

Evaluating Visual (Aesthetic) Impacts Of Wind Energy Projects



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For

Clean Energy States Alliance (CESA)



Some General Considerations:

The goal of visual impact assessment is not to predict whether specific individuals will find wind energy projects attractive... but rather to identify important visual characteristics of the surrounding landscape that contribute to scenic quality, and how a particular project will affect valued scenic resources.

- Scenic resources can be identified.
- Obligation of States/regulators to reasonably protect documented public scenic resources.
- Visibility by itself does not mean that a proposed wind project will have significant or unreasonable impacts on visual resources.
- Visual impacts are likely to occur for most projects. It is important, therefore, for siting regulations to provide reasonably clear criteria as to when the threshold between “reasonable” and “unreasonable” visual impacts will be crossed.

The Visual Impact Assessment Process

A. Basic Graphic Information

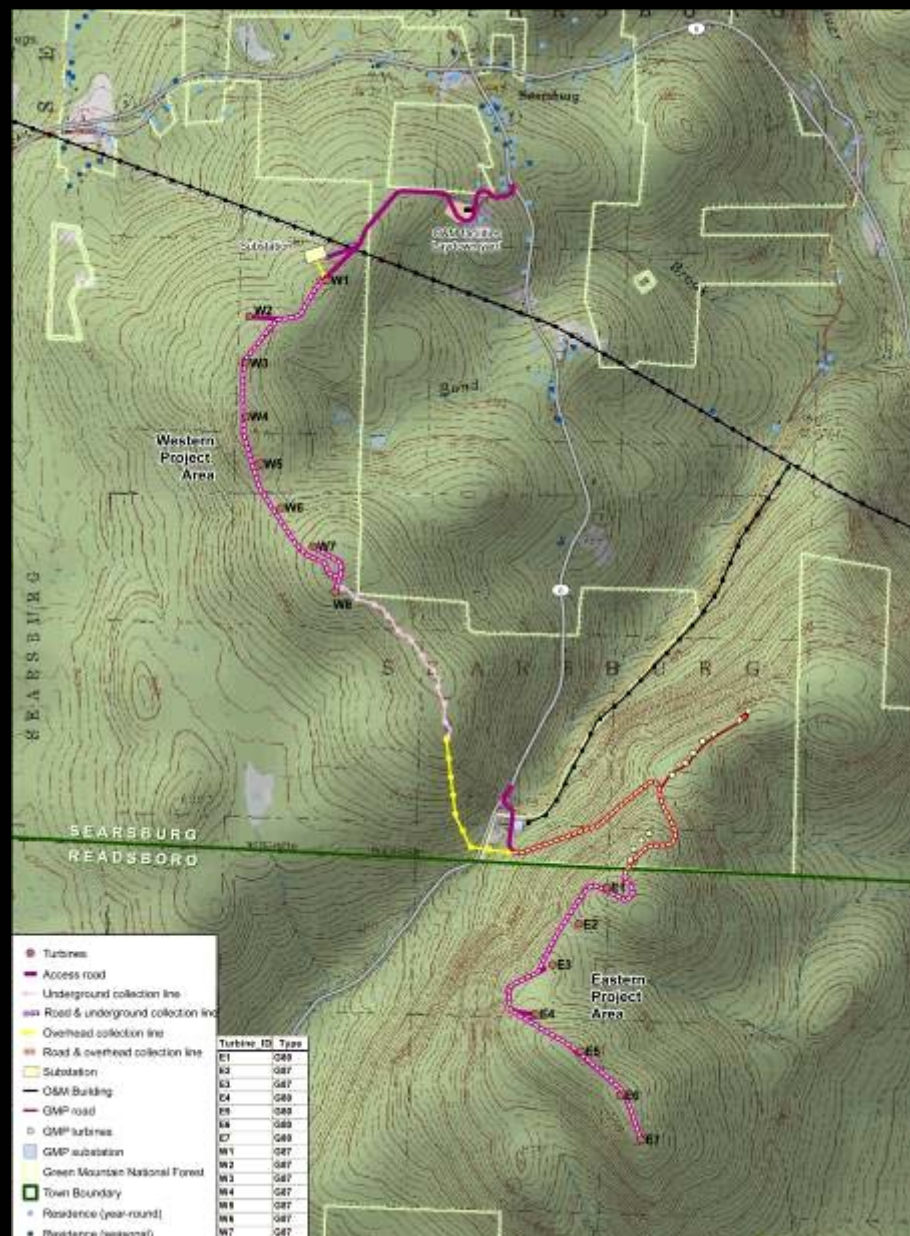
- Project Map
- Viewshed Mapping (Zone of Visual Influence)
- Identification of Public Natural and Cultural Resources and Features
- Identify Viewpoints
- Existing Character of the Area (Photographic Illustrations)
- Simulations (Visualizations)

B. Evaluation of Visual Impacts

1. Would the Project have Adverse Visual Impacts? What are they?
2. Would the Project have Unreasonable or Undue Visual Impacts?

