Wind Energy Plan for Dukes County

Adopted in October 2012

The Wind Energy Plan for Dukes County was adopted by the Martha's Vineyard on October 16, 2012.

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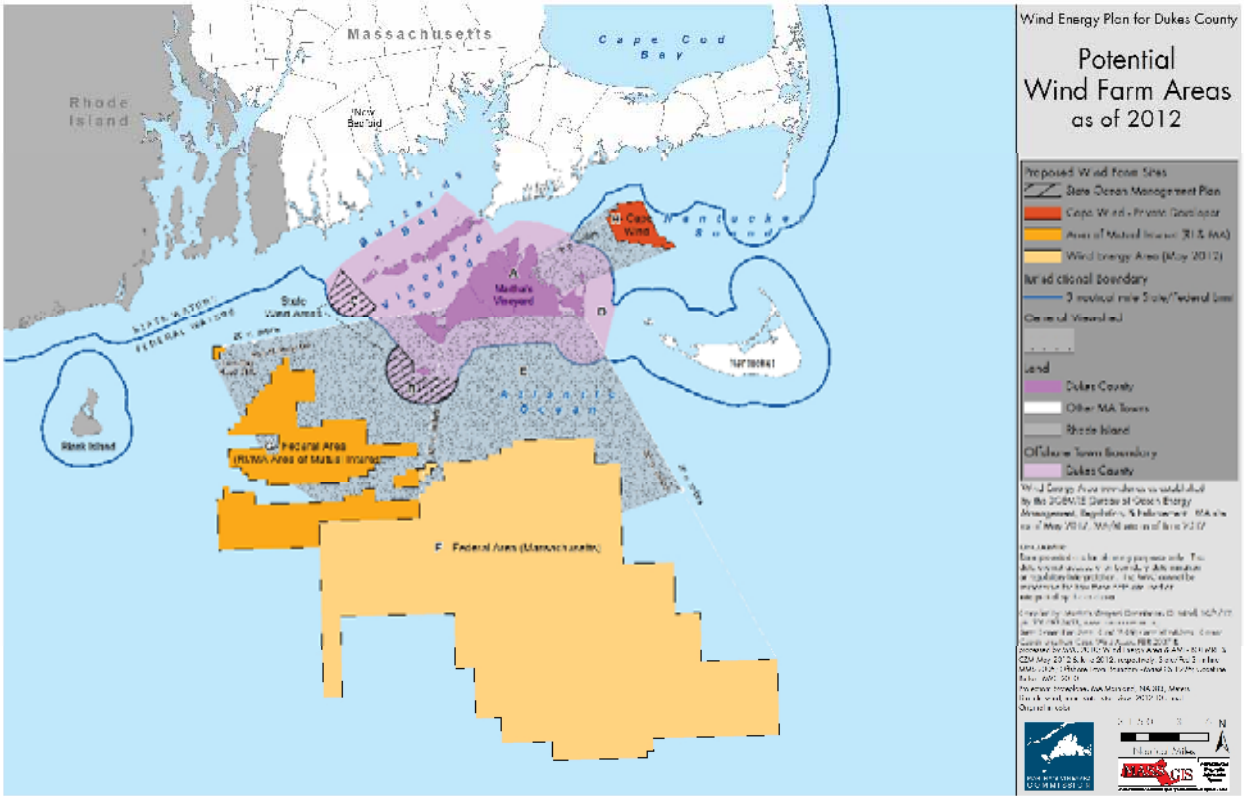
1. Introduction

In the coming years the Martha's Vineyard and Gosnold communities will be involved in many decisions about wind energy development, both on land and offshore in state and federal waters.

In 2008 and 2009, the Commonwealth of Massachusetts prepared the Massachusetts Ocean Management Plan which designated for commercial scale wind energy development two Wind Energy Areas (with a capacity of about 160 turbines), both in Dukes County. It also provided an allocation of 17 additional turbines in the other state waters of Dukes County. The Commonwealth also proposed an act that would allow the state to preempt local authority in authorizing land-based utility-scale wind facilities. (see section 2.4)

In late 2009, the Martha's Vineyard Commission designated the Island Wind District of Critical Planning Concern (see section 2.5.2) to provide a regulatory framework for development of utility scale turbines, and late 2010, it adopted interim regulations for this type of development. In 2011, the interim regulations were extended for another two years.



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The Wind Energy Plan

The Wind Energy Plan for Dukes County is an effort – facilitated by the Martha's Vineyard Commission and involving a Work Group of representatives of the seven towns and other organization – to help the community deal with the potential and challenges of wind energy.

The MVC staff and Work Group researched wind energy to better understand the specific pros and cons of what wind turbines might mean for our community with respect to a wide range of topics, including wind resources, noise, scenic and cultural impacts, natural resources, recreational activities, construction, operation, and decommissioning. They identified criteria, prepared a series of maps of areas with special resources that appear to be more sensitive to the impacts of wind turbines, and developed a methodology to identify the areas of the most significant scenic resources.

The Plan deals with both land-based and offshore wind energy facilities, including wind turbines, ancillary equipment, access roads, and transmission lines.

The following are some of the specific outcomes of the Plan:

- DCPC Model Regulations: The Plan includes a set of model regulations, completed in December 2010, for possible adoption by the towns under the Island Wind District of Critical Planning Concern now in effect in most of the land and waters of Dukes County. (Appendix A1)
- Offshore Wind in State Waters: The Plan provides a basis for the MVC's determination of what constitutes "appropriate scale" for offshore development in state waters in Dukes County, as the Commission is mandated to do under the Massachusetts Ocean Management Plan.
- DRI Thresholds and Policy: The Plan recommends thresholds for adoption by the MVC in its DRI Checklist to determine when towns should refer turbine applications to the Commission for review as Developments of Regional Impact.
- Project Evaluation Criteria: The Plan provides analysis and criteria that the Martha's Vineyard Commission and town boards can use to review applications for wind turbines.
- Federal Planning: The planning process has already helped the community comment on offshore planning in federal waters, especially with respect to the Rhode Island / Massachusetts Area of Mutual Interest southwest of the Vineyard, and the Massachusetts BOEMRE Request for Interest Area south of the Vineyard (see section 2.3).
- Town Regulations: Towns can use elements in the Plan, and especially the Model DCPC Regulations, as a basis to draft or modify their regulations and standards.
- Project Planning: The Plan can be used by towns, cooperatives, and property owners to locate and plan wind energy projects. The existence of clear project evaluation criteria will allow property owners and developer to know what parameters must be met and what factors the regulatory authority will weigh in evaluating the proposal.

The Wind Energy Plan draws on a number of sources of information.

- The Massachusetts Ocean Management Plan, described in more detail below, compiled maps and data from a wide variety of sources on many of the factors involved in siting offshore wind turbines. Many of these materials about natural resources and human uses were used as a starting point for efforts here and no attempt has been made to repeat that information.
- The Rhode Island Ocean SAMP, also described in more detail below, provided additional data and criteria, including information about
- The MVC, working with the Dukes County Martha's Vineyard Fishermen's Association, compiled data about where local fishermen fish.

- MVC staff also did considerable research on various aspects of wind energy development. It is worth noting that it has been challenging to find objective and reliable information about wind energy development; much of the available information comes from sources which might not be completely objective. On one hand, there could be concern that information and proposed standards from the wind industry and government departments with the specific mandate of promoting wind energy might downplay the possible negative impacts associated with developing wind turbines and propose standards that are too permissive. On the other hand, groups opposing wind farms seem to emphasize the most negative impacts of wind energy development and call for standards that appear to be quite restrictive.
- The MVC coordinated efforts with the Cape Cod Commission's largely parallel effort to prepare the Cape Cod Ocean Management Plan, and draws from some of its research and analysis.

An Evolving Context and Levels of Uncertainty

A fundamental dilemma regarding wind energy within the boundaries of Dukes County is how to reconcile two important environmental and community goals: increasing the generation of renewable energy to supplant fossil fuel-based fuels, and protecting the unique character, ecology, and quality of life of a place such as the Vineyard. For example, what are the pros and cons of locating wind turbines on land compared to in the ocean? It is possible to erect much bigger turbines in the ocean, where the wind is faster and steadier and most impacts are lessened. However, the construction cost is higher, though this might be offset by increased energy production.

A related challenge is determining a reasonable, balanced approach to wind energy development in a context where clear information about resources and the potential impact of wind energy development on these resources is incomplete. For example, there are no offshore wind farms in North America and those in Europe are in areas with very different ocean conditions. Recent developments with land-based turbines in areas such as Vinalhaven and Cape Cod have resulted in unexpected negative impacts.

The desire to move ahead quickly with wind energy development results in can backfire. As wind energy expert Paul Gipe has said: "Opinion surveys show that wind has high public support . . . but this erodes once specific projects are proposed. . . . Support is fragile and can be squandered by ill-conceived projects." (Gipe, 1995). The recent experience on Cape Cod can serve as a cautionary tale. The people of Falmouth enthusiastically supported the development of municipally owned, utility-scale turbines. However, once they went into operation, the noise and vibrations turned out to be much greater than anticipated.

There has been a considerable evolution in official and community attitudes to wind energy development in recent years, and even in the three years since the adoption of the Oceans Act.

- In Europe, which has considerable experience with offshore wind farms, the distance offshore has been steadily growing, from about 10 km in 2008, to 14 km in 2009, to 30 km for farms under construction in 2010, according to the European Wind Energy Association.
- The Commonwealth's Office of Energy and Environmental Affairs – which prepared the Massachusetts Ocean Management Plan (MOMP) that identified areas for large offshore windfarms only a few miles offshore from Martha's Vineyard – now is focusing on working with the federal government on developments located at least 12 nautical miles offshore.
- The completion of Rhode Island's Ocean Special Area Management Plan brought to light additional factors that had not been considered in the MOMP, and highlighted factors for which there does not appear to be adequate information or understanding to make informed decisions.
- Several utility scale turbines were erected in Falmouth between 2008 and 2010 which had noise, flicker, and other impacts that were considerably greater than anticipated. Partly as a result, in 2010, the voters in four towns on Cape Cod that been working for many years on their own municipal turbine projects turned these projects down.

- The Towns of Edgartown and Tisbury, which had been contemplating the erection of utility scale turbines at their wastewater treatment facility and park-and-ride respectively, have both opted to pursue development of large arrays of solar panels, largely out of concern about the potential impacts of large-scale wind turbines.

At the same time, there remains a level of uncertainty about several aspects of the potential impacts of wind energy development, both with respect to the availability of data and to an analysis of what that data means.

The Wind Energy Plan for Dukes County should be updated every 5 to 7 years, to reflect the anticipated increase in data and understanding about resources and the potential impacts of wind energy development, to reflect changing needs for and perceptions of wind energy development, and to allow consideration for changes in the context as it becomes clear whether or not various projects already in the planning stages come to fruition.

A Cautious, Balanced Approach

The precautionary principle states that if an action or policy has a suspected risk of causing harm to the public or to the environment, in the absence of scientific consensus that the action or policy is harmful, the burden of proof that it is *not* harmful falls on those taking the action.

As is explained in more detail in the Synthesis section and through this document, the Wind Energy Plan for Dukes County takes what could be described as a balanced but cautious approach.

Even with this careful approach, it would appear that there is the potential for a great deal of wind energy development in the area around Dukes County. This approach will allow a first phase of development of wind energy projects in locations and with standards that minimize the risk to the natural environment and to human uses. These projects should be carefully monitored. If the impacts turn out to be no worse than expected, it would then be possible to revise the Wind Energy Plan to allow development in locations which are excluded in this version of the Plan

How the Plan is Organized

The Wind Energy Plan for Dukes County is organized in the following way:

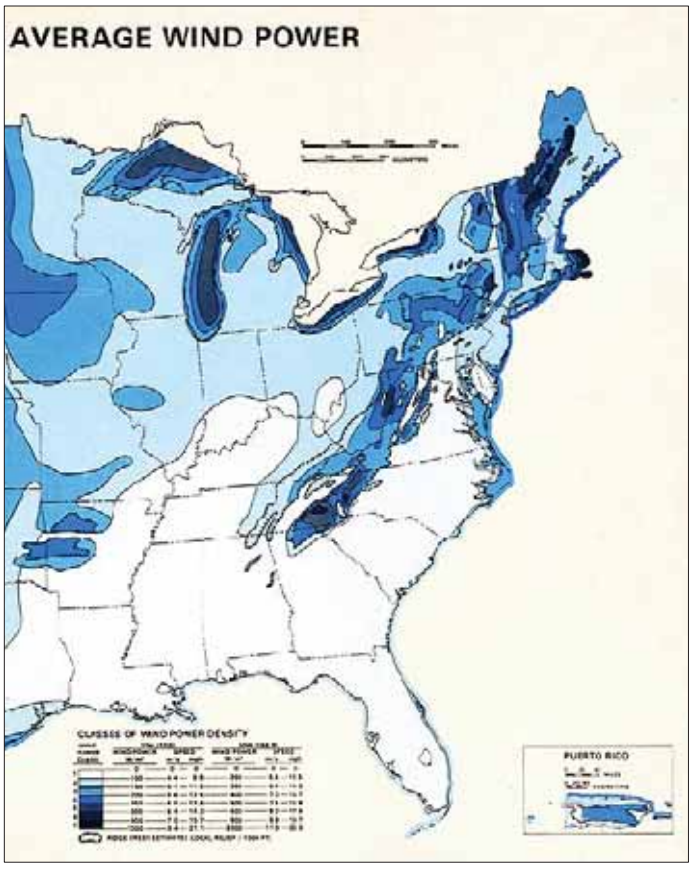
- Sections 1 and 2 give the introduction and context for the planning effort,
- Sections 3 to 5 describe the resources, likely impacts of wind energy development on these resources, and proposed policies for dealing with these impacts. The General section deals with those resources that are found on land and offshore, while the next two sections deal with resources found only on land or only offshore.
- Sections 6 to 9 deal with various other considerations related to wind energy development.
- Section 10 provides a synthesis combining the factors discussed in previous sections and comparing the relative merits of wind energy development in various locations.
- Section 10 outlines the Martha's Vineyard Commission's determination of Appropriate Scale.
- Section 11 is made up of the Plan's recommendations.

2. Planning and Regulatory Context

2.1 Wind Energy in the United States and Dukes County

Fossil fuels – coal, oil, and natural gas – supply 85% of the energy in the United States, two thirds of its electricity and almost all the energy used in transportation, but there is increasing concern about the negative impacts related to their use. There is general scientific agreement that burning fossil fuels produces carbon dioxide that is influencing the earth's atmosphere and contributing to rapid climate change. Burning these fuels also results in air and water pollution and emissions, which endanger health. Much of these fossil fuels, including 60% of oil, are imported, raising concern about uncertainty of supply and the cost of the political and other efforts to protect this supply. Domestic production of fossil fuels also has considerable human and environmental impacts and risks, such as mountain-top removal that EPA estimates will have resulted in the destruction of 2200 square miles of Appalachian forests, and two accidents that dominated the news in 2010, the death of 29 coal miners in West Virginia, and the Deepwater Horizon disaster that killed 11 people and released an estimated 5 million barrels of crude oil into the waters of the Gulf of Mexico.

As a result, major efforts are underway to achieve two related goals, decreasing fossil fuel consumption and increasing energy independence. This involves efforts to reduce, or at least limit the growth of, energy consumption with a variety of programs and measures to improve energy efficiency. In addition, there are major efforts to increase energy production from renewable sources located in the United States that do not produce greenhouse gases, such as wind, solar, tidal, and geothermal. The federal and many state governments have a variety of programs, including regulations, tax credits, subsidies, technical assistance, and education to support these efforts.

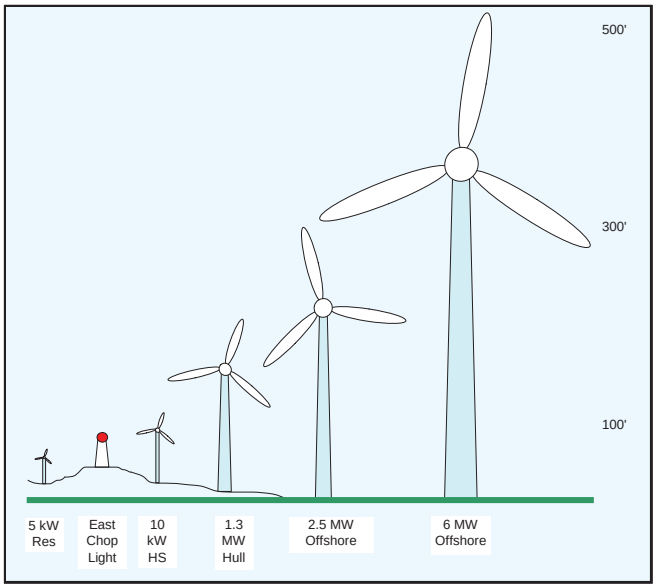


2.1.1 Wind Energy

The choice of which technology to use in a given area depends on the characteristics of the region and also on the current state of renewable energy technologies, which have advanced significantly in recent years. The intense and continuous sunshine in some parts of the country make solar power especially suitable. Massachusetts, especially the area around the Cape and Islands, has some of the best wind resources on the Atlantic coast, making wind energy the most promising source of renewable energy in our area. (See map to the right from the National Renewable Energy Laboratory: Renewable Resource Data Center).

Wind energy development is not without controversy. Critics question various technical

aspects, such as the continuity of supply from an intermittent source, and the fact that this development is currently only economically feasible as a result of public subsidies. Proponents note that the oil, coal, and natural gas industries are also heavily subsidized and argue that the public benefits of energy independence and reduction of greenhouse gases warrants the public investment. The Wind Energy Plan does not take a position on these larger questions. It assumes that there is a good possibility that there will be wind energy development in our area and aims to identify how this development should be planned regulated, and managed.



Note: In future editions of the Wind Energy Plan, this illustration will be revised to better portray the current proportions of wind turbines.

There are three general categories of wind turbines:

- Small, residential-scale, or on-site, facilities serving the relatively small energy demands of the individual landowner,
- Medium, municipal-scale facilities for individual users with large energy needs or serving a cluster of energy users, and
- Large, utility-scale facilities providing power to a broad community of users.

There are no standardized measures to distinguish among these categories, though some places use the power generation capability to differentiate among classes.

2.2 Energy Use and Needs on Martha's Vineyard

Note: This section is excerpted from the Martha's Vineyard Island Plan

As of 2005, the Vineyard used approximately 4.3 trillion BTUs of energy annually (equivalent to 757,000 barrels of oil, or three quarters of a 1000'-long supertanker). We use about 30% of this energy for heating and cooling our buildings, 33% for electricity for lighting, appliances, machinery, and 37% for transportation. Our primary energy fuels are oil, propane, and gasoline, as well as electricity generated primarily from the source fuels (in order of magnitude) natural gas, nuclear, coal, and oil. Most of the cordwood burned for heat comes from off-Island. The generation of electricity on-Island from small wind turbines and various solar systems does not yet produce a meaningful percentage of our energy needs.

The Vineyard intrinsically consumes a disproportionally high amount of energy because of the nature of our buildings and settlement pattern. It costs a lot more to heat a single-family dwelling with four exposed walls and a roof, than an apartment that only loses heat through one exterior wall. And our low-density housing, spread-out across the Island, means that we have a much higher proportion of people that drive compared to an inner-city neighborhood where people can more easily walk, bike, and take transit.

There are several reasons to want to change the current system of providing energy to the Vineyard community.

- With respect to cost, the Vineyard has a large and steadily increasing annual energy bill (more than $64 million in 2005). Our energy costs are among the highest in the United States. Since more than 99% of our energy is produced off-Island, these expenditures leave our local economy. Both the Vineyard's year-round community and visitor-based economy are particularly sensitive to high energy costs and disruptions to the energy supply.
- With respect to the environment, fossil fuels are our major source of energy, as they are in the rest of the country. Annual carbon dioxide emissions attributable to the Vineyard were 329,000 tons in 2003 and will rise to 457,000 tons by 2050 if we take no new action. The Vineyard is particularly vulnerable to effects of climate change such as rising sea levels, more frequent and severe weather, and health risks from insect-borne diseases. Importing our electricity from distant power plants means that a substantial amount of power is wasted in the conversion of source fuels into electricity and in transmission losses; it takes about three units of energy at the plant to produce one unit on the Vineyard.
- With respect to reliability, foreign fuel sources are increasingly insecure and unstable and may subject the community to supply shortages and price fluctuations beyond our control. The fact that we have to bring energy to the Island results in additional risks related to shipping fuels to the Island by ferry or barge. Electricity is brought to the Island by four 23.2 kilovolt underwater cables that are vulnerable, hard to repair, and the Vineyard's 50-megawatt peak electricity usage level is fast approaching their 62.5 megawatts capacity; the cost of additional cables will be high and will be borne by all.

Many communities in the U.S. and elsewhere are well ahead of us in embracing new technologies to change their dependence upon fossil fuels, and can serve as models for Martha's Vineyard. Also, the Vineyard's abundant resource of wind energy gives us options not available to most other communities.

Well before 2050, the Vineyard could generate enough renewable energy to supply our electricity needs and to offset the carbon from the fossil energy we would still likely need to import, based on the projection that energy efficiency measures will reduce demand by 50%. Any number of potential combinations of energy source type and scale could achieve energy self-sufficiency. The Martha's Vineyard Island Plan looked at several scenarios, including a largely decentralized scenario of mostly on-site, municipal-scale wind and solar facilities with a capital cost of about $1.4 billion, and a more centralized scenario of utility-scale facilities that would produce the same energy at about half the cost.

The Island Plan concludes that wind, especially the stronger winds offshore, offers the best opportunity for utility-scale generation, which is needed if we are to meet much of our Island's energy needs. It notes that relatively large amounts of land would be needed for utility-scale solar and wind facilities.

As indicated in the Island Plan: "to produce the amount of energy we are likely to need, it would take 32 of the largest, utility-scale wind turbines (more than 550 feet high at the blade tip, presumably located well offshore in federal waters) at a cost of about half a billion dollars, whereas it would take an impractical 85,500 small, domestic-scale wind turbines (one for every ¾ of an acre of land) at a cost of $2.6 billion." [clarify - not consistent with other figures above]

2.3 Federal Government Initiatives

The federal government is actively pursuing wind energy development in the federal waters near Dukes County. The lead agency for the federal government is the Bureau of Ocean Energy Management, Regulation, and Enforcement (formerly the Minerals Management Service).

2.3.1 Cape Wind

In 2001, Cape Wind Associates proposed construction of a large wind farm on Horseshoe Shoals in Nantucket Sound. After many years of studies and legal action and amid considerable controversy, the project received its final approvals in 2011(?). The final project is for 130 turbines, 440 feet high, covering a 24 square-mile area. The $2.5 billion project would have a maximum capacity of about 450 megawatts, and an anticipated average production of 170 megawatts.

2.3.2 Rhode Island / Massachusetts Area of Mutual Agreement (AMI)

The State of Rhode Island's Coastal Resources Management Council has worked with the University of Rhode Island on the preparation of an Ocean Special Area Management Plan (SAMP) for the state and federal waters located south of Rhode Island. To allow for a comprehensive analysis, it extended its study area by ten miles on the sides and therefore included the band of waters in Massachusetts located west of Martha's Vineyard. Preparation of the SAMP was an $8-million effort including original survey work and research on many topics. The Plan was adopted in 2010.

Also in 2010, the governors of Rhode Island and Massachusetts decided to work together to promote offshore wind energy development in an Area of Mutual Agreement (AMI), an area located in the eastern part of the SAMP study that showed the most promise for development. The AMI is located at least 12 nautical miles from the Rhode Island mainland and from Martha's Vineyard.

At the time of the preparation of the Dukes County Wind Energy Plan, BOEMRE had received two unsolicited developer proposals to erect several hundred turbines.

Note that the SAMP, the Wind Energy Plan for Dukes County, as well as the other wind energy plans described below (the Massachusetts Ocean Management Plan and the Cape Cod Ocean Management Plan), each uses slightly different terminology and definitions of terms. Some use the term "prohibited" to describe areas where turbines are not permitted, and "exclusionary" to refer to areas where turbines would normally be excluded, but where they might be allowed under certain narrow circumstances. In line with the cautionary approach described above, the Wind Energy Plan for Dukes County uses the term "exclusionary" as synonymous with "prohibited", and uses other terms as described in this plan.

2.3.3 Massachusetts Area Under Consideration

In 2009, BOEMRE started planning for development in federal waters adjacent to Massachusetts. In collaboration with the Massachusetts Secretary of Energy and Environmental Affairs (EEA), they indentified a vast area south of Martha's Vineyard and Nantucket as the most promising area. In an effort to avoid the controversy that had typified the Cape Wind project, BOEMRE set up a task force with representatives of a wide range of federals and state agencies as well as elected officials and representatives of the Martha's Vineyard Commission, the County, and all towns in Dukes County. Based on the recommendations of the task force, BOEMRE and EEA carried out an initial compilation of data, which led to a reduction in the size of the area it was pursuing, eliminating areas with sensitive resources such as the Nantucket Shoals, and increasing the minimum setback from occupied land to 12 nautical miles. At the time of the preparation of the Wind Energy Plan for Dukes County, BOEMRE had completed a Request for Interest which attracted 11 proposals from 10 developers, as well as 250 public comments. EEA has a budget of close to a million dollars per year to carry out research in the federal waters in order to help guide future development.

The federal government is not currently pursuing development outside the Area Under Consideration, though they and Commonwealth officials have indicated that the area less than 12 nm offshore might later be considered for innovative/community development.

2.3.4 NOREIZ

The National Ocean Renewable Energy Innovation Zone (NOREIZ) – set up by federal and state governments, the towns of Edgartown and Nantucket, and a number of university and non-profit entities – is a 300 square mile marine renewable energy technology test bed located in ocean waters just south of Martha's Vineyard and Nantucket.

The aim is to provide a variety of platforms for companies to test and develop marine-related technology designed to capture energy from ocean wind, waves, tides, and current. Presently, an effort is underway to develop a tidal energy plant in Muskeget Channel between Edgartown and Nantucket.

2.4 Commonwealth of Massachusetts Energy Initiatives

The Commonwealth of Massachusetts and Secretary of Energy and Environmental Affairs (EEA) have taken an aggressive approach to energy efficiency and renewable energy generation. The Governor set an objective of having 2000 megawatts, 15% of the Commonwealth's total electrical consumption, coming from renewable sources by 2020.

2.4.1 Green Communities Act

In July 2008, Massachusetts Governor Deval Patrick signed into law the Green Communities Act (Section 105 of chapter 169 of Acts of 2008). This Act *"launches the Commonwealth into a new era of clean energy development. It remakes the electricity market to reduce energy consumption through a dramatic increase in energy efficiency technology and renewable energy development. The Act requires that the Department of Energy Resources (DOER) complete numerous tasks within a relatively short period of time."*

The Act created the Green Communities Program within DOER to serve as the hub for all cities and towns on all matters related to energy. The goal of the Program is to: "enable cities and towns to maximize opportunities to save energy in schools, city halls, firehouses, and other public buildings; to generate some of their energy needs from wind, solar, and forest trimmings; and to make other decisions that reduce their environmental impact and carbon footprint, and ultimately, to put the Commonwealth at the hub of the 21st century clean energy economy."

Municipalities can qualify as Green Communities provided they meet five requirements:

- adopt local zoning bylaw or ordinance that allows "as-of-right-siting" of renewable energy projects – siting that does not unreasonably regulate these uses;
- adopt an expedited permitting process related to the as-of-right facilities;
- establish a municipal energy use baseline and establish a program designed to reduce baseline use by 20% within five years;
- purchase only fuel-efficient vehicles for municipal use, whenever such vehicles are commercially available and practicable;
- require all new residential construction over 3,000 square feet and all new commercial and industrial real estate construction to reduce lifecycle energy costs.

The Green Communities Program offers a range of initiatives and services to cities and towns on the path to becoming Green Communities. These include:

- An Energy Audit Program that provides auditors to assist communities in benchmarking their buildings with the EIS, perform detailed energy audits of those building that are underperforming, provide recommendations for energy efficiency measures with their costs and estimated energy savings, and performs feasibility studies for clean technology where appropriate.
- Energy Management Services Technical Assistance, a form of energy savings performance contracting, to allow town implement significant energy savings measures without upfront capital; the projects are paid for by borrowing against future energy bill savings. Per statute, the state's Department of Energy Resources (DOER) has oversight authority for city and town performance contracts, and can assist communities in all aspects of considering the use of this contracting mechanism.
- The Green Communities Grant and Loan Program for qualifying communities, to help them implement significant energy efficiency measures, construct large renewable energy projects, or pursue other innovative projects that further the communities' efforts to reduce their fossil fuel energy consumption.

- The Program also offers a team of experts to assist towns in becoming Green Communities and a toolkit to guide communities through the Qualification Criteria for becoming a Green Community and other services. Two towns in Dukes County, Tisbury and West Tisbury, are among the 106 municipalities in Massachusetts that requested and were given Green Community planning technical assistance.

As of the writing of this Plan, Tisbury and West Tisbury are Green Communities.

2.4.2 Massachusetts Ocean Management Plan

The Massachusetts Oceans Act, adopted in May 2008, allows for certain types of development within ocean waters that had previously been prohibited by the Ocean Sanctuaries Act. It allows for "appropriately-scaled" renewable energy (wind, tidal), sand and gravel, pipelines, aquaculture, etc. in conformity to an Ocean Management Plan and set a procedure for development of this Plan. The Commonwealth's Ocean Management Plan was finalized at the end of 2009. It includes a comprehensive analysis of available data in order to determine what ocean areas a suitable for various types of development.

The Ocean Plan identifies two areas in state waters for commercial, utility-scale wind-generated renewable energy, both in the waters of Dukes County. One area is south of Nomans Land Island (in the waters of Chilmark and Aquinnah) and the other is south of the Cuttyhunk Island (in Gosnold). Combined, these two areas could host about 150 turbines (3.4 megawatt, 440' high) producing about 600 megawatts.

MGL Chapter 164 allows the State's Energy Facilities Siting Board (EFSB) to override town or MVC decisions to deny or condition commercial developments within the EFSB's jurisdiction, currently more than 100 megawatts. As a result of representations by state and local elected officials and by the MVC, the Secretary of Energy and Environmental Affairs agreed that the final version of the Ocean Plan specifies that Regional Planning Agencies with regulatory authority will make the determination as to what constitutes the "appropriate scale" of a facility, effectively determining what type of development is acceptable. It specifies that for Dukes County, the recognition of MVC applies only to the Nomans Land site, not to the Gosnold one.

In addition, the Ocean Plan provides for "community" wind developments, namely up to a given number of turbines per region – 17 for Dukes County – to be planned and apportioned among member municipalities by regional planning agencies and subject to approval by town boards of selectmen.

The Ocean Management Plan had suggested that the federal government develop additional turbines in federal waters between and beyond the two state-designated areas to create one large wind farm area which would wrap around the western and southern sides of Dukes County, although the Commonwealth is no longer proposing this and the federal government is not pursuing development in this area.

The Ocean Plan provides that 50% of mitigation fees from renewable energy projects would go directly to the municipalities to fund local mitigation.

The Plan also suggests that the federal government designate the federal waters joining these areas to create one large wind farm area. The federal government has initiated a process for planning development of wind farms in a large area of federal waters stretching from south of Martha's Vineyard to south of Nantucket identified as having exceptionally good wind resources. This area offers the potential of significantly greater energy production due to higher wind speeds, while minimizing environmental and other impacts on the land and in coastal areas (birds, boating, scenic values, etc.). However, technologies for erection of wind turbines in deeper waters are not as proven.

These state and federally identified areas could not only serve as the site for any Vineyard-initiated or owned wind projects, they could also generate many times the power needed by the Vineyard. It is very likely that power from these wind facilities would be connected to a substation in New Bedford.

The Gosnold Board of Selectmen came out in favor of the windfarm west of Cuttyhunk provided it meets certain requirements, such as setting turbines farther offshore and avoiding the fishing area on Sow and Pigs reef.

The MVC made comments on the Ocean Plan supporting local control over decision making and pointing out several deficiencies in the methodology. The MVC criticized the fact that the Massachusetts focused exclusively on state waters, instead of taking a broader look at both state and federal waters as the State of Rhode Island did with its Ocean SAMP. It also questioned making important planning decisions in a short time span based on simply compiling existing data without obtaining additional information, as Rhode Island did in its SAMP. There is a concern that some of the data was not adequate for decision making, and that the MOMP often did not follow the recommendations of its technical working groups (such as the recommendation to exclude areas of unexploded ordnance, as was done in the RI-SAMP).The MVC did not take a position in favor or against the basic idea of having wind turbines in the proposed or other locations.

Since the publication of the MOMP, representatives of EEA have said that they are not actively pursuing development in the two commercial Wind Energy Areas identified in the MOMP, but are putting their main efforts into facilitating development in federal waters. In discussing federal projects in the AMI and the Massachusetts RFI area, they supported the principle of requiring a minimum setback of 12 nautical miles from land for any offshore wind farm. They did not address the seeming contradiction of the proposed commercial Wind Energy Areas in the MOMP, only a mile or two offshore from the islands in Dukes County, still on the record as the Commonwealth's official Ocean Management Plan.

2.4.3 Wind Energy Facilities Siting Reform Act

As called for in the Green Communities Act, the Commonwealth intends to adopt the Wind Energy Facilities Siting Reform Act, which would streamline approval of large-scale wind turbines throughout Massachusetts. The objective is to: *Encourage the development wind energy generating plants and ancillary facilities by establishing clear siting standards, one-stop permitting at the local and state level, and streamlined appeals of such permits.*

The current version of the Act deals with facilities greater than 2 megawatts, such as three 660 kw turbines and includes the following provisions.

- The Commonwealth's Energy Facilities Siting Board (EFSB) already has the authority to override local permitting for energy facilities of more than 100 megawatts. The current wording of the bill would lower this threshold to 2 megawatts.
- It calls for the establishment of state wind siting standards, to be set with input from an Advisory Group and which could vary region to region. The standards should protect residential neighborhoods, and protect significant scenic and recreational resources and environmentally sensitive areas (state or federally recognized). A project developer who meets the state standards would be eligible for fast-track permitting at state and town levels.
- It allows for the creation of municipal "Wind Energy Permitting Boards", with representatives from the Planning Board, Conservation Commission, and ZBA. In high wind speed areas designated by DOER, creation of the Board is mandatory; otherwise, the Planning Board acts. The Board would be the single permitting entity for the town, can waive local requirements (e.g. zoning height and use limits), can hire technical consultants and charge a fee, can impose an impact fee (capped by DOER), can accept other

mitigation, and can enter into a power purchase agreement. If a proposal meets the state standards, the Board must act in 120 days; otherwise in 180 days.

- The original proposal included a provision that would have allowed the Commonwealth's EFSB to override an MVC or town decision to condition or deny a wind energy facility of more than 2 megawatts. As a result of efforts by the MVC and other regional planning agencies, by the Mass Municipal Association, and by our senators and representatives, the latest draft wording no longer includes this provision. However, abutter and other third party appeals would go to the EFSB.

As of the writing of this Plan, the legislature has not take action on this proposal.

2.5 Martha's Vineyard Commission

2.5.1 Energy Policies

In 2006, the MVC adopted an Energy Policy favoring promotion energy efficiency and the appropriate development of local renewable energy production.

In 2008, the MVC adopted the DRI Energy and Environmental Building Policy. It outlines criteria for project review including energy efficiency standards. It also includes guidelines to: *Design and construct all buildings to provide for the incorporation - now or in the future - of renewable energy.*

2.5.2 Island Wind District of Critical Planning Concern

In 2009, the Martha's Vineyard Commission designated the Island Wind District of Critical Planning Concern for the airspace above most of the lands and waters under its regulatory jurisdiction. The Ocean Zone of the DCPC was designated on November 5, 2009, and includes the airspace above elevation 220'. The Land Zone was designated on December 17, 2009, and includes the airspace above 150' in Aquinnah, Chilmark, Oak Bluffs, Tisbury, and West Tisbury, with certain exclusions. Under the DCPC, the MVC set goals and guidelines which provide the framework for the towns to develop regulations that are then administered by the towns. A moratorium on permits in the District was in effect until towns adopt regulations or for a maximum of twelve months.

After being informed that most towns consider zoning amendments only at their spring annual town meetings, the MVC adopted interim DCPC regulations on November 3. 2010, requiring all applications for wind turbines in the District be referred to the MVC as Developments of Regional Impact until the towns are able to adopt District regulations in conformance to the District Guidelines. The MVC's interim regulations were set to expire November 3, 2011, unless earlier superseded by a town's adoption of District regulations. Several towns have indicated that they would like more time to adopt more detailed regulations. In 2012, the interim regulations were extended for another two years until November 2013.

2.5.3 Island Plan

In December 2009, the MVC adopted the Island Plan for guidance and vision. The Plan outlines long-term goals for the Island, including the proposal that over the next generation, the Island become much more energy self-sufficient. This would involve greater efficiency measures and locally produced energy from renewable sources. The Plan recommends that, with current technology, off-shore wind appears to be the most cost-effective way of producing substantial amounts of renewable energy, but the Plan makes no suggestion as to where such offshore facilities might be located.

Island Plan Objectives and Strategies Related to Renewable Energy Generation
Objective E5: Pursue local, utility-scale generation of energy. ▪ *Advocate changing State law to allow electricity distribution by local energy generation facilities.* ▪ *Establish an electrical cooperative or Island utility company.* • *Prepare a plan that identifies the best locations for renewable energy facilities.* • *Explore renewable energy generation with site-specific sources.* *Objective E6: Optimize potential for on-site, residential-scale energy generation.* • *Identify sites with advantageous access to renewable energy sources.* • *Require that new development provide for the incorporation - of renewable energy.*

- *Promote conversion to more energy-efficient building and hot water systems.*
- *Develop information and incentive programs for property owners to encourage on-site energy generation.*
- *Investigate renewable energy options specific to farmers.*

Objective E7: Develop capacity and a regulatory framework to encourage and support the development and installation of renewable energy generation.

- *Create training programs for workers needed to support the growing renewable energy industry.*
- *Adopt development regulations that encourage renewable energy generation.*
- *Improve consumer education and protection by providing current information on products and practices.*

2.6 Town Regulations

Regulation of wind turbines vary greatly among the seven towns of Dukes County. Some have relatively detailed regulations dealing with wind energy facilities, others have minimal regulations, and some make no specific reference to wind energy facilities. Some treat wind turbines as they would communication towers with height exemptions. Others have added or are in the process of adding wind turbines as an accessory land use and proscribing the zones in which they are allowed. All towns that deal directly with wind turbines, except Oak Bluffs, require a special permit.

All the town's wind regulations seem oriented to single user scaled turbines but also allow for shared "community" and municipal turbines. Oak Bluffs' new bylaw and Aquinnah's proposed adopted wind bylaw limit land-based turbines to a blade-tip height of 150 feet, except for publicly owned turbines.

- Aquinnah: The Town currently has no regulation dealing specifically with wind turbines and they are presently prohibited since there is an overall height limit of 28' in a visible area, with a possible additional 10' for rooftop structures. In 2009, Town Meeting has adopted new regulations that are awaiting review by the MVC for conformance with DCPC goals and guidelines before they go into effect. The Planning Board intends to present some revisions to the new Aquinnah bylaw to incorporate the results of the Wind Energy Plan of Dukes County.
- Chilmark: The Town has a wind turbine regulation allowing turbines with special permit. The Planning Board is currently working on a more detailed regulation for presentation to Town Meeting.
- Edgartown: The Town has a regulation that allows turbines with a special permit. A revision to the bylaw proposed for April 2011 Town Meeting would also make any offshore development an automatic Development of Regional Impact which the MVC would review for conformance with this Wind Energy Plan.
- Gosnold: The Town does not have a regulation for wind turbines.
- Oak Bluffs: The Town adopted a new wind turbine bylaw in April 2010 that allows turbines up to 150' high as of right throughout the town provided setbacks are met.
- Tisbury: The Town does not have any regulations dealing with wind turbines. The present regulation allows structures with a maximum height of 45'.
- West Tisbury: The Town adopted a new bylaw in April 2010 that allows turbines by special permit.

2.7 Relation Between Research, Planning and Development

When it comes to planning for wind energy development, there is a fundamental conflict between the desire to get projects built as quickly as possible and the desire to carry out adequate research and planning before allowing projects to go ahead.

Dating back to its 2005 first comments about the Cape Wind project, the Martha's Vineyard Commission has repeatedly called for creation of comprehensive planning and regulatory framework before considering specific offshore development projects, pursuant to the Oceans Act of 2000 and as recommended by the U.S. Oceans Commission in 2004. The aim is to balance the need for renewable energy development with the need to protect significant natural resources and human uses. The Commission argued that in the long run, such an Ocean Policy would allow appropriate future proposals to be fully evaluated and proceed through the process more quickly and efficiently, and be less vulnerable to legal challenge and delay. The MVC called for a comprehensive planning process for the continental shelf involving solid scientific analyses and community input, resulting in a clear framework indicating where offshore wind and other types of human activities are permitted, and laying-out a clear approval process. It called for the policy to include adequate protection of natural and scenic resources, and consider, for example, that the pristine, bountiful, wild and scenic ecosystems of the Cape and Islands – including Martha's Vineyard and the Cape Cod National Seashore – have long been recognized by local, state and federal agencies as well as conservation organizations as deserving special protection for the benefit not just of local residents, but the broader public interest at the state and federal levels.

A comparison of the processes followed by Massachusetts, Rhode Island, and BOEMRE illustrates the reasons for concern. With the Massachusetts Ocean Management Plan, the planners did their best to compile available data within very limited time and budget constraints that did not allow for gathering of additional data. The MOMP's identification of areas for potential commercial-scale wind energy development now appears to pose serious problems based on information obtained since that plan was completed. The Rhode Island SAMP took more time and money, but its more comprehensive analysis, including original research where data was missing, should not only allow for better protection of resources, but also allow for a more expeditious project review and approval process.

With respect to the Massachusetts Area under Consideration, BOEMRE is proceeding with a process to select developers and identify areas of interest before there has been any comprehensive marine spatial planning process for the area, although the delineation of the Massachusetts RFI area has taken into consideration some initial information about areas likely to have sensitive resources. The Massachusetts EEA is now carrying out a limited analysis of available data and hopes to do some data collection in the future. However, developers are already being invited to select blocks for development. Depending on the qualification process and the presence of competition for blocks, it is possible that developers will have staked out their blocks in the coming year, and all research and planning will be limited to those blocks, even if more widespread research would have indicated that development of other blocks might have less negative impacts.

There is a concern is that, once developers have selected certain blocks for development in federal waters, it will be difficult to relocate projects, especially after the developers have invested considerable time and money in studies of their original blocks, to say nothing about the increased political and community expectations that a project would move ahead expeditiously. Unless some major information comes to light that merits denial of a project in a given block, the project will likely go ahead there, perhaps with some mitigation, even if it turns out that another location would have had far fewer negative impacts.

The current process will mean that only the areas the developers want are analyzed without studying other areas that may well be more suitable for development. How can the development versus protection of

resources calculus be done when we don't know which areas are most important for resources and which areas will involve the least damage to these resources?

Although all governments are strapped for funds these days, it is well worth spending several million dollars now in order to ensure that development costing hundreds of millions if not billions of dollars is located and planned as effectively as possible. The present process is something of a Catch-22 situation where the government wants developers to fund the research; however, at least in the case of non-competitive leases, they can only do this once they have secured development blocks. Although one can hope that developers select the 'right' blocks or that remediation measures will be effective, this calculated gamble seems questionable given the environmental and economic importance of the natural ocean resources south of the Islands

The MVC has called on BOEMRE and EEA to do everything possible to advance and publicly fund preliminary research and planning effort for the all of the Massachusetts RFI area, or at least the portions that look more promising, rather than limit this to data collection only for the blocks where developers have expressed interest. It asked BOEMRE, to the greatest extent possible; to hold off awarding development blocks until a significant set of preliminary research and planning results are in. It also supported the Commonwealth of Massachusetts' request to NOAA for a geographical boundary expansion extending 30 miles offshore for federal consistency purposes. This would ensure greater state and local input into development in federal waters with respect to presumed impacts related to state waters and lands, and would provide a framework for gathering and analyzing additional data in a comprehensive way.

3. General Resources

This section deals with natural resources and human uses that are found both on land and in the ocean.

3.1 Birds and Bats

3.1.1 Resources

The exceptional location and ecology of Martha's Vineyard make it a significant locale for avian resources, along with the Elizabeth Islands. Some avian species make their homes on Vineyard lands and waters year-round. In addition to the resident population, there are migrants who utilize the land and nearby waters for at least part of their life cycles.

The Piping Plover and Roseate Tern are federally listed Threatened and Endangered species, respectively.

The Massachusetts Natural Heritage and Endangered Species Program also protects the following Vineyard avian species:

- Endangered: Leach's Storm Petrel, American Bittern, Short-eared Owl, Roseate Tern, Peregrine Falcon;
- Threatened: Northern Harrier, Piping Plover, Northern Parula, Grasshopper Sparrow;
- Special Concern: Least Tern, Common Tern, Arctic Tern, Common Barn-owl, Long-eared Owl, Common Loon.

Several main resources provide data about avian resources in the area.

- Peter Paton et al, University of Rhode Island researchers, produced the academic report *Spatial Distribution, Abundance, and Flight Ecology of Birds in Nearshore and Offshore Waters of Rhode Island - Interim Technical Report for the Rhode Island Ocean Special Area Management Plan 2010*. The Rhode Island Ocean SAMP involved carrying out considerable research and data collection, which provided a more current and refined analysis than was possible in the MOMP.
- Allan Keith and Stephen Spongberg have created a comprehensive listing of the birds and mammals on and around the Vineyard (as well as other life forms) in the guide *Island Life: A Catalog of the Biodiversity on and Around Martha's Vineyard, 2008.* Keith & Spongberg report that 405 bird species have been recorded on and around the Vineyard.
- In conjunction with the preparation and review of the MOMP, the MVC facilitated the formation of a Vineyard Avian Advisory Committee to provide a local perspective on Vineyard residents and migrants. It was made up of Susan B. Whiting (Vineyard Gazette Bird News columnist for thirty years and co-author of "Vineyard Birds" and "Vineyard Birds II: Where and What to See on Martha's Vineyard"), Allan R. Keith (former President/CEO of the American Birding Association and co-author of "Island Life: A Catalog of the Biodiversity On and Around Martha's Vineyard"), and Matt Pelikan (former editor of "Bird Observer").
- Mass Audubon, the Massachusetts Department of Fish and Wildlife, and the Massachusetts Natural Heritage and Endangered Species Program collaborated with the Massachusetts Ocean Management Plan (MOMP) to identify critical habitats for selected species offshore in state waters. Due to legislated time constraints and limited funds, no new surveys were undertaken; the effort was limited to compiling data from other sources in order to identify highlights of important locales for only a few endangered species and for nesting colonial waterbirds. Those critical habitats are identified as Special, Sensitive or Unique Areas (SSU's) in the *MOMP.*

Land Birds: English settlers found the Vineyard forested and cleared most of the forest lands for fuel and farming. Since colonial times, open fields predominated, particularly sandplains grasslands. Present land uses encourage scrub encroachment and reforestation, threatening to reduce the sandplains grasslands. Sandplains grasslands presently constitute a globally rare ecosystem which is threatened by scrub encroachment and subsequent reforestation. Many species on the Vineyard, including birds, bats and their insect prey, depend on sandplains grasslands systems and their habitats. The protected avian species dependant on sandplains grasslands habitats include the resident Long-eared Owl, Northern Harrier, and Common Barn Owl; Short-eared Owl (winter) and Grasshopper Sparrow (autumn migrant). The Long-eared Owl is shown at right (photo: C. Buelow, NHESP).

The Endangered American Bittern and the Threatened Northern Parula depend on the Vineyard's wetlands and wet woods habitats. Both species may visit in autumn and spring.

Of particular concern for land birds is the autumn migratory pathway for songbirds and the raptors that follow them as predators, including the Endangered Peregrine Falcon. Martha's Vineyard and Gosnold are located in the Eastern Flyway (also called the Great Atlantic Flyway), the main migratory path along the east coast. The warmed ocean waters make for comfortable autumn temperatures and migrant land birds use the area as they pass north to south in preparation for winter. The wet, chilly Vineyard spring is not as hospitable and the same migrants travel north in the spring by a more inland route.

