New England Wind

AVANGRID RENEWABLES

Construction and Operations Plan

Lease Area OCS-A 0534

Volume III Appendices

June 2022

Submitted by
Park City Wind LLC

Submitted to
Bureau of Ocean Energy Management
45600 Woodland Rd
Sterling, VA 20166

Prepared by
Epsilon Associates, Inc.

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June 2022

SARATOGA ASSOCIATES

NEW ENGLAND WIND

VISUAL IMPACT ASSESSMENT

June 27, 2022

Landscape Architects, Architects,
Engineers and Planners, P.C.

#2019-065

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ABBREVIATIONS

BOEM	Bureau of Ocean Energy Management
COP	Construction and Operations Plan
ESP	Electric Service Platform
FAA	Federal Aviation Administration
ft	Feet
KOP	Key Observation Point
mi	Statute mile
mi^2	Square miles
MLLW	Mean Lower Low Water
MW	Megawatt
nm	Nautical Miles
NNL	National Natural Landmark
NRHP	National Register of Historic Places
PATON	Private Aid to Navigation
USCG	United States Coast Guard
VIA	Visual Impact Assessment
SWDA	Southern Wind Development Area
ZVI	Zone of Visual Influence
WTG	Wind Turbine Generator

1.0 INTRODUCTION

New England Wind is the proposal to develop offshore renewable wind energy facilities in Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0534 along with associated offshore and onshore cabling, onshore substations, and onshore operations and maintenance (O&M) facilities. Lease Area OCS-A 0534 is within the Massachusetts Wind Energy Area identified by BOEM, following a public process and environmental review, as suitable for wind energy development. Park City Wind LLC, a wholly owned subsidiary of Avangrid Renewables, LLC, is the Proponent of this Construction and Operations Plan (COP) and will be responsible for the construction, operation, and decommissioning of New England Wind.

New England Wind's offshore renewable wind energy facilities are located immediately southwest of Vineyard Wind 1, which is located in Lease Area OCS-A 0501. New England Wind will occupy all of Lease Area OCS-A 0534 and potentially a portion of Lease Area OCS-A 0501 in the event that Vineyard Wind 1 does not develop "spare" or extra positions included in Lease Area OCS-A 0501 and Vineyard Wind 1 assigns those positions to Lease Area OCS-A 0534. For the purposes of the COP, the Southern Wind Development Area (SWDA) is defined as all of Lease Area OCS-A 0534 and the southwest portion of Lease Area OCS-A 0501 (see Figure 1.1-1 in COP Volume I).

To address issues of potential aesthetic impact, the Proponent has retained Saratoga Associates, Landscape Architects, Architects, Engineers, and Planners, P.C. ("Saratoga Associates") to conduct a Visual Impact Assessment (VIA) of New England Wind. The purpose of this VIA is to identify potential visibility of New England Wind's offshore facilities and objectively determine the difference in landscape quality with and without New England Wind in place. The information and recommendations included in this report are intended to assist regulatory agencies, interested stakeholders, and the general public in their review of New England Wind, in accordance with applicable regulatory requirements. Figure 1 illustrates the location of New England Wind.

1.1 Description of New England Wind[1]

New England Wind will be developed in two Phases with a maximum of 130 wind turbine generator (WTG) and electrical service platform (ESP) positions. Phase 1, also known as Park City Wind, will be developed immediately southwest of Vineyard Wind 1. Phase 2, also known as Commonwealth Wind, will be located southwest of Phase 1 and occupy the remainder of the SWDA. Each Phase of New England Wind will be developed and permitted using a Project Design Envelope (the "Envelope"). This approach defines and brackets the characteristics of each Phase for the purposes of environmental review while maintaining a reasonable degree of flexibility with respect to the selection of key components (e.g. WTGs, foundations, offshore cables, and ESPs). To assess potential impacts and benefits to various resources, a "maximum

[1] See Sections 3 and 4 of COP Volume I for a full description of New England Wind.

design scenario," or the design scenario with the maximum impacts anticipated for that resource, is established (see Section 3 of COP Volume III).

The SWDA may be 411–453 square kilometers (km2) (101,590–111,939 acres) in size depending upon the final footprint of the Vineyard Wind 1 project. At this time, the two positions in the separate aliquots located along the northeastern boundary of Lease Area OCS-A 0501 are not proposed for development as part of New England Wind. The SWDA (excluding the two separate aliquots that are closer to shore) is just over 32 kilometers (km) (20 miles [mi]) from the southwest corner of Martha's Vineyard and approximately 38 km (24 mi) from Nantucket. In accordance with US Coast Guard (USCG) recommendations, the WTGs and ESP(s) in the SWDA will be oriented in fixed east-to-west rows and north-to-south columns with