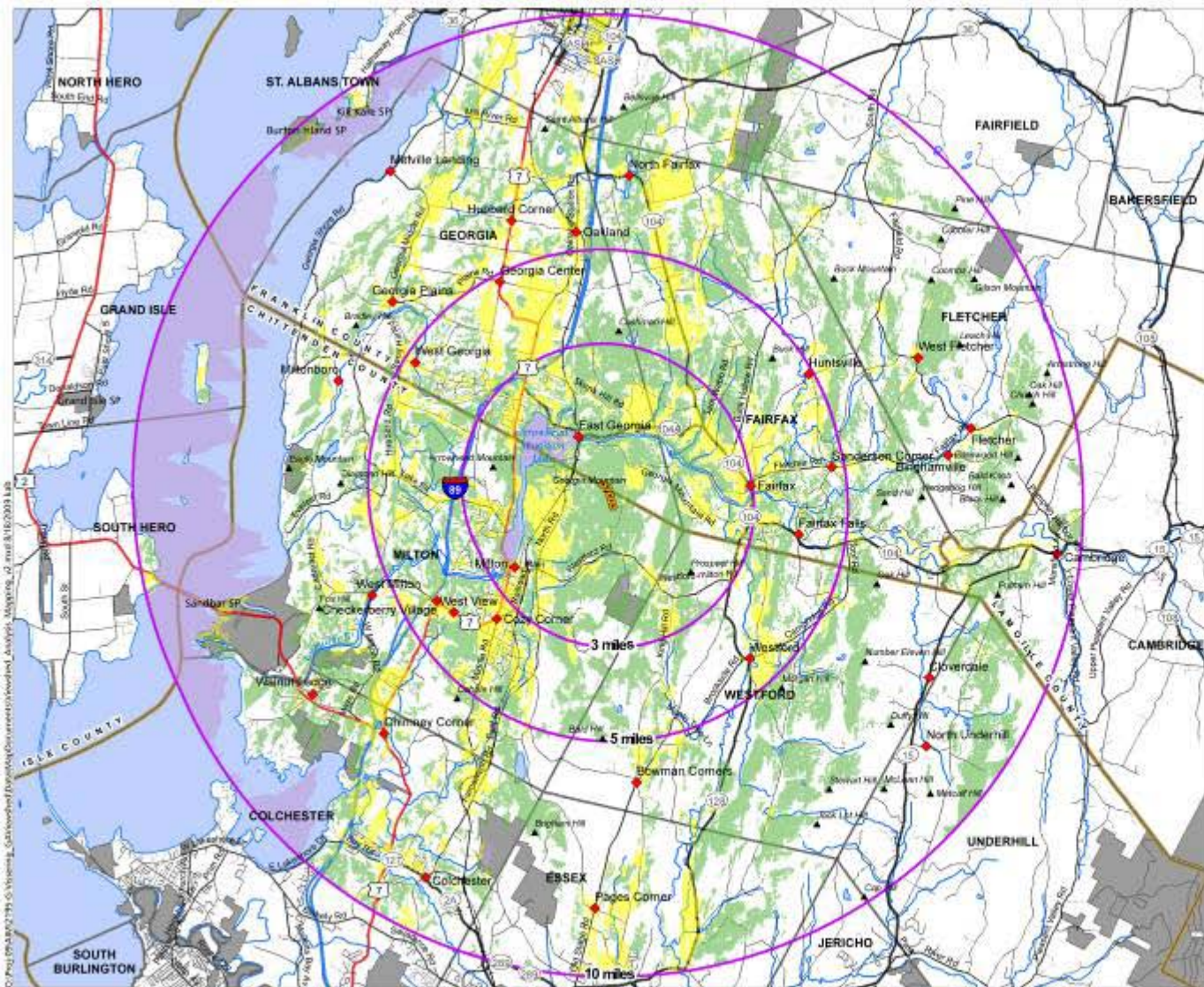
A. Graphic Information Required

- Project Map
- Viewshed Map (Zone of Visual Influence)
- Identification of Public Natural and Cultural Features
- Identify Viewpoints
- Existing Character of the Area (Photographs)
- Simulations



Project Map Example

(VERA and T.J. Boyle Associates)



Viewshed Analysis Parameters	
Turbine Height (nacelle)	262.5 ft / 80m
Turbine Height (tip of blade, analysis height)	405 ft / 123.5 m
Vegetation Height Used	40 ft / 12.192 m
Landcover Types Chosen As "Forest" (for vegetation height increase)	deciduous forest, evergreen forest, mixed forest, woody wetlands
Date of Landcover Data	2006 (NLCD)
Analysis Radius	10 miles
Earth Curvature Correction Used?	Yes
Viewshed Analysis Software	ESRI ArcGIS Spatial Analyst/Desktop
Unit Used For Calculations	meters
DEM Accuracy	1/3 Arc Second / ~10m

Legend

- Proposed Turbines
- ◆ Village
- ▲ Summit
- Interstate
- US highway
- State Route or Class 1
- Town Class 2
- Town Class 3
- Town Class 4
- Other Road
- Railroad
- Rivers and Streams
- Lakes and Ponds
- Distance from Turbines
- Town Boundary
- County Boundary
- Public Conserved Lands

POTENTIAL AREAS OF VISIBILITY

- Potential Views in Forested Areas
- Potential Views in Non Forested Areas
- Potential Views from Open Water
- Turbines Not Visible