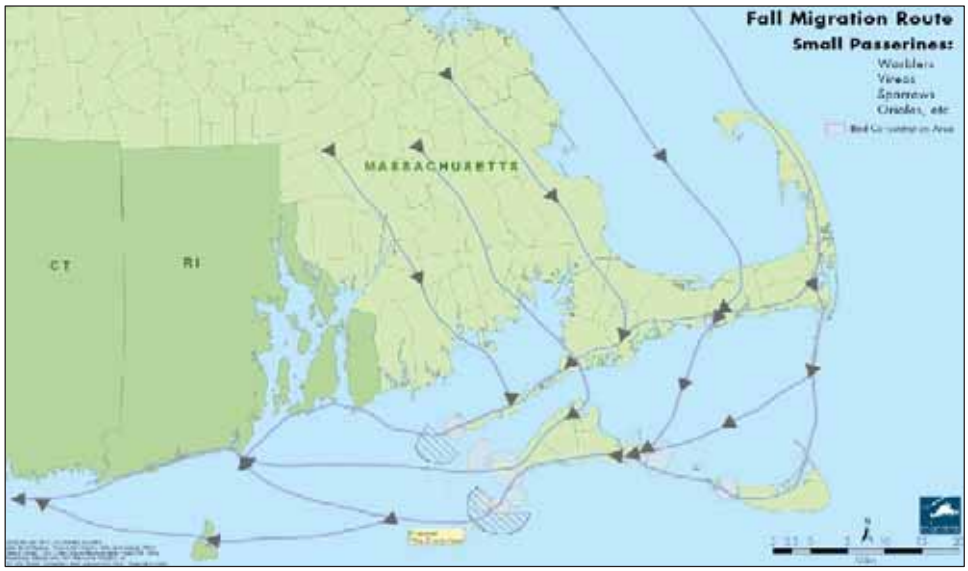
A challenge for the islands is that there is little accurate information on the specific migratory patterns. Vineyard birders participate in the Christmas bird count, a regular check on resident land birds. There has been no rigorous academic research specific to migratory habits of the Vineyard's autumn visitors, and therefore very little hard data available for the immediate area.

Mass Audubon performed surveys of the Horseshoe Shoals area in conjunction with the Cape Wind Energy Project, proposed for several miles northeast of the Vineyard (MMS, 2009). Aerial, boat and radar surveys were made. Radar surveys are particularly important for collecting nighttime data, when songbirds are moving. Radar surveys are helpful in focusing in on timing and flight height. The autumn migrations were recorded from a cliff on Cape Poge, representing the only such migratory data for the Vineyard. Birds flying southwest from Horseshoe Shoals in radar range of Cape Poge should pass over or stop on the Vineyard. The radar recorded higher flight heights at night, presumably the nocturnal migration of songbirds. More of the nighttime flight heights exceeded the proposed turbine height than the daytime flights of shorebirds and water migrants. Because the songbirds migrate at night, none appeared in the aerial surveys and only a few in the boat surveys.

Peter Paton et al (2010) reported in conjunction with the Rhode Island SAMP from radar units on Block Island, about 40 miles West Southwest from the Vineyard, potentially on the same Northeast to Southwest flight route as the songbirds recorded in the Cape Pogue radar data. The flights heights at night in the autumn (representing the songbirds) were higher than daytime. The night records included the lowest proportion of targets detected in the 100 m altitude range (below turbine height).

There is data available for nearby areas. The nearby Manomet Center for Conservation Services Bird Observatory has been collecting data on passerines for forty years, using banding as well as net capture. The center is about 40 miles north (inland) of the Vineyard. In their 2003 report comparing capture rates of spring and autumn migrants, T. Lloyd-Evans and J. Atwood found that the "capture rates of numbers of 45 species of autumn migrants (58%) declined significantly between early (1970–1985) and late (1986–2001) years of the study". The decline was a bit more than the decline of spring (more inland) migrants (50%).

The Vineyard Avian Advisory Committee prepared a series of illustrations of the autumn migratory paths for a variety of species. The maps below show the route for songbirds and a combined map. Similar maps were prepared for raptors, gulls and terns, and sea ducks. Though the maps are primarily based on shore-based observations and lack academic standing, they illustrate represents credible observations of very knowledgeable birders that indicate that key migratory paths for some species move along the south shore of Cape Cod and the Elizabeth Islands, along the north and south shores of Martha's Vineyard, and along Buzzards Bay and Vineyard Sound, converging at the western tips of Gosnold and of the Vineyard and Nomans before heading back to the coast of Rhode Island and Connecticut with a possible stopover on Block Island.



Bats: According to Keith and Spongberg (2008), several bat species are seasonal (summer) residents or migrants who pass through: Little Brown Myotis, Keen's Myotis, Silver-haired Bat, Eastern Pipistrelle, Big Brown Bat, Red Bat and rarely the Hoary Bat. None of the Vineyard bats are protected. Bats are important in pollination, seed dispersal, and insect control. Although Vineyard bats are not rare species, their services to humans are important. Bats are particularly effective at reducing populations of night-flying insects such as mosquitoes. Each bat consumes thousands of mosquitoes every night. Bats remain on land or just offshore, and are not an issue for most offshore development.

Shorebirds: Because islands have small tidal ranges, there is very little of the preferred intertidal area for shorebird habitat. Relatively small numbers of shorebirds utilize Vineyard beaches for spring and summer nesting, particularly the barrier beaches. Because of the dynamic nature of such habitats, nesting site selection may be very different from year to year. Some shorebird species are protected (Roseate Tern, Least Tern, Common Tern and Piping Plover) with strict guidelines for monitoring and protection. Others, such as the Oystercatcher, nest on Vineyard beaches with less fanfare. Although shorebird breeding on the Vineyard is relatively minor, the autumn migration may be significant, directly in line from important breeding areas such as Monomoy to the northeast. (Roseate tern photo at left, by B. Byrne, MDFW)

Shorebirds were not identified in large numbers in the Rhode Island SAMP and Cape Wind studies, other than a few in the shore-based surveys for the SAMP.

Inshore and Nearshore Birds and Ducks: Resident and migrant ducks use Vineyard waters for feeding, staging, resting and/or breeding. There are waterfowl (geese, swans and duck species such as the Mallard) which stay within ponds and embayments. Wetland and pond habitats are important for the inshore waterfowl. Paton et al (2010) found the Rhode Island SAMP area critical habitat for wintering loons, including Common Loons, a Species of Special Concern in Massachusetts. Although loons breed

elsewhere, Paton et al estimated that about 54% of the breeding population of loons in the Northeast winters in the Rhode Island SAMP area. Allan Keith recorded more than 100 Common Loons flying west in less than an hour past Squibnocket Point on November19, 2002.

Sea Ducks: Sea ducks feed far from shore and retreat even farther from shore at night to rest out of reach of predators. The RI Ocean SAMP has made all ocean waters less than 20 meters deep exclusionary for wind energy development as prime foraging areas for sea ducks. Paton et al (2010), have indicated that the most recent European research indicates that the sea duck foraging habitat extends to even greater depths, about 25 meters. The most common were the Common Eider, Surf Scoter, and Black Scoter. The same ducks depart that habitat every evening for unknown offshore spots to rest for the night. That nighttime locale is unknown, because night detection by radar was limited to a site on Block Island. Results of a Surf Scoter satellite telemetry project in conjunction with the RI Ocean SAMP during the winter 2010-11 should be helpful.

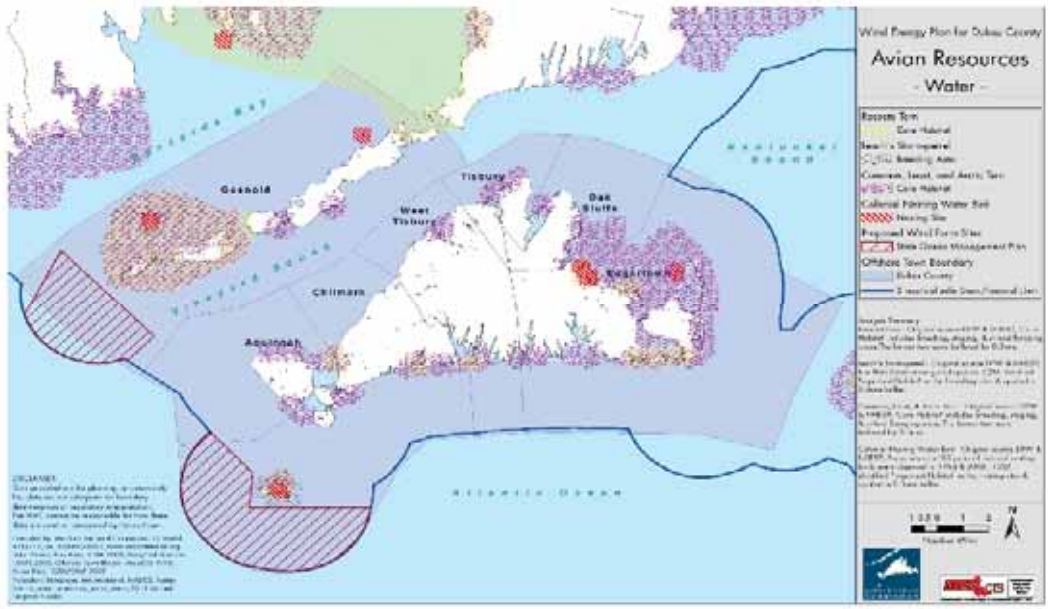
The Sea Duck Joint Venture estimates the total population of the American race of Common Eider at about 280,000, with about 57,000 of these breeding in the United States. The Martha's Vineyard Christmas Bird Count (CBC) tallied 49,000 Common Eider in 2002/2003; 45,000 the following year; and 52,000 in 2008/2009 (data from the National Audubon Society website). Eider occur all around the Vineyard, but the vast majority of these birds are members of flocks around Gay Head and Squibnocket Point.

Allan Keith has found that typical numbers of sea ducks of four species off Gay Head every winter are 10,000 to 15,000 and that these birds move around, sometimes further east up Vineyard Sound and other times off both the north and west sides of Nomans Land Island. His personal records include the following sea duck concentrations off Gay Head and Squibnocket Point: 35,000 (Nov. 4, 2004), 15-20,000 Nov. 22, 2003), 50,000 (Oct. 24, 2002), 32,500 (Nov. 19, 2002), and 150,000 (Oct. 26, 2000).

Sea Birds: Another component of avian life includes birds that remain offshore for most of their lives, coming to dry land only for breeding. Leach's Storm Petrel is an example (shown in photo at left). Listed as Endangered in Massachusetts, the species nests only on Nomans Land and Penikese Islands. More common sea birds include Gannets, Skuas, Jaegers, and Alcids (Murres, Dovekies, Razorbills and Puffins). Allan Keith recorded 5,000-8,000 Gannets off Gay Head moving south on December 2, 2001.

Critical Shore and Nearshore Avian Habitat identified in the MOMP

The Massachusetts Ocean Management Plan identified the following Shore and Nearshore areas as critical habitat, labeled Special, Sensitive or Unique Areas (SSU's):



- Core nesting, staging and critical foraging areas for the Roseate Tern;
- Nesting, staging and core foraging areas for Special Concern tern species (Arctic, Least, Common);
- Colonial waterbird important nesting habitat;
- Leach's Storm Petrel important nesting habitat.

3.1.2 Potential Impacts of Wind Energy Development

There is some information available on impacts of wind facilities and means for protection. There are mortality reports for land-based turbines, but the monitoring is not consistent. For instance, there are monitoring reports associated with California turbines, including the well-publicized mortality at Altamont Pass. However, there is no monitoring data from Texas, although that state is second only to California in wind power generation on land. Offshore experience is limited. There is useful monitoring data associated with the Horns Rev and Nysted wind farms off the coast of Denmark.

Land Birds: Regarding land birds, industry sources point out that land bird mortality from wind turbines is minor compared to other causes such as domestic cats and collisions with tall buildings. However, the UMass (Amherst) Renewable Energy Research Laboratory notes that areas in heavily used bird migration paths or that have endangered species may not be appropriate for wind power. A National Wind Coordinating Committee publication states "*while collisions…are relatively infrequent, they do occur, and birds and bats are killed or seriously injured. Depending upon the protective status or the number of individuals involved, these collisions may or may not be considered a biologically or legally significant impact. Because state and federal laws protect most raptors, any threat posed to these animals may present a legal barrier*" to permitting a wind turbine.

The United States Government Accountability Office (GAO) presented a Report to Congressional Requesters in 2009, *Wind Power: Impacts on Wildlife and Government Responsibilities for Regulating Development and Protecting Wildlife*. The report summarized a number of impacts and strategies:

- Because birds have been known to collide with wires, bury electrical transmission lines and avoid using guy wires on meteorological towers.
- "Although some studies have shown that there are no differences in mortality rates for lit turbines vs. unlit turbines, some experts argue that, regardless, it is best to use low lighting to avoid attracting birds

that migrate at night". Sodium vapor lights should never be used, because these have been known to attract birds. "The largest number of birds killed at one time near wind turbines was found adjacent to sodium lights after a dense fog". Mortality ceased after removal of the sodium vapor lights.

- Turn off turbines during times of migration and low wind.
- Pre-construction studies on wildlife and their impacts should identify preferred areas with the least harmful impacts.

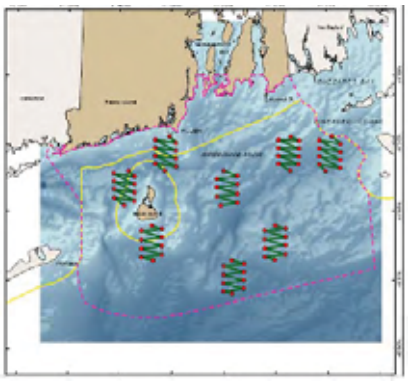
A potential conclusion from the three data sources discussed in Section 3.1.1(Manomet, Cape Wind and RI SAMP) would appear to be that the songbirds mostly migrate at night, at heights higher than a turbine, and may be in decline (at least landward of the Vineyard). It may be possible to make a rough extrapolation of migration paths between the Block Island radar data and the Cape Poge radar data, although the data were taken in different years and there may have been variations for that reason. An additional radar station, perhaps inland on the Vineyard, would be helpful and should remain in place for at least three autumn seasons, perhaps focusing on the relation of flight height to weather conditions such as fog and storms, as well as to potential landing for resting and feeding. From existing data, it would appear that land sites for wind turbines could be more problematic for migrating land birds than offshore sites. Songbirds have been reported to account for up to eighty percent of mortality at land-based wind facilities ((Johnson et al, 2003; Erickson et al, 2001). Offshore, they are more likely to fly high over the turbine height at night, when there is less wind. Further investigation is clearly needed, particularly regarding migratory details of seasonality, time of day and altitude.

Nomans Land Island is a National Wildlife Refuge, owned and managed by the U.S. Fish and Wildlife Service. Because of its status as a National Wildlife Refuge and because of unexploded ordnance from its former use as a target range for naval bombers, no wind development or construction of infrastructure for offshore generation could occur on the Island. The ad hoc Vineyard Birders group has also recommended a one nautical mile buffer around Nomans from offshore wind development. A mile is the approximate distance that a peregrine falcon might be expected to chase a songbird, for example. A mile is also the distance needed for migrating flocks using Nomans to make their ascents or descents to and from higher elevations. (Vineyard Avian Advisory Committee and MVC staff, 2009). In its comments on the Draft MOMP in 2009, the U.S. Fish and Wildlife Service criticized the proposal to have a buffer around Nomans of only 0.3 nautical miles, and called for considerably more investigation; the final MOMP eliminated the buffer around Nomans altogether.

The Vineyard Avian Advisory Committee expressed serious reservations about the possibility of two large Wind Energy Areas proposed in the MOMP within the Great Atlantic Flyway, configured perpendicular to the main Autumn migratory paths. It is unclear what the impact would be when these migratory paths are aligned with specific geographic features such as a shoreline or channel, as would be the case if wind farms were erected in the two Wind Energy Areas. The concern is that it might push the migratory path of species that currently use Block Island, Nomans, the Vineyard, and the Elizabeth Islands as resting areas, and by pushing these paths south into open ocean away from these resting areas, this could impact survival rates. This emphasizes the need for additional data collection and analysis about bird migration in this area before the possibility of commercial wind energy development in this area is consider further.

Bats: Bat collisions and mortality in relation to wind energy development have been shown to be most prevalent during the autumn migration, during times of low wind (GAO, 2005). Pre- and post-construction monitoring should identify timing of the autumn migration from the Vineyard and pinpoint the wind speeds with the most potential for bat collision during that migration. Turbines should be shut down then. Because of the low wind speeds involved, this should not prove costly in terms of lost generation.

Inshore, Nearshore and Offshore Birds and Ducks: In comparison with the small-bodied land migrants (passerines, or songbirds), the larger bodied and longer lived water birds breed later in life, producing less young over a lifetime. Migrant songbirds have evolved prolific breeding to compensate for heavy losses from predation and during migration. Losses of habitat or mortality to the less prolific water birds could have long-term impacts on the population. The Endangered Leach's Storm Petrel, for instance, is known to live an average of 20 years, with 36 years the known record (Wikipedia). Most of its life is spent at sea, including the 3-5 years prior to maturity. Coming to land only for breeding, pairs produce a single egg per season. This species would have a difficult time recovering from loss of the few breeding pairs known to nest in Dukes County. The only 2 nesting sites in Massachusetts are on Nomans and Penikese.



Regarding inshore, nearshore and offshore birds and ducks, there needs to be much more information gathered regarding their needs, as well. The procedures used for the RI SAMP represent a good model, including precisely timed shore-based surveys, boat and aerial surveys, and radar as the only means to identify night flights. The following graphic illustrates boat-based surveys; a good model, and also illustrates how close the surveys were made to the Vineyard. It indicates eight randomly-located saw tooth line transects to estimate density carried out between February 2009 and May 2010. Presumably, autumn migrants from the Vineyard area would have been picked up (except for the night flights).

The Danish Department of Wildlife Ecology and Biodiversity reported on pre-and post-construction avian monitoring for the Horns Rev and Nysted wind farms; Fox et al, 2009, *Birds – Avoidance Responses and Displacement (in Danish Offshore Wind – Key Environmental Issues)*. Research included pre- and post-construction radar, aerial surveys and impact modeling. The aerial surveys included the construction area, a strip 2 km distant from the site and a strip 4 km distant from the site. This was helpful in determining avoidance. The radar also served the same purpose, particularly capturing night movements missed in the aerial surveys. Post-construction sensing and observations were made from stations mounted on the structures, including remote controlled infrared video surveillance (Thermal Animal Detection System, NADS), important in detecting collision for comparison to the modeling.

The Danish data showed general avoidance of the wind farms, with 71-86% of all bird flock trajectories veering outside of the turbine rows. The data showed species-specific responses as well. Autumn migrating birds (large waterfowl and eiders) avoided the Nysted wind farm 91-92% after construction, for example. Gulls ventured through without hesitation. The impacts are therefore species-specific as well. For sea ducks, the strict avoidance shows that a large area of habitat has been removed from their use. For birds exhibiting less avoidance, the chances for collision are greater. Changes in flight direction occurred closer to the turbines at night, and infrared monitoring at Nysted showed no evidence of night movements of birds below 120 m, even during times of heavy migration. Radar also showed that night migrating birds flew higher than those migrating in daytime. Although species identification was not possible at night, most of the night flyers were presumed to be eiders.

The MOMP identified Special, Sensitive or Unique Areas (SSU's) to protect selected Shorebirds and Nearshore avian species. The selected habitats were identified in the MOMP as *exclusionary* regarding commercial wind development and restricted regarding community wind development. The Wind Energy Plan considers the SSU's as minimum of such critical habitat in need of protection and proposes to take protection to the more conservative level of prohibiting development there.

Sea Ducks: Eiders, Scoters and related species are known as sea ducks. Not endangered, they are rather quite numerous, making up a large part of the biomass of water birds. The data from Nysted and

Horns Rev (Fox et al, 2009) showed definitive avoidance of turbine areas by sea ducks. A large-scale wind farm would therefore represent a virtual loss of that particular habitat for the sea ducks. Because sea ducks form such a large part of the biomass, their departure or loss would represent a large enough population shift to cause concern for overall biodiversity and health of the ecosystem. The Rhode Island Ocean SAMP restricts turbines in general foraging habitat for sea ducks, generally believed to be to depths of 20 m. The Wind Energy Plan takes protection to the more conservative level of outright prohibition, as does the Cape Cod Ocean Management Plan currently in preparation. Additional research could modify this limit in a future version of this plan. (The map of this area is included in section 5.1 of this Wind Energy Plan.) The Wind Energy Plan further proposes to protect the foraging area identified by most recent research by Paton et al to extend the depth to 25 m by requiring additional review of development between 20 m and 25 m.

3.1.3 Policies

Overall Objective: The objective is to avoid negative impacts from wind energy facilities on birds and bats.

The most expedient means of protection would be to avoid bird and bat habitat. Birds and bats, however, are moving targets in that regard. Most breed in one location and migrate seasonally away from their breeding sites. Avoidance of migratory impacts is not as straight forward. Data gaps of most concern include migratory patterns for the autumn migration; including times of day and season, flight heights and avoidance tendencies. Very few mitigation methods have been successful other than shutting down operations during the height of migration for vulnerable flyers.

In order to safely develop wind energy generation facilities, it will be important to generate significantly more academic research data before large commercial developments could be considered.

Siting Requirements

The Wind Energy Plan sets the following policies for siting turbines greater in height than 150' on land or 220' over water, and associated infrastructure above ground or above sea level.

- Exclusionary Areas: The Plan identifies the following as Exclusionary Areas. These are highly critical areas where no turbines or infrastructure shall be located.
    - Critical Land Habitat identified in the Island Plan, namely Wetlands, frost bottoms, and vernal pools (See Land Habitat Section)
    - Nomans Land Island and the waters within one nautical mile
    - Critical Shore and Nearshore Avian Habitat identified in the Mass. Ocean Management Plan (based on compilation and analysis of data from various sources)
        - Core nesting, staging and critical foraging areas for the Roseate Tern;
        - Nesting, staging and core foraging areas for Special Concern tern species (Arctic, Least, Common);
        - Colonial water bird important nesting habitat;
        - Leach's Storm Petrel important nesting habitat.
    - Sea Duck Foraging Habitat; water depths twenty meters or less
    - Areas Identified as Critical Habitat under the Endangered Species Act and the regulations thereunder (Note: this criterion has been included in anticipation of possible designation of such areas, though none are presently so identified.)

- Areas of Special Concerns: The Plan identifies the following as Areas of Special Concern. Any proposal for the development of turbines and/or infrastructure shall be reviewed by the MVC with

a view to avoiding, or minimizing and mitigating, any negative impacts, using the criteria in the Plan. Development should only be considered if the project benefits warrant special consideration to consider these locations and that every effort is made to avoid, minimize or mitigate any negative impacts.

- Island Plan Areas of Special Concern, including 300' from wetlands, frost bottoms and vernal pools (See Land Habitat Section)
- NHESP Estimated Habitats of Rare Wildlife and Priority Habitats of Rare Species PH 15, PH 212, and PH 905 (See Land Habitat Section)
- Sea Duck foraging habitat; water depths between twenty and twenty-five meters

Performance Standards

The Wind Energy Plan sets the following standards for turbines greater in height than 150' on land or 220' over water, and associated infrastructure above ground or above sea level.

- Pre- Construction Surveys:
  - Three autumn seasons of surveys focused on flight patterns; species (only daytime identification to species level), flight height, weather observations, wind speed, date and time of day. For small-scale land-based projects (one turbine), human observation through regularly scheduled intervals should be sufficient. For large-scale land-based projects and for water-based projects, surveys should also include radar surveillance and aerial observations to include the project area and a strip 2 km distant and a strip 4 km distant. For water-based projects, ship-based observations shall also be included.
- Restriction on Sodium Vapor Lighting: Sodium vapor lighting is prohibited from turbines and infrastructure.
- Transmission Lines and Wires: Transmission lines shall be buried, and meteorological towers shall not be constructed with guy wires.
- Monitoring: Monitoring needs will focus on the autumn migration and are best assessed after initial surveys and prior to construction.
- Post-construction Surveys and Modeling: At least three autumn seasons of survey shall be repeated.
  - For Areas of Autumn Migration (as identified in pre-construction surveys), include remote-controlled infrared video surveillance (Thermal Animal Detection System) once turbines and infrastructure are in place for attachment. (This will provide avoidance data.)
  - Use pre-construction surveys to focus on birds and bats at risk and to model potential impacts for dates identified in the surveys; during daytime, nighttime and various weather patterns and wind speeds. Use post-construction surveys to update the model with avoidance and collision data.
- Mitigation for Autumn Migration: Turbines are to be shut down as risk increases more than 15%, based on surveys and modeling of the autumn migration and impacts. For birds, the shutdown is likely to be in the daytime for days of heavy migration. For bats, the shutdown is expected to occur during nights of low wind coupled with periods of heavy migration.

3.2 Scenic Resources and Visual Impacts

The impact on scenic values can be one of the most important factors related to the development of wind turbines in an area. However, this can also a difficult factor to deal with.

Some proponents feel that wind turbines are things of beauty that adding interest to a landscape, and they dismiss concerns about scenic values and visual impacts as subjective and superficial. Some critics argue that wind turbines are industrial machines that are out of place in and a blight on the countryside, and that no turbines should be visible at all in a place such as Martha's Vineyard. The Wind Energy Plan is based on a middle position, accepting that wind turbines could be compatible with scenic values provided their visual impacts are minimized, especially on locations with significant visual resources. A large structure such as a wind turbine might be considered normal or even a visual improvement in an industrial park or a built-up area, but would be jarring in an area of pristine natural beauty.

In order to transcend anecdotal opinion about individuals' favorite views (from their house or along their preferred walking trail), the Wind Energy Plan sets out an objective methodology and criteria to identify the most significant scenic resources on land and offshore. This includes identifying highly critical areas where turbines will be excluded, and areas of special concern where proposals to erect turbines will be subject to review based on criteria in the Wind Energy Plan.

The analysis and methodology outlined in this section are based on an extensive review of the literature in this field (see bibliography), and much has been adapted from the methodology used in the Cape Cod Ocean Management Plan. However given the relatively smaller size of the Vineyard and the fact that all the islands in Dukes County have quite a high level of scenic values, the analysis and policies are more finely grained, focused on specific vantage points and viewsheds rather than broad areas. (In the future, it would be desirable that the Martha's Vineyard Commission and town planning boards work together to refine the scenic and visual analysis of Dukes County, which should then be considered along with the Wind Energy Plan in evaluating proposals, and could also lead to revisions of this Plan.)

3.2.1 Resources

Importance of Scenic Resources: In Dukes County, scenic values are central to the islands' quality of the environment, quality of life, and community image. Extensive public input in the Martha's Vineyard Island Plan and the Wind Energy Plan for Dukes County indicates that protecting the Vineyard's scenic character and pristine natural beauty are very high priorities among residents and visitors. The residents of and visitors to the Vineyard and Gosnold have chosen to live or visit a place of great scenic beauty despite the high cost of living and other inconveniences; thus, we likely have a much higher percentage of people for whom aesthetics and scenic values are very important.

Scenic values are also critical to the Vineyard's vacation-based economy. For Martha's Vineyard alone, this represents a gross domestic product of about $800 million a year and property values of about $18 billion *[update]*. By far the most economically important sector of the marine economy in the Commonwealth is coastal tourism and recreation ($8.7 billion annually) and that the second most important activity, after swimming, is "ocean viewing" (Massachusetts Ocean Plan).

Intrinsic Character of Scenic Resources: The significance of scenic resources in a given location depends on a number of factors, notably the intrinsic character and integrity quality of the landscape/seascape, and the visibility afforded by the landscape.

The character of a landscape depends mainly on the landform (e.g. topography), vegetation (e.g. woods, scrub, grassland), and settlement patterns (e.g. villages, commercial, industrial, residential, roads, parking).

The character of a seascape depends to some extent on features in the ocean; however it also depends largely on the character of the adjacent coastal landscape.

A higher quality and more sensitive landscape/seascape is one in which:

- The character is distinct, with a strong sense of place;
- The area is natural, remote, and tranquil;
- The essential elements of the area's character or character type are present, and are unaltered or in their natural condition;
- The character type is rare;
- The viewscape is simple, making any disruption more visible;
- Visibility in the viewscape is great, due to topography and the absence of vegetation and/or buildings.

A lower quality and less sensitive landscape/seascape is one in which:

- The elements are fragmented, missing, or altered;
- The area is more human influenced, crowded, busy, and with;
- There is a weaker sense of place and elements that detract from the essential elements of the area's character;
- The character type is common;
- The viewscape is complex, making any disruption less visible;
- Visibility in the viewscape is limited due to topography, vegetation and/or buildings.

The four landscape character categories identified in the Cape Cod Ocean Management (based on the methodology outlined in the US Army Corps of Engineers Visual Resource Assessment Procedure) are:

- Developed/Built Areas – including buildings and other structures as well as roads and parking areas as primary visual characteristics;
- Wooded Landscapes – predominantly forested or characterized by dense vegetation that blocks visual access to lands or waters beyond;
- Open Landscapes – natural lands that have predominantly low vegetation such as heath landscape, agricultural fields, and mown areas where visual access to lands beyond is un-obstructed;
- Coastal Landscapes – beaches, dunes, marshes, and their associated waterways with open views to the ocean.

Some areas have been officially recognized by federal, state, regional, or local entities for scenic or related reasons.

Relation to Users: The significance of a landscape or seascape for a community depends not only on its intrinsic value based on the factors described above, but also on how accessible it is to members of the community, based on factors such as whether it is public or private and whether it is heavily frequented.

The highest priority is views of and from public lands visited by the general public, especially if the purpose of those visits includes enjoying their scenic qualities. On land, they include public open spaces (parks, overlooks, beaches, public waterfronts, etc.), scenic roads (including shoreline roads and their adjacent viewsheds), significant vistas, public trails, and publicly accessible waters such as views from the ocean and coastal ponds. Offshore, the most critical areas are those that are most visible from public vantage points, as identified above.

Although secondary to public views, consideration of private views is also warranted in this community where they play an important role in the quality of life, property values, and the attraction for people to live on and visit a given property.

Scenic Resources on Land: The characterization of scenic resources on land in the Wind Energy Plan is based a combination of a series of maps identifying areas which are significant for various reasons.

The highly critical scenic resources – Exclusionary Areas – are public open spaces, the coastline (Coastal DCPC Shore Zone), national landmarks, historic districts, and scenic roads, plus their appropriate buffers.

The areas of special concern with respect to scenic resources are other open spaces, cultural and historic DCPCs, Tribal special areas, and other historic and traditional areas, along with their buffers.

Note that many of these criteria will result in overlapping areas, so the total area covered will be less than the sum of the areas affected by each individual criterion. Most areas that are considered to have significant scenic resources are identified in the Wind Energy Plan for a variety of other reasons as well, while some are identified only because of their scenic values. For example, the suggested buffers around historic districts would likely end up being unsuitable for the development of wind turbines because of noise regulations or minimum setbacks in these generally higher density areas.

Scenic Resources Offshore: The Wind Energy Plan analyzed offshore scenic resources on the basis of the significance of vantage points on land and their related viewsheds. The aim is to provide guidance about how visible various ocean areas are from these significant vantage points.

Each vantage point and related viewshed was analyzed based on a number of criteria including features of the vantage point (number of visitors, importance of the view to visitation, extent to which it is a destination area), as well as the official recognition and/or pristine character of the vantage point and viewshed. This involved three steps.

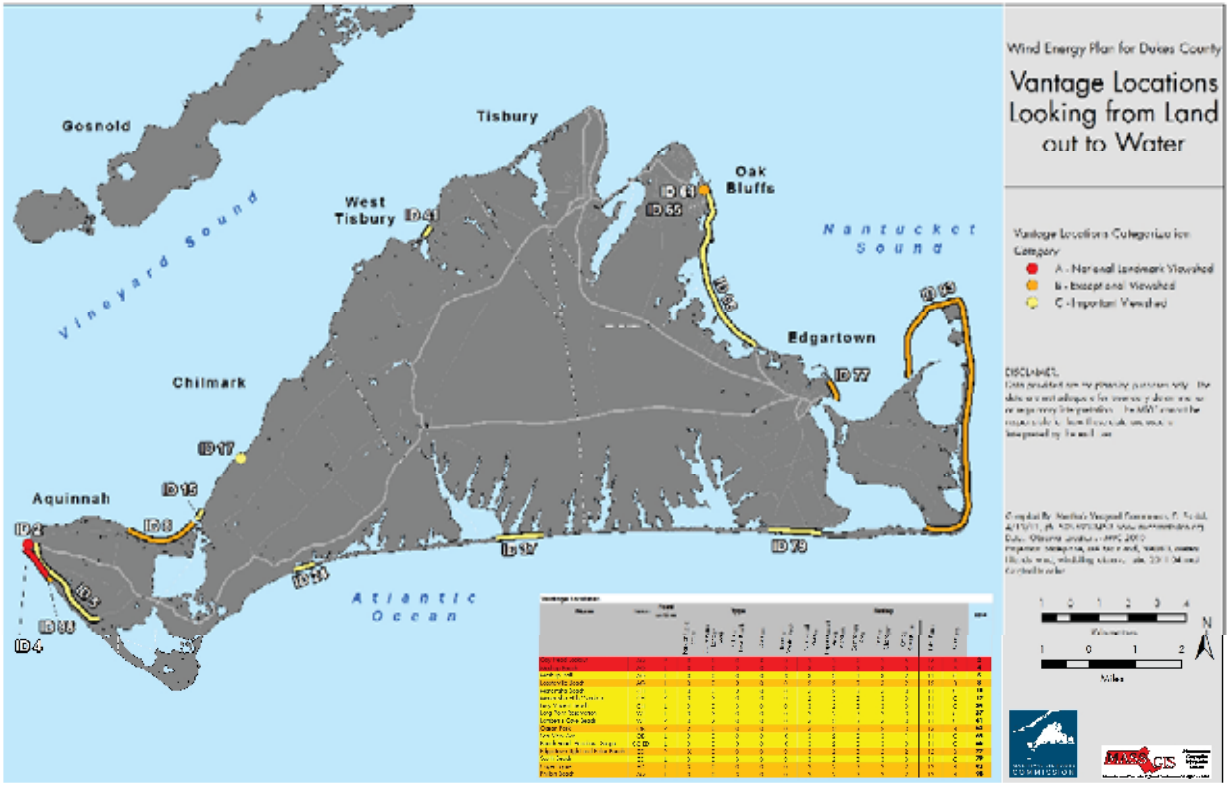
1) Identification and Categorization of Significant Vantage Points: About a hundred potential public vantage points (such as overlooks) or vantage lines (i.e. linear viewing locations such as beaches or waterfront parks) were analyzed and prioritized based on the criteria listed in the table below

Criteria for Categorization of Vantage Points	
Official Recognition	
Viewshed of National Natural or Historic Landmark	*5*
Viewshed of national historic sites and sites with Commonwealth or MVC designation	*2*
Town designation	*1*
Number of Daily Visitors (approximate)	
Large number (about 1000 or more)	*3*
Moderate number (about 300 to 1000)	*2*
Limited number (under 300)	*1*
Importance of View for Visitation	
The view is the main purpose of visitation (e.g. overlooks)	*3*
Open space / recreational area where the view is an important part of experience for most visitors	*2*
The view is one of many reasons for most visits	*1*
Destination Area	
Most visitors stay for more than an hour	*3*
Most visitors stay for less than a half hour	*2*
Most visitors pass by	*1*
Pristine Character	
Vantage point and viewshed are very pristine nature and homogeneous	*3*
Vantage point and/or viewshed have some man-made elements and heterogeneity	*2*
Vantage point and/or viewshed have many man-made elements, much heterogeneity	*1*
Categories based on totals of ratings	
A – National Landmark Viewshed – 14 or more points	
B – Exceptional Viewshed – 12 to 13 points	
C – Important Viewshed – 11 points	
D – Notable Viewshed – 10 or fewer points	

The table above and map below show the 16 vantage points which rated in the top three categories, namely

A. National Landmark Viewshed,
B. Exceptional Viewshed, and
C. Important Viewshed.

The Gay Head Cliffs have been designated by the Secretary of the Interior as a National Natural Landmark. They are one of the main attractions of Martha's Vineyard and arguably one of the most important scenic vistas on the east coast of the United States. The Overlook at the Cliffs is a major tourist destination, including people coming for the dramatic sunset, since it is one of the few locations on the east coast where people can see the sun set into the ocean. Protection of the key public vistas of and from the National Landmark is of prime importance.



c

ant Viewsheds: The viewshed was then delineated from each vantage point using GIS computer mapping, indicating where a turbine at least 200' high would be visible from that vantage point or line. The viewshed is the area that can theoretically be seen from the vantage point, not considering possible local obstructions. It is made up of two parts.

Table x - **Scenic Resources - Vantage Points for Critical Viewsheds**

Name	Town	Point or Line	Type					Rating						
			Park or Public Space	Conservation Land or Beach	Public or Town Beach	Overlook	Road with Water View	Number of Visitors	Importance of View to Visitation	Destination Area	Pristine Character	Official Recognition	Total Points	Category
Gay Head Lookout	AQ	P				X		3	3	2	3	5	16	A
Moshup Beach	AQ	L			X			3	2	3	3	5	16	A
Cape Pogue	ED	L	X					3	2	3	3	2	13	B
Philbin Beach	AQ	L			X			3	2	3	3	2	13	B
Ocean Park	OB	P	X					3	2	3	2	3	13	B
Edgartown Light and Fuller	ED	P	X					3	2	3	2	2	12	B
Lobsterville Beach	AQ	L			X			2	2	3	3	2	12	B
Beach Road Beaches - Sengo	OB ED	L			X		X	3	2	3	3	0	11	C
Lambert's Cove Beach	WT	P		X				3	2	3	3	0	11	C
Long Point Reservation	WT	L		X				3	2	3	3	0	11	C
Lucy Vincent Beach	CH	L			X			3	2	3	3	0	11	C
Menemsha Beach	CH	L			X			3	2	3	3	0	11	C
Menemsha Hills Overlook	CH	P		X				2	3	3	3	0	11	C
Moshup Trail	AQ	L					X	3	2	1	3	2	11	C
Sea View Ave	OB	L					X	3	2	2	3	1	11	C
South Beach	ED	L			X			3	2	3	3	0	11	C

- The Central Viewshed: This is the main view for the majority of visitors, the area looking generally forward from the vantage point or line.
- The Peripheral Viewshed: This is the remainder of the viewshed from each vantage point.

Delineation of Central Viewsheds

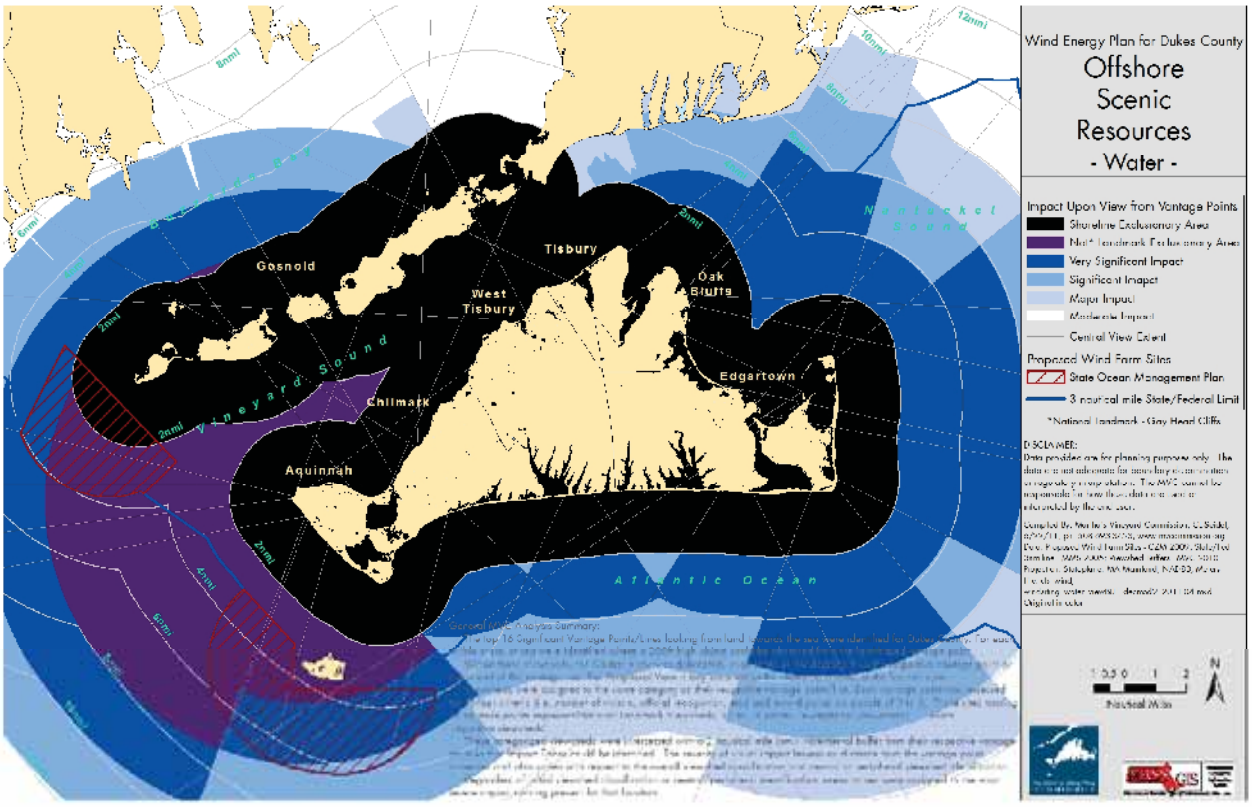
- *In the case of spaces looking seaward from a linear shore, the central viewshed is determined by projecting lines at 30 degrees from the vantage point, or from the ends of the vantage line. (This involves first drawing a straight line parallel to the vantage line, then projecting a perpendicular line from the first line, and then drawing a line 30 degrees off the perpendicular line.)*
- *In the case of curved vantage lines less than a mile long, the central viewshed was projected from the ends of a straight line joining the two ends of the vantage line.*
- *In the case of vantage lines longer than one mile, the central viewshed was projected from lines coinciding with the end portions of the vantage line.*
- *In a few cases, topographic obstructions narrow the overall viewshed, so the central viewshed is also narrowed.*
- *For the Gay Head National Natural Landmark, the central viewsheds from the lookout and adjacent beaches encompass the extent of the landmark visible from those vantage points.*

2) Preparation of Buffer Map Based on Viewsheds: The third step establishes a series of two-mile buffers based on the distance offshore, with the first two miles identified as highly critical, and with a gradation of buffers declining with increasing distance. The categories of the buffers are then increased based on the categorization of viewsheds discussed above, in order to have larger buffers for the most significant viewsheds.

Miles Offshore	National Landmark Viewshed		Exceptional Viewshed		Important Viewshed	
	Central Viewshed	Peripheral Viewshed	Central Viewshed	Peripheral Viewshed	Central Viewshed	Peripheral Viewshed
0 to 2	Shoreline Exclusionary Area					
2 to 4	Exclusionary Area	Very Significant Impact	Very Significant Impact	Very Significant Impact	Very Significant Impact	Significant Impact
4 to 6	Exclusionary Area	Very Significant Impact	Very Significant Impact	Significant Impact	Significant Impact	Major Impact
6 – 8	Exclusionary Area	Significant Impact	Significant Impact	Major Impact	Major Impact	Moderate Impact
8 to 10	Significant Impact	Major Impact	Major Impact	Moderate Impact	Moderate Impact	Moderate Impact
10 to 12	Major Impact	Moderate Impact	Moderate Impact	Moderate Impact	Moderate Impact	Moderate Impact

The central viewshed of the Gay Head National Natural Landmark out to a distance of eight miles is identified as an Exclusionary Area as is a two-mile shoreline buffer. The other ocean waters within Dukes County are Areas of Special Concern.

Offshore Scenic Resources



3.2.2 Potential Impacts of Wind Energy Facilities

The impact on scenic values can be the single most important factor as to whether people were favorable or oppose to the installation of wind turbines in various locations.

"A negative view of wind turbines on the landscape is the major factor determining opposition to wind energy." (Gipe 1995 referring to research by Maarten Wolsink)
"To succeed, future wind-power plants must somehow enfranchise their 'visual consumers' – those neighboring residents who must look at the wind turbines in their landscape. . . . Visual resources belong to the public and their use implies an obligation to use the public resource wisely." (Robert Thayer, U.C.Davis)
Prominence/Dominance: Prominence has to do with both distance and position in the view. Wind turbines diminish in prominence quickly with distance. Within a quarter mile they can be both seen and heard, and will be very noticeable. Within a half mile away they are considered to be part of the foreground view (assuming they can be seen). As distance increases, the turbines will become a much smaller portion of the overall view, and therefore, less dominant. At five miles, turbines will be visible, but much less prominent. Prominence also increases when an object is seen in the center of a view. This is especially problematic if turbines are seen in the context of an important visual focal point, where it will compete for our attention. Ideally, turbines should be located so they are at the periphery of a scenic view, or sufficiently far away to appear as a small part of the overall scene. (Vissering)

Three main factors affect the visual impacts of the development of wind energy facilities, or any development for that matter, on scenic values.

- The type of development,
- The visibility of the development,
- The sensitivity of the landscape/seascape and users.

Type of Development: The basis for any visual impact analysis is the nature of the development itself.

- Configuration and Design of Turbine(s): The visual impact depends primarily on the physical design of the project, namely the number, height, spacing, configuration, color, and shape of the turbine(s). Generally, white or light-colored turbines and towers with simple design are preferred. Monopole towers have several advantages over guyed and lattice towers: a simpler appearance less visually discordant with surroundings, the ability to house electrical equipment and cabling in the tower where they are protected from the elements and offer safer cold-weather access, and lower overall bird mortality with reduced attractive perching opportunities (Maine Model Wind Energy Facility Ordinance). For arrays of turbines, it is generally preferable to cluster them in a way that minimizes their visibility.
- Lighting: The impact at night can be especially significant if lighting is required, such when turbines trigger FAA requirements, for those higher than 200' (or lower in certain locations). The FAA's agreement that only the perimeter turbines of the Cape Wind windfarm need to be lit would somewhat reduce nighttime visibility if applied to other offshore windfarms.
- Roads, Buildings, and Storage: The visual impact of an access road can be as great as that of the turbine itself, especially when serving hilltop facilities. Similarly, support buildings and outdoor storage can have negative impacts on scenic resources or abutters unless carefully considered.

Visibility of Development: The visibility of the project will depend on its location relative to the viewer, and several other factors.

- Proximity: In most cases, how far the development is from the viewer is the most important factor. A turbine twice as far away will appear half as high. The overall visual presence of a group of turbines (height times width) varies by the square of the setback. For each doubling of the distance from shore, a group of turbines would only be a quarter as visible, so turbines 12 miles offshore (the approximate distance of the Rhode Island / Massachusetts Area of Mutual Interest) would be only a quarter as visible as one located 6 miles away (the approximate distance of the Cape Wind project in Nantucket Sound). The 2-mile exclusionary zone means that any wind energy facility would have at least a minimal setback from shore and would limit somewhat its visual impact, though turbines located two miles away would still be very prominent. On land, the minimal setbacks not only address with safety and vibrations, but also deal with visual impact, limiting the extent to which turbines could be located where they would loom over abutting properties.

  Vineyard Power did a survey of 380 people, mostly its members (a self-selected group that is likely to be especially favorable to wind energy development) using computer-screen-sized visual simulations of arrays of 17 turbines in various offshore locations. *"The majority opinion about the appearance of offshore wind turbines shifted from unacceptable to acceptable at around six miles from land"* while *"59% expressed the opinion that turbines at ten miles were acceptable and 64% found turbines at 14 miles to be acceptable. This number increased to above 80% at 18 miles."* Vineyard Power concluded that no turbines should be located closer than 10 miles. BOEMRE, in consultation with the Massachusetts Task Force made up of representatives of federal, tribal, state, regional, and local governments and agencies set the area for its commercial wind development area at a minimum of 12 nautical miles (about 13.8 miles) offshore, and the Rhode Island / Massachusetts Area of Mutual Interest respects the same setback.
- Location: Siting wind turbines in Dukes County in a way that doesn't negatively impact scenic resources is challenging because of the high sensitivity of the area as described in above. On land, most locations identifies as Qualified Areas should be suitable with respect to scenic impacts, although there might be some that turn out to be problematic. Some locations identified as Areas of Special Concern for scenic reasons might be acceptable, but need careful siting and design to minimize their impacts. Offshore, since all the coastline of the islands of Martha's Vineyard and the Elizabeth Islands have significant scenic resources, it would be quite problematic to locate any turbines close to the islands. The consensus of the Wind Energy Plan Work Group, that now is apparently shared by state and federal authorities, is that offshore commercial turbines should be located a minimum of 12 nautical miles (about 14 miles) from the shore of inhabited lands, and that locations closer to shore should only be considered for community-supported projects if it is not possible to locate them farther offshore.
- Curvature of the Earth: For offshore turbines located at a considerable distance from the viewer, visibility can be reduced or eliminated because of the impact of the curvature of the earth. In looking at the ocean from sea level, the horizon is 2.9 miles away. However, the top of a 450-foot high wind turbine would be visible up to about 28.9 miles away (Cape Cod Ocean Management Plan).
- Atmospheric Conditions: The visibility of one or more turbines depends on atmospheric conditions out of the control of the owner or permit-granting authority, such as weather conditions (fog, rain, wind) and air quality (haze, pollution). These factors can considerably reduce the visibility of a development visible in perfect viewing conditions. Even on a clear, sunny day, the blue sky overhead usually fades into pale blue or white close to the horizon due to atmospheric conditions. For offshore development located a considerable distance offshore, the average visibility conditions in our region would significantly lessen the visual impact of a windfarm on many days throughout the year.

