 million cubic feet of beech harvested. Yet, between 1997 and 2006, the Vermont bear population increased approximately 27%, despite increasing development pressure, continued harvest of beech trees and at times, very little beechnut production. The Forest Service reports that the number of beech trees in Vermont that are 11 inches DBH or larger has actually grown more than 50% between 1983 and 1997. Although beech bark disease is a concern, there is no evidence that high-quality beech habitat is becoming scarcer; in fact, the ratio of growth to removal for beech is estimated to be 1.2:1 (USDA Forest Service, 2003b).

The Hoosac Wind Power Project is currently under construction, with operation anticipated to commence in 2012. This project is located in towns of Florida and Monroe, MA, with most of the project lying about 8 to 10 miles south of the Deerfield Project. The Hoosac facility will consist of two arrays of turbines, one of 11 turbines and one of 9 turbines, located along forested ridgelines at elevations ranging from approximately 2,300 to 2,800 feet. Near the edge of the Deerfield Project cumulative effects analysis area, it is the closest future wind facility to the Project. It is conceivable that bears from that area could make their way to and through the Deerfield Project area, but there are many existing barriers to that movement such as town roads and highways, houses and other facilities, and small, mostly rural population centers. Information gathered from that project indicates that the area of disturbance consists primarily of the Spruce-Fir-Northern Hardwoods natural community. Mostly forested with a few small openings, the two ridges impacted by the Hoosac facility contain a component of beech habitat as is typical for this region. Approximately 73 acres would be disturbed. Even if some amount of bear habitat is removed for the Hoosac facility, it will not provide a measureable cumulative impact for the Deerfield Project given distance between the projects, and the abundance of beech and other bear habitat features within and adjacent to the Deerfield Project, and in areas south of the Project into northern Massachusetts.

Another wind facility, the Berkshire Wind Power Project was dedicated in May 2011 and has begun operations. This 10-turbine facility, operated by a cooperative of non-profit public power entities, is located in the Town of Hancock in Berkshire County, MA, approximately 23 miles southwest of the Deerfield Project site. Each of the 1.5 MW turbines is slightly smaller than those proposed for installation at Deerfield. These turbines are located along a forested ridge at elevations of about 2,500 to 2,700 feet. Although little information is available about this project, presumably the amount of clearing and construction of roads and turbine pads is proportional to that of the proposed

Deerfield Project or the Hoosac facility, based on the number of turbines. Considering the distance between the Berkshire facility and the proposed Deerfield Project, and the presence of barriers to movements of bears, the Berkshire Wind Power Project is not likely to be a factor for measureable cumulative impacts for the Deerfield Project.

No other future wind projects close to the Deerfield Project are anticipated in the reasonable foreseeable future.

The Forest Service is not aware of any major road improvement projects, large subdivisions or housing developments, or any other large-scale development projects proposed for private lands within the Project area or cumulative impact analysis area that would adversely affect bears. Basic road maintenance and paving would be expected to continue on existing roads. The remoteness of the area and abundance of public land in the region contributes to the lack of major developments.

Cumulative impacts and risks to future bear habitat and use would be greatest under the Proposed Action, followed respectively by Alternative 2 and Alternative 3. The No Action alternative does not contribute any additional impacts or risk to past or reasonably foreseeable cumulative effects. Direct impacts for all action alternatives would result from construction of the proposed Project. The amount of beech habitat, including BSB, that would be removed (direct impact) by any action alternative when combined with all other similar activities during the previous 10 years and reasonably foreseeable activities over the next 10 years would likely still be a small percentage in comparison to the abundance of beech habitat across the southern GMNF and across southern and central Vermont (Brooks et al., 1987; Wolfson 1992; Wharton et al., 2003; Brooks, 2008). Therefore, while some level of cumulative impacts would be expected when considering past actions, the proposed activities, and foreseeable future actions, the level of cumulative impacts would not be anticipated to adversely affect most individual black bears within the Project area, or affect the continued existence of a viable population of black bears in the Project area or surrounding region.

3.12.4 Scientific Monitoring and Research Study

Scientific uncertainty over the impacts of a development like the proposed Deerfield Wind Project can be resolved only through continuing monitoring and research. Post-construction monitoring and research are specifically required under Conditions #10 through #13 of the CPG issued by the Vermont PSB for the 15-turbine layout (described as Alternative 2 in the SDEIS and FEIS). The CPG stipulates a multi-year study following a protocol approved by the PSB. Similarly, the Forest Service would also require pre- and post-construction monitoring and research as part of any issued authorization for the Project. Specific elements of the overall monitoring and research program would be developed in consultation with an expert team of biologists including representatives of the Forest Service, Vermont ANR, and experts in ecology and biology of bears. This comprehensive monitoring plan would have to be completed and approved by the GMNF Forest Supervisor prior to beginning of construction. It can also be expected that the monitoring plan may be adjusted over time as more is learned about the specific site and about appropriate techniques. Although the exact details of the monitoring program are not known at this time, it is the intention of the Forest Service that this monitoring program would meet "state-of-the-art" scientific standards. A more detailed discussion of scientific monitoring and research is provided in Appendix H.

Pre-construction monitoring has already begun. This includes a bear hair snag study and monitoring of beechnut crop production that began in the fall of 2009 on the Western Project site. In addition, hair snag studies and remote camera surveys have been conducted around the Searsburg Wind Facility.

In November 2010, the ANR and the Applicant reached an agreement (stipulation) on the scope of studies needed to satisfy Conditions #10 and #12 of the CPG. This agreement has been approved by the PSB. It states that the on-going bear hair snag study would continue. It also stipulated that a GPS-based telemetry study would be conducted. In accordance with the CPG, the Agency of Natural Resources is taking the lead on this study. A four-person oversight panel, including representatives from the Forest Service and USF&WS, is participating as needed. In June 2011, the ANR put forth a prospectus for the stipulated bear study. Responses were received and evaluated, and Western EcoSystems Technology, Inc. (WEST) was retained to conduct the study. Specific protocols and procedures were developed, and the study began in September 2011 with attempts to capture and collar bears. As of this writing in November 2011, one adult male bear has been captured and collared. The study will resume again in the spring of 2012. It is planned to continue for many years, and as such, will provide for comparison between pre-construction and post-construction data that will hopefully provide some answers regarding impacts of wind facilities on black bears.

Adaptive Management

Results from post-construction monitoring would be used for adaptive management, or adjustment of facility operations, if necessary, to reduce impacts on black bears. That adaptive management plan could include reasonable, scientifically proven measures to reduce impacts of lost beech habitat and disturbance or displacement of bears from important habitat. Given the scientific uncertainty and the fact that the potential impacts of a wind facility on eastern black bears have never been studied, it is difficult to determine at this time specific measures that would be taken to minimize impacts. Certain mitigations involving closures and restricting access (roads, timing of maintenance access, lighting, and so on) are discussed in various sub-sections of Section 3.12. Other options such as reducing operations during specific critical times of the year might also be proposed. However, The Forest Service cannot specifically require these types of measures without knowing if they truly are needed. Results from the scientific monitoring and research program would be useful for determining if and when adaptive management or operational adjustment is warranted. Any Special Use permit issued for the Project would include appropriate measures known at that time and would accommodate for adding additional measures as needed. The permit would consider the conditions of the CPG issued by the PSB. It would also require that any adaptive management strategies be developed in consultation with the Forest Service, the Applicant, and other experts in ecology and biology of bears in the Northeast identified by the Forest Service. See Appendix H.

3.13 Recreational Resources

This section describes recreational resources that could be affected by the proposed activities, and evaluates the types and degrees of potential impacts. As noted in the Forest Plan (USDA Forest Service, 2006a), the 400,000-acre GMNF offers a variety of recreational opportunities to the more than 70 million people who live within a day’s drive.

Goal 12 of the Forest Plan (USDA Forest Service, 2006a: 15-16) emphasizes a diverse range of high-quality sustainable recreation opportunities that complement those provided off NFS lands. For purposes of this assessment, the term "recreational resources" includes developed and dispersed recreation sites and activities (termed recreational opportunities) available on federal, state, local, and privately held lands within the defined affected environment. Given that enjoyment of views and scenery is generally considered recreational, designated scenic resources are also included as recreational resources.

3.13.1 Affected Environment

The affected environment for disclosing direct impacts on recreational resources is the Project area. Direct impacts of the Proposed Action, primarily physical disturbance to recreational resources that could affect developed and dispersed recreational activities, are focused on construction and operation of the wind facility (i.e., disturbance at the Project site and how it affects recreation activities in the Project area). Visual and noise impacts to recreationists are considered indirect effects in this discussion. However, the details of those impacts are not included in this section to avoid redundancy and may be found in Sections 3.5. and 3.4, respectively.

Lands in the southern Green Mountains provide a wide range of outdoor year-round recreational activities to residents and visitors. The Forest Service's National Visitor Use Monitoring (NVUM) results for the Green Mountain and Finger Lakes National Forests estimate that over the 12 months between October 2004 and September 2005, almost 1.9 million visits occurred to the GMNF (USDA Forest Service, 2006e). Of the 1,840 visitors to both forests who agreed to be interviewed by NFS staff over that survey year as part of the NVUM study, more than half (52%) reported that the primary purpose of their visit was recreation. These individuals were interviewed further about recreation (while interviews were terminated with those individuals reporting their visit was not recreational). The survey found that the recreational activity found to have the highest participation was 'viewing natural features' at 58%. After viewing natural features, the survey found the most popular recreational activities to be downhill skiing; viewing wildlife; hiking and walking; and general relaxation (USDA Forest Service, 2006e).

Field visits to key recreational areas and area reconnaissance were conducted by members of the Project team between 2004 and 2006. The team preparing the Visual Impact Assessment (VIA) visited the Aiken Wilderness, the Lamb Brook Area and surrounding GMNF and state recreational areas during the winter (the time of greatest visibility). Trips were conducted on foot, on snowshoes or skis, and on one occasion by snowmobile with a local guide. On-water views from major surface water bodies near the Project area were also assessed using canoe or kayak. A field visit of the Project area was completed by a GMNF recreation planner and an archaeologist in the spring of 2006, to assess recreational use in the Project area.

3.13.1.1 NFS Land Classification Systems and Recreational Resources

There are three types of classification systems used to assess Project impacts to recreational resources: 1) MAs; 2) the Recreational Opportunity Spectrum (ROS); and 3) the Visual Condition Guidelines. These three classification systems are summarized briefly below and are explained in detail in Visual Quality section 3.5.1.1.

Management Areas

These are land areas of the forest that have been designated with similar management objectives. The entire Project site lies within the Diverse Forest Use MA, which allows a variety of different uses. Within the four-compartment Project area, Diverse Backcountry, Diverse Forest Use and Remote Backcountry Forest MAs exist. Other MAs within the 10-mile visual affected environment include Alpine Ski Area, Alpine Ski Expansion, Appalachian National Scenic Trail, Diverse Backcountry, Diverse Forest Use, Ecologically Special Area, Remote Backcountry Forest, Remote Wildlife Habitat, and Wilderness.

Recreational Opportunity Spectrum

The MAs are overlaid with a second formal NFS classification system called the Recreation Opportunity Spectrum. The ROS is "designed to delineate, define, and integrate outdoor recreation opportunities in land and resource management planning…[and] attempt to describe the kind of recreation experience one may expect to have in a given part of the National Forest." (USDA Forest Service, 2006a). ROS classifications have been inventoried for the GMNF using GIS modeling and the Forest Plan provides desired future conditions for ROS.

As presented in Table 3.13-1, the five ROS settings range from Urban to Primitive, based upon specific physical, managerial, and social criteria (USDA Forest Service, 2006a). The intermediate settings are demarcated largely by the level and type of roads, as the kind of recreation experience available in a given ROS setting depends upon the type of access to that area. The two types of ROS classes are the Inventoried ROS Class, describing the existing array of recreational settings in an area of Forest, and the Desired ROS Class, used to guide recreation management to attain the desired condition of the Forest in the future. Figure 3.13-1 depicts the ROS classes within and adjacent to the Project area.

Table 3.13-1: Recreational Opportunity Spectrum.

Recreation Opportunity Spectrum (ROS)	
A formal Forest Service classification system designed to delineate, define, and integrate outdoor recreation opportunities in land and resource management planning. ROS classes are used to describe all recreation opportunity settings, from natural, undisturbed, and undeveloped to heavily used, modified and developed. ROS designations attempt to describe the kind of recreation experience one may expect to have in a given part of the National Forest. The ROS classes include:	
▪ Urban	This setting is characterized by a substantially urbanized environment, although the background may have natural-appearing elements. Affiliation with individuals and groups is prevalent, as is the convenience of sites and opportunities. Large numbers of users can be expected, both on-site and in nearby areas. Facilities for highly intensified motor vehicle use and parking are available. Regimentation and controls are obvious and numerous.

Recreation Opportunity Spectrum (ROS)	
▪ Rural	This setting is characterized by a substantially modified natural environment. Sights and sounds of humans are readily evident and the interaction between users is often moderate to high. A considerable number of facilities are designed for use by a large number of people and are often provided for special activities. Facilities for intensified use and parking are available. Motorized use may be present on designated roads and trails and off-road (where not restricted). In this setting the probability for experiencing affiliation with individuals and groups is prevalent, as is the convenience of sites and opportunities. Opportunities for challenges, risk taking, and use of outdoor skills are generally unimportant. Management activities and designed roads or highways may dominate the natural landscape. Structures are readily apparent.
▪ Roaded Natural	This setting is characterized by a predominately natural appearing environment with moderate evidence of the sights and sounds of people. Interaction between users may be low to moderate, but with evidence of other users prevalent. Opportunities for both motorized and non-motorized forms of recreation are possible. Motorized use may be present on designated roads and trails, and off-road (where not restricted). In this setting there is an equal probability of experiencing affiliation with other user groups and experiencing isolation from sights and sounds of humans. Challenge and risk opportunities associated with more primitive types of recreation are not very important. Natural settings may have modifications that range from being easily noticed to strongly dominant; roads and/or highways present; structures readily apparent.
▪ Semi-primitive Motorized	This setting is characterized by a predominately natural or natural-appearing environment of moderate to large size (generally greater than 2,500 acres). Interaction between users is low, but there is often evidence of other users. Motorized use may be present on designated roads and trails and off-road (where not restricted). In this setting there is a moderate probability of experiencing isolation from the sights and sounds of humans and self-reliance through the application of outdoor skills in an environment that offers challenge and risk. Management activities mimic natural occurrences. Primitive roads may be present, but structures are rare and isolated. Snowmobile/OSV use is possible.
▪ Semi-primitive Non-motorized	This setting is characterized by a predominately natural or natural-appearing environment of moderate to large size (generally greater than 2,500 acres). Interaction between users is low, but there is often evidence of other users. Motorized use is generally not present. In this setting there is a high probability of experiencing isolation from the sights and sounds of humans and self-reliance through the application of outdoor skills in an environment that offers challenge and risk. Management activities mimic natural occurrences. Primitive roads may be present and structures are rare and isolated.
▪ Primitive	A classification of wilderness and recreation opportunity. It is characterized by an essentially unmodified environment where trails may be present, but structures are rare, and where it is highly probable to be isolated from the sights and sounds of people.
Desired ROS Class (DROS)	Management tool used to describe the desired array of recreation settings across the Forest. Desired ROS classes guide recreation management and describe the desired condition of the Forest in the future. All MAs have an associated Desired ROS class to guide recreation management.

Recreation Opportunity Spectrum (ROS)	
Inventoried ROS Class (IROS)	An inventory tool used to describe the existing array of recreation settings for lands within the Forest boundary. Inventoried ROS describes the existing condition of the Forest. See also Recreation Opportunity Spectrum (ROS) and Desired ROS Class.

Source: USDA Forest Service, 2006c.

Visual Conditions Guidelines

The Forest Plan offers visual conditions guidelines for on-site and off-site views, based upon an area's ROS designation, resource type, and perceived viewer sensitivity. These are described in Table 2.3-2 of the Forest Plan, which is reproduced in Section 3.5 as Table 3.5.1.1-1.

As a result of these classifications, an overall MA is assigned to a specific GMNF land area, depending on its characteristics. Different ROS classes may be applied within that specific MA, depending on the types of recreational opportunities available or desired. Visual Conditions Guidelines are then applied within the ROS class for the specific location. This framework will be used to assess Project impacts and consistency with NFS objectives in Section 3.13.2 for GMNF lands in the affected environments.

3.13.1.2 Types of Recreational Activities in Southern Vermont

The GMNF differentiates recreational activities (also termed recreational opportunities) that are offered at developed recreation sites from those considered dispersed recreational activities. Developed recreation sites include but are not limited to campgrounds, public beaches, boat ramps, trailheads for designated (marked) hiking and snowmobile trails, parking areas, and ski areas. Dispersed recreational activities are those typically done outside of developed recreation sites, and include, but are not limited to, hiking on trails or bushwhacking (off-trail), peakbagging (summit climbing/hiking), backcountry camping, licensed hunting, trapping and fishing, and touring by bike or car along designated scenic routes, as well as dispersed winter activities such as snowmobiling, cross-country skiing, backcountry glade skiing, ice fishing and snowshoeing. Hunting is regulated by the Vermont Department of Fish and Wildlife. Primitive camping is allowed on GMNF lands subject to certain guidelines, such as staying back a certain distance from water bodies.

36 CFR Parts 212, 251, 261 and 295: *Travel Management; Designated Routes and Areas for Motor Vehicle Use; Final* (USDA 2005b; the 2005 Travel Management Rule) includes the following definitions for vehicles and trails on Forest Service lands:

- *Off-highway vehicle* (OHV)*.* Any motor vehicle designed for or capable of cross-country travel on or immediately over water, sand, snow, ice, marsh, swampland, or other natural terrain.
- *Over-snow vehicle* (OSV)*.* A motor vehicle that is designed for use over snow and that runs on a track or tracks and/or a ski or skis, while in use over snow. Commonly referred to as snowmobiles although other similarly configured vehicles can meet this definition.

- *Trail.* A route 50 inches or less in width or a route over 50 inches wide that is identified and managed as a trail.

- *Unauthorized road or trail.* A road or trail that is not a forest road or trail or a temporary road or trail and that is not included in a forest transportation atlas. Generally considered undesignated.

The Forest has completed an analysis of wheeled motorized use on the GMNF and has produced its Motorized Vehicle Use Map, in accordance with the 2005 Travel Management Rule, that identifies where wheeled motorized uses are allowed. Currently, there are no trails or roads designated for All Terrain Vehicles (ATVs) or other form of wheeled off-highway vehicles (OHVs) on the GMNF.

As previously noted, designated scenic areas will also be considered as recreational resources, based upon the NVUM report finding that surveyed visitors indicated the viewing of natural features as their most popular recreational activity (USDA Forest Service, 2006e).

Developed and dispersed recreation sites and opportunities and designated scenic resources on federal, state, and private lands were inventoried within the affected environments and are briefly described below. The inventory is summarized in Table 3.13-2 and was compiled from the Forest Plan, GIS data obtained in July 2006 from the Vermont Center for Geographic Information (VCGI) and the GMNF in 2006 and 2007, and review of available maps, atlases, and web sites cited in Chapter 5.0.

Table 3.13-2: Inventory of Recreational Resources Within Ten Miles.

Recreational Areas	Description and NFS Land Classifications	Primary Recreational Opportunities
Within Western Project Site (GMNF in Searsburg, VT)	Within GMNF: ▪ MA: Diverse Forest Use (3.1) ▪ IROS: Roaded Natural ▪ DROS: Roaded Natural	Dispersed recreation only: Hiking, Hunting, Peakbagging (Summit Climbing/Hiking), Back-Country Camping, Snowshoeing, Backcountry Glade Skiing
Within Eastern Project Site (GMNF in Readsboro, VT)	Within GMNF Lamb Brook Area (described below): ▪ MA: Diverse Forest Use (3.1) ▪ IROS: Roaded Natural & Semi-primitive Motorized ▪ DROS: Roaded Natural	Dispersed recreation only: Hiking, Hunting, Peakbagging (Summit Climbing/Hiking), Back-Country Camping, Snowshoeing, Backcountry Glade Skiing

Recreational Areas	Description and NFS Land Classifications	Primary Recreational Opportunities
Lamb Brook Area (GMNF in Readsboro & Searsburg, VT; Lamb Brook Area is within the Eastern section of the Project area) Topographic features: ▪ Devil's Staircase ▪ Cascade ▪ Freezing Hole ▪ Cemetery Peak Vast Corridor 9 and Local VAST trail to Dome	Approximately 4,795-acre GMNF area surrounded by Route 9 on north, Route 8 on west, Route 100 and Heartwellville on south and extending almost to Harriman Reservoir on the east. WTGs in Eastern Project site would extend southward along same ridge that now contains the 11 WTGs of the existing Searsburg Wind Facility on private land. ▪ MA: Diverse Forest Use (3.1) ▪ IROS: Roaded Natural & Semi-primitive Motorized ▪ DROS: Roaded Natural MA: Remote Backcountry Forest (6.1) ▪ IROS: Semi-primitive Motorized ▪ DROS: Semi-primitive Motorized ▪ No marked trails to these features; no parking areas. Major E-W snowmobile trail across southern Vermont. Coincides with Readsboro town road & historic former Albany-Boston turnpike trail (Old Stage Road). ▪ MA: Remote Wildlife ▪ ROS: Roaded Natural and Semi-primitive Motorized	Dispersed: Hiking, Peakbagging (Summit Climbing/Hiking), Hunting, Fishing, Back-Country Camping, Cross-Country Skiing, Snowshoeing, Backcountry Glade Skiing, OSV-use/Snowmobiling, Berry Picking, Bird Watching
VAST Snowmobile Corridor 7 (GMNF Searsburg, VT) 0.5 mile W of Project Site	The regional VAST trail serves as a moderately busy snowmobile trail during the winter months. Intermittent views likely, especially of WTGs in Western Project site.	Hiking, Hunting, OSV-use/Snowmobiling
Molly Stark Trail **VT Scenic Byway** Route 9 eastbound, at Woodford State Park and Little Pond Road east to Route 8 0.7 to 3.2 miles W of Project Site	This stretch of Route 9 is predominantly wooded with scattered commercial and recreational development. The existing Searsburg Project is not visible along this portion of Route 9.	Sightseeing, Biking
VAST snowmobile Corridor 7A on Forest Road 74 (Aiken Road) (GMNF in Woodford, VT) Approx. 1.3 miles W of Project Site (Forest Road 74) to 0.5 mile (Corridor 7A)	Northern hardwoods predominate throughout this area along higher terrain, with softwoods concentrating around wetlands and streams. The VAST trail serves as a moderately busy snowmobile trail during the winter months. The trail skirts the northeast boundary of the George D. Aiken Wilderness Area. Long range views are limited due to dense forest canopy, though some open views to the east are available.	Hiking, Hunting, OSV-use/Snowmobiling

Recreational Areas	Description and NFS Land Classifications	Primary Recreational Opportunities
George D. Aiken Wilderness Area (GMNF in Woodford VT) Approx. 1.5 miles W of Project Site	The 5,060-acre George D. Aiken Wilderness is one of eight designated wilderness areas within the GMNF in Vermont. The area consists of streams and wetlands surrounded by higher hills on the eastern and western edges. Numerous wetland ecosystems include forested and shrub swamps, open water, marshes, and boggy areas. The entire area is a high plateau most of which is over 2,300 feet in elevation, but due to the mature forest canopy, long range views are limited even on the forested hill summits. ▪ MA: Wilderness (5.1) ▪ IROS: Semi-primitive Non-motorized ▪ DROS: Primitive	Dispersed recreation only; No designated trails Backcountry Hiking, Camping, Hunting (including bear), Cross-Country Skiing, Snowshoeing
Woodford State Park (Woodford, VT) Approx. 1.9 to 2.7 miles NW of Project Site	This 398-acre state park is located south of Route 9 on a densely forested mountain plateau. At approximate highest elevation of 2,400 feet, it is the highest Vermont state park. The park offers 103 campsites around Adams Reservoir. There are several designated hiking trails, including a 2.7-mile loop around the reservoir. There are no views of the existing WTGs, due to the mature spruce/fir/birch tree canopy.	In-season Camping, Picnic Area and Beach near Dam, Boats for Rent, Hiking, Off-season Cross-Country Skiing, Snowshoeing
Deerfield River (southern Stratton, Somerset, Searsburg, Wilmington, Whitingham) 2.0 miles N of Project Site	Some reaches within GMNF determined eligible for designation as a scenic river under the Wild, Scenic and Recreational Rivers classification. ▪ MA: Eligible Wild, Scenic and Recreational Rivers (9.4) ▪ DROS: Roaded Natural ▪ Desired Future Condition: recreational ▪ Outstanding Resource Values: Wildness and hydrology	Canoeing, Boating, Fishing
Forest Road 73 (GMNF in Woodford, VT) 2.5 miles SW of Project Site	This forest road parallels the southern boundary of the Aiken Wilderness and the West Branch stream. The road provides access into Aiken Wilderness for hunters, hikers and anglers. ▪ MA: Diverse Backcountry (6.2) ▪ IROS: Roaded Natural ▪ DROS: Semi-primitive Motorized	Hiking, Hunting
Red Mill Brook Campground (GMNF in Woodford, VT) 3.2 miles N of Project Site	Located north of Route 9 on Forest Road 72, the campground is heavily wooded. There are no views of the existing WTGs. ▪ MA: Diverse Forest Use (3.1) ▪ IROS and DROS: Roaded Natural	Closed 2009 (no indication as to whether or not it may re-open)

Recreational Areas	Description and NFS Land Classifications	Primary Recreational Opportunities
Harriman Reservoir: Castle Hill at Boat Launch and Picnic Area (Wilmington, VT) 3.4 miles E of Project Site	This is a small boat launch area suited to canoes, kayaks and small fishing boats. Structures associated with the picnic area, and the 115kV transmission line clearing (seen in the distance) are the only obvious signs of human alteration. The existing WTGs are not visible from View Point 18.	Boating, Picnicking
Harriman Reservoir (on water) (Wilmington/Whitingham, VT) 3.6 miles SE of Project Site	Harriman Reservoir is almost 9 miles long but only about 0.3 mile wide at its widest point. It is heavily used during the summer months for boating, water skiing, jet skiing, canoeing, kayaking, fishing and swimming. The shoreline is largely undeveloped except for the northern end near Wilmington village and Route 9, and the southern end by the dam and Whitingham village. There are a few other smaller boat launches and beach and picnic areas. A few houses can be seen in the surrounding hills, but the views are predominantly of wooded hillsides. The existing WTGs can be seen from about six areas along the reservoir. In nearly all cases, intervening hills obscure some of the WTGs.	Swimming, Boating, Fishing, Skating
Haystack Ski Area (on GMNF land in West Dover, VT) 4.0 miles NNE of Project Site	Haystack is located approximately 2.5 miles southwest of Mount Snow. Current plans are for ski slopes to re-open on weekends this winter, but only to prospective members and residents of Wilmington and Dover. The existing WTGs are likely visible from the summit and some trails. ▪ MA: Alpine Ski Areas (7.1) ▪ DROS: Rural	Closed in 2005 (under new ownership; scheduled to re-open in December 2011) Skiing, Hiking
City Stream (GMNF in Woodford, VT) 4.0 miles W of Project Site	Determined eligible for designation as a recreational river under the Wild, Scenic and Recreational Rivers classification. Flows westerly from Big Pond along Route 9 to Roaring Branch. ▪ MA: Eligible Wild, Scenic and Recreational Rivers(9.4) ▪ DROS: Roaded Natural ▪ Desired Future Condition: recreational ▪ Outstanding Resource Value: Wildlife	Canoeing, Boating, Fishing
Prospect Mountain Nordic Ski Center (Privately owned in Woodford, VT) 4.0 miles W of Project Site	The Prospect Mountain Nordic Ski Center, located along a prominent ridge outside of the western boundary of the Aiken Wilderness, is a destination that receives a moderate level of use for snowshoeing and cross country skiing during winter months.	Cross-Country Skiing, Snowshoeing Closed in Summer