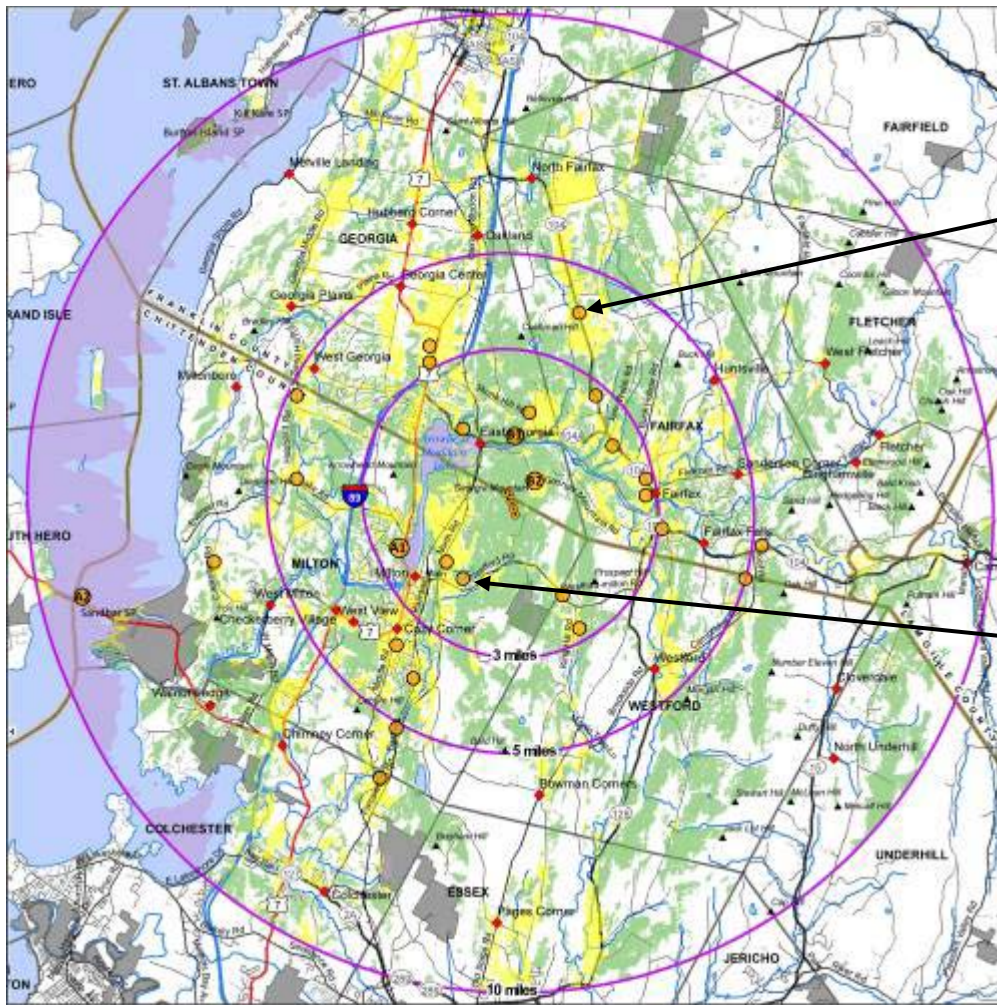


Sources: Viewshed analysis derived from USGS NED elevation data (1/3 Arc Second) corrected using EPA NLCD 2006 vegetation classes, Stone 2009; turbine locations, SOURCE, hydrology, town boundaries, roads, conserved lands, villages, and summits, VCGI 2008.

Prepared by:
Jean E Vissering Landscape Architecture
STONE ENVIRONMENTAL INC

APPENDIX 1. VIEWSHED MAP: AREAS OF POTENTIAL VISIBILITY
 Georgia Mountain Community Wind

Viewshed Map Example with Natural and Cultural Features



● Illustrated Viewpoint

AL Simulation Viewpoint

Legend

- Proposed Turbines
 - Village
 - ▲ Summit
 - Interstate
 - US Highway
 - State Route or Class 1
 - Town Class 2
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 - Town Boundary
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- POTENTIAL AREAS OF VISIBILITY**
- Potential Views in Forested Areas
 - Potential Views in Non-Forested Areas
 - Potential Views from Open Water
 - Turbines Not Visible

APPENDIX 2. VIEWPOINTS MAP
Georgia Mountain Community Wind Project

Prepared by Jean Vissering Landscape Architecture and Stone Environmental Inc.



Viewpoint 22 a - Millsfield Pond

Project Location

99 MW windpark in Dixville and Millsfield, Coos County, New Hampshire

Turbine Information

Turbine Model	Vestas V90 2500
Hub Height	262 ft (80 m)
Rotor Diameter	295 ft (90 m)

Camera Information

Date and Time	4:37 PM, July 05, 2007
Latitude (N)	44°46.6522'
Longitude (W)	71°15.529'
Elevation above sea level	1738 ft (530 m)
Focal Length in 35mm	52mm
Distance to turbines	2.6 miles (4.2 km)

Technical Information

Software	WindPRO 2.5
Digital elevation data	SRM (1 arc sec)
DEM source	http://searices.usgs.gov

Original Photograph



Viewpoint Location Map



Granite Reliable Power **Viewpoint 22 a** **December, 2007**
Millsfield Pond (Millsfield)

Prepared For **Prepared By**




Simulation Example "Normal View" (50mm equivalent focal length)



Simulation Example Panorama (Merged Photographs)

The Visual Impact Assessment Process

A. Basic Graphic Information

- Project Map
- Viewshed Mapping (Zone of Visual Influence)
- Identification of Public Natural and Cultural Resources and Features
- Identify Viewpoints (Inventory of Views)
- Existing Character of the Area (Photographic Illustrations)
- Simulations (Visualizations)

B. Evaluation of Visual Impacts

1. **Would the Project have Adverse Visual Impacts? What Are They?**
2. **Would the Project have Unreasonable or Undue Visual Impacts?**

STEP 1: Would the Project have Adverse Visual Impacts? What are they?

a) What are the Visual Attributes of the Project?

b) What is the Surrounding Landscape Character and Its Distinctive Features?

c) Are Important Scenic Resources Present and What Are their Sensitivity Levels (some scenic resources are more valuable than others)

- Scenic Quality and Intactness of Resource
- Viewer Expectations
- Uniqueness of the Resource
- Numbers of Users

d) How will the Project be Seen and Experienced from Identified Viewpoints in the Surrounding Area?

- Project Scale (Size)
- Proximity (Distance from the Project)
- View Duration
- Angle of View
- Panoramic vs. Narrow View
- Project Relation To Landscape Focal Points
- Numbers of Turbines Visible and Area of View Occupied
- Visual Clutter
- FAA Hazard Lighting

c) Are Important Scenic Resources Present and What Are their Sensitivity Levels

- Scenic Quality and Intactness of Resource



Increasing scenic quality 



Intactness



- **Viewer Expectations:**

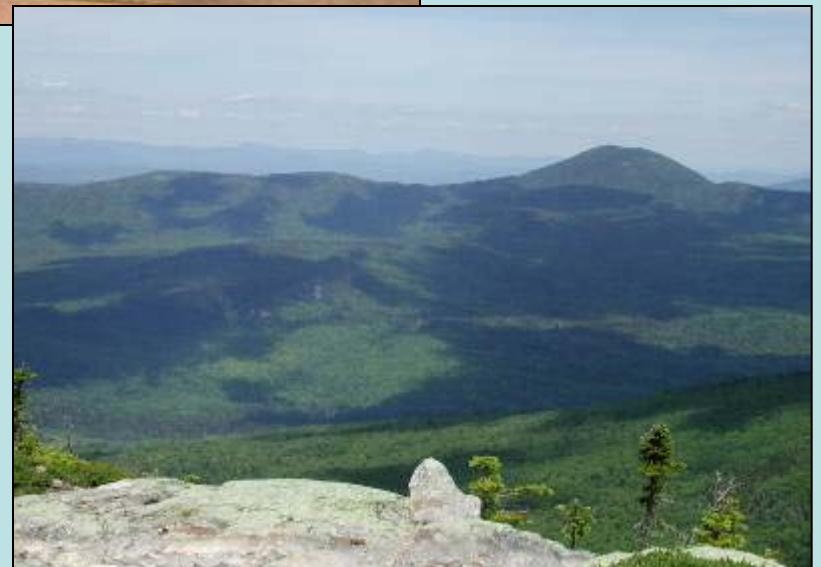
Is there documentation that would lead viewers to expect that the surrounding landscape will remain relatively unchanged?