- Sun Position The visibility of turbines changes considerably depending on the position of the sun. When the sun is behind the viewer, the color of the turbine will be clearly visible. For offshore development, the typically white turbine will largely blend into the light sky above the horizon line. However, when the turbine is backlit, it will appear to be black and the contrast with the background will significantly increase its visibility. This factor should be considered with respect to project siting in locations to the west within viewsheds where the sunset is especially important to visitors, such as the Gay Head Cliffs and Menemsha Beach.
- Specific Surroundings: The presence of topography and or vegetation can have a significant impact on the visibility of a turbine or ancillary structures from a given location, by filtering or completely screening the turbine or other parts of the facility from view. For example, the turbine at Morning Glory Farm is quite visible for westbound traffic on the adjacent Edgartown – West Tisbury Road, but is hardly visible to eastbound traffic because it is screened most of the year by dense vegetation. A turbine located right on the visual axis of a straight road or on the outside of a curved road would be more visible than one located on the inside of a curved road. Visibility from a hillside sloping gently down to the coast would be greater than land than from a plateau. This should be considered in project siting as well as in facility design which could include screening vegetation. [add illustrations]

3.2.3 Policies

The overall objective of the policies with respect to scenic resources and visual impact is to avoid, or minimize and mitigate negative impacts from wind energy facilities on scenic resources of national, state, or regional significance and minimize the visual impact of wind energy facilities on abutters and others in the vicinity of the turbine. This should consider the existing character of the surrounding area, the expectations of the typical viewer, the project purpose, the duration of potentially affected public uses, and the scope and scale of the potential effect on views. The policies are in four parts: Siting Requirements, Design Standards, Assessment Criteria, and Mitigation.

Siting Requirements

The Wind Energy Plan sets the following policies for siting turbines with respect to scenic resources and visual impacts.

- Exclusionary Areas: The Plan identifies the following as Exclusionary Areas. These are highly critical areas where no turbines shall be located.

  On land, the Exclusionary Areas include:
  - Open space land owned by a governmental body,
  - Coastal DCPC Shore Zone,
  - Municipally designated scenic roads plus a 200-foot buffer from the centerline of the road,
  - Main rural roadside viewsheds identified in the Island Plan, including the portions of fields and open areas located up to 500 feet from the centerline of the road.

  Offshore, the Exclusionary Areas include:
  - The 2-mile exclusionary zone around the coast of all inhabited islands,
  - The Gay Head National Natural Landmark Viewshed.

- Areas of Special Concern: The Plan identifies the following as Areas of Special Concern. Any proposal for the development of wind turbines shall be reviewed by the MVC and the local special permit granting authority with a view to avoiding, or minimizing and mitigating, any negative impacts on scenic resources, using the criteria in this Plan, with the greatest effort to avoid turbines in the highest categories.

On land, the Areas of Special Concern include:

- Open space land owned by a non-profit organization, or privately owned,
- A 500-foot buffer around open space land,
- Districts of Critical Planning Concern designated for natural reasons (not including the Town of Aquinnah DCPC except for those portions within other DCPCs),
- A buffer of 500' from municipally designated historic districts,
- The portion of the main rural roadside viewsheds identified in the Island Plan that is located more than 500 feet from the centerline of the road,

Offshore:

- Wind turbines should preferably be located at least 12 nautical miles offshore, in federal waters.
- All waters in Dukes County that are not Exclusionary Areas are identified as Areas of Special Concern;
- Turbines should be avoided in state waters if at all possible. If turbines are to be located in state waters based on the criteria outlined in section 11.3 (Appropriate Scale), they shall be sited to avoid areas of highest impact.

- Array of Turbine Groupings: In the case of a group of two or more turbines, especially for offshore wind, it is usually desirable that the turbines be clustered so that as much as possible of the viewscape remains undisturbed. The shape of an offshore cluster shall, as much as possible, minimize the percentage of the angle of view that is disturbed from each vantage point. This evaluation shall consider the total cumulative impact if several groupings could be visible from one vantage point.
- Setbacks: Part of the reason for the minimal setbacks described in section 6 is to reduce the visual impact on abutters.

Performance Standards

The following standards shall be used in designing and evaluating a wind energy facility.

- Support Towers: Towers greater than 150' high shall be monopole type. *[add reasons]* Offshore towers shall be monopole above the foundation transition platform. For towers under 150 feet high, monopole towers are preferred; however another type may be appropriate for its setting in consideration of noise, other impacts, and economically viability.
- Color and Finish: Wind facilities shall be painted a neutral, non-reflective exterior color designed to blend with the surrounding environment, in conformance with regulations of the Federal Aviation Administration.
- Lighting: Lighting of turbines shall be prohibited except as required by the Federal Aviation Administration or other state or federal law, and shall be the minimum necessary. Lighting of other parts of the wind energy facility, such as appurtenant structures, shall be limited to that required by regulation for safety and operational purposes. Lighting shall be designed to minimize glare on abutting properties and except as required by the FAA, shall be directed downward with full cut-off fixtures so there is no light cast beyond the property lines of the project parcel. (For communal wind energy facilities, the cut off shall be at the property line of an owner not part of the communal facility.)
- Signage: Signage at the wind energy facility is limited to no trespassing, danger, emergency contact information, reasonable identification of the manufacturer or operator, and educational information. All signs shall comply with the requirements of the Town's sign regulations. No signage, whether on the tower or freestanding, shall be erected more than ten feet above the

ground. No advertising, nor any sign, writing, or picture that may be construed as advertising, shall be permitted.

- Appurtenant Structures: All equipment necessary for monitoring and operation of the wind energy facility shall be contained within the turbine tower whenever technically and economically feasible. If this is unfeasible, ancillary equipment such as equipment shelters, storage facilities, transformers, and substations, may be located outside the tower provided they are designed to minimize their impact and are architecturally. Structures shall only be used for housing equipment for this particular site. Whenever reasonable, structures shall be shielded from view by vegetation and/or located in an underground vault and joined or clustered to avoid adverse visual impacts.
- Facility Planning: Access roads and support facilities shall be located and designed to minimize visual impact by avoiding ridgelines and steep slopes, and by providing screening of support facilities such as with appropriate enclosures, fencing, or vegetation. Reasonable efforts shall be made to locate utility connections from the wind energy facility underground.

In some cases, it is not feasible to completely deal with the visual impacts of a project that is deemed, on balance, to be desirable. In this case, the project proponent might offset negative visual impacts by correcting an existing visual problem identified within the viewshed of the same scenic resource, such as burying telephone wires, screening existing unsightly structures, or increasing vegetation. Another possible offset would be to create a public viewing amenity such as a scenic overlook.

Assessment Criteria

In order to allow a project proponent to design, and review board to analyze, a proposal to erect one or more wind turbines, the applicant shall prepare and submit a Visual Impact Assessment (VIA) of the proposal. This is an assessment of the visual impact of the project and an analysis of possible mitigation measures. The following are the components of a full VIA; the permit-granting authority could scale back the VIA requirements in the case of smaller proposals.

- Zone of Visual Influence (ZVI): This is a map of the area over which a development can theoretically be seen (also called the Zone of Theoretical Visibility). It may not actually be visible in reality due to localized screening. The ZVI indicates all areas where there may be a line of sight, and does not convey the nature or magnitude of visual impacts. For facilities with multiple turbines, it is possible to use colors to indicate the number of turbines visible from each location.
- Visualizations: These are visual simulations of what the turbine(s) would look like from representative and worst-case viewpoints. Visual simulations shall be required for any wind turbines more than 150 feet high, those in Areas of Special Concern for scenic reasons, and in other cases as deemed necessary by the application review board.

A number of viewpoints are chosen in order to assess: the existing visual resource; the sensitivity of this resource to windfarm development; the proposed design (incorporating mitigation measures to minimize any adverse impacts); and the predicted appearance of the final proposed development.

- Representative viewpoints shall be selected to be representative of the range of views and viewer types where a proposed development is likely to be visible and to result in significant effects on the view and the people who see it (receptors). These should include various landscape character types, areas of high landscape or scenic value, populated areas, main roads, and points at various distances and elevations, and various extents of windfarm visibility.

- Specific viewpoints shall be chosen for their importance as key viewpoints within the landscape. Examples are public spaces, lookouts, local visitor attractions, settlements, routes valued for their scenic amenity, or places with cultural landscape associations.

For a single turbine, three to six viewpoints should be adequate. For a major windfarm proposal, it is common that there be 10 to 25 viewpoints.

View Representations. These shall be in color and include actual pre-construction photographs and accurate post-construction simulations of the height and breadth of the wind energy facility (by superimposing a visual model of the wind energy facility onto photographs of existing views). All view representations shall include existing, or proposed, buildings or tree coverage, and be accompanied by a description of the technical procedures followed in producing the visualization (distances, angles, lens, etc…).

Photomontages should be printed for selected viewpoints to be shared with members of the public. Printed, hand-held, visualizations should be designed to be seen at an arm's length (16-20") and all viewing distances should be the same. If a panorama is very wide, such as a hilltop 360° view, it is useful to show the full panorama at a smaller scale in addition to the photomontage of the area where the turbines will be. Ideally, photomontages should be exhibited at a larger scale on site where the visualizations can be compared to the 'real life' view, with large images mounted on display boards, with the correct viewing distance marked upon the ground. In addition to full photomontages for the main viewpoints, it could be useful to generate wireframes (computer-generated line drawings based on a digital terrain model) for additional viewpoints.

Visualizations can never exactly match what is experienced in the field. The human brain tends to exaggerate vertical dimensions, so the visual impact seems greater in real life than it appears in a photograph. The literature cites examples of people being surprised by the visibility of a wind turbine installation, despite the fact that photomontages are technically accurate.

4. Land Resources

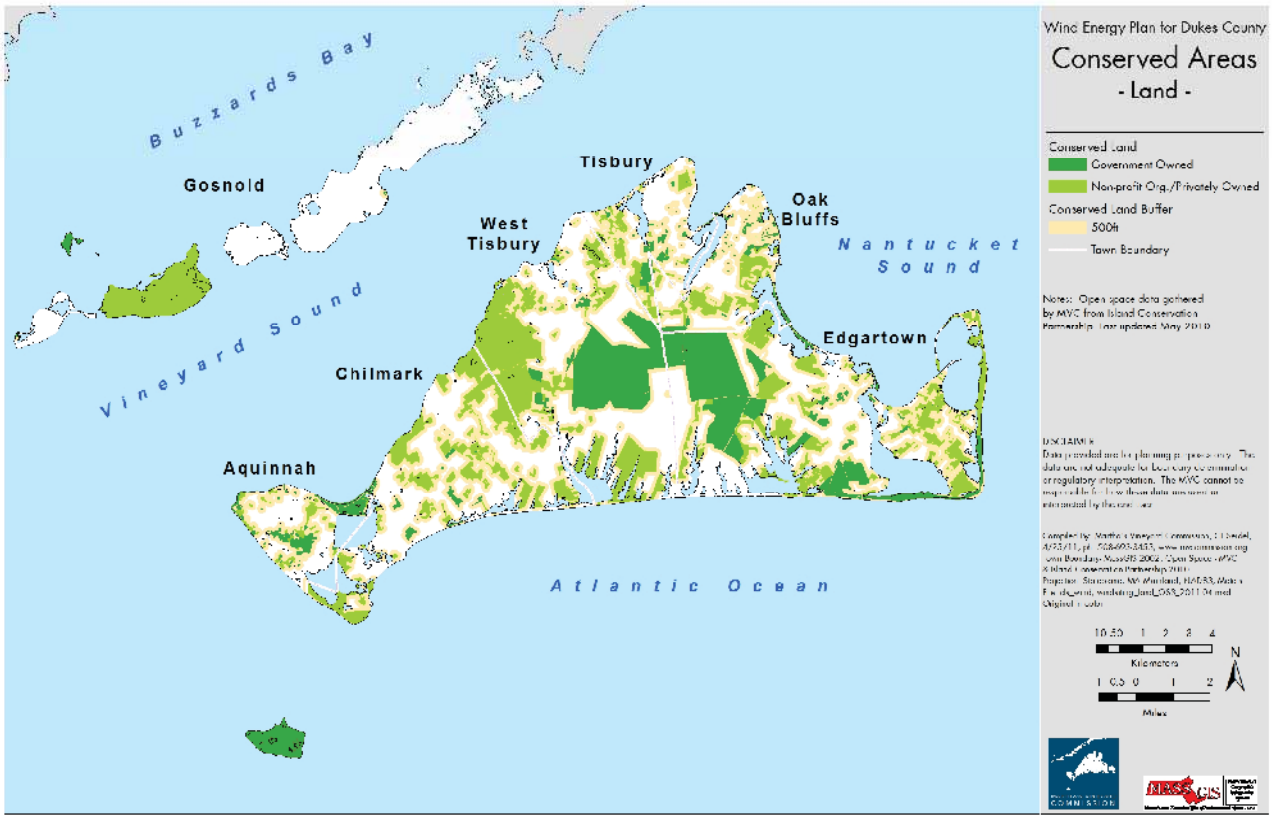
The maps and explanations on the following pages describe each of the land-based natural and cultural resources, discuss how they could be impacted by wind energy development, and outline policies aimed at limiting negative impacts.

4.1 Open Space and Natural Resources

This section describes land-based open space, areas with particular natural resources and habitats that could be affected by the construction of wind facilities, and outlines potential impacts and measures to avoid or mitigate those impacts.

4.1.1 Resources

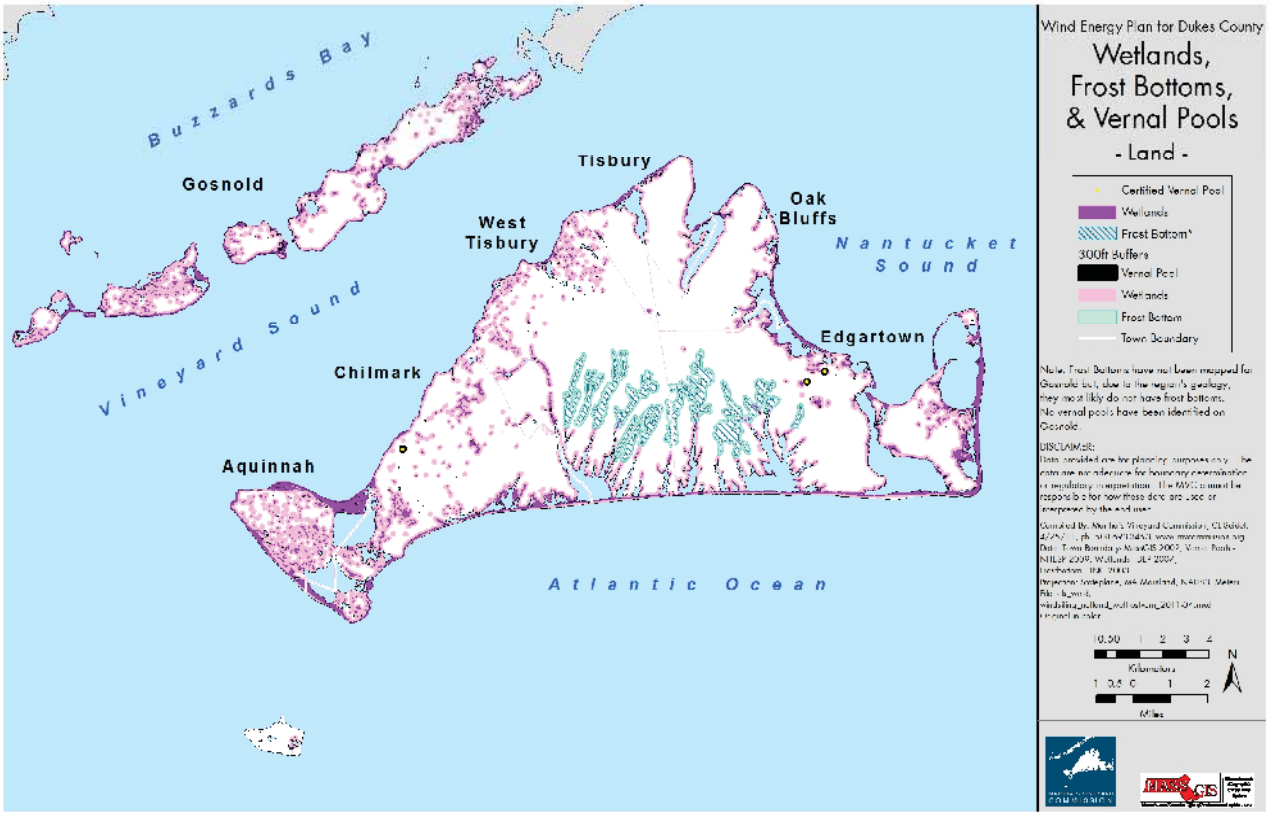
Open Space



Dedicated open space is land that was acquired or is used for conservation or recreation purposes and is:

- Owned by a governmental body (such as the State Forest, parks, beaches) ;
- Owned by a non-profit organization (such as conservation lands and reserves); or
- Privately owned and protected by a permanent conservation restriction.

Wetlands, Frost Bottoms, and Vernal Pools



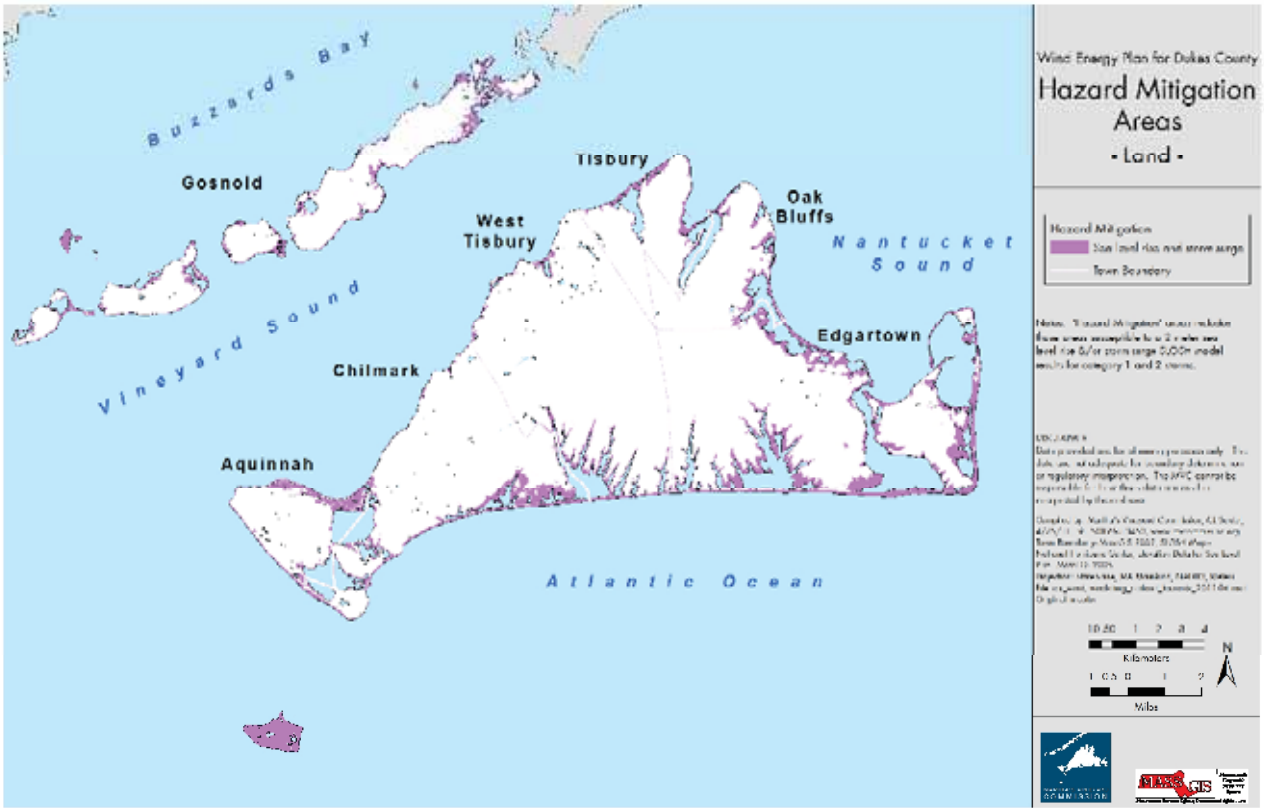
Wetlands, frost bottoms and vernal pools are either exceptionally productive and high in biodiversity (wetlands) or specialized habitats which host rare species adapted to otherwise hostile conditions (frost bottoms and vernal pools).

Wetlands habitat is highly productive in terms of biodiversity. The salt marsh, particularly, is perhaps the most productive environment on earth. Where water meets land, the combination of nutrients and water make for a very hospitable habitat which is important for a number of commercial and rare species. Overall biodiversity and biomass are also abundant in wetlands habitats.

At the other end of the extreme are inhospitable habitats like frost bottoms and vernal pools. Frost bottoms are u-shaped valleys with gravel bottoms, remnants of glacial retreat. They are named for the extremes of temperature, with frost possible during any month. Even tough scrub oak can be hit with frost damage in summer, leaving a barren-looking patch until recovery. This environment is so hostile that only a few species are adapted to life there, and they have developed a need for that habitat to survive. Several species of rare invertebrates, particularly moths, inhabit the frost bottoms.

Vernal pools are also inhospitable habitat hosting rare species which have become adapted to and dependent upon the ephemeral vernal pool habitat. Vernal pools only fill with spring rains, and are dry for most of the year.

Hazard Mitigation Lands

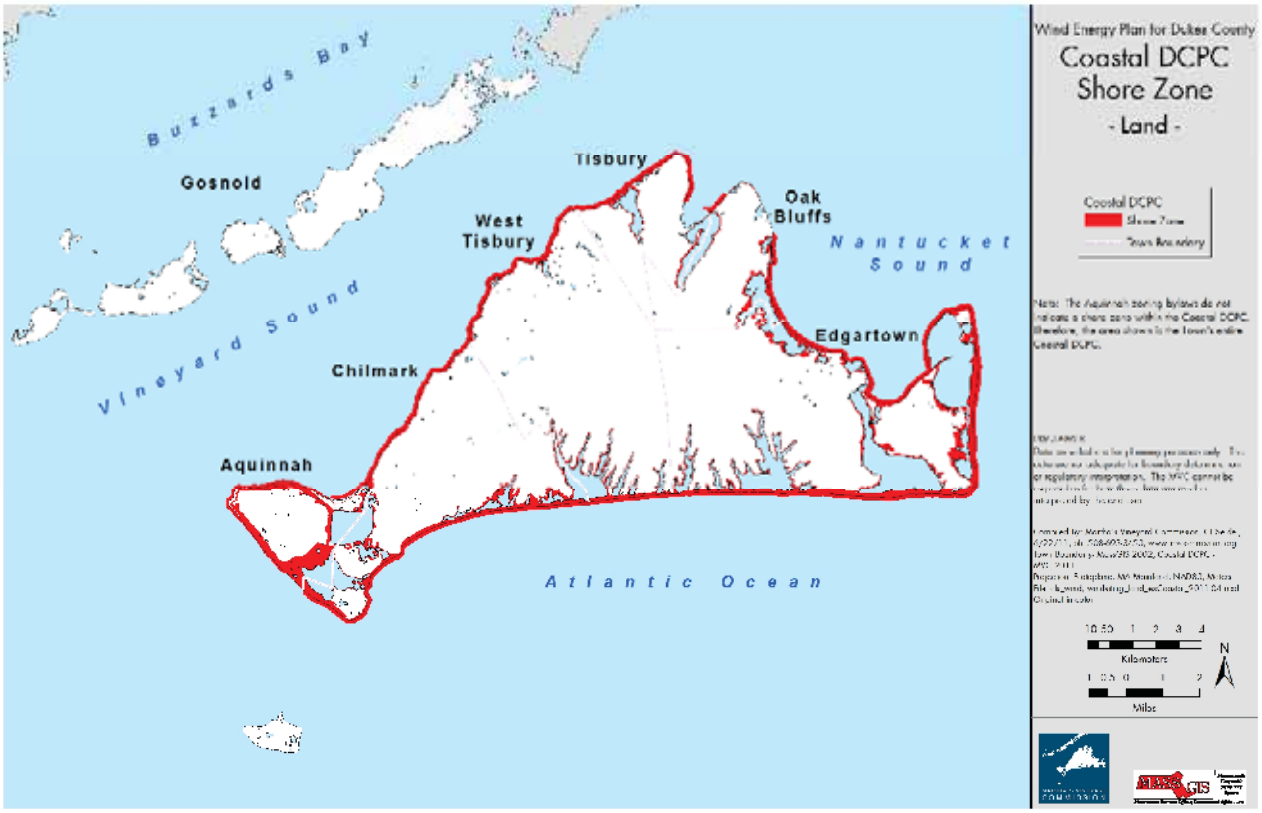


The map above indicated those areas that are most at risk from natural hazards such as coastal flooding, as well as at risk from the effects of sea-level rise. The low-lying and highly exposed areas include:

- Areas subject to flooding due to storm surges resulting from category 1 and 2 hurricanes, as identified by the US Army Corps of Engineers in SLOSH (Sea, Lake and Overland Surge from Hurricanes) maps;
- Areas less than two meters above mean sea-level, which will be subject to the impacts of sea-level rise. Note that this largely overlaps the first areas.

It is projected that the impacts of climate change will also lead to an increase in the frequency and severity of major storm events, namely hurricanes and nor'easters. It would be useful to carry out computer modeling to identify the areas susceptible to a combination of the areas currently subject to storm surges and to sea-level rise as well as the effects of coastline migration, namely the annual shift in the location of the coast, which can be as much as 12 feet per year in some parts of the south shore of Martha's Vineyard.

Coastal District of Critical Planning Concern

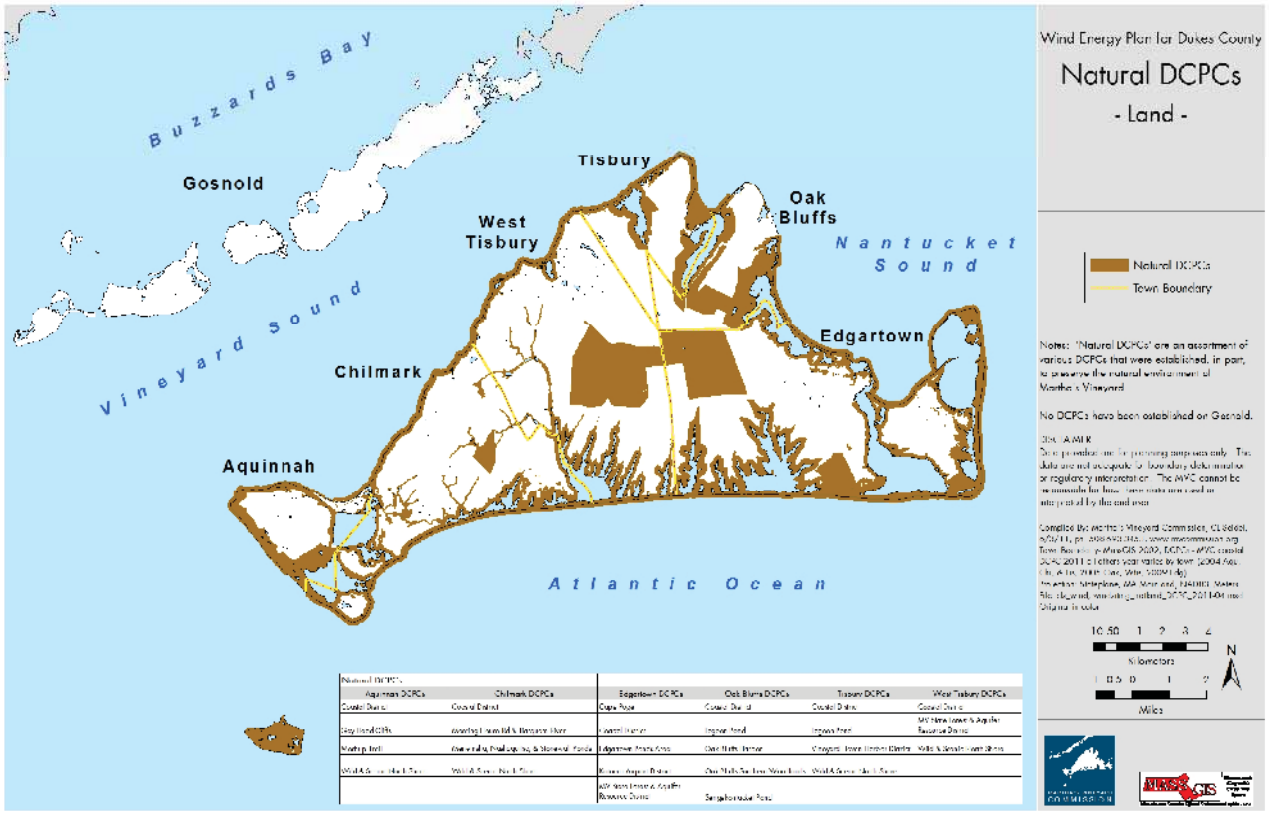


In 1975, the Martha's Vineyard Commission designated the Coastal District as an Island-wide District of Critical Planning Concern, in accordance with the Commission's legislative authority. The Coastal District generally includes the areas below 10-foot contour or within 500' of Mean High Water, but excluding most downtown areas. The District includes two zones:

- The Shore Zone includes the area from Mean Low Water to 100' inland of the inland edge of beach or marsh grass and 100' inland of the crest of a bluff greater than 15' in height;
- The Inland Zone is the remainder of the District.

The Coastal District largely overlaps with the Hazard Mitigation Lands identified on the previous page.

Natural Resource Districts of Critical Planning Concern

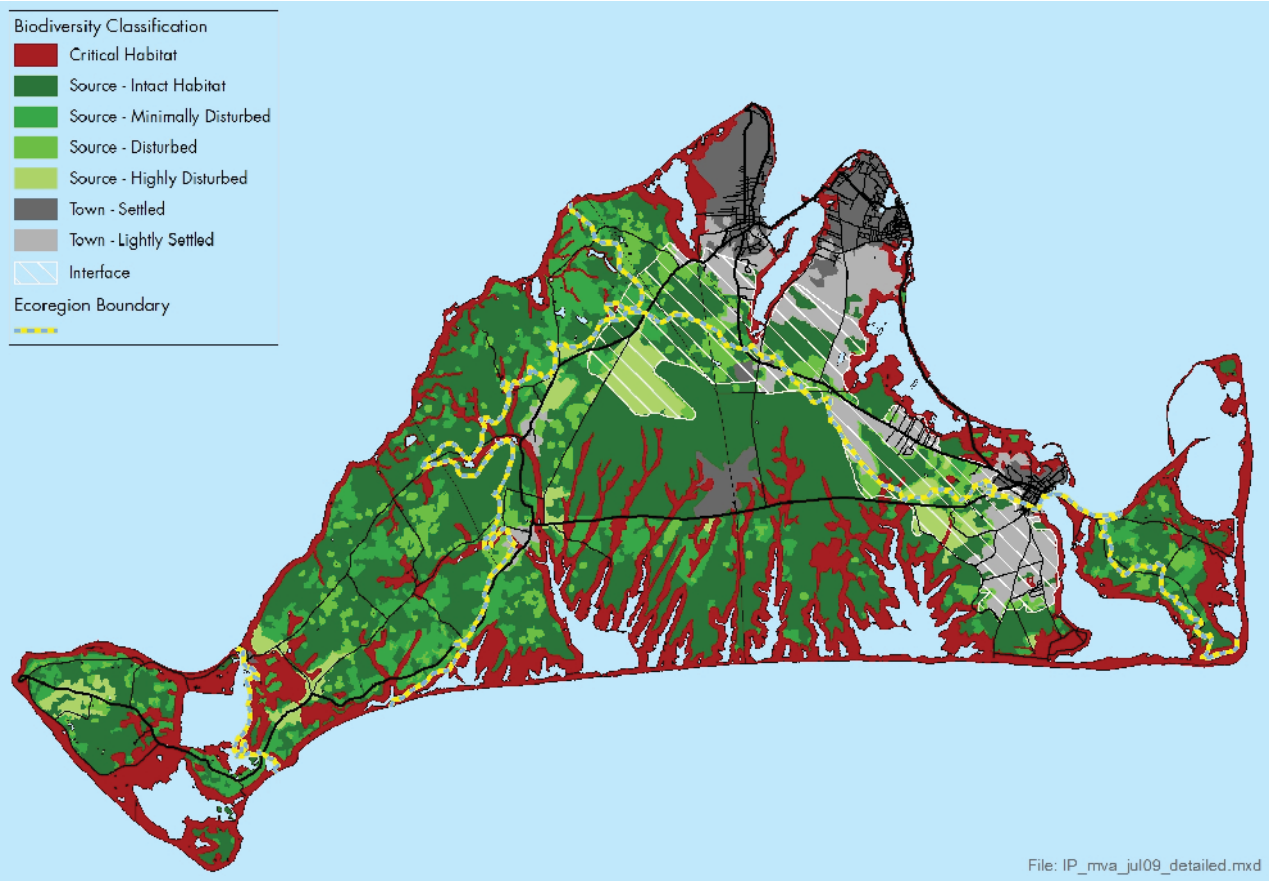


Since 1975, the Martha's Vineyard Commission has designated many Districts of Critical Planning Concern for a number of "natural resource" reasons including: as a Drinking Water District; a Fishing Resource District; a Farming Resource District; a Wildlife, Natural, Ecological, or Scientific Resource District; or a Hazardous District. The following Districts include natural resource criteria in their designations:

- Coastal District
- Island Road District
- Gay Head Cliffs District
- Moshup Trail District
- Wild and Scenic North Shore District
- Meeting House Road and Tiasquam River District
- Menemsha, Nashaquitsa and Stonewall Ponds District
- State Forest and Aquifer Resource District
- Lagoon Pond District
- Oak Bluffs Harbor District
- Oak Bluffs Southern Woodlands District
- Sengekontacket Pond District
- Cape Pogue District
- Edgartown Ponds District
- Katama Airport District
- Vineyard Haven Harbor District.

Note that the whole town of Aquinnah is a DCPC including for natural reasons, but this has not been included other than for those areas within other "natural resource" Districts.

Habitat



Nearly 40% of the Vineyard (40,000 acres) has been designated by the Commonwealth's Natural Heritage and Endangered Species Program as Priority Habitat for rare and endangered plants and animals.

Many of the most endangered species include Sandplain Grassland insects and birds which feed on them. Sandplain Grassland is an open field community that developed at the end of the last continental glaciation. This rare ecosystem only developed on the outwash plains adjacent to the last ice front; on Martha's Vineyard, Nantucket, Cape Cod, Block Island, Long Island, and in New Jersey.

Biodiversity, the variety of species, is important to the health of any ecosystem. The Island Plan (2009) identified five eco-regions on Martha's Vineyard: the Central Sandplain, the Southern Sandplain, the Western (Moist) Moraine, Aquinnah Moraine, and the Eastern (Dry) Moraine. The western moraine is particularly suitable for biodiversity. With its variable terrain and moisture-retention capacity, this is the only part of the Vineyard capable of supporting hardwood growth, for instance. The ridge extends to the southwest under the sea, where it continues to provide undersea biodiversity.

Particularly important to biodiversity is functional land and surface water needed to sustain viable populations of native species. Since these areas act as essential source areas for the plant and animal inhabitants that might disperse to other parts of the Vineyard, they are referred to as Source Areas. In general, Source Areas should be maintained and restored to large enough tracts to absorb a variety of carefully managed uses, including limited human activity (e.g. low density housing on large lots with limited development envelopes); fragmentation is of particular concern. The Island Plan identified the following areas identified as particularly sensitive.

- Critical Source Habitats: These areas, such as scrub oak frost bottoms, barrier beaches, streams and valleys, are individual habitats (parts of an ecosystem) that are particularly rare and vulnerable, and cannot absorb much human-based impact. These habitats tend to be linear features. Development should be avoided if at all possible.
- Source Areas - Intact: This category includes conservation lands. It also includes other areas where the habitat is still intact, and where it is important to avoid destruction or fragmentation of habitat. It is especially important that these areas are managed in their optimum native habitat as they constitute the main sources of wildlife that populate the other areas (called "sink" areas).
- Interface Areas: These are areas of significant habitat located between the main Source Areas and the main Down-Island towns. Though they have considerable habitat value on their own, they are somewhat less critical that the more centrally located Source Areas.

4.1.2 Possible Impacts of Wind Energy Development

Open Space: Government-owned Open Space has been set aside for conservation and/or recreation, often with public funds. Public open spaces are not suitable for development, which is generally prohibited and this includes wind energy facilities. Sometimes people propose to build what they consider to be worthwhile projects in public open spaces, which they see as empty or unused land; but these properties are not "unused", they are public open spaces and play an important part in the community.

Private and Nonprofit-owned Open Space, whether or not it is accessible to the public, are generally significant pieces of land, generally represent a significant investment in conservation, and development is generally prohibited. Though they are generally not suitable for wind energy development, making these lands Areas of Special Concern could allow limited development, such as for support facilities.

Should development of wind turbines in an open space ever be contemplated by the public, non-profit, or private owners, this would require a revision to the Wind Energy Plan.

The erection of wind turbines close to open space could have a significant impact on that open space. Therefore, the Wind Energy Plan calls for review of any turbine within a 500' buffer from protected Open Space Land, so that the reviewing authority can ensure that the impacts on the open space have been avoided, or minimized and mitigated.

Wetlands, Frost Bottoms, and Vernal Pools: Wildlife habitat is the priority use of Wetlands, Frost Bottoms and Vernal Pools. These areas are not suitable for development at all and the Wind Energy Plan prohibits wind energy development there. Careful project review is needed within 300' of Wetlands, Frost Bottoms, and Vernal Pools in order to protect those resources from intrusive edge effects.

Hazard Mitigation Lands: Development in the highest risk areas is unsuitable**.**

Coastal District of Critical Planning Concern: The Wind Energy Plan prohibits the construction of turbines in the Shore Zone and requires special review of projects proposed within the Inland Zone.

Natural Resource Districts of Critical Planning Concern: Since wind energy development in one of these DCPCs could impact the resources that led to the designation of these districts, development should be avoided if possible and any proposed wind energy development should be subject to special review to ensure that the resources and values that led to the original designation.

4.1.3 Policies

Overall Objective: Avoid negative impacts from wind energy facilities on the most productive or specialized habitat and protected open space. Avoid construction in the most hazardous areas. Avoid, or minimize and mitigate the impact of wind energy facilities on buffer areas.

Siting Requirements:

- Exclusionary Areas: Wind energy development is prohibited in the following areas:
  - Dedicated Public Open Space
  - Wetlands, Frost Bottoms, and Vernal Pools Wetland resource areas as identified by the Massachusetts Department of Environmental Protection and/or as determined by the Town's Conservation Commission.
  - Coastal District Shore Zone
  - Hazard Mitigation Lands
  - Critical Source Habitats and Intact Source Areas identified in the Island Plan (2009)

- Area of Special Concern:
  - Dedicated privately owned or non-profit owned Open Space
  - Buffer of 500' around Open Space
  - Buffer of 300' around Wetlands, Frost Bottoms, and Vernal Pools
  - Coastal District Inland Zone
  - Districts of Critical Planning Concern with natural resource designations
  - Habitat Interface Areas identified in the Island Plan.

Performance Standards:

- **Exclusionary Areas:** No wind energy facilities shall be located in the Exclusionary Areas. Cables should also avoid exclusionary areas. However, cables may be considered in Exclusionary Areas other than Wetlands if it can be demonstrated that the cable cannot be placed in another location, provided that the impacts have been minimized to the greatest extent feasible and that the remaining impacts have been fully offset with mitigation measures.
- **Areas of Special Concern:** No wind energy facilities should be located in an Area of Special Concern. However, if it can be demonstrated that there is no feasible alternative, a development proposal may be considered, provided that the impacts have been minimized to the greatest extent feasible, and that the remaining impacts have been offset with mitigation measures.

4.3 Cultural Resources

This section describes the cultural resources and human uses on land that could be affected by the construction of wind turbines, and outlines the measures to mitigate potential negative impacts, including the prohibition of turbines in some areas, the requirement for special review in other areas, and performance criteria for project review.

4.3.1 Resources

Martha's Vineyard has a rich cultural history reflecting the 10,000 years of the presence of native people discussed in the last section, as well as over four centuries of European settlement. Cultural resources include archeological, historic, and architectural, sacred resources of national, statewide, regional, and local significance. Identification of these resources in Dukes County could not be considered exhaustive, and protection measures are also somewhat limited.

- Archeological Resources: There are many properties that have yielded, or may be likely to yield, artifacts or other information important to prehistory or history. In the early 1990s, preliminary archeological surveys were conducted in all Vineyard towns but Tisbury. There are no public maps of these resources.

- Historic Resources: These are defined as structures, properties, or areas that are associated with significant historic events that have made a significant contribution to the broad patterns of our history; or that are associated with the lives of people significant in our past.

- Architectural Resources: These are buildings or other structures that embody the distinctive characteristics of a type, period, or method of construction, that represent the work of a master, that possess high artistic values, that serve as landmarks in a community, and/or that are contributing elements to larger groupings such as streetscapes, roadscapes, or districts that have the above significance.

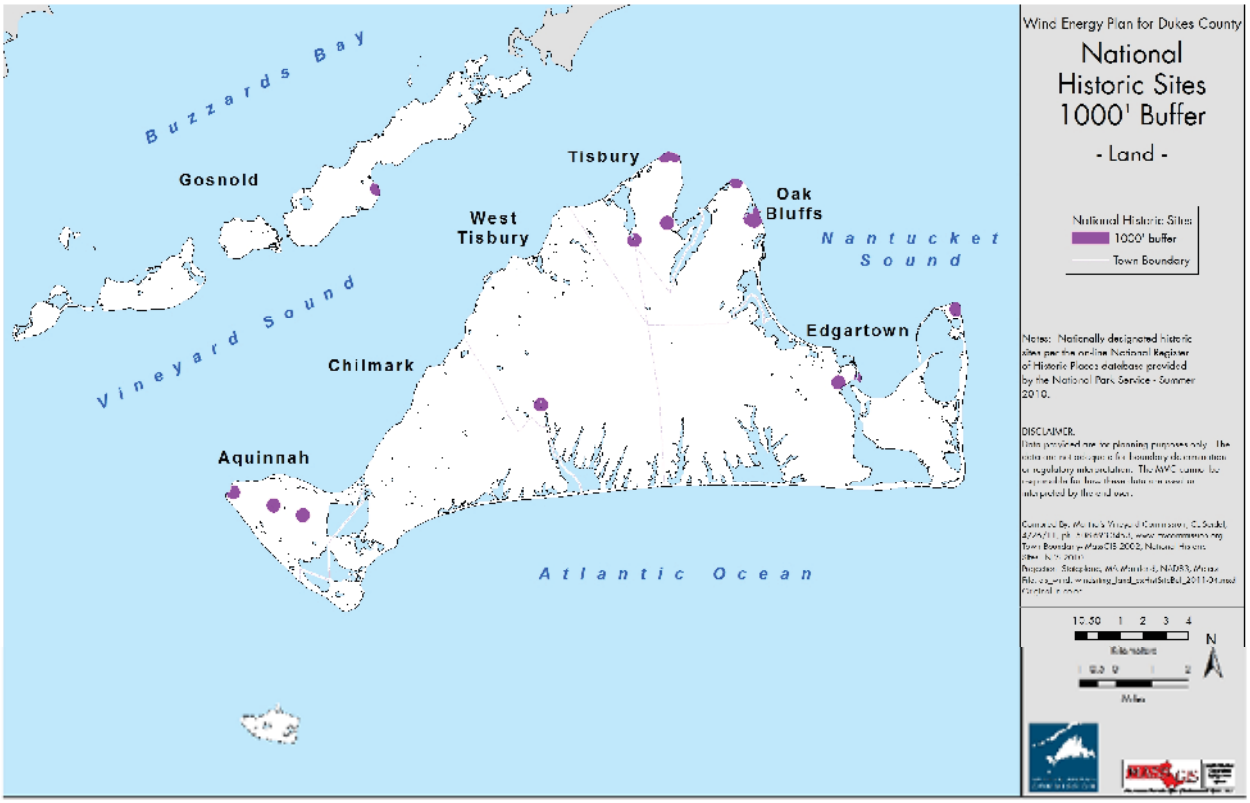
  There are about 2,000 buildings more than 100 years old on the Vineyard, and another 1,500 built up to the end of World War II. Of these, about 930 are located in the Island's six designated Historic Districts (which cover 502 acres), four of which are on the National Register of Historic Places. Another 1900 are concentrated in Historic Areas (about 2,000 acres for the Island) and Traditional Neighborhoods (about 500 acres).

  A decade ago, historic building surveys for parts of all six Island towns. More than 150 structures and places were recommended for nomination to the National Register of Historic Places or Districts and additional properties were recommended for further study.

  The Island Plan mapped areas that include a significant proportion of the pre-1946 buildings, comprising about 5% of the land area of the Island.
  In addition, many other structures or man-made elements have cultural significance, such as traditional roads, trails, and stone walls.

- Sacred Resources: These include tangible and intangible resources that have spiritual value. In addition to the Tribal resources listed in the previous section, examples include cemeteries, monuments. [other examples?]

National Historic Sites

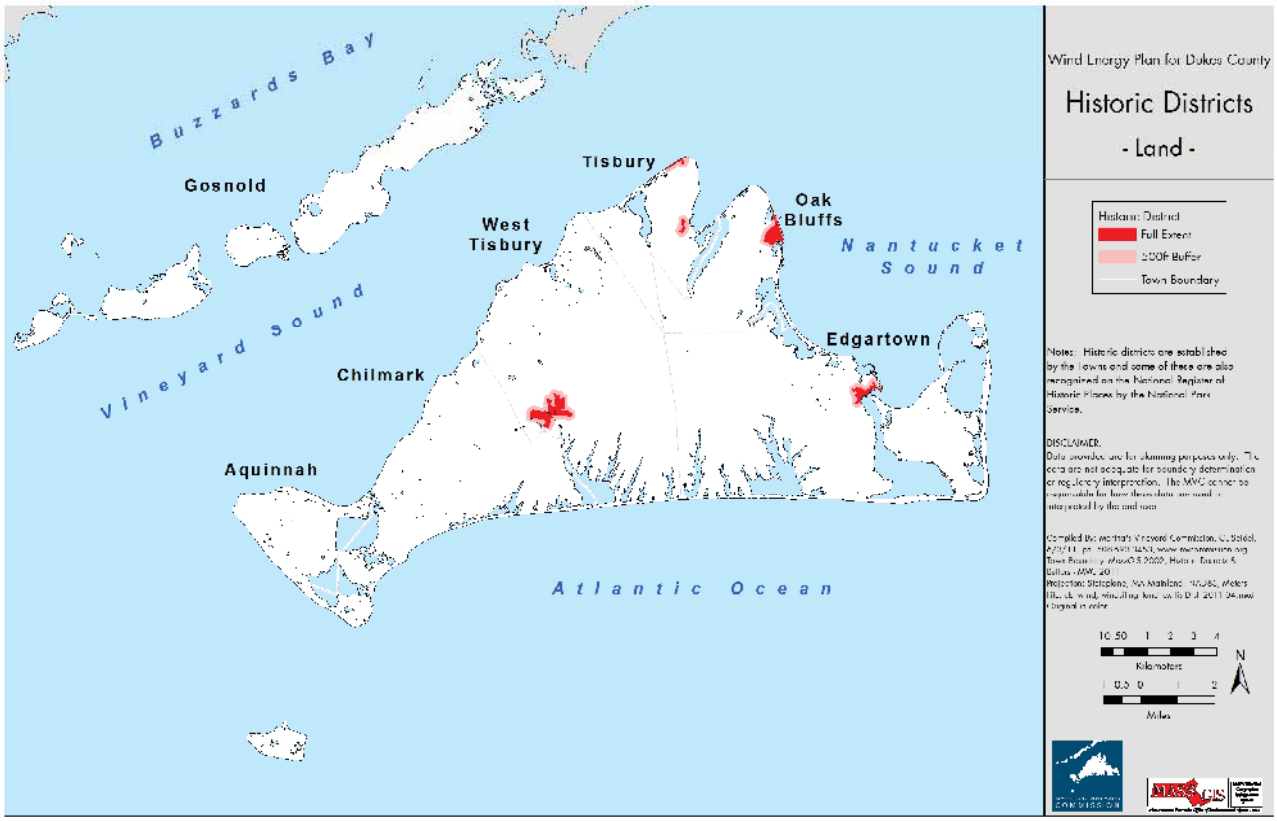


There are presently 18 National Historic Sites in Dukes County, namely:

- Arcade - 134 Circuit Ave. Oak Bluffs
- Cape Poge Light - Chappaquiddick Island
- East Chop Light - Lighthouse Rd. Oak Bluffs
- Edgartown Harbor Light - Off N. Water St.
- Edgartown Village Historic District - Bounded by Water St. (North and South) and Pease's Point Way(North and South)
- Flying Horses - 33 Oak Bluffs Ave
- Gay Head Light - Lighthouse Rd
- Gay Head--Aquinnah Town Center Historic District - South Rd. and Church St.
- Gay Head--Aquinnah Town Center Historic District (Boundary Increase) - South Rd., Totem Pole Way and Jeffers Way (not mapped)
- (Martha's Vineyard Campground (Wesleyan Grove)- Roughly bounded by Cottage Path, Quequechan, Clinton, Dukes, County, Siloam, Lake, and Central Aves.
- Old Mill - Edgartown-West Tisbury Rd. West Tisbury
- Ritter House - Beach St Tisbury (not mapped
- Tarpaulin Cove Light - Naushon Island Gosnold
- Tashmoo Springs Pumping Station - 325 W. Spring St. Tisbury
- Tucker, Dr. Harrison A., Cottage - 42 Ocean Ave. Oak Bluffs
- Union Chapel - Bounded by Circuit, Kennebec, and Narragansett Aves. and Grove St. Oak Bluffs
- Vanderhoop, Edwin DeVries, Homestead - 35 South Rd. Aquinnah
- West Chop Club Historic District - Iroquois Ave. Tisbury
- West Chop Light Station - W. Chop Rd. Tisbury
- William Street Historic District - Williams St. from Wood Lawn Ave. to 24 Williams St. Tisbury

It order to protect the historic settings of these sites, the Wind Energy Plan identified a 1000-foot buffer around each one within which the erection of wind turbines would be prohibited.