Recreational Areas	Description and NFS Land Classifications	Primary Recreational Opportunities
Harriman Reservoir: Mountain Mills Boat Launch and Picnic Area (Whitingham, VT) 4.2 miles SE of Project Site	Harriman Reservoir is one of four public water bodies formed from the damming of the Deerfield River to generate hydroelectric power. It is a narrow 7-mile long sinuous water body. Its north end is a heavily trafficked area where motorboats, jet skis and kayaks are launched, especially busy on summer afternoons and weekends. Rt. 9 is just to the north along with other boats and businesses. The tops of the northernmost existing WTGs can be seen from the far southern end of the launch area, and from the water near the eastern shore.	Boating, Picnicking
Harriman Reservoir Ward's Beach Picnic Area and Boat Launch (Wilmington, VT) 4.5 miles SE of Project Site	The picnic area is dotted with trees and sits on a bluff above the beach and reservoir. A small marina can be seen to the south, but otherwise views over the reservoir are predominantly natural. A few of the existing WTGs are seen on the farthest ridge, but most are obscured by intervening hills.	Swimming, Beach Activities, Picnicking, Boating, Skating
Stamford Stream (GMNF in Woodford, VT) 4.5 miles W of Project Site	Determined eligible for designation as a recreational river under the Wild, Scenic and Recreational Rivers classification. Located between the confluence of City Stream to Woodford and Stamford town line. ▪ MA: Eligible Wild, Scenic and Recreational Rivers(9.4) ▪ DROS: Roaded Natural ▪ Desired Future Condition: recreational ▪ Outstanding Resource Value: Botanical, Ecological	Canoeing, Boating, Fishing
Somerset Airfield Campground (GMNF in Somerset) 4.7 miles N of Project Site	Located along Forest Road 71, north of the intersection with Somerset Road. A grassy, open campground with camping permitted only in designated sites. ▪ MA: Diverse Forest Use (3.1) ▪ IROS: Roaded Natural ▪ Desired Future Condition: recreational	Camping
Molly Stark Scenic Byway: westbound Route 9 East of Wilmington, VT 4.8 to 8.0 miles E of Project Site	Offers views starting just east of Molly Stark State Park. Views focus on a sequence of hills to the west, and include the existing WTGs.	Sightseeing, Biking

Recreational Areas	Description and NFS Land Classifications	Primary Recreational Opportunities
Haystack Golf Club Mann Road (Wilmington, VT) 5.5 miles NE of Project Site	Mann Road is heavily wooded to the west except for one point where the golf course provides an opening with views across the valley toward Haystack Mountain and the ridge to the south of Route 9, including the existing WTGs. Haystack is a strong and prominent focal point from this vantage point. The existing WTGs are also visible from the vicinity of the entrance and deck of the Haystack Golf Clubhouse and the surrounding greens.	Golf
The Long / Appalachian Trail (Stamford, Woodford, Glastenbury, Sunderland, VT) 5.1 to 7.7 miles SW-W-NW of Project Site	The Long/Appalachian Trail runs north-south through the western part of the geographic area, and is considered a highly sensitive hiking corridor. The Appalachian Trail is designated as a National Scenic Trail. The trail runs over the spine of Glastenbury Mountain, and offers open panoramic views from the fire tower at this remote summit (requiring a 10-mile hike from either direction). Views along much of the trail in the geographic area are limited due to forests and abundant coniferous cover at higher elevations. From the peak of Glastenbury Mountain, the existing WTGs appear very small though they are easily visible in clear weather conditions. They occupy a small portion of the overall scene, which is predominantly natural. A few open meadows, the power line clearing, and a faint trace of a few roads are the only other evidences of human alteration. The existing WTGs are also visible from Porcupine lookout, located on the AT south of Glastenbury Mountain. The WTGs are visible from one or two more limited areas heading south along the ridge toward Route 9, and a few limited views are possible south of Route 9. ▪ MA 8.1 and 8.2 (minimum 500 feet on either side of trail ▪ IROS: range ▪ DROS: Semi-primitive Non-motorized	Hiking, Camping, Cross-Country Skiing, Snowshoeing

Recreational Areas	Description and NFS Land Classifications	Primary Recreational Opportunities
Glastenbury Wilderness **Glastenbury Mountain Fire Tower** **Goddard Shelter** Section of Long-Appalachian Trail (Within GMNF in Glastenbury, VT) 5.5 to 8.5 miles NW of Project Site	The fire tower at the summit of Glastenbury Mountain (elevation 3,748 feet) is wooded with abundant coniferous cover at higher elevations. The existing WTGs appear very small though they are easily visible in clear weather conditions. They occupy a small portion of the overall scene, which is predominantly natural. A few open meadows, the power line clearing, and a faint trace of a few roads are the only other evidences of human alteration. The WTGs are visible from one or two more limited areas heading south along the ridge toward Route 9. Within the Glastenbury Wilderness Area ▪ MA: Wilderness Management Area 5.1 ▪ DROS: Primitive	Hiking, Camping, Cross-Country Skiing, Snowshoeing
Sherman Reservoir (Whitingham, VT) 5.6 to 6.4 miles S of Project Site	Sherman Reservoir is part of the Deerfield hydroelectric generation system. There is a small picnic area and boat launch.	Boating, Fishing, Swimming, Picnicking, Skating
Sadawga Pond (Whitingham, VT) 5.8 miles SE of Project Site	Sadawga Pond is in a relatively open area with some views to the south and west. The existing WTGs cannot be seen from the boat launch area, but can be seen from a few points on the pond. There are no beach or picnic facilities.	Boating, Fishing, Skating
Bolles Brook (Glastenbury and Woodford) 6.0 miles NW of Project Site	Determined eligible for designation as a scenic (through Glastenbury Wilderness) and recreational river (south to confluence with Roaring Branch) under the Wild, Scenic and Recreational Rivers classification. MA: Eligible Wild, Scenic and Recreational Rivers(9.4) ▪ DROS (scenic segment): Semi-primitive Motorized ▪ DROS(recreational segment): Roaded Natural ▪ Outstanding Resource Value: Wildlife	Canoeing, Boating, Fishing
Whitingham Recreation Area and Brigham Young Monument (Whitingham, VT) 6.4 miles SE of Project Site	Whitingham has a picnic area and ball fields at the top of a hill at the intersection of Town Hill Road and Poverty Row Road. The site offers beautiful views to the hills and mountains to the west. During the summer months, the existing WTGs are not visible except in the area of the Brigham Young Monument at the southeast corner of the site.	Picnic Area, Ball Fields, Monument

Recreational Areas	Description and NFS Land Classifications	Primary Recreational Opportunities
Somerset Reservoir (Somerset, VT) 6.5 to 8.0 miles N of Project Site	Somerset Reservoir is remote and undeveloped. Except for the dam, and one building on top of nearby Mount Snow, almost no development can be seen in the surrounding hills. It is primarily used by canoeists and kayakers, along with a few fishing boats with small motors. There are some primitive campsites along the shore. The existing WTGs are visible from a small portion of the reservoir along the western shore.	Swimming, Boating, Fishing, Skating, Camping, Picnicking
Mount Snow Resort Ski Area (on GMNF land in West Dover, VT) 6.5 miles NNE of Project Site	Various trails and lifts reaching the summit of Mt. Snow offer a range of different vistas depending on one's location. Trails off the summit are oriented primarily to the east and north. The existing WTGs are visible from the top of at least two of the summit lifts. The restaurant deck and some interior windows also offer views of the existing WTGs. Given the breadth of the view, the existing WTGs appear noticeable, but not prominent in the landscape. ▪ MA: Alpine Ski Areas (7.1) ▪ DROS: Rural	Skiing, Hiking
Raponda Lake (Wilmington, VT) 7.5 miles E of Project Site	The eastern shore of this lake contains many camps and homes, and a small beach for Wilmington residents. There is a boat launch at the northern end of the lake. Views of the existing WTGs are blocked by a ridge west of the lake.	Swimming, Boating, Fishing, Skating
Molly Stark State Park (Wilmington, VT) 8.3 miles E of Project Site ▪ Trail to Fire Tower on Mt. Olga ▪ 23 tent/trailer sites ▪ 11 lean-to sites ▪ Open lawn areas ▪ Picnic pavilion ▪ Play area	The fire tower atop Mt. Olga offers a 360° view of the many hills, mountains and ridges in the area. Since it is close to the ridge dividing Wilmington from Marlboro and Brattleboro, it offers views much farther to the east and west than anywhere else in the area. Haystack Mountain, Mount Snow, and Mount Greylock are prominent. A communications tower can be seen in the foreground. The trail to the fire tower is a popular hike especially during the summer and fall. There are no views of the existing WTGs from the wooded campsites but open views are available from the fire tower.	Hiking, Climbing, Sightseeing, Camping, Picnicking,

Abbreviations:
- IROS: Inventoried (i.e., Existing) Recreational Opportunity Spectrum (Winter)
- DROS: Desired Recreational Opportunity Spectrum (Winter)
- MA: Management Area

Sources:
- Vermont State Parks, 2006.
- USDA Forest Service, 2006f, 2006g, 2010.
- VAST, 2006.
- USDA Forest Service Green Mountain National Forest (South half) Vermont Map, 1974, Revised 1992.

3.13.1.3 Inventory Results for Recreational Resources

Major federal, state, municipal, and privately owned developed recreation sites, GMNF lands, and MAs in the affected environment are shown on Figure 3.13-1. These are summarized on Table 3.13-2 together with expected dispersed recreational opportunities, distances and directions from the closest proposed turbines, MAs, and inventoried and Desired ROS classes where applicable. Key areas offering developed and/or dispersed recreational opportunities in southern Vermont include the GMNF and its congressionally designated George D. Aiken Wilderness Area, the Glastenbury Wilderness Area, and the Appalachian National Scenic Trail (AT), along with many campgrounds, surface water bodies, and designated hiking and OSV/snowmobile trails. In addition, the Woodford and Molly Stark State Parks, the Mount Snow and Haystack ski areas, the Molly Stark Scenic Byway, and a number of lakes outside the GMNF offer many types of recreational activities.

No congressionally designated areas are located within the Project area. However, the George D. Aiken Wilderness Area is located within the 10-mile visual affected environment. The Glastenbury Wilderness lies between 5.5 and 8.5 miles from the Project site while the AT passes within 5.5 miles of the Project site at its closest point.

No Wild, Scenic and Recreation (WSR) Rivers are located in the State of Vermont, although several reaches of rivers determined eligible for WSR River designation under the National Wild and Scenic Rivers Act (PL 90-542) are located within the 10-mile visual affected environment (National Wild and Scenic Rivers System, 2007).

There are no developed recreation sites, no marked trails, and no designated public parking areas or OSV/snowmobile trailheads in the Eastern or Western Project sites. The closest facilities used for recreation are several designated snowmobile trails within the four-compartment Project area (see Figure 3.13-1). One trail is located approximately 0.5 mile west of the Western Project site (end of Corridor 7A at Corridor 7). Two are located within the Lamb Brook Area, a minimum of 0.8 mile south of the Eastern Project site.

Dispersed recreational activities such as hunting, hiking, skiing, and primitive camping are allowed, but there are few indications of recreational use in the overall Project area, based upon field observations over several seasons. Several unmarked trails traverse the Project area and vicinity. Some evidence of use by unauthorized OHVs/ATVs or snowmobiles was observed on existing trails within the Western Project site during a field visit in April 2006. Other evidence of unauthorized OHV/ATV use on portions of the Corridor 9 snowmobile trail where it intersects Route 8 has also been noticed sporadically over the last few years.

Major Recreational Resources

The following section will briefly describe the sites and features that offer the more popular opportunities for recreation in the Project area and vicinity. More detail on these sites and features may be found in the Project Record.

Lamb Brook Area: The Lamb Brook Area is located just south of the existing Searsburg Wind Facility. It previously consisted of an estimated 5,561 acres and was subject of a timber harvest and road building proposal in the early to mid-1990s. During development of the 2006 revised GMNF Forest Plan, a more accurate assessment determined that the area contains an estimated 4,795 acres (based upon GIS data reported in the 2006 Forest Plan). The area was considered during the revision of the Forest Plan for designation as a Wilderness Area. The identification of wilderness and roadless areas was extensively reviewed in Appendix C of the FEIS prepared for the Forest Plan (USDA Forest Service, 2006c). The Lamb Brook Area did not meet NFS criteria to be an Inventoried Roadless Area, as it contains an existing road under non-Forest Service jurisdiction. Although there has been jurisdictional dispute for many years regarding the Old Stage Road, it is the Forest Service understanding that this section of the Old Stage Road is still recognized by the Town of Readsboro as a Class 4 road (USDA Forest Service, 2006c). Designation as an Inventoried Roadless Area is a precursor for evaluating a potential wilderness area (USDA Forest Service, 2006a). However, in response to public concerns, the Forest Supervisor authorized evaluation of the Lamb Brook Area as a potential Wilderness Area. The proposed Project site is not located in areas that meet the national criteria to be categorized as inventoried roadless areas. The New England Wilderness Act of 2006, proposing designation of two new wilderness areas and adding acreage to others in the GMNF, specifically did "not propose a wilderness designation for the area known as Lamb Brook" in the bill (Leahy, 2006). The bill passed in both the House and Senate in November of 2006, and by December of that year, had become law (U.S. Government Printing Office, undated).

The MAs found in the Lamb Brook Area are Diverse Forest Use, Remote Backcountry and Remote Wildlife Habitat. The entire Project site is located within the Diverse Forest Use Management Area, which emphasizes a variety of forest uses. The Diverse Forest Use MA specifically permits the development of wind energy facilities, by approving a land use authorization and issuing a non-recreation Special Use permit (USDA Forest Service, 2006a). The portion of the area containing the proposed Eastern Project site has a Desired ROS class of Roaded Natural. This ROS setting is characterized by structures "readily apparent…with moderate evidence of the sights and sounds of people" (see Table 3.13-1).

The area is rimmed by hills and ridges and is drained by several stream systems, including Lamb Brook, Medbury Branch, and Wilder Brook. The Lamb Brook Area's highest elevation is 3,110 feet at the southern end of a ridge known as Cemetery Peak; this ridge would be occupied by the turbines of the Eastern Project site. Other prominent landforms in the area are locally known as The Dome in the southeast, Freezing Hole in the east, and the Devil's Staircase, where the Medbury Branch spills over rocks known as the Cascades in the northwest portion of Lamb Brook Area. Unmarked trails lead to each of these topographic features.

No developed recreation sites are located within the Lamb Brook Area and within the portions of the area that contain the Eastern Project site. Access to the Lamb Brook Area is difficult and it has no designated parking areas. Two unpaved roads are located within the area, but neither is open to vehicles. These are the gated Forest Road 266 and a Class 4 road known as the Old Stage Road. The Old Stage Road (also called the Albany-Boston Turnpike) was originally constructed in 1760 and has been determined eligible for listing on the National Register of Historic Places (Vermont Wilderness Association, 2007). The Old Stage Road is also heavily used as a designated snowmobile trail (Corridor 9) in winter, and is one of two snowmobile trails in the Vermont Association of Snow Travelers (VAST) network that are located within the Lamb Brook Area, as shown on Figure 3.13-1 (Vermont Association of Snow Travelers, Inc., 2006).

In regards to motorized use in the Lamb Brook Area, neither portion of the snowmobile trails under Forest Service jurisdiction noted above are authorized for wheeled motorized uses such as by ATVs. However, on portions of the Corridor 9 snowmobile trail that lie on the same footprint as the Old Stage Road, ATV use is allowed by the Town, since it is the Forest Service understanding that the Town considers the Old Stage Road as a Town road. Debate continues over the jurisdiction of this road. Any ATV use of this road/trail is limited and sporadic. There is no easy, direct ATV access from the Old Stage Road across Forest Service lands to the proposed access road for the Eastern Project site turbines due to lack of existing trails, steep terrain, and thick conifer cover adjacent to the proposed access road.

Dispersed recreational activities in the Lamb Brook Area include hiking, peakbagging (summit climbing/hiking), hunting, fishing, back-country camping, cross-country skiing, snowshoeing, backcountry glade skiing, snowmobiling, berry picking, and bird watching. GMNF staff familiar with the area characterized the overall recreation use of Lamb Brook Area as relatively low (especially in the north due to lack of access), except for key times during hunting season and the peak of snowmobile season (USDA Forest Service, 2006a).

Wilderness Areas: The 5,060-acre congressionally designated George D. Aiken Wilderness Area is approximately 1.5 miles west of the Western Project site at its closest. It has an Inventoried ROS Class of Semi-primitive Non-motorized and a Desired ROS Class of Primitive. Viewer sensitivity is high for this category (Table 3.5.1.1-1).

The Aiken Wilderness is almost entirely surrounded by State or National Forest lands. While areas near the Aiken Wilderness receive moderate recreational use (especially those along Route 9), few people venture into the wilderness itself due to lack of easy access. There are no designated trails or bridges. Dispersed recreational opportunities in the Aiken Wilderness include bushwhacking and fishing in the summer, and backcountry skiing and snowshoeing in the winter. The area is used by bear hunters, who camp in the fall along the accessible Forest Roads 74 (also called the Aiken Road, just east of the Wilderness) and 73 (just south of the Wilderness). These forest roads are shown in Figure 3.13-1.

The Glastenbury Wilderness Area encompasses 22,425 acres, and is almost the entirely within the northwest portion of the 10-mile visual affected environment, although no part of it lies within the Project area. Congressionally designated as Wilderness by the passage of the New England Wilderness Act of 2006, it has no campgrounds, no parking areas, little access, and no motorized vehicles are allowed (Leahy, 2006; Wilderness.net, 2008). There are minimal trails through this Wilderness, with its main access being the Long/Appalachian Trail, which runs through the center in a north-south route (see discussion below). The Desired ROS for this area is Primitive, which tends towards a natural setting with very little alteration.

VAST Snowmobile Corridors 7 and 7A; Corridor 9: Portions of designated snowmobile Corridor trails 7 and 7A are found within the Project area, located approximately 0.5 mile west of the Western Project site. The segments are part of VAST's north-south trail system, crossing Route 9 west of Searsburg. Corridor 7A coincides with Forest Road 74 (also called Aiken Road), just outside of the eastern boundary of the George D. Aiken Wilderness Area. Corridor 7A turns easterly then intersects with Corridor 7 approximately 0.5 mile west of the proposed turbines. The inventoried ROS for these recreational corridors are Roaded Natural, with a Desired ROS of Semi-primitive Motorized.

The Corridor 9 snowmobile trail lies in the Lamb Brook Area. It crosses Route 8 about 1.3 miles south of the entry road to the Searsburg Wind Facility, and runs basically east-west. At its closest point, it is approximately 0.5 mile south and west of the southern-most proposed turbine on the Eastern Project site.

The Long Trail/Appalachian Trail: The Long/Appalachian Trail is considered a highly visually sensitive hiking corridor and has a Desired ROS of Semi-primitive, Non-motorized. The trail traverses the westernmost part of the Project's visual affected environment and at its closest is approximately 5.5 miles west of the Project site (though visibility is screened by vegetation and intervening hills in that area). Descriptions of visual characteristics of the area can be found in Sections 3.5.1.5 and 3.5.2.1.2.

Other Sites and Features: A number of other recreation sites and features may also be impacted by the proposed Project. None of these occur in the Project area; impacts would be to the visual experience. These include the Red Mill Brook Campground in Woodford, located north of Route 9 on Forest Road 72 with a desired ROS of Roaded Natural. Red Mill Campground has been closed since 2009 due to low visitation, duplication of services with Woodford State Park, and lack of funding for maintenance. There is no indication at this time if the campground will reopen and for what purposes. The Mount Snow Resort Ski Area in West Dover is approximately 6.5 miles north of the Project site, and offers views of the existing Searsburg Wind Facility as well as the proposed Project. The Mt. Haystack Ski Area in West Dover is approximately 2.5 miles south from Mount Snow and 4 miles from the Project site. Although most trails off the summit are oriented to face east, views of the existing turbines are available from the upper portions of some trails.

Two Vermont state parks and one designated state scenic byway (the Molly Stark Trail on Route 9) are located nearby. The 398-acre Woodford State Park lies on Route 9 approximately 2 miles west of the Project site. Molly Stark State Park is located 8 miles east of the Project site off Route 9. The Molly Stark Trail Scenic Byway (Route 9) is a Vermont Scenic Byway designated under the Vermont Scenic Byways Program (Vermont Agency of Transportation, 2006). The byway crosses portions of the towns of Bennington, Woodford, Searsburg, Wilmington and Marlboro. The Byway's Corridor Management Plan lists the existing "Searsburg Windmill Facility" as a cultural and scenic resource in its Intrinsic Resources Inventory, and notes that the wind facility is sometimes open for tours, and therefore could be considered recreational as well (LandWorks, 2003). The Plan assigned the existing Searsburg Wind Facility turbines the highest positive Vermont Byways Program Scenic Evaluation Rating of +3. The existing wind facility was described as "an outstanding example of an industrial form which many observers and those who support wind energy believe to be a beautiful example of current technology for renewable energy… [The Searsburg] section [of the Trail] warrants a positive scenic assessment, from a +1 for the forested sections to a +3 for the wind WTGs, unique to the state." (LandWorks, 2003.)

Waterbodies: There are a number of lakes, rivers, and streams within the 10-mile visual affected environment. Water based recreation opportunities in the southern part of the GMNF are somewhat limited; other opportunities exist off of NFS lands and are frequently visited by recreating people. No Outstanding Resource Waters have been designated by the State of Vermont to date within the Project area or Project site (American Rivers, 2007).

Other key bodies of water that offer recreation opportunities include Harriman Reservoir in Wilmington and Whitingham, located approximately 4 miles southeast of the Eastern Project site. Also called Lake Whitingham, it is heavily used in the summer for boating and swimming. There are no campsites. Somerset Reservoir is located approximately 6.5 miles north of the Project site and offers bird watching, picnicking, motorized and non-motorized boating, fishing, and swimming. Sadawga Pond in Whitingham is located approximately 6 miles southeast of the Project site and recreational opportunities include boating, fishing, and ice-related winter activities.

Rivers and Streams: As mentioned, no National Wild & Scenic Rivers have been designated to date in Vermont (USDA Forest Service, 2007). However, several have been determined eligible for the Wild, Scenic & Recreational River designation. Rivers within the 10-mile visual affected environment that have been determined eligible due to their outstanding recreational or scenic qualities are the Deerfield River, City Stream, Stamford Stream, and Bolles Brook.

The Deerfield River flows southerly through the towns of Stratton, Somerset, Searsburg, Wilmington, and Whitingham. Certain reaches have been determined eligible for NFS designation as a Wild, Scenic and Recreational River under a tentative scenic classification, based upon largely undeveloped shorelines with some road access. At its closest point, it is approximately 2 miles north of the Project site. Recreational management is towards the Desired ROS Class of Semi-primitive Motorized to protect the natural scenic landscape (USDA Forest Service, 2006a). The eligible reaches of the Deerfield River were assigned outstandingly remarkable values for wildness and hydrology. The river offers opportunities to canoe, kayak, boat, fish, and observe wildlife. Viewer sensitivity is high.

Other streams and rivers within the 10-mile visual affected environment include City Stream in Woodford, Bolles Brook in the towns of Glastenbury and Woodford, and Stamford Stream in the Stamford Meadows Ecological Special Area. Much of City Stream has been determined eligible for congressional designation as a Wild, Scenic and Recreational River under a tentative recreation classification, with outstandingly remarkable values assigned for wildlife. It also has a Desired ROS of Roaded Natural. Viewer sensitivity is high. Certain reaches of the Bolles Brook have been determined eligible for congressional designation as a Wild, Scenic and Recreational River under two tentative classifications. The northern half of Stamford Stream has been determined eligible for congressional designation as a Wild, Scenic and Recreational River under a tentative recreation classification, with outstandingly remarkable values assigned for botanical and ecological values. Viewer sensitivity ranges from low to high (see Table 3.5.1.1-1).

3.13.2 Direct and Indirect Impacts Presented by Alternative

No significant issues were raised during public scoping in regard to the direct impacts of the Proposed Action on developed and dispersed recreation. One significant issue was identified in regard to the Project's potential visual impacts on visually sensitive resources, including recreational resources, particularly with regards to the character of the ridgelines. Other lesser issues and concerns raised during scoping and/or the comment period for the DEIS included whether or not the Proposed Action would adversely affect the solitude and wildland attributes of the nearby Lamb Brook Area; whether it would limit hiker, skier, and peakbagger access to the high points of the east and west ridges; whether it would adversely affect general recreation use of the area; and whether it would provide opportunities for unauthorized OHV/ATV activities on facility roads.

The level of developed and dispersed recreational activities and how they are affected by necessary closures for construction and operation will be used to focus the evaluation of potential impacts of the Project on developed and dispersed recreational resources.

Potential noise impacts and visual impacts of the Project on recreational resources and how they may affect the visitor experience would be considered indirect impacts. As noted below, these impacts are discussed in the Noise and Visual Quality sections of this FEIS.

To focus the evaluation of potential impacts to the solitude and wildland attributes of the Lamb Brook Area, two indicators will be used. The first is the extent and character of Project visibility within the area. The second is the magnitude of sounds due to construction and operation of the Project.

3.13.2.1 Proposed Action

The Project is located wholly within the GMNF's Diverse Forest Use MA with a Desired ROS of Roaded Natural. The Project is consistent with the objectives of the MA, which emphasizes "a variety of forest uses" (USDA Forest Service, 2006a). The Project is also consistent with the Desired Roaded Natural ROS Class (i.e. modifications "easily noticed to strongly dominant", and "structures readily apparent") for Diverse Forest Use, and would not conflict with any of the existing dispersed recreational opportunities for that class allowed for the area (see Tables 3.13-1 and 3.13-2).

Direct impacts to recreational resources would be the physical disturbance to developed and dispersed recreation sites and opportunities within the Project site and Project area. Project activities/components that could create direct impacts include the construction, operation, and maintenance of turbine sites, access roads, corridors for electrical connection lines, temporary lay down areas, and other built facilities. Indirect impacts include off-site noise and visual impacts associated with Project construction and operation.

Direct impacts from facility construction would be minor and temporary, lasting as long as needed to complete construction (about 9 to 12 months). Some limited closures of portions of the unmarked trails and the surrounding area as well as restrictions to access would occur for safety and security reasons. These temporary closures would affect any dispersed recreation occurring directly on or adjacent to the ridgelines but would have no impact on developed recreation or OSV/snowmobile use. Given the light use of the area, these impacts would be expected to be minor.

The long-term closure of the area under and directly adjacent to the turbines and along the access roads during site operation as described in the DEIS (p. 305 and 346) is no longer being proposed in response to public comments. There is currently no plan to construct gates or fencing around the entire proposed wind facility. Access to public lands adjacent to the Project site would not be restricted, except for gating the access roads and fencing some of the ancillary facilities. The access roads would be gated at the entry point to restrict public vehicular access. Public use of the area would be monitored during the first one or two years of operation and, if desired for public safety and site security, an area closure could be implemented surrounding the access roads and turbines, with a setback of an appropriate number of feet from the edge of the facilities (roads and turbines).