Evolving
Developed Landscape



Cultural Landscape



Natural Landscape (AT)

c) Are Important Scenic Resources Present and What Are their Sensitivity Levels (cont.)

Uniqueness of the Resource

Numbers of Users



← Distinct Peak



↑ Scenic Lake:

Non-Motorized Use Only
(photo by The Nature Conservancy)



← Rare Natural Landscape
(photo by The Nature Conservancy)

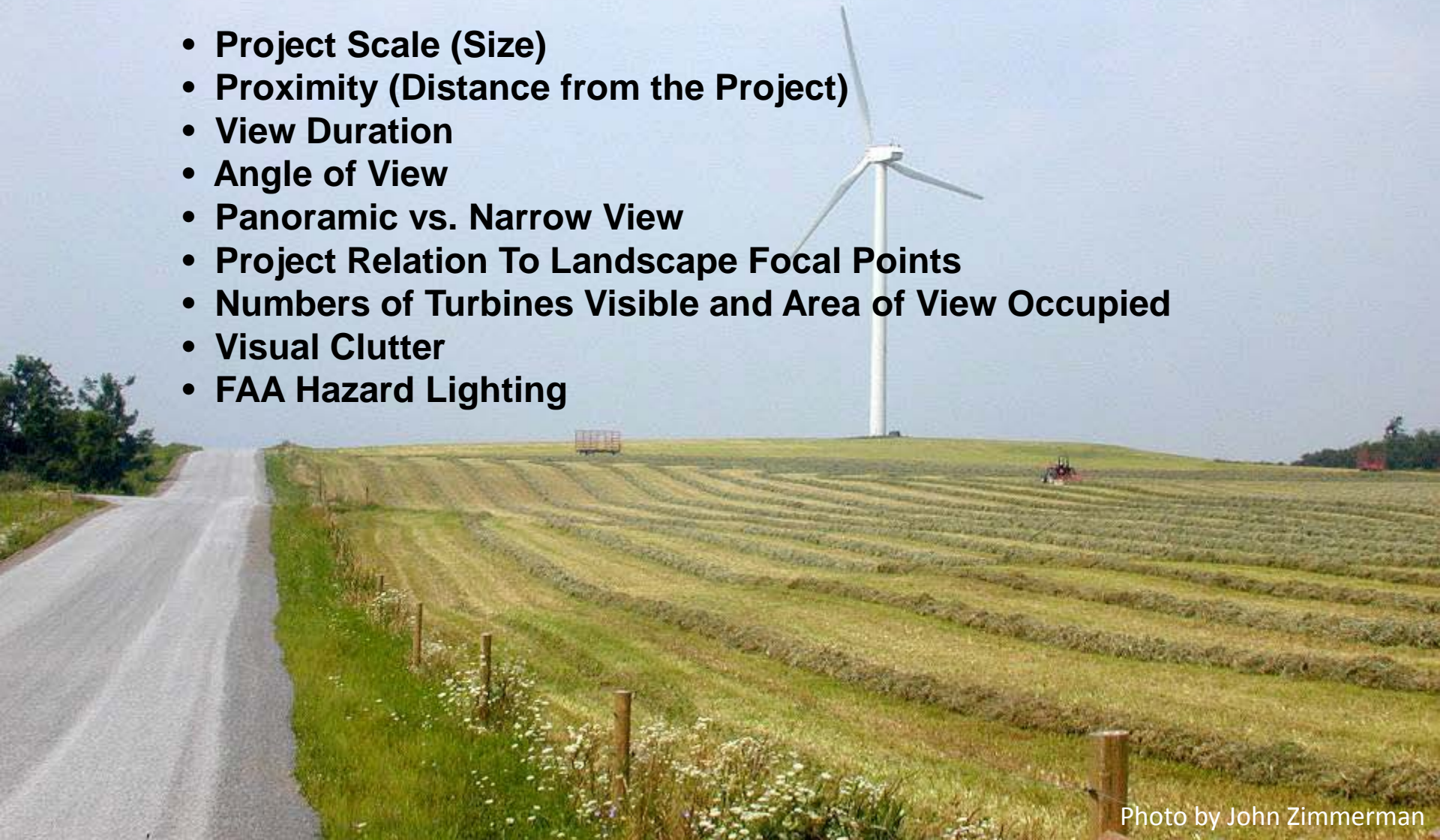


Summary:

- **Identify all sensitive viewing areas**
- **Describe their scenic values**
- **Note sensitive areas from which there would be NO visibility**
- **Focus on the most sensitive viewpoints/resources**

d) How will the Project be Seen and Experienced from Identified Viewpoints in the Surrounding Area?

- **Project Scale (Size)**
- **Proximity (Distance from the Project)**
- **View Duration**
- **Angle of View**
- **Panoramic vs. Narrow View**
- **Project Relation To Landscape Focal Points**
- **Numbers of Turbines Visible and Area of View Occupied**
- **Visual Clutter**
- **FAA Hazard Lighting**



•Project Scale (Size)

The size of an object is experienced in relationship to it's surroundings.