Historic Districts



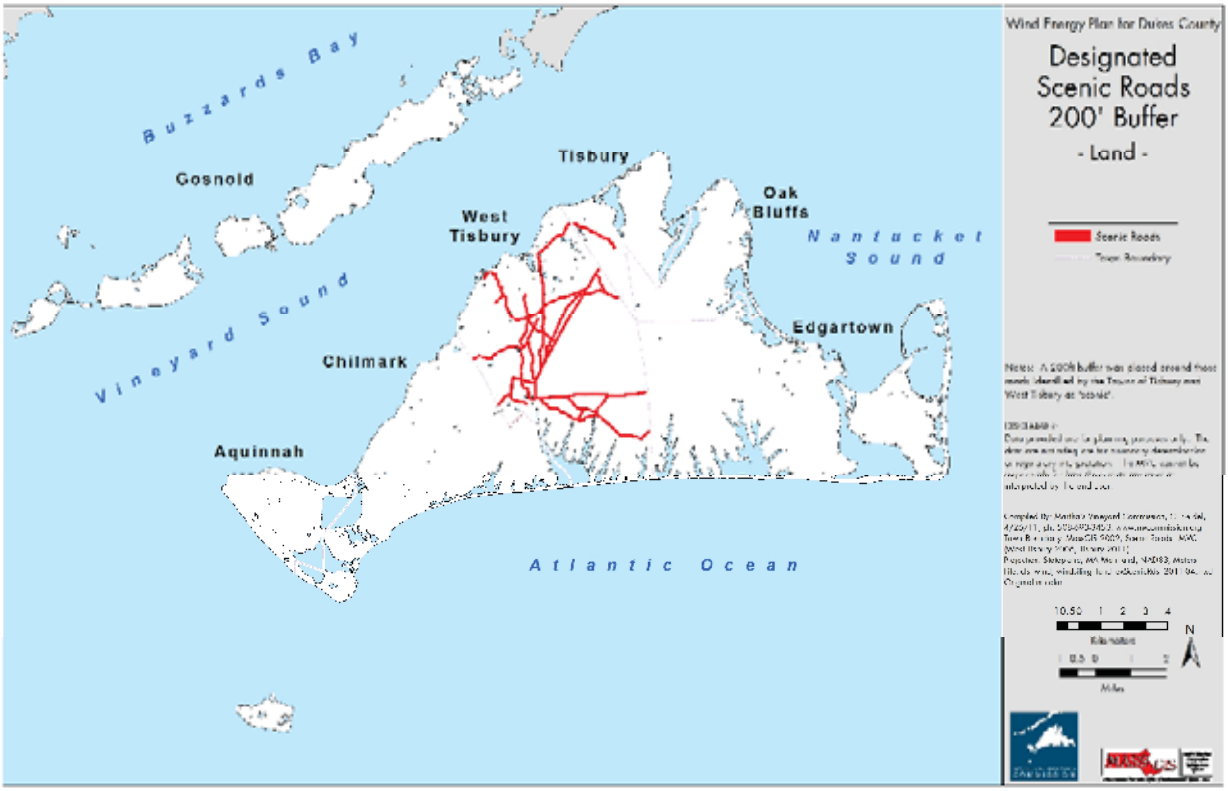
There are six historic districts designated by the towns of Martha's Vineyard, namely:

- Edgartown Historic District,
- Oak Bluffs Historic District
- West Tisbury Historic District,
- William Street Historic District, Tisbury,
- West Chop Club Historic district, Tisbury
- Aquinnah town Center Historic District (not mapped)

The first four of these Historic Districts are on the National Register of Historic Places. These districts cover 502 acres and include about 930 of the Island's 3,500 pre World-War-II buildings.

The Wind Energy Plan makes these districts Exclusionary Areas. It also calls for special review of proposals to erect a turbine within a 500-foot buffer of these historic districts, in order to ensure that the turbine would not negatively affect the historic resources.

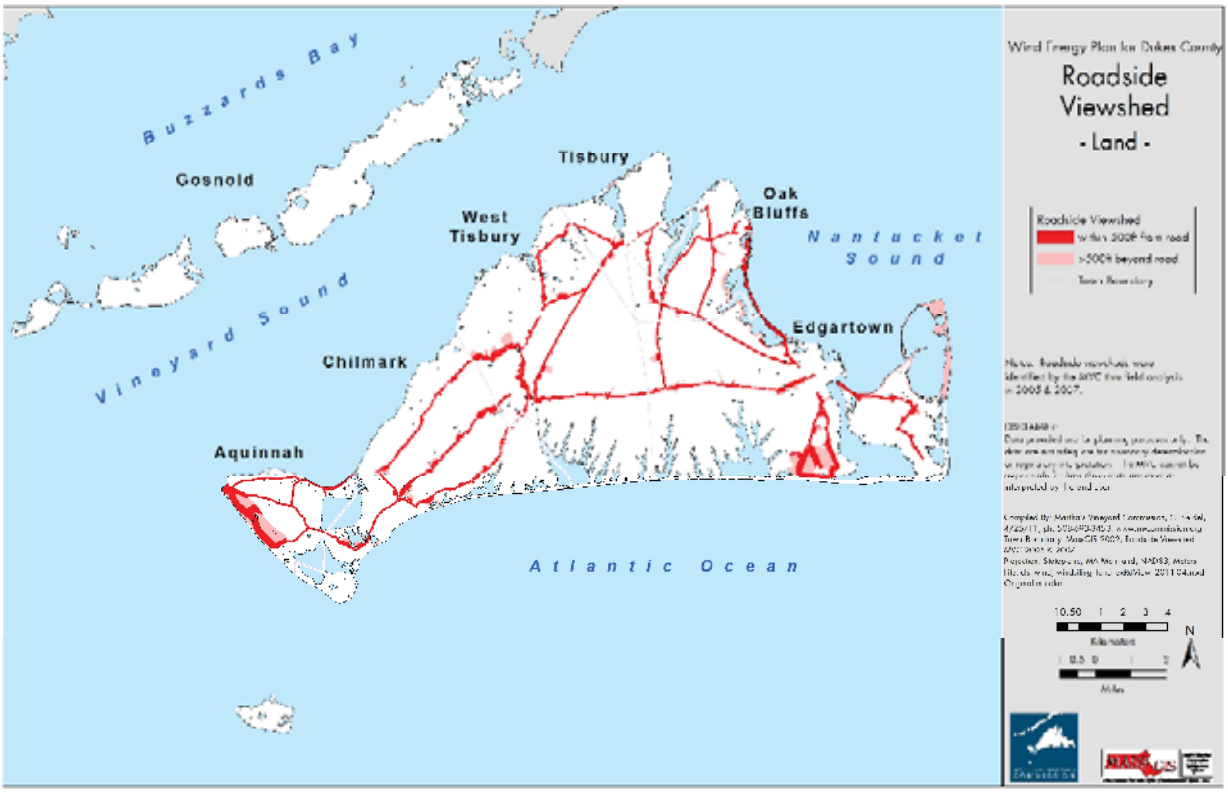
Scenic Roads



There is a provision in the Massachusetts Zoning Act that allows municipalities to designate scenic roads, which affords them certain protections from alterations of character. Currently, West Tisbury is the only town in Dukes County to have done so.

The Wind Energy Plan makes the areas within 200 feet of these roads a prohibited area for wind turbines. Note that turbines would not be able to be built in most of these areas due to the minimum setbacks from public roads.

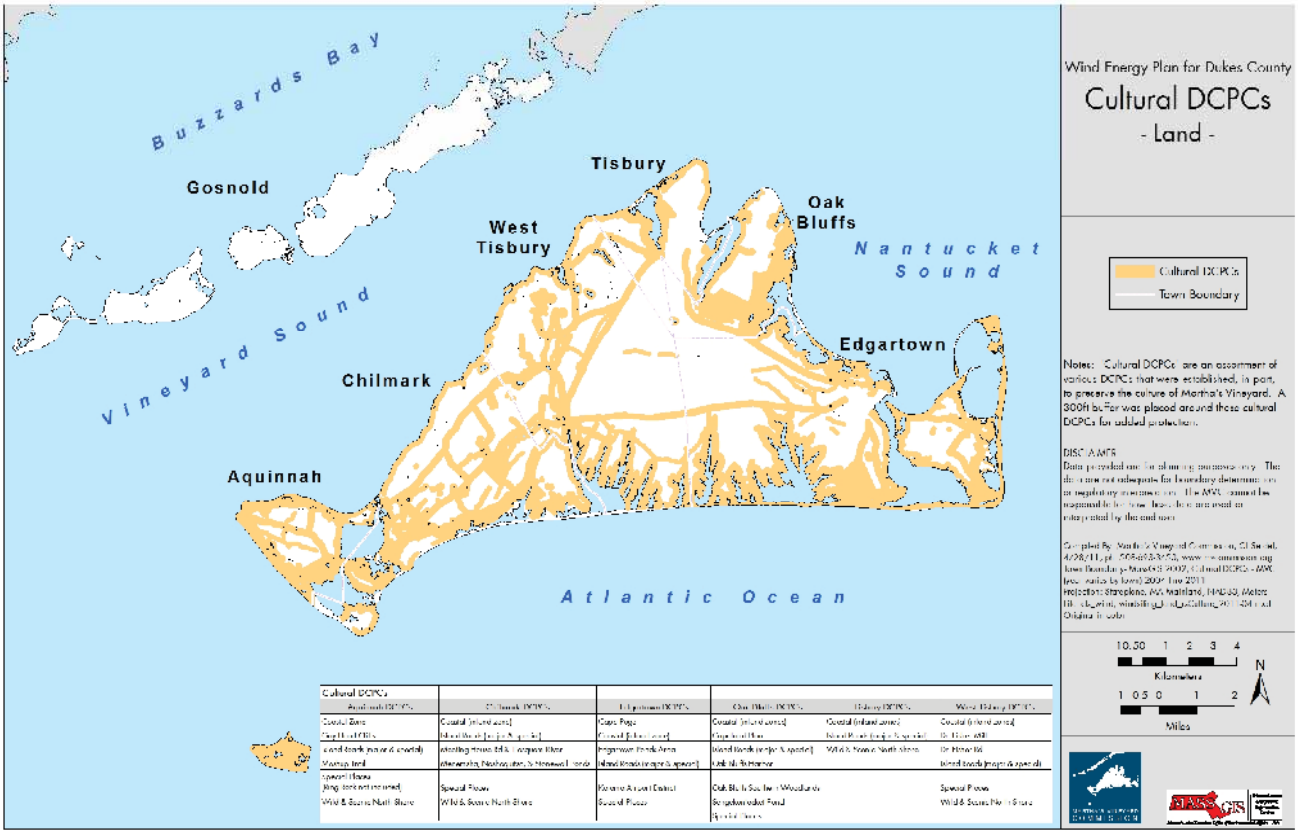
Scenic Roadside Viewsheds



In relation to the preparation of the Island Plan, the Martha's Vineyard Commission did an extensive inventory of the scenic viewsheds of the main Island roads. This includes the areas immediately visible from the roadsides, typically about fifty feet in wooded areas, and much greater when there are fields or other open areas along the road.

The Wind Energy Plan prohibits turbines in this viewshed. For the relatively few areas where the viewshed extends far from the road, the prohibition only includes the area up to 500 feet from the centerline of the road. Proposals for turbines within the scenic roadside viewshed but beyond 500 feet could be permitted subject to special review to ensure that impacts are limited.

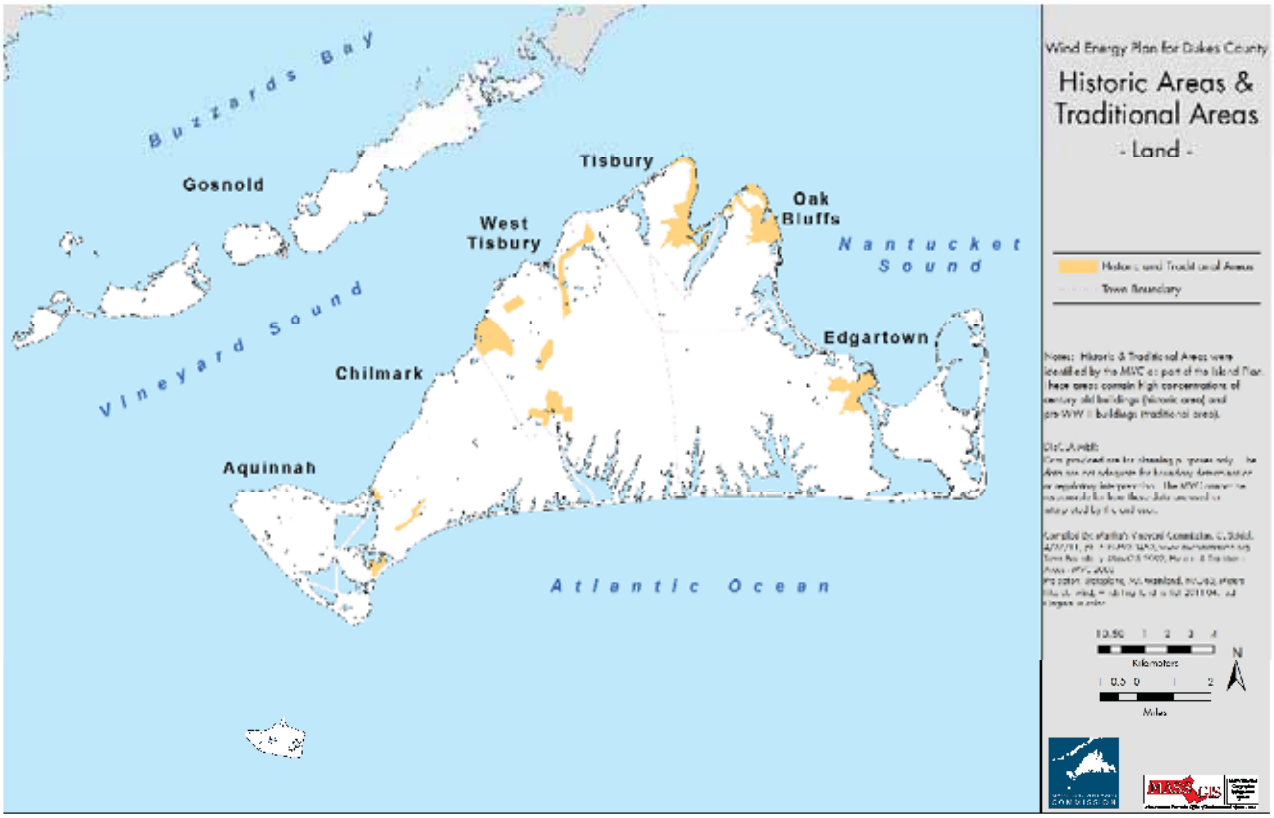
Scenic and Cultural DCPCs



The Martha's Vineyard Commission has designated several Districts of Critical Planning Concern for cultural and historic reasons. These include:

- The Island Road District – made up of Major Roads and Special Ways,
- The Coastal District
- Coastal District,
- Island Road District,
- Special Places District,
- Gay Head Cliffs District,
- Moshup Trail District,
- Wild and Scenic North Shore District,
- Meeting House Road and Tiasquam River District,
- Menemsha, Nashaquitsa and Stonewall Ponds District,
- State Forest and Aquifer Resource District,
- Dr. Fisher Mill District,
- Dr. Fisher Road District,
- Lagoon Pond District,
- Oak Bluffs Harbor District,
- Oak Bluffs Southern Woodlands District,
- Sengekontacket Pond District,
- Cape Pogue District,
- Edgartown Ponds District, and
- Katama Airport District.

The Wind Energy Plan calls for special review of wind turbine proposals in these districts.



The Island Plan identified areas with high concentrations of historic and older buildings, namely

- Historic Areas: These areas have high concentrations of buildings over a hundred years old, whether or not they are now officially designated as historic districts, including the town centers of Edgartown, Oak Bluffs, Tisbury, West Tisbury, and Menemsha. They cover about 2000 acres.
- Traditional Neighborhoods: These areas, outside the Historic Areas, have high concentrations of buildings built before the end of World War II, and/or where the urban pattern was set before the War. They cover an additional

The Wind Energy Plan calls for special review of proposals to erect wind turbines in these areas.

4.3.2 Potential Impacts of Wind Energy Facilities

The construction of one or more wind turbines could have two types of impacts on cultural resources:

- Direct impacts such as disturbing archeological resources, or modifying or demolishing a significant structure;
- Indirect impacts such as altering the historic or architectural setting of the resource because of the visual and noise impacts of the turbine.

Similar to other types of resource protection, the basic tools are mapping of resources, prohibition of development in the most critical areas, and a requirement for additional project review for some areas along with guidelines for carrying out this review.

4.3.3 Policies

Overall Objective

The overall objective is to avoid, or minimize and mitigate negative impacts from the construction of turbines and ancillary facilities on cultural resources through the siting and design.

Siting Requirements

The Wind Energy Plan sets the following policies for siting turbines with respect to historic resources.

- Exclusionary Areas: The Plan identifies the following as Exclusionary Areas. These are highly critical areas where no turbines shall be located.

  On land, the Exclusionary Areas include:
  - National Natural and Historic Landmarks plus a buffer of 1000 feet,
  - Municipally designated historic districts,

- Areas of Special Concern: The Plan identifies the following as Areas of Special Concern. Any proposal for the development of wind turbines shall be reviewed by the MVC and the local special permit granting authority with a view to avoiding, or minimizing and mitigating, any negative impacts, using the criteria in this Plan.

  On land, the Areas of Special Concern include:
  - Districts of Critical Planning Concern designated for cultural or historic reasons, plus a buffer of 300' (not including the Town of Aquinnah DCPC except for those portions within other DCPCs);
  - A buffer of 500' from municipally designated historic districts,
  - Historic and traditional areas identified in the Island Plan,

Performance Standards

The following standards shall be used in designing and evaluating a wind energy facility:

- The facility shall be sited and designed to avoid, or minimize and mitigate, any direct impacts to historic resources
- The facility should also avoid, or minimize and mitigate, indirect impacts to the settings of cultural resources.

In order to allow a project proponent to design, and review board to analyze, a proposal to erect one or more wind turbines located in an Area of Special Concern identified for cultural reasons, the applicant shall prepare and submit a Cultural Impact Assessment of the proposal – prepared by an independent expert under the supervision of the review board and financed by the project proponent –that:

- Identifies the areas, buildings, structures, artifacts, and other cultural resources
- Assessing the impact of the project on cultural resources, and
- Outlining mitigation measures avoid, or to minimize and mitigate these impacts.

5. Ocean Resources

A complex web of regulations governs nearshore and offshore development. Effective planning calls for a partnership between scientists and other experts developing scientific, academic, and technical data collection and analysis, and local planners and authorities who can contribute valuable insight into the less tangible aspects of resource protection, complementing the science data with practical local perspective. It is important that all stakeholders understand the level of detail available or not available for a particular resource and the comfort level associated with identifying development sites and practices based on the body of data at a given point in time.

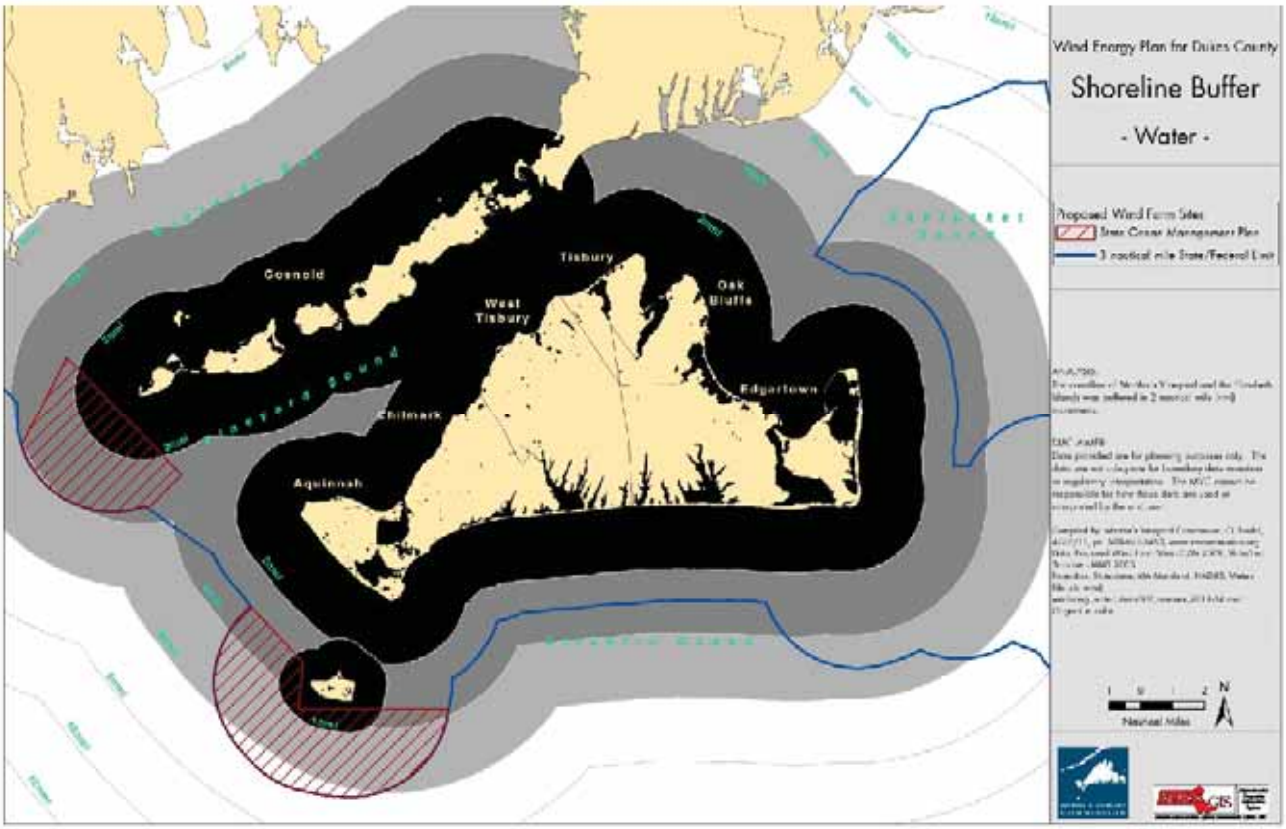
The ocean is a vast resource that can belong to no one person or corporation. Everyone is born with the same rights to the resource, particularly for navigation. Marine regulation is based on the public trust doctrine. Originating from old English and Roman law, the public trust doctrine encompasses two basic principles:

- The public has fundamental rights and interest in natural resources such as the air, the ocean, and the shore.
- Government, as trustee of the public interest, has a duty to protect and enhance these natural resources and the public's right to use them.

The Wind Energy Plan looked at the following resources of particular relevance to planning for potential wind energy development:

- Shoreline buffer,
- Seafloor habitat,
- Eelgrass
- Marine mammals,
- Fishing and
- Navigation.

5.1 Shoreline Buffer



5.1.1 Resources

As is discussed in several sections of this Plan, the waters closest to shore have a very high concentration of many sensitive resources and human uses. The economy and lifestyle of the community are focused largely on recreational activities and scenic values related to the shoreline such as fishing and boating. Several natural resources are located in the shallowest waters (e.g. eelgrass) or in relation to the shore (e.g. many migrating birds). On land, the most important public spaces are beaches, overlooks, and waterfront parks. Property development is largely focused on relation to the shoreline, with the most expensive properties located in the waterfront, and with many other houses sited to take advantage of ocean views. Unlike most regions, Dukes County does not have any large industrialized waterfront areas or related offshore areas.

5.1.2 Potential Impacts of Wind Energy Facilities

The potential impacts of wind energy development close to shore are discussed throughout this plan. The high concentration of resources and the great potential impacts of development on these resources led to the conclusion that wind turbines should be prohibited the area closest to shore. The Massachusetts Ocean Management Plan included an exclusionary buffer of 1 mile from inhabited lands when selecting commercial wind areas. The Rhode Island SAMP includes a coastal buffer of one kilometer (a bit more than half a mile) as an Area of Special Concern. The Cape Cod Plan includes a 2-mile buffer "Prohibited" for Wind Energy Facilities. The Wind Energy Plan opted for a 2- mile buffer (see Section 3.2).

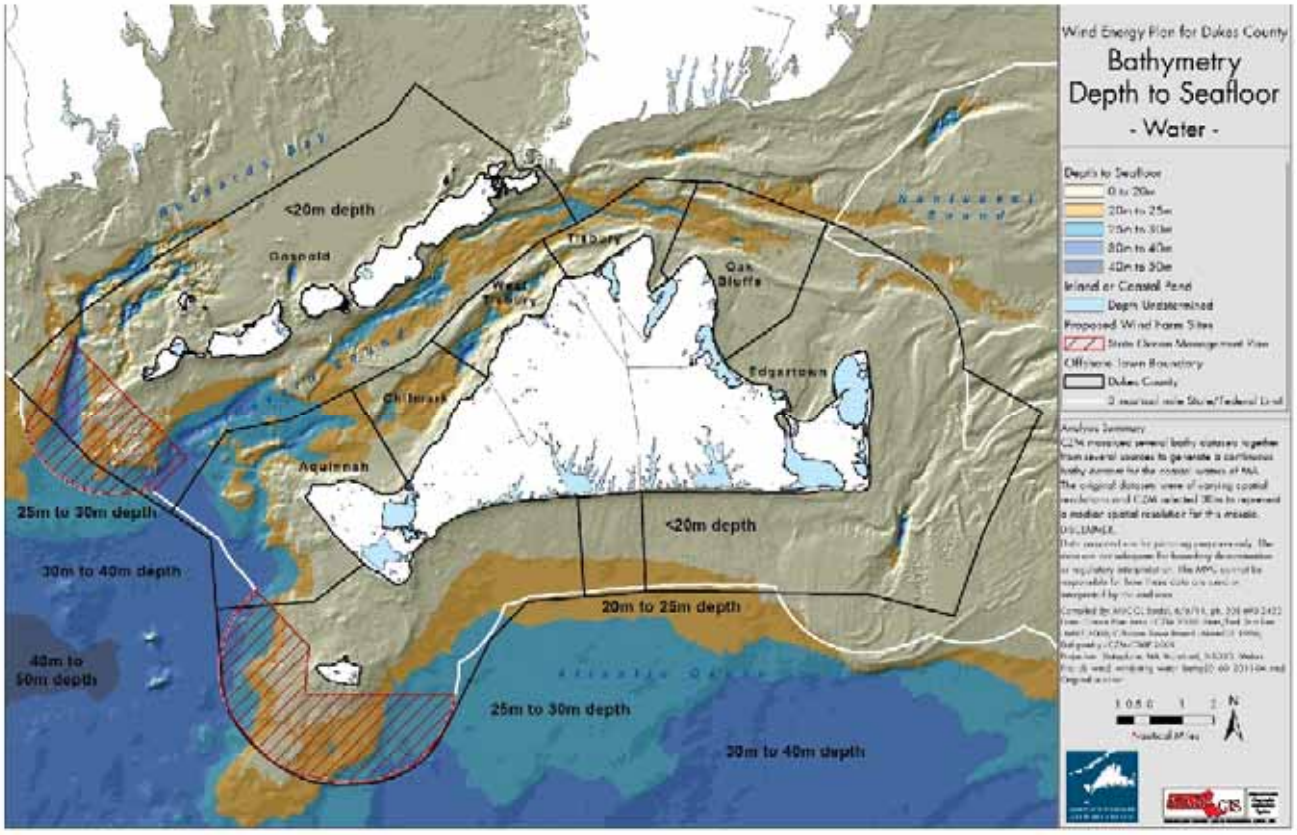
5.1.3 Policies

Overall Objective: Limit the impacts of wind energy development on the areas of high concentration of resources close to shore.

Siting Requirements: no wind turbine shall be erected less than 2 miles from the shore of inhabited lands in Dukes County, or less than 1 mile from the shore of Nomans Land Island.

5.2 Seafloor Habitat

Sea Depth

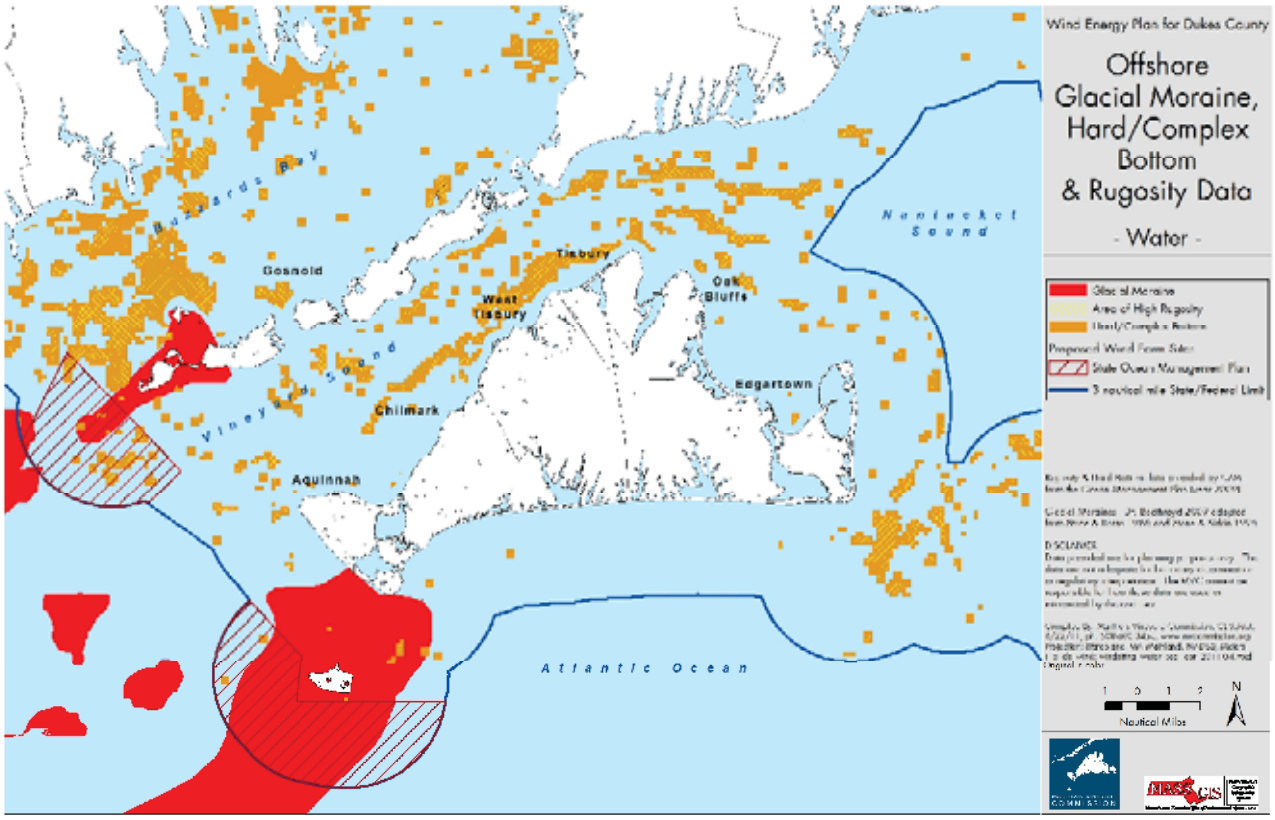


5.2.1 Resources

Marine life relies on the seawater, seafloor beneath, and substrate below the seafloor. The water column itself is influenced by tides and currents, particularly the Gulf Stream that brings warmer waters in summer and generally induces a west to east flow year-round. Water quality may be influenced locally, particularly by hazardous spills, and in general responds to inputs from the land.

Some habitats are more valuable than others for supporting life. Generally, speaking, the more diverse the habitat, the more diverse the population it supports, from the tiniest burrowing animals on up the food chain.

Hard/Complex Bottom, Glacial Moraines, and Rugosity



There are several ways to identify sea bottom areas with high concentrations of resources. Though each criterion comes from the same fundamental concern, each involves somewhat different areas.

Hard/Complex Bottom is the term used in the Massachusetts Ocean Management Plan for bottom with bedrock, rough terrain, or man-made structures such as wrecks. These seafloor types are likely to support diverse populations.

Glacial moraines are poorly sorted sediments left that mark where the glacial ice in the last Ice Age stopped its southerly advance, also indicate a complex bottom capable of supporting an abundance of marine life.

Rugosity is a term used to describe the complexity of the seafloor in a given location, based on data measurements and mathematical formulas. High rugosity is a good indicator of important habitat, particularly useful where distinct species habitats have not been defined.

Other habitats are significant to specific species. Some of these habitats have been mapped with varying degrees of effort and success, with migratory details generally more enigmatic.

5.2.2 Potential Impacts of Wind Energy Facilities

Various important habitats are vulnerable for different reasons. The needs of such species should be respected, generally by avoidance. Because discrete habitats are not appropriate or not known for other species, it is important to avoid the most complex seafloor, presumed to be the most productive. Thoughtful planning should avoid siting turbines in important habitat. It may be more challenging to completely avoid important habitat when making and maintaining cable connections.

The *MOMP* made areas of hard and complex sea bottom an exclusionary area in determining commercial wind energy areas. The Rhode Island Ocean SAMP excluded all glacial moraines from consideration for wind energy development in the near future, although such development is not explicitly prohibited. The Wind Energy Plan for Dukes County excludes both these areas from consideration for the duration of this first version of the plan. This could be revised in the next version based on additional data collection and analysis of potential impacts of wind energy development on these resources.

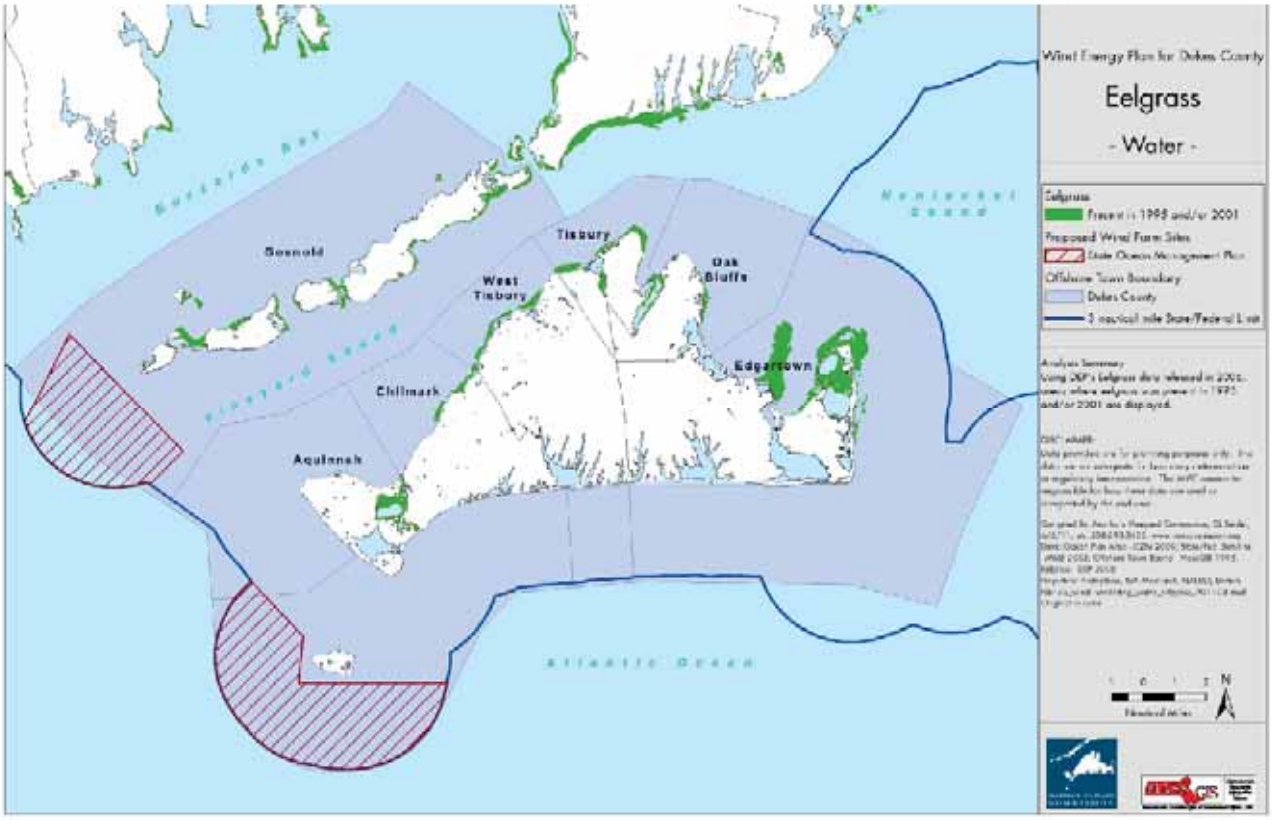
5.2.3 Policies

Overall Objective: Avoid negative impacts from wind energy facilities on the seafloor habitats most important for supporting marine life and biodiversity. Avoid eelgrass beds and avoid, or minimize and mitigate negative impacts from cables associated with wind energy facilities.

Siting Requirements:

- Exclusionary Areas for Wind Turbines: Glacial moraines, areas of high rugosity, and areas of hard and complex sea bottom are not suitable for development of wind turbines and are excluded from consideration.
- Areas of Special Concern for Cables: Glacial moraines, areas of high rugosity, and areas of hard and complex sea bottom are generally not suitable for cables and should only be considered if the project benefits warrant special consideration to consider these locations and that any negative impacts are avoided, or minimized and fully mitigated.

5.3 Eelgrass



5.3.1 Resources

Eelgrass is a critical habitat for supporting fish production, and is a habitat that lends itself to mapping.

5.3.2 Potential Impacts of Wind Energy Development

Eelgrass is vulnerable to any activity or condition that might reduce the amount of light reaching the leaves. It is particularly vulnerable to the turbidity that is associated with construction activities such as dredging and cabling. Damage can result even without actual burial. Eelgrass beds are so significant for fish production that every effort should be made to avoid damage.

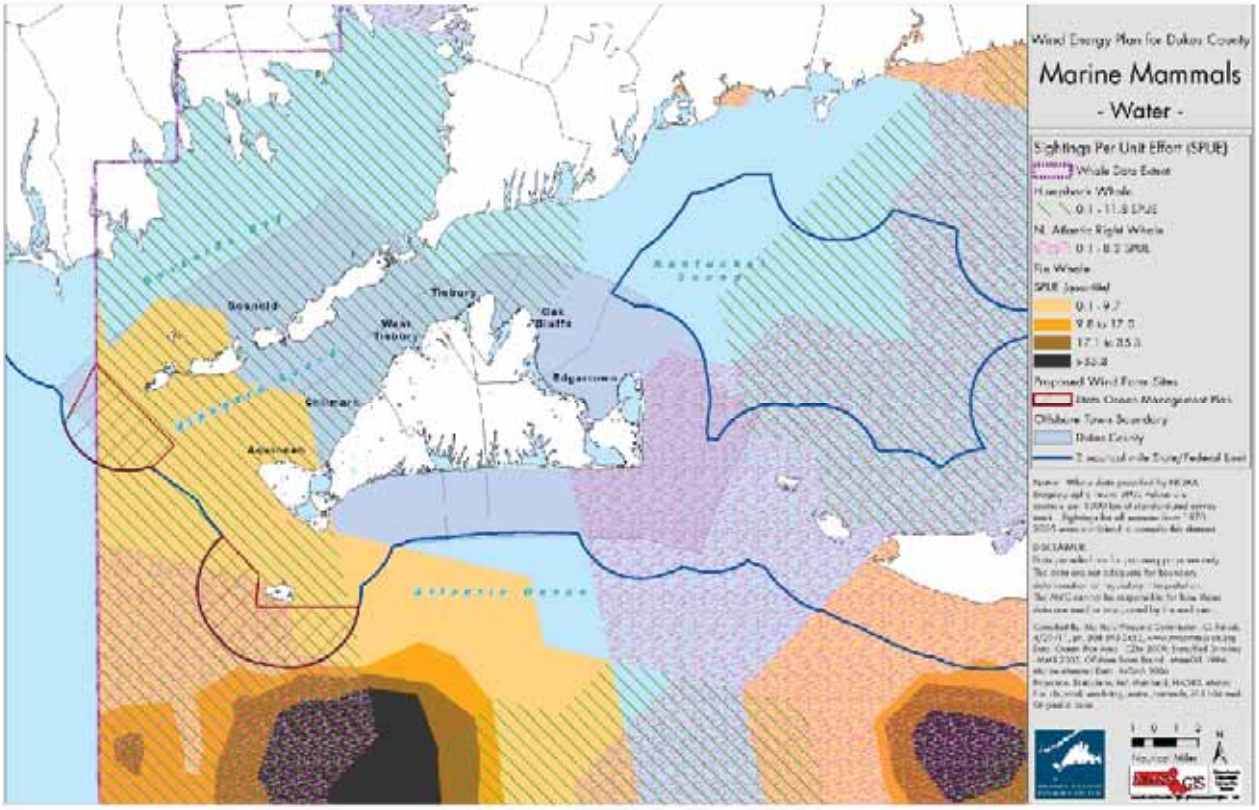
Note that eelgrass beds are all located within the 2 mile Shoreline Buffer (section 5.1) where wind energy development is already excluded under policy 5.1.3. It is listed separately here because this exclusion also applies to cabling within the 2 mile limit.

5.3.3 Policies

Siting Requirements:

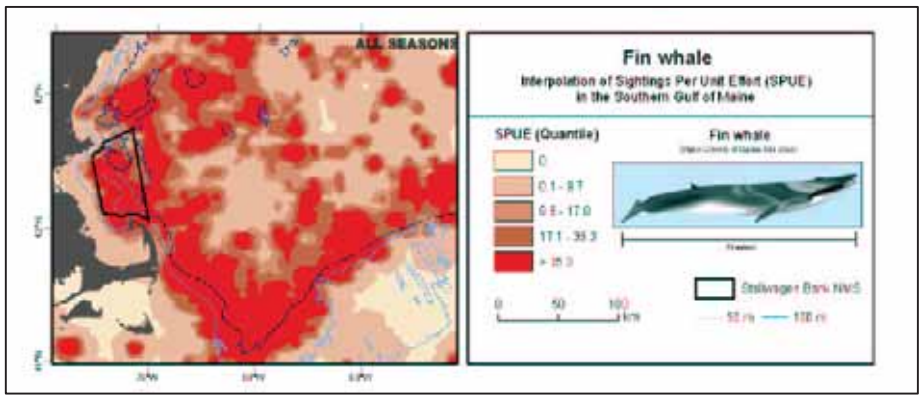
- Exclusionary Areas for Wind Turbines and Cables: Cables are prohibited from eelgrass beds. Because eelgrass areas shift over time, the precise location should be mapped in conjunction with any cabling project.

5.4 Marine Mammals



5.4.1 Resources

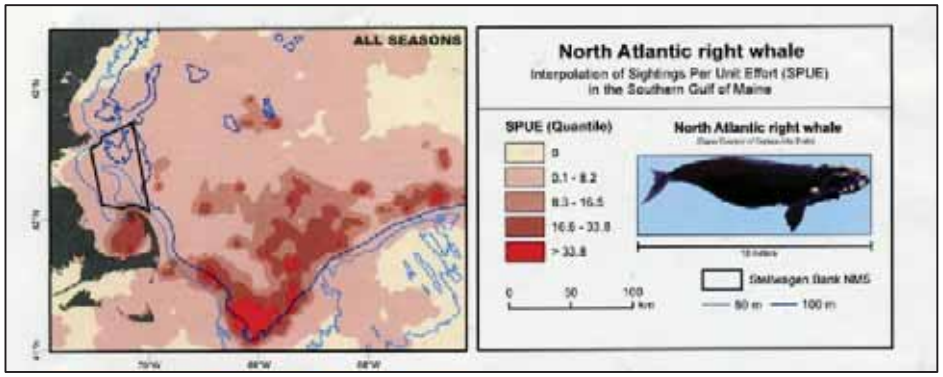
Whales, porpoises and seals populate or pass through Vineyard waters during at least some part of the year. Northern Right Whales, Fin Whales, and Humpback Whales are federally and State-designated Endangered species. The Northern Right Whale was hunted almost to extinction, and only about 300 (NMFS, 2004) remain living. Although Northern Right Whales are not known to be residents, they have been known to pass through travelling to and from their springtime gathering and feeding grounds in the Stellwagen Bank area. About three dozen Northern Right Whales were observed visiting in April 2010 en route to their spring 2010 gathering. Only the Fin Whale is known to spend its summers very close to the Vineyard. According to NCCOS (NCCOS, 2009), the Fin Whale's seasonal habitat extends to just south of the Vineyard. The Fin Whale is large (about 25 meters, or 80 feet), second in size only to the Blue Whale. For all its size, it is very fast, known as the "greyhound" of the Atlantic.



Fin Whale Seasonal patterns of interpolated sightings-per-unit-effort (SPUE) data for in spring, summer, fall, winter and all seasons combined for the southern Gulf of

Maine (1970-2006). SPUE values are animals per 1,000 km of standardized survey track. (NCCOS, 2009)

In contrast to the localized Fin Whale habitat, most of the great whales prefer to gather to the north and east. Northern Right Whales may pass through our area before gathering in spring in Cape Cod Bay and the Southern Gulf of Maine and after leaving at the end of summer, as shown below.



Northern Right Whale (NCCOS, 2009)

Other marine mammals visit or reside here and are not protected by the Endangered Species Act, but are nevertheless protected by the Marine Mammal Protection Act. These include the Pilot Whale, the Harbor Porpoise, the Atlantic White-sided Porpoise, the Gray Seal and the Harbor Seal.

5.4.2 Potential Impacts of Wind Energy Development

Potential impacts of wind energy development include ship strikes, entanglement, and the less tangible impacts of noise and overall habitat loss. The obvious first choice for eliminating potential impacts is to avoid the feeding and gathering grounds and migratory routes, particularly for the endangered species. This is only useful where discrete habitat areas are defined. The migration habits of those who just pass through our waters are not well defined. Migratory predators follow their food sources, and whales are known to cover great distances and pop up in expected places. The best protection cannot be limited to specific sites, but should rather focus on the known seasonal patterns of migration, and include speed limits and special watches during those times of the year. For the Fin whale, discrete habitat areas are defined here and provided with standards. Although there are other areas of known Fin whale habitat in the region, it is important to note that the Fin whale is the only large whale making its seasonal home very close to Martha's Vineyard. The Fin whale's role in the food chain and possible relation to other local species should be determined. When the codfish disappeared from Vineyard waters and no longer fed on green crabs, green crab populations in Vineyard coastal ponds escalated. Any such relationship should be examined for the Fin Whale and its diet of small crustaceans.

For most whales, reliance on protection of specific geographic locations would be likely to provide little more than a false sense of security. Protection must be dynamic and respond as needed wherever endangered whales are at a given time. Endangered mammals are protected by the Endangered Species Act with specific procedures for identifying and responding to their presence. Even common marine mammals are protected by the Marine Mammal Protection Act. The Marine Mammal Protection Act allows for hunting only by native Alaskans and acknowledges that human activities such as fishing, fireworks, etc. may involve unintended loss of marine mammals and limits such "take".

Noise impacts include pain, hearing damage, and/or interruption of vital activities such as communication, navigation and foraging. Data are available on which frequencies are emitted by various whale and porpoise species, as well as the frequencies, loudness and duration of wind turbines and related activities.

Proper siting should avoid known habitats, at least for the Fin Whale. During construction, maintenance and decommissioning, relevant sounds of activities such as pile driving should be avoided or alleviated by use of acoustic harassment devices (annoying sound to warn off marine life prior to making more harmful noise). During operation, management measures should avoid sound impacts through flexible response to the appearance of migrating endangered species.

Only the endangered Fin Whale can best be protected by defining discrete areas for protection. For other species, a number of performance standards can be used to minimize the potential impacts of wind energy development on sensitive resources.

5.4.3 Policies

Overall Objective: Avoid negative impacts from wind energy facilities on endangered whales and avoid, or minimize and mitigate the impact of wind energy facilities on all marine mammals.

Siting Requirements:

- Exclusionary Area: Fin Whale habitat identified on the map *Criteria for Marine Mammals* shall be excluded from development where the SPUE (Sightings per Unit Effort) exceeds 9.7.
- Area of Special Concern: Fin Whale habitat identified with SPUE between .1 and 9.7 shall define an Area of Special Concern. The aim is to ensure that, during the summer months, reduced speed limits and sound restrictions are incorporated into construction, maintenance and decommissioning activities. Operational sounds should be restricted as necessary during the summer months. Further investigation into the role in the food chain should be undertaken prior to siting in this area.