Construction of the Proposed Action would cause no direct impacts to developed recreation sites, because none are located within the Project site. Also, there are no marked trails, campsites, or designated public parking areas or snowmobile trailheads within the Project area. Wildlife would be temporarily displaced during construction and would be anticipated to acclimate to the site after a period of time. This would most likely result in a minor adverse impact to hunting and wildlife viewing opportunities. This impact may affect the presently undeveloped Western Project site more than the Eastern Project site, which has operating wind turbines at the existing facility. No other direct impacts to developed or dispersed recreational activities would be anticipated.

3.13.2.1.1 Noise

Noise impacts on recreational resources would be considered indirect impacts. Redundant information regarding noise impacts that was previously presented in this section has been removed. The details of the anticipated noise impacts of the Proposed Action and alternatives on recreational resources are fully described in Section 3.4 of this FEIS.

3.13.2.1.2 Visual Impacts

Visual impacts on recreational resources would also considered indirect impacts. Redundant information regarding visual impacts that was presented in this section previously has been removed. The details of the visual impacts of the Proposed Action and alternatives on recreational resources are fully described in Section 3.5 of this FEIS.

3.13.2.1.3 The Lamb Brook Area and Opportunities for Unauthorized OHV Use

Opportunities for, and actual unauthorized OHV/ATV use have been and continues to be an issue of concern on the GNMF. This is also a national issue that prompted a significant change in policy and direction regarding wheeled motorized vehicles. In the mid-1990s, the Lamb Brook Area was subject to litigation involving timber harvesting and road building. An injunction was put into place that prohibits timber harvesting and road building in the area unless issues associated with those activities (e.g., OHV/ATV use) are properly addressed in analysis. The Deerfield Project EIS analysis addresses the issues associated with the injunction. This section will characterize OHV/ATV use in and around the Project area and describe what effect the Project will have on OHV/ATV use. The impacts of this use on various resources will be addressed as needed in the individual resource sections. Of particular concern in the former Lamb Brook project area was impacts of unauthorized ATV use on black bears (see Section 3.12).

The decision documentation for the Lamb Brook Area Environmental Assessment (EA) was issued in February 1993. An area of 5,561 acres, based on compartment boundaries at that time, was analyzed for resource management opportunities. This area included compartments 123 and 124, both of which are included in the Deerfield Project area. The Eastern Project site is wholly within compartment 124. Due to its poor, low quality wood resource, as noted above, no projects were proposed in Lamb Brook EA in the area that now contains the Eastern Project site.

The former 5,561-acre Lamb Brook Area was recalculated using GIS to 4,795 acres and described as such in the 2006 Forest Plan. This was most likely the result of more accurate delineation or adjustment of compartment boundaries and private land/NFS land boundaries. As a result of the Forest Plan revision process, including input from members of one of the groups that had advocated for Wilderness designation of the Lamb Brook Area, the 2006 GMNF Forest Plan redesignated the Lamb Brook Area into three management areas: MA 3.1 or Diverse Forest Use, which is the most permissive MA, previously covered much of the area, and now covers only about 1/4 of the area; MA 6.3 Remote Wildlife Habitat, which occupies about 1/4 of the area; and MA 6.1 Remote Backcountry Forest, which is one of the most restrictive MAs and now occupies about 1/2 of the area. The portion that is now Diverse Forest Use MA contains the Eastern Project site, in which motorized use is allowed on designated routes only. The remote Wildlife MA limits motorized use to winter use of designated system OSV/snowmobile trails, while the Remote Backcountry MA, in which the majority of the area is now characterized, prohibits motorized recreational trail uses.

Unauthorized ATV use has been observed in the Lamb Brook Area periodically since the early 1990s. The use tends to be sporadic, has never been characterized as heavy, and due to the remote nature and light visitation of the area, most likely involves local residents during certain times of the year such as hunting season. The problem is compounded by the jurisdictional question regarding the Old Stage Road. The Deerfield Project would utilize approximately 1.25 linear miles of the existing Searsburg Wind Facility access road. That access road would be extended for the Eastern Project site into the far northwestern section of the former Lamb Brook Area. The new section of access road for the Eastern Project site would be approximately 1 mile from the section of the Old Stage Road that runs through the Lamb Brook area. The extension of the access road may encourage unauthorized use by OHVs. Motorized vehicles such as ATVs generate noise and disturb recreational visitors and wildlife. They also tend to cause soil erosion and rutting on softer roads. The access roads, however, would be hardened roads and not subject to rutting from ATVs and similar machines.

One of the primary concerns is that the newly created access road could facilitate the creation of illegal side trails that would provide access to more remote areas such as the interior of the Lamb

Brook Area. It is important to note that the area of concern in the Lamb Brook litigation was the deep interior core area, which contains quality beech habitat preferred by bears. The creation of the logging road and skid trails that would have resulted from the proposed Lamb Brook timber sale could have increased opportunities for unauthorized ATV intrusion into the core area and disturb bears. Because of the litigation and subsequent injunction, no harvesting or road building has been done in the Lamb Brook Area. Furthermore, Forest Road 266, the formerly hardened spur road into the Lamb Brook area, which would have been extended for the timber sale, has not been maintained for years and has been allowed to revegetate naturally. It continues to be gated at both its intersection with Route 100 and further up FR266, near the intersection with the Old Stage Road/Corridor 9 snowmobile trail. Therefore, it is expected that since FR266 has not been maintained and no additional road and skid trail building has occurred, opportunities for ATV access into the core area would now be much less than what would have been possible from the Lamb Brook project. Any ATV use that may be occurring is most likely light use from a few local residents that know the area and have historically used it. This was exactly what was found during the Lamb Brook EA analysis. Also, the main access points are most likely off of the Old Stage Road on which the Town allows ATV use. This is well south of the interior core that was of concern.

Since the mid-1990s, much progress has been made in identifying and managing unauthorized ATV and OHV use forest-wide. Monitoring has increased in the past few years. The GMNF annual monitoring report for 2007 (USDA Forest Service, 2008) describes two projects from previous years that have had success in regards to treating areas damaged by OHVs (both 4-wheel drive trucks and ATVs), characterizing them as "75% successful", that "road closures have stopped most illegal four-wheel-drive and ATV traffic", and that "increased Law Enforcement worked to maintain most road closures". It also notes that cooperation of local residents, member of the ATV club, Town officials, and the Forest Service is very important to continued success. As an example, further follow-up on one of the projects showed that additional damage had been done to some of the areas after the restoration. Further attempts at educating the public and seeking their assistance in reporting incidents were then done in an attempt to deter the repetitive use. The 2008 GMNF annual monitoring report (USDA Forest Service, 2008) notes other projects that also have been monitored for OHV/ATV use. Field-going personnel are always looking for signs of unauthorized use and report such findings in incident reports, which are then used to measure trends.

Law enforcement is perhaps the most effective deterrent to unauthorized OHV/ATV use. Law enforcement efforts have increased in the last few years and further work is being done to collect meaningful data regarding incidents and violations. As of this writing, efforts are being made to increase the number of Forest Protection Officers (FPOs) on the GMNF that can assist in patrolling and writing violations. As noted in the monitoring reports, incidents (occurrences) seem to have decreased between 2005 and 2008 (USDA Forest Service, 2008, 2009). Except for a small upward spike in 2007, violations also seem to show a decreasing trend. Other deterrents such as gates, stiles, rock berms, and slash piling on timber sale skid roads, in combination with natural barrier features that can "pinch off" access points for ATVs and 4-wheeled vehicles have also proven effective in deterring use but, for ATVs, this is mostly a short-term remedy. ATVs, or "all-terrain" vehicles, are capable of navigating most terrain features or simply move until they find another access point. It is difficult to prevent their use 100% of the time. Areas that have seen heavy use, have shown a consistent historic use, and have some destination feature that attracts users are the most problematic areas. Again, enforcement and education, along with cooperation from organized ATV associations and Town officials are the most effective tools to deter unauthorized OHV use.

The existing Searsburg Wind Facility has had considerable success managing and controlling unauthorized OHV/ATV access. The facility and the surrounding area, including the Eastern Project site, have seen little or no historic OHV/ATV use, and any use has been light. Based on the observations of field personnel, little or no unauthorized OHV/ATV use occurs in the Project area (Wallin, 2010a). This low level of use helps facilitate effective control of any unauthorized use. For example, there is an existing administrative trail extending from the end of the access road that was created to allow maintenance of the permitted meteorological (wind measurement) towers. This trail has been permitted by the Forest Service for many years on the section of land proposed for the Deerfield Project's Eastern site. Its only use has been to periodically maintain the met towers or erect replacement towers as needed. No side trails have ever been discovered off of this trail leading through the very steep, thick terrain either down to Route 8 or towards the interior of the Lamb Brook Area. This trail would be absorbed by the proposed Eastern Project site's access road.

To minimize the risk of increased OHV/ATV activity, design criteria would be implemented to control access, post signs, and provide for a routine presence of facility maintenance people and law enforcement personnel. The main entry point to the access road would continue to be gated to control access. There are currently no existing unauthorized OHV/ATV trails off of the existing private land facility's access road. The natural barriers provided by the generally thick conifer vegetation, and steep rocky terrain surrounding the Eastern Project site's proposed access road (the extension of the existing access road) and turbines, would essentially prevent OHV/ATV access without considerable effort to first create a trail. Should any illegal trails leading to or from the proposed access road along the ridge be built or attempt to be created, they would be removed. Law enforcement, perhaps the best deterrent, would be used to find those responsible. The presence of the site's operation and maintenance personnel would provide for a quick response to addressing any illegal trails and also facilitate law enforcement. Barriers would be erected, plantings done as needed, and obliteration techniques used to prevent further use in areas where OHV/ATV use has been noted.

Furthermore, unauthorized use would be monitored. Unlike the Lamb Brook timber sale situation, which would have occurred in a remote setting and most likely resulted in little opportunity for constant, routine on-site monitoring once the harvesting activities were complete, there would be a constant presence at the Deerfield site. Once operational, the plan to monitor for unauthorized use would consist of:

1. During normal operations and maintenance (O&M) activities, personnel would watch for signs of OHV/ATV use including actual sightings, tracks, sounds, and recently created holes, openings, or areas cleared of vegetation along the sides of the access roads.

2. During the first year of operation, routine patrols would be made along the boundary of the closed area looking for signs of intrusion. Patrols may occur as often as once a week or every other week, depending upon what these patrols find. They could be reduced over time if little or no activity is continually found. The patrols would concentrate in locations that seem to provide the greatest opportunity for intrusion and be done during the times of the year that would most likely have unauthorized OHV/ATV use.

3. Forest Service personnel would work closely with O&M personnel to assist in monitoring as needed, including during visits for regular permit administration.

4. Personnel would document all incidents regarding unauthorized OHV/ATV use in order to keep an on-going record of the level of use discovered, and all incidents would be reported to the Forest Service.

5. Forest Service law enforcement personnel would assist as needed when evidence of OHV/ATV use is found. Patrols of the Project site would be integrated into the regular patrol routine as needed.

6. Efforts would continue to work with the Towns of Readsboro and Searsburg and with any locally active ATV groups to cooperatively address unauthorized use on Forest Service land.

7. Any terms and conditions from the PSB Certificate of Public Good related to controlling and monitoring OHV/ATV use would be implemented.

Training and instruction would be given to the on-site personnel as needed, along with clearly identifying the protocols needed to implement the monitoring plan. Any necessary terms and conditions related to the monitoring plan would be added to the site operating permit. Should these monitoring measures not produce the desired results, law enforcement efforts would be stepped up to find those responsible for the intrusions. Further cooperation from the Towns and local residents would be sought.

Considering the many factors discussed above, such as the success of the existing facility's management and control of unauthorized OHV/ATV use including quick response and enforcement capabilities, the overall low use of the Project area by recreationists including those who might use OHVs, and the natural barriers of thick conifer habitat and steep rocky terrain surrounding the proposed Eastern Project site access road and turbines, there is a very high likelihood that the monitoring plan described above would be successful, and that little or no opportunities for OHV/ATV intrusion into the Lamb Brook Area would be provided by the Project's construction.

3.13.2.1.4 Unauthorized OHV Opportunities in the Eastern Project Site

The opportunities for OHV/ATV intrusion into other portions of the Eastern Project site would be the same as described for the Lamb Brook area. Therefore, based on the discussion above, any impacts to Eastern Project site resources that would result from unauthorized OHV/ATV use would likewise be negligible.

3.13.2.1.5 Unauthorized OHV Opportunities in the Western Project Site

The Western Project site, like the Eastern Project site, shows very little recreational use. There are no developed recreation sites or designated trails that intersect the proposed footprint of the access road and turbine configuration. The existing trail that has been and is used to access the ridge for Project study purposes and for access to maintain or replace permitted meteorological towers would be absorbed by construction of the proposed access road. The area is mostly mature hardwood growth with some evidence of old skid trails from previous timber sales. Most of these skid trails are overgrown and will continue to naturally revegetate. Should any of these old trails be found capable of OHV/ATV use, particularly those close to the proposed access road, they would be obliterated. Observations by personnel accessing the area for Project study and data gathering over the past few years report no incidents of unauthorized OHV/ATV use (Wallin, 2010a).

The same design criteria described above would be used to reduce or eliminate opportunities for unauthorized OHV/ATV use created by construction of the proposed Western Project site. These would be further enhanced by the presence of the substation and maintenance facility, and the on-site staff associated with these, to monitor unauthorized OHV/ATV use and other access issues, and respond quickly to any incidents. As noted, law enforcement and presence are the most effective deterrents. The monitoring plan described above would also be implemented for the Western Project site. Therefore, little or no impacts from unauthorized OHV/ATV use would result from implementing the Proposed Action in the Western Project site.

3.12.2.1.6 Summary of Proposed Action’s Impacts to Recreation

The Project would result in no direct impacts to developed recreational resources, such as campgrounds, designated hiking and trailheads, and recreational water resources, as none are located within the Project site’s construction footprint, nor within the Project area. In addition, the four-compartment Project area offers few opportunities for dispersed recreation and appears to be lightly used. Little or no opportunities for unauthorized OHV/ATV use would result from Project construction.

Access to the Project site would be temporarily restricted during Project construction for safety and security reasons. The access roads would be closed to public vehicle use during and after construction (i.e. during all site operation). Monitoring of public use of the area after construction would determine any need for more restrictive closures such as along the access roads and turbines.

As described in Section 3.5, views of some or all of the existing and proposed turbines would be available from many of the recreation sites, Wilderness areas, and other areas that lie within the 10-mile visual affected environment. In general, no undue adverse visual impacts would be expected to the recreation resources or to the recreation experience of those using these sites. Noise impacts to the recreation experience, as described in Section 3.4, would also be minimal.

3.13.2.2 Alternative 1: No Action

No turbines, access roads, or other Project components would be constructed under the No Action alternative, and therefore no direct, indirect, or cumulative impacts to recreational resources or to the recreation experience of visitors to the Project area and surrounding vicinity would be anticipated. The impacts of on-going management activities and physical presence of the existing turbines at the Searsburg Wind Facility would continue.

3.13.2.3 Alternative 2: Reduced Turbines in Western Project Site

Alternative 2 would construct two fewer turbines in the Western Project site. This alternative would eliminate the three southernmost turbines and add one additional turbine into the northern end of the western turbine string. Development in the Eastern Project site would be the same as for the Proposed Action. Since there are no developed recreation sites (designated trailheads, campsites, or public parking areas) in the Project site or Project area, there would be no direct impacts to developed recreation opportunities as a result of the construction. Temporary and any potential long-term restrictions to site access and the impact to dispersed recreation would be similar to those for the Proposed Action. Opportunities for, and the resultant impacts from, unauthorized OHV/ATV intrusion into the Lamb Brook area from construction of the Eastern Project site's access road, as well as opportunities for and impacts from unauthorized OHV/ATV use in the Western Project site, would be as described for the Proposed Action.

There would be no measurable difference in noise and visual impacts (indirect impacts) on recreational resources from this alternative when compared to the Proposed Action. Impacts would be mostly minor. Again, the complete details of all noise and visual impacts may be found in Sections 3.4 and 3.5.

3.13.2.4 Alternative 3: Turbines in Eastern Project Site Only

Alternative 3 would eliminate all turbines from the Western Project site, leaving only the seven turbines in the Eastern Project site. As with the Proposed Action and Alternative 2, there would be no direct impacts to developed recreations sites. Removal of all turbines from the Western Project site would eliminate all direct and indirect Project-related impacts to the dispersed recreational opportunities in and adjacent to the Western Project site. There would be no restricted access to most of the Western Project site, although vehicle access would still be restricted in the northern portion of the site, along the road that would access the proposed substation and O&M building, and in the vicinity of those facilities. There would be little or no adverse impacts to ridgetop hikers, hunters, skiers, or peakbaggers. Opportunities for, and the resultant impacts from, unauthorized OHV/ATV intrusion into the Lamb Brook area from construction of the Eastern Project site's access road would be as described for the Proposed Action. Opportunities for and impacts from unauthorized OHV/ATV use in the Western Project site would remain similar to what exists currently without the proposed access road but would also be further deterred by the presence of the substation and maintenance facility and associated personnel.

As described in Section 3.5, Alternative 3 would result in only modest reduction in visual impacts on recreation resources, as the Eastern Ridge is the most visible. Noise impacts would also be lesser for those recreating in or near the Western Project site, while noise impacts to visitors within the vicinity of the Eastern Project site would be the same as for the Proposed Action and Alternative 2.

Therefore, Alternative 3 would result in a slight reduction in overall impacts to the recreation experience of visitors to the area when compared to the Proposed Action and Alternative 2.

3.13.3 Cumulative Impacts

The affected environment for the discussion of cumulative impacts to recreation resources is the same as for the Proposed Action. This would be the Project area for cumulative impacts related to the disturbance to recreational resources resulting from construction and operation of the wind facility (i.e., disturbance at the Project site and how it affects recreation activities in the Project area).

There are no developed recreation sites in the Project area, and thus, no cumulative impacts to developed recreation. Only dispersed recreational opportunities such as hunting, fishing, hiking, peakbagging, OSV/snowmobiling, skiing, driving for pleasure, and wildlife watching occur within this area, as previously described. Past actions within the last 5 to 10 years that impacted dispersed recreation opportunities in the Project area include operation of the Searsburg Wind Facility (constructed slightly beyond the 5 to 10 year period of past activities), and limited timber sales on nearby private lands. These activities appear to have had minimal effect on the recreational enjoyment of the area and in some instances, may have resulted in an increase of recreational use as evidenced by the various sightseeing groups who have toured the existing Searsburg Wind Facility.

In the foreseeable future of the next 5 to 10 years, there are no other known projects, such as large-scale developments on private land or timber sales on Forest Service land within or close to the Project site that would affect the existing dispersed recreational experiences and opportunities. A landscape-scale planning effort for NFS lands south and west of the Project area is expected to begin in 2011. This planning effort might include additional GMNF lands south of Route 9 and east of the Project area, as well. It would be at least 1 to 2 years beyond 2011 before any definite proposals would be analyzed. No specific proposals are known at this time. Should any activities or projects be proposed on Forest Service lands in the vicinity, they would be analyzed in detail, including any cumulative impacts specific to those projects and how they would be impacted by the Deerfield Wind project. Timber sales may occur on private lands in or adjacent to the Project area but these would have little or no impact on dispersed recreation opportunities on NFS lands.

As discussed, little or no additional opportunities for unauthorized OHV/ATV use would result from the Project's construction and operation. Therefore, there would be little or no cumulative effect resulting from the Project to overall opportunities for additional unauthorized OHV/ATV use in the Project area, and in particular, the Lamb Brook Area.

The cumulative effects of the Project's noise and visual impacts on the recreation experience are disclosed in Sections 3.4 and 3.5. To summarize for recreation, given the relatively low minor impacts to the recreation experience for the Proposed Action and alternatives, there would be little if any cumulative visual impact to recreation experiences of visitors to the Project area. Likewise, little cumulative adverse impacts to recreation resulting from noise would occur.

The proposed Project would be the main additive component to overall cumulative impacts. When combined with past activities and those anticipated in the foreseeable future, and given the small numbers of people that recreate in the area, a minimal cumulative impact to dispersed recreation would be expected from the Proposed Action. Any cumulative impact to dispersed recreation resulting from the activities of Alternatives 2 and 3 would expect to be even less. There would be no cumulative impact from the No Action Alternative.

3.14 Socioeconomics

This section describes the anticipated socioeconomic impacts due to the construction and operation of the Deerfield Wind Project, and addresses the specific concerns identified during public scoping. For the purpose of this Section, socioeconomic impacts include social and economic impacts to the affected environment. The information presented in this Section is based, in part, on the *Regional Economic Impact Analysis for the Proposed Deerfield Project* reports, prepared by Kavet, Rockler & Associates, LLC of Williamstown, Vermont. The original report, released in February 2008, evaluated economic impacts from the 17-turbine Proposed Action (Kavet & Rockler, 2008a). A revised edition, released in June 2008 as part of the Vermont PSB proceedings, was updated to analyze the 15-turbine Reduced West alternative (Kavet & Rockler, 2008b). Both of these reports are available in the Project Record.

3.14.1 Affected Environment

The area of impact for evaluation of socioeconomic effects is the Towns of Searsburg and Readsboro. In order to understand the effects this Project would have on the socioeconomic conditions within these towns, it is important to consider the current state of the economy in this area. Therefore, this chapter begins with a description of the local socioeconomic conditions in Bennington County and the Towns of Searsburg and Readsboro. Existing population and housing, employment and income, and municipal budgets and taxes in the Towns of Searsburg and Readsboro are described below.

3.14.1.1 Population and Housing Characteristics

In comparison to the State of Vermont and Bennington County as a whole, the Towns of Searsburg and Readsboro are rural and sparsely populated. Various measures of income and earnings in Bennington County approximate those of the State as a whole. However, the economies in the Towns of Searsburg and Readsboro are below State and County averages for some income statistics and related economic metrics (Kavet & Rockler, 2008a, 2008b).

According to the 2000 census, 19,403 total housing units existed in Bennington County. Approximately 77% (14,846 units) of these units were occupied and 23% (4,557 units) were vacant (U.S. Census Bureau, 2000b). The Town of Searsburg contained 87 total housing units in 2000, of which approximately 46% (40 units) were occupied, while the remaining 54% (47 units) were vacant. Approximately 44% of vacant housing in Searsburg is attributed to seasonal and recreation residences (U.S. Census Bureau, 2000c). In 2000, 466 total housing units existed in the Town of Readsboro. Approximately 69% (321 units) were occupied, and 31% (145 units) were vacant. Approximately 23% of vacant housing in Readsboro is attributed to seasonal and recreation residences (U.S. Census Bureau, 2000d).

The rate of home ownership in Bennington County is an estimated 71.4% (U.S. Census Bureau, 2000b). Similarly, home ownership in 2000 is reported at 92.5% and 71.3% in the Towns of Searsburg and Readsboro, respectively (U.S. Census Bureau, 2000c, 2000d). The percentages of ownership reflect stability and affordability characteristics of owner-occupied housing in an area. In consideration of the population declines in this area, it may suggest that the availability of housing is strong.

Home values in the Towns of Searsburg and Readsboro are moderate to low in comparison to average home values in Bennington County and the State of Vermont. According to Kavet and Rockler (2008a, 2008b), median home values in Searsburg and Readsboro were $86,700 and $78,600 in 2000, respectively. The countywide median value at that time was $113,300 and the statewide median value was $111,200.

3.14.1.2 Economy and Employment

According to the 2000 Census, the largest industries in Bennington County are education, health, and social services, which employ approximately 23.7% of all workers. The second largest industry group is manufacturing (16.9% of all workers), and the third is retail trade (14.6% of all workers). Some of the major employers in Bennington County include Southwestern Vermont Medical Center (health services), Mack Group Inc. (manufacturing), and the Vermont Country Store (retail). Industry-specific employment data was not provided at the town level because of the small sizes of Searsburg and Readsboro. For 13 of the 18 years between 1990 and 2007, Bennington County's annual unemployment rate was higher than the State of Vermont's annual unemployment rate. Historically, Bennington County's annual unemployment rate has typically been less than the national annual unemployment rate (Kavet & Rockler, 2008a, 2008b).

According to Kavet and Rockler (2008a, 2008b), unemployment rates in the Towns of Searsburg and Readsboro tend to be volatile due to their smaller populations and the impact single job loss events (e.g., plant closures) can have on local economies. For example, in 1990 and 2000, the Town of Searsburg's annual unemployment rate (2.0% and 1.5% respectively) was lower than both Bennington County's (5.4% and 2.8% respectively) and Vermont's statewide annual unemployment rate (4.9% and 2.7% respectively). However, since 2000, the Town of Searsburg's annual unemployment rate has trended higher than both Bennington County's and Vermont's annual unemployment.

Over the past 18 years, unemployment rates in the Town of Readsboro have fluctuated less than Searsburg, and since 2000, have been lower than Searsburg. In comparison to Bennington County, the Town of Readsboro has had a higher annual unemployment rate for seven of the past 18 years, a lower annual unemployment rate for nine of the past 18 years, and the same unemployment rate for the remaining two years. In comparison to the State of Vermont, Readsboro has had a higher annual unemployment rate for 12 of the past 18 years, a lower annual unemployment rate for four of the past 18 years, and the same unemployment rate for the remaining two years.

3.14.1.3 Municipal Budgets and Taxes

Municipalities (towns, villages, and counties) and school districts are responsible for providing specific services and facilities to those who live and work within them. Municipalities and school districts incur costs when providing these facilities and services, and to pay these costs, they collect revenues by levying taxes.

Tax revenues in the Project area accrue from both state sales tax and real property taxes. Real property taxes are subdivided into municipal and school property tax. Both types of taxes are billed and collected by the town or city where the real estate is located (Retirement Living Information Center, 2008). Real property is classified as either homestead or nonresidential and a statewide education tax is imposed on these two classes of property at different rates. The homestead education tax rate in each municipality depends upon local per pupil spending. Both the homestead and nonresidential education tax rates are adjusted by the local common level of appraisal. Each town receives an annual notice of the education rates to be levied (Vermont Department of Taxes, 2008a). A statewide sales tax of 6% is levied on purchases in Bennington County. There are no county-specific taxes in the State of Vermont; and the Towns of Searsburg and Readsboro do not employ the optional 1% local town tax (Vermont Department of Taxes, 2008b).

The town, county, and school districts face the yearly challenge of meeting their service obligations, or expenditures, through the collection of sales and/or real property taxes. As with most taxing jurisdictions in Vermont, loss of, or lack of, commercial and industrial tax base, in combination with rising labor and material costs, make it increasingly difficult to meet their budgets without significantly raising taxes.

Several federal programs with potential economic impact apply to the Towns of Searsburg and Readsboro because their boundaries overlap with the GMNF. These programs are presented briefly here. The Towns of Searsburg and Readsboro are eligible for "Payments in Lieu of Taxes"[22] (PILT) from the federal government. PILT are Federal payments to local governments to help offset losses in property taxes due to nontaxable Federal lands within their boundaries.[23] Federal payments are made lump-sum to each state and divided up by the state and sent to eligible municipalities.

The Twenty-Five Percent Fund Act of 1908 requires that the Forest Service return to states and territories 25% of all of moneys received from National Forests within their boundaries. This generally refers to 25% of receipts from sale of timber. The Bankhead-Jones Farm Tenant Act[24]

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[22] See Public Law 97-258, dated September 13, 1982.

[23] *See* Public Law 94-565, dated October 20, 1976. This law was rewritten and amended by Public Law 97-258 on September 13, 1982 and codified at Chapter 69, Title 31 of the United States Code. The Law recognizes that the inability of local governments to collect property taxes on Federally-owned land can create a financial impact.