San Geronio Wind Facility

Photograph by David Policansky, National
Academy of Sciences



Project Scale (continued)

- Both Horizontal and Vertical Scale are Relevant



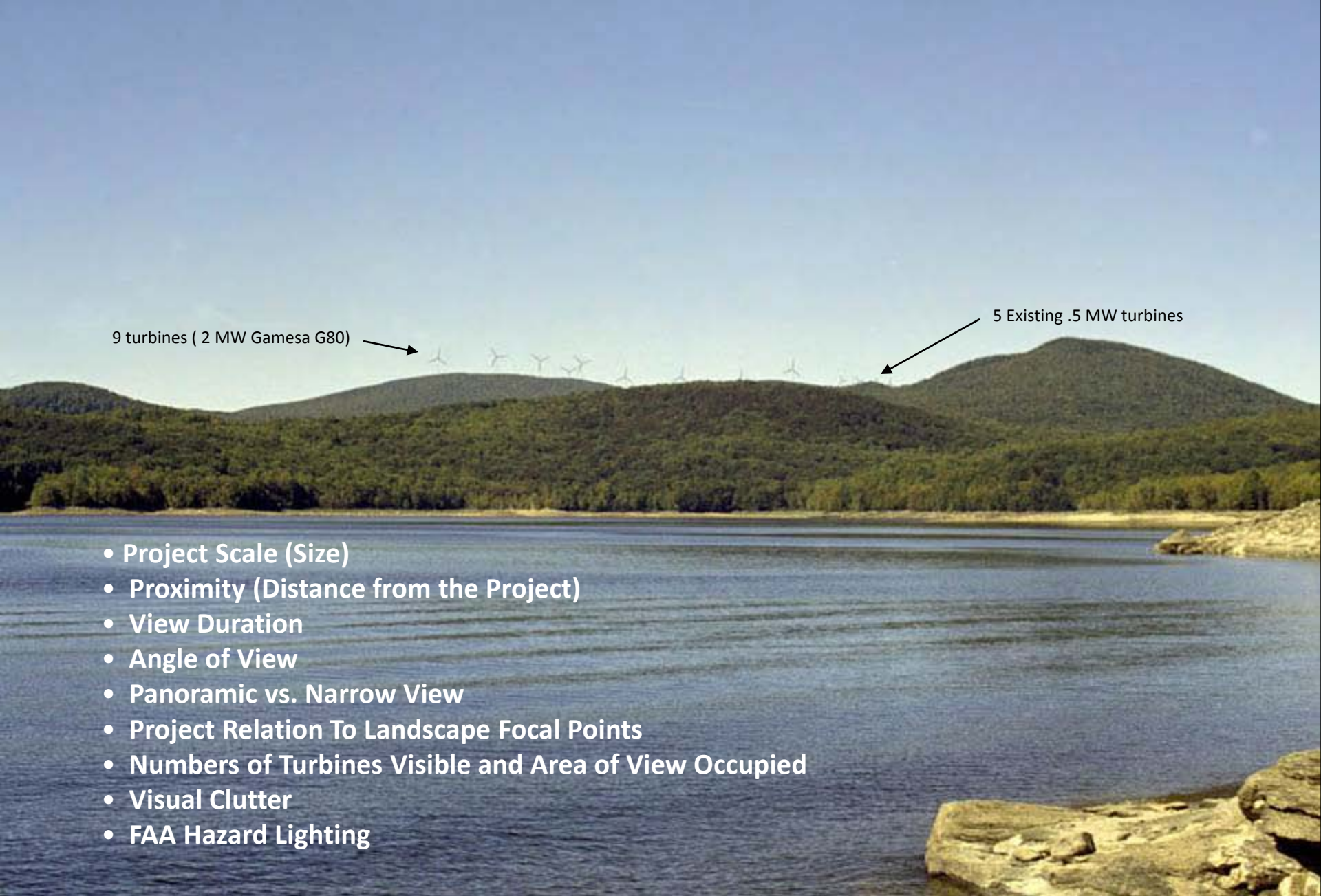
↑ Fenner Wind Project, New York, 20 turbines/ 9 visible (30 MW) -



↑ Simulation of 5-turbine project in Vermont (project approved; simulation by VERA)



Simulation of proposed 54-turbine project in Maine (by Terrance DeWan Associates; project undergoing revisions) →



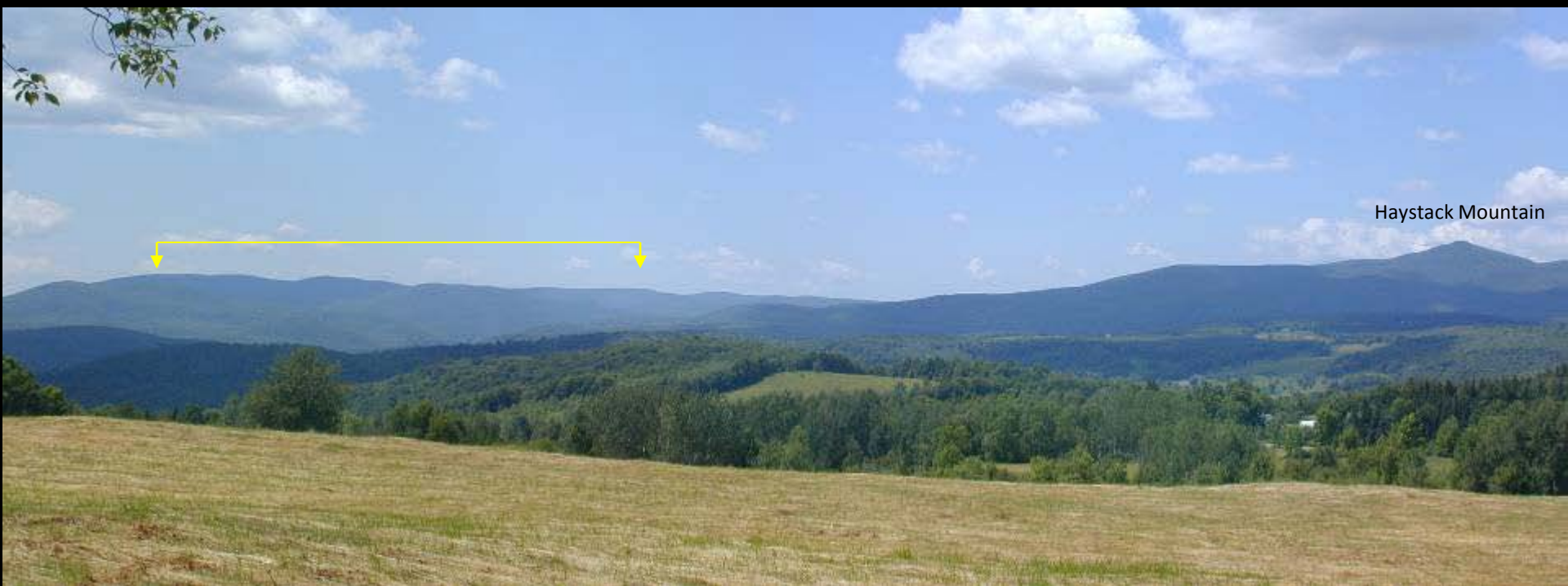
9 turbines (2 MW Gamesa G80)