Performance Standards:

- Northern Right Whales must be protected at all times throughout the entire planning area. In early spring, watches and protection of Northern Right Whales should be incorporated, including reduced speed limits and sound restrictions as needed. Passive acoustic monitoring should be employed in addition to the requirements of the Endangered Species Act. There should be a flexible response plan to react immediately to the appearance of Northern Right Whales during any other time of the year.
- All activities shall be in compliance with the Endangered Species Acts (MA and US) and with the Marine Mammal Protection Act.

There hasn't been academic investigation specific to Vineyard waters. General documents and documents specific to nearby areas were consulted and are noted in the Bibliography. The most helpful documents include:

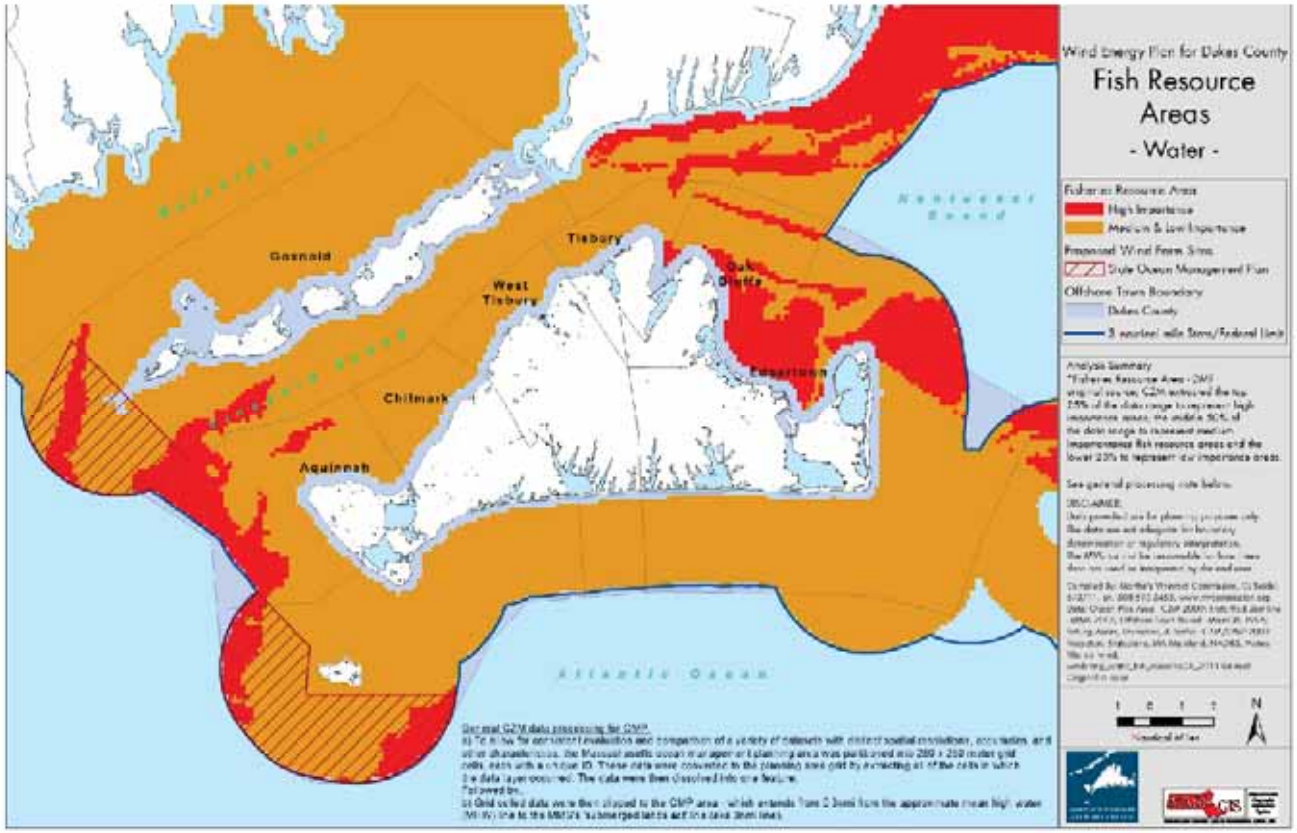
- OSPAR Commission, 2009, *Module 3: Background on General Aspects of Impacts of Sound and Marine Life* http://qsr2010.ospar.org/en/index.html
- National Centers for Coastal Ocean Science (NCCOS), 2009, *An Ecological Characterization of the Stellwagen Bank National Marine Sanctuary Region* http://ccma.nos.noaa.gov/products/biogeography/stellwagen/welcome.html

5.5 Fishing

5.5.1 Resources

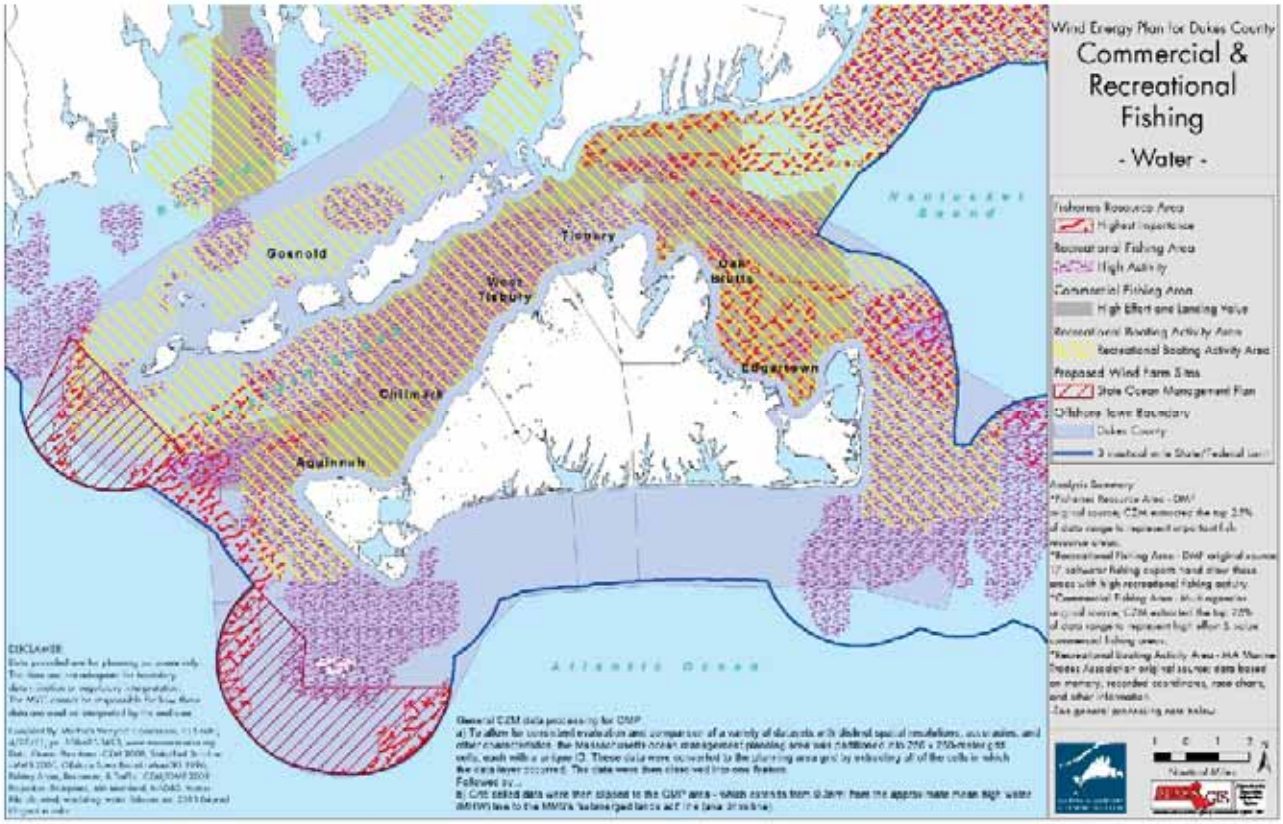
Fishing is important in a coastal community for a number of reasons. The direct livelihoods of fishermen and their families are at stake. There are also impacts on the fishing community, including the availability of fresh and healthy seafood, the economic impact that spreads throughout the community (including fish dealers, boatyards, etc.) and the desirability of maintaining cultural values and a prominent presence.

Fish Resource Areas



Fisheries Resource Areas were identified in the *MOMP* based on NOAA's 2008 Groundfish Assessment Review Meeting. According to the assessment, the most rebuilt stocks are Gulf of Maine and Georges Bank haddock, and the most overfished stock is Southern New England/Mid Atlantic winter flounder. The assessment only identified those stock susceptible to capture in an otter trawl, in deep water on level bottom, and only in May and September during daylight hours. Thus, the resource map is incomplete as a true assessment of resources other than those captured in those otter trawl surveys.

Commercial and Recreational Fisheries

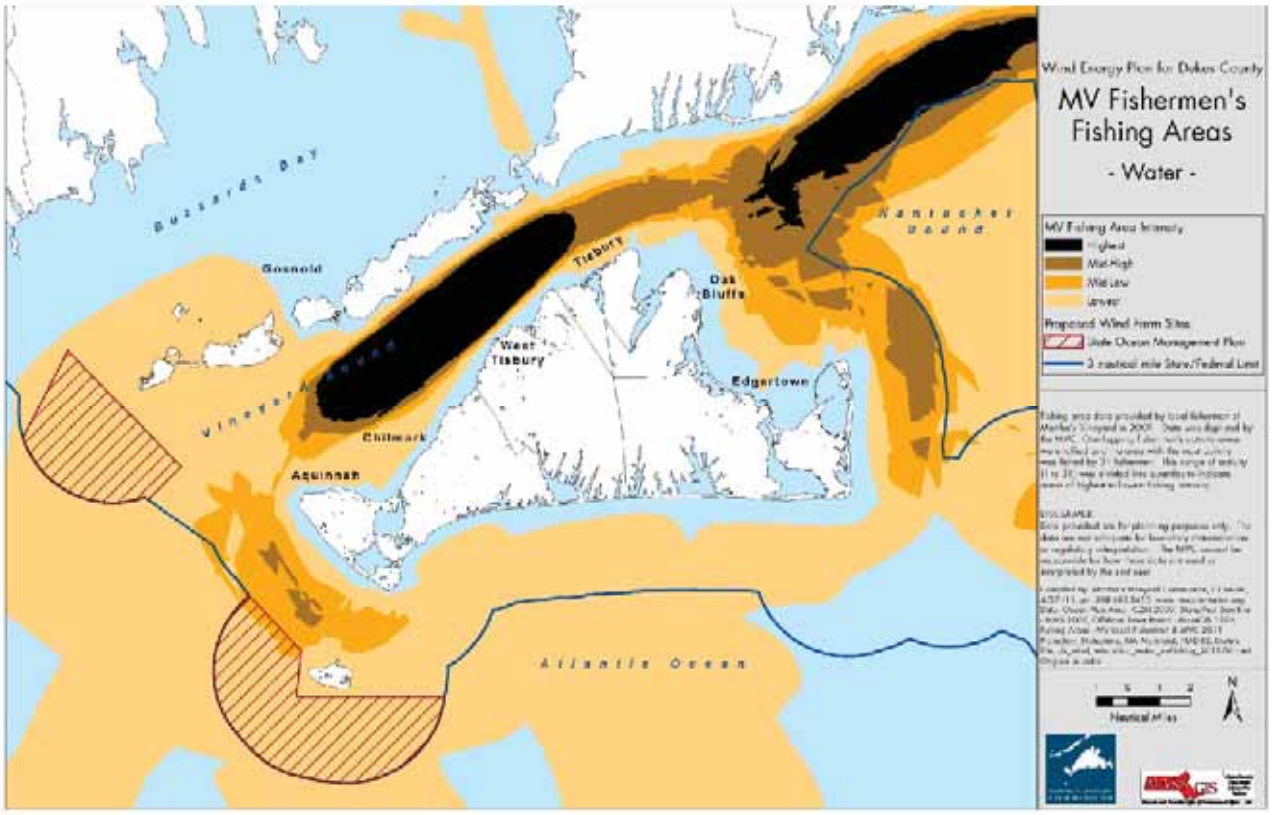


Commercial and Recreational Fishing and Fishing Resources (MOMP, 2009 based on CZM and DMF data)

The ports of Dukes County host a number of commercial fishing vessels. The commercial fishing industry, though not of the scale of New Bedford, is nevertheless an important part of the local economy. The vacation industry relies on maintaining the colorful presence of commercial fishing and other traditional pursuits. Recreational fishing draws many visitors to Vineyard waters.

The Massachusetts Ocean Management Plan (2009) includes data regarding fisheries resource areas, commercial and recreational fishing areas and recreational boating activity. (*CZM, and Mass. Marine Trades Association data).*

Martha's Vineyard Fishing Areas



The mapping of fishing areas included in the MOMP focused on large boats. In 2009, Vineyard fishermen provided confidential raw data locating their fishing grounds, which was merged to create the map *M V Fishermen's Fishing Areas*.

Note that this mapping focused on the areas closest to Martha's Vineyard, and the information for federal waters is very incomplete.

5.5.2 Potential Impacts of Wind Energy Facilities

Offshore turbines pose potential negative impact for commercial fishing. In addition to concerns about damaging or changing the habitat that sustains the fisheries, there are issues about equipment entanglements and the prospect of exclusion zones around the turbines – whether for safety or security purposes.

The Coast Guard determined that vessels should be able to continue safely through an offshore windfarm, so long as COLREGS standards are met, including having someone on watch while the other is tending the fishing gear. However, there remain several issues that could make it impractical for many fishermen to continue to fish in this area. The risk to fishermen's safety should be weighed in deciding whether or not to approve these new uses given the risk to the health and safety of fishermen and the risk of possible damage to or loss of vessels.

- Holding draggers financially liable for the very high costs of repairing a damaged windfarm cable could mean that fishermen would not be able to afford the insurance, or not take a chance in fishing there.
- The U.S. Coast Guard determined that the Cape Wind project would impact radar reception in the vicinity. Even though the Coast Guard has indicated that the manning of a boat is up to the captain, the practical reality is that many captains will conclude that they do need an additional watch on board to safely navigate between the turbines. Many of these boats currently operate one-handed, and having to double their manpower would have serious financial implications.
- While the Coast Guard has indicated that restricting access within a wind farm in order to ensure navigational safety would be a last resort, it is not impossible. There is always the danger that wind energy facilities in the United States might end up being totally closed to any kind of boating access, as is the case of many offshore windfarms in Europe. Depending on the extent of the restriction, this would have a large negative impact on the fishing industry, removing potential fishing areas and increasing fuel and time to navigate beyond the wind farm. It would be of concern that a windfarm might be approved based on the assumption of continued access to the waters within the wind farm for fishermen, when this is not guaranteed.

These concerns also relate to the impact on recreational fishing which also has a considerable direct and indirect impact on the economy.

This issue was addressed to some extent in the Massachusetts Ocean Management Plan, including mapping of commercial and recreational fishing areas, although there is some concern that the data compilation focused on larger fishing vessels. Most fishing boats from the Vineyard are smaller pot boats. The Martha's Vineyard Commission worked with the Dukes County Fishermen's Association to compile more detailed data about the fishing areas used by local fishermen.

5.5.3 Policies

Overall Objective: The overall objective of these policies is to avoid, or minimize and mitigate negative impacts of wind energy development on fish resources, fishermen, fishing families and fishing communities. Respect the fundamental principle that the fishing community should not have to bear the additional operating costs and risk associated with wind energy development.

Siting Requirements: Important fish resources, fishing areas and fishing routes have been identified.

- Exclusionary Areas: Fishing Resource Areas, Fishing Routes, and Areas with High Fishing Effort (as identified on the *M V Fishermen's Fishing Map* as well as the MOMP areas)
- Areas of Special Concern: Areas with lesser fishing activity (medium level)

Performance Standards: The burden of proof is on the developer to prove that impacts in an area of Special Concern may be overcome.

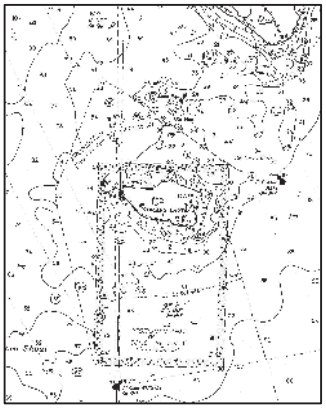
- Impact Reports For any application for a facility of more than 2 megawatts, require that the developer prepare an impact report that would include the a clear assessment of impacts to fisheries habitat and operations, during construction, operation, maintenance and decommissioning
- Minimize or Mitigate the Impact of Cabling: Organize the network of cables to leave as many areas as possible clear of cables, developer to bury all cables and remain responsible for ensuring that these cables remain buried or at least shielded.
- Provide Navigation Fairways: The planning of wind energy facilities should incorporate half-mile-wide navigation and fishing fairways through any wind farms. These would serve two purposes.
    - If the whole wind farm remains accessible for fishing and other boating – and every effort should be made to ensure that this is the case – such fairways could facilitate boating and navigation, especially in bad weather. These fairways should have a minimum of cabling to allow dragging in all or at least most of these areas.
    - Fairways could be kept open to boating and fishing in the worst-case-scenario of elimination of boating access from the rest of a wind farm.
- Mitigation Where impacts can clearly not be avoided, but may be overcome by mitigation, a clear mitigation plan should be discussed early in the process, including the fishing and community stakeholders. Possible mitigation would be for the wind farm developer to pay for insurance to cover the risks associated with fishing within a wind farm, including harm to individuals and damage to boats and cables.

5.6 Navigation and Boating

5.6.1 Resources

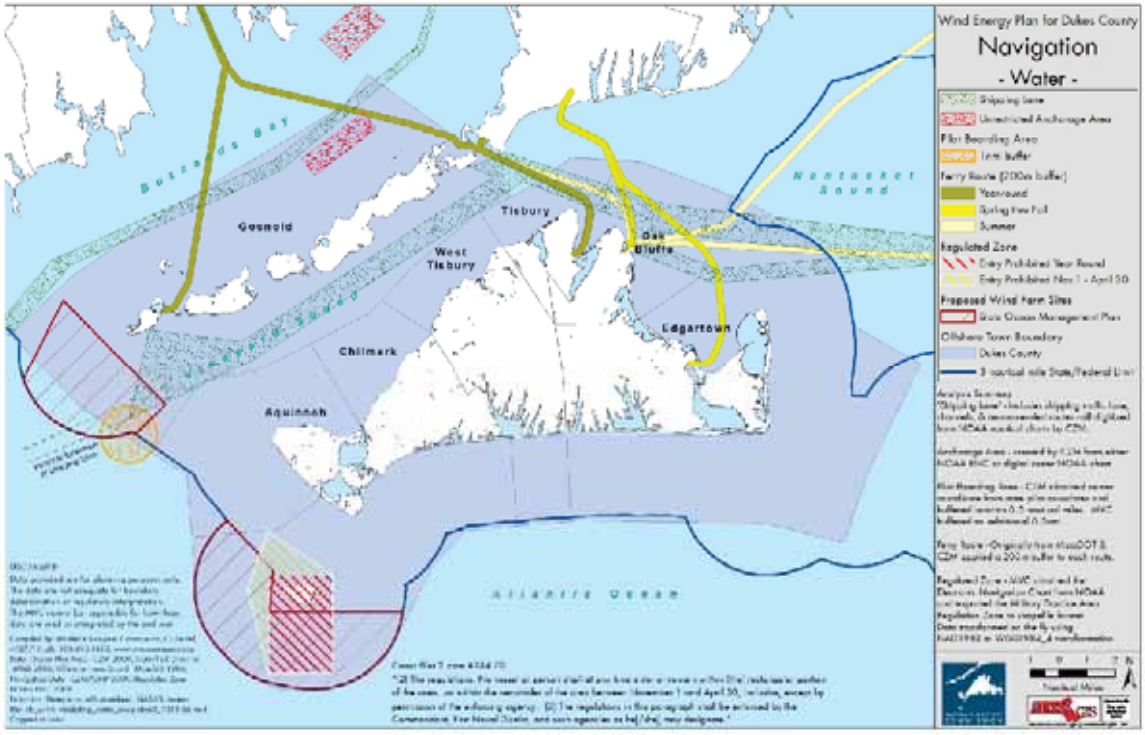
Navigation is carefully regulated in order to allow all the users safe passage. Unlike land, ocean and the seafloor under it cannot be bought or sold, only leased or licensed. Even licenses for structures such as piers do not transfer ownership. The license is issued "to maintain" the use and structure.

Tidal range is small at sea, including the shores of islands, but tidal currents are generally strong in Vineyard waters and nearby, and hazards abound in the form of boulders, storms, ice, etc. Shipping lanes have been identified with various rules and suggestions associated.



Nomans Land and its surrounding waters have a concentration of buried ordnance remaining from its use as an airfield and live target practice during World War II and for target practice until 1996. Established in 1961, amended in 1962, 1968, 1985 and 1997, the regulation regarding Nomans reads: *" …No vessel or person shall at any time enter or remain within a rectangular portion of the area… or within the remainder of the area between November 1, and April 30, inclusive, except by permission of the enforcing agency… The regulations in this paragraph shall be enforced by the Commandant, First Naval District, and such agencies as he may designate."* The enforcement office no longer exists, but the duties were transferred to the 1st Navy Region Mid-Atlantic, and Lt. McDonough, the staff judge advocate at CNIC Newport, that the regulation remains in effect and that the Navy remains responsible for enforcement.

A shipping lane has been identified crossing Vineyard Sound, with a fan shape at the western end, near Cuttyhunk. The fan shape is intended to accommodate large vessels turning and maneuvering while picking up a pilot and/or tugboats for safe passage from open water into and through Vineyard Sound.

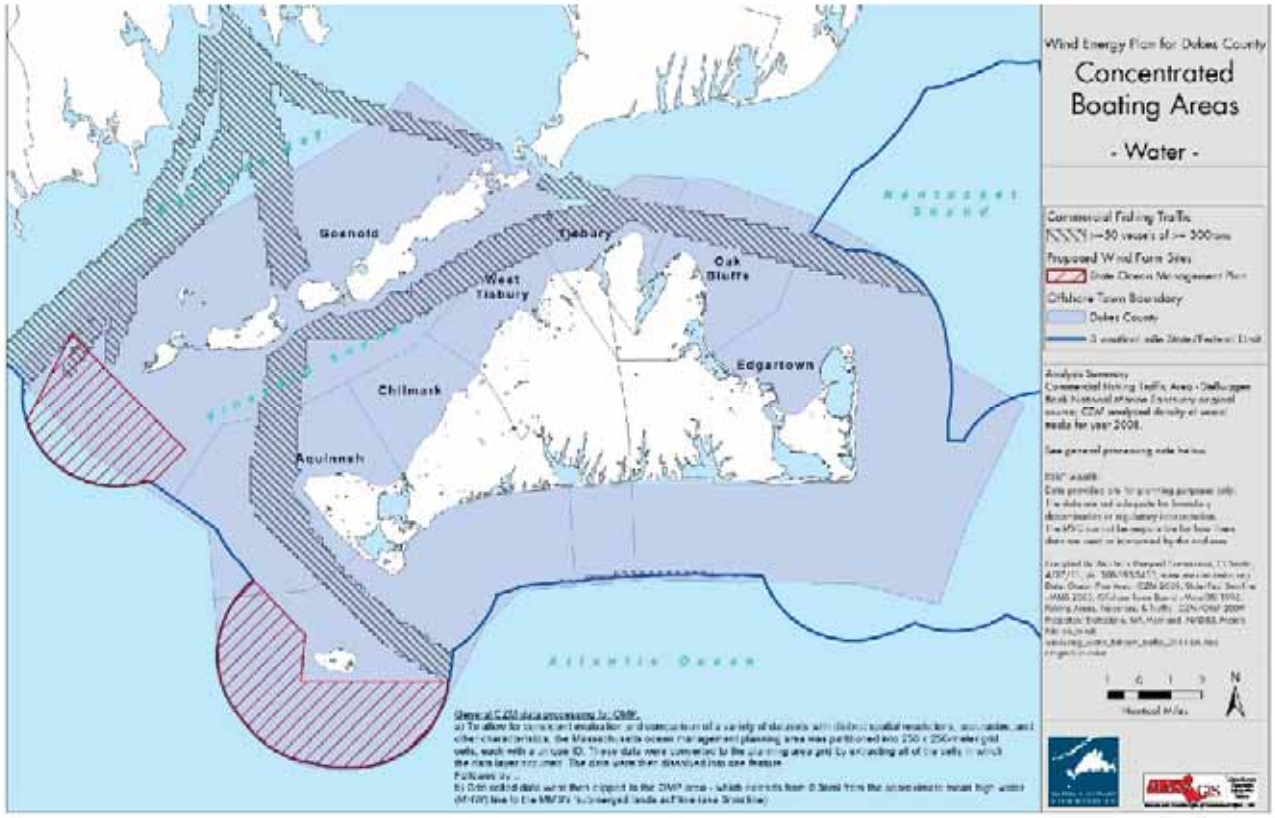


There is a pilot pickup designated in the vicinity. The map also includes a westerly projection of the Vineyard Sound shipping lane assuming that this would be required in the event that a wind farm were to be built to the west of the area already designated.

Ferry routes are vital cargo links, carrying essential supplies to and from the islands. Ferries also carry passengers whose lives depend on safe passage.

Commercial fishermen must be able to access the fishing grounds by practical and safe routes that minimize diesel consumption.

Concentrated Boating Areas



Commercial Fishing Traffic, large vessels

Larger commercial fishing vessels are equipped with locator devices for monitoring their fishing activity. The MOMP analyzed density of tracks from 2008 NCCOS data from the Stellwagen Bank National Marine Sanctuary. The MOMP layer represents traffic with more than 50 vessels of greater than 300 tons.

5.6.2 Potential Impacts of Wind Energy Facilities

In order to provide for safe navigation, there must be some order to the system. Ferry routes and other safe passages are often restricted in lateral extent by adjacent hazards in the way of rocks, shallows, etc. Vessels venturing outside the known safe routes would be at great risk. Placement of solid structures, in particular, is not an allowable use of safe navigable routes. Vessels must often rely on remote sensing such as radar to navigate safely in dark, bad weather or fog conditions.

In its report (2008) the Navigation Workgroup for the development of the Mass. Ocean Management Plan recommended excluding the Vineyard Sound shipping lane and pilot boarding turnaround at the western end of Vineyard Sound, as well as the Prohibited Area surrounding Nomans. This was not followed in the final MOMP. However, the Rhode Island Ocean SAMP did exclude wind energy development in areas of unexploded ordnance at the request of the Department of Defense. The Wind Energy Plan for Dukes County adopts this more cautious approach. This could be revised in future versions of the Plan based on additional analysis of the location, potential impacts, and possible mitigation.

5.6.3 Policies

Overall Objective: The overall objective is to maintain safe navigation. This can only be done by avoiding development in inappropriate areas such as shipping routes.

Siting Requirements

- Exclusionary Areas for wind turbines: Wind turbines shall be excluded from the following areas:
  - Nomans Land Prohibited Navigation Area (Department of Defense *Prohibited Entry Zone - Coast Pilot 2 note #334.70)*,
  - ferry routes plus a 200-foot buffer on both sides;
  - within one mile of the Vineyard Sound pilot pickup designation,
  - the Vineyard Sound shipping lane and its westward extension where open water meets the fan-shaped western end.
  - Concentrated boating traffic (MOMP and M V Fishermen's Fishing Routes).
- Exclusionary Areas for cabling: Cables shall be excluded from the Nomans Land Prohibited Area.
- Areas of Special Concern for cabling: If at all possible, cables should be avoided in the Vineyard Sound shipping lane, ferry routes and within one mile of the Vineyard Sound pilot pickup designation.

Performance Standards

- Where there is no alternative to crossing an Area of Special Concern with cabling, local harbormasters and other town personnel shall be consulted in addition to the Coast Guard and Commonwealth authorities.
- Development in the presently open waters west of the Vineyard Sound shipping lane should be avoided if possible. If unavoidable, development there should maintain an extension of the fairway associated with the shipping lane and generally be designed so that large vessels, such as cruise ships, can safely navigate from open ocean into and through Vineyard Sound.

6. Impacts on Persons and Property

The abundance of Dukes County's natural, cultural and scenic resources identified in other sections of this plan attracts people to live on the islands and many more to visit seasonally. Combined, these resources are instrumental in how the island communities have developed and they continue to be linchpins of their character and economies. Wind turbines can potentially affect people and property physically – both directly, such as from structural failure, and remotely, such as from noise and shadow flicker. These impacts can result in secondary health and economic impacts. Note that industry data and existing regulations focus primarily on utility scale turbines, and rarely specifically address small, residential scale turbines.

6.1 Safety

6.1.1 Potential Impacts

Accident Types: The presence and operation of wind energy facilities can potentially affect human safety through a variety of ways. As with any machine, turbines are subject to failure. The height and necessarily exposed locations of turbines make them particularly at risk to lightning strikes, which can be a source of turbine fires and blade failure (Larsen 2003).

- Tower collapse poses a potential risk to areas within the blade-tip height of the wind turbine. Such total failures are rare, but catastrophic.
- Fire can result from the turbine's mechanical and electrical sources as well as from lightning strikes. Turbines have lightning protection systems similar to those of aircraft to diffuse the lightning's energy and reduce the potential for damage and fire. Local firefighting capabilities may not be able to reach the height of the tower, leaving the fire to extinguish itself. This poses a wider-area to fire risk, especially under windy conditions.
- Blade failure results in either whole blades or pieces of blade being thrown from the turbine and arises from a number of possible sources, lightning strikes being the greatest contributor (Chatham-Kent, 2009). A commonly referenced confirmed maximum distance from a turbine's base that small blade fragments have flown is 500 meters , or 1,640. The maximum confirmed throw distance of an entire blade was 150 meters (492 feet) (Rademakers et al, 2005).
- Ice throw and ice shedding is when ice formed on the turbine blades breaks free either when the blades are rotating (throw) or stationary (shed). Ice shedding falls generally within a rotor diameter of the turbine's base and is of greatest concern during construction and, post construction, to the turbine operators. Ice throw has been confirmed as far as 140 meters (459 feet), approximately one-third the distance of the farthest blade fragment. Most wind turbines are fitted with vibration sensors to detect any imbalance which might be caused by icing of the blades and shuts down the turbine. However, icing occurs evenly while the blades are rotating and may not produce an imbalance. At least one source raises the question of whether glaze ice has been sufficiently studied, stating that most data involves the opaque, granular rime ice from higher elevations (Rideout, 2010). Glaze ice results from rain or fog contact with cold surfaces and is more likely to occur along the Atlantic. Glaze ice is smooth, dense and adheres more tenaciously to surfaces.

> *Various formulas exist to estimate the throw distance, whether for a blade fragment or ice chunk, for a given turbine. One formula shows a distance-to-height ratio of 3.3 for large turbines with rotor speeds of approximately 20 rpm under perfect conditions such as a smooth spherical projectile. Accounting for imperfect conditions and probability, 1.6 times the turbine height would*

sufficiently minimize the risk. The same approach for small turbines with faster tip speeds but substantially smaller mass indicates the practical risk area to be slightly less than the turbine height distance (Pimentel, 2011). Another approach determines the vulnerable area as the throw distance a twice the turbine's rated speed but calculates the unacceptable risk area where the strike risk is less than one in one million. For a 1.5 MW turbine 121m high, the vulnerable area is 370m – just over 3 times the height – and the risk area is between 100m and 150m – or .8 and 1.2 times the height (Moner-Girona, et al, 2005).

- Collision can occur when something strikes the tower of ventures into the sweep of the blades. The siting of turbines avoids airport approaches and vessel routes, and employs hazard lights as necessary. For power output, turbine blades are more effective the higher they are above the surface and any vegetation or structures that can interfere with the wind. On flat, open areas – particularly offshore – the blades may not need to be above the surface as much as in other locations.
- Transport accidents involving the large components of the turbines to the site for assembly can occur on or off site, including beyond a community's jurisdiction. An annual average of 11 incidents the last five years have mostly involved turbine sections falling from transporters (including ships for offshore installations).

Accident Risk: A study of reported wind turbine accidents from 2005 through 2009 quantified the relative frequency among the four accident types but since the study did not include the total number of wind turbines (i.e. all the turbines that did not have accidents), it provides no sense of the rates of accidents.

- Blade failure - 82 accidents
- Fire - 72 accidents
- Tower collapse - 48 accidents
- Ice throw - 11 accidents (The study thought this to be greatly underreported, reflecting only the incidents that resulted in damage. A study of "icing events" in Germany from 1990 to 2003 – when there were much fewer turbines and an earlier technology – reported a yearly average of more than 60 (CWIF citing Durstwitz).)

A broader study from the mid-90s through 2010, confirming the relative order of accident types, identifies a steep increase in the number of accidents since 2005. Total numbers of turbines are not readily available for a determination of accident per number of turbines, but using the imperfect proxy of total installed turbine MW capacity, the accident per MW capacity dropped 50% from 2005 to 2009 – from 1 per 843 to 1 per 1,294. How much of this change is masked by the increase MW per turbine in recent years is unknown.

Calculations of the probable risk turbines pose to turbine operators and neighbors are mostly based on pre-2005 data. The figures vary widely because they measure different probabilities and use different metrics, and do not always identify all assumptions, all of which thwarts comparisons. Larwood put the probability of blade failure per turbine per year as high as between 1 in 100 to 1 in 1,000. The risk of such projectiles striking people or structures varies with site specific circumstances, but a setback of 100 to 150 meters from a 1.5 MW turbine in a particular, sparsely populated rural area was determined to present a 1 in 1,000,000 risk of turbine projectiles striking people (Moner-Girona).

William Lawrence defines human safety as "a judgment of the acceptability of risk, and risk, in turn, as a measure of the probability and severity of harm to humans" he continues, "a thing is safe if its risks are judged to be acceptable". Driving a car is an example of an acceptable risk that most individuals experience on a daily basis. - *Chatham-Kent Public Health Unit*

Potential Strategies: A setback distance from property lines is the method to protect surrounding properties and abutters from potential physical impacts of turbines. Localities' setback regulations and industry recommendations often state a single setback that may address issues in addition to physical safety such as noise, so it cannot always be determined when a setback is based solely on safety issues. The minimum setback found was equal to the tower height plus half the rotor diameter – essentially, the turbine's blade-tip height – from buildings, infrastructure and roads that are not part of the wind facility. The Massachusetts model wind by-law is one example of this smallest of setbacks, as are recommendations from several other states. Below are some setbacks specifically addressing safety:

- The Canadian Wind Energy Association suggests that one blade length plus 10 meters is sufficient setback for ice or blade projectiles (Rideout), whereas Ontario advises minimizing risk of injury with setbacks of 200 to 500 meters (CMOH).
- Turbine manufacturer General Electric recommends 1.5 times the tip height for safety from ice throw.
- Canadian utility Hydro One Systems requires its wind turbines to be 500 meters (1,640 feet) from its critical assets, the 500 kV transmission line corridors. Less critical power lines based partly on redundancy have lesser setbacks of 250m and 150m (820 feet and 492 feet, respectively). (Palmer, 2009)
- Offshore wind farm developers within 12 miles of the English, Scottish and Welsh coastlines can apply for safety zones around any wind, wave or tidal energy generating station. These can be up to 500m during construction and 50m during operation (New Energy Focus, 2009).
- Taking into account deterioration of ship radar performance in the vicinity of turbines, a maritime insurer recommends vessels chart courses 2 nautical miles (3,700 meters) from wind farms (Steamship Mutual).

Some setbacks are relative to the turbine height, others are a static distance. A relative setback tied to the dimension of part of or the entire structure is more responsive to the wide range of total height of just large land-based turbines. Even with a relative setback, communities should weigh the appropriateness of whether small, residential scale turbines which use different technologies and generally have much fewer impacts, require the same standards as large turbines..

Another approach communities use to minimize risk to safety is education. For icing, the global consulting, engineering and project management firm AMEC recommends mandatory icing training of all construction workers and signage of the potential for icing (Chatham-Kent). To reduce risks from fire, local fire officials can conduct fire preparedness reviews with turbine operators and landowners. Fire fighters can receive specific training on the types of fires turbines can produce and protocols for managing fires beyond reach of equipment.

United Kingdom's approaches for offshore turbine safety

The blade sweep must be at least 22 meters above the highest astronomical tide. The base is painted yellow at least 15 meters above high tide. Navigational lights for watercraft are placed at a wind farm's perimeter turbines no more than 3 nautical miles apart, and must be visible in all horizontal directions for at least 5 nm. These lights are fixed between 6 and 15 meters above the high water level and flash in a synchronized fashion. There may be a secondary level of perimeter turbines not more than 2 nm from the primary perimeter turbines, also with synchronized lights, but with a different flash pattern. Unique alphanumeric identifiers on each turbine visible from 150 meters are also lit for nighttime visibility. Transformer towers may have their own distinctive warning lights and, as with individual offshore turbines not part of a wind farm, have sound signals every 30 seconds audible in all directions to at least 2 nm, activated when visibility is less than 2 nm. (Steamship Mutual)

6.1.2 Policies

Overall Objective: Minimize risk to persons and property from wind energy facilities by employing design and operational practices and through minimum setbacks from property lines, occupied structures and shared roads or navigation routes.

Performance Standards:

1 The wind energy facility shall be located, designed, and installed in a manner which ensures the safety of persons and property, eliminating or mitigating unreasonable risk from tower collapse, blade failure, ice throw, collision, transport of materials, fire and unauthorized access to the facility

2 Wind turbines of 100 kW or greater should be set back from roadways and from a property line of another landowner not less than one and a half (1.5) times the blade-tip height of the turbine.

3 Wind turbines smaller than 100 kW should be set back from the property line of another landowner not less than the blade-tip height of the turbine.

4 Turbines may be exempt from setbacks from property lines of an adjacent landowner who is a participant in the project through a land lease or wind access agreement. Communities may also wish to develop a process for waiving the property line setbacks though the consent of non-participating landowners, but this should requiring acknowledgement of the waiver by an instrument recorded in the Registry of Deeds.

5 Turbine operators should provide project plans and operation information to local emergency and utility officials and, if requested, work with them to develop emergency preparedness and response plans.

6 Wind turbines or other structures part of a wind energy facility should be designed to prevent unauthorized access.

6.2 Noise and Vibration

Wind turbines generate sound through mechanical and aerodynamic routes depending upon the size and make of the turbine and upon atmospheric conditions. Modern large wind turbines have greatly minimized mechanical sound generated from gearboxes and control mechanisms, although these can still be a source of tonal sound – a distinctive continuous sound. The main source of turbine sound is aerodynamic, produced by the turbine blades moving through the air. The aerodynamic sound is present at all frequencies, from the normal audible range to low frequency to (although there remains debate) inaudible infrasound. Aerodynamic sound is greatest at the blade tip and most pronounced on the downswing of the blade, resulting is a perceptible, rhythmic "swooshing" with the passing of each blade approximately every second. This frequency modulation, sometimes described as a pulsing of noise, is thought to be related to the difference in wind speed between the top and bottom of the rotation of a blade. (Leventhall 2006, Colby et al. 2009, CMOH 2010, C-K)

Sound is characterized by its frequency (pitch) and pressure level (loudness), which are measured in standard units known as Hertz (Hz) and decibel (dB), respectively. The threshold of hearing is frequency dependent – the lower the frequency, the greater the sound pressure needed in order for humans to hear the sound.

Frequency/Pitch

- *Audible Sound - sound frequencies from 20 to 20,000 Hz perceived by the "normal" human ear; best sensitivity at the 1,000 to 5,000 Hz range.*
- *Low Frequency Sound - frequencies below 200 Hz.*
- *Infrasound - frequencies below about 20 Hz, considered inaudible except at very high decibels.*
- *Broadband - sound comprised of a mixture of frequencies.*
- *Octave Band – a group of frequencies whose lower frequency boundary is one-half the upper boundary.*
- *Tonal Sound or Pure Tone - sound with any one octave band significantly exceeding the decibels of adjacent bands.*

Pressure/Loudness

- *A decibel indicates the ratio of the sound pressure relative to the auditory threshold pressure at 1,000 Hz (0 dB).*
- *The decibel scale is logarithmic – a 10 dB increase is a ten-fold increase in sound energy (but only perceived as a doubling of loudness)*
- *At least a 3 dB change in sound pressure is needed for most people to clearly perceive a change in loudness.*
- *High levels of sound pressure can cause pain and impair hearing.*

Wind turbines are usually set in remote, rural areas with low ambient noise levels are commonly 25 dB at night (Cummings, 2011). The American and Canadian Wind Energy Associations characterize such areas as typically having baseline noise levels of at least 40 dB. At distances between 1,000 and 2,000 feet, wind turbine noise is generally within 40 to 50 dBA, which the industry compare to the typical sound in a living room (40 dB) or light auto traffic from 50 feet (50 dB). But rural background noise levels can often be much lower than 40 dB, especially at night, when levels below 30 dB are common. The acoustic study near the West Tisbury School in late fall of 2009 measured levels of less than 22 dB at nearby residences. Occupants of such relatively quiet areas are more likely to perceive the introduction of new sounds.

The inherently windy nature of turbine sites can generate increased background noise sufficient to mask sounds generated by a wind turbine. However, wind shear – when ground surface wind speed is disproportionately low as compared to hub-height wind speed – can prevent such masking. Winds 200 feet

up can be strong enough to power a turbine when there is little wind at ground level to mask the turbine noise. Wooded areas that block the wind will have a greater wind shear than open fields. Wind shear is most pronounced under stable atmospheric conditions – which usually occur at night, when there are generally fewer and quieter background sounds, and people are more likely to be trying to sleep.

Measurement of sound pressure or loudness is commonly filtered to better reflect the varying sensitivity of the human ear to sound at differing frequencies. Filtering to emphasize the wide frequency range is called A-weighting (dBA). This focuses attention on the loudness of sound, but significantly reduces the measured intensity of the problematic low frequency component of wind turbine sound, nor does it address the major issue of the fluctuation nature of turbine sound. "A-weighting sound descriptors do not accurately describe the sound or perception of a wind turbine or wind farm" (Thorne). A C-weighting filter is used to focus on how people are likely to perceive the lower frequency sounds. No one type of sound measurement of wind turbines can appropriately describe the broad array of sounds turbines may produce.

Whether wind turbine sound is objectionable – i.e. "noise" – is partly a subjective determination made by individuals, but the Vineyard community has an interest in protecting the well being of its residents and visitors from wind turbine sounds that may unreasonably disrupt people's enjoyment of their properties and the Island as a whole. Issues with wind turbine noise involving people (as opposed to flora and fauna, which are discussed elsewhere in this plan) revolve around the acceptable increase in environmental, or background, sound from wind turbines, the types of sounds to be measured, and the physiological health impacts on people.

6.2.1 Potential Impacts

Unanticipated problems with wind turbine noise, while not the norm, are widespread. Just in New England, wind turbines installed in the past couple of years have led to serious complaints from neighbors. On Vinalhaven, Maine, five of the fifteen households within a half-mile of the three 1.5 megawatt turbines have formally complained about the turbines' noise. Of the 120 families within one mile of a 1.65 MW turbine in Falmouth, Massachusetts, 45 have expressed problems with the noise and 12 have filed formal complaints (source to be verified). There have also been complaints about the smaller, 100 kilowatt wind turbine at the Woods Hole Research Center, also in Falmouth. As a result, all three projects are operating under restrictions that prevent full use of the turbines and each is investigating how to address the noise issues. The unforeseen problems with these regional pioneering projects have had a marked dampening effect on plans for turbines in other communities.

Change in Background Sound: Background sound can vary by location, seasonality, time of day and other factors. Wind turbines are usually set in remote, rural areas with low ambient noise levels. The wind industry characterizes such areas as typically having baseline noise levels of at least 40 dB but, in fact, noise levels can often be much lower. The acoustic study near the West Tisbury School in late fall of 2009 measured levels of less than 22 dB at nearby residences. Occupants of such relatively quiet areas are more likely to perceive the introduction of new sounds, but perception of sound is subjective. Research of people that live within a mile and a half of wind turbines showed about 20% of the population was inherently noise sensitive, 30% moderately sensitive, and 50% not particularly sensitive. People in quiet areas have an expectation of quiet and such areas may attract higher percentages of noise sensitive people. Noise from turbines also differs from other introduced noises in rural areas in that wind turbines may be noisy at all hours, whereas most industrial, airport, and road noise is reduced at night. It is increasingly apparent that more than just audible sound plays a role in the perception of wind turbines.

Types of Sound to Measure: Most wind industry and medical discussions of wind turbine sound emphasize the audible broadband frequency spectrum and focus on the absence of excessive sound loudness as demonstrating little impact to nearby residents. Research shows people are about twice as

sensitive to noise at the same decibels from wind turbines compared to other sources. One reason may be the amplitude modulation of 5 to 10 dB, whereas other noises are steadier.

Low frequency sound and infrasound from large turbines are typically around 50 to 70 dB and there is no evidence of adverse effects to health from infrasound below 90 dB (Leventhall 2003, 2006). Yet there is abundant anecdotal information on the perceived harm caused by low frequency sound and infrasound. Interviews of Australian residents report the low frequency sound from wind turbines 2 kilometers away "penetrating" their building's double glazed windows and new insulation (Thorne). The reverberation is worse inside the house than outside. The effects of the vibrations – headaches and dizziness – are compared to those from Sick Building Syndrome (Society for Wind Vigilance).

Sound Impacts on Human Health: The considerable dispute whether wind turbine sound can result in impaired health seems to depend upon whether one looks only at direct, immediate "health impacts" versus considering secondary "health outcomes". Up until the past couple of years, the medical community's examination of the health effects of wind turbine sound focused only on the pressure level of sound to impact auditory health. There seems to be consensus that wind turbine noise does not pose a direct risk to health when separation distances reduce turbine sound at receptors to 40 dB. Broadband sound pressure levels of 75 dB can result in impaired hearing, depending on length of exposure and an individual's sensitivity. The 40 dB level is comparable to background sound indoors and is the World Health Organization's recommended European guideline for night-time noise. This level is below where sound effects sleep and health, but above where complaints may occur (CMOH).

Decibel Levels of Harm to Human Hearing

(Normal conversation at one meter is 40 – 60 dB)

- *Hearing damage over a long term (need not be continuous) occurs at 85 dB [75dB DMOH*
- *Hearing damage is possible at 120 dB.*
- *Threshold of pain is 130 dB.*

source: Wikipedia – "Sound Pressure" [get better source]

Nor is there dispute that some people experience irritation and annoyance in reaction to wind turbine noise. But while the National Wind Coordinating Committee in 2002 recognized that sound that is chronically annoying, including very soft sounds, may create chronic stress and sleep disturbance for some people, "which can in turn lead to other health problems", the wind industry appears not to acknowledge eventual stress-induced health problems as resulting from wind turbine sound. The draft of the 2012 Wind Turbine Health Impact Study prepared by the Commonwealth's departments of Environmental Protection and Public Health did little to clarify this nuanced distinction, for which it received broad criticism. A final report has yet to be released.

Dr. Nina Pierpoint coined the term "wind turbine syndrome" to describe the experience of wind turbine noise sufferers extending over a number of years: distraction, dizziness, eye strain, fatigue, feeling vibration, headache, insomnia, muscle spasm, nausea, nose bleeds, palpitations, pressure in the ears or head, skin burns, stress, and tension. A subsequent case study of people near wind turbines led Dr. Michael Niessenbaum to declare "[t]here is absolutely no doubt that people living within 3500 feet of a ridgeline arrangement of turbines 1.5 MW or larger turbines in a rural environment will suffer negative effects."

A 2010 Canadian health reports note that most data on wind turbine sound is based on models. They call for noise level assessments at wind power facilities and surrounding receptors as necessary for "making informed decisions on whether epidemiological studies looking at health will be useful" (CMOH).

Potential Strategies

Wind industry sources commonly state no or relatively little impact from turbine sound at "normal separation distances" or "typical setbacks", yet industry acknowledges that no uniform regulatory approach for wind turbine noise has been established in North America or internationally. In practice, communities pose one of both of two regulatory measures: a separation distance or setback from property lines or buildings, and sonic thresholds.

Before deciding upon an appropriate method for guarding against unreasonable noise, a community should first agree on what the sonic norm (environmental or background sound level) is and on how much of an increase from that norm is acceptable. It may be appropriate to have different standards, or even different regulatory approaches, for parts of the community that differ significantly in their background noise levels or character. Scotland recognizes low noise environments where the combination of all noises cannot exceed 35-40 dB, depending upon the number of dwellings in the neighborhood.

Setbacks: The use of setbacks is a traditional approach to separating incompatible land uses and sound decreases rapidly with distance, although lower frequency sound waves travel farther than higher frequencies. Doubling the distance from a sound source to a listener lowers the sound by roughly 6 dB from a single wind turbine, less from a group of turbines. There is also debate on what to setback from – property lines or occupied buildings; some places have a setback for each. Use of property lines in determining setbacks assures that future uses of unbuilt adjacent parcels will not be exposed to unreasonable noise impacts. Noise is generally a problem at night, so sound level at the exterior of residences is important. Measuring sound from both property lines and residences protects against the possibility that terrain, vegetation or other factors cause turbine sound to project at higher levels beyond the property line.