[24] See Public Law 75-210 dated June 4, 1897 and amended.

also requires the Forest Service to return to counties 25% of monies received from grazing rights and mineral rights fees.

The Secure Rural Schools and Community Self-Determination Act of 2000 (SRS), separate from the 25% Fund Act, requires the Forest Service to restore stability and predictability to the annual payments made to states and counties containing National Forest System lands and public domain lands managed by the Bureau of Land Management for use by the counties for benefit of public schools, roads, and other purposes. Because 25% Fund payments to states have changed dramatically over the past few years, the SRS is intended to provide a relatively stable payment. The towns within the State of Vermont may elect to receive one or the other. In the most recent years, all towns local to the Project have chosen to receive SRS payments. Extension of the SRS was once again approved by Congress. The status of the Vermont towns and their choices regarding the SRS are unknown at this time. It is anticipated that towns would again request those funds in lieu of 25% Fund monies.

3.14.2 Direct and Indirect Impacts Presented by Alternative

No significant issues were identified relating to socioeconomics during the scoping process. However, a number of key concerns were raised that will help to guide the impacts discussion. The first concern is that the Proposed Action will adversely affect the socioeconomic status of the local area. The discussion addressing this concern will focus on the effects of Project construction and operation on population and housing; employment; revenues; real estate and property values; tourism and educational benefits; and the effects on tax rates/tax revenues (+/- dollars). The second concern is that the public benefits provided by the Proposed Action will not be justified by the economic costs and environmental impacts. The indicator used to focus this discussion is the effect of implementing the Proposed Action on the electric rates paid by the ratepayers.

As noted above, the analysis area for the evaluation of direct and indirect impacts to socioeconomic resources are the Towns of Searsburg and Readsboro.

3.14.2.1 Proposed Action

3.14.2.1.1 Potential Impacts of Construction

This section discusses socioeconomic impacts from facility construction.

Population and Housing

Construction of the Project is expected to produce only minor, perhaps negligible, impacts on area population. The Project would require approximately 250 jobs during the construction period. Approximately half of these employment gains are anticipated to occur from Bennington and Windham counties (Kavet & Rockler, 2008b). For the duration of construction (approximately 9 months) there could be a temporary increase in local population and modest demand for temporary housing by nonresident workers.

Employment

As stated above, the construction and development phase of the Project is anticipated to result in the creation of approximately 250 jobs, which can draw from the working population of Bennington and Windham counties. In light of the size of the labor force and the number of unemployed in the two counties, the local labor pool could most likely supply the required non-specialized work force. Local employment would primarily benefit those in the construction trades, including equipment operators, truck drivers, laborers, and electricians. Project construction would also require workers with specialized skills, such as crane operators, turbine assemblers, specialized excavators, and high voltage electrical workers. These workers, if they do not currently reside in Bennington or Windham counties, would likely come from the northeast region and temporarily relocate to the local area during construction. This creation of new jobs would result in minor beneficial impacts to employment.

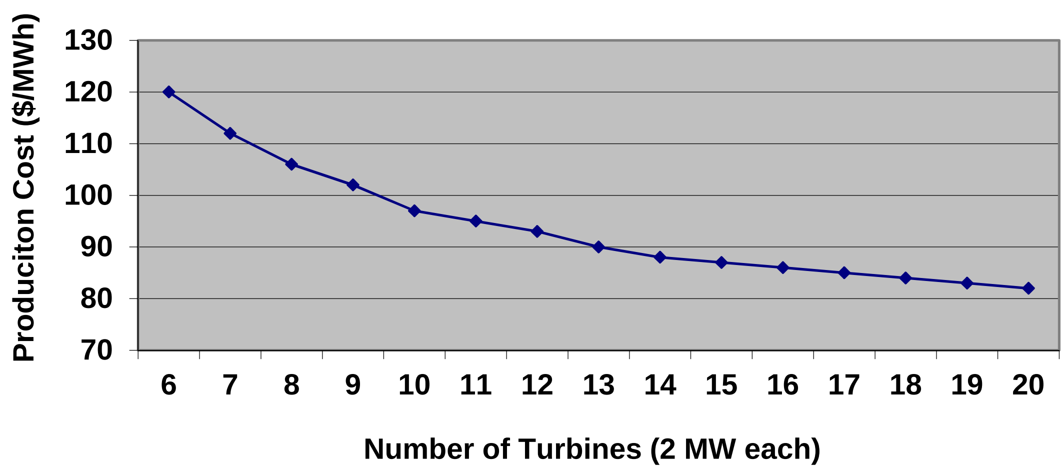
Economic Considerations and Revenues

Kavet, Rockler & Associates, LLC conducted the regional economic impact analysis for the Deerfield Wind Project using the Regional Dynamics, Inc. (REDYN) model developed by Oak Ridge National Laboratories. Based on direct inputs including construction development, equipment purchases, and estimated operational expenditures, the REDYN model estimated secondary indirect impacts, induced impacts, and demographic impacts for the region and the state.

It is anticipated that the Project would be more than an $85 million investment (Kavet & Rockler, 2008b). More than half would be allocated for wind turbines and associated structures that are not manufactured in Vermont. Therefore, money spent on structure manufacturing would not generate a positive impact to the economy of Bennington County or the State of Vermont. However, approximately $14 million in construction expenditures are expected to result in direct positive impacts in Vermont (Kavet & Rockler, 2008b). The economic impact of $14 million in direct local construction expenditures would positively affect locally sourced construction material, fuel, construction-related labor, equipment and services, and many related indirect and induced expenditures benefiting a wide range of downstream local service businesses such as restaurants, lodging, and other service establishments.

Output results from the REDYN model suggest that the Project would generate growth in total State economic output of more than $15 million during construction (Kavet & Rockler, 2008b). One possible benefit to the communities would be from road improvements necessary to accommodate transport vehicles. Because of the overweight/oversized nature of the specialty transport vehicles and their loads, some modifications would be necessary to a few road intersections in order to ensure proper turning radii and clearances. Roadway modifications within Route 9 and/or Route 8 would be designed to State of Vermont highway standards by a Vermont licensed professional engineer. If requested, all roadway modifications at the intersections would be removed and the areas returned to their prior state following the installation of the wind turbines. Local roads may also need improvements to accommodate the construction traffic. These impacts are described in more detail in Section 3.15 of this FEIS.

An economic evaluation was performed to provide a relative measure of the cost of energy production and profitability for the Proposed Action, the 15-turbine Reduced West alternative, and the 7-turbine East Side Only alternative as described in Chapter 2.0. More specifically, the purpose of the analysis was to demonstrate, in non-specific terms, the effect that Project size (i.e., number of turbines) has on the economic return for wind facility developers. The findings of this analysis are illustrated in the following graph.



Wind facility development follows the general "economy of scale" principal, and therefore, larger wind facilities tend to be more economical (i.e., have lower production costs) than smaller ones. This principal is applicable to wind facility development because a portion of the total annual costs is fixed, i.e., does not vary with respect to the total number of turbines. Stated differently, as the number of turbines falls, most fixed costs remain the same, thereby increasing the unit cost of producing power (production cost). As the cost of producing power rises, the economics become less favorable.

While this analysis should be taken as indicative of a general trend and not specific to the Deerfield Wind Project Proposed Action, the analysis shows clearly how production costs decrease as project size increases. Although absolute numbers may vary, this generalized trend is likely applicable to the various project sizes proposed for the Proposed Action and the alternatives to the Proposed Action (excluding the No Action alternative).

The data provided for the Project analysis included an estimate of the fixed and variable cost associated with all of the action alternatives for the Deerfield Wind Project, which indicated that the fixed cost component for the Proposed Action and the two alternatives would remain relatively constant at approximately $23,000,000. This is because certain costs are independent of Project capacity. For example, costs for the substation and ring bus, O&M facility, interconnection equipment, construction yard, mobilization/demobilization, and construction management would be the same for a 17- or 7-turbine project. The cost of a substantial portion of the roads and collection system would also be the same across all action alternatives.

Based on the fixed costs, as described above, along with variable costs, the Applicant has estimated that the investment in a 7-turbine project would be approximately $4,143,000 on a unit cost basis or on the order of 30% higher than the investment in a 17-turbine project with an estimated unit cost of approximately $3,176,000. It has also been indicated that the 34 MW (17 turbine) size Project resultant cost per MWh appears to be close to or slightly below the reasonable market range, estimated to be approximately $115 per MWh. Given this, it would appear that a 7-turbine configuration with a 30% greater investment per MW than the 17-turbine configuration, would have an approximate cost per MWh of $161. This cost would fall well above the estimated market range of $115 per MWh. Therefore, a 7-turbine Project would have questionable economic viability.

3.14.2.1.2 Potential Impacts of Operation

The long-term socioeconomic impacts of the Proposed Action are best characterized by the operation of the facility over its life, and include factors other than those related to the short-term impacts of Project construction.

Population and Housing

Operation and maintenance of the Proposed Action would generate a total employment impact (direct, indirect, and induced) in Vermont of about nine jobs, with at least five expected to be in Bennington and Windham counties, and 2.5 jobs directly at the facility (Kavet & Rockler, 2008a, 2008b; PSB, 2009). Some of these employees would reside locally, which could translate into purchases of area homes and result in the addition of new families to the area. Although this activity represents a positive economic impact, long-term employment associated with the Project is not large enough to have a major impact on local population or housing characteristics because the existing housing stock in the area can easily accommodate this number of workers and their families.

Real Estate and Property Values

Concerns are often expressed regarding the potential impact of wind energy projects on real estate values. The Renewable Energy Policy Project (REPP) issued a report (Sterzinger et al., 2003) comparing changes in property value within 5-mile project viewsheds and in comparable, nearby communities for 10 wind energy projects throughout the country, including the 11-turbine Searsburg facility in Bennington County, VT and facilities in Riverside County, CA; Madison County, NY; Carson County, TX; Kewaunee County, WI; Somerset County, PA; Buena Vista County, IA; Kern County, CA; and, Fayette County, PA. REPP analyzed real estate transaction records for a time period covering roughly six years; three years pre-construction and three years post-construction. The analysis included a total of 25,000 property sales records, and found no evidence that wind energy project development had reduced property values within the 5-mile viewsheds. In fact, for nine of the 10 locations analyzed, property values in the post-development period increased faster within the 5-mile viewshed than in the corresponding comparable community. In addition, for nine of 10 locations, property values in the viewshed increased faster in the three years post-development, than in the three years preceding project development (Sterzinger et al., 2003).

Most comparable to the proposed Deerfield Wind Project are the REPP data and findings related to the existing Searsburg Wind Facility. When analyzed independently of the other nine wind energy facilities, the results from the Searsburg Wind Facility indicated that there was no significant evidence that the presence of the wind energy facility had a negative effect on the local residential property values. The analysis of the Searsburg Wind Facility included a total of 3,340 property sales records. In the three-year post-construction period, sale prices from within the 5-mile viewshed were greater than in the corresponding comparable community. Additionally, following suit with the overall REPP analysis results, property values within the Searsburg Wind Facility's viewshed increased faster in the three years post-development, compared to the three years preceding project development. For example, the Searsburg 5-mile viewshed home sales prices from January 1994 to January 1997 decreased by a rate of $301.52 per month while the viewshed home sales prices from February 1997 to October 2002 increased by a rate of $771.06 per month (Sterzinger et al., 2003). The Searsburg Project went on-line in mid-1997.

A more recent study of the Fenner Wind Facility in Madison County, NY analyzed 280 home sales within a 5 mile radius. Study results did not identify a significant relationship between the proximity or visibility of the wind energy facility and the sale price of homes. Additionally, the study did not identify a relationship between the announcement of the wind energy facility's construction and the sale prices of homes within 1 mile of the proposed project's location that sold immediately after the announcement (Hoen, 2006).

Since release of the DEIS, the U.S. Department of Energy released a technical analysis of the impact of wind energy facilities on the property values of nearby residences. Researchers collected data on almost 7,500 sales of single-family homes situated between 800 feet and 10 miles of 24 wind energy facilities in nine different states. The transactions occurred between 1996 and 2007, spanning the period prior to the announcement of each wind energy facility to well after its construction and full-scale operation. Researchers visited each home to determine the degree to which the wind energy facility was likely visible at the time of home sale, and to collect other essential data. The conclusions of the study were drawn from eight different hedonic pricing models, as well as repeat sales and sales volume models. The various analyses were strongly consistent in that none of the models uncovered conclusive evidence of the existence of any widespread property value effects that might be present in communities surrounding wind energy facilities. There was no evidence that prices of homes in the vicinity of wind facilities are consistently or measurably affected by either the view of wind facilities or the distance of the home to those facilities. Though the analysis could not conclusively dismiss the possibility that individual homes or small numbers of homes could have been negatively impacted, it concluded that if such impacts do exist, their frequency is too small to result in any statistically observable impact (Hoen et al., 2009).

<u>Employment</u>

As described above, operation and maintenance of the Proposed Action would be estimated generate a total employment impact in the Vermont of about nine jobs, with at least five expected to be in Bennington and Windham counties (Kavet & Rockler, 2008a, 2008b). Direct employment at the proposed facility would consist of 2.5 jobs, with the additional 6.5 jobs gained within the Region and State through indirect and induced employment impacts (PSB, 2009). Indirect impacts would result from inter-industry economic activity, while induced impacts would result from changes in local household spending. The increased wealth from jobs and spending could have a ripple effect in the local economy, but the level of this effect is unknown. This occurs because the wages of the locally-based workers goes toward the support of local businesses and households, thereby creating the need for additional jobs in the area.

Municipal Revenues and Taxes

One of the concerns of the town and local residents was the loss of federal tax revenue to the towns due to the proposed Project being located on federal lands. Federal payments to the towns come in the form of PILT and either Secure Rural Schools (SRS) or Twenty-five Percent Funds (25% Fund). Since the lands proposed for the Project are already National Forest System lands, there would be no increase in the federal land base in these towns. Hence, there is no expected change in PILT to the towns.

As described earlier, 25% Fund payments are compensation to the towns from revenues generated from timber and mineral extraction within the GMNF. SRS funds are available to communities that opt not to receive 25% Fund payments. According to the Forest Service, Bennington County received PILT in the amount of $21,447 and SRS payments of $152,728 in 2007 (U.S. Department of Interior, 2008). The Project would produce little or no change in these payments, again dependent on the SRS fund being approved by Congress and available to the states (who divide the monies up among towns). For any towns opting for the 25% fund, the change to this would be based on income generated from other timber sales on GMNF lands and from the sale of timber cleared for this Project. This sale would be managed by the Forest Service and the value determined by the quality and quantity of timber harvested, which has not been evaluated. As noted, since the PILT payments are not expected to change and the amount of 25% fund or SRS payments is not based on any fees collected from permitting and operation of a wind facility, the Proposed Action or any of the alternatives would have no effect on the amount of these payments.

The Project would provide revenue to the local and state economy through the payment of property and income taxes from Project employee-owned housing and their salaries. In addition, the owner/operator would pay the government for the use of federal lands over the life of the Project in accordance with the terms of a Special Use permit that would be issued. These Special Use permit fees would be determined based upon the final decision using a fair market value appraisal method. Since this would be the first fee calculation for a wind facility on NFS lands, no definitive figure can be provided at this time. An estimated annual fee of $210,000 is based upon a calculation method that is used by the Bureau of Land Management, and is included for illustrative purposes only. For the action alternatives with fewer turbines, assuming they occupy less land, the fee would likely be somewhat less than this amount.

Disposable income gains of about $850,000 per year are predicted by the REDYN model as a result of all economic expenditures, direct and indirect, including tax payments, job growth, and material purchases (Kavet & Rockler, 2008a, 2008b). According to the REDYN model, in its operational phase the Project is expected to generate very little in the way of new demand for state and local services and consequently little need to raise taxes. Hence, the Project could theoretically result in increases in disposable income among existing Searsburg and Readsboro residents, simply from the fact that the Project would bring income without costing the municipalities for more services. Also, approximately $3 million per year in operational expenditures are anticipated, of which approximately 41% are expected to result in direct Vermont impacts (Kavet & Rockler, 2008b). Using methodology approved by the PSB in 1999, the Proposed Action would have an estimated annual benefit of approximately $0.9 million per year in avoided external costs due to the displacement of conventional generation (Kavet & Rockler, 2008a).

In the April 16, 2009 Order accompanying the Certificate of Public Good, the PSB found that the proposed Project would "result in an economic benefit to the State and its residents" (PSB, 2009). Condition #38 of the CPG states "Deerfield shall comply with the terms and conditions of the agreements between Deerfield and the Towns of Searsburg and Readsboro." In these agreements, the Towns determined that the Project has the potential to be a net benefit by providing much needed revenue to the Towns and an environmentally sound energy option for the State of Vermont. The agreements provide for specific guaranteed annual payments to the Towns, through a combination of municipal property tax payments and Supplemental Payments. The amounts of the payments were originally determined based on the number of turbines and other Project components located within each Town. The details of these guaranteed annual payments are described below for each Town.

Town of Searsburg: The Proposed Action would include 10 wind turbines, the substation, and the O&M facility to be located within the Town of Searsburg. According to the terms of the Agreement (executed April 8, 2008), the Applicant would pay municipal property taxes, in accordance with applicable laws. In addition, the Applicant would pay an additional amount to the Town each year (the "Supplemental Payment"). The municipal tax and Supplemental payments would combine for a guaranteed payment of $240,000 per year. This total payment would represent $220,000 for 20 MW of turbines, and $20,000 for the other Project infrastructure (Town of Searsburg, 2008).

Town of Readsboro: The Proposed Action would include seven wind turbines to be located within the Town of Readsboro. According to the terms of the Agreement (executed August 20, 2008), the Applicant would pay municipal property taxes, in accordance with applicable laws. In addition, the Applicant would pay an additional amount to the Town each year (the "Supplemental Payment"). The municipal tax and Supplemental payments would combine for a guaranteed payment of $154,000 per year. This payment is for 14 MW of turbines (Town of Readsboro, 2008).

Although some Vermont towns would likely consider such amounts relatively small in comparison to their annual budgets, the PSB (2009) found that these Agreements would result in substantial economic gains to the Towns of Searsburg and Readsboro. Based on 2006 population estimates (Kavet & Rockler, 2008b), these financial payments are equivalent to more than $2,600 per resident per year in Searsburg, and approximately $195 per resident per year in Readsboro. The amount that would be paid to Searsburg is nearly equal to the Town's annual budget of approximately $251,000. The Town of Readsboro recently considered the sale of its municipal electric utility for approximately $217,050; the guaranteed annual payments from Deerfield would each represent nearly two-thirds of that amount (PSB, 2009).

Table 3.14.2-2 compares the municipal payments that would be made to the Towns under each of the Project alternatives, based on the agreements described above.

Table 3.14.2-2: Potential Municipal Revenue for the Proposed Action and Alternatives.

Action	Number of Turbines in Searsburg	Searsburg Municipal Revenue ($ per year)	Number of Turbines in Readsboro	Readsboro Municipal Revenue ($ per year)
Proposed Action	10	240,000	7	154,000
No Action alternative	0	0	0	0
Reduced West alternative	8	240,000	7	154,000
East Side Only alternative	0	20,000	7	154,000

Tourism and Educational Benefits

It is reasonable to assume that the presence of a major wind facility could provide numerous educational opportunities for children and teachers in the school. Impacts from heightened tourism following Project development would positively affect the local economy. Using the nearby existing Searsburg Wind Facility as an indicator of potential tourism and community interest, visitors to the facility, including those from tour buses and local school children and teachers, are present year-round and numbers increase substantially during the fall foliage season. There have been no targeted visitor surveys to determine the visitation or number of tours of the existing wind energy facility. However, based on the observations of the facility's technicians and the regular demand for brochures at the Searsburg Wind Facility Viewing Area along Route 8, it is a reasonable to assume that perhaps hundreds of people visit this site during peak periods. Comparable visitor traffic to view the Deerfield Wind Project can be expected (Zimmerman, 2007a).

Another piece of supporting evidence for wind energy facilities as tourist attractions is the presence of internet tourist sites showcasing the Searsburg Wind Facility as a designated stop on southern Vermont recommended drives (This is Vermont, *Undated*). The Searsburg Wind Facility also offers tours to take groups on site several times per year, primarily during the late summer when potential wildlife impacts are minimized. These tours are popular with academic institutions, civic groups and clubs, as well as members of the general public from New York, New Hampshire, Massachusetts, and Vermont. Pre-arranged tour attendance in 2005 marked an unprecedented high in visitor volume with more than 1,000 visitors. The addition of the Deerfield

Wind facility would be anticipated to maintain or increase the level of visitation and associated tourism benefits.

Tourism may also be negatively affected by the proposed Project. One concern expressed by the public is development on Vermont's ridgelines, particularly its effect on aesthetics. See Section 3.5 for impacts related to aesthetics and visual quality. The Project area is not a heavily used recreation area with most visitation, other than planned visits as described above, occurring as people drive through the area on the way to other highly used recreation areas like the nearby State parks and campgrounds, Harriman Reservoir, and the Mount Snow region. Any avoidance of the area because of the negative aspects of the wind facility is expected to be minimal.

Because of the remoteness and lack of destination stops in the Towns of Readsboro and Searsburg, changes (most likely increases) in tourism revenue directly related to the proposed Project would be difficult if not impossible to accurately predict. It would seem that more people would visit the area (mostly passing through to other destinations) than would avoid the area due to the turbines. Therefore, any additional revenue to local businesses and the Towns would most likely be minimal, as would any decrease in revenue attributable to avoidance of the area.

Effects on the Ratepayer

The Proposed Action is consistent with the recommendations and goals contained in the Vermont Electric Plan 2005 and State Energy Policy's stated goal of meeting "Vermont's electric energy needs growth in a manner that is efficient, adequate, reliable, secure, sustainable, affordable, safe, and environmentally sound, while encouraging the State's economic vitality and maintaining consistency with other state policies" (Vermont Department of Public Service, 2005). Although Vermont's energy contract with Hydro Quebec was recently renewed securing approximately one-third of the State's energy requirement, the current energy contract with Vermont Yankee (accounting for another third of the State's energy requirement) is approaching conclusion and probable re-negotiation. There is an increased importance in finding new and diverse supply sources at this time. The Proposed Action would result in greater diversification of Vermont's energy portfolio and would add another energy source that does not rely on cost-sensitive fossil fuel sources. The increased diversification can help buffer increasing energy costs and provide a sustainable energy source whose costs are not volatile like fossil fuels (Zimmerman, 2007a). Estimates of the economic value of the Project's wind-generated power avoidance of environmental externalities inherent to fossil fuel-based sources (e.g., fuel supply issues, emissions costs) range from $6.60 per MWh to $8.30 MWh (Hausman et al., 2006). Though it is difficult to predict the exact effect construction and operation of the Proposed Action would have on the rates paid by the ratepayer, over the life of the Project, some of these incremental benefits may appear in the form of savings for the rate payer.

Condition #4 of the Certificate of Public Good stipulates that the Applicant "shall enter into long-term, stably-priced power contracts with Vermont utilities for a substantial portion of the Project's power output" (PSB, 2009). According to an agreement executed September 9, 2010, Central Vermont Public Service would purchase two-thirds of the output of the proposed Project (CVPS, 2010), thus helping to satisfy the PSB stipulation that the Project must benefit the public good of the State of Vermont.

3.14.2.1.3 Proposed Action Summary

As a result of the construction of turbines, access roads and ancillary components, the Proposed Action would have both direct and indirect positive economic and social impacts on Vermont, Bennington County and the local communities, commencing with the construction phase and continuing throughout the operational life of the Project. In the short term, the benefits of Project construction would include additional employment and income stemming from jobs in the various construction trades that would be generated to build the Project. To the extent possible, local services and goods would be used for various aspects of construction such as site clearing and preparation, road construction, and foundation installation. Increased economic opportunity during Project construction would mostly impact local contractors, merchants, and their families thus providing an economic boost to these households, which has the potential to translate into positive gains in quality of life for these individuals and the community as a whole.

In the long term, Project operations would generate additional revenue for affected municipalities and school districts. It would also provide full-time employment for a limited number of individuals. As indicated by observed trends at the existing Searsburg Wind Facility, the Project would likely result in more visitors to the area. Project-driven tourism dollars could have a minor beneficial effect on local businesses. Documented trends observed at residences within the Searsburg Wind Facility's viewshed suggest that home sale prices may increase after the Deerfield facility goes on-line (Sterzinger et al., 2003). However, it is difficult to differentiate changes (increases or decreases) in home sale prices due to the wind facilities from increases that could result from other factors that affect housing sales and prices. The overall variability in the housing market, dependent on economic conditions, may well exert more influence over home sales and prices than any other local factors. Generally speaking, as explained in Section 3.14.2.1.2, the proposed Project is not expected to have any adverse effect on real estate values within and adjacent to the Project area. Furthermore, the Project would provide for new, emissions-free electrical generating capacity to help meet projected economic and population growth rates of Vermont and New England, and replace expiring energy sources in the near future (Kavet & Rockler, 2008a, 2008b).

As noted above, the effect that the Proposed Action would have on the rates paid by the ratepayer is difficult to predict. However, benefits to the ratepayer would stem from the fact that the Proposed Action would result in greater diversification of Vermont's energy portfolio and would add another energy source that does not rely on inputs from outside of the state or on cost-sensitive fossil fuel sources. Agreements have also been reached that should provide for the majority of the power produced by the Deerfield facility to service Vermont homes. This would provide an opportunity to stabilize rates as Vermont re-negotiates its energy contracts and seeks out new sources, and over the long term, may result in savings for the ratepayer.

3.14.2.2 Alternative 1: No Action Alternative

Under the No Action Alternative, no turbines, access roads, or other Project components would be constructed, and therefore, no direct, indirect, or cumulative impacts to socioeconomics would be anticipated other than those already associated with the continuing and on-going operation and management activities of the existing GMP turbines. As a result, the state of Vermont, Bennington County and the local municipalities would not experience a net increase in the positive economic benefits that would be expected from the construction phases (short-term) and the viable economic life (long-term) of the Proposed Action.

With the No Action alternative, population and housing, employment, property values, tourism, and revenues and taxes would most likely remain status quo. There would be no additional income from jobs in the various construction trades. In addition, the potential for long-term benefits would also diminish. This would include no generation of additional revenue for the affected towns and school districts. There would also be no Special Use permit fees paid to the Forest Service for use of the land. The No Action alternative would not provide for additional needed electric capacity and would forego the opportunity to provide a source of renewable electric power and the potential stabilizing effect on electricity prices due to lack of dependence on volatile fossil fuels.

3.14.2.3 Alternative 2: Reduced Turbines on Western Project Site

The Reduced West alternative would have both direct and indirect beneficial economic and social impacts on Vermont, Bennington County, and the local communities, commencing with the construction phase and continuing throughout the operational life of the Project. Reducing by two the number of turbines on the Western Project site would only very slightly reduce the economic benefits from those produced by the Proposed Action. It can be anticipated that the construction period and the amount of goods, services, and employment would decrease slightly. The effects on housing, tourism, and real estate would remain the same or very similar as those for the Proposed Action. The land area occupied by the Project would likely remain the same or decrease very slightly, since the reduced western configuration would still span the ridge southward to Route 8 for the transmission line, and the fees paid to the Forest Service would also most likely decrease slightly since fair market value of the Project would be decreased due to its smaller size.