5 Existing .5 MW turbines

- Project Scale (Size)
- Proximity (Distance from the Project)
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Simulation of Deerfield Wind Project, Vermont, Harriman Reservoir (4 Miles Away)

Simulation by VERA (older version of project)



Panorama View from Whites Road of Deerfield Wind Project Site, Vermont, (6.1 Miles Away)

15-19 Turbines (2.0 MW) Proposed in Area Marked by Arrows

Factors reducing visual impacts:

- Distance Away
- Cultural vs. Natural Context
- Occupies Limited portion of the View
- Project would appear lower in elevation and away from major focal point.



Normal View Simulation of Deerfield Wind Project, Vermont, Whites Road (6.1 Miles Away)



Wind Farming?

- **Project Scale (Size)**
 - **View Duration**
- **Project Relation To Landscape Focal Points**
- **Numbers of Turbines Visible and Area of View Occupied**
 - **Visual Clutter**
- **FAA Hazard Lighting**



Wind Features

STEP 1: Defining the Project's Visual Impacts

Summary: What are the important visual/scenic resources in the area and how (or whether) will they be impacted by the proposed project?

- a) What are the Visual Attributes of the Project?**
- b) What is the Surrounding Landscape Character and Its Distinctive Features?**
- c) Are Important Scenic Resources Present and What Are their Sensitivity Levels**
 - Scenic Quality and Intactness of Resource
 - Viewer Expectations
 - Uniqueness of the Resource
 - Numbers of Users
- d) How will the Project be Seen and Experienced from Identified Viewpoints in the Surrounding Area?**
 - Project Scale (Size)
 - Proximity (Distance from the Project)
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STEP 2: Would the Project have Unreasonable or Undue Visual Impacts?

- a. Inconsistent with Clear Written Aesthetic Standard**

- b. High Degree of Dominance: Would the project dominate views from highly sensitive viewing areas or within the study area as a whole?**

- c. Mitigation Measures Taken: Has the developer failed to take reasonable measures to mitigate the impacts of the project?**

a. Inconsistent with Clear Written Aesthetic Standard

- Public documents which identify and describe aesthetic or scenic resources are invaluable to developers and to permitting bodies as they can provide clear guidance as to the particular values of natural and cultural landscape features.
- Relevant documentation can be found in state law or local, regional, state or national planning documents. Citations within publically adopted planning documents to studies or reports may also be relevant to establishing a written aesthetic standard.
- To be considered an aesthetic “standard” however, there must be clear and unambiguous language as to particular aesthetic values that are to be protected.

Example 1



**Georgia Mountain
Wind Project**

Simulation by VERA

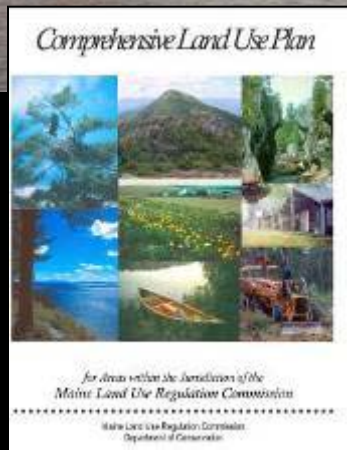
- Georgia Mountain is in a “Forestry, Conservation, Scenic Ridgeline” zoning district, and is mentioned as a “prominent natural feature” along with a pond and a creek in town.
- In the description of this district there is no mention of the scenic attributes of Georgia Mountain, only of its conservation values (even this are unclear).
- There is no discussion of Georgia Mountain in the “Aesthetics” section of the Town Plan

Example 2



Simulation by TRC

- Lake Listed as one of 21 “Especially High Value Accessible Lakes”
- Noted as having “Outstanding Scenic Value”
- Detailed Descriptions list only shoreline and immediately surrounding mountains, but not ridges behind as important features.

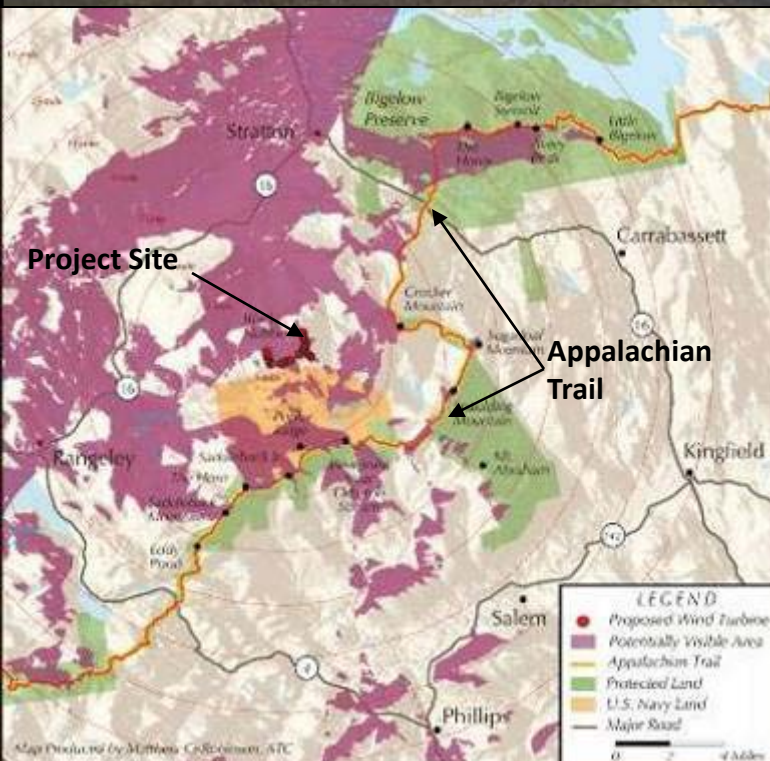


b. High Degree of Dominance: Would the project dominate views from highly sensitive viewing areas or within the region as a whole?