In practice, setbacks for wind turbine sound range widely. Massachusetts' Renewable Energy Research Laboratory suggests a "rule of thumb" of three times the hub height from residences, which for most utility-scale turbines would be less than twice the blade-tip height, or about 800 feet. The industry cites decibel levels at 1,000 to 2,000 feet from turbines. The National Research Council concluded in 2007 that noise produced by wind turbines is generally not a major concern beyond a half mile, or 2,640 feet. European setbacks are customarily on the order of 1,500 feet, but some nations have adopted setbacks up to 2 kilometers – more than 6,500 feet. As sound is cumulative, some places incorporate setbacks that increase with the number of turbines. The minimum setback in Ontario for a wind turbine with a sound power level of 107 dB is 550 meters from a receptor, but that setback increases to 950 meters for a wind project with five turbines (CMOH).

Setbacks, even when linked to turbine size, do not take into account the variability of sound from different makes of machines, topography, prevailing winds, vegetative cover or the ambient noise of the surroundings. A setback that is sufficient to provide the intended level of protection from turbine sound in all situations may be excessive for many, perhaps even the majority, of wind turbine development scenarios.

Sonic Thresholds: Establishing a threshold above which a wind turbine cannot increase sound levels provides a failsafe when setbacks are not used or prove inadequate. There are two types of noise limits:

- Absolute standards establish a fixed limit irrespective of existing sound levels. This may be an absolute floor (a limit below which facility sound levels need not achieve) or ceiling (above which sound levels may not exceed).
- Relative standards limit the increase of sound over some existing referenced sound level. The appeal of this approach is that it accounts for differences in circumstances and provides a kind of "failsafe" protection for unanticipated noise. The Massachusetts regulation limits sound produced by a new facility to not more than a 10 dBA increase from the pre-existing background level.

These two approaches are sometimes combined to use the advantages of each. For example, if a relative increase of 10 dBA with a ceiling of 50 dBA is allowed and the existing level is 45 dBA, a level of 55 dBA would not be allowed. Similarly, if a floor of 40 dBA was established and the existing level is 25 dBA, 40 dBA rather than 35 dBA would be allowed.

It is also common to have a different standard for day and for night, differing by 5 or 10 dBA, to account for increased community sensitivity to nighttime sound levels. A 5 dBA "penalty" to measured and calculated wind turbine A-weighted sound levels can be applied to counterbalance modulated broadband sound noted by many as the annoying feature of wind turbine sound. Some places even establish different sound limits for various wind speeds.

Post Construction Measures: A fundamental flaw in the reliance on either measurable sound thresholds or setbacks is the assumption that, if exceeded, they can be remedied. Actual sound levels occurring after installation of a turbine are not always as anticipated, despite accurate noise modeling prior to construction. Mechanical noises can often be adjusted, but few remedies exist for broadband blade turbulence noise other than shutting down the turbine when adverse conditions are present. Often this adverse condition occurs at turbine blade cut-in, when background sound from wind is low. Delaying turbine cut-in until higher wind speeds can sometimes remedy noise problems with minimal economic effect on the turbine operator. More weighty economic penalties occur when blades must be feathered short of optimum operating conditions, or a turbine is shut down entirely. Shifting the location of a large turbine is not a practical solution.

The limited economical options for remedying the source of noise concerns has resulted in turbine operators sometimes financially purchasing "sound easements" over adjacent property or sharing of royalty payments with affected neighboring landowners. This type of financial compensation to neighbors can reach the extreme of a turbine developer purchasing homes because of the inability to adequately abate the noise in an economical manner. Some governments have established thresholds for compensation of lost property value (see Property Values section).

6.2.2 Policies

Overall Objective: Protect people and their enjoyment of their property from unreasonable potential negative consequences due to sound generated from wind turbines.

Wind energy facilities require noise standards more nuanced than typical regulation of just the audible sound spectrum.

Performance Standards: *(Note that the following standards address human impacts and not necessarily potential impacts to flora and fauna.)*

1. Sound measurement or modeling shall be conducted for each integer wind speed at hub height from turbine cut-in to rated power during conditions when the difference between wind energy facility sound emissions and background sound at receptors is the greatest.
2. Audible sound from a wind energy facility at a receptor shall be regulated by a combination of relative and absolute standards:
   - Not exceed background sound level for each integer wind speed by more than 5 dBA.
   - Not exceed 35 dBA at night or 40 dBA at daytime.
3. Low frequency sound from a wind energy facility at a receptor shall be regulated by a combination of relative and absolute standards:
   - Not exceed background sound level for each integer wind speed by more than 20 dBC.
   - Not exceed 50 dBC.
4. In addition to respecting Massachusetts Department of Environmental Protection standards on tonal sound, a 5 dB penalty is added to measured or predicted wind turbine sound at a receptor when it

contains one or more pure-tones, defined here as when the sound pressure level in a one-third octave band exceeds the arithmetic average of the sound pressure levels of the two contiguous one-third octave bands by 5 dBA for center frequencies of 500 Hz and above, by 8 dBA for center frequencies between 160 Hz and 400 Hz, or by 15 dBA for center frequencies less than or equal to 125 Hz. (Oteri, 2008).

5. Specification of sound limits should be from property lines and residences of non-participating parcels, but allow for flexibility through a waiver or other process, particularly for property line setbacks.
6. The Massachusetts noise regulation of construction activities (310 CMR 7.10 U) should be adequate to address sound levels from construction and demolition of wind energy facilities, but permitting authorities should consider whether to establish time and duration conditions for particularly noisy tasks, such as pile driving.
7. Permitting authorities should develop procedures outlining how facility operators are to demonstrate compliance with sound regulations and the process for remedying any violations thereof. These procedures should address such factors as the location and timing of sound measurement, qualifications of persons involved with sound measurements and their interpretation, and the steps and timing of application review and decision by the permitting authority.

6.3 Shadow Flicker

6.3.1 Potential Impacts

Shadow flicker describes the rapid, intermittent interruption of sunlight by rotating wind turbine blades, which cast repetitive shadows upon a given point. The frequency of this interruption can be every second with large wind turbines, and more frequent with faster spinning smaller turbines. Where flicker occurs is a function of distance from the turbine, angle of the sun and turbine blade angle and width. Flicker is most pronounced at distances from wind turbines less than 1,000 (Rideout, PWP) to 1,300 (Gierord webinar) feet where the portion of the sun's disk covered by the blade is increased, increasing the flicker intensity. At longer distances from the turbine, shadow flicker is less distinct and of shorter duration. Flicker is of limited duration – usually less than 30 minutes – at any given point as the sun moves across the sky and the seasonal azimuth of the sun. The higher the sun angle, the longer the duration of the shadow flicker but fewer locations effected. Shadow flicker is visible from more points when the sun is at a low angle in the sky, such as mornings and evenings in the summer, or during the winter when the sun's lower azimuth increases the range where shadow flicker may occur. Shadows also extend further when the shadow is downhill from the turbines. Importantly, a person can perceive flicker shadows on surroundings without being directly in the shadow, which can expand the exposure area and duration of flicker.

Beyond nuisance irritation, health concerns from shadow flicker include headache, loss of balance, nausea and disorientation. There appears to be little chance of shadow flicker inducing epileptic seizures: only about 3% of people with epilepsy are photosensitive, generally to flicker frequencies between 5 and 30 Hz (Rideout). Flicker from large turbines does not usually exceed 1 Hz (for comparison, strobe lights in discotheques flicker between 3 Hz and 10 Hz). To ensure shadow flicker frequency does not approach this range, turbine blades should be programmed to stop when blade rotation exceeds 3 Hz (60 rpm for a three-blade turbine). Most industrial turbines operate at 30 to 60 rpm.(Rideout))

As the rotating turbine blades are blocking sunlight on one side of the blades, on the other side they can also reflect the sunlight, causing repetitive flashes of light called strobing or glint. Strobing can occur at any time of day from anywhere the turbine is visible, but principally from the east, south and west. Use of non-reflective materials on the blades may be the most effective mitigation measure for strobing.

Potential Strategies

Turbines should be sited to minimize the extent of their shadows cast upon adjacent lands and buildings, such as positioning the turbine towards the southern side of the site parcel rather than the northern side. Computer models can accurately predict where shadows from a proposed turbine would occur as well as the frequency of their likely occurrence, based on historical climatological data. Alameda County, CA increases the setback distance from three times the total turbine height to four times where terrain is sloped. The most common setback for flicker is 10 rotor diameters, usually from dwellings as opposed to property lines.

The Commonwealth's Model Wind Bylaw suggests the following regulation:

> *Shadow/Flicker Wind facilities shall be sited in a manner that minimizes shadowing or flicker impacts. The applicant has the burden of proving that this effect does not have significant adverse impact on neighboring or adjacent uses through either siting or mitigation.*

This language provides no guideline of what might constitute "significant adverse impact". Some communities specify a number of hours above which a turbine may not cause flicker – usually less than 30 hours per year. The potential areas affected as well as the probable total duration of flicker can be well modeled. Such modeling only factors the direct shadow and not views of the shadow.

One study (Bolton, 2007) pointed out the obvious that annoyance of shadow flicker was associated more with when people were at home than with the duration of the shadows (if they were not present to witness it). This suggests that regulation of shadow flicker might be most effective by tailoring it to the specific neighbors affected than by imposing a uniform number of hours or fixed time of day that flicker must be prevented. This is complaint driven, much like the Massachusetts model bylaw, and most likely will require the turbine to be shut down while the probability of flicker is present. Shutting down the turbine will mean lost energy and income, but it should be of short duration before the conditions have passed and the turbine can resume operation.

It is possible to install sensors that shut down the wind turbine when flicker is causing a serious problem (Wind Energy Planning website).

Strobing is much harder to predict and mitigate, but some communities factor the potential for such glare in their setbacks from major road intersections.

6.3.2 Policies

Overall Objective: Wind facilities shall be sited and operated in a manner that minimizes shadow flicker impacts on receptors.

Performance Standard: There shall be no shadow flicker on normally occupied buildings within 1,000 feet of the turbine except those located on participating parcels. The applicant has the burden of proving that this effect does not have significant adverse impact on neighboring or adjacent uses, through either siting or mitigation.

6.4 Electromagnetic Fields

6.4.1 Potential Impacts

As an electrically charged object, wind turbines produce electromagnetic fields (EMF). EMF can interfere with various electromagnetic systems such as TV, radio, cell phones, microwave links, and radar waves within the vicinity of the field. The degree and nature of interference from turbine EMF will depend on the signal transmission and reception methods used by the particular system and the electromagnetic scattering characteristics of the turbine blade, which depend on turbine dimensions, rotational speed, blade construction material, blade angle and geometry, and tower geometry. Signal interference standards ensure that the construction and operation of a wind energy facility will not interfere with television, microwave, navigational, or radio reception in any neighboring areas.

Wind turbines are not considered a significant source of EMF exposure. EMF around wind farms can originate from the grid connection lines, wind turbine generators, electrical transformers, and underground network cables. The grid connection lines are similar to other power lines and generate low levels of EMF comparable to those of household appliances. Turbine generators at the top of towers results in little or no EMF at ground level. The underground cables that connect the turbines effectively generate no EMF at the surface (Rideout, 2010). Nevertheless, some communities specify separation distances a turbine must be from critical communications facilities. Manitowoc, Wisconsin prohibits large turbines within 500 feet of a line connecting a pair of emergency communication towers (Oteir, 2008). A European maritime insurer recommends vessels steer 2 nm distant from offshore wind energy facilities due to the deterioration of ship radar performance near turbines (Steamship Mutual).

6.4.2 Policies

Overall Objective: Ensure that wind energy facilities do not interfere with off-site electrical signals.

Performance Standards:

1. Review wind facility proposals with communication networks and navigational operators to avoid, or minimize and mitigate potential interference issues.

7. Operational Considerations

7.1 Wind Availability and Access

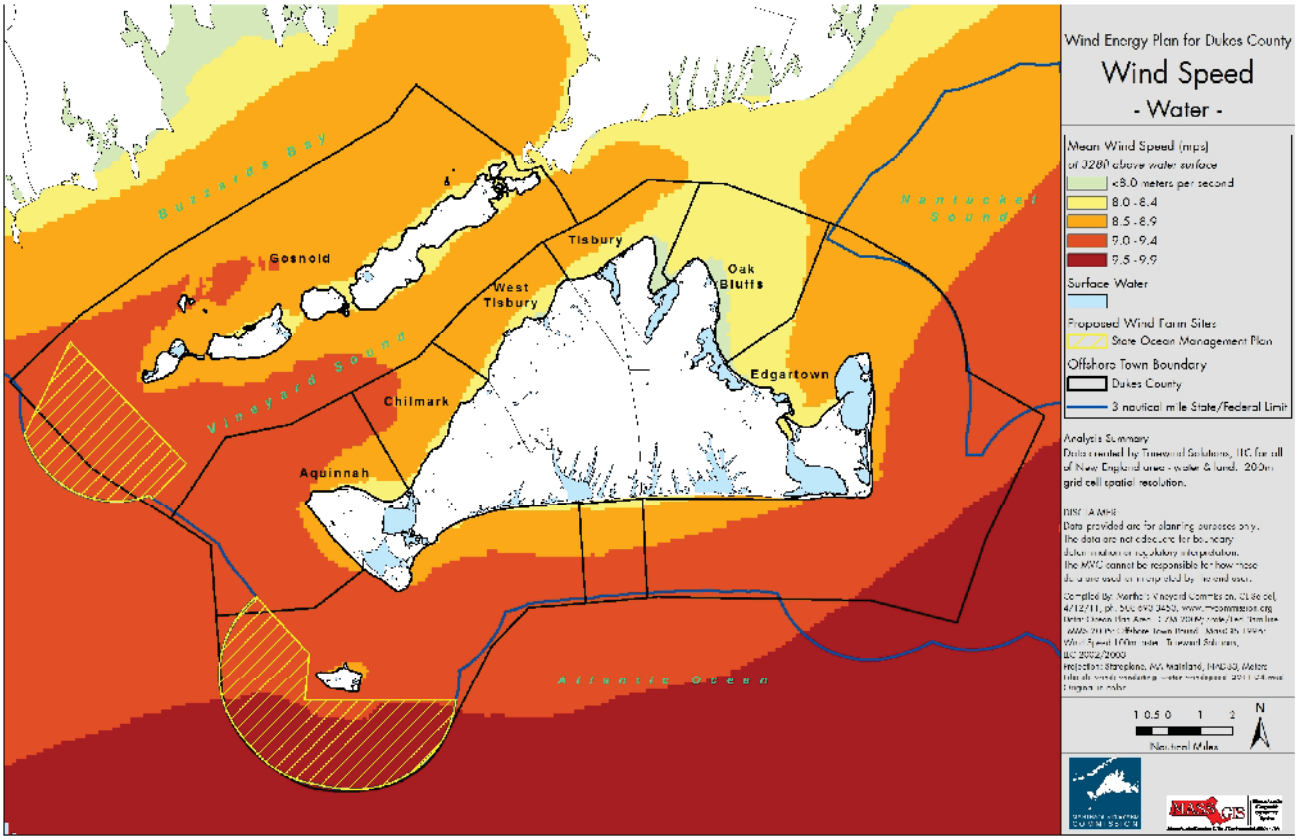
Whether it is technically feasible for a particular site to generate electricity from wind depends upon the quality of the wind resource and the infrastructure of the electrical grid and transportation networks serving the site.

7.1.1 Resources

Wind Resource: Wind must be of a certain quality for wind turbines to convert the energy to electricity. The speed, variability and turbulence of wind varies with time of day and seasonally. The type of terrain and vegetative cover also affect turbulence. Even slight differences in speed greatly affect the energy potential of the wind. The energy available in wind is proportional to the cube of its speed, which means that doubling the wind speed increases the available energy by a factor of eight. Wind Power Density, measured in watts per square meter, indicates how much energy is available at the site for conversion by a wind turbine.

Annual average wind speeds of about 8 miles per hour may be adequate for small domestic turbines. Large turbines may only begin to start up at that wind speed and need wind speeds closer to 12 mph, but wind speed is not considered "good" for large turbines until nearing 16 mph.

At 50 meters above vegetative cover, all of the lands of Dukes County have estimated average wind speeds above 13.4 mph, powerful enough for smaller turbines but "Marginal" for large turbines. At 80 meters up,



wind speeds over Gosnold, Aquinnah, Squibnocket, Katama and much of Chappaquiddick are "Excellent" and over most of the rest of the Vineyard are "Fair".

Predicted average wind speeds over much of Dukes County appear adequate for large scale turbines, especially over the waters, where winds at 90 meters up the National Renewable Energy Lab classifies all open water Class 6 or Class 7, the highest wind power classes. Note that while these wind speed estimates appear very conducive for wind power, because of the high sensitivity to slight variations in wind speed, it is necessary for on-site measurements to establish more refined estimates of the availability of wind at the proposed turbine site.

Supporting Electrical Infrastructure Network: In addition to the quality of the wind resource, siting wind facilities is dependent on the electrical grid network into which they will tie. Even small residential turbines serving only a portion of the site's electricity needs will usually be connected to the electrical utility's grid to take advantage of net metering (selling excess electricity to the utility). Large, multi-megawatt wind turbines must be linked to the electrical grid via large-capacity transmission lines. If these are not part of the local existing electrical grid network, lines will have to be extended – adding to the project cost. With the possible exception of the high-power transmission line in Tisbury, additional transmission lines would be necessary for large turbines on the Vineyard or Gosnold unless the electricity generated was able to be consumed (or, in the future, stored) on site. The expense of developing offshore power generation requires utility-scale operations, which need to connect to large transmission stations that are not likely to be constructed on the islands because the electricity would still need to be transferred to the mainland via another cable.

Potential Approaches

Proper siting in windy locations, away from large obstructions, enhances a wind turbine's performance. Localities can zone areas with favorable wind resources to encourage the development of wind facilities, looking at possible grid connections and planning upgrades. While virtually all of Martha's Vineyard has promising wind speeds at elevations for large turbines, the larger setbacks needed for such turbines and the dispersed development of the Vineyard make it difficult to delineate appropriate areas.

Since wind is a resource with economic value, it is reasonable for a community to protect a landowner's natural wind resource from being diminished by nearby landowners. The wake effects of a turbine on wind currents are such that multiple turbines are spaced 3 rotor diameters crosswind and 10 diameters downwind. A California community requires a lateral setback relative to the wind direction of three rotor diameters. Sometimes a turbine developer will obtain easements to prevent abutting property from potentially affecting the characteristics of wind that approaches its turbines. This same principle could be used for downwind abutters when the developer could not meet setbacks designed to protect the wind resource of downwind landowners. Here, again, the relatively fragmented property lines of island towns make it difficult to comply with setbacks of many hundreds of feet.

7.1.2 Policies

The Wind Energy Plan does not set out specific policies with respect to wind availability and access. It does not identify areas of Dukes County that may be especially promising for wind energy generation because of the extensive areas of suitable wind and the relative absence of expansive areas under common ownership. Nor does the plan take a position on whether communities should adopt regulations to protect the innate wind resource of such areas.

7.2 Construction, Operation and Maintenance, and Decommissioning

A wind energy facility involves more infrastructure than the turbine itself, and once installed, requires ongoing maintenance. For large-scale onshore facilities, adjacent the actual footprint of the turbine tower's supporting foundation, a flat crane pad – well graded and constructed of compacted crushed rock – is needed for erection, repairs and, eventually, removal of the turbine. The huge turbine sections and equipment require 18 to 20' wide access roads. An above ground medium-voltage power collection line usually links the turbine to an on-site substation, which then connects via a high-voltage interconnection line to the electric grid transmission line. Accessory structures may be necessary for the storage of spare parts, control computers and communications system. For offshore turbines, components are transported to the site from main ports and multiple power substations may sit on towers within a wind farm project. Cabled power connection lines either rest on or are placed beneath the ocean floor.

Wind turbines are designed to function about twenty years, but rotor blades pit and degrade and may be replaced every five years. Turbines use a variety of specialty lubricants critical to mechanical operation. Each turbine manufacturer will have oil change specifications for each model. The task of replacing more than 50 gallons of gear oil 200 or more feet in the air necessitates very long lasting oil formulations. Some lubricants are engineered for changing every 25,000 to 50,000 service hours (Siebert), but routine monitoring is necessary to keep abreast of any unusual wear of degradation of the lubricant. One land based wind farm of GE 1.5 SLE turbines required gear oil change after three years (Hurd).

Turbines eventually need to be removed (decommissioned) or replaced with new turbines ("repowered"), depending upon whether the significant infrastructure invested in the site remains viable with future technology. By anticipating the eventual removal of a turbine should it become abandoned or inoperable, communities can act to ensure that the turbine owner bears the cost of removal rather than the community.

7.2.1 Potential Impacts from Wind Energy Development

There is a variety of potential impacts resulting from different stages of a wind turbine's development. These can be of limited duration and may occur off site as well as on site. [Some impacts are addressed more specifically in the resource sections of this plan.]

Construction and Decommissioning: Both construction and decommissioning of wind turbines take place over a few months. The large components of a turbine, especially the blades, must be transported to the site over long distances just to reach the site. The existing public roads in the remote locations of most onshore turbines may not be designed for such large loads – dimensional as well as weight. Transport may require removal of roadside vegetation, temporary removal of utility lines and even temporary road fortification. The Vineyard's narrow roads bordered by buildings in the port areas of Tisbury and Oak Bluffs present additional potential obstacles. Transport via barge directly to a construction site on the Vineyard or Gosnold might be possible to avoid these areas of tight street geometry. It is likely that the construction of larger, offshore turbines would be out of another location, such as New Bedford. In planning for the transportation of turbine components, localities should consider the physical capacity to accommodate large turbine components, and the extent and duration of any physical disruption of the roadways or the circulation of normal vehicular or vessel traffic.

Between the turbine foundation, crane pad, access roads, and other site infrastructure for onshore turbines, significant amounts of land disturbance can occur, so potential soil erosion and impacts to water quality need to be addressed.

Noise can be significant from truck traffic, heavy equipment operation and the possible blasting or pile driving of foundations. Developers should program noisy or otherwise disruptive activities when least a potential irritation. For humans, this may be certain hours of the day or the busy summer season. For plants and animals, it may be migrating, nesting or flowering periods for sensitive species.

For both construction and decommissioning, the locality should know which site disturbances are only temporary. A plan could identify the acceptable site conditions after the construction or decommissioning: the final grading, re-vegetation of disturbed areas, the extent below the surface from which foundations are removed, etc.

Operation and Maintenance: The following are some of the main issues related to the operation and maintenance of wind energy facilities.

- Vehicle traffic during ongoing land-based operations is usually minimal because it is unlikely to site multiple turbines on a single property. Offshore facilities will have many more turbines, with a greater cumulative amount of support vessel traffic.
- Turbines require lubricating oil and hydraulic and insulating fluids, some of which may be hazardous if spilled on the ground. If not maintained, turbines may leak fluids not just dripping downward but also flying off tips of the rotating blades.
- Wind facilities must be secure. Most facilities prevent unauthorized access and climbing.

Site plan review during the initial permitting process can address a wide range of factors discussed in detail elsewhere in this plan, such as monitoring of noise, wildlife, animal fatalities, and shadow flicker.

- Require signs containing contact information; restrict signage or advertisements.
- Waste management plans.
- Use of non hazardous fluids should be encouraged. If hazardous materials are used, the facility should have a Hazardous Materials Management Plan addressing avoidance, handling, disposal, and clean-up.
- Turbine maintenance and repair should also be considered; some permits for large wind farms have banned on-site repairs of construction and maintenance vehicles.

7.2.2 Policies

Overall Objective: The developer of a wind energy facility should avoid, or minimize and mitigate, potentially detrimental impacts to humans and the environment. Communities should be aware of the duration and intensity of potential impacts and present clear expectations of the developer.

Performance Standards:

1 The developer should be accountable for any damages or restoration or mitigation.

2 Construction activities should be timed not to occur when they might disrupt mating, nesting or other critical life-cycle activities of animals of concern. They should also be prevented from occurring during off-hours to minimize disturbing people.

3 The proposal should minimize construction-related impacts from shipping, site clearance and temporary access.

4 Developers of turbines more than 150 feet high should submit a construction management plan indicating such things as:
   - How facility components will be transported to the site,
   - What impacts will result from site preparation, component transport, turbine erection, and other construction, and
   - How these impacts would be avoided, or minimized and mitigated.

5 Turbine owners shall maintain facilities in conformance with manufacturers' specifications.

6 Any component of a wind energy facility that has reached the end of its useful life or has been abandoned shall be removed from the site.

7 A wind turbine shall be considered discontinued or abandoned if it has not generated power in more than one year without the written consent of the local board that originally permitted the facility.

8 Decommissioned offshore wind facilities shall be removed to a depth of five feet below the ocean bottom.

Resources

- Table of wind speeds and power density from American Wind Energy Association, *Basic Principles of Wind Resource Evaluation* http://www.awea.org/faq/basicwr.html
- Larwood, Scott, and van Dam, C.P. (California Wind Energy Collaborative). 2006. *Permitting Setback Requirements for Wind Turbines in California*, California Energy Commission, PIER Renewable Energy Technologies. CEC-5–2005-184.
- TruWind Solutions/AWS Scientific, "Wind Energy Resource Map of New England – Predicted Mean Wind Speed at a Height of 70 m (230 ft) Above Surface" 2003
- National Renewable Energy Laboratory, U.S. Dept. of Energy "Massachusetts 50-Meter Wind Resource Map" 2007 http://www.windpoweringamerica.gov/pdfs/wind_maps/ma_50m.pdf
- National Renewable Energy Laboratory, U.S. Dept. of Energy "Massachusetts – 90 m Offshore Wind Speed" 2011 http://www.windpoweringamerica.gov/pdfs/wind_maps/ma_90m_offshore.pdf

8. Economic Impacts

The driving economic force on the Cape and Islands is the seasonal, vacation industry, which imports money to local economies and sustains the commercial, construction and service industries. For Martha's Vineyard alone, this economy represents a gross domestic product of about $800 million a year and property values of about $18 billion. The desire to visit or live on Martha's Vineyard or Gosnold is tied to the islands offering a different pace of life and more human-scale development amidst abundant natural beauty. Wind energy development may pose both positive and negative economic impacts, including on property values, which need careful evaluation.

8.1 Impacts on Business and Employment

8.1.1 Potential Impacts of Wind Energy Development

In general, wind energy development offers many opportunities for business development and employment, including fabricating, erecting, and maintaining turbines and related facilities. It would appear that most of those benefits will be felt off-Island, and even outside of the country.

Most turbines in the United States are currently fabricated in other countries, although it is hoped that the growth of wind energy will lead to the growth of a domestic industry. If large-scale offshore wind farms are built in the waters surrounding Martha's Vineyard, the staging of construction as well as ongoing maintenance will likely be based in large ports such as New Bedford where they can take advantage of easier access, skilled workers, and specialized equipment. Although our small vibrant ports cannot compete with New Bedford and others as primary ports for shipping equipment and materials for offshore turbines, the Vineyard may be able to house some support or service activities.

With respect to smaller land-based turbines, there are already a couple of small, island businesses involved with the planning, construction, and monitoring of turbines.

As was discussed to some extent in the scenic resources section, it is difficult to ascertain just what the impact of wind energy development would have on tourism and on the desirability of the area for second-home ownership. Surveys indicate mixed attitudes. A survey in Scotland indicated that visitation would go down if there was wind energy development in scenic areas, although a smaller percentage of those surveyed said they would be interested in the eco-tourism aspect that could be associated with wind energy development. A program offering eco-touring of the Cape Wind project has been announced. It would be useful that the planning of any large land-based or offshore wind energy facility incorporate interpretation and tourism accommodations, either at the facility or, for offshore wind farms, at an overlook on land. Such efforts could go a long way in overcoming public concerns about a project and in helping it to be perceived as an asset to the community.

Some of the other potential economic impacts have already been discussed in other sections of this Plan, including the potential economic impacts on fishing and boating, and the possible impacts of environmental deterioration on tourism.

8.1.2 Policies

Overall Objectives: Capitalize on the potential jobs and economic opportunities this growing industry may bring. Prevent detrimental impacts of wind projects on existing businesses and employment.

Performance Standards

1. Require the developer of a large wind energy facility, including any offshore windfarms, to prepare a complete Economic Impact Statement that includes an analysis of anticipated impacts as well as measures to maximize the benefits and minimize the negative impacts associated with this development. In making the determination of whether the proposed development is of Appropriate Scale, the MVC shall make a determination

8.2 Property Values and Municipal Taxes

The residential tax base of the Vineyard and Gosnold is substantially linked to the desirability of property by seasonal residents. Properties with water frontage or just views of the water command the highest prices. Such properties have higher assessed values and contribute significantly to town tax coffers. The extent to which wind turbines may potentially diminish property values is of great local significance from an economic standpoint.

8.2.1 Potential Impacts of Wind Energy Development

Other sections of this plan detail potential issues with wind turbine noise, vibration, visibility, obstruction of scenic vistas, and other issues that might negatively affect some surrounding – or relatively distant – properties and reduce their desirability and value. Such impacts can occur from a single wind turbine, large or small, if sited or operated inappropriately. Larger turbines wind farm arrays have the potential to significantly alter not only the visual appearance of an area, but change an ecological characteristic, such as a species or habitat. If substantial, these types of broad changes could reduce the appeal of the islands to visitors and second homeowners – fundamentally altering the local economy.

The strong linkages of property values to proximity and aesthetics are well studied – whether decreases due to nearby highways or electricity transmission lines, or increases due to ocean views or nearby open space. It is reasonable that aesthetic and property value concerns consistently rank high in the list of concerns held by those considering a wind energy facility in their area. Surveys and predictive models have estimated decreases in property values of more than 40% resulting from proposed wind facilities, but notable reductions have not been experienced post construction [Hoen]. Concern about the unknowns of any project – not just a wind turbine – often decreases surrounding property values more so than after project construction.

A frequently cited extensive 2009 U.S. Department of Energy study examined actual sales data around ten wind energy facilities in nine states. It tested if the views of and distance from a wind facility have a measureable effect on selling prices of nearby homes. The authors visited homes from some 7,600 sales and rated each for a) its scenic quality and b) its visibility of turbines. The analysis indicated that home sales prices are very sensitive to the overall quality of the scenic vista from a property, but that a view of a wind energy facility did not demonstrably affect sales prices. Even among only those properties (127) within one mile of a turbine showed no persuasive evidence of a property value impact. They conceded that there could be small numbers of homes that have been negatively impacted, but that "their frequency was too small to result in any widespread, statistically observable impact." The lead author subsequently clarified that the findings are somewhat surprising, but posited "…that any impact that does exist only occurs for a small number of homes that are located at very close range to wind facilities, for instance inside 1000 feet, and those homes are so infrequent that analyzing them with our techniques is difficult."

The DOE - Hoen study identifies three types of concern: Area Stigma (concerns over "industrialization" or losing the bucolic character of the area, i.e. "no one will move here."), Scenic Vista Stigma (concerns over decrease in quality of views from homes, i.e. "it will ruin my view.") and Nuisance Effects (potential

health/well-being concerns of nearby residents, i.e. "I won't be able to live in my home, nor will potential buyers." They concluded that there is no statistical evidence that homes near wind facilities are stigmatized by those facilities as compared to other homes in the region that homes with a view of wind turbines have different values than homes without such views, or that homes within ¼, ½ and 1 mile of turbines sell for different values than those further away.

Critics of the study questioned various other aspects of the study's methodology. The analysis required the authors to select wind farm areas with enough home sales to be statistically significant. Therefore, communities with insufficient home sales, whether on not they were for sale but did not sell, were not included. In other words, if a particular wind farm was depressing the sales of houses, it would be less likely to be included in the study of effects on home values. Furthermore, the DOE study's conclusion of no significant change in the percentage of home value should apply regardless of absolute property value, the study's authors' assumption that wind turbines will not occupy prime or high value real estate raises questions about the applicability to communities such as Dukes County, as evidenced by the following:

- The studied wind projects were overwhelmingly in rural farmlands and sparsely populated, with low to moderate home values.
- No projects were on ridgelines or coasts, where some land may have significantly higher scenic (and property) value, which may create a greater disparity with nearby property values that do not also benefit from the same scenic value.
- Only multi-unit wind farm projects were examined. They assumed a wind developer would be unlikely to pay for high value land. However, single turbines by existing landowners would not be constrained by land costs.
- Two thirds of the homes sampled did not see the wind facility at all and the analysis made little or no distinction between homes near the turbines and those five miles away thus assuming the effect of the turbines was equal on all properties regardless of proximity.

Consequently, the DOE study's finding that a view of a wind energy facility did not demonstrably affect sales prices may say more about the quality of the vistas in the vicinity of the studied wind farms and less about the "insignificant" change in values.

There is at least one court case that supports the case of depreciated value due to the presence of a wind turbine. A judge in the United Kingdom found that a landowner who had sold a home without divulging that a turbine was to be erected nearby had to compensate the purchaser for the 20% reduction in value from the purchase price.

Potential Strategies

In Denmark, there are provisions requiring turbine owners to compensate abutters for any loss of property value greater than 1%. Any owner of a property located up to six times the height of a turbine can request an impartial property evaluation, to be carried out at the cost of the turbine owner, and if the assessor determines that their property value has decreased by more than 1%, the turbine owner must compensate the other property owner. If the property is located more than six times the turbine height away, it is up to them to pay for the cost of the assessment, but if it indicates that the property value has declined by more than 1%, the owner is compensated and the cost of the assessment is also reimbursed by the turbine owner.

Calls for such property value guarantees (PVG) are increasingly being demanded by landowners and communities facing proposed wind farms. The lead author of the DOE study supports this concept because there are too many unknowns and homes that are close (1,250' from turbines) "have a lot more ambiguity and real issues" other than just views, such as noise and shadow flicker. (Schneider) It can be difficult to accurately determine if, or how much of, a property's reduced value is due to a new wind turbine or some other variable, and whether the lowered value is temporary.

8.2.2 Policy

Overall Objective: Development of wind turbines, as with other types of land uses, should not be at the unreasonable financial detriment of other landowners. As a general policy, the burdens of negative impacts of wind turbine generators should be borne by owners rather than abutters to the greatest extent possible.

Performance Standards

At this time, the Plan does not recommend any mechanisms for quantifying the potential lowered value of a surrounding property, nor mitigation to minimize the impact of such change in land values:

Resources

Schneider, Clif, "Ben Hoen on need for Property Value Guarantee" December 21 , 2010
http://www.wind-watch.org/documents/ben-hoen-on-need-for-property-value-guarantee/

9. Project Ownership and Regulatory Process

9.1 Public, Inter-Municipal and Community Development

There are several public and private ownership models for wind turbines that can influence the location and scale of turbines, the degree of community control over their development, and the extent of direct benefits to the community. Two elements in the legal framework of the provision of electricity are fundamental to understanding why the various ownership models exist.

- Public Utilities: A public utility is a regulated private monopoly protected from local regulation but subject to public oversight of rates. This ownership model produces and distributes most of the electricity in the nation within which other models must function. Regulations governing private electric utilities such as NStar give them certain exclusive jurisdiction with respect to the transmission and distribution of electricity within a municipality. As a result, a property owner or public entity may install a wind turbine, or other energy source, to generate electricity for its own use, but may not sell or give this electricity for use on another property, other than the exceptions outlined below. (Department of Public Utilities' website: www.mass.gov/dpu.)
- Net Metering: Net metering allows customers of an electric distribution company to generate their own electricity in order to offset part or all of their electricity usage, and thereby reduce or eliminate their electricity bill. It also allows customers to be compensated for electricity they generate but do not use and feed into the utility's distribution grid for others to use. Customers install generating facilities such as solar panels or wind turbines that spin the meter backwards when they generate more electricity than they use, building up a credit for other times when they need to draw energy from the grid. The 2008 Green Communities Act facilitates net metering in Massachusetts and increases the maximum for a property from 60 kilowatts to 2 megawatts.

9.1.1 Public Ownership Models

Public ownership models provide more local control, which is usually manifested in lower electricity costs distributed broadly among its citizens or members.

Municipal Light Plants: Presently, 41 Massachusetts cities and towns have a municipal utility, each owning its electric distribution system (poles, wires, transformers, substations, etc.) and performing all the functions of a public utility, including billing, maintenance and power supply. No city or town has created a municipal utility since 1926 as the current regulations apparently make the cost and process onerous on municipalities. There have been recent efforts to change the regulations to make it easier for municipalities to create municipal electric utilities. The Town of Lexington concluded that residential customers would save up to 25% if the town had a municipal electric utility and customers typically receive better service compared to investor-owned utilities. The fact that the Hull Municipal Light Plan is a municipal electric utility was critical in leading the town to erect two utility-scale wind turbines that generate electricity that is then distributed to citizens of the town.

Municipal or County Ownership: As distinguished from a municipal light plant, a municipality or county may generate electricity for its own uses but not for its citizens or businesses. In recent years, Vineyard towns have explored wind and solar generation of electricity. Edgartown also has a tidal energy project winding through the permitting process. The Wampanoag Tribe of Gay Head (Aquinnah) has conducted a study of the potential for wind turbines on its lands in Aquinnah.

Electric Cooperatives: An electric cooperative may generate electricity, feed it into the electric grid, and assign the electricity to its members. Two electric cooperatives exist in Dukes County.

- The Cape & Vineyard Electric Cooperative: CVEC was established in September 2007 to develop renewable energy projects to stabilize electric rates for ratepayers within CVEC member communities. CVEC membership also provides eligibility for lower cost financing for renewable energy projects, such as through the United States Department of Agriculture's Rural Utilities Service, and the cooperative structure generally limits member communities' financial liability. There are currently fifteen members, including the towns of Edgartown, Tisbury and West Tisbury, with Aquinnah pursuing membership . CVEC plans on allowing member communities to use renewable energy projects on town land built and leased by DVEC. The towns will net meter their municipal electricity load and allocate excess generation to other member communities. CVEC's long-term goal is to develop 20 to 30 wind turbines distributed throughout member communities in the next five to ten years,. Through the Cooperative, it would appear possible for one town to collaborate with another on a joint project for construction of a single wind facility, and have the excess energy assigned to the other town. In 2011, the CVEC aggregated nine solar array projects in seven member communities – including Edgartown and Tisbury – to negotiate installation costs with a single contractor. The array in Edgartown alone is expected to produce 30% of the municipal electricity use.
- Vineyard Power: In 2009 emerged the community-owned consumers' energy cooperative Vineyard Power (VP). Its purpose is to generate renewable energy and stabilize and minimize its members' electrical costs while reducing the Island's overall energy carbon footprint. It was established by the Vineyard Energy Project. In early 2011, it had 1,100 members and aims to eventually have 8,000. VP's position on renewable energy generation is as follows. *"Given the state of current technology, studies have shown that wind power is the most promising and abundant renewable energy resource on and around Martha's Vineyard. Private wind power developers have also realized this potential; the waters surrounding Martha's Vineyard have become the subject of many development interests. Vineyard Power is a way for Vineyarders to take ownership for our island and our surroundings, and to ensure that the generation of wind energy off our shores directly benefits our community. Local control will also ensure that location of offshore turbines must be appropriate for our island's landscape and cultural values. How and where Vineyard Power generates energy will be determined directly by its member-owners."* VP's objective is to develop 40 to 100 MW from offshore wind but is also pursuing smaller, solar energy installations around the Vineyard.

9.1.2 Private Development Models

Development of wind generated electricity can occur on private land and by private business on public land. Economic benefit is focused on the landowner and, if different, on the turbine owner.

Individual Landowner: A landowner may generate his own electricity to reduce electricity costs and, with net metering, be credited for excess power.

Farms: Farms traditionally used wind turbines to augment powering their operations, including in Dukes County. Today, farms around the world commonly host utility-scale wind turbines as part of larger wind farms of dozens or hundreds of turbines because these agricultural areas offer wide-open, wind-swept spaces for the turbines. The presence of turbines doesn't normally interfere with farm operations and this provides an additional source of revenue to farmers who lease land to the energy producer. In such cases, there are generally few close abutters that might be affected by the presence of the turbines and, importantly, local landowner perception is more commonly that of land as economic resource to be utilized rather than land as aesthetic resource to be preserved. Non-agricultural landowners are more likely to

adhere to the latter perception, evidenced by rural areas populated with non-farming residents frequently at odds with farm operations. With net metering, it is possible to generate electricity on one farm, and assign to other farms the excess electricity beyond that needed by the host farm. This is an incentive to produce more renewable energy than needed on site, but is capped at 50% of the total energy production.

Private Power Generator: PPGs are large producers of electricity they sell to the public utilities. They usually do not own the land on which their turbines are located, but instead lease it from private landowners – often broad farmland. A number of forces are directing PPGs to focus on offshore locations. This could especially be the case with respect to the large commercial wind areas designated in state and federal waters.

9.2 Community Benefits

9.2.1 Discussion

In addition, to providing specific measures to avoid, or minimize and mitigate direct impacts on specific resources and human uses, the inevitable indirect and generalized negative impacts on affected communities should also be offset. Wind energy development is being supported by significant direct and indirect public investments in direct subsidies and tax credits. It is only fair that a portion of these public funds are used to mitigate the impacts that are associated with this development.

It could be argued that some communities, such as New Bedford, will receive significant economic impacts related to the construction and operation of wind farms in federal or state waters that would more than compensate for any negative impacts on the community as a whole, although some kind of mitigation might be appropriate in order to offset certain categories of impacts. Since, as discussed above, the economic benefits to Dukes County are likely to be quite limited, greater effort should be made to find ways to provide appropriate community benefits.

There are a number of different ways that a project could provide community benefits to an impacted community, including providing for a share of project ownership, direct and/or indirect financial compensation, job creation, and/or reduced, or at least stabilized, energy rates.

- Mitigation fees: These may be assessed to offset project impacts that cannot be otherwise mitigated, such as impacts to resources. There should be a direct nexus and proportionality between the impact and the mitigation assessed. These fees should be used exclusively to mitigate project impacts in the same geographic area as generated.
- Royalties or user fees: These are essentially rent for use of public land or waters. They also offset general impacts on the community beyond those able to be specifically identified and mitigated.
    - For projects in federal waters, BOEMRE regulations require royalties and other payments; for projects less than six miles offshore, it also requires that 27% of these payments go to the adjacent state.
    - For projects in the state's commercial Wind Energy Areas, since the Commonwealth owns the seabed, offshore royalties should be assessed for the use of public property and to mitigate the indirect impacts relative to the public trust doctrine that protects the public's rights to a pristine resource. The royalties should not be held to the same nexus criteria as mitigation fees. The MVC proposed that, in the case of offshore wind energy projects, they should be shared between the Commonwealth and host communities, possibly 50% each. The final MOMP includes the 50% split.

The fact that the MOMP gives the MVC purview over projects within the waters of Martha's Vineyard gives the Commission the authority to require appropriate community benefits. Projects located in state waters but outside the commercial Wind Energy Areas are also subject to approval by the town's Board of Selectmen, which gives them the ability to require appropriate community benefits.

The two federal offshore areas identified for priority development – the RI/MA RFI and the Massachusetts Area under Consideration – are located beyond the 6-mile limit for requiring that a share of leasing revenues and royalties be paid to the adjoining state. However, there are other ways in which BOEMRE could help ensure that the local communities gain at least some benefits to offset projects' detriments. The Commonwealth of Massachusetts could play a role in achieving this goal, especially with respect to its role in approving cable connections within state waters.

For commercial projects on public land or in public waters, and for other major projects, it could be possible to require one or a combination of the following.

- Community Ownership. Areas could be set aside public/community projects. For the federal waters south of Massachusetts, the MVC has suggested that BOEMRE set aside an area within the area under consideration or in the area less than 12 nautical miles offshore that could be used for community/innovative projects. It also suggested that BOEMRE encourage developers to facilitate construction of public/community turbines in adjacent blocks, such as by allowing access to the cable network, or by agreeing to build and/or operate the turbines at a moderate cost. Another way to facilitate local ownership would be to have a time period when adjacent town or a rate-payers cooperative could propose a project before an RFP is issued, or have a right of first refusal for municipalities or local cooperative projects. This would allow the local community to partner with a developer and incorporate community concerns directly in the partnership agreement.
- Community Partnerships: Permitting authorities could requiring or facilitate that a portion of a private project be locally owned. This could translate into public private partnerships, such as with a town or with one or both of the two local cooperatives (Cape and Vineyard Electric Cooperative, and Vineyard Power). In Denmark, the government requires that a developer offer up to 20% ownership of a large project to local communities.
- Royalties: Permitting authorities could set a fixed rate for royalties and a fixed percentage of these royalties that are directed to local communities, as described above. These royalties could be directed to achieving sustainability objectives, especially related to energy such as funding energy-efficiency programs in host communities, setting up prototype projects for energy-efficient transportation, etc.
- Community Fund: A similar approach is to require, or at least encourage and facilitate, developers to contribute financially to fund mitigation in the communities adjacent to their projects. This could either be a general fund or directed to a sector that will be affected by a wind energy project. This was done in Gloucester with Energy Excelerate's agreement for $23.7 million in mitigation for its Northeast Gateway deepwater LNG port and Suez Energy's agreement for $23.5 million to support the local fishing industry and other local causes in mitigation for its Neptune deepwater LNG port project.
- Energy Rates: As part of an agreement with a local community, a developer could offer reduced, or at least stabilized electricity rates.
- Local Businesses and Jobs: Developers could commit to giving local preference for hiring sub-contractors and employees or for purchasing. As was discussed earlier, it is not clear that there will be many opportunities to address this in a serious way within Dukes County.
- Other Benefits: There are other specific ways that developers could mitigate the impacts of their projects on local communities by providing benefits to that community.
    - A developer could offset the impact of an offshore wind energy project on scenic values in a community by making land-based improvements that enhance the scenic values in the same viewshed. For example, as discussed in the scenic resources section, a developer of an offshore wind energy project facing Aquinnah could make improvements to the public areas facing the project (e.g. landscaping the Cliffs overlook, parking and access areas; burying the power lines along Moshup Trail).
    - The residents of Gosnold were interested in the possibility that a wind energy project in their area could include providing a connection from Gosnold to the electric grid so power no longer has to be generated from diesel generators.

The draft Cape Cod Ocean Management Plan policy framework includes the requirement that "Regulations should require that projects demonstrate at least 3 community benefit criteria, including but not limited to

direct job creation, local ownership, contribution toward energy conservation or education, and energy import substitution."

The fact that the MOMP allows community wind energy projects in locations – smaller scale and subject to town approval – where commercial projects are not allowed, reflects the principle that different standards are appropriate for projects which provide greater community benefit.

An important issue is how to deal with a wind energy project located in one municipality that has a significant impact on another one. For example, the Nomans Wind Energy Area located in Chilmark, but a wind farm located there would most significantly impact Aquinnah, and would have some impacts on all the towns in Dukes County. An equitable system has to be set up that assesses the impact on each municipality and apportions the community benefits accordingly. It would be desirable to set out an approach or formula for dealing with this well in advance of dealing with any specific proposals.

9.2.1 Performance Requirements

a) Wind Energy Facilities shall provide direct and indirect benefits to the Dukes County community with local ownership, lower electricity costs, direct job creation, payment of royalties or impact fees to the host and affected communities, and/or other community benefits, as determined by the Martha's Vineyard Commission.

9.3 Planning and Regulatory Processes

This section outlines some considerations related to the planning and regulation of wind facilities in Dukes County.

9.3.1 Relation between State, MVC, and Town Processes

The Commonwealth, MVC, and towns are all potentially involved in various aspects wind energy, namely:

- Planning,
- Regulation, and
- Development, in some cases.

It will be desirable to work out a way to clarify respective roles and to seek collaboration between various entities:

- To share expertise and data about these often complex issues, and
- To provide a coherent regulatory framework so the requirements at various levels are complementary rather than contradictory,
- To ensure that developments carried out by public entities are coordinated with other efforts.

For regulations, this will mean setting thresholds to determine which authority or authorities review projects, depending on criteria such as project size and location. This includes the MVC setting DRI thresholds for review of wind turbines by the Commission.

For the possible future development in the commercial Wind Energy Areas identified in the Ocean Management Plan, the MVC has proposed that representatives of the MVC, towns, the Wampanoag Tribe, and the Commonwealth work on a protocol which allows for meaningful involvement of all these entities at all stages of the project planning and approval process. This would include early collaboration in all stages leading to the possible development of projects, including the pre-planning stages, to set the parameters of any RFP and then working with developers to outline studies and shape the project. The aim is to avoid a situation where a developer has invested significantly in preparing a proposal before it is submitted for town or RPA consideration. This should include phased approvals by all parties to allow closing in on an optimum project design in mutually agreed steps. This would reduce the cost and delay for the developer.

Type of Approval Process: There are essentially two types of approval processes, as-of-right and discretionary.