As indicated in Table 3.14.2-2, because the facilities proposed in Alternative 2 that are located in the Town of Readsboro would remain essentially the same as the Proposed Action, there would be no expected reduction in direct fiscal benefits. The municipal tax and Supplemental payments would combine for a guaranteed payment of $154,000 per year. The payments outlined in the executed Agreement with the Town of Searsburg were originally based on the number of turbines and other infrastructure to be located within the Town. However, although the Applicant reduced the number of turbines proposed to be located in Searsburg from ten to eight in the PSB process, no reduction in payments was negotiated. As indicated in the Order accompanying the CPG, the municipal tax and Supplemental payments would combine for a guaranteed payment of

$240,000 per year under the 15-turbine Preferred Alternative. Therefore, when compared to the Proposed Action, there would be no reduction in payments to either Town.

The Reduced West alternative would also result in greater diversification of Vermont's energy portfolio and would add another energy source that does not rely on inputs from outside of the state or on cost-sensitive fossil fuel sources. The turbine reduction detailed under this alternative would reduce potential electrical generation by approximately 7% when compared to the Proposed Action. While Alternative 2 would result in more diversification of Vermont's energy portfolio when compared to No Action, it would result in slightly less diversification of Vermont's energy portfolio and require slightly more reliance on inputs from outside of the state or on cost-sensitive fossil fuel sources when compared to the Proposed Action due to the reduction in number of turbines. As stated above for the Proposed Action, it is difficult to predict whether an operational wind energy facility would have positive or negative, direct incremental impact on consumer electricity rates, so the reduction in the number of turbines for Alternative 2 would not necessarily impact rates much differently than would the Proposed Action. However, any net benefits created by the Proposed Action as a buffer to increasing energy costs and providing a sustainable energy source whose costs are not volatile like fossil fuels would be slightly decreased if a reduction of two turbines occurred. This suggests that over the long-term, savings for the ratepayer similar to those anticipated for the Proposed Action may be possible.

3.14.2.4 Alternative 3: Turbines in the Eastern Project Site Only

This alternative does not include any turbines, substation, or electrical interconnect on the Western Project site, and would result in a smaller project implemented over a shorter time. Given that, socioeconomic impacts would be appreciably less than those identified above for the Proposed Action and the Reduced West alternative. Specifically, the construction period and the amount of goods, services, and employment opportunities would most likely be substantially reduced when compared to the Proposed Action. The effects on housing, tourism, and real estate would most likely be the same or very similar as those for the Proposed Action. The land area occupied by the Project would also be reduced when compared to the Proposed Action, and therefore the fees paid to the Forest Service would also be proportionally less.

As indicated in Table 3.14.2-2, because the facilities proposed in Alternative 3 that are located in the town of Readsboro would remain the same as the Proposed Action, there would be no expected reduction in direct fiscal benefits. The municipal tax and Supplemental payments would combine for a guaranteed payment of $154,000 per year. There would be no turbines located in the Town of Searsburg under the East Side Only alternative. The municipal tax and Supplemental payments would combine for a guaranteed payment of $20,000 per year for the other Project infrastructure that would be sited within the Town, (i.e., portions of the electric interconnection line and substation).

The East Side Only alternative would diversify Vermont's energy portfolio and would add another energy source that does not rely on inputs from outside of the state or on cost-sensitive fossil fuel sources. This alternative reduces the number of turbines down to seven and would result in a decrease of potential electrical generation by approximately 59% when compared to the

Proposed Action. While it would result in more diversification of Vermont's energy portfolio when compared to No Action, it would result in much less diversification, and would require more reliance on inputs from outside of the state or on cost-sensitive fossil fuel sources, when compared to the Proposed Action due to the reduction in number of turbines. As noted for Alternative 2, it is difficult to predict how the operating facility would affect electricity rates. However, any net benefits created by Alternative 3 as a buffer to increasing energy costs and providing a sustainable energy source whose costs are not volatile like fossil fuels would be less than the Proposed Action and Alternative 2 due to the reduction in turbine numbers. Likewise, any possible long-term savings for the ratepayer similar to those anticipated for the Proposed Action and Alternative 2 would be minimal for the East Side Only alternative.

The East Side Only alternative would therefore result in direct and indirect positive economic and social impacts on Vermont, Bennington County, and the local communities. However, these impacts would be much less than those that would be realized under other action alternatives.

3.14.3 Cumulative Impacts

The cumulative impacts analysis area encompasses the region surrounding the Project including southern Vermont, Bennington County and the local host municipalities (Towns of Readsboro and Searsburg). Past activities that would incrementally add to the cumulative impact include only the existing Searsburg Wind Facility (slightly beyond the 5 to 10 year period of past activities considered for cumulative impact discussion). Foreseeable future wind projects that may influence cumulative impacts include the Hoosac and Berkshire Wind Power Projects, both in western Massachusetts, and the Lempster facility, in New Hampshire. A small number of other wind facilities in Vermont are either being reviewed by the approving authorities, or are in the early stages of viability testing. One facility in Sheffield, Vermont, is currently under construction, while another in Lowell, Vermont, has just recently been approved. These facilities would be located in the far northern part of Vermont, well away from the Deerfield Project and the factors that would be affected by the Project. The Hoosac facility has been approved and construction is currently underway. The Berkshire facility, consisting of ten 1.5 MW turbines, began operation in spring 2011. The Lempster, NH, facility, about 45 to 50 miles (80 km) northeast of the Deerfield Project area, began operations in 2008. Operation of these facilities would not directly affect diversification of Vermont's energy portfolio.

The Deerfield Wind Project would incrementally add to the overall cumulative impacts on the region in the form of positive economic and social benefits for the area, as described above. These impacts also include availability of competitively priced electric energy and clean, renewable power in the State and region. Socially, wind energy offers unique advantages over fossil fuel-derived energy such as no emissions of greenhouse gases and other environmental pollutants, while displacing reliance on existing fossil fuel-based generation facilities that have significant, cumulative and far-reaching ecological impacts.

Combined with the existing Searsburg Wind Facility and other current and future wind energy projects in the region, the Proposed Action and Alternatives 2 and 3 would contribute to the beneficial cumulative impacts that commercial wind energy facility development would have on the regional economic and social environment. Beneficial impacts would not only be experienced due to the avoidance of external costs associated with fossil fuel-based energy, but would also occur from payments to towns and municipalities and the stimulation of the regional economy. Job creation, service procurement, and increased tourism would all most likely trend upward due to the Proposed Action and Alternatives 2 and 3. Also, the incremental impact that the Deerfield Wind Project and other wind energy projects could have on stabilizing or perhaps reducing energy prices could result in long-term savings for the ratepayers.

3.15 Transportation and Roads

The following chapter summarizes the existing conditions and potential impacts to area roadways and transportation systems that may result from the proposed Project. This chapter draws upon the results of the Route Evaluation Study for the Deerfield Wind Project conducted by CH2M HILL in January 2008. This study reports the effects and potential impacts from the proposed Project on the local road network, including oversize/overweight (OS/OW) vehicle use. In addition, this report identifies the preferred access route for the proposed Project and suggests several design criteria to eliminate or minimize potential impacts.

3.15.1 Affected Environment

The area of Searsburg and Readsboro, Vermont is served by a network of state, county, and local highways and roads in the Project area ranging from two-lane highways to gravel roads. Portions of the Vermont State Highway System intersect the Project area. Route 8 bisects the Eastern and the Western Project sites and runs north-south, while Route 9 is situated north of the Project area and runs east-west. The presence of an extensive road network in such proximity to the Project area dramatically enhances site access and material and equipment transportation to the site.

Current traffic levels on area roads are generally low due to the area's rural nature. The closest residence to the proposed Project site is 0.5 mile. A number of residences as well as the existing 11-turbine Searsburg facility are found along Route 8 in the Project area. Although the town center of Searsburg, located approximately 0.75 mile from the most northerly turbine on the Western Project site, represents the most populated area in the immediate vicinity of the Project, the entire town has a small residential population of 96 people (U.S. Census Bureau, 2000a). The town of Readsboro is larger, with a population of 809, and contains two small, unincorporated communities. Heartwellville lies along the southern edge of the Project area, at the intersection of Routes 8 and 100, while the town center of Readsboro is located along Route 100 approximately 5 miles south of the Project area (U.S. Census Bureau, 2000b).

The following three sub-sections that describe the materials delivery, construction periods, route selections, and necessary roadway modifications apply to all the alternatives including the Proposed Action. Differences between the alternatives are disclosed in the impact sub-sections for each alternative.

3.15.1.1 Materials Delivery and Construction

Wind turbine components would be delivered to the site via large trucks and specialty vehicles. All required transportation permits would be sought well in advance of all desired movements of overweight/overdimensioned vehicles/loads. Transportation and delivery of materials would be conducted by licensed and insured haulers and would adhere to protocols as outlined in the "Rules and Instructions Governing the Overweight & Overdimension Vehicle Permits" and "A Guide to Motor Carrier Safety Regulations" as issued by the State of Vermont Department of Motor Vehicles.

Construction of the Deerfield Wind Project is expected to take about nine months. Peak employment is anticipated to occur in the fifth month of construction and would consist of about 23 laborers on site. At peak construction, the Project would generate an estimated 37 vehicular round trips per day due to construction personnel, or less than five round trips per hour on average. Also during peak construction, the Project would generate 40 vehicular round trips per day due to concrete and fill deliveries, or less than 6 round trips per hour on average.

3.15.1.2 Preferred Access Route Determination

In order to determine the optimal access and delivery route for the proposed Project, CH2M HILL analyzed the feasibility of three separate access routes (CH2M HILL, 2008a). These routes are:

1. Interstate 91 (I-91) – Vermont Route 9 – Vermont Route 8 – Sites, with the presumed primary movement east to west.[25]

2. U.S. Route 7 – Vermont Route 9 – Vermont Route 8 – Sites, with the primary movement from south to west to east.

3. Regional/Local Roads – Vermont Route 8 – Sites, with the primary movement south to north.

All potential access routes were driven, photo-documented and assessed in mid-October 2007. Access Routes #2 and #3 were analyzed, but subsequently eliminated from the analysis due to less than ideal road conditions, lower road condition standards, and/or an existing traffic mix of a developed urban area. Access Route #1 was determined to be the most viable option due to its ability to accommodate the unique characteristics of the transport vehicles and the fact that the route is relatively free of existing traffic congestion and has few sensitive receptors. Approximately 25 miles of Route 9, from its intersection with I-91, would be traveled. Approximately 2.5 miles of Route 8, from its intersection with Route 9 just north of the Project site, would also be traveled. In the Order accompanying the Certificate of Public Good, the PSB (2009) identified Access Route #1 as the preferred access and delivery route.

3.15.1.3 Roadway Modifications

The OS/OW nature of the specialty transport vehicles and their loads would require that slight modifications be made to a few road intersections in order to ensure proper turning radii and clearances. Roadway modifications within Route 9 and/or Route 8 would be designed to State of Vermont highway standards by a Vermont licensed professional engineer. If requested, all roadway modifications at the intersections would be removed and the areas returned to their

[25] "Primary movement' indicates the movement of a fully-loaded/-weighted transport vehicle. The return trip – without the primary load – would be considered a "non-primary movement."

prior state following the installation of the wind turbines. All intersections would be photo-documented before and after construction of the proposed modifications, and upon their removal, if so requested. Graphic depictions of proposed roadway modifications are located in the Project file.

Some of the roadway modifications may impact wetlands or the protective strip adjacent to wetlands that lie on NFS lands. Section 3.8 contains further details on wetland impacts.

Proposed roadway modifications are depicted in Figures 3.15-1 through 3.15-3 and include the following actions:

- Widening of the shoulder along the inner left hand turn from Route 9 onto Route 8 would be required, including the possible temporary relocation of a number of utility poles along the northern edge of Route 9 for blade tip clearance (Figure 3.15-1). There is some ground elevation along this edge and some lowering of grades may be in order.
- The right hand turn from Route 8 onto Putnam Road, a local gravel roadway that serves as access to the Western Project site, would need to be modified (Figure 3.15-2). Approximately 150 feet on the south side of the old Putnam Road entrance would be cleared to accommodate rotor blade swing. During preparation of the Route Evaluation Study and the DEIS, the Applicant was considering acquiring a land parcel to the south of Putnam Road, in order to accommodate the required turning movement of OS/OW vehicles (CH2M HILL, 2008a). Further evaluation has indicated that acquisition of that land parcel would not be necessary to accommodate the turning radius of trucks entering the Project site. Therefore, the Applicant would no longer pursue purchasing property south of Putnam Road (Hammond, 2010).
- A section along the eastern edge of Route 8 would be cleared for a short distance to allow the rotor blade to sweep around the turn free of any obstructions.
- The left hand turn from Route 8 onto Sleepy Hollow Road would require the placement and compaction of temporary fill and related improvements along the inner turn radius (Figure 3.15-3). Approximately 50 feet on the north side of the Sleepy Hollow Road entrance would be cleared to accommodate rotor blade swing. Drainage swales and grading along Route 8 would require modification. Both sides of Sleepy Hollow Road at its intersection with Route 8 are proposed for regrading and strengthening to accommodate construction traffic at this intersection.

3.15.2 Direct and Indirect Impacts Presented by Alternative

No significant issues specifically relating to roadways, transportation systems, or traffic were identified during the public scoping process. Traffic concerns associated with the construction of a wind energy project (including the potential for accidents, falling objects, increased road congestion, increased noise, and increased vehicular emissions) are standard construction-related concerns.

Impacts are discussed below using the following indicators to focus the discussion: inconvenience to road users and local residents, wear and tear on roads, traffic volumes, safety measures, dust abatement, and effects on wildlife. All the impacts described below are best characterized as direct impacts. There are no tangible indirect impacts to roadway and transportation system resources.

3.15.2.1 Proposed Action

Due to the siting of the Project's 17 turbines in a relatively undeveloped area which has portions of the Vermont State Highway System intersecting the site, transportation-related impacts are anticipated to be minimal. Modifications to the municipal roadways as described above are expected to be minor. Access road construction has been carefully planned to minimize wetland impacts. As described in Section 3.8.2, construction of Project access roads is anticipated to directly impact 289 square feet (0.0066 acre) of Wetland F, 1,873 square feet (0.043 acre) of Wetland AH, and 241 square feet (0.0055 acre) of Wetland BB, which are situated on private land; and 1,555 square feet (0.0357 acre) of Wetland AA, and 947 square feet (0.0217 acre) of Wetland AJ, situated on Forest Service land. In addition, construction activities would impact the protective strip and/or 100-foot buffers of 12 wetlands (A, B, C, D, S, AA, AB, AJ, BA, BD, WW, and XX); most of these impacts occur in the vicinity of access roads.

Access Route #1 as noted above, using Interstate 91 to Route 9 to Route 8 to the Project site, was determined to be the preferred route due to its direct routing, its capacity for handling oversized loads without excessive road modifications, and because it has the fewest impacts to local Vermont roads and communities. The primary impacts would be short-term construction-related inconvenience to road users and local residences as equipment passed by, and some wear and tear on local roads. Major highways built for and accustomed to large heavy loads would be expected to show less wear and tear than local roads from this use. In general, Routes 8 and 9 are constructed to withstand loads of up to 80,000 pounds, within the range of weights of the heaviest loads expected during materials delivery and construction.

Weight, size and load limitations for vehicles using State roads are detailed in Title 23 sections 1391 to 1393 of the Vermont Statutes. Vermont State law generally limits gross vehicle weights to 80,000 pounds. Weight limits are also determined by axle load. On State highways, single axle loads are limited to 22,400 pounds with an allowed 10% tolerance. Tandem axle loads are limited to 36,000 pounds and also allow a 10% tolerance. On the Interstate Highways (as on I-91), single axle loads are limited to 20,000 pounds with no tolerance allowed and tandem axle loads are limited to 34,000 pounds with tolerances allowed by permit. The weight limit for bridges with a wood floor is 16,000 pounds, unless otherwise posted; and 24,000 pounds upon a class 2, 3, and 4 town highway or bridge. Please note that individual Towns may post their own weight limits for town roads and bridges, which are subject to the approval of the Secretary of Transportation. Absolute maximum weight limits based on the number of axels are summarized in Table 3.15.2-1 below.

Table 3.15.2-1: Absolute Maximum Weight Limits Based on the Number of Axles

	2 axles	3 axles	4 axles	5 axles	6 axles	7 axles
Max Weight Limits	40,000	60,000	70,000	80,000	80,000	80,000

Source: Title 23 Section 1392 of the Vermont Statutes

In addition, on an annual basis, a maximum gross weight of 99,000 pounds is allowable on State and town highways for, "unprocessed forest products" "unprocessed milk products" and "unprocessed quarry products". Additional weight exemptions in excess of these limits may be permitted for special uses. All required transportation permits would be sought well in advance of all desired movements of overweight/overdimensioned vehicles/loads.

For the Proposed Action, approximately eight trips, the bulk in specialized vehicles, would be required to deliver the components of each turbine, including four trips for the four tower sections alone (one trip per tower section). This would result in an estimated 136 total trips in order to deliver the components for the 17 proposed turbines. The heaviest load would be about 260,000 pounds (130 tons), well in excess of the maximum weight limits presented in Table 3.15.2. The oversized and overweight nature of the specialty transport vehicles and their loads will require special processing through the Vermont Agency of Transportation (VTrans) Commercial Vehicle Permit Unit. Vermont state statutes enable the Commissioner of Motor Vehicles to require an engineering inspection of the transport vehicle, load and route when the weight, size or load is considered sufficiently excessive for the routing requested (23 V.S.A. §1402). In instances of a so-called "Super Load," engineering studies for state highways are required. Based on the weight and dimensions of the turbine components and those of the specialized transport vehicles required to transport them, multiple permits in each weight category may be necessary. As indicated above, all required transportation permits would be sought well in advance of OS/OW deliveries, which would be conducted by licensed and insured haulers, and would adhere to protocols as outlined in the "Rules and Instructions Governing the Overweight & Overdimension Vehicle Permits," as issued by the State of Vermont Department of Motor Vehicles.

Because the level of anticipated traffic is low enough to be easily absorbed by the existing local roadway network, only minimal congestion or delay impacts to the surrounding communities and to the local transportation network are anticipated. During construction, impacts associated with working construction equipment would be minimized through adherence to a construction routing and sequencing plan that minimizes impacts on local roads and residences.

A number of design criteria would be implemented to minimize impacts. The primary movement of transport construction material vehicles would be made in off-peak periods when other traffic movements are at a minimum. Moreover, construction deliveries would be coordinated to avoid peak arrival and departure times for area schools. In order to address safety concerns, all through and turning movements would be coordinated with State and local safety officials and first responders. In all instances, first responders/emergency vehicles would be given the right of way. The timing of movements through developed West Brattleboro (Western Avenue) and congested Wilmington Center would be examined closely with the Vermont Department of

Transportation and local safety officials to minimize disruption in these areas. If necessary, police details would be used to assist in traffic control in these areas, and police escort would be provided for all specialty transport vehicles passing in front of the Marlboro Elementary School on Route 9 (Milepost 8.8) when the elementary school is in session. Also, if needed, flagmen would be used during peak periods to direct traffic safely in and out of the Putnam Road and Sleepy Hollow Road intersections with Route 8.

Roadway modifications within the Route 9 and/or Route 8 right-of-ways would be designed to State of Vermont highway standards by a Vermont licensed professional engineer. If requested, all roadway modifications at the intersections would be removed and the areas returned to their prior state following construction. All intersections would be photo-documented before and after construction of the proposed modifications, and upon their removal, if so requested.

A dust control plan and a sediment and erosion control plan would be developed and implemented to minimize direct impacts of construction and also off-site visual impacts associated with the construction activities. Construction activities and traffic would be monitored for dust problems. Water would be used to wet down dusty roads (public roads, as well as Project access roads) as needed throughout the duration of construction.

Increased traffic volumes and OS/OW vehicle use associated with the nine-month construction period may result in short-term adverse impacts with respect to road wear and tear, and inconvenience to road users and local residents along Routes 8 and 9. An increase in road maintenance activities could be expected during and after construction depending on the resulting amount of wear and tear. Impacts to wildlife from the increased noise, dust, human activity, and traffic from construction-related use of the roadways would potentially result in displacement and incidental injury and mortality. Displacement would be expected to be temporary. Injury and mortality from wildlife/vehicle collisions may be slightly higher than would normally occur due to increased traffic but most likely not increase substantially due to the generally slower movement of the larger construction vehicles. These impacts are expected to be short-term and localized. Due to the low number of operational staff, negligible traffic related impacts are anticipated as a result of maintenance and operation of the facility.

3.15.2.2 No Action Alternative

No new turbines, access roads, or other Project components would be constructed under the No Action Alternative, and therefore there would be no impacts to roadways and transportation systems. Routine reconstruction and maintenance of the local roads would continue.

3.15.2.3 Reduced Turbines in Western Project Site

Reducing the number of turbines in the Western Project site by two would slightly reduce overall impacts to roadways and transportation systems. The reduction of the number of turbines from 17 for the Proposed Action to 15 for the Western Project site alternative would reduce the amount of deliveries necessary for turbine components by approximately 12%. Approximately 120 total trips would be required in order to deliver the components for the 15 proposed turbines. The construction period would be only slightly lessened. Furthermore, the numbers of construction labor employees, and their subsequent use of roadways, would not be appreciably reduced. The same routes, schedules, and roadway modifications would be used. Inconvenience to road users and local residents, and the amount of wear and tear on roads, would be slightly reduced. The same design criteria and mitigation would be applied, and it would be anticipated that the overall environmental impacts would also be slightly reduced from those produced by the Proposed Action.

As described in Section 3.8.2, construction of Project access roads for the Reduced West alternative is anticipated to directly impact 6 square feet (0.0001 acre) of Wetland F, 1,873 square feet (0.043 acre) of Wetland AH, and 56 square feet (0.0013 acre) of Wetland BB, which are situated on private land; and 1,717 square feet (0.0394 acre) of Wetland AA, situated on Forest Service land. In addition, construction activities would impact the protective strip and/or 100-foot buffers of 13 wetlands (A, B, C, D, S, AA, AB, AJ, AL, BA, BD, WW, and XX); most of these impacts occur in the vicinity of access roads.

3.15.2.4 Turbines in Eastern Project Site Only

Eliminating all turbines in the Western Project site would substantially reduce overall impacts to roadways and transportation systems. The removal of all 10 wind turbines from the Western Project site would reduce the amount of deliveries necessary for turbine components by approximately 59%. Approximately 56 total trips would be required in order to deliver the components for the seven proposed turbines in the Eastern Project site. The construction period would be reduced from about nine months to about seven months. Numbers of construction labor employees and their subsequent use of roadways would be reduced as well as overall construction-related traffic. The same routes and roadway modifications would be used but schedules may be adjusted to accommodate a much smaller project. Inconvenience to road users and local residents, and wear and tear on roads, would be substantially reduced. The same design criteria and mitigation would be applied, and it would be anticipated that environmental impacts would also be much less from those produced by the Proposed Action.

As described in Section 3.8.2, construction of Project access roads for the East Side Only alternative is anticipated to directly impact 6 square feet (0.0001 acre) of Wetland F, 1,873 square feet (0.043 acre) of Wetland AH, and 56 square feet (0.0013 acre) of Wetland BB, which are situated on private land; and 1,717 square feet (0.0394 acre) of Wetland AA, situated on Forest Service land. In addition, construction activities would impact the protective strip and/or 100-foot buffers of seven wetlands (A, B, C, D, S, AA, and AJ); most of these impacts occur in the vicinity of access roads.

3.15.3 Cumulative Impacts

The cumulative impacts analysis area is defined as the system of roads and highways within or adjacent to the Project area, and includes sections of Routes 8 and 9. Although travel over I-91 and other non-local roads and highways would occur, cumulative impacts discussion is primarily focused on roads within jurisdiction of State and local agencies. It is assumed that roads outside these jurisdictions would be impacted to basically the same amount of wear and tear as local roads and highways with the exception of larger interstate highways that are built for heavier loads.

Little or no major improvements have been made to Route 8 in the vicinity of the Project site since before 1998. According to the 2008 State Highway System for pavement management, pavement conditions between Heartwellville and Route 9 range from poor to very poor (Vermont Agency of Transportation, 2009). In contrast, since 2004, Route 9 has been re-paved from Wilmington to the intersection with Route 8. The 2008 State Highway System for pavement management rated the sections of Route 9 from Wilmington into Searsburg that were re-paved in 2004 and 2008 as good; at that time, the Searsburg to Woodford section had not yet been re-paved and was rated fair to very poor (Vermont Agency of Transportation, 2009). The heaviest loads moving over these roads in the recent past have most likely been log trucks and occasional construction equipment haulers and concrete trucks working on local construction projects. In addition, while not a major factor on Route 8, tractor-trailer traffic is common on Route 9.

In the foreseeable future of the next 5 to 10 years, no large industrial expansion is predicted, nor is a substantial increase in housing starts and population expected that would increase the wear and tear on these roads beyond what would be expected. Logging and log hauling over local roads, and tractor-trailer traffic on Route 9, would be expected to continue close to the present rate. Generally, the current level of use of these roads receive should continue.

The increase in traffic and the heavier loads over the Deerfield Project construction period, when added to what has occurred in the recent past and what can be expected in the near future, would produce a slight cumulative impact, primarily in terms of road wear and tear, and inconvenience to road users and local residents along Routes 8 and 9. An increase in road maintenance could be expected during and after construction depending on the amount of wear and tear that results. This slight cumulative impact would occur for the Reduced West and East Side Only alternatives as well as the Proposed Action but to a lesser extend due to the shorter construction period and fewer trips with oversized loads. There would be no cumulative impact for the No Action alternative.

3.16 Telecommunications

This section summarizes the existing conditions and potential impacts to telecommunications that may result from the proposed Project. To evaluate the potential for the Project to impact existing telecommunication signals, Comsearch was retained to conduct various studies that evaluate the effect the Deerfield Wind Project would have on existing non-federal government telecommunication systems. These study reports may be found in the Project Record.

3.16.1 Affected Environment

The affected environment for the analysis of telecommunications impacts is the Project area and nearby pertinent air space. A number of telecommunication features that potentially intersect with the affected environment are evaluated herein, including microwave, television, radio, mobile telephones, and land mobile radios.

3.16.1.1 Microwave Analysis

Microwave telecommunication systems are wireless point-to-point links that communicate between two sites (antennas) and require clear line-of-sight conditions between each antenna.

Wind turbines can interfere with microwave paths by physically blocking the line-of-sight between two microwave transmitters. Microwave bands that may be affected by the installation of wind turbine facilities operate over a wide frequency range (900 MHz – 23 GHz). These systems are the telecommunication backbone of the country, providing long-distance and local telephone service, backhaul for cellular and personal communication service, data interconnects for mainframe computers and the Internet, network controls for utilities and railroads, and various video services (Comsearch, 2010). Comsearch performed database searches in 2006 for the DEIS, and again in 2010 for the SDEIS. No licensed microwave paths were identified in the Project area (Comsearch, 2006, 2010).

3.16.1.2 Television Analysis

Off-air television (TV) stations transmit broadcast signals from terrestrially located facilities that can be received directly by a TV receiver or house-mounted antenna. Rotating turbine blades can cause a time-varying signal that competes with the "direct wave" appearing at the antenna of a ground receiver. The result can be TV signal distortion capable of making reception difficult (Evans, 2005). The main causes of interference with television reception are electro-static interference, and electro-mechanical, electromagnetic, or radio frequency interference. Electro-static interference is primarily associated with extremely high voltages, and tends to affect devices that are nearby. Electro-mechanical, electromagnetic, and radio frequency interference can occur when turbines or their electrical emissions obstruct broadcast signals. Such interferences primarily depend upon the location of the wind turbines in relationship to the broadcast antennas and the pathway to the individual receptors (Polisky, 2008). Due to the undeveloped and isolated nature of the Project area and limited number of nearby residences, a TV station search of the off-air TV stations has not been conducted.