The following factors will affect the degree of dominance, but it is nearly always a combination of these factors which is necessary to result in unreasonable visual impacts.

- **Viewed in Close Proximity**
- **Long View Duration**
- **Expectation for Natural or Intact Landscape Setting**
- **Unique Scenic Resource**
- **Project Viewed Directly Ahead in Typical Direction of Travel**
- **Large Numbers of Turbines Visible in Many Views**

Example: Black Nubble Wind Project, Redington Township, Maine (18 turbines/32 MW)



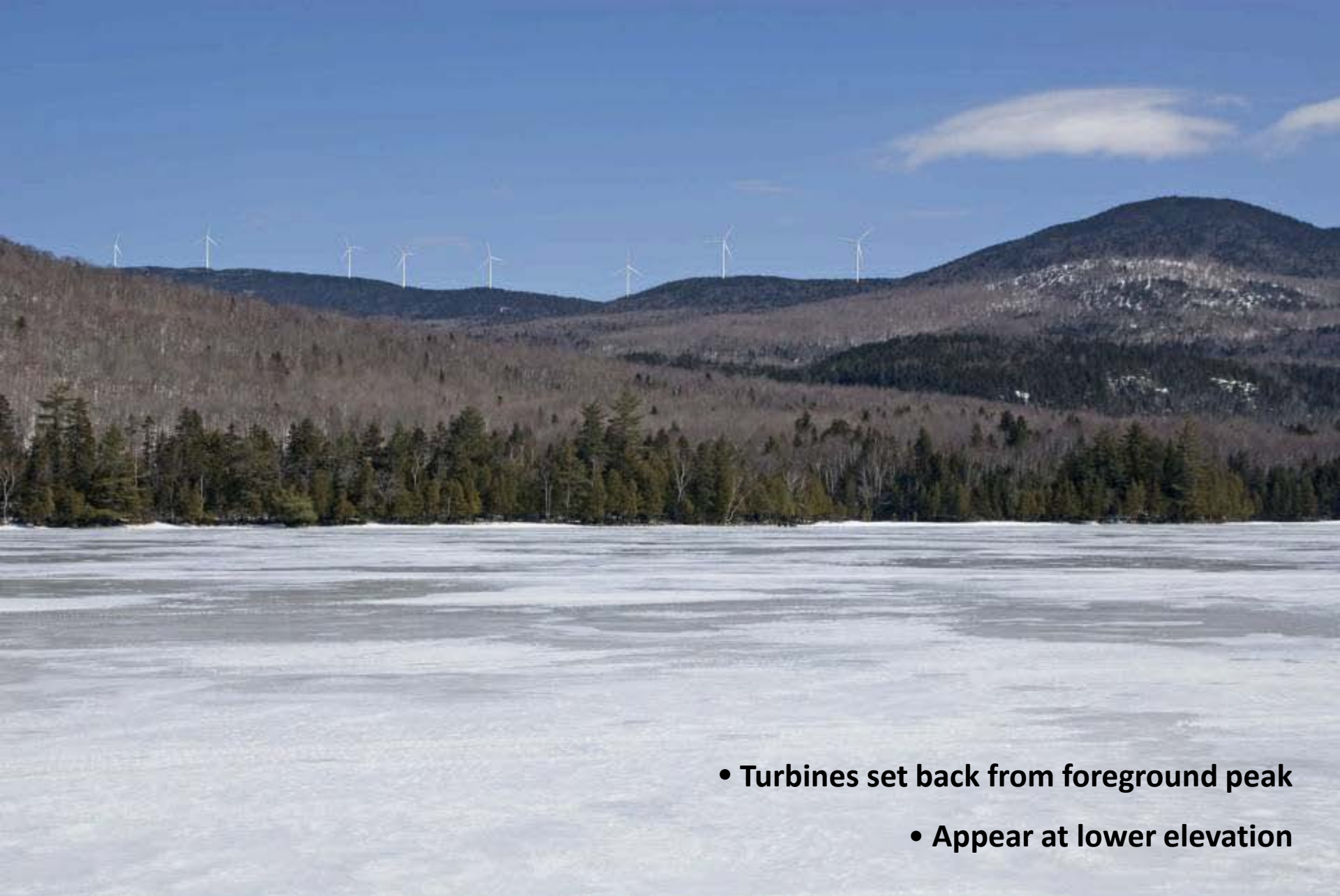
- Viewed in Close Proximity: Next ridge; 3-6.5 miles
- Long View Duration: from open alpine summits over 30-50 miles of the Appalachian Trail; visible from 6-9 scenic viewpoints along trail
- Unique and Documented Scenic Resource: Considered to be one of most scenic sections along AT, and noted in Comprehensive Plan; National Park and National Scenic Trail
- Expectation for Natural or Intact Landscape Setting: Some of most remote hiking along AT (footpath in wilderness); significant land protection efforts in area.
- Large Numbers of Turbines Visible in Many Views: entire project visible in most views.

c. Mitigation Measures Taken: Has the developer failed to take reasonable measures to mitigate the impacts of the project?