- An as-of-right process pertains to certain uses that are automatically allowed without discretionary review by a regulatory authority. This mostly applies to local zoning regulations and usually applies only to uses that will not impact neighboring landowners, or the potential impacts can be controlled by specific, pre-defined standards set out in the zoning regulations. As-of-right zoning provides assurance that a landowner or developer will get a town permit if they meet the stated standards.
- An exempt status exists from some land uses, most notably farms. Massachusetts, like most states, exempts farms from many local zoning regulations in order to promote continued farming operations. This agricultural exemption could provide the owner of a farm with an opportunity to bypass normal zoning review in erecting a turbine, provided it was for farm use. On Martha's Vineyard, farm uses are not exempt from the regulatory authority of the Martha's Vineyard Commission, so a town could refer to the MVC a proposal to erect a wind turbine as a Development of Regional Impact.
- A discretionary process makes issuance of the project approval subject to additional review, such as with a Special Permit Process at a town level or a DRI process at the MVC. This type of process is applied to larger or complex uses involving the relation of many different factors that are not easily controlled by pre-defined standards.

Whether a proposed use should be regulated by an as-of-right or a discretionary process depends upon the extent of the potential negative impacts beyond the applicant's land, the degree by which such impacts can be adequately controlled by pre-defined standards, and whether the permitting authority wishes to encourage or discourage a specific use based upon broader policy issues.

With respect to wind turbines, thresholds for discretionary review could involve criteria such as the following.

- Size: For example, there could be a requirement that any turbine greater than height X needs a special permit, and any turbine greater than height Y be referred to the MVC as a DRI.
- Location in or near a critical resource areas: For example, there could be a requirement that projects located in resource areas with regional impact be referred to the MVC, and those located in resource areas with local impact be reviewed by the town.
- Location closer than given setbacks: For example, as will be further discussed below, there could be two setback numbers, anything closer than the lower number would be prohibited, anything greater than the higher number would be as-of-right, and in between could be permitted by special permit and/or MVC approval.

Performance Standards: In addition to, and often in relation to, the mapping of resources is a series of standards dealing with each of the topics outlined in sections 2 to 6 of this Plan. These can be translated into regulations and or guidelines for project review. Standards can prohibit projects in certain resource areas and set requirements for projects in other areas. The two standards that generally have the greatest impact, in terms of preventing land-based wind turbines, are setbacks from buildings and property lines, and noise standards.

Setbacks: Minimum setbacks are probably the most critical parameter affecting the development of wind turbines.

- Setbacks from buildings and adjacent properties directly or indirectly address most of the environmental factors discussed in section 3, such as safety, noise, shadow flicker, and visual impact. They can also be used to protect the access to wind resources of property owners by limiting the possibility that another upwind turbine is so close that it creates a wake effect, reducing the wind energy available to the downwind property.
- Setbacks are typically established from dwellings, from occupied buildings, from property lines, and/or from roads. Setbacks are generally set as: a multiple of (or other mathematic formula based on) the turbine height and/or blade radius; a fixed distance; or as the greater of the two numbers. The setback can vary by area, and could be increased on sloping sites.
- There is often a method of differentiating between participating and non-participating properties, so that most setback provisions other than those needed for safety can be reduced or waived for properties either involved in the turbine project (e.g. joint owners), or who otherwise give their consent.
- A concern about establishing setbacks only from existing dwellings or buildings is the impact on future development, particularly for smaller lots which

Increasing minimum setbacks reduces the potential impact of a turbine on abutting and nearby properties, but requires larger parcels of land and can reduce both the physical and fiscal feasibility of erecting a turbine on a given property.

As mentioned earlier, required or recommended setbacks seem to vary widely in different areas. Requiring that a turbine be set back three times its overall (blade tip) height seems to be a common setback in North America. There is unconfirmed information on various websites indicating much larger setbacks around the world (1 kilometer in Western Australia, 1.6 km in Germany, and 1.8 km in Holland). Apparently, in Denmark, the minimum setback is 4 times the overall height.

The Massachusetts Department of Energy Resources model bylaw suggests the following wording.

> *3.10.3 Setbacks A wind turbine may not be sited within:*
> *(a) a distance equal to the height of the wind turbine from buildings, critical infrastructure, or private or public ways that are not part of the wind energy facility;*
> *(b) three times (3x) the height of the turbine from the nearest existing residential structure; or*
> *(c) one point five times (1.5x) the height of the turbine from the nearest property line.*
> *3.10.4 Setback Waiver The Site Plan Review Authority may reduce the minimum setback distance as appropriate based on site-specific considerations, or written consent of the affected abutter(s), if the project satisfies all other criteria for the granting of a building permit under the provisions of this section.*

It would appear that the minimum setbacks in the regulations in some Vineyard towns are much less than typical.

Although Dukes County has a generally remote and rural character, the settlement pattern of Vineyard towns is quite dispersed, leaving relatively few large tracts of land and few expansive areas without residences. Applying typical setbacks would make it difficult to erect wind turbines of more than 150 feet height in most areas.

General Policies in Different Areas	
Exclusionary Zones	No turbines
Areas of Special Concern	Avoid, or Minimize and Mitigate. Mandatory MVC Review and/or Special Permit
Qualified Areas	Town review only for turbines less than 150' high (some exceptions)

10. Synthesis

10.1 Overview of Relative Benefits and Detriments by Location

During the planning process, the Work Group analyzed the relative merits of development in various possible general locations in and near Dukes County. The purpose was to step back from the specifics of individual variables, and give a general assessment of the overall benefits and detriments of wind energy development in various possible locations, in order to assess whether it was preferable to encourage or discourage wind energy development in each area.

10.1.1 Scenarios

For each for each of the locations within Dukes County, two scenarios were identified for, one with less restrictive limits allowing a greater number of turbines and the other with more restrictive limits allowing a smaller number. For each location and scenario, an estimate was made of a reasonable potential number of turbines that might be erected in each area.

The following are the scenarios evaluated.

- Land: On Martha's Vineyard or the Elizabeth Islands:
  - Permissive Scenario – Assumes limited regulations, such as on setbacks and noise, resulting in 5 turbines of 600 kW (similar to Mass Maritime Academy), 5 turbines of 100 kW (similar to Woods Hole Research Center), 10 turbines of 50 kW (similar to Morning Glory Farm), and 200 turbines of 10 kW (typical residential turbine)
  - Restrictive Scenario – Assumes stricter regulations such as on setbacks and noise resulting in 2 turbines of 100 kW, 4 turbines of 50 kW, 60 turbines of 10 kW.
- Cuttyhunk Wind Energy Area: As delineated in the MOMP:
  - Full Extent Scenario – Assumes full buildout of 60 turbines, 3.5 MW each.
  - Limited Extent Scenario – Assumes 30 turbines, 3.5 MW each, to be located farther offshore and to avoid sensitive areas.
- Nomans Wind Energy Area: As delineated in the MOMP:
  - Full Extent Scenario – Assumes full buildout of 100 turbines, 3.5 MW each.
  - Limited Extent Scenario – Assumes 50 turbines, 3.5 MW each, to be located farther offshore and to avoid sensitive areas.
- Other State Waters: The MOMP allows up to 17 turbines in state waters outside the two commercial Wind Energy Areas. The scenario assumes they would also be 3.5 MW each.
- Federal Community/Innovative Area: The federal Bureau of Ocean Management, Regulation, and Enforcement is not pursuing commercial development closer than 12 nautical miles from land. It has indicated that the area between state waters and the federal commercial area might be used for innovative or community-based projects, though the parameters remain unclear. The scenario assumes that there might be 20 turbines, 3.5 MW each.
- Federal Commercial Area: This area is located between 12 and 20 nautical miles south, west and east of Martha's Vineyard. This vast area could accommodate many thousands of turbines. For purposes of comparison, the scenario assumes 1000 turbines, 3.5 MW each.

10.2 Summary of Potential Benefits and Detriments for Each Scenario

The table on the next page gives a general overview of how the different possible locations and scenarios compare to each other based on a limited number of criteria.

Benefits: Some of the main potential benefits include the following.

- Likely Energy Capacity: The total potential on land is quite limited. Significant amounts of energy could theoretically be produced in the offshore commercial Wind Energy Areas, but all areas pale in comparison to the potential in the vast federal commercial area.
- Wind Resource: The higher wind speeds and steadier winds south of the Vineyard could result in much higher output than an equivalent facility closer to or on the Vineyard.
- Available/Simple Technology, Constructability: It is much easier to erect turbines on land. Offshore, areas of high seabed rugosity and glacial moraines pose construction challenges.
- Cost: Offshore construction costs at least double the cost on land, and costs rise in deeper water.
- Potential for Distributed Generation or Community Wind: An advantage of construction on land is that it allows individuals, organizations, and towns to erect turbines on their own properties for their own use. Offshore, the state and possibly federal waters outside the commercial areas offer an advantage for the development of community wind in that they wouldn't have to compete with commercial developers.

Detriments: Some of the main potential detriments include the following.

- Noise: Noise is primarily a concern on land, especially if there were permissive regulations. There could be some limited noise impact on land and on recreational boating and fishing close to shore for turbines in nearshore locations.
- Scenic and Cultural: Most problematic is on land, especially with permissive regulations, and close to shore, especially in the National Landmark Viewshed of the Gay Head Cliffs and other key viewsheds.
- Other Abutter Impacts: Impacts such as flicker or electromagnetic interference would be mainly on land, especially with permissive regulations, with possible limited impacts in offshore locations close to shore.
- Birds: Construction of turbines on land and shallow waters would tend to have the greatest impacts on birds, though specific siting could result in very different impacts. Offshore, the more limited extent scenarios would allow greater avoidance of sensitive areas compared to scenarios that maximize development in a give location.
- Other Natural Resources: Offshore, the more limited extent scenarios would allow greater avoidance of sensitive areas.
- Fishing, Boating, and Navigation: Obviously, development on land has no impacts. Offshore, the areas close to land are generally most problematic, and the limited extent scenarios would allow greater avoidance of sensitive areas.

Comparative Analysis of Wind Energy Development Scenarios									
	Land		Cuttyhunk Wind Energy Area		Nomans Wind Energy Area		Other State Waters	Federal Community Innovative Area	Federal Commercial Area
	Permissive	Restrictive	Full Extent	Limited Extent	Full Extent	Limited Extent			
Likely Energy Capacity (MW)	6	1	210	105	350	175	60	70	3,500
Benefits									
Likely Energy Capacity	-1	-2	+1	+1	+1	+1	0	0	+2
Wind Resources	-2	-2	-1	-1	0	0	0	+1	+2
Available/Simple Technology, Constructability	+2	+2	-2	-1	-1	-1	0	-1	-1
Cost	+2	+2	0	0	0	0	0	-1	-2
Potential for Distributed Generation or Community	+1	+1	-1	-1	-1	-1	+1	+1	-1
Overall Benefits	+2	+1	-3	-2	-1	-1	0	0	0
Detriments									
Noise	-2	-1	0	+1	+1	+2	+2	+2	+2
Scenic and Cultural	-2	-1	-2	-2	-1	-1	-1	0	+1
Other Abutter Impacts	-2	-1	0	+1	+1	+2	+2	+2	+2
Birds	-1	-1	-1	-1	-1	-1	0	+1	+1
Other Natural Resources	0	0	-2	-1	-1	0	0	+1	+2
Fishing, Boating, Navigation	+2	+2	-2	-1	-1	0	-1	+2	+2
Overall Detriments	-5	-2	-9	-5	-1	0	+1	+8	+10
Net Overall Benefits / Detriments									
	-3	-1	-10	-6	-3	-1	+2	+8	+10

Conclusions: Though the exact individual rating for each factor and location could be debated, this analysis is very revealing with respect to the overall pattern. The federal waters, especially the federal commercial area are clearly most advantageous. The Cuttyhunk Wind Energy Area is most problematic, and the Noman's Wind Energy and taking a permissive approach on land would also appear to have many detriments. The other areas are in between, with the more restrictive and limited extent scenarios more advantageous than the more permissive and full extent scenarios.

It is notable that in terms of renewable energy production, putting up one or two additional offshore turbines would be more efficient and would more energy than could potentially come from the hundreds of

land-based turbines that could theoretically be erected with permissive regulations, and would have far fewer negative impacts.

Several years ago, the enthusiasm for the development of renewable energy was leading to proposals to allow widespread wind energy development in many areas, including those which would have had been quite problematic. Public sentiment and official policies have evolved over the past two years, and are now more aligned with the analysis in this section. The current thrust is put the priority on offshore development in federal waters more than 12 nautical miles offshore, and allow, but be cautious, about development on land and close to shore.

The Wind Energy Plan for Dukes County reflects this approach, opting for an especially high level of protection of resources and users through careful siting and performance standards on land and in areas close to shore.

10.2 Definition of Exclusionary Areas, Areas of Special Concern, and Qualified Areas

10.2.1 Identification of Areas

This section summarizes the three types of area within Dukes County that serve as a basis for the guidance and proposed regulations outlined section 11, namely:

- Exclusionary Areas,
- Areas of Special Concern
- Qualified Areas

The Land Zone is made of three subzones:

- Land Exclusionary Areas – Subzone LE,
- Land Areas of Special Concern – Subzone LS, and
- Land Qualified Areas – Subzone LQ.

The Ocean Zone is made of two subzones:

- Offshore Exclusionary Areas - Subzone OE, and
- Offshore Areas of Special Concern – Subzone OS.

The tables and maps on the following pages list each of the factors that go into defining each of the zones and subzones. For each of the factors, the table indicates what area is affected, and the percentage this represents of either area of the land or ocean in Dukes County. Note that the total areas for each category are less than the sum of individual factors because many of the factors overlap.

Summary of Land Areas in Each Category							
	Exclusionary Areas		Areas of Special Concern		Qualified Areas		Total Area
	Acres	%	Acres	%	Acres	%	Acres
Aquinnah	1,708	*50%*	1,618	*47%*	90	*3%*	3,416
Chilmark	3,400	*28%*	7,229	*59%*	1,578	*13%*	12,208
Edgartown	8,804	*51%*	7,121	*42%*	1,203	*7%*	17,128
Gosnold	1,840	*22%*	3,440	*41%*	3,164	*37%*	8,444
Oak Bluffs	1,295	*28%*	2,783	*59%*	603	*13%*	4,681
Tisbury	1,138	*27%*	2,586	*62%*	459	*11%*	4,183
West Tisbury	6,737	*42%*	7,332	*46%*	1,960	*12%*	16,029
Martha's Vineyard	**23,082**	***40%***	**28,669**	***50%***	**5,893**	***10%***	**57,645**
Dukes County	**24,922**	***38%***	**32,109**	***49%***	**9,057**	***14%***	**66,089**

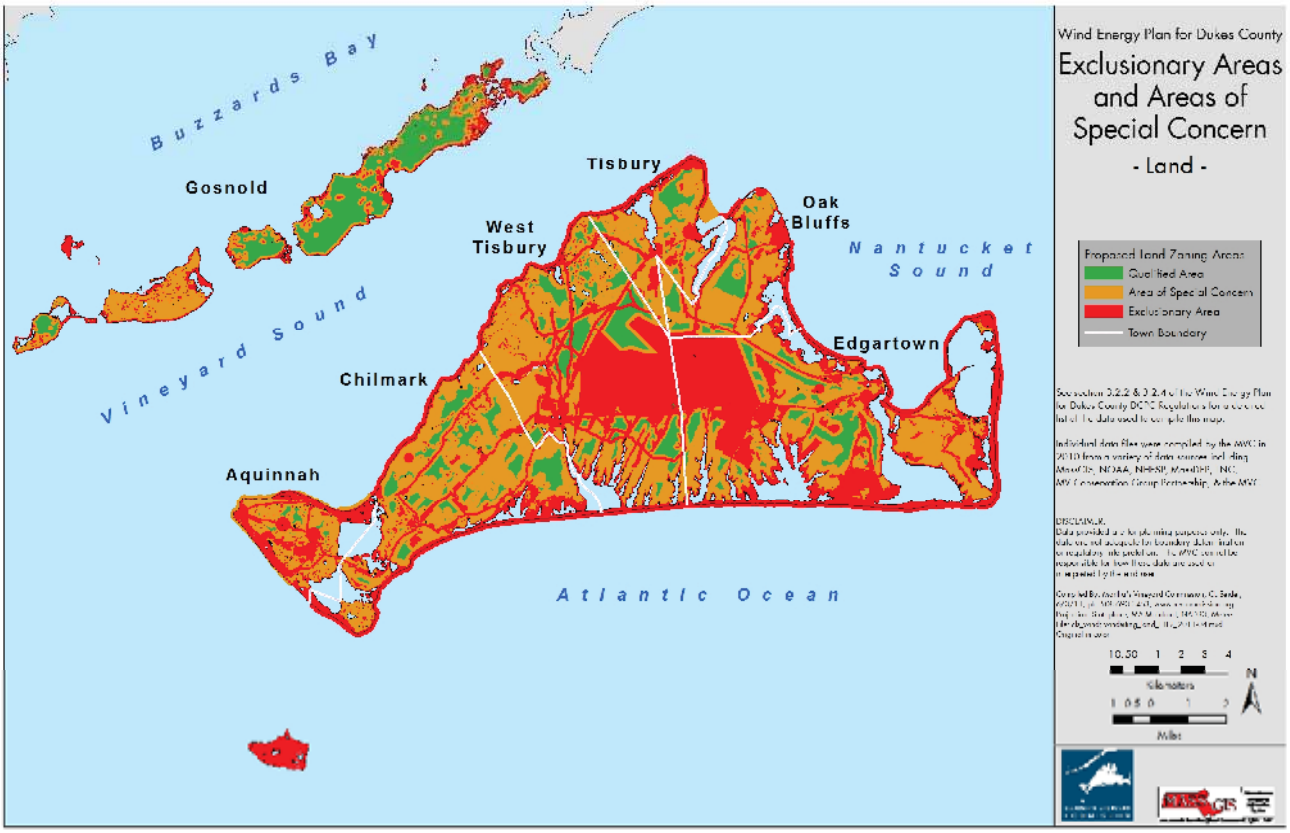
Summary of Ocean Areas in Each Category					
	Exclusionary Areas		Areas of Special Concern		Total Area
	Acres	%	Acres	%	Acres
Aquinnah	22,606	*100%*	0	*0%*	22,606
Chilmark	47,072	*89%*	6,032	*11%*	53,104
Edgartown	60,736	*97%*	1,664	*3%*	62,400
Gosnold	78,928	*98%*	1,594	*2%*	80,522
Oak Bluffs	13,492	*100%*	0	*0%*	13,492
Tisbury	7,481	*100%*	0	*0%*	7,481
West Tisbury	9,472	*87%*	1,432	*13%*	10,904
Martha's Vineyard	**160,858**	***95%***	**9,129**	***5%***	**169,987**
Dukes County	**239,787**	***96%***	**10,723**	***4%***	**250,510**

10.2.2 Land Areas

Land Exclusionary Areas, Areas of Special Concern, and Qualified Areas			
Factor	**Description**	**Area**	**% of Land**
Land Exclusionary Areas - Subzones LE			
Public Open Space Land	Owned by a governmental body.	9,397	14%
Wetland Resource Areas	As identified by the Massachusetts Department of Environmental Protection or as determined by the Town's Conservation Commission, but not the buffer zones to such resource areas.	5,280	8%
Frost Bottoms and Vernal Pools	As described in the Wind Energy Plan of Dukes County or as identified by the town Conservation Commission.	1,692	3%
Hazard Mitigation Areas	Areas less than 2 meters above mean sea level and areas identified on the SLOSH map prepared by the US Army Corps of Engineers in 2002 as subject to a storm surge in a hurricane of categories 1 and 2.	8,012	12%
Coastal DCPC Shore Zone		4,933	7%
National Natural and Historic Landmarks	Plus a buffer of 1000 feet.	848	1%
Historic Districts	Municipally designated.	477	1%
Scenic Roads	Municipally designated scenic roads, plus a 200-foot buffer from the centerline of the road.	1,814	3%
Main Rural Roadside Viewsheds	These areas are identified in the Island Plan. For large fields and other expansive viewshed areas, the exclusionary area includes only up to 500 feet from the centerline of the road.	4,539	7%
Sub-Total - LE		**24,924**	**38%**
Land Areas of Special Concern - Subzones LS			
Non-Public Open Space Land	Land owned by a non-profit organization, or privately owned.	13,569	20%
Open Space Buffers	A 500-foot buffer around open space land.	20,808	31%
Cultural and Historic DCPCs	Districts of Critical Planning Concern designated for cultural or historic reasons, plus a buffer of 300'. This does not include the Town of Aquinnah DCPC except for those portions within other DCPCs.	28,855	43%
Natural DCPCs	Districts of Critical Planning Concern designated for natural reasons. This does not include the Town of Aquinnah DCPC except for those portions within other DCPCs.	19,819	30%

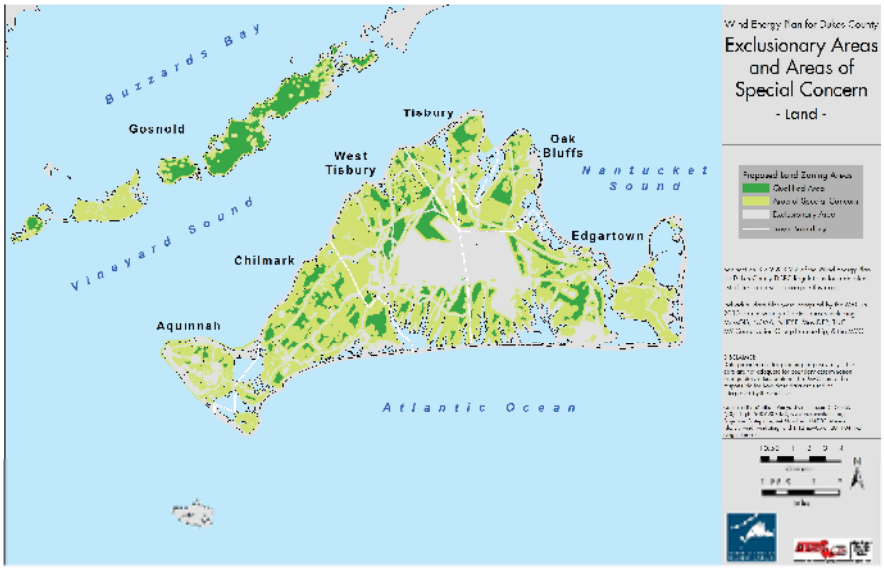
Wetland, Frost Bottom, and Vernal Pool Buffers	*A buffer of 300' from designated frost bottoms, vernal pools, and wetlands.*	*19,575*	*29%*
Historic District Buffers	*A buffer of 500' from municipally designated historic districts.*	*624*	*1%*
Main Rural Roadside Viewsheds – Farther Areas	*The portion of the main rural roadside viewsheds identified in the Island Plan that is located more than 500 feet from the centerline of the road.*	*1,813*	*3%*
Historic and traditional areas	*Areas of high concentrations of older buildings identified in the Island Plan.*	*3,176*	*5%*
Tribal Special Areas	*As identified in the Wind Energy Plan, section 3.3.*	*8,657*	*13%*
Sub-Total - LS		***32,110***	***49%***
Land Qualified Areas *– Subzone LQ*			
Subtotal - LQ		***9,056***	***14%***

Exclusionary Areas, Areas of Special Concern, and Qualified Areas – On Land



The map above synthesizes the Exclusionary Areas (red), the Areas of Special Concern (orange), and the Qualified Areas (green) on land within Dukes County.

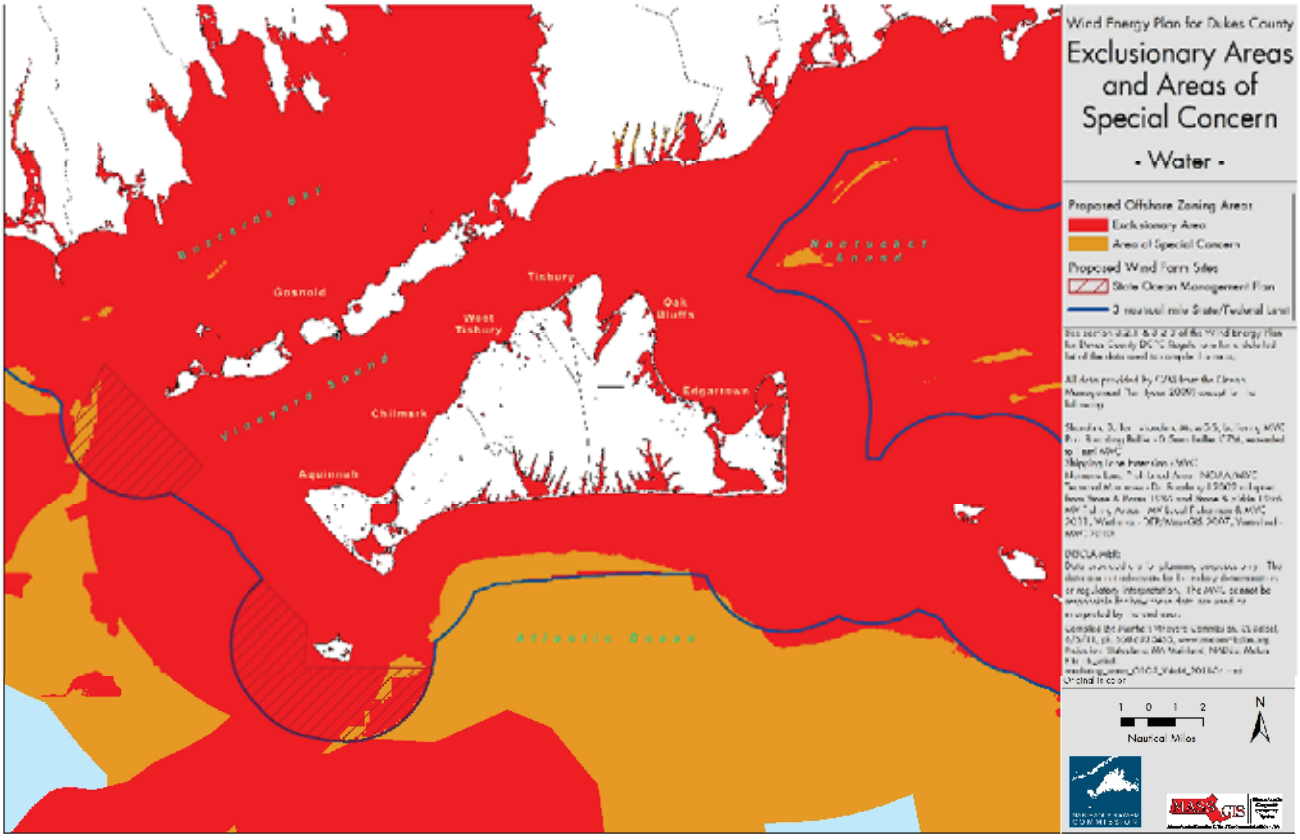
The smaller map to the right presents the same information in reverse, highlighting those areas where the Wind Energy Plan recommends that turbines be permitted – provided they meet setbacks and other performance criteria – possibly with additional review because they are Areas of Special Concern, and subject to whatever other MVC or town requirements apply.



10.2.2 Offshore Areas

Ocean Exclusionary Areas and Areas of Special Concern			
Factor	**Description**	**Area**	**% of Ocean**
Ocean Exclusionary Areas - Subzones OE			
Shoreline Area	Within two nautical miles of the coast of land other than Nomans Land, or within one mile of Nomans Land.	159,143	64%
Glacial moraines	As identified in the Wind Energy Plan section 5.2.	29,814	12%
Sea Duck Foraging Habitat	Waters less than 20 meters deep.	162,398	65%
Critical avian habitat	As identified in the Massachusetts Ocean Management Plan, namely: - Roseate Tern core nesting, staging and critical foraging areas; - Special Concern tern species (Arctic, Least, Common) nesting, staging and core foraging areas; - Long-Tailed Duck (Old Squaw to Vineyarders) important habitat; - colonial waterbird important nesting habitat; - Leach's Storm Petrel important nesting habitat.	41,577	17%
Fin Whale Habitat	Core habitat of the Fin Whale identified as more than 9.7 Whale Sightings per unit effort, using NCCOS data.	51	0%
Critical Habitat	Areas identified under the Endangered Species Act and the regulations thereunder. Presently, there are no such areas within Dukes County though some are under consideration. This category has been included so that any federal designation would automatically be incorporated into this plan.	0	0%
Concentrated Boating Areas	Identified in the Massachusetts Ocean Management Plan, areas with traffic in 2008 of more than 50 vessels of at least 300 tons in size.	37,603	15%
Critical Navigation Areas	These include: - ferry routes plus a 200-foot buffer on both sides; - the Nomans Prohibited Navigation Area, - the Vineyard Sound shipping lane plus its westward extension, and - a one-mile buffer around Vineyard Sound pilot boarding area as identified in the Wind Energy Plan, section 5.6.	38,660	15%
Critical Fishing Areas	Identified in the Massachusetts Ocean Management Plan, namely: - highest category of fishing resource areas; - highest effort and landing value of commercial fishing areas, - high activity recreational fishing and boating areas.	159,469	64%
National Landmark Viewshed	The main viewshed of the Gay Head National Natural Landmark; see Wind Energy Plan section 3.2.	94,814	38%
Hard/Complex	As identified in the Massachusetts Ocean Management Plan.	27,109	11%

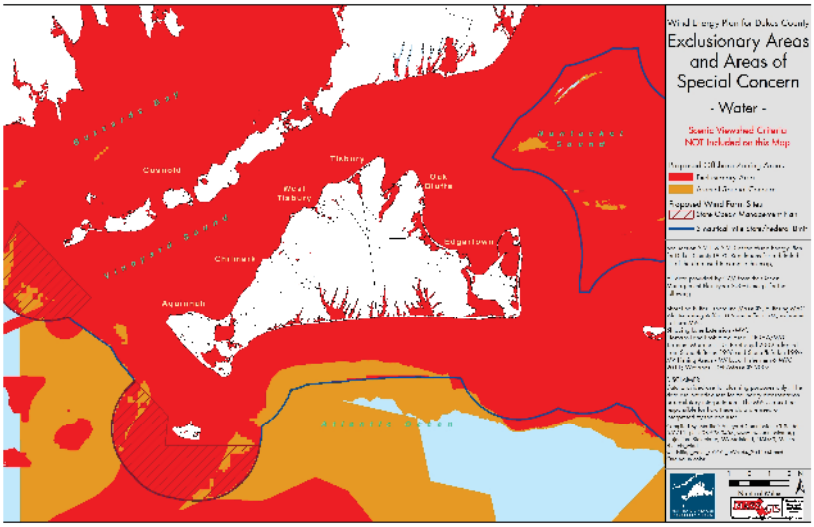
Seafloor and Areas of High Rugosity			
Martha's Vineyard Fishing Areas	*Martha's Vineyard and Dukes County Fishermens Association*	*31,115*	*12%*
Tidal Flats		*358*	*0%*
Eelgrass	*DEP*	*5,654*	*2%*
Sub Total OE		***239,787***	***96%***
Ocean Areas of Special Concern *- Subzones OS*			
Important Fish Resource Areas	*As identified in the Massachusetts Ocean Management Plan*	*186,222*	*74%*
Sea Duck Habitat	*Water depth between 20 and 25 meters.*	*47,996*	*19%*
Fin Whale Habitat	*Habitat of the Fin Whale identified as between 0.1 and 9.7 Whale Sightings per unit effort, using NCCOS data.*	*90,574*	*36%*
Critical Viewsheds	*As identified in the Wind Energy Plan for Dukes County, section 3.2*	*96,955*	*39%*
Subtotal OS		***10,723***	***4%***



Exclusionary Areas, Areas of Special Concern, and Qualified Areas – Offshore

The map above synthesizes the Exclusionary Areas (red) and the Areas of Special Concern (orange) offshore within Dukes County. The combination of exclusionary factors discussed in this plan results in a considerable proportion of the offshore waters being categorized as Exclusionary Areas. It shows that there are a few areas for potential wind energy development within the commercial Wind Energy Areas designated in the MOMP, namely the western part of the Cuttyhunk area and the eastern part of the Noman's area. There is also a band for potential wind energy development south of Chilmark, West Tisbury, and extending south of Edgartown; remember that according to the MOMP, development in these areas is only for community projects approved by the respective town's Board of Selectmen.

The small map to the right illustrates what the Exclusionary Areas and the Areas of Special Concern would be without including Scenic Resources. It shows that removing this factor would have a limited impact on the classification of most areas. (Note that the categorization in federal waters is not completely reliable in that certain factors were not mapped there.)



11. Determination of Appropriate Scale for Offshore Development

Note to Readers: This section recapitulates the policies and standards of the Wind Energy Plan for Dukes County (WEPDC) with respect to the determination of Appropriate Scale for Offshore Development, repeating various policies and standards as they relate to a series of factors for making this determination.

The Oceans Act (Section 15) provides for certain activities in Massachusetts' state waters that would otherwise be prohibited because of the Oceans Sanctuaries Acts. The only offshore electric generating stations that the Oceans Act permits are *"appropriate-scale renewable energy facilities, as defined by an ocean management plan promulgated pursuant to section 4C of chapter 21A, in areas other than the Cape Cod Ocean Sanctuary; provided, however, that:*

(i) the renewable energy facility is otherwise consistent with an ocean management plan;

(ii) siting of all such facilities shall take into account all relevant factors, including but not limited to, protection of the public trust, compatibility with existing uses, proximity to the shoreline, appropriateness of technology and scale, environmental protection, public safety and community benefit; and

(iii) in municipalities where regional planning agencies have regulatory authority, a regional planning agency shall define the appropriate scale of offshore renewable energy facilities and review such facilities as developments of regional impact, and the applicant may seek review of the regional planning agency's development of regional impact determination, but not its determination of appropriate scale, pursuant to the authority of the energy facilities siting board to issue certificates of environmental impact and public interest pursuant to sections 69K to 69O, inclusive, of chapter 164"

The Massachusetts Ocean Management Plan provides the following additional detail with respect to the determination of Appropriate Scale.

> *The Oceans Act amends the Ocean Sanctuaries Acts to allow the development of renewable energy facilities "of appropriate scale," provided that the renewable energy facility is otherwise consistent with an ocean management plan. In doing so, the Oceans Act recognized the importance of providing an opportunity to achieve significant social benefits from the development of renewable energy in balance with other social values. The Oceans Act addresses these interests by requiring that the seven factors listed in Table 2-2 be addressed in the definition of appropriate scale. These factors address the same values and concerns as the screening criteria and siting and performance standards developed through the planning process, as shown in Table 2-3. As discussed below, regional planning authorities (RPA) with regulatory authority shall define the appropriate scale of any wind energy project whose turbines are located within waters of those municipalities within the jurisdiction of such regional planning authorities as of the date of issuance of this plan.*
>
> *. . .*
>
> *For different types of renewable energy projects and/or those that are outside of the jurisdiction of regional planning authorities with regulatory authority, the ocean management plan defines appropriate scale as follows: Appropriate scale is that scale facility capable of being sited in a given location such that, as identified by the ocean plan, the following factors are addressed at a level of detail necessary for the secretary of EEA to make a determination of adequacy on an EIR, and, where applicable, for the Department of Environmental Protection (DEP) to authorize a project under the Chapter 91 and Water Quality Certificate regulations:*

1. *Public trust rights are protected*
2. *Public safety is protected*
3. *Significant incompatibilities with existing uses are avoided*
4. *Proximity to shoreline avoids and minimizes conflicts with existing uses and minimizes visual impact to the maximum extent feasible*
5. *Impacts to environmental resources are avoided, minimized, and mitigated to the maximum extent practicable*
6. *For community-scale wind and pilot-scale wave or tidal projects, the host community (or communities) must formally support the project and, for projects other than test or demonstration scale projects, must receive an economic benefit from the renewable energy facility. Further, other conditions described below apply to community wind projects.*
7. *The technology and scale of the facility are appropriate to the proposed location as demonstrated by consistency with 1 through 5, above.*

In addition to the seven factors mentioned in the Oceans Act, the Wind Energy Plan for Dukes County adds the following three factors to address concerns particular to Dukes County as recognized in the Martha's Vineyard Commission Act:

- Scenic values,
- Cumulative impact,
- Conformance with the MVC Act.

As mandated by the legislature in the Oceans Act and pursuant to the Massachusetts Ocean Management Plan, the Martha's Vineyard Commission herein defines the appropriate scale of Wind Energy Facilities located within an area comprised of all the ocean waters (comprising approximately 250,510 acres of open water) and land below and air above within Dukes County, starting from a line drawn 0.3 nautical miles seaward from Mean High Water (MHW) around Dukes County and extending to 3 nautical miles from MHW, or the state jurisdictional boundary, whichever is farther from the shore. This area is coincident with the planning area as defined in the Massachusetts Ocean Management Plan.

The determination of *Appropriate Scale* of a project by the Martha's Vineyard Commission shall be made based on the application and supporting materials as well as testimony at a public hearing. Making this determination involves an analysis of:

- The physical characteristics of the wind energy facility such as the number, size, spacing, and location of the project,
- The appropriateness of the project, which may be a function of the specific location (with respect to its environmental or human use characteristics) and/or other non-physical aspects of the proposal, such as its community benefits or decommissioning protocol.

This determination of *Appropriate Scale* for projects in Dukes County shall be taken into consideration in conjunction with the MVC's subsequent *Development of Regional Impact* review process, as the MVC's Appropriate Scale determination informs the DRI review.

A Wind Energy Facility of *Appropriate Scale* is defined as a facility sited in a given location that the Martha's Vineyard Commission determines conforms to the Wind Energy Plan of Dukes County (WEPDC), including consistency with all of the following parameters and criteria.

1. Protection of the Public Trust
   a) Wind Energy Facilities are not of appropriate scale unless they are located outside the areas of exclusion in the WEPDC and the MVC determines that they meet the performance criteria and adequately avoid, or minimize and mitigate, impacts on human uses and on the environment – notably fishing, fowling, and navigation.

b) Wind Energy Facilities are not of appropriate scale unless the MVC determines that they meet the performance standards in section 7.2.2 of the WEPDC and that any potential negative impacts to humans and the community have been avoided, or minimized and mitigated.

2. Compatibility with Existing Uses
   a) Wind Energy Facilities are not of appropriate scale unless sited outside Critical Navigation Areas identified in the WEPDC including ferry routes and related buffers, the Nomans Prohibited Navigation Area, the Vineyard Sound shipping lane plus its western extension, and a one-mile buffer around the Vineyard Sound pilot boarding area identified in the WEPDC, and Areas of Concentrated Boating Traffic identified in section 5.6 of the WEPDC.
   b) Wind Energy Facilities are not of appropriate scale unless the MVC determines that they meet the performance standards in section 5.63 of the WEPDC and that any negative impacts on navigation and boating are avoided, or minimized and mitigated.
   c) Wind Energy Facilities are not of appropriate scale unless sited outside the Fishing Resource Areas, Fishing Routes, and Areas with High Fishing Effort in the MOMP and in the WEPDC (section 5.5).
   d) Wind Energy Facilities are not of appropriate scale unless sited outside Critical Fishing Areas identified in the Massachusetts Ocean Management Plan.
   e) Wind Energy Facilities are not of appropriate scale unless the MVC determines that they meet the performance standards in sections 5.53 of the WEPDC and that any negative impacts on fishing have been adequately avoided, minimized, or mitigated.

3. Proximity to the Shoreline
   a) Wind Energy Facilities are not of appropriate scale unless sited more than two nautical miles off the coast (mean low water line) of land other than Nomans Land, or within one mile of Nomans Land.

4. Appropriateness of Technology and Scale
   a) Appropriateness of technology and scale is a function of the balance between environmental, social, and economic interests addressed by the plan.

5. Environmental Protection
   a) Wind Energy Facilities are not of appropriate scale unless sited more than two nautical miles off the coast (mean low water line) of land other than Nomans Land, or within one mile of Nomans Land.
   b) Wind Energy Facilities are not of appropriate scale unless sited outside Critical Avian Habitat identified in the Massachusetts Ocean Management Plan, identified in section 3.1.3.
   c) Wind Energy Facilities are not of appropriate scale unless sited outside Sea Duck Foraging Habitat in water depths of less than 20 meters deep, as identified in section 3.1.3.
   d) Wind Energy Facilities are not of appropriate scale unless sited outside Glacial Moraines, the Areas of High Rugosity, and Areas of Hard and Complex Sea Bottom identified in section 5.2.3.
   e) Wind Energy Facilities are not of appropriate scale unless sited outside Eelgrass Beds identified in section 5.3.
   f) Wind Energy Facilities are not of appropriate scale unless sited outside Fin Whale Habitat identified in the section 5.4 of the WEPDC, based on NCCOS data.
   g) Wind Energy Facilities are not of appropriate scale unless the MVC determines that any negative impacts on Fin Whale habitat and on Right Whales have been adequately avoided, minimized, or mitigated and that all activities are in compliance with the Endangered Species Acts (MA and US) and with the Marine Mammal Protection Act.
   h) Wind Energy Facilities are not of appropriate scale unless sited outside federally designated Critical Habitat under the Endangered Species Act and the regulations thereunder, should any such area be designated within Dukes County.

i) Wind Energy Facilities are not of appropriate scale unless the MVC determines that any negative impacts on Sea Duck foraging habitat in water depths between twenty and twenty-five meters have been adequately avoided, minimized, or mitigated.
j) Wind Energy Facilities are not of appropriate scale unless the MVC determines that they meet the performance standards in section 3.1.3, any negative impacts on Sea Duck foraging habitat in water depths between twenty and twenty-five meters have been adequately avoided, minimized, or mitigated.

6. Public Safety
   a) Wind Energy Facilities are not of appropriate scale unless sited outside Critical Navigation Areas identified in the WEPDC including ferry routes and related buffers, the Nomans Prohibited Navigation Area, the Vineyard Sound shipping lane plus its western extension, and a one-mile buffer around the Vineyard Sound pilot boarding area identified in the WEPDC, and Areas of Concentrated Boating Traffic identified in section 5.6 of the WEPDC.
   b) Wind Energy Facilities are not of appropriate scale unless sited more than two nautical miles off the coast (mean low water line) of land other than Nomans Land, or within one mile of Nomans Land.
   c) Wind Energy Facilities are not of appropriate scale unless sited outside Critical Navigation Areas identified in the WEPDC including ferry routes and related buffers, the Nomans Prohibited Navigation Area, the Vineyard Sound shipping lane plus its western extension, and a one-mile buffer around the Vineyard Sound pilot boarding area identified in the WEPDC, and Concentrated Boating Areas of concentrated boating traffic identified in section 5.5 of the WEPDC.
   d) Wind Energy Facilities are not of appropriate scale unless the MVC determines that they meet the performance standards in sections 5.63 of the WEPDC and that any negative impacts on navigation and boating are avoided, or minimized and mitigated.
   e) Wind Energy Facilities are not of appropriate scale unless sited outside the Fishing Resource Areas, Fishing Routes, and Areas with High Fishing Effort in the MOMP and in the WEPDC (section 5.5).
   f) Wind Energy Facilities are not of appropriate scale unless sited outside Critical Fishing Areas identified in the Massachusetts Ocean Management Plan.
   g) Wind Energy Facilities are not of appropriate scale unless the MVC determines that they meet the performance standards in sections 5.53 of the WEPDC and that any negative impacts on fishing have been adequately avoided, minimized, or mitigated.
   h) Wind Energy Facilities are not of appropriate scale unless the MVC determines that the performance standards in section 6.1.2 of the WEPDC have been met.

7. Community Benefit
   a) Wind Energy Facilities are not of appropriate scale unless they meet the performance criteria in section 9.2.2. of the WEPDC by providing direct and indirect benefits to the Dukes County community with local ownership, lower electricity costs, direct job creation, payment of royalties or impact fees to the host and affected communities, and/or other community benefits.

8. Scenic Values
   a) Wind Energy Facilities are not of appropriate scale unless sited more than two nautical miles of the coast (mean low water line) of land other than Nomans Land.
   b) Wind Energy Facilities are not of appropriate scale unless they are located outside the National Landmark Viewshed of the Gay Head Light identified in section 3.2.3 of the Wind Energy Plan of Dukes County.
   c) Wind Energy Facilities are not of appropriate scale unless the MVC determines that they meet the visual impact performance and assessment standards and that any negative impacts have been

adequately avoided, minimized, or mitigated as described in section 3.2.3 of the Wind Energy Plan.

9. Cumulative Impact
   a) Wind Energy Facilities are not of appropriate scale unless the Martha's Vineyard Commission determines that their impacts, combined with the impacts of other projects that are in existence, under construction, approved, or under consideration within or having an impact on Dukes County are cumulatively in conformance with the Wind Energy Plan of Dukes County.
10. Conformance with the Martha's Vineyard Commission Act
   a) Wind Energy Facilities may be deemed to be of appropriate scale when the public benefits of the project outweigh the cumulative adverse impacts of a proposal within Dukes County or having an impact on resources protected under the Martha's Vineyard Commission Act.

12. Recommendations

This section includes three key sets of recommendations of the Wind Energy Plan, namely:

- Model Regulations for the Island Wind DCPC,
- Modifications to the MVC's DRI Checklist,

These documents as well as the definition of Appropriate Scale described in the previous section are mutually consistent, and reflect the overall analysis and recommendations of the Wind Energy Plan.

12.1 Model Regulations for the Island Wind DCPC

The Wind Energy Plan for Dukes County includes model regulations for the Island Wind District of Critical Planning Concern, found in Appendix 1. The purpose of the model regulations is to serve as the possible basis for town regulations under the Island Wind DCPC designated by the MVC in late 2009. Each town may hold hearings, make modifications, or draft its own regulations, in conformance with guidelines of the Island Wind DCPC.

The model regulations were prepared by MVC staff in collaboration with the Wind Energy Plan for Dukes County Work Group, made up of representatives of Boards of Selectmen, Planning Boards, and/or Energy Committees from all towns in Dukes County, as well as representatives of the Tribe, the MVC, the County and some non-profit organizations. The model regulations were approved by consensus by the Work Group on December 21, 2010. The members of the Work Group were not unanimous on a number of issues addressed by the model regulations; however, after working on these regulations for several months, the consensus of the Work Group was that the model regulations reflected a sincere effort to address the pertinent issues and that the model regulations should be submitted to the planning boards for their consideration in drafting the towns' Island Wind DCPC regulations.

The preparation of these model regulations involved an intensive effort that involved considerable research and participation by the Work Group to draft a by-law that meets the District Guidelines, especially the balance implicit in the overall goal, namely "To protect the natural, cultural and economic resources in the County of Dukes County, while allowing for development of wind energy facilities consistent with the enabling legislation of the Martha's Vineyard Commission (MVC), Chapter 831 of the Acts of 1977 as amended." The MVC hired an acoustical engineer to advise on the sound section, and the entire model regulation was reviewed by Commission counsel.

These regulations assume that the MVC will extend the District dimensions down to the ground and seabed, in order to deal with all components of a wind energy facility. The regulations also deal with proposals less than 150 feet high located in areas of critical regional impact identified as Areas of Special Concern. This will mirror proposed changes to the MVC's DRI Checklist that the Work Group suggests the Commission adopt in the coming year.

The Work Group felt that there would be many advantages to having all towns use the same regulations, at least for the Ocean Zone. However, each town may modify these model regulations, or prepare its own regulations, consistent with the District Guidelines. Each town must have its draft regulations reviewed for conformance with District Guidelines before adopting them at Town Meeting.

Towns might also find these draft regulations useful as a basis for their regulations of wind energy facilities other than those covered by the Island Wind DCPC (in most towns, this is for turbines under 150' not located in Areas of Special Concern).

The Model Regulations are made up of the following sections:

1. Purpose
2. Definitions
3. General Siting and Review Requirements
4. Siting and Performance Standards – General
5. Siting and Performance Standards – Ocean Zone
6. Siting and Performance Standards – Land Zone
7. Application, Permitting Process, and Requirements

12.2 Modifications to the MVC's DRI Checklist

The MVC's DRI Checklist is made up of the standards and criteria that identify when an application to a town for a development permit must or may be referred to the Martha's Vineyard Commission for review as a Development of Regional Impact (DRI). Currently, there is no requirement specifically for wind turbines; however, any development in the ocean is automatically a DRI. The Commission is currently carrying out an extensive review of its DRI Checklist with the intention of making revisions in 2012.

Consistent with the recommendations of the Wind Energy Plan and the DCPC Model Regulations, it is recommended that the Martha's Vineyard Commission revise its DRI Checklist to include the following thresholds for referral of development applications to the MVC:

> *Wind Energy Facilities: The erection, construction, installation, or modification of a wind energy facility or met tower in the following categories:*
>
> *a) Any facility whose height is more than 150 feet;*
> *b) Any facility located in the Ocean Zone,*
> *c) Any facility located in the Land Zone – Exclusionary Area or Area of Special Concern – with concurrence;*
> *d) Any facility located less than six (6) times the turbine height from a municipal boundary – with concurrence;*
> *e) Any turbine that would be subject to special permit review under a town bylaw where such special permit review is preempted or otherwise not allowed by virtue of an act, regulation, policy, or other law applicable to the town but not to the Martha's Vineyard Commission.*

The term "with concurrence" means that the town must refer the application to the MVC, but that the Commission must concur with this referral before the project is deemed to be a Development of Regional Impact requiring full review by the Commission. The Commission should use the Wind Energy Plan to make this determination. For example, if the only reason for the referral is because the proposal is in an Area of Special Concern, the Commission could make the determination that the proposal clearly does not affect the specific factor(s) that led to the property being in an Area of Special Concern.

In the case of offshore wind energy development, the MVC should first make a determination that a proposal is of Appropriate Scale by being consistent with the Wind Energy Plan for Dukes County as described in the previous section. Subsequently, the application would be reviewed as a Development of Regional Impact pursuant to the Martha's Vineyard Commission Act (Chapter 831).