Cable headend facilities generally receive programming from satellites and off-air TV stations located in larger cities, up to 40 miles away. This programming is subsequently re-distributed on a cable network system. The Duncan Cable TV (DCTV) headend facility is located on Mount Olga, east of the village of Wilmington, Vermont, approximately 8 miles from the Deerfield site. The DCTV headend facility receives off-air TV programming from cities like Albany, NY, Springfield, MA, and Pittsfield, MA (Comsearch, 2008c).

3.16.1.3 AM Radio Analysis

If a turbine intercepts a low frequency radio wave from an AM broadcast antenna, it can "re-radiate" the signal with an arbitrary phase delay. This secondary radiator then becomes a radio frequency source that interferes with the primary signal, causing fading and noise in receivers tuned to the frequency (Evans, 2005). Wind energy facilities can affect radio transmission when the proposed turbines are located within 1 kilometer of a non-directional broadcast station and/or within 3 kilometers of a directional broadcast station. Due to the undeveloped and isolated nature of the Project area and limited number of nearby residences, a radio station search has not been conducted.

3.16.1.4 Mobile Telephone Analysis

Cellular telephone and personal communication system (PCS) services are available within the Project area. Comsearch (2008a) determined that there are two cellular telephone operators and seven PCS telephone operators in Bennington County. The band of operation and license number for each mobile telephone operator is presented below in Table 3.16.1-1.

Table 3.16.1-1. Mobile Telephone Operators in Bennington County, Vermont

Operator	Type of System	Band of Operation	License
Rural Cellular Corp.	Cellular	A	KNKN749
U.S. Cellular	Cellular	B	KNKQ277
T-Mobile	PCS	A	KNLF202
AT&T/Cingular	PCS	A	WPLS626
Sprint Nextel	PCS	B	KNLF204
Verizon	PCS	C2	WPTB363
U.S. Cellular	PCS	D	KNLG723
Rural Cellular Corp.	PCS	E	KNLG531
AT&T/Cingular	PCS	F	KNLH723

Source: Comsearch, 2008a.

3.16.1.5 Land Mobile Radio Analysis

Land Mobile Radios (LMR) systems are wireless communications often used by emergency first responder organizations, public works organizations, and companies with large vehicle fleets or numerous field staff. LMR coverage is the result of the placement of tower-mounted repeaters. Comsearch (2008b) determined that there are 466 LMR systems registered within 15 miles of the Project area center point, and 14 LMR systems registered within the Project area. The frequency for each LMR system within the Project area is presented below in Table 3.16.1-2.

Table 3.16.1-2. Land Mobile Radio Operators in the Project Area

Owner/Operator	Frequency (MHz)
Central Vermont Public Service Corporation	153.53
Central Vermont Public Service Corporation	153.56
Central Vermont Public Service Corporation	153.68
Central Vermont Public Service Corporation	451.275
Central Vermont Public Service Corporation	462.9
Green Mountain Power Corporation	47.8
Green Mountain Power Corporation	48.68
Green Mountain Power Corporation	451.1625

Owner/Operator	Frequency (MHz)
TransCanada Hydro Northeast, Inc.	48.96
TransCanada Hydro Northeast, Inc.	151.97
USGen New England, Inc.	154.45625
USGen New England, Inc.	154.47875
USGen New England, Inc.	173.3375
Valois, Paul L.	152.48

Source: Comsearch, 2008b.

3.16.1.6 National Telecommunications and Information Administration Notification

Comsearch, on behalf of the Applicant, sent a written notification of the proposed Project to the National Telecommunications and Information Administration (NTIA) of the United States of America Department of Commerce. The NTIA provides plans for the proposed Project to the federal agencies represented in the Interdependent Radio Advisory Committee, which include the Department of Homeland Security, Department of the Interior, Department of Justice, Federal Communications Commission (FCC), various branches of the military, and the FAA. A response letter from the NTIA was received on March 11, 2008. No concerns regarding blockage of communication systems were identified. The correspondence from the NTIA is provided in the Project Record.

3.16.1.7 Emergency Alert System

The Emergency Alert System (EAS) is a national public warning system that requires TV and radio broadcasters, cable television systems, wireless cable systems, satellite digital audio radio service providers, direct broadcast satellite service providers, and wireline video service providers to offer to the President the communications capability to address the American public during a national emergency. The system also may be used by state and local authorities to deliver important emergency information such as AMBER (missing children) alerts and emergency weather information targeted to a specific area. The EAS allows participating providers to send and receive emergency information quickly and automatically, even if their facilities are unattended. If one link in the system for spreading emergency alert information is broken, members of the public have multiple alternate sources of warning. Along with its capability of providing an emergency message to the entire nation simultaneously, the EAS allows authorized state and local authorities to quickly distribute important local emergency information. EAS equipment can directly monitor the National Weather Service for local weather and other emergency alerts, which local broadcast stations, cable systems, and other EAS participants can then rebroadcast, providing an almost immediate relay of local emergency messages to the public (FCC, 2011). Since they are broadcast over standard television and radio systems, EAS signals would be affected by any Project-related impacts to those systems.

3.16.2 Direct and Indirect Impacts Presented by Alternative

No significant issues specifically relating to telecommunications were identified during the public scoping process. Telecommunication concerns associated with the construction of a wind energy facility include the potential for interference to microwave, TV, radio, cellular/PCS telephone, and land mobile radio reception.

Impacts are discussed below using the following indicators to focus the discussion: inconvenience to local businesses and residents, and compliance with federal telecommunication standards.

3.16.2.1 Proposed Action

As a result of the construction and operation of 17 turbines, the Proposed Action could potentially affect telecommunications in Bennington County and the immediate vicinity of the Project area. Although unanticipated, temporary communication interference as a result of Project construction may occur. In some instances, cranes used during construction activities (and the individual turbine components being raised by the cranes) may cause temporary obstruction of microwave links as well as some degradation to TV and radio signals (Polisky, 2006). However, because there are no microwave paths that cross the Project, microwave interference by equipment assembling and erecting these turbines is not anticipated.

In the unforeseen event that disruptions to existing communication systems occur as a result of Project construction, they would be temporary, and would only occur during the erection of individual turbines. Because turbine installation/crane activity would occur at different locations and at different times during the construction period, any degradation/disruption to existing communications would not represent a constant interference to a given TV/radio reception area. (Polisky, 2006). In addition, turbine erection would be performed as efficiently as possible (under favorable conditions, one turbine can be erected in one day).

Microwave Analysis

To assure an uninterrupted line of communications, a microwave link should be clear, not only along the axis between the center point of each antenna, but also within a mathematical distance around the center axis known as the Fresnel Zone. As described above, Comsearch performed database searches for microwave paths in the Project area in 2006 and in 2010. No licensed microwave paths were identified within the Project area (Comsearch, 2006, 2010). Therefore, none of the proposed turbines would conflict with licensed microwave systems, and no adverse impacts would result from the Proposed Action.

Mobile Telephone and Land Mobile Radio Analyses

Telephone communications in the cellular and PCS frequency bands would be unaffected by the presence of the wind turbines in the Project area. Mobile telephone signals are designed to be able to reach more than one cell within a system. Because of the way these systems are designed to operate, any signal blockage caused by wind turbines would not materially degrade the network. Therefore, local obstacles are not normally a problem for these telephone systems, whether they are installed in urban areas near large structures and buildings, or in a rural area such as the Project area (Comsearch, 2008a).

The operation of LMR repeaters are generally unaffected by the presence of wind turbines due to the radio wave propagation characteristics at these frequencies and the modulation characteristics of LMR repeaters. Due to these factors, negligible change in the coverage of the repeaters would be expected from the Proposed Action (Comsearch, 2008b).

Though not anticipated based on the findings of the Comsearch study, if a cellular or PCS company were to claim that their coverage has been compromised by the presence of the proposed turbines, coverage could be restored by installing an additional cell or an additional sector antenna on an existing cell for the affected area. Utility, meteorology, and/or the turbine towers within the Project area could serve as the structure platforms for the additional cellular or PCS base station or sector antennas. Similarly, if there is a reported change in LMR coverage in the area, it can be corrected easily by repositioning or adding repeaters that operate with the LMR mobile systems. This could be accomplished by adding or positioning the repeaters at locations within the Project area. Repeater antennas could also be installed on utility, meteorological, or turbine towers within the Project area, if needed. The installation of these antennas on any Project facilities would be subject to review and approval by the Towns of Searsburg and Readsboro, and the Forest Service.

Television Analysis

As described in Section 3.16.1.2, the main causes of interference with television reception are electro-static interference, and electro-mechanical, electromagnetic, or radio frequency interference. Electro-static interference is primarily associated with extremely high voltages, and tends to affect devices that are nearby. However, the voltages associated with the Project would not be at a level that normally creates electro-static interference. Furthermore, all residences are located beyond the area that could potentially be affected. Electro-mechanical, electromagnetic, and radio frequency interference can occur when turbines or their electrical emissions obstruct broadcast signals. Because the turbines meet FCC limits on electrical emissions, electromagnetic and radio frequency interference would not occur. However, there is potential for the turbines to have a minimal electro-mechanical distortion on television reception. Such interferences primarily depend upon the location of the wind turbines in relationship to the broadcast antennas and the pathway to the individual receptors. Since there are multiple broadcast stations, a receptor may experience distortion in one channel and none in the other channels (Polisky, 2008).

High-power television broadcast stations ceased analog operations in June 2009 and began broadcasting exclusively in digital format. Low-power TV broadcasters and translators were exempt from the FCC's digital requirement, and may still broadcast analog signals. Since translator stations rebroadcast high-power stations to a limited local audience, their programming is typically in digital format as well. Analog television broadcast signals are subject to variations in signal level by the motion of wind turbine blades, which may result in distortions in the contrast, brightness, and clarity of the video. In addition, changing reflections produced by the motion of wind turbine blades may cause ghosting. Digital television signals are also subject to level variations and reflections, but as long as the signal remains above the operational threshold of the receiver, the video produced is unaffected. Wind turbines can cause signal attenuation in both analog and digital signals. However, because they require a much lower signal level to produce excellent video, digital signals can withstand the attenuation effect to a greater extent. For analog television, as the signal is degraded by external effects, video quality is reduced in a sliding scale of performance. For digital television, as the signal is degraded, the video quality remains excellent until the signal level falls below the operational threshold of the receiver. In the two years since the conversion to digital broadcast, there has been an improvement in television reception in the vicinity of wind energy facilities (Polisky, 2011).

A number of public comments received on the SDEIS raised concerns about potential impacts to the DCTV headend facility, which receives off-air and satellites broadcasts and distributes that programming via subscription cable service. In a technical memorandum found in the Project Record, Comsearch (2008c) concluded that the Project would not adversely affect TV reception at the DCTV facility. Because the turbines would not physically obstruct the signals, and the turbines would comply with FCC limits on electrical emission levels, TV programming from satellites would not be obstructed. With regard to off-air TV, calculations show that the interference levels would be well below the sensitivity and operational levels of the receivers. There would be physical attenuation of off-air TV signals in one 18.5º sector from relative azimuths of 262.5º - 281º. The TV signal attenuation would be no greater than 2.5 dB, which would have no measureable effect on the quality of the TV signal received at the headend facility. This analysis was conducted using standard telecommunication modeling techniques, FCC regulations for interference emissions from electrical devices, and data collected by Comsearch from various wind energy facilities in the United States (Comsearch, 2008c; Polisky, 2008).

The State review process's Certificate of Public Good concluded "there is no indication that the Project will interfere with television signal reception at the DCTV headend facility in Wilmington or interfere with residential off-air, broadcast television reception." Condition #42 of the CPG specifically addressed television reception:

- Prior to commencement of construction, Deerfield Wind would conduct a study of reception quality at the Duncan Cable TV Service ("DCTV") headend facility in Wilmington, Vermont, and provide a copy of this study to the Board, the Department of Public Service, and DCTV.
- The study would measure and document the off-air signal strength and video quality received at the DCTV headend for analog and digital television stations of sufficient quality for commercial distribution (defined as having at least 20 dB carrier to noise ratio), and the signal strength received at the DCTV headend of each FM radio station that DCTV distributes to its subscribers as of the date of the study.
- Signal levels would be measured using a commercially available test antenna with a known gain figure. The study would include a one-minute recording of each measured television channel and radio station. Measurements and recording would be conducted no more than 45 days prior to commencement of construction.

- DCTV would be required to allow Deerfield Wind access to the DCTV headend facility, as necessary, to conduct the baseline study with at least 7 days advance notice. DCTV personnel would be permitted to observe all measurements and recordings taken at the DCTV headend facility.

- Deerfield Wind would be required to provide notice of at least seven days to DCTV prior to commencement of commercial operation of the turbines. Deerfield Wind would remediate any material interference at the DCTV headend facility caused by operation of the Project. Within two weeks of receipt of a complaint, Deerfield Wind would be required to complete an interference measurement study for the DCTV headend facility, and provide a copy of this study to DCTV, the Department of Public Service, and the PSB. If the interference measurement study demonstrates that the Project is causing material interference at the DCTV headend facility, Deerfield would be required to submit, at the same time, a plan and schedule for remediation to DCTV, the Department of Public Service, and the PSB. Deerfield Wind would be required to complete remediation within two weeks of the date it submits any remediation plan, and to submit to DCTV, the Department of Public Service, and the PSB a report demonstrating the elimination of the interference upon completion of the remediation work.

- Deerfield Wind and DCTV would be required to make good faith efforts to resolve amongst themselves any disputes concerning the methodology for investigating or remediating a complaint, or the time frame for completion of remediation. Unresolved disputes may be taken to the PSB for resolution, and would be in an expedited manner.

- During operation of the Project, Deerfield Wind would be required to investigate complaints of Project-related interference with television broadcast signals received at any residence. Deerfield Wind would use commercially practicable efforts to remediate material interference experienced at any residence affected by the Project. Deerfield Wind and the affected homeowner(s) would be required to make good faith efforts to resolve amongst themselves any disputes concerning the methodology for investigation or remediating a complaint, or the time frame for completion of remediation. Unresolved disputes may be taken to the PSB for resolution.

Should the Responsible Official decide to issue a land use authorization for the Proposed Action, the Forest Service permit would require compliance with the terms and conditions of the CPG. Condition #42, described above, would require pre-construction monitoring of television signals at the DCTV headend facility, and ensure for remediation in the unlikely event of interference.

AM Radio Analysis

It is unlikely that the Project would interfere with existing AM radio transmissions, because all proposed wind turbines within the Project area are located farther than 1 kilometer from a non-directional AM broadcast station and/or 3 kilometers from a directional AM broadcast station.

National Telecommunications and Information Administration Notification

Compliance with federal communication standards was determined based on correspondence received from the NTIA, which states that there are no identifiable Project-related concerns related to signal blockage.

Emergency Alert System

Public comments received on the SDEIS raised concerns about potential impacts to the emergency alert system. As described in Section 3.16.1.7, EAS signals are broadcast over standard television and radio systems, and would thus be affected by any Project-related impacts to those systems. Potential impacts to television and radio systems have been assessed in this Section, immediately above. In summary, the Project is not anticipated to result in adverse impacts to existing television or radio transmissions. Therefore, the Project is not anticipated to result in adverse impacts to the emergency alert system.

Summary of Proposed Action Impacts

In conclusion, little or no inconvenience to local businesses and residents would be expected due to interference with existing telecommunications in the area. The Proposed Action would be in compliance with federal telecommunication standards. The Applicant would address any issues that arise on a case by case basis in the unlikely event that Project operation results in impacts to existing off-air TV coverage, including emergency broadcasting signals. Condition #42 of the CPG requires the Applicant to conduct pre-construction studies of television signals at the DCTV headend facility. The CPG also provides guidance for resolving any complaints about interference, and gives the PSB authority to expedite any unresolved disputes.

3.16.2.2 Alternative 1: No Action

Under the No Action alternative, no turbines or other Project components would be constructed, and therefore no direct, indirect, or cumulative impacts to telecommunications would be anticipated.

3.16.2.3 Alternative 2: Reduced Number of Turbines in Western Project Site

Reducing the number of turbines could potentially reduce any direct and indirect impacts on telecommunications that result from the construction and operation of the Proposed Action. However, in light of the analyses conducted by Comsearch, very little to no impacts are expected during both the construction and operation of the Proposed Action. Thus, a reduced number of turbines in the Western Project site would also result in little or no impact, and also not result in additional measurable reduction of impacts to telecommunications as compared to the Proposed Action.

3.16.2.4 Alternative 3: Turbines in the Eastern Project Site Only

As stated for the Proposed Action and Alternative 2, elimination of the turbines on the Western Project site would also result in little, if any, measurable adverse impacts.

3.16.3 Cumulative Impacts

The cumulative impacts analysis area would be the same area used for direct and indirect impacts, which is the Project area and nearby air space. Little or no impacts have been reported for the existing Searsburg Wind Facility and no other facility has been constructed in the last 5 to 10 years that would produce an adverse impact to telecommunications. Due to the remote location of the Project site, as described above, little or no interference from microwave, TV, radio, cellular/PCS telephone and land mobile radio reception is anticipated from construction of the Proposed Action or any of the alternatives. No other similar facilities with similar potential to disrupt telecommunications are anticipated to be constructed in the Project area or nearby for the next 5 to 10 years. Therefore, there would no cumulative impacts to telecommunications.

3.17 Safety and Security

This chapter discloses the impacts of the Proposed Action with regards to public safety and security. Also included is background information on public health, safety, and security concerns associated with construction and operation of the proposed wind energy.

3.17.1 Affected Environment

Public safety concerns associated with the construction of a wind project are fairly standard construction-related concerns. These include the potential for injuries to workers and the general public from the movement of construction vehicles, equipment and materials; falling overhead objects; falls into open excavations; and electrocution. These types of incidents are well understood, and do not require extensive background information.

The proposed wind turbines would be situated a minimum of 0.5 mile from the nearest private homes and 0.2 from the nearest public roads. No designated hiking trails, snowmobile trails or other developed recreational resources are located in the immediate vicinity of the Project site. However, several miles of designated snowmobile trails do traverse the Project area. The closest designated trail to the Western Project site (VAST Corridor 7 Trail) is approximately 0.5 mile west of the nearest turbine. The closest designated trail to the Eastern Project site (VAST Corridor 9 trail) is approximately 0.8 mile south of the nearest turbine.

Big and small game hunters occasionally visit the area before and during hunting season. The area is popular for bear hunters. Due to its remoteness and the lack of maintained hiking trails, the area experiences only occasional hiking use.

Wind energy facilities may be considered safer than other forms of energy production, since combustible fuel sources and fuel storage are not required. In addition, use and/or generation of toxic or hazardous materials are minor when compared to other types of generating facilities. However, wind turbines are generally more accessible to the public, and risks to public health and safety can be associated with these facilities. Examples of such safety concerns include ice shedding, tower collapse and blade failure, stray voltage, fire, and lightning strikes. Moreover, wind energy facilities share similar electrical infrastructure requirements with more conventional power generating projects, and therefore, public safety concerns include the potential for overexposure to electromagnetic fields (GEC, 2005).

3.17.1.1 Ice Shedding

Ice shedding, or ice throw, refers to the phenomenon that can occur when ice accumulates on rotor blades and subsequently breaks free and falls to the ground. Icing on rotor blades would generally result from freezing rain events that form a "glaze" ice when the rain contacts cold surfaces at temperatures close to 32^0 F. Rime ice can occur when super cooled moisture in the atmosphere contacts cold surfaces at or below 32^0 F. Under such conditions, ice would build up on the rotor blades and/or sensors, slowing its rotational speed and potentially creating an imbalance in the weights of the blades. Such effects of ice accumulation can be sensed by the turbine's control system and would result in the turbine being shut down until the ice melts.

Field observations and studies of ice shedding indicate that most ice shedding occurs as air temperatures rise and the ice on the rotor blades begins to thaw. Therefore, the tendency is for pieces of ice to drop off the rotors and land near the base of the tower (Morgan & Seifert, 1998). Ice can potentially be "thrown" when ice begins to melt and stationary turbine blades begin to rotate again (although usually turbines do not restart until the ice has largely melted and fallen straight down near the base). Several observational studies and mathematical models examining this phenomenon have calculated how far ice potentially can be thrown from a moving rotor blade before hitting the ground (Morgan & Bossanyi, 1996). The distance traveled by a piece of ice depends on a number of factors, including: the position of the blade when the ice breaks off, the location of the ice on the blade when it breaks off, the rotational speed of the blade, the shape of the ice that is shed (e.g., spherical, flat, smooth), and the prevailing wind speed (GEC, 2005).

3.17.1.2 Tower Collapse and Blade Failure

Another potential public safety concern is the possibility of a wind turbine tower collapsing or a rotor blade dropping or being thrown from the nacelle. While uncommon, such incidents do rarely occur, and can be dangerous for project personnel, and potentially for the general public as well. A 2006 report prepared for the California Energy Commission provides a literature review of turbine blade failure. The reasons for a turbine collapse or blade failure vary depending on conditions and tower type. Past occurrences of these incidents have generally been the result of incorrect design for ultimate and/or fatigue loads, poor quality manufacturing, improper maintenance, unforeseen environmental events, human error, or lightning strikes. Although many turbine failures have resulted from a combination of these factors (Larwood & van Dam, 2006), evidence suggests that human error in interfacing with control systems is the most common cause of blade failure (Garrad Hassan, 2007). Most instances of blade failure and turbine collapse were reported during the early years of the wind industry. Technological improvements and mandatory safety standards during turbine design, manufacturing, and installation have greatly reduced such occurrences.

One of the existing Searsburg towers collapsed in September 2008, during high winds associated with Hurricane Ike. The accident occurred when one blade failed and struck another blade, causing both blades to hit the tower, bringing the entire turbine down. Green Mountain Power determined that the initial blade failure was the result of a faulty repair completed earlier in the summer. No one was harmed in the incident, and damage was confined to the specific turbine site. The remaining 10 turbines were not damaged and continue generating power (Porter, 2008; Smallheer, 2008). Replacement of the damaged turbine has been completed, and it is expected to be operational by fall 2011.

3.17.1.3 Stray Voltage

Stray voltage is a phenomenon that has been studied and debated since at least the 1960s. It is an effect that is primarily a concern of farmers whose livestock can receive electrical shocks. Stray voltage can be defined as a "low level of neutral-to-earth electrical current that occurs between two points on a grounded electrical system" (Wisconsin Rural Energy Management Council, 2000). Stray voltage typically originates from low levels of alternating current voltage on the grounded conductors of a wiring system. These voltages are termed "stray voltage" when they are large enough to form a circuit when a person or an animal touches simultaneously two objects which are part of an electrical system.

The occurrence of stray voltage may result from a damaged or poorly connected wiring system, corrosion on either end of the wires, or weak/damaged insulation materials on the "hot" wire. Wind power projects and other electrical facilities can create stray voltage to varying degrees, based on factors such as operating voltage, geometry, shielding, rock/soil electrical resistively, and proximity. Stray voltage from such facilities usually only occurs if the system is poorly grounded and located in proximity to ungrounded or poorly grounded metal objects (fences, buildings, etc.). The occurrence of stray voltage can be eliminated by incorporating proper grounding techniques within and around project components.

3.17.1.4 Fire

Wind turbines, due to their height, physical dimensions, and complexity, have the potential to present response difficulties to local emergency service providers and fire departments. Although the turbines contain relatively few flammable components, the presence of electrical generating equipment and electrical cables, along with storage and use of various oils including diesel fuels, lubricating oils, and hydraulic fluids, does create the potential for fire or a medical emergency within the tower or the nacelle, or in places where these oils may be stored such as the substation, in electrical transmission structures, staging area(s), and the O&M building. This, in combination with the elevated location of the nacelle and the enclosed space of the tower interior, makes response to a fire or other emergency difficult, and beyond the capabilities of most local fire departments and emergency service providers.

3.17.1.5 Lightning Strikes

Due to their height and metal/carbon components, wind turbines are susceptible to lightning strikes. Statistics on lightning strikes to wind turbines are not readily available, but it is reported that lightning causes four to eight electrical faults per 100 turbine-years in northern Europe, and up to 14 faults in southern Germany (Korsgaard & Mortensen, 2006). Most lightning strikes hit the rotor, and their effect is highly variable, ranging from minor surface damage to complete blade failure. Over a five-year period from 1997 to 2002 two different lightning strikes reportedly hit and damaged turbine blades at the Searsburg Wind Facility (Leaning, 2002). According to GMP, a lightning strike is also thought to be responsible for a broken blade that occurred in February 2006. All modern wind turbines include lightning protection systems, which generally prevent catastrophic blade failure.

3.17.1.6 Electromagnetic Fields

Power frequency electromagnetic fields (EMFs) are time-varying fields that mimic the nature of the electrical signal producing them. As the current traveling through a transmission line sweeps from its negative and positive maxima (at a frequency of 60 Hz in the United States), the EMF does precisely the same. The result is a 60 Hz EMF which is strictly governed by physical laws, as described in the analysis of EMF prepared for the Project by Gradient Corporation, entitled *Electric and Magnetic Field (EMF) Analysis for PPM Energy, Inc.* (available in the Project Record) (Gradient Corporation, 2007). While Earth's gravitational field is constant over time and pertains to bodies of matter, EMF influences bodies of charge, and depending on how the fields are created, they may be time-varying. But, similar to gravitational forces, the strength of EMF produced by electric lines diminishes rapidly with increasing distance (as the square of distance) from the source.

The energy generated by the Project would produce the type of EMF described above around the overhead and underground power lines. There are currently no federal guidelines for occupational or residential exposure to the type of 60 Hz EMF generated by the transmission of electrical power in the United States. This might be due to the large number of studies that have failed to make a causal link between exposure to EMF and diseases, or the historically weak statistical association between EMF and health risks. Nonetheless, the International Agency for Research on Cancer did designate EMF as a Class 2B carcinogen – or "possibly carcinogenic" (IARC, 2002).

3.17.2 Direct and Indirect Impacts Presented by Alternative

No significant issues specifically relating to safety and security were identified during the public scoping process. Impacts are discussed below using the following indicators to focus the discussion pertaining to the operation of the facility: ice shedding, tower collapse and blade failure, stray voltage, fire, lightning strikes, and EMF. Safety and security impacts connected with general facility construction are discussed first, followed by concerns regarding operations. Design criteria and any special measures used to reduce impacts are discussed within each of the sub-sections below. All the impacts described below are best characterized as direct impacts. There are no tangible indirect impacts regarding safety and security.

3.17.2.1 Proposed Action

In brief, overall safety and security risks of the Proposed Action would be anticipated to be minimal. Factors that affect safety considerations include the siting of the Project's 17 turbines in an undeveloped and lightly used area approximately 0.5 mile from the nearest residence; the safety and structural features designed to guide, monitor, and if needed, shut down operations in the event of a safety concern; and the plans and procedures that would guide and direct responses to an emergency. The Final Order dated April 16, 2009 that accompanied the Vermont PSB's Certificate of Public Good for the Project addresses Public Health and Safety in Findings 125-129, and concludes that "the Project will not have an undue adverse impact on public health and safety" (PSB, 2009:45-46).

3.17.2.1.1 Construction

As noted in Section 3.17.1 above, public safety concerns associated with Project construction include the movement of large construction vehicles, equipment and materials, falling overhead objects, falls into open excavations, and electrocution. These concerns are most relevant to construction personnel who would be working on-site.

Risk of construction-related injury would be minimized through regular safety training for construction personnel, use of appropriate safety equipment, and compliance with applicable construction safety standards. All construction personnel would be required to adhere to safety compliance program protocols that would be prepared prior to construction. Any terms and conditions of the Forest Service Special Use permit applicable to facility construction would be enforced. Contractors would comply with all Occupational Safety and Health Administration (OSHA) regulations during construction, in addition to state worker safety regulations regarding electricity, structural climbing, and other hazards.

In addition, material safety data sheets for potentially hazardous construction materials would be provided to local fire and emergency service personnel. Construction managers would also coordinate with these entities to assure that they are aware of where various construction activities are occurring, and avoid potential conflicts between construction activity and the provision of emergency services (e.g., road blockages, etc.).

The general public could also be exposed to construction-related hazards due to the passage of large construction equipment on area roads and unauthorized access to the work site (on foot, by motor vehicle, ATV, or snowmobile). Construction activities would occur primarily on Forest Service land and to the maximum extent practical would be located away from proximal roads and residences. The majority of the construction would take place approximately 0.5 mile from the nearest private homes. Public access to the Project site during construction would be restricted by locked gates and signage. The general public would not be allowed on the construction site, and, after hours, vehicular access to such sites would be blocked by parked equipment or temporary fencing. Temporary construction fencing or other visible barriers would be placed around excavations that remain open during off hours.

In the event that blasting is required to install the foundations for the towers, the contractor would contract a licensed, bonded, and insured blasting company. Blasting would be conducted in compliance with safety measured detailed in a Blasting Plan, prepared following receipt of permits and prior to construction. The plan would be provided in advance to the appropriate local and regulatory agency personnel. All abutting landowners would be notified in advance of planned blasting operations and warning sirens and radio communication controls would be utilized if necessary. Because on-site storage of explosives (dynamite or ammonium nitrate) is not permitted, materials would be brought to the site on an as needed basis. The blasting company would obtain all necessary licenses, bonding and local permitting per standard industry practice and applicable regulations.

Safety, environmental protection, and QA/QC inspections of the major facilities and equipment would also assure that the Project is constructed in a manner that minimizes risks to the public and Project personnel. These inspections would typically include the following components and procedures:

- review of safety procedures
- wind turbine generators and towers inspections
- concrete/structural inspections
- electrical collection system inspections
- turbine transformers and main substation transformers inspections
- substation breaker inspections
- substation relaying and instrumentation inspections
- substation structural steel work inspections

Forest Service permit administrators would also participate in construction oversight and safety inspections to enforce the terms and conditions of the Forest Service Special Use permit.

3.17.2.1.2 Operations

General Public and Personnel Access

To reduce safety and security concerns, public access to the facility shall be limited in accordance with the terms and conditions established in a public access control plan. This plan would be incorporated as necessary into the Special Use permit issued by the Forest Service and will also consider any requirements resulting from the State PSB approval process. The public access control plan for the existing Searsburg Wind Facility would also be considered in developing the Project access control plan. The Searsburg Wind Facility plan has been very effective as there have been no public health or safety issues encountered.

A public access control plan may include the following measures, if appropriate and consistent with Forest Service management objectives:

- As desired, posting the property around the site with signs warning the public of potential safety issues, such as high voltage, ice shedding, and so on.
- Any area closures desired to restrict access and provide for site security.
- Gating the access roads to limit unauthorized vehicle use.

- Planting vegetation to further limit unauthorized entry onto the access roads from points beyond the gated entry.

- Monitoring plans to measure effectiveness of the public access control plan. This would include, for instance, monitoring of the area surrounding the access roads to see if unauthorized access by illegal off-highway vehicles, in particular ATVs, is occurring and what additional measures may be warranted.

There is no plan currently to gate the entire facility. The new substation, approximately 0.5 acre in size, would be enclosed in a chain link fence approximately 8 feet high for security and safety purposes. The fenced area would contain transformers, electrical switchgear, and other components that would be generally less than 25 feet in height. Lightning protection devices would extend as high as approximately 45 feet. In order to address public concerns raised in regard to the proposal in the DEIS to close the area immediately surrounding the turbines and access roads, that proposed closure would not be implemented. Public access to public lands adjacent to the Project site would not be restricted, except for gating the access roads and fencing some of the ancillary facilities as described. The public would still have access to much of the Project area for dispersed recreation (e.g., hunting, snowmobiling, hiking, skiing). Fencing/gating would close the access roads to public vehicle use.

Safety signing would be posted around the roads, turbines, and all ancillary facilities where necessary, in conformance with state and federal regulations and guidelines. Public use of the area would be monitored during the first one or two years of operation and, if necessary for public safety, site security, or to minimize potential disturbance to black bears (see Section 3.12.2.1.2), an area closure could then be implemented surrounding the access roads and turbines, with a setback of an appropriate number of feet from the edge of the facilities (roads and turbines).

In addition to monitoring the public access control plan, the performance of the physical plant (i.e., the operating facility) would be also be monitored. Any abnormal events that may pose a risk to the public would be detected and the O&M personnel or proper authorities would be notified to take corrective action.

Ice Shedding

Turbine icing would occur at times, but any ice that accumulates on the rotor blades would likely cause an imbalance or otherwise alert turbine sensors, which have been designed to shut down. As the ice begins to thaw, it would typically drop straight to the ground. Any ice that remains attached to the blades as they begin to rotate could be thrown some distance from the tower. However, such a throw would usually result in the ice breaking into small pieces, and falling near the tower base.

Data gathered at existing wind facilities has documented ice fragments on the ground from 50 to 328 feet from the base of the tower (from turbine having <33 to 197 foot rotor diameters). These fragments were in the range of 0.2 to 2.2 pounds in mass (Morgan & Seifert, 1998). The risk of ice landing at a specific location is found to drop dramatically as the distance from the turbine increases.

Studies of safety distances for wind turbines indicate that an appropriate (and conservative) safety distance, beyond which the probability of being injured by falling ice is very low, is approximately one and one half times the sum of a turbine's hub-height plus its rotor diameter (Tammelin & Seifert, 2000; Wahl & Giguere, 2006). For the highest turbines being considered for this Project, this corresponds to a distance of 1.5 X (80 meters + 90 meters) = 255 meters (836 feet). This distance is significantly less than the distance that would exist between the closest Project turbine and the nearest private homes (approximately 0.5 mile) or public roads (approximately 1,290 feet). The surrounding overstory vegetation and the very low public use of the surrounding area, especially in the winter, would reduce the chances of being hit by falling ice to an extremely low level. Signs would be posted around the facility to alert the public and maintenance workers of the potential ice shedding risks.

Because the closest designated snowmobile trail to the Western Project site is approximately 0.5 mile west of the nearest turbine, no snowmobile restrictions are necessary. Although no new snowmobile trail development is expected within the Project area, any new trails would take into consideration safety concerns of the facility. If need be, the Forest Service, and facility operator would also meet with local landowners and VAST (which maintains designated trails for permitted snow travelers across private and GMNF lands) to explain the risks of ice shredding and proper safety precautions.

It is important to note that while more than 55,000 wind turbines had been installed worldwide as of 2005, there were no reported injuries to the public caused by ice being thrown from a turbine (GEC, 2005; Jaffe, 2006). Site technicians would follow year-round proper safety procedures, developed by the facility operator and the Forest Service based on experience and applicable federal and state safety regulations. It is also instructive to note that there have been no instances of injury as a result of icing conditions reported at the existing Searsburg Wind Facility since it has been in operation (Zimmerman, 2008).

Design criteria could be required to further determine the effects of icing. Ice detectors could be installed on any meteorological towers erected on-site, and on selected wind turbines (as necessary) to alert maintenance personnel of icing conditions, and allow for turbine shutdown and/or notification to area residents if so desired. To determine if ice detectors are warranted, monitoring of icing would be done during the first winter, and subsequent winters if needed. A decision to add ice detectors would be made by the Forest Service, in cooperation with the site operator and considering any State PSB approval requirements.

Based on the siting of the Project and the proposed control of public access to the turbine sites, it is not anticipated that the Project would result in any measurable risks to the health or safety of the general public due to ice shedding.

Tower Collapse and Blade Failure

The recognition of the circumstances under which this type of phenomena becomes a safety hazard has led to the advancement of turbine technology, which in turn has eliminated much of the potential for impacts to safety and security. Technological improvements and mandatory safety standards during turbine design, manufacturing, and installation have greatly reduced occurrences of tower collapse and blade failure. When compared with the blade failure rates of earlier turbine models from the 1980's and 1990's (like the turbines at the existing Searsburg facility), the overall blade failure rate of modern commercial turbines has declined by a factor of three. This is primarily due to the improved reliability of modern commercial wind turbines (Larwood & van Dam, 2006). State-of-the-art braking systems, pitch controls, sensors, and speed controls on wind turbines have greatly reduced the risk of tower collapse and blade failure (including blade throw).

As indicated above, evidence suggests that human error in interfacing with control systems is the most common cause of blade failure. Manufacturers have reduced that risk by limiting human adjustments that can be made in the field (Garrad Hassan, 2007). The reduction in blade failures also coincides with the widespread introduction of wind turbine design certification and type approval. Modern utility-scale turbines are certified according to international engineering standards, which include ratings thresholds for withstanding different levels of hurricane-strength winds and other criteria. The engineering standards of the wind turbines proposed for this Project are of the highest level, and are required to meet all applicable federal, state, and local codes. The design specifications are based on established construction standards set forth by the various standard industry practice groups such as:

- American Concrete Institute
- International Electrotechnical Committee
- National Electric Code
- National Fire Protection Agency
- Construction Standards Institute

The certification bodies perform quality control audits of the blade manufacturing facilities, and perform strength testing of construction materials. These audits typically involve a dynamic test that simulates the life loading and stress on the rotor blade. This approach has largely eliminated blade design as a root cause of blade failures (Garrad Hassan, 2007). The wind turbines proposed for the Project would be equipped with two fully independent braking systems that allow the rotor to be brought to a halt under all foreseeable conditions. The design of structural elements of the turbines and other systems would also be reviewed and approved by licensed professional engineers. Furthermore, the turbines are designed to automatically shut down at wind speeds over the manufacturers threshold (approximately 56 mph), and would also shut down if significant vibrations or rotor blade stress were sensed by the turbines' blade monitoring system.

For all of these reasons, the risk of catastrophic tower collapse or blade shear at modern wind energy facilities is minimal. To address the small risk of tower or blade failure (including blade throw), a setback from public roads and residences equivalent to the turbine fall zone is generally considered adequate for public safety purposes. A fall zone is the land surrounding a wind turbine that could be affected by debris should the supporting structure or components collapse and fall to the ground. In those rare instances where towers or blades have failed, the failure typically results in components crumpling or falling straight down to the ground. However, under certain circumstances, blade parts can be thrown from a spinning wind turbine. It would be very unusual for the entire tower to break off at the base and fall over. Fall zone setbacks ensure that even a "worst case" tower failure would not endanger residential structures or public roadways. Under the Proposed Action, the turbines would all be located in relatively remote, isolated locations, a minimum of 0.5 mile from the nearest residence, and a minimum of 1,290 feet from the nearest public road. These distances far exceed the fall-zone for the proposed turbines.

Stray Voltage

Stray voltage is preventable with proper electrical installation and grounding practices. The Project's power collection system would be properly grounded and would not be connected to the local electrical distribution lines that provide electrical service to farm buildings and homes. In addition to proper grounding of the equipment, the turbines are proposed to be erected on undeveloped, forested land that does not have any buildings closer than 0.5 mile. Therefore, it is highly unlikely that stray voltage would affect humans or farm animals in the Project area. Potential impacts to wildlife would be minimized due to proper installation and grounding practices.

The Project's electrical collection lines would be located at least 36 inches below ground, and the interconnection lines would be overhead to prevent incidental contact and to protect insulating materials from sustaining any damage. Proper grounding, installation, and maintenance practices would assure that the Project does not cause or contribute to stray voltage in the area.

Fire

Fire at these facilities could result from a lightning strike, short circuit, or mechanical failure/malfunction. However, all turbines and electrical equipment would be inspected by the local utilities (for grid and system safety) prior to being brought on line. This inspection, along with implementation of built-in safety systems, minimizes the chance of fire occurring in the turbines or electrical stations. The likelihood of fire at the facility would be further minimized by routine inspection and repair by qualified personnel pursuant to preventative maintenance schedules (Habig et al., 2008; PSB, 2009:45)

Implementation of a Site Control and Data Acquisition system would be a design criteria to address system failure. Any of the above occurrences (lightning strike, short circuit, or mechanical failure/malfunction) at a turbine would be sensed by the system and reported to the Project control center. Such a centralized system would monitor the condition of the facility's equipment, alert service technicians to any fault or alarm conditions, record and sort data, and allow remote control of the turbines. Under such conditions, the turbines would automatically shut down and/or Project site personnel would notify local officials and respond pursuant to detailed emergency procedures (PSB, 2009:46).

In the unlikely event that a wind turbine catches fire, standard industry practice is to allow the fire to burn itself out while maintenance and fire personnel enact fire suppression and control measures at ground level as necessary (Habig et al., 2008; PSB, 2009:46). Power to the section of the Project with the turbine fire is also disconnected. Oil inside the nacelle is air cooled and containment is typically within the nacelle. An effective method for extinguishing a turbine fire from the ground does not exist, and the events generally do not last long enough to warrant attempts to extinguish the fire from the air (GEC, 2005). However, since public use of the land on which the turbines are located and vehicle access to facility components would be restricted, risk to public safety during a fire event would be minimal.

Local emergency service providers (including Deerfield Valley Rescue, Inc., Whitingham Ambulance Services, Inc., the Vermont State Police, the Readsboro and Wilmington Fire Departments, and the Bennington County Sheriff) have provided written or verbal statements indicating that construction of the Project would not pose an undue burden on their ability to provide services (PSB, 2009:46). The Applicant has executed agreements with both the Towns of Searsburg and Readsboro that include commitments to compensate both towns for any incremental costs associated with fire protection services for the Project (PSB, 2009:56; Town of Readsboro, 2008; Town of Searsburg, 2008). Generally, any emergency/fire situations at a wind turbine site or substation that are beyond the capabilities of the local service providers would be the responsibility of the facility operator. All technicians at the facility would be trained and equipped to respond to emergency situations including tower rescue, first aid, and CPR. Fire extinguishers would be standard equipment on all maintenance vehicles. The facility operator would also work with local emergency responders (police and fire departments) to provide tower rescue training, conduct reviews of on-site safety programs, and review appropriate emergency response procedures (Habig et al., 2008; PSB, 2009:56).

Fire is also possible in electrical transmission structures, staging area(s), and the O&M building where the storage and use of various oils including diesel fuels, lubricating oils, and hydraulic fluids create the potential for fire or a medical emergency. The oil containment around the substation transformer is designed to contain full oil volume and is filled with round rock to cool and provide passive suppression. Due to the accessibility of these storage and use areas from access roads, response to an emergency should not pose difficulty to local fire and emergency personnel. However, the presence of potentially hazardous materials as well as high-voltage electrical equipment at the substation could present potential safety risks to local responders.

In accordance with generally accepted wind facility operating procedures, the facility operator would prepare a Fire Prevention and Control Plan in consultation with local fire officials. This would be incorporated into a facility O&M safety manual or procedures guide for the Project, and would also be incorporated into the Forest Service Special Use permit. Any terms and conditions specific to fire prevention and control required by the Forest Service would be included.

With the development and implementation of this plan and other safety measures, risks from fires to public safety, facility personnel, or the personnel and equipment of local emergency service providers would be minimal.

Lightning Strikes

Lightning protection systems were first added to rotor blades in the mid 1990s, and are now a standard component of modern turbines (Korsgaard & Mortensen, 2006). The Gamesa G80 2.0 MW and G87 2.0 MW wind turbine generator models proposed for the various Project alternatives both use a proprietary lightning protection system developed in accordance with International Electrical Commission (IEC) standard IEC 61024-1. The lightning protection system conducts the lightning from both sides of the blade tip down to the root joint and from there across the nacelle and tower structure to the grounding system located in the foundations (Gamesa, 2009a,b). The blade monitoring system for the turbines provides documentation of all critical lightning events. If a problem is detected, the turbine would shut down automatically. Most impacts due to lightning strikes would be localized structural damage to the turbines, but should more serious damage occur, measures would be taken by personnel (i.e. in case of a fire igniting) to ensure a timely response to the problem.

Lightning protection devices extending to heights of approximately 45 feet would be installed at the substation, to minimize risks of damage due to lightning strikes.

The risk of impacts from lightning to facility personnel and the public would be minimal.

Electromagnetic Fields

An analysis of EMF anticipated to be produced by the Project was conducted by Gradient Corporation in October 2007. Models were run using FIELDS software, which calculated the values for both expected electric and magnetic fields as a function of distance from the centerline above or below the proposed lines. The modeling predicted EMF levels emanating from underground lines at a location 3 feet above finished grade directly over a proposed underground line. The modeling predicted EMF levels emanating from overhead lines at a height of 40 feet above finished grade. In summary, the predicted peak value of the electric field directly below the proposed overhead transmission lines is less than 0.05 kV per meter. The predicted peak value of the electric field above the proposed underground cables is zero, due to the lack of electrical permittivity (a material's ability to permit an electric field to pass) through soil.

The result for the modeled peak magnetic field value directly below overhead lines is less than 3 milli-Gauss (mG). The value quickly drops to below 1.0 mG at 50 feet laterally from the centerline. Lastly, the modeling yielded a peak value of approximately 42 mG directly above underground cables.

The ambiguous nature of the evidence supporting EMF as a health risk has delayed the widespread establishment of regulatory standards or guidelines for EMF exposures. National and international health organizations have suggested guidelines based on the concern for risks to public health. Meanwhile, some state regulations have been established so that new transmission lines maintain current levels of EMF, typically at the edge of ROWs. In a position paper dated

April 11, 2005, the Vermont Department of Health's Division of Health Protection evaluated the EMF levels produced by a transmission project against the most stringent state guidelines available (Florida). The Florida guidelines are 2.0 kV per meter and 150 mG at the edge of ROWs. As described above, the modeling results for the proposed activities yielded peak values directly below and above the proposed transmission lines at levels far below Florida's guidelines. In addition, the Project layout provides for conservative setbacks from public access for all EMF generating components such as the switching station, power lines, and turbines

3.17.2.2 Alternative 1: No Action

No new turbines, access roads, or other Project components would be constructed under the No Action alternative, and therefore there would be no safety and security impacts due to ice shedding, tower collapse and blade failure, stray voltage, fire, lightning strikes, or EMF. Public access and use of the area would most likely remain the same as or similar to what exists now.

3.17.2.3 Alternative 2: Reduced Number of Turbines in Western Project Site

Reducing the number of turbines in the Western Project site would slightly reduce the safety and security impacts from those anticipated for the Proposed Action. With two less turbines, the risks from ice shedding, blade failure, turbine collapse, lightning, and fire would be slightly lessened. All collection lines between the Western and Eastern Project sites would still need to be constructed and therefore, stray voltage and EMF concerns would remain the same or very similar to that for the Proposed Action. Fire impacts related to the turbines and supporting facilities including the substation and O&M facility would remain the same. All design criteria regarding safety and access plans would be developed and implemented. Access by the public and facility personnel would remain the same as for the Proposed Action, including closure of access roads to public use.

3.17.2.4 Alternative 3: Turbines in the Eastern Project Site Only

The alternative of developing turbines only in the Eastern Project site would eliminate all safety and security impacts in the Western Project site, with the exception of those associated with the O&M facility, which would remain on the northern corner of the Western Project site. Under this scenario, there would be no turbines in the Western Project site and the substation would be relocated to an area on the Eastern Project site. Risks from ice shedding, blade failure, turbine collapse, lightning, and fire would be lessened due to the removal of 10 turbines. Fire impacts related to the turbines and supporting facilities including the substation and O&M facility would remain the same. All design criteria regarding safety and access plans would be developed and implemented. Access by the public and facility personnel would remain the same as for the Proposed Action, including closure of access roads to public use.

3.17.3 Cumulative Impacts

The cumulative effects analysis area is the same as the Project area. Recent past impacts include the existing string of turbines at the Searsburg Wind Facility that has been operating since late 1997 (slightly beyond the 5 to 10 year period of past activities typically considered for cumulative impacts discussion). This facility produces some level of risks to the safety and security of the public and site personnel in the area, as described above. This in combination with the proposed Project would result in some relatively minor cumulative risk of impacts to safety and security. The same could be said for the Reduced West and the East Side Only alternatives but to a lesser extent because of the fewer turbines proposed for these alternatives. There would be no cumulative impacts for the No Action alternative.

Safety concerns such as ice shedding, tower collapse, blade failure, fire, EMF, and lightning strikes associated with the proposed Project would have an increased probability of occurrence with the cumulative addition of these turbines to the existing Searsburg turbines. However, these concerns would be minimized because the structural and operational design of the turbines include precautionary features such as grounding techniques and shut-off contingencies, as described in the previous sections. Also, the technological advances made to enhance the safety features of wind facility components would further reduce any cumulative impact. In the foreseeable future of the next 5 to 10 years, there are no known projects anticipated which could further contribute to cumulative impacts regarding safety and security.

3.18 Short-term Uses and Long-term Productivity

Pursuant to NEPA regulations (40 CFR 1502.16) an EIS must consider the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity. The Forest Plan describes the desired future condition for the Forest, its productivity goals and objectives, and the allowable activities that would work in moving the Forest toward its desired future condition (USDA Forest Service, 2006a).

The Deerfield Wind Project proposes to construct and operate 17 wind turbines, each capable of generating 2.0 MW, for a combined capacity of up to 34 MW of renewable electric power with no operating emissions of pollutants or greenhouse gases to the atmosphere. Alternatives to the 17-turbine Proposed Action include 15-turbine (30 MW) and 7-turbine (14 MW) configurations, along with No Action. Compared to other energy types consumed by users in the New England states, wind energy currently makes up a small fraction of the region's total energy consumption.[26] The anticipated electrical output would be purchased by Vermont utilities to the extent possible as required by the Certificate of Public Good issued by the PSB, while the remaining power would go into the New England regional electric grid operated by Independent System Operator for New England. According to an agreement executed September 9, 2010, Central Vermont Public Service would purchase two-thirds of the output of the proposed Project (CVPS, 2010).

As stated in Chapter 1.0, the development of the Project furthers Forest Plan Goal 11 to provide opportunities for renewable energy use and development. Forest goals describe desired conditions to be achieved sometime in the future, as part of the long-term plan for the Forest.[27] Although wind projects could result in adverse environmental effects (see Chapter 3.0), energy generated from other nonrenewable sources (i.e., fossil fuels and nuclear) typically have greater adverse environmental and

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[26] Energy Information Administration, 2011. State Energy Data System (SEDS) Complete State-Level Estimates Through 2009 [website]. Available at: http://www.eia.gov/state/seds/, last updated June 30, 2011 (Accessed July 2011).

[27] *See* Green Mountain National Forest *2006 Land and Resource Management Plan* and Section 211 of the Energy Policy Act of 2005 (Public Law 109-58).

public health issues, such as air emissions, greenhouse gas generation, operating impacts, and risk of catastrophic events (e.g., oil spills, nuclear accidents). From this perspective, the proposal would contribute to long-term productivity by capturing wind energy and utilizing this renewable resource for the generation of electric power. In doing so, it would reduce utilization of non-renewable/depletable resources (i.e., conventional forms of fuel), which is one of the goals of the National Environmental Policy Act (Pub. L. 91-190, 42 U.S.C. 4321-4347, Jan 1, 1970 as amended).

Development of any of the action alternatives for the Deerfield Wind Project would result in a short-term use of the area for construction and a long-term use for the operation of the facility. The Project is proposed in the Diverse Forest Use Management Area. The 9,523-acre Project area consists of all NFS and private lands in GMNF compartments 121, 122, 123, and 124. Up to 87.4 acres of this area would be cleared and/or graded for construction of the Proposed Action. NFS lands would account for 73.1 acres of proposed clearing and grading activities; the remaining 14.3 acres would occur on private lands. Lesser amounts of clearing and/or grading are proposed for Alternative 2 (85.4 total acres; 66.5 NFS and 18.9 private lands) and Alternative 3 (49.6 total acres; 29.7 NFS and 19.9 private lands). The area cleared and/or graded is the footprint of Project disturbance, or the Project site. The Project site for the Proposed Action would represent up to 0.9% of the Project area, and 0.02% of the GMNF. Should the land use authorization be granted, the Special Use permit is anticipated to cover approximately 30 to 80 acres, depending on alternative.

Regarding the impact of this short-term use on the long-term productivity of the Forest, the Project would not affect the health of the forest or the wide range of uses that could continue to occur under the current, or future, Forest Plan. The proposal would preserve options for future generations and land managers regarding the long-term use of the Project area. Upon Project decommissioning, the turbines would be removed, and the Project site would be restored to a natural condition. The area would be available for other uses allowed by the Forest Plan in effect at that time. As noted in Chapter 3.0, the design criteria and mitigation measures to protect soil, water quality, and related resources during construction would comply with Forest Plan S&Gs, and the proposed activities would not have a substantial short- or long-term environmental effect (adverse or beneficial).

As noted in the next section, there would be some unavoidable long-term impacts, primarily in two areas: visual characteristics and wildlife. The clearing of the ridge for turbine construction would change the appearance of the landscape for the life of the Project and beyond. This change would not affect the long-term productivity of the forest, as described above. In terms of wildlife, there would most likely be some level of bird and bat mortality, and there is scientific debate about whether the Project would have a short- or long-term effect on black bears and bear habitat (see Section 3.12). There is concern regarding short-term use and long-term productivity as to whether or not unintended consequences would occur to black bear habitat and the bear population in the Project area and surrounding region, as noted in Section 2.5.1. With strict limitations on access and use of the Project site, and with implementation of mitigation measures and design criteria, unacceptable impacts to the long-term productivity of black bear habitat and viability of the bear population would not be expected under the Proposed Action or any of the alternatives.

The Proposed Action and Alternatives 2 and 3 would enhance the long-term productivity of the wind, land and airspace by dedicating these resources to electricity generation by sustainable, non-depletive means for the duration of any land use authorization, expected to be a 30-year Special Use permit. The 17 turbines of the Proposed Action would provide the largest amount of long-term wind energy productivity, followed by the 15 turbines of Alternative 2 (the Preferred Alternative), and the seven turbines of Alternative 3. Although the short-term use of from 30 to 80 acres of NFS lands to construct and operate the wind facility would displace other uses of the Project site to some extent (i.e., timber harvesting, wildlife habitat, dispersed recreational uses), the use of this relatively small amount of GMNF land to generate wind energy would further long-term productivity expressed in the Goals of the Forest Plan.

3.19 Unavoidable Adverse Effects

This section identifies unavoidable adverse effects that may occur as a result of the development of the Proposed Action or one of its alternatives. The use of the Project site for the construction and operation of the wind facility would result in mostly minimal direct and indirect impacts to the physical environment from ground disturbance and changes in land use. The majority of the adverse environmental impacts associated with the Proposed Action and alternatives would be temporary and would result from construction activities. Site preparation (e.g., clearing and grading), and the construction of roads, turbines, collection lines, an O&M facility, and the substation would have short-term and localized adverse impacts on the soil, water, wetlands, vegetation, wildlife and other ecological resources on the Project site. Construction would also have short-term impacts on the local transportation system, air quality, and noise levels. These impacts would largely result from the movement and operation of construction equipment and vehicles. The level of impact to each of these resources has been described/quantified in Chapter 3.0 and would generally be localized and/or of short duration.

Long-term unavoidable impacts associated with operation and maintenance of the Project would include changes in landscape character due to the visibility of the Project; a minor increase in noise levels at some receptor locations (residences and other key locations) within and adjacent to the Project area; changes in the use of approximately 30 to 80 acres of NFS lands and possible influences on the use of surrounding lands; a loss of forestland that would be converted in part to developed open space for the life of the Project; both beneficial and adverse changes in the quality and quantity of wildlife habitat, including the removal of important bear habitat; direct impacts to a total of up to 6,192 square feet of wetlands, depending on alternative: up to 4,475 square feet on private lands (for the East Side Only alternative) and up to 2,502 square feet on NFS lands (for the Proposed Action); and some potential level of avian and bat mortality. Impacts to these resources are fully described in Chapter 3.0. Although adverse environmental impacts would occur, they would be reduced through the use of Forest Plan S&Gs, and various general and site-specific design criteria and mitigation measures, as well as the conditions of the State-issued Certificate of Public Good.

3.20 Irreversible and Irretrievable Commitments of Resources

An irreversible commitment of a resource is one that cannot be changed once it occurs, and thus represents a loss of future options. It applies primarily to resources such as minerals or heritage resources, or to those factors or functional values such as soil productivity that are renewable only over long periods of time. Irretrievable commitments apply to a loss of production, harvest, or use of natural resources. The issuance of a land use authorization and subsequent Special Use permit to construct and operate a utility-scale wind facility on the approximately 30 to 80 acres of NFS land in the Project area would change the use of that parcel for the life of the Project. Production and use of natural resources that would ordinarily occur in a Diverse Forest Use MA would be limited by the dedicated use of the specific site for wind energy development. Consequently, some loss of production of certain resources such as timber would be irretrievable. However, because the turbines and other components of the facility could be removed, and the land restored to natural conditions to the extent possible, the commitment of the land is not considered to be irreversible.

One important commitment of environmental resources would be the removal of between 55 and 470 BSB trees (depending upon selection of one of the action alternatives), along with other beech trees that provide an important food source for black bears. The State ANR considers the concentration of bear-scarred beech (BSB) within the Project area to be among the highest known in the State and significant to bears regionally (see Section 3.12.1.1.1). The ANR also believes this to be an unacceptable loss of necessary bear habitat, especially when the scale of removal for this Project is compared to that for other development projects in Vermont that the ANR has reviewed. Once these specific valued trees are taken, the results cannot be changed and hence, this would be considered irreversible. However, it should be noted that the Project would be removed at the end of its economic life and the area restored to a natural condition. The restoration over a long period of time would most likely replace the loss of production of these beech trees with other beech trees and wildlife habitat; however, unknowns associated with possible climate and other environmental change make this uncertain.

One other irreversible commitment is the loss of soil productivity resulting from conversion of forestland to access roads and turbine pads. Even if the area were to be restored, pre-construction soil productivity could only be restored over a very long period of time.

3.21 Overall Cumulative Impacts for the Deerfield Wind Project

This section summarizes the potential overall cumulative impacts that may result when all potential impacts disclosed for the proposed Deerfield Wind Project are added to the incremental impacts of other past, present, or foreseeable projects, as discussed in the various preceding sections of Chapter 3.0.

3.21.1 Non-Wind Energy Actions

The Proposed Action and the various action alternatives under consideration could combine with other activities on the GMNF and surrounding area to create cumulative effects. For example, if a timber sale were scheduled in the area, this activity, in combination with tree removal associated with the proposed Project, could produce cumulative forest habitat alteration impacts that would affect a variety of wildlife species. Other activities producing impacts to visual, soil and water, and recreational resources within the area, when combined with the activities of the proposed Project, could also result in overall cumulative impacts.

However, no timber sales have occurred within the Project area over the past 15 years, and none are currently scheduled to occur in this area within the next 10 years. As indicated in Section 3.13, there are no developed recreational facilities in the area, and public use within the Project area is well dispersed and generally light. There are no known non-wind energy proposed activities that would produce unacceptable cumulative impacts to visual, soil and water, wetland, noise, cultural/heritage, or ecological resources (see also the various resource sections in Chapter 3.0). The Forest Service is expected to begin work in 2011 on a landscape-scale planning effort for much of the NFS lands in the vicinity of the Project area. It would be at least one to two years beyond 2011 before any definite proposals would be analyzed. No specific proposals are known at this time.

There are also no major activities that have occurred or are anticipated to occur on private lands in the vicinity of the Project site that could contribute to cumulative impacts. There is very little private land within the Project area. No major logging operations, residential housing developments, commercial developments, or highway projects have occurred within the area on private land over the past 10 years that would contribute to overall cumulative impacts to wildlife, ecological, soil and water, visual, or other resources. There are no other known projects or developments pending elsewhere in the vicinity that would remove substantial amounts of beech habitat and BSB, although timber sales on private lands could occur and affect the amount of BSB remaining in the area. However, this in combination with the Deerfield Project should not result in an unacceptable adverse cumulative impact to beech habitat, BSB, or bear populations in the region given the abundance of BSB that would remain available on NFS lands within the four-compartment Project area and the surrounding region.

While it is not possible to predict with certainty the quantity or nature of future residential, commercial, and other development within the Towns of Searsburg and Readsboro, recent historical trends and stated municipal planning objectives allow for a reasonable estimation of future development patterns. The existing Windham Regional (WRC, 2006) and Town of Readsboro (Town of Readsboro, 2010) plans provide information concerning recent development trends, existing conditions, and desired future directions for the area.

As described in Section 3.1, the Windham Region encompasses 27 municipalities in southeastern Vermont (including Searsburg and Readsboro) and has a relatively low overall population (less than 50,000 people in 2000). In the period between 1970 and 2000, the Region experienced sustained population growth at rates slightly below the state average. Between 1990 and 2000, the number of housing units in the Windham Region grew by about 5%, while the number of housing units in Readsboro and Searsburg decreased by 2.5% and 5.4%, respectively (WRC, 2006). Population projections predict moderate or slow regional population growth for the period between 2000 and 2020 (WRC, 2006).

The Windham Regional Plan and Readsboro Town Plan both articulate future land use goals that emphasize revitalizing villages and downtowns, maintaining rural and village character, and limiting sprawl (Town of Readsboro, 2010; WRC, 2006). The recent trends in population, housing, and economic indicators, coupled with stated local and regional values that seek to discourage commercial and residential sprawl, indicate that future development activities in the Project vicinity will likely be relatively infrequent and concentrated in established village areas. In general, these areas do not include wildlife habitat or other natural resources comparable to those found in the forested ridgeline settings that characterize the Project site. Therefore, potential cumulative impacts to ecological resources for the Deerfield Project would not be affected by future residential and/or commercial development.

3.21.2 Other Wind Energy Developments

3.21.2.1 Potential Cumulative Impacts

The degree to which other existing and proposed wind projects in the region would have environmental impacts that could contribute to the cumulative impacts associated with the construction and operation of the Deerfield Project is dependent on distance. For most resources, wind projects located beyond 10 miles from the Project site would generally have no direct or indirect impacts on the Deerfield Project site or the surrounding Project area, nor contribute to overall cumulative impacts. These projects would not impact the same watersheds, habitats, recreational facilities, viewsheds, roads, or residents that may be affected by the Deerfield Project.

The Searsburg Wind Facility is the only operating utility-scale wind energy facility in southern Vermont. As mentioned throughout this FEIS, the existing Searsburg facility is adjacent to the proposed Deerfield Wind Project. A number of other existing, permitted, or proposed utility-scale wind facilities have been considered in some level of detail in analyzing the cumulative impacts for the various resources. The Hoosac Wind Power Project is located in the rolling hills of the northern Berkshires in the Towns of Florida and Monroe in Berkshire County, MA, about 8 to 10 miles south of the Deerfield Project site. Construction of the Hoosac facility is currently underway. The Hoosac facility will include 20 1.5 MW turbines similar to those proposed for the Deerfield Project. The Berkshire Wind Power Project was dedicated in May 2011. This 10-turbine facility, operated by a cooperative of non-profit public power entities, is located in the Town of Hancock in Berkshire County, MA, approximately 23 miles southwest of the Deerfield Project site. The Lempster Wind Facility in New Hampshire began operation in November 2008. This 12-turbine facility is located on a forested ridge approximately 45 to 50 miles northeast of the Deerfield Project area and includes turbines similar to those proposed for the Deerfield Wind Project. Although this facility is well beyond the distance that would be require consideration during cumulative impact analysis for the Deerfield Project, migratory and resident birds and bats potentially affected by the Deerfield Project could also frequent this facility. The mortality data for the Lempster facility, along with the data for a number of operating facilities in the Northeast and New England, has been used as a source of estimates for bird and bat mortality in Sections 3.10 and 3.11. However, with the exception of the Lempster facility and others in the region as noted above for bird and bat mortality, only the existing Searsburg facility and the proposed Hoosac facility would likely have environmental impacts for most resources that could interact with those of the proposed Deerfield Project, and thus provide meaningful additive cumulative impacts to the potential cumulative impacts of the proposed Project.

The Searsburg Wind Facility consists of 11 operating 550 kW wind turbines located directly north of the Eastern Project site. The southern-most turbine at the existing Searsburg facility is approximately 0.1 mile northeast of the nearest turbine proposed for the Deerfield Project. Like the proposed Project site, the Searsburg site is located on a forested ridgeline.

As noted in many of the resource impacts sections in Chapter 3.0, and in Section 3.21.1 above, there are no other known past or foreseeable projects such as large timber sales, road projects, or large-scale developments that would produce effects similar to the Deerfield Project or to the two other wind projects discussed here. Therefore, although some discussion related to the Berkshire and Lempster facilities may be found in a couple resource sections (bats and avian in particular), this summary discussion of potential cumulative effects when considering other wind projects is focused on the interactions of the Project, the existing Searsburg facility, and the approved Hoosac facility.

3.21.2.1.1 Potential Construction Cumulative Impacts

Because the Searsburg Wind Facility is already built, there would be no cumulative construction-related impacts (e.g., cumulative impacts upon local roads, as well as cumulative noise or dust impacts). Due to the distance between the Hoosac and Deerfield Projects, and the fact that construction of these two projects would not likely occur simultaneously, construction-related cumulative impacts to individual roads, watersheds and adjacent homeowners would not occur.

3.21.2.1.2 Potential Operational Cumulative Impacts

Should the Deerfield Wind Project be constructed and begin operation, there may be potential for cumulative impacts to some of the resources of concern discussed in Chapter 3.0 when operational effects of the Deerfield Project are combined with those of the Searsburg and Hoosac facilities. However, little or no cumulative adverse or beneficial impacts to resources including soil and geology, wetlands, streams, fish habitat and water quality, vegetation, cultural and heritage resources, recreation, land use, telecommunication, transportation, or threatened, endangered, or sensitive species are anticipated. This is due to the physical separation of the Hoosac facility from the Project site, and/or lack of impacts at one or more of the Deerfield, Searsburg or Hoosac sites that would contribute to cumulative effects. Because neither the Deerfield nor Searsburg Projects are anticipated to have meaningful impacts on resources such as fisheries, recreational resources, transportation and listed threatened or endangered species, cumulative impact to these resources would not occur. Although each Project may have some impact to resources such as soils and geology, wetlands, vegetation, transportation, and land use, the built status of the Searsburg facility and the distance from the Hoosac facility would generally prevent these impacts from affecting the same resources in a cumulative manner. There may be potential for a positive overall impact to air quality from reductions in NO_x, SO_2, and CO_2 resulting from operation of these three facilities. However, this net improvement to air quality and how it could affect global warming and climate change cannot be reliably measured (see Section 3.3.3 for further discussion). The Hoosac facility would not create additive noise or shadow flicker cumulative impacts for the Deerfield Project due to the distance between project sites. Cumulative impacts of the Deerfield Project related to shadow flicker, when considering any additive impact from the Searsburg facility, would also not be expected due to the distance to the nearest residences and the intervening vegetation. However, there could be adverse cumulative noise impacts when considering the additive impacts of the Searsburg facilities to the Deerfield Project. See Section 3.4 for impacts discussion. Other cumulative impacts arising from simultaneous operation of the three projects are anticipated to be limited to wildlife and visual impacts as discussed next.

Avian/Bat Impacts

Estimates of avian mortality attributed to wind facilities across the region and across the country vary widely. The science and technology to accurately measure and thus predict mortality has been and will continue to evolve. Based on post-construction monitoring results from similar forested ridgetop wind energy facilities operating in the Eastern United States, estimates of average avian mortality would likely be in the range of 0.44 to 6.75 birds/turbine/year (see Sections 3.10.1.3 and 3.10.2.1.1). Applying these rates of mortality to the Deerfield Project would result in a range of estimated total mortality of 8 to 115 birds per year for the Proposed Action, 7 to 102 birds per year for the Reduced West alternative, and 3 to 48 birds per year for the East Side Only alternative. As discussed in detail in Section 3.10.3, applying the same mortality rates to the 11-turbine Searsburg facility, the 10-turbine Berkshire Wind Power Project, and the 20-turbine Hoosac Wind Power Project, and adding in the estimated rate for the Deerfield Project, would result in a total cumulative avian mortality for the four Projects on the order of 27 to 393 birds per year for the Proposed Action, 26 to 380 birds per year for the Reduced West alternative, and 22 to 326 birds per year for the East Side Only alternative. Even though estimates of avian mortality from the Searsburg facility were included in calculating the total cumulative impact numbers above, it was noted in Section 3.10 that this estimated level of mortality would not be expected for the Searsburg facility based on lower turbine height and results of previous on-site monitoring, and thus overall mortality numbers are anticipated to be lower. Consideration of other forms of mortality that may affect avian species across their ranges, from winter range to summer range, is also discussed in Section 3.10. Even though the level of mortality is difficult to predict, it is anticipated that cumulative mortality associated with the Proposed Action would be unlikely to impact overall abundance, distribution, or viability of the local and migrating bird populations on the GMNF and surrounding area.

The mortality rates of bats documented at some mid-Appalachian wind facilities do provide credible cause for concern regarding the potential cumulative impact of operating wind facilities on bat populations. However, considerable variability in documented mortality rates for bats has been observed across the county and across the landscapes on which wind facilities have been constructed. Based on post-construction monitoring results from similar forested ridgetop wind energy facilities operating in New England, estimates of average mortality would likely be in the range of 0.17 to 7.13 bats/turbine/year (see Sections 3.11.1.2 and 3.11.2.1.1). Applying these rates of mortality to the Deerfield Project would result in a range of estimated total mortality of 3 to 122 bats per year for the Proposed Action, 3 to 107 bats per year for the Reduced West alternative, and 2 to 50 bats per year for the East Side Only alternative.

The lowest (0.17 bats/turbine/year) and highest (7.13 bats/turbine/year) mortality figures used to calculate the range of expected mortality, as summarized above, were derived from post-construction studies conducted at the Lempster, Mars Hill, and Stetson I and II facilities. As discussed in detail in Section 3.11.3, the area of potential movement for resident, hibernating bats could include the Searsburg, Berkshire, Hoosac, and the proposed Deerfield facilities. The Lempster facility may also be within the normal range of movement of resident bats that occur in southern Vermont and western Massachusetts. Therefore, these facilities should be considered when estimating overall cumulative impacts. Applying the range of estimated mortality for all bats for these facilities and adding in the incremental impact estimated for the Deerfield Project, described in the previous paragraph, would result in an average annual cumulative mortality range of 13 to 502 bats per year for the Proposed Action, 13 to 487 bats per year for Alternative 2, and 12 to 430 bats per year for Alternative 3. It is also clearly discussed in Section 3.11 that no reliable method exists for predicting bat mortality at wind facilities, and thus, many studies produce a wide variety of mortality estimates. These different levels of mortality findings, along with the absence of reliable data on population size, total range-wide mortality, and other demographic parameters, demonstrate the difficulty in predicting mortality from proposed wind energy facilities.

The potential cumulative impacts of the proposed Project on resident bats cannot be evaluated without consideration of the extremely high mortality from WNS for several species in the region. Mortality of resident bat species is typically low at wind facilities, compared to that of the migratory bat species. If mortality is assumed to be directly proportional to the level of local populations, risk of mortality likely would be reduced in the wake of WNS, as would the potential cumulative impacts of the proposed Project on these species. If mortality of resident bat species from the Project operation is higher than anticipated, impacts of the Project could result in a substantially greater incremental cumulative impact when added to those from WNS, although this is not anticipated. Whatever the resultant cumulative mortality (or lack thereof) of resident bats, the magnitude of any incremental impact from the Project would be greatest for the Proposed Action, slightly less for Alternative 2, and substantially less for Alternative 3. Continued research and post-construction mortality monitoring surveys would be needed to determine overall cumulative impacts to bat populations. Adaptive management techniques could then be applied to reduce mortality levels.

Bear Impacts

Cumulative impacts to bears would not be anticipated beyond the direct and indirect impacts already discussed for the proposed Deerfield Project. It is possible that bears could wander between the Deerfield/Searsburg sites and the Hoosac site. However, there are no known major concerns with impacts to bear habitat or bear populations for the Hoosac facility, and only the existing Searsburg facility is close enough to contribute in any meaningful way to any impacts to bears and bear use of the Project area. As discussed in Section 3.12, it appears that the Searsburg Wind Facility has caused little, if any, continuing impact on black bears. Although studies have only recently begun to specifically determine the age, sex, and number of individual bears moving and foraging in the Project area, other studies conducted for the Searsburg facility and for the Deerfield site have demonstrated that this area continues to be used by bears as a foraging area and travel corridor (Wallin, 1998, 2003, 2005b, 2006b; Wallin & Capen, 2010).

As discussed in Section 3.12, the State ANR is concerned about the loss of BSB in the Deerfield Project area. However, even with construction of the Deerfield Project, an abundance of beech habitat will remain in and around the Project area and in the region. As discussed in Section 3.12 the Deerfield Project, the Hoosac facility, and management of the existing Searsburg facility should not result in an unacceptable adverse cumulative impact to most individual black bears within the Project area, or affect the continued existence of viable black bear populations in the region.

Visual Impacts

Another source of potential cumulative impact resulting from the construction of multiple wind projects within the region would be the effects on visual/aesthetic resources and community character. The cumulative impact of multiple projects could be highly variable depending upon the number of turbines visible, their proximity to the viewer, the landscape setting and the viewer's attitude toward wind energy. If multiple projects were visible from a particular viewpoint, the typical scenario would have portions of one project being visible in the foreground or mid-ground while another would be visible in the background. Although a project may be visible from many miles away, its visual impact diminishes considerably at distances over 3.5 miles (Eyre 1995, Bishop 2002). In addition, long distance views across southern Vermont are highly variable and often screened by mountainous topography and forest vegetation.

Cumulative visual impacts associated with the proposed Project, the existing Searsburg Wind Facility, and the Hoosac Wind Power Project would be minor due to the distance between the Hoosac facility and the combined Deerfield/Searsburg site, and the screening providing by intervening hills and trees. Areas with potential simultaneous views of these two projects are limited to higher elevation ridgetops and slopes that lack forest cover. Such circumstances are very rare, and limited to sites such as the Glastenbury Fire Tower. Where such views would be available, they would generally be distant, and the distance of the projects from the viewer would reduce their visibility (especially under overcast or hazy conditions). When seen together, the projects would generally both appear as very small background features on the horizon. Valley areas, where the majority of residents and visually sensitive resources are located (including all of the villages, hamlets, and major roads) would generally have potential views of only one of these projects.

Cumulative visual impacts of the Deerfield Wind Project and the existing Searsburg Wind Facility are illustrated in the visual simulations prepared as part of the Deerfield VIA (see Appendix C). Because the Searsburg turbines are already part of the existing landscape, they are shown in any simulations where they would be visible along with the proposed Deerfield turbines. As discussed in Section 3.5, the addition of the proposed Deerfield turbines would add to the overall visual impact in the Project area. However, both the existing and proposed facilities are relatively small, and even when considered together (i.e., a total of up to 28 turbines), constitute what would generally be considered a small utility-scale wind facility. Furthermore, the proposed Project is consistent with the existing Searsburg facility in terms of line, color, texture, and form.

Economic Impacts

In regard to cumulative economic impacts, the Regional Economic Impact Analysis prepared for the Deerfield Project reported that more than $80 million in investment would be needed to construct the Project. While more than half would be allocated for wind turbines and associated structures that are not manufactured in Vermont, approximately $14 million in construction expenditures are expected to result in direct positive impacts in Vermont. The construction and development phase of the Project is anticipated to result in the creation of approximately 250 jobs, which can draw from the working population of Bennington and Windham counties. Operation and maintenance of the Proposed Action would generate a total employment impact (direct, indirect, and induced) in Vermont of about nine jobs, with at least five expected to be in Bennington and Windham counties. This total includes 2.5 employees who would work onsite at the facility (Kavet & Rockler, 2008). A similar level of economic impact could be anticipated for the Hoosac facility, although that project would be likely to impart the majority of benefits to municipalities in Massachusetts. The physical separation of the two projects, and the fact that concurrent construction of the two projects is unlikely, suggest that meaningful cumulative socio-economic impacts are unlikely. Job creation, payments to municipalities, service procurement, increased tourism, and stabilization of energy prices resulting from both projects would potentially result in some overall beneficial cumulative impact to the regional economy. However, the spatial and/or temporal separation of possible other wind energy projects within the region and the relatively small size of the Deerfield and Hoosac developments, makes the prospect of a substantial boost to the regional economy due to wind energy development extremely unlikely.

Project Precedent

An additional element of cumulative impact is the degree to which the proposed Project might set a precedent for future actions or significant impacts. To the extent that this is the first utility-scale wind energy project on National Forest lands, and that one of the main components of the Project Purpose and Need is the advancement of national energy policy encouraging the development of renewable energy projects on federal lands, the Deerfield Wind Project could set a precedent for future projects on the GMNF and other National Forest lands. However, as discussed in Section 2.3.2 and Appendix I, screening of alternate sites for this Project indicates that perhaps only one or two other sites on the GMNF may actually be feasible for the development of a reasonably large commercially viable utility-scale wind energy project. Most of the sites available for development could accommodate only small facilities of 1 to 5 or so turbines, typical of those looking to meet small rural community needs.

In considering National Forest lands more broadly, it is certainly possible that additional wind energy projects will be developed in the future, and that the Deerfield Project will, to some extent, set the standard for review and approval of those projects. However, consideration of other proposals would demand the same site-specific screening and analysis to determine if the site is the right place for consideration at that time. Each proposal in the GMNF, or on any National Forest, will require its own site-specific environmental review to determine whether it is consistent with the individual Forest Plan and other applicable requirements. Although the design criteria and mitigation measures proposed for this Project, and the information that would be gained from this Project's monitoring and adaptive management programs, may help inform future project proposals and reviews, any proposed wind energy project would be reviewed on a site-specific basis. The Forest Service would review each proposed project on its own merits. In addition, it is national and regional policies and needs (as discussed in Section 1.3.1), and not the Deerfield Project, that are stimulating wind energy proposals. The likely spatial and temporal separation of such projects, particularly given the small amount of NFS lands in New England and the Northeast, would minimize the potential for any form of cumulative impacts, adverse or beneficial.

3.21.3 Conclusion

In summary, when considering the overall cumulative impacts to all resource areas, only potential mortality to bats, and possibly birds, appears to be of concern. This is not due necessarily to the anticipated mortality from the Deerfield Project, which is expected to be relatively low and result in a small additive component to overall cumulative mortality. The primary cause for concern is the uncertain and unpredictable nature of bird and bat mortality from all sources across their ranges, which now includes concern for bats due to white-nose syndrome. The Project could also have cumulative visual impacts for views that also include the existing Searsburg and/or proposed Hoosac facilities. However, as discussed above, cumulative visual impacts are not anticipated to be substantial due to the distance between the Deerfield and Hoosac sites, and the small size and consistent character of the adjacent Searsburg project. Therefore, the Deerfield Project in combination with the Hoosac facility and the existing Searsburg Wind Facility would not be anticipated to result in overall undue adverse cumulative impacts.

3.22 Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Population and Low-income Populations" mandates that "…each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." (Executive Order 12898, February 11, 1994.) Evidence shows that low income and minority populations bear a disproportionate risk of suffering adverse environmental conditions in their communities. Some examples of this problem include the siting of toxic waste facilities, garbage disposal operations, or unmonitored factory dumping grounds in impoverished or heavily ethnic areas. In order to protect the rights and health of these populations, the Executive Order dictates the consideration and analysis of the demographics of a proposed project's location within the NEPA framework.

Before a policy or proposal is implemented, the likelihood of a disproportionate effect on minority or low-income populations must be investigated and disclosed. The standards used to analyze environmental justice issues at a given project location on the GMNF are as follows:

1. If the demographics of a proposed location show a minority or low-income population greater than twice that of the State average, then the potential for environmental injustice exists.

2. If the demographics of a proposed location show a minority or low-income population greater than, but less than two times greater than the State average, and there are community-identified environmental justice issues, then the potential for environmental injustice exists.

3. If the demographics of a proposed location show minority or low-income populations equal to or less than that of the State average, then the potential for environmental injustice is considered

nonexistent, and there is no basis for disregarding the proposal on account of ethnic or financial discrimination.

These thresholds are consistent with the guidance document issued by the Executive Office of the President, Council on Environmental Quality (CEQ, 1997) and with the standards used in the FEIS for the Forest Plan (USDA Forest Service, 2006c).

Tables 3.22-1 and 3.22-2 compare the ethnic and income demographics for the county that potentially would be affected by the Proposed Action to the Vermont State averages. The Project area lies within the Towns of Readsboro and Searsburg in Bennington County.

Table 3.22-1: Ethnic Demographics for Bennington County and the State of Vermont

Municipality	% Native American	% African American	% Asian	% Hispanic
Town of Readsboro	0.5	0.0	0.2	1.1
Town of Searsburg	0.0	0.0	0.0	0.0
Bennington County	0.2	0.4	0.6	0.9
State of Vermont	0.4	0.5	0.9	0.9

(U.S. Census Bureau, 2000a, 2000b, 2000c & 2000d)

Table 3.22-1 demonstrates that the Town of Searsburg and Bennington County do not contain an ethnic population segment greater than two times that of the State average. All ethnic populations in these municipalities are equal to or less than the State average. Ethnic populations in the Town of Readsboro are greater than the State average, but less than two times greater than the State average. The Forest Service is not aware of any community-identified environmental justice issues. The proposed Project is not expected to have a disproportionate effect on any ethnic populations. Project activities are not planned in areas in which concentrated ethnic populations reside, and no physical or financial ripple effects on ethnic populations are expected to occur.

Table 3.22-2: Income Demographics for Bennington County and the State of Vermont

Municipality	% Below Poverty Level
Town of Readsboro	7.0
Town of Searsburg	17.5
Bennington County	10.0
State of Vermont	9.4

(U.S. Census Bureau, 2000a, 2000b, 2000c & 2000d).

Table 3.22-2 shows that the poverty level in the Town of Readsboro is less than the state average. The poverty level in the Town of Searsburg and Bennington County is greater than the State average, but less than two times greater than the State average. While not available at the Town level, 2009 data for Bennington County is consistent with the 2000 census data, with 12.8% of Bennington County resident living below the poverty level compared to 11.5% in the State of Vermont (U.S. Census Bureau, 2010). The Forest Service is not aware of any community-identified environmental justice issues. Project activities are not planned in areas in which a disproportionately large poverty-level population resides, and no disproportionate impact on such populations is expected.

In conclusion, none of the alternatives considered are expected to adversely impact minority or low-income populations. There were no issues related to potential impacts on either of these demographic groups identified during public scoping.

CHAPTER 4.0 ACKNOWLEDGEMENTS, PREPARERS, AND CONTRIBUTORS

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CHAPTER 5.0 REFERENCES

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