- *Appropriate Siting*
- *Downsizing*
- *Relocation*
- *Turbine Pattern*
- *Infrastructure Design, Siting and Screening*
- *Color*
- *Maintenance*
- *Effective Decommissioning Plan*
- *Non-reflective materials*
- *Minimizing vegetation removal*
- *Minimizing lighting impacts*
- *Burial and sensitive siting of power lines*



Turbine Relocation/Reduction A



- Turbines set back from foreground peak
- Appear at lower elevation



San Geronio Wind Project

Photo by David Policansky

Turbine Maintenance/Visual Clutter



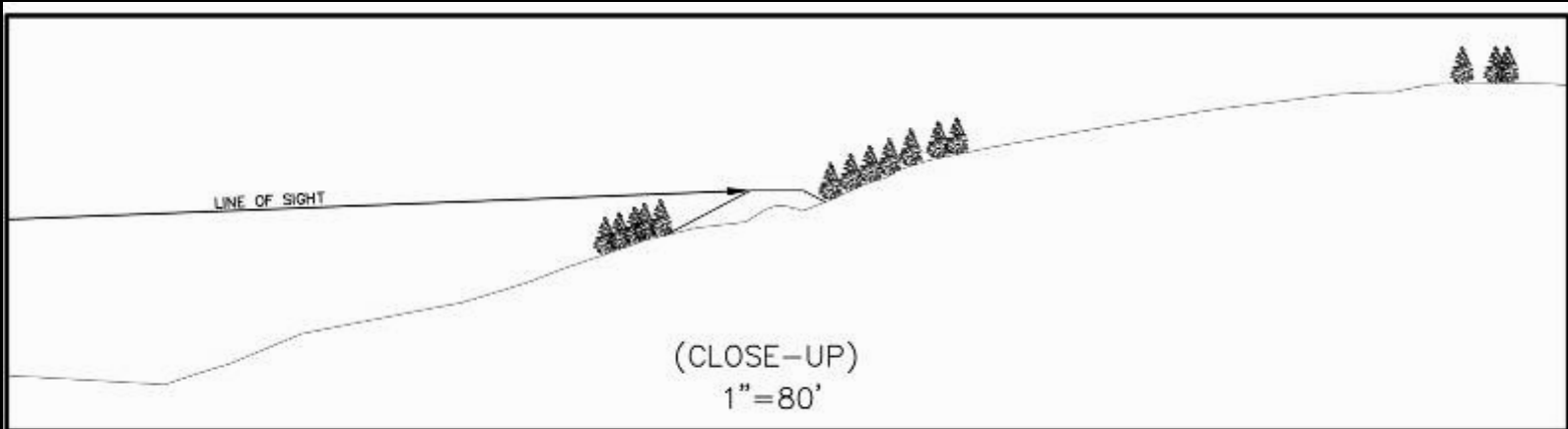
Turbine Maintenance/Visual Clutter

Photo by David Umling

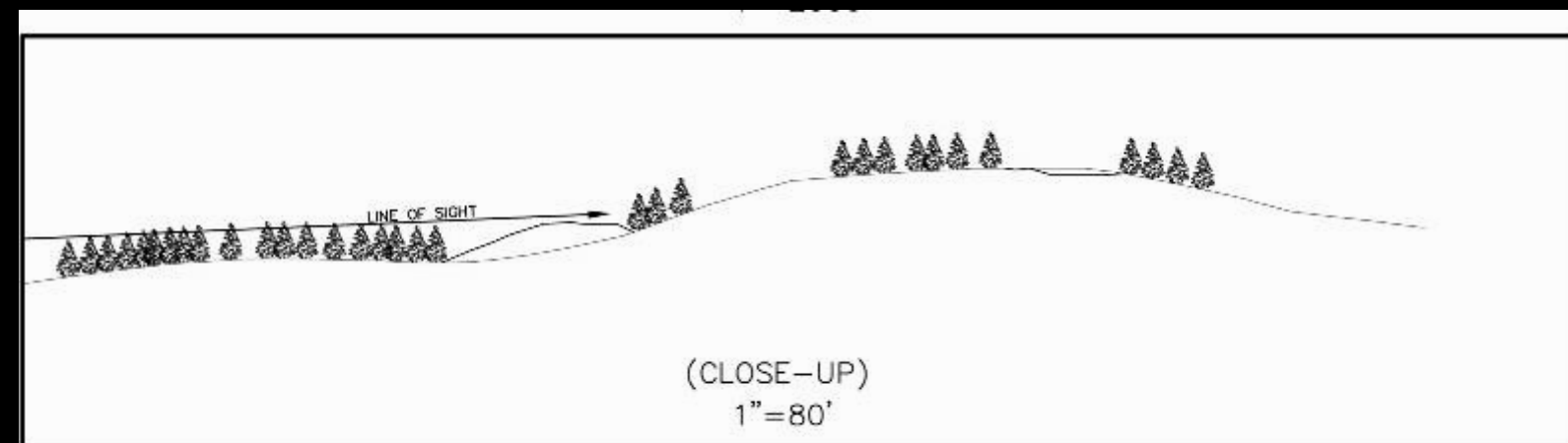


Roads and Clearing: Kibby Wind Project, Maine (year 1)

- **Impacts will decrease after 5 years**
- **Impacts may be minimal when viewed from below**
- **May be a concern with highly sensitive viewing area above and in close proximity.**



T. J. Boyle Associates, LLC				off drawn by	09-30-08 date	Deerfield Wind, LLC	sheet no.
Deerfield Wind LLC Swanton/Readsboro, VT	landscape architects • planning consultants	301 college street • burlington • vermont • 05401 802•658•3555	www.tjboyle.com	scale	varies	View Simulation Sections	4(1)



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Deerfield Wind LLC Swanton/Readsboro, VT	landscape architects • planning consultants	301 college street • burlington • vermont • 05401 802•658•3555	www.tjboyle.com	scale	varies	View Simulation Sections	4(2)

Line of Sight: Tool for Understanding Visibility



Transmission Line Siting: Avoid highly visible cleared corridors from sensitive viewpoints.



**Regulation, Policy, and Planning:
Tools for Guiding Wind Energy Siting**

The Visual Impact Assessment Process

A. Basic Graphic Information

- Project Map
- Viewshed Mapping (Zone of Visual Influence)
- Public Natural and Cultural Resources and Features
- Viewpoints
- Existing Character
- Simulations (Visualizations)

B. Evaluation of Visual Impacts

1. **Would the Project have Adverse Visual Impacts? What are they?**
 - Visual attributes of the Project?
 - Landscape character and distinctive features of surroundings?
 - Scenic resources are present and sensitivity levels?
 - How will the project be seen and experienced from sensitive viewpoints?
2. **Would the Project have Unreasonable or Undue Visual Impacts?**
 - a. Inconsistent with Clear Written Aesthetic Standard
 - b. High Degree of Visual Dominance
 - c. Reasonable Mitigation Measures not Employed

Thank you,

Jean Vissering and Clean Energy States Alliance

Mountaineer Wind Project,
West Virginia