12.3 Revisions to the Wind Energy Plan

It is recommended that this plan be thoroughly reviewed and revised as necessary in five years. This will allow obtaining better information about resources and the impacts of wind energy development – especially with respect to specific issues outlined in this document such as: areas of unexploded ordnance, sea duck foraging habitat, and glacial moraines. This information should become available as work progresses in priority development areas in federal waters near Massachusetts, as well as from similar development in other areas in the US and abroad.

This information might allow refining and possibly reducing some of the Exclusionary Areas identified in the WEPDC, which could make wind energy development more viable in state waters.

Alternatively, if the development of large areas under consideration in federal areas surrounding Dukes County, takes place the resulting cumulative impact on Martha's Vineyard might be such that no additional development would be acceptable, especially since the potential negative impacts from development in state waters appear to be far greater than development farther offshore in federal waters.

Appendices

A1 Island Wind DCPC Model Regulations – Complete Text

December 30, 2010

Note: These model regulations for the Island Wind District of Critical Planning Concern were prepared by MVC staff in cooperation with the Wind Energy Plan for Dukes County Work Group, which included representatives of all Island towns. They were provided to all towns in Dukes County to allow them to put regulations on the warrant for town meetings. Each town may hold hearings, make modifications, or draft its own regulations, in conformance with guidelines of the Island Wind DCPC.

These regulations assume that the MVC will extend the District dimensions down to the ground and seabed, in order to deal with all components of a wind energy facility and to permit dealing with proposals less than 150 feet high located in areas of critical regional impact identified as Areas of Special Concern.

The integration of new information and analysis in this draft Wind Energy Plan would call for some adjustments to the DCPC Model Regulations, which have not been made in this draft but will be integrated in the final version after review by the Work Group.

Table of Contents

1. PURPOSE

1.1 The purpose of this by-law is to provide for the construction and operation of wind energy facilities and to provide standards for the placement, design, construction, monitoring, modification, and removal of wind energy facilities that address public safety, protect the unique natural, historical, ecological, scientific, cultural and other values of Martha's Vineyard, and provide adequate financial assurance for decommissioning, all in conformance with the Wind Energy Plan for Dukes County, the Island Wind District of Critical Planning Concern and the enabling legislation of the Martha's Vineyard Commission (Chapter 831 of the Acts of 1977 as amended).

1.2 Applicability

1.2.1 Types of Facilities: This bylaw applies to the following wind energy facilities and met towers, proposed to be constructed within the Island Wind District of Critical Planning Concern (Island Wind DCPC) and the Town's municipal boundaries after the effective date of the bylaw:

f) Any facility whose height is more than 150 feet;

a) Any facility located in the Ocean Zone,

b) Any facility located in the Land Zone – Exclusionary Area, and Land Zone - Area of Special Concern;
c) Any facility located less than six (6) times the turbine height from a municipal boundary;
d) Any facility whose turbine is located less than three (3) times the turbine height from the building envelope of an adjacent property;
e) Any turbine normally subject to special permit review in a town, for which the town is not authorized to carry out such a review.

1.2.2 Modifications: Any physical modifications to existing wind facilities, including those approved before the coming into effect of this regulation, that materially alters the type or increases the size of such facilities or other equipment shall require a special permit.

2. DEFINITIONS

Area of Special Concern: An area of significant resources or vulnerability within which wind energy facilities are prohibited or may be allowed only if a number of criteria are met.

Avoid, or Minimize and Mitigate: For the purposes of this bylaw, the phrase "avoid, or minimize and mitigate" shall have the following meaning. The proposal shall be sited and designed to avoid negative impacts on the natural resources or human uses from pre-construction, construction, operation, or decommissioning. However, if the applicant can demonstrate that there is no practicable alternative and the proposal cannot be located or designed to totally avoid these impacts, the SPGA may approve the proposal provided the impacts have been minimized to the greatest extent feasible, and that the remaining impacts have been offset with mitigation measures. The burden is on the applicant to prove that all impacts have been avoided; and that if they cannot be avoided, they have been minimized and offset. If the impacts have not been avoided and/or fully mitigated, the SPGA shall deny the application.

Blade: Extensions from the hub, which are designed to catch the wind and turn the rotor to generate electricity.

Building Envelope: The portion of a "buildable" lot, not included in any required yard setback in the town's zoning bylaw and not part of any regulated wetland resource area. The building envelope may be further constrained by a development or building line restriction of record, or a view easement or other instrument of record, which has an effective life longer than the expected service life of a wind energy facility.

Commercial Wind Energy Facility: A facility whose primary use is electrical generation to be sold to the wholesale electricity markets.

Communal Wind Energy Facility: A facility that is owned by, or serves the energy needs of two or more residential customers who reside in a single neighborhood and are served by a single distribution company; and is located within the same neighborhood as the customers that own or are served by the facility. Residents may form associations or other legally binding forms of cooperative ownership for the purpose of building and operating wind energy facilities, and specifying the financial and other responsibilities of the owners in a legally binding agreement.

Community Wind Energy Facility: A facility in which the majority ownership is held by a municipality, another public entity, or a non-profit energy cooperative located in Dukes County.

Cumulative Impact: The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions (especially other facilities for which an application, such as Notices of Intent, building permit applications, or Environmental Notification Forms, have been filed). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Cut-out/Furling Wind Speed: The high wind speed at which the facility will shut-down and/or turn perpendicular to the wind (furled) to protect itself from being overpowered.

District of Critical Planning Concern (DCPC): A district designated by the MVC as described in the Martha's Vineyard Commission Act (Chapter 831 of the Acts of 1977, as amended).

Endangered Species Act: The federal Endangered Species Act of 1973.

Exclusionary Area: An area of exceptional resources or vulnerability within which wind energy facilities are prohibited.

Height: The height of a wind turbine measured from mean natural grade to the tip of the rotor blade at its highest point, or blade-tip height. With reference to a met tower, "height" shall mean the distance from the mean natural grade of the base to the highest point on the structure.

Hub: The center of the rotor to which the blades are attached.

Hub Height: The height as measured from the mean natural grade of the land below the wind energy facility to the center of the rotor or hub.

Island Plan: The Martha's Vineyard Island Plan, namely, the regional comprehensive plan adopted by the Martha's Vineyard Commission on December 10, 2009.

Island Wind District of Critical Planning Concern (or Island Wind DCPC): The District designated by the Martha's Vineyard Commission consisting of the Ocean Zone and the Land Zone.

Island Wind DCPC Map: The map identified in the Wind Energy Plan for Dukes County showing the limits of the Island Wind DCPC, its zones, and its subzones.

Land Zone: The portion of the Island Wind DCPC consisting of the lands and inland waters within the County of Dukes County extending from the Mean Low Water line landward, except the Elizabeth Islands, the lands and inland waters within the Town of Edgartown, school buildings and grounds, the Indian Common Lands (generally known as the Cranberry Bogs, the Clay Cliffs and Herring Creek) and the Settlement Lands, as was designated as a DCPC on December 17, 2009.

Martha's Vineyard Commission ("Commission"): The regional planning agency of Dukes County established by the Martha's Vineyard Commission Act (Chapter 831 of the Acts of 1977, as amended).

Massachusetts Ocean Management Plan: The comprehensive plan for Massachusetts ocean waters developed by the Secretary of Energy and Environmental Affairs (EEA) and promulgated on December 31, 2009.

Meteorological Tower (Met Tower): A tower equipped with devices to measure wind speeds and direction, used for a temporary period to determine how much wind power a site can be expected to generate.

Mitigation: Mitigation includes the restoration, creation, enhancement, or in exceptional cases, preservation of other resources for the purpose of compensating for unavoidable impacts. The possibility of mitigation shall not indicate that mitigation can necessarily overcome the unsuitability of a site or design.

National Landmark Viewshed: The primary viewshed of and from the National Natural Landmark of the Gay Head Cliffs as identified in the Wind Energy Plan.

Normally Occupied Building: A building used for human occupancy in which people are generally living, working, or visiting, such as homes, offices, stores and schools but not including buildings such as storage facilities, barns, or sheds.

Ocean Zone: The portion of the Island Wind DCPC consisting of the all ocean waters within the County of Dukes County seaward to the bounds of the municipal corporation, as was designated as a DCPC on November 5, 2009.

On-Site Wind Energy Facility: A wind project, which is located at a commercial, industrial, agricultural, institutional, or public facility that will consume more than 50% of the electricity generated by the project on site.

Open Space Land: Land acquired or used for conservation or recreation purposes and is:

- owned by a governmental body;
- owned by a non-profit organization; or
- privately owned and protected by a permanent conservation restriction.

Participating Parcel: Means a parcel of real estate that is not a project parcel, but is subject to an agreement between the owner and applicant allowing the construction of all or part of a wind energy facility closer to a participating parcel property line or structure on the participating parcel than would be permitted under the by-law in the absence of such an agreement. To qualify as a participating parcel, the agreement between the owner and the applicant must be approved by the SPGA and a notice of that agreement must be recorded in the Dukes County Registry of Deeds.

Project Parcel: Means the parcel or parcels of real estate on which all or any part of a wind energy facility will be constructed including all parcels in common ownership with the parcel on which the facility will be constructed.

Qualified Areas: The parts of the Island Wind DCPC that are neither Exclusionary Areas nor Areas of Special Concern.

Receptor: Any point beyond or at the boundary of the project parcel at which sound levels or flicker are measured or determined.

Rotor: A wind turbine's blades and the hub to which they are attached.

Special Permit Granting Authority (SPGA): The special permit granting authority shall be the board of selectmen, planning board, zoning board of appeals, or other town board as designated by zoning by-law for the issuance of special permits, or by this section for the issuance of special permits to construct and operate wind energy facilities. *[Note: Each town may specify which board is the special permit granting authority in this definition, or could replace the term "SPGA" throughout the document.]*

Viewshed: All of the land, water and sky seen from a point, or along a series of points such as a road or trail.

Wind Energy Facility: All equipment, machinery, structures, and infrastructure, whether located underwater, underground, on the ground, or overhead, utilized in connection with the generation, storage, and transmission of electricity from wind. This includes, but is not limited to, one or more wind turbines, collection and supply equipment, substations, transformers, electrical generators and other electrical equipment, anemometers, control and maintenance facilities, site access, construction areas, service roads, and power lines /corridors up to the point of interconnection with the existing distribution utility.

Wind Energy Plan for Dukes County: The Plan adopted by the Martha's Vineyard Commission on October 16, 2012.

Wind Turbine: A mechanical device which converts kinetic wind energy into rotational energy that drives an electrical generator. The primary components of a conventional wind turbine are the tower, the nacelle (which houses the electrical generator), and the rotor.

3. GENERAL SITING AND REVIEW REQUIREMENTS

3.1 Delineation of Zones and Subzones

The Island Wind District of Critical Planning Concern consists of the following zone(s) and subzones.

3.1.1 Ocean Zone: The Ocean Zone is made of two subzones:

a) Offshore Exclusionary Areas - Subzone OE, and
b) Offshore Areas of Special Concern – Subzone OS,

3.1.2 Land Zone: The Land Zone is made of three subzones:

a) Land Exclusionary Areas – Subzone LE,
b) Land Areas of special concern – Subzone LS, and
c) Land Qualified Areas – Subzone LQ.

3.2 Determination of Exclusionary Areas and Areas of Special Concern

3.2.1 Offshore Exclusionary Areas: The Offshore Exclusionary Areas (Subzone OE) include the following areas.

a) Within two nautical miles of the coast of land other than Nomans Land, or within one mile of Nomans Land.
b) Glacial moraines identified in the Wind Energy Plan.
c) Waters less than 20 meters deep (sea duck foraging habitat).
d) Critical avian habitat identified in the Massachusetts Ocean Management Plan, namely: core nesting, staging and critical foraging areas for the Roseate Tern; nesting, staging and core foraging areas for Special Concern tern species (Arctic, Least, Common); Long-Tailed Duck (Old Squaw to Vineyarders) important habitat; colonial waterbird important nesting habitat; Leach's Storm Petrel important nesting habitat.
e) Core habitat of the Fin Whale identified in the Massachusetts Ocean Management Plan.
f) Areas identified as Critical Habitat under the Endangered Species Act and the regulations thereunder.
g) Concentrated Boating Areas identified in the Massachusetts Ocean Management Plan, areas with traffic in 2008 of more than 50 vessels of at least 300 tons in size.
h) Critical navigation areas including ferry routes plus a 200-foot buffer on both sides; the Nomans Prohibited Navigation Area, the Vineyard Sound shipping lane plus its westward extension, and a one-mile buffer around Vineyard Sound pilot boarding area as identified in the Wind Energy Plan for Dukes County.
i) Critical fishing areas identified in the Massachusetts Ocean Management Plan, namely the highest category of fishing resource areas; highest effort and landing value of commercial fishing areas, high activity recreational fishing and boating areas.
j) National Landmark Viewshed identified in the Wind Energy Plan for Dukes County.
k) Department of Defense Prohibited Entry Zone - Coast Pilot 2 note #334.70.

3.2.2 Land Exclusionary Areas: The Land Exclusionary Areas (Subzones LE) include the following areas.

a) Open space land owned by a governmental body.
b) Wetland resource areas as identified by the Massachusetts Department of Environmental Protection or as determined by the Town's Conservation Commission, but not the buffer zones to such resource areas.
c) Frost bottoms and vernal pools as described in the Wind Energy Plan of Dukes County or as identified by the Conservation Commission.

d) Hazard mitigation areas made up of areas less than 2 meters above mean sea level and areas identified on the SLOSH map prepared by the US Army Corps of Engineers in 2002 as subject to a storm surge in a hurricane of categories 1 and 2.
e) Coastal DCPC Shore Zone.
f) National Natural and Historic Landmarks plus a buffer of 1000 feet.
g) Municipally designated historic districts.
h) Municipally designated scenic roads plus a 200-foot buffer from the centerline of the road.
i) Main rural roadside viewsheds identified in the Island Plan, up to 500 feet from the centerline of the road.

3.2.3 Ocean Areas of Special Concern: The Ocean Areas (Subzones OS) include the following areas.

a) Important fish resource areas identified in the Massachusetts Ocean Management Plan.
b) Hard/Complex Seafloor and Areas of High Rugosity identified in the Massachusetts Ocean Management Plan.
c) Important Fishing Areas identified in the Wind Energy Plan for Dukes County.
d) Within the Critical Viewshed(s) identified in the Wind Energy Plan for Dukes County.

3.2.4 Land Areas of Special Concern: The Land Areas of Special Concern (Subzones LS) include the following areas.

a) Open space land owned by a non-profit organization, or is privately owned.
b) A 500-foot buffer around open space land.
c) Districts of Critical Planning Concern designated for cultural or historic reasons, plus a buffer of 300'. This does not include the Town of Aquinnah DCPC except for those portions within other DCPCs.
d) Districts of Critical Planning Concern designated for natural reasons. This does not include the Town of Aquinnah DCPC except for those portions within other DCPCs.
e) A buffer of 300' from designated frost bottoms, vernal pools, and wetlands.
f) A buffer of 500' from municipally designated historic districts.
g) The portion of the main rural roadside viewsheds identified in the Island Plan that is located more than 500 feet from the centerline of the road.
h) Historic and traditional areas identified in the Island Plan
i) Tribal Special Areas identified in the Wind Energy Plan

3.3 Authority to Develop Wind Energy Facilities in Different Zones

3.3.1 Exclusionary Areas: No wind turbine shall be located in the Exclusionary Areas of the Ocean Zone (subzone OE) or the Land Zone (subzone LE). Parts of a wind energy facility other than the turbine should also avoid exclusionary areas; however, if the applicant can demonstrate that the component cannot be placed in another location, the SPGA may approve a proposal provided the impacts have been minimized to the greatest extent feasible, and that the remaining impacts have been fully offset with mitigation measures.

3.3.2 Areas of Special Concern: No wind energy facilities shall be located in an Area of Special Concern. However, if the applicant can demonstrate that the proposal cannot be placed in a Qualified Area, the SPGA may approve a proposal provided the impacts have been minimized to the greatest extent feasible, and that the remaining impacts have been offset with mitigation measures. If the impacts have not been avoided or fully mitigated, the SPGA shall deny the application for a wind energy facility in an Area of Special Concern.

f) **Qualified Areas:** An application for a wind energy facility with a turbine less than 150 feet high in the Land Qualified Areas (Subzone LQ) is not subject to the provisions of this by-law unless:

- the facility is located less than six (6) times the turbine height from a municipal boundary,
- the turbine is located less than three (3) times the turbine height from an existing building used for human habitation or occupation on an adjacent property or the building envelope of an adjacent property;
- the facility would normally be subject to special permit review in a town, but the town is not authorized to carry out such a review .

[Note: Towns may wish to insert here a reference to their other wind regulations.]

3.4 Referral to the Martha's Vineyard Commission as a Development of Regional Impact

3.4.1 MVC Referral: No application for a permit to erect, construct, install, or modify a wind energy facility or met tower in the following categories shall be approved unless it has first been referred for review to and approved by the Martha's Vineyard Commission as a Development of Regional Impact:

g) Any facility whose height is more than 150 feet;
h) Any facility located in the Ocean Zone,
i) Any facility located in the Land Zone - Area of Special Concern;
j) Any facility located less than six (6) times the turbine height from a municipal boundary;
k) Any turbine normally subject to special permit review in a town, for which the town is not authorized to carry out such a review.

3.4.2 Joint Hearings: The SPGA may hold joint hearings with the MVC in order to expedite the hearing process. However, each board shall deliberate and make its decision independently based on its own enabling legislation, regulations, and criteria.

3.5 Special Permit Granting Authority

3.5.1 Requirement for a Special Permit: No wind energy facility or met tower in the following categories shall be erected, constructed, installed or modified without first obtaining a permit from the Town's special permit granting authority (SPGA):

a) Any facility whose height is more than 150 feet;
b) Any wind energy facility located in the Ocean Zone,
c) Any facility located in the Land Zone - Area of Special Concern;
d) Any facility located less than six (6) times the turbine height from a municipal boundary;
e) Any facility whose turbine is located less than three (3) times the turbine height from the closer of an existing normally occupied building on an adjacent property or the building envelope of an adjacent vacant property.

3.5.2 Permissible Locations: The construction of a wind energy facility may be permitted in any zoning district other than the Ocean and Land Exclusionary Areas, provided that the wind energy facility complies with all requirements set forth in sections 3, 4, 5, 6 and 7 of this bylaw.

3.5.3 Conformance to Wind Energy Plan: The wind energy facility shall conform to the Wind Energy Plan for Dukes County**.**

3.5.4 Minimization of Impacts: All such wind energy facilities shall be constructed and operated in a manner that minimizes any adverse visual, safety, and environmental impacts to the maximum extent reasonably practicable.

3.5.5 Issuance of Special Permit: No special permit shall be granted unless the SPGA finds in writing that:

a) the specific site is an appropriate location for such use;
b) the proposed use does not derogate from the intent or purpose of the Town zoning by-laws;

c) the use is not expected to have a significant adverse impact on the health, safety, or general welfare of the Town or of other towns with respect to traffic, noise, environmental considerations, visual character, nearby neighborhoods, or other concerns;
d) no nuisance is expected to be created by the use; and
e) adequate and appropriate facilities will be provided for the proper operation of the use.

3.5.6 Conditions: Such permits may also impose reasonable conditions, safeguards and limitations on time of use and operation of the wind energy facility and may require that the operation of the facility be modified or suspended in order to conform to the standards and the conditions specified in the special permit.

3.5.7 Community Benefit: In applying the standards for granting the special permit, the SPGA may consider the impacts of the proposal in relation to the anticipated public benefits including but not limited to: the amount of renewable energy produced, the amount of greenhouse gas emissions likely to be avoided by the facility's operation, the type of wind energy facility (e.g. community, commercial, private residential), and other community benefits. This may include whether a commercial wind energy facility provides a reasonable portion of the energy produced for local consumption, and whether this is provided at prices that are or are likely to become competitive.

3.5.8 Modifications: Any material modification to a wind energy facility made after issuance of the special permit shall require approval by the SPGA as provided in this section. This shall include any attachments to the exterior of the tower or nacelle such as a personal wireless service or radio antenna. The building inspector shall determine whether a proposed modification is material, and in case of doubt, may refer the question to the SPGA.

3.5.9 Meteorological Towers: Meteorological towers shall be permitted subject to issuance of a special permit for a temporary structure and provided they are located to respect the applicable minimum setbacks specified in this bylaw. The SPGA may reduce these minimum setbacks as appropriate based on site specific considerations or if the nearest property line is a public right of way, if the project satisfies all other criteria for the granting of a special permit under the provisions of this section. Due to the temporary status of these facilities and the long-term benefit of the information they provide, siting guidelines may be applied less rigorously to Met Towers. (Note that Conservation Commission regulations may impose other setback requirements).

3.6 Compliance with Laws, Ordinances and Regulations

The construction and operation of all met towers and wind energy facilities shall comply with all applicable local, state and federal requirements, including but not limited to all applicable safety, construction, environmental, electrical, communications and aviation requirements.

3.7 Engineering and Technical Certification

Compliance with building, electrical and safety codes applicable to the design and construction of any wind energy facility, including the tower(s), the associated equipment, and the compatibility of the tower structure with the rotors and other components shall be certified by an Engineer licensed by the Commonwealth of Massachusetts:

a) as part of the application package,
b) after completion of construction, and
c) at a reasonable schedule thereafter as determined by the SPGA.

3.8 Site Control

At the time of its application for a special permit, the applicant shall submit documentation of actual or prospective control of the project site sufficient to allow for installation and use of the proposed facility. Documentation shall be in the form of a deed, lease or other legal instrument demonstrating proof of control over the site of the wind energy facility and over the setback areas described herein and a right to use any private ways required for access. Control shall mean the legal

authority to prevent the use or construction of any structure for human occupancy within all required setback areas around the wind energy facility, including any which may extend onto adjacent property.

4. SITING AND PERFORMANCE STANDARDS – GENERAL

The following standards shall apply to wind energy facilities in both the Ocean Zone and the Land Zone.

4.1 Safety Requirements

4.1.1 General: The wind energy facility shall be located, designed, and installed in a manner which ensures the safety of persons and property. The wind energy facility shall eliminate or mitigate risks including, but not limited to, climbing hazards, the effects of flicker, ice throw, guy wires, blade separation, collapse, and unauthorized access to electrical equipment and to the interior of towers.

4.1.2 Unauthorized Access: Wind turbines or other structures part of a wind energy facility shall be designed to prevent unauthorized access. If towers require external climbing apparatus, they shall have either tower climbing apparatus located not lower than twelve feet to the ground or be un-climbable by design for the first twelve feet.

4.1.3 Hazards: The proposal shall minimize possible hazards related to the installation of facilities, including collapse of facilities and spills of oil, hazardous materials and/or chemicals and shall include provisions to limit and mitigate potential harms.

4.1.4 Emergency Services: The applicant shall provide a copy of the project summary and site plan to the local emergency services entity, as designated by the SPGA. Upon request by the local emergency services entity, the applicant shall cooperate in developing an emergency response plan satisfactory to the local emergency services entity.

4.2 General Impacts

The wind energy facility, including cables connecting said facilities to an electrical grid serving other facilities or electrical users, shall be sited and designed so that negative impacts from pre-construction, construction, operation, or decommissioning shall be avoided on

- Wildlife, wildlife habitat, and other natural resources,
- Cultural and historic uses and values including Tribal resources,
- Significant public vistas and viewsheds, including the impact of facilities on night viewing, "dark skies", and ambient lighting.
- Other human uses.

If the applicant can demonstrate that a proposal cannot be located or designed to totally avoid these negative impacts, the SPGA may approve the proposal provided the impacts have been minimized to the greatest extent feasible, and that the remaining impacts have been fully offset with mitigation measures. If the negative impacts have not been avoided and/or fully mitigated, the SPGA shall deny the application. The SPGA shall consider both the individual and cumulative impacts of a proposal

4.2.1 Scenic Impacts: The wind energy facility siting and design shall avoid, or minimize and mitigate negative impacts on scenic resources of national, state, or regional significance, considering the existing character of the surrounding area, the expectations of the typical viewer, the project purpose, the duration of potentially affected public uses, and the scope and scale of the potential effect on views.

4.2.2 Electromagnetic: The wind energy facility siting and design shall create no television or other electromagnetic interference extending beyond the property boundaries of the project.

4.2.3 Alternative Energy Reduction and Generation Measures: For on-site or communal wind energy facility projects with significant impacts on resources and human uses, the SPGA may

require as part of the application that the owner demonstrate that reasonable efforts have been made to use efficiency and conservation measures to reduce the owner's energy consumption, and that alternative means of generating renewable energy with fewer impacts have been explored. Applicants for all types of wind energy facility who propose to sell the majority of their output to the electrical grid shall provide a comparison with the net energy savings that could be realized by an equal capital investment in energy efficiency, conservation or alternative renewable energy methods.

4.3 Design Standards

4.3.1 Support Towers: Towers greater than 150' high shall be monopole type. Offshore towers shall be monopole above the foundation transition platform. For towers under 150 feet high, monopole towers are preferred; however the SPGA may approve another type that it deems is appropriate for its setting, minimizes its noise and other impacts, and is economically viable.

4.3.2 Color and Finish: Wind facilities shall be painted a neutral, non-reflective exterior color designed to blend with the surrounding environment in conformance with regulations of the Federal Aviation Administration.

4.3.3 Lighting: Lighting of turbines is prohibited except as required by the Federal Aviation Administration or other state or federal law, and shall be the minimum necessary. Lighting of other parts of the wind energy facility, such as appurtenant structures, shall be limited to that required by regulation for safety and operational purposes. Lighting shall be designed to minimize glare on abutting properties and except as required by the FAA, shall be directed downward with full cut-off fixtures so there is no light cast beyond the property lines of the project parcel. For communal wind energy facilities, the cut off shall be at the property line of an owner not part of the communal facility.

4.3.4 Signage: Signage at the wind energy facility is limited to no trespassing, danger, emergency contact information, reasonable identification of the manufacturer or operator, and educational information. All signs shall comply with the requirements of the Town's sign regulations. No signage, whether on the tower or freestanding, may be erected more than ten feet above the ground. No advertising, nor any sign, writing, or picture that may be construed as advertising, is permitted.

4.3.5 Appurtenant Structures: All appurtenant structures to such wind facilities shall be subject to this bylaw's regulations concerning the bulk and height of structures, yard sizes, lot area, setbacks, open space, parking and building coverage requirements. To the extent that the SPGA finds that any of these dimensional controls are not suited to the appurtenant structures proposed for this purpose, it may grant the minimal dimensional relief that it deems reasonable and necessary to permit operation of the wind energy facility. All equipment necessary for monitoring and operation of the wind energy facility shall be contained within the tower; if this is unfeasible, ancillary equipment may be located outside the tower. All such appurtenant structures, including but not limited to, equipment shelters, storage facilities, transformers, and substations, shall be architecturally compatible with each other and shall be contained within the turbine tower whenever technically and economically feasible. Structures shall only be used for housing of equipment for this particular site. Whenever reasonable, structures should be shielded from view by vegetation and/or located in an underground vault and joined or clustered to avoid adverse visual impacts.

4.3.6 Utility Connections: Reasonable efforts shall be made to locate utility connections from the wind energy facility underground, depending on appropriate soil conditions, shape, and topography of the site and any requirements of the utility provider. Electrical transformers for utility interconnections may be above ground if required by the utility provider.

4.4 Sound

The operation of wind energy facilities shall comply with the following sound limits and requirements.

4.4.1 Construction and Demolition Sound: Sound from the construction or demolition of a wind energy facility shall be subject only to the Commonwealth's noise regulations for construction activities (310 CMR 7.10 U), unless the SPGA specifies more restrictive measures during the approval process.

4.4.2 Audible Sound Limit: Wind energy facility sound level (L_{Aeq}) from a wind energy facility at a receptor shall not exceed the background sound level ($L_{A90,10\ min}$) at each integer wind speed by more than 5 dB(A), but in no instance shall exceed 35 dB(A) between 6 p.m. and 6 a.m. or 40 dB(A) between 6 a.m. and 6 p.m.

4.4.3 Low Frequency Sound Limit: Wind energy facility low frequency sound level (L_{Ceq}) from a wind energy facility at a receptor shall not exceed the background sound level ($L_{C90,10\ min}$) at each integer wind speed by more than 20 dB, but in no instance shall exceed 50 dB(C).

4.4.4 Tonal Sounds: A 5 dB penalty is added to measured or predicted wind turbine sound if it is characterized as tonal sound, that is sound containing one or more pure-tones. A pure-tone exists when the sound pressure level in a one-third octave band at a receptor exceeds the sound pressure levels in both adjacent one-third octave bands, and if the average amount exceeded in both adjacent bands is greater than the following: 16 dB for the 100Hz one-third octave band frequency; 14 dB for 125 Hz; 12 dB for 160 Hz; 11 dB for 200 Hz; 9 dB for 250 Hz; 8 dB for 315 Hz; 7 dB for 400 Hz; 6 dB for 500 and 630 Hz; 5 dB for 800 Hz; 4 dB for 1000, 1250, and 1600 Hz; 3 dB for 2000, 2500, 3150, and 400 Hz; 3 dB for 2000, 2500, 3150, and 4000 Hz; 4 dB for 5000 and 6300 Hz; 5 dB for 8000; and 6 dB for 10,000 Hz. The wind energy facility must also respect current Massachusetts Department of Environmental Protection standards on tonal sounds.

4.4.5 Sound Measurement: Sound measurements shall be measured or determined at both of the following receptors, if applicable.

a) The boundary line of any adjacent lot not in common ownership with the lot containing the wind energy facility.
b) Residences not in common ownership with the lot containing the wind energy facility Measurements at residences shall be made near the outside wall nearest to the closest wind turbine, or at an alternate exterior wall as specified by the owner of the residence.

Measurement or modeling of wind energy facility sound emissions shall be conducted during conditions when the difference between wind energy facility sound (L_{Aeq}) and background sound ($L_{A90,\ 10\ min}$) at receptors is the greatest. Wind energy facility and background sound levels shall be measured or determined at receptors for hub-height integer wind speeds from cut-in to rated power. If measured wind energy facility sound is less than 10 dB(A) above the background sound level at a measurement location, the background contribution may be removed from the measured wind energy facility sound level using the method in ANSI S12.18 paragraph 7.5.4.

4.4.6 Sound Waiver: Upon request by an owner of a wind energy facility, an owner of an affected residence or normally occupied building may by written contract relieve the wind energy facility owner of the requirement to meet any of the noise limits in this section. Any such waiver shall expressly state that it shall be encumbrance on the title of the real property, and shall run with the land until the wind energy system is decommissioned. The sound waiver shall be recorded with the Registry of Deeds, noted on the certificate of occupancy for any building which shall be covered by the waiver and expressly disclosed in any lease of the property subject to the waiver. Before entering into a contract, an owner of a wind energy facility shall provide a copy of this section 4.4 to the owner of an affected nonparticipating residence or normally occupied building.

4.4.7 Compliance:

a) The SPGA may require a wind energy facility owner to conduct pre- and post-construction sound studies to evaluate compliance with this section. Such studies shall follow measurement protocols as described herein and shall be conducted by an independent qualified acoustical expert approved by the SPGA or building inspector, and under the supervision of an INCE (International Noise Control Engineering) Board Certified Engineer**.**

b) Any complaint regarding a wind energy facility's compliance with the sound limits of this section must be sent by certified mail to the town building inspector, the SPGA, and the owner of the facility. The complaint must include any substantiating information as the SPGA or building inspector may require, such as a log by the complainant detailing the sounds found objectionable and the times and weather conditions of such occurrences, so the wind energy facility owner may understand the nature of the complaint and decide upon corrective actions, if any.

c) Upon receipt of a complaint, about a noise under section 4.4, the wind energy facility owner shall suspend or curtail operation of the wind energy facility to eliminate the excessive noise until the SPGA or building inspector has authorized reinstatement of normal operations.

d) The owner shall obtain an on-site investigation and report from an independent qualified acoustical expert approved by the SPGA or building inspector, and file copies of said report with the SPGA, the building inspector and the complainant.

e) Within thirty (30) days of the receipt of the report, the SPGA or building inspector shall evaluate the sound study to determine compliance with the noise standards of this bylaw The SPGA or the building inspector may submit the report for professional peer review at the owner's expense. The SPGA or building inspector shall notify the owner and complainant by certified mail as to whether the facility complies with section 4.4.

f) If the facility complies, the owner may resume normal operation of the facility.

g) If the facility does not comply, the owner shall either modify the facility to the satisfaction of the SPGA or building inspector, or continue operational curtailment.

h) If the SPGA deems the owner's sound study to be defective, erroneous or inadequate, the SPGA may commission an independent field investigation from a qualified acoustical engineer, at the owner's expense, and may modify, condition or rescind the special permit, after notice and a public hearing, as it deems necessary to cause the wind energy facility to comply with Section 4.4.

4.5 Construction, Maintenance, Decommissioning and Abandonment

4.5.1 Construction Impacts: The proposal shall minimize impacts related to project construction including impacts from shipping, site clearance, and temporary access. The applicant for a turbine more than 150 feet high shall submit a Construction Management Plan indicating:

a) how the components of the facility will be shipped to the site,

b) what the impacts would be of site preparation, transportation of components, erection of the turbine, and other construction, and

c) how these impacts would be avoided, or minimized and mitigated.

The building inspector may require submission of a Construction Management Plan for turbines less than 150 feet high if he determines that the shipping, transportation or construction of the project present special concerns**.**

4.5.2 Monitoring and Maintenance: A wind energy facility shall be operated and maintained in sound working order in conformance with the manufacturer's specifications at all times. The applicant shall maintain the wind energy facility site in good condition. Maintenance shall include, but not be limited to, painting, structural repairs, and integrity of security measures. Site access shall be maintained to a level acceptable to the local Fire Chief and Emergency Medical Services. The project owner shall be responsible for the cost of maintaining the wind energy facility and any

access road, unless accepted as a public way, and the cost of repairing any damage to a public or private way occurring as a result of operation and construction. The applicant or facility owner shall maintain a current phone number and identify a responsible person for the public to contact with inquiries and complaints throughout the life of the project by filing a certificate containing that information with the building inspector and the SPGA.

4.5.3 Removal Requirements: Any wind energy facility which has reached the end of its useful life or has been abandoned shall be removed. When the wind energy facility is scheduled to be decommissioned, the applicant shall notify the town building inspector and SPGA by certified mail of the proposed date of discontinued operations and plans for removal. Prior to any removal activities, the owner/operator shall confer with the building inspector and review the proposed plan for dismantling and removing all components of the wind energy facility. The owner/operator shall physically remove the wind energy facility no more than 150 days after the date of discontinued operations. At the time of removal, the owner shall restore the wind energy facility site to the state it was in before the facility was constructed or may convert the lot to another legally permitted use.

Decommissioning shall consist of:

a) Physical removal of all wind turbines, structures, equipment, security barriers and transmission lines from the site.
b) Disposal of all solid and hazardous waste in accordance with local and state waste disposal regulations.
c) Stabilization or re-vegetation of the site as necessary to minimize erosion. The SPGA may allow the owner to leave landscaping or designated below-grade foundations in order to minimize erosion and disruption to vegetation.
d) For offshore facilities, the SPGA may require complete removal down to the seabed, or may allow the owner to leave foundations, parts of towers, or other parts of the facility provided they do not disrupt habitat or interfere with boating or fishing.

4.5.4 Abandonment: Special permits for wind energy facilities shall contain the terms of this section 4.5 as conditions. A wind energy facility shall be considered abandoned when the facility fails to operate for more than one year without the written consent of the SPGA. Upon a finding by the Building Inspector that the facility has been abandoned or has been left in disrepair or has not been maintained in accordance with its approved maintenance plan, the Building Inspector shall notify the owner(s) of the facility and the land on which it is located, in writing by certified mail that the facility must be restored to good working order or must be decommissioned. If the owner does not decommission the wind energy facility, or make the required repairs or maintenance within 60 days after the date of the certified letter, the special permit may be rescinded by the SPGA, at the request of the building inspector. If the owner fails to remove the abandoned wind energy facility in accordance with this section after rescission of the special permit, the town may enter the property and physically remove the facility at the expense of the property owner and the owner of the facility. At the request of the property owner or the owner of the facility, the SPGA, with the concurrence of the building inspector, may allow extensions of these time periods

4.5.5 Financial Security: The SPGA shall require the applicant for commercial wind facilities to provide security, through escrow account, surety bond or otherwise, to cover the cost of removal in the event the town must remove the facility. The amount, type and form of the financial security must be approved by the SPGA and town counsel, but in no event shall exceed 150 percent of the estimated cost of removal and compliance with the requirements set forth herein. The financial security mechanism shall assure that the town may draw upon all of these funds, solely upon a vote of the SPGA, for the useful life of the facility plus 3 years. If the owner of the wind energy facility obtains an extension of the special permit to operate the wind energy facility beyond its stated

useful life, the financial security mechanism shall also be extended for an equal term, plus three years. The applicant shall submit a fully inclusive estimate of the costs associated with removal, prepared by a qualified engineer. The estimate shall include a mechanism for Cost of Living Adjustment, which shall be incorporated into the financial security mechanism. Such security will not be required for municipally or state-owned facilities. Upon satisfactory completion of the removal of the facility by the owner/operator, the SPGA shall release the financial security mechanism.

5. SITING AND PERFORMANCE STANDARDS – OCEAN ZONE

5.1 General Impacts

5.1.1 Resources and uses as to which impacts should be avoided, or minimized and mitigated as described in section 4.2.1 include but are not limited to the following:

a) ocean habitat and on the sea bottom, both within the Ocean Zone and in adjacent areas;
b) the commercial fishing industry as well as on recreational fishing, both within the Ocean Zone and in adjacent areas, considering impacts both on the fish and their habitats as well as on fishermen's equipment and livelihood;
c) commercial and recreational boating and navigation within the Ocean Zone and in adjacent areas.

6. SITING AND PERFORMANCE STANDARDS – LAND ZONE

6.1 Setbacks

6.1.1 Minimum Setbacks: Wind turbines shall be set back a distance equal to at least:

a) One and a half (1.5) times the height of the turbine from the nearest property line of all adjacent lots, (except participating parcels), a public way, or a private way that is not part of, or used solely by the facility;
b) Three (3) times the height of the turbine from an existing normally occupied building on an adjacent property, or from the building envelope of an adjacent vacant property, except participating parcels.

6.1.2 Setback Waiver: The setbacks from property lines, private roads, and non-participating residences may be reduced with the written and recorded agreement of all affected property owners. However, in no case shall the setback from a residence or other normally occupied building be less than 1.5 times the height of a turbine more than 150' high, or 1.1 times the height of the turbine for a turbine less than 150' high. The setback waiver shall be recorded with the Registry of Deeds, noted on the certificate of occupancy for any building which shall be covered by the waiver and expressly disclosed in any lease of the property subject to the waiver.

6.2 Shadow Flicker

6.3 Wind facilities shall be sited and operated in a manner that minimizes shadow flicker impacts on receptors. There shall be no shadow flicker on normally occupied buildings within 1000 feet of the turbine except those located on participating parcels. The applicant has the burden of proving that this effect does not have significant adverse impact on neighboring or adjacent uses, through either siting or mitigation.

6.4 Siting, Land Clearing, Soil Erosion and Habitat

6.4.1 General: The wind energy facility shall be built and operated so as to avoid, or minimize and mitigate impacts on topography, vegetation, and habitat. The application shall include plans or a narrative showing erosion control, restoration of vegetation and prevention of noxious weeds, and

provisions for site restoration after project dismantling, including for disposition of foundations. The SPGA may incorporate such provisions into the special permit.

6.4.2 Location: Wind energy facilities should be located in relation to existing roadways and transmission facilities to avoid clearing of vegetation to the greatest extent possible.

6.4.3 Land Clearing: Clearing of natural vegetation shall be limited to that which is necessary for the construction, operation and maintenance of the wind energy facility and is otherwise permitted by applicable laws, regulations, and ordinances. Land clearing for the purposes of reducing wind turbulence in the vicinity of the turbine is prohibited, unless the special permit granting board finds it is essential to operation requirements, it does not adversely affect the natural resources in the area and that adequate erosion controls are proposed.

6.4.4 Buildings and Equipment: Any ground level equipment associated with the facility shall be camouflaged or screened. Buildings and equipment shelters for wind energy facilities shall be designed to be consistent with the traditional architecture of the Town and shall be surrounded by buffers of dense tree growth and understory vegetation in all directions to create an effective year-round visual buffer. Trees and vegetation may be existing on the property or installed as part of the proposed facility or a combination of both. The SPGA shall approve the types of trees and plant materials and depth of the needed buffer based on site conditions.

6.4.5 Screening: Site selection should maximize screening capability of existing vegetation close to public ways. Access roadways should be winding in order to minimize visibility of ground-based portions of the facility. If the size of the facility requires a straighter road, vegetative or other screening of these ground-based portions must be employed.

6.4.6 Impact on Existing Uses: The project siting and design shall avoid, or minimize and mitigate the impact on farm operations or on other commercial or other activities on the property in which the turbine is located as well on other properties in the vicinity.

7. APPLICATION, PERMITTING PROCESS AND REQUIREMENTS

7.1 Term of Special Permit

7.1.1 Basic Term: A special permit issued for a wind energy facility shall be valid for 20 years, unless extended or renewed. At the end of that period (including extensions and renewals), the wind energy facility shall be removed as required by this bylaw.

7.1.2 Extension or Renewal: The time period may be extended or the permit renewed by the SPGA for periods of five years at a time upon demonstration that the facility is still operating satisfactorily. A request for renewal must be submitted at least 180 days prior to expiration of the special permit. Submitting a renewal request shall allow for continued operation of the facility until the SPGA acts. A renewal application shall be reviewed using the same criteria as those used for new installations.

7.1.3 Replacement: A new permit is required to install a replacement system or components that will materially change the design or operation of the facility, as determined by the building inspector. This does not include routine replacement of individual components.

7.2 Application Requirements

7.2.1 General: The application for a wind energy facility shall be filed in accordance with the rules and regulations of the SPGA concerning special permits.

7.2.2 Application: Each application for a special permit shall be filed by the applicant with the town clerk pursuant to section 9 of chapter 40A of the Massachusetts General Laws.

7.2.3 Liability Insurance: The applicant or owner of the wind energy facility shall provide, as part of the submissions for review by the SPGA, evidence of liability insurance in an amount and for a duration sufficient to cover loss or damage to persons and structures arising from the installation, use and maintenance of the wind energy facility. Recertification of liability insurance coverage shall

be provided to the Town on an annual basis. Failure to maintain insurance coverage shall be grounds for cessation of operation on order of the SPGA and, after notice and hearing, revocation of the special permit by the SPGA.

7.2.4 Independent Consultants: Upon submission of an application for a special permit, the SPGA may hire outside consultants, pursuant to section 53G of chapter 44 of the Massachusetts General Laws. The SPGA may require the applicant to pay the consultant's fees, in which case it shall inform the applicant of the estimate of such fees and may require the applicant to pay that estimate before retaining the consultant. The consultant's report shall be a public document, and shall be provided to the applicant. An applicant who questions the proposed consultant's qualifications and/or believes the consultant has a conflict of interest may appeal the selection of the consultant to the Board of Selectmen as provided by c. 44, § 53G, but such an appeal shall toll the deadlines applicable to the SPGA in acting on the special permit application..

7.2.5 Crane or Balloon Test: For turbines under 150 feet high and if requested by the SPGA, the applicant shall arrange for a balloon or crane test at the proposed site to illustrate the height of proposed facility. The date, time and location of such test shall be advertised in a newspaper of general circulation in the town at least 14 days, but not more than 21 days prior to the test.

7.3 Required Application Documents

7.3.1 General: The applicant shall provide the SPGA with ten (10) copies of the application. All plans and maps shall be prepared, stamped and signed by a professional engineer licensed to practice in Massachusetts. Included in the application shall be:

a) Name, address, phone number and signature of the applicant, as well as all co- applicants or property owners, if any.
b) The name, contact information and signature of any agents representing the applicant.
c) Documentation of the legal property right to use the wind energy facility site.
d) A legal description of the property for which a special permit is sought., and a listing of all lots located, in whole or in part, within a circle, the radius of which is three time the height of the proposed turbine, together with the names and mailing addresses of the owners of those lots.. .

7.3.2 Location and Legal Maps: The following location and legal maps shall be submitted.

a) A copy of a portion of the most recent USGS Quadrangle Map, at a scale of 1:25,000, showing the proposed facility site, including turbine sites, and the area within at least two miles from the facility.
b) An assessor's map of the site.
c) Zoning district designation for the subject parcel or a copy of a zoning map with the parcel identified.
d) A map showing the limits of all Districts of Critical Planning Concern, National Natural Landmarks, National Historic Sites, historic districts, scenic roads, located within 500 feet of the property.

7.3.3 Site Plan: A plan of the proposed wind energy facility site, at a scale of one inch equals 200 feet with contour intervals of no more than 10 feet, showing the following:

a) Property lines for the site parcel and adjacent parcels within 1000 feet of the turbine. Indicate distances from all proposed turbines to the closest property line for each property within 1000 feet.
b) Outline of all existing buildings, including purpose (e.g. residence, garage, etc.) on site parcel and all adjacent parcels within 1000 feet of the turbine. Indicate distances from the wind energy facility to each building shown.

c) Location of all roads, public and private on the site parcel and adjacent parcels within 1000 feet of the turbine, and proposed roads or driveways, either temporary or permanent.
d) Existing areas of tree cover, including average height of trees, on the site parcel and adjacent parcels within 1000 feet of the turbine.
e) Locations of wetlands, frost bottoms, and vernal springs on the site parcel and adjacent parcels within 200 feet of the wind energy facility.
f) Proposed location and design of wind energy facility, including all turbines, ground equipment, accessory structures, transmission infrastructure, access, fencing, exterior lighting, etc.
g) Location of view representations.

For turbines less than 150 feet high, the SPGA may adopt rules to reduce the coverage area of the site plan.

7.3.4 Energy Reduction and Alternative Means of Generation: Information about the anticipated renewable energy production and alternative means of generating renewable energy. This includes but is not limited to:

a) Information about the anticipated electrical generation of the proposed facility including its rated capacity and its capacity factor;
b) In the case of on-site and communal facilities, if requested by the SPGA, information about the energy consumption of the owner or owners, their efforts to reduce this consumption by means of energy-efficiency and conservation measures, and the possible use of other renewable energy generation techniques which might have less impact on the environment.

7.3.5 Visualizations: Visual simulations for wind turbines more than 150 feet high or as required by the SPGA. The SPGA shall select between three and six sight lines, including from the nearest building with a view of the wind energy facility, for pre- and post-construction view representations. Sites for the view representations shall be selected from populated areas or public ways within a 2-mile radius of the wind energy facility. View representations shall have the following characteristics:

a) View representations shall be in color and shall include actual pre-construction photographs and accurate post-construction simulations of the height and breadth of the wind energy facility (e.g. superimpositions of the wind energy facility onto photographs of existing views).
b) All view representations will include existing, or proposed, buildings or tree coverage.
c) Include description of the technical procedures followed in producing the visualization (distances, angles, lens, etc…).

7.3.6 Landscape Plan: A plan indicating existing conditions and all proposed changes to the landscape of the site, including temporary or permanent roads or driveways, grading, vegetation clearing and planting, exterior lighting, screening vegetation, and structures.

7.3.7 Sound Modeling Report: A report prepared by a qualified acoustical consultant, whose credentials have been accepted in advance by the special permit granting authority, which addresses all the noise issues set forth in Section 6.2 above.

7.3.8 Shadow/Flicker Report: A report prepared by a qualified engineering consultant, whose credentials have been accepted by the special permit granting authority, which addresses the shadow/flicker issues set forth in Section 6.3 above.

7.3.9 Operation & Maintenance Plan: A plan for maintenance of access roads and storm water controls, as well as general procedures for operational maintenance of the wind energy facility, including a copy of the manufacturer's specifications and instructions.

7.3.10 Compliance Documents

If required under previous sections of this by-law, the applicant will provide with the application:

a) a description of financial security mechanism that satisfies section 4.5.5 of this bylaw,
b) proof of the availability of liability insurance that satisfies section 7.2.3 of this bylaw,
c) certification of height approval from the FAA,
d) a statement that satisfies section 4.4 of this bylaw, listing existing and maximum projected sound levels from the wind energy facility.
e) Documentation of compliance with the Commonwealth of Massachusetts' Minimum Technical Requirements for Wind Installations if applicable.

7.3.11 Proof of Notifications: The applicant shall notify the following agencies, via certified mail upon submitting an application to the Town. Copies and proof of delivery shall be provided to the Town:

a) Property owners located within the greater of 1000 feet or five times the height of the proposed facility;
b) Federal Aviation Administration;
c) Town Fire Department;
d) Town Police Department
e) Town Planning Board
f) Town Conservation Commission,
g) Town Highway Department;
h) NStar;
i) For facilities located in priority habitat of rare species and estimated habitat of rare wildlife, the Massachusetts Department of Environmental Protection - Natural Heritage and Endangered Species Program.
j) For turbines higher than 150 feet high, the Otis Air Force Base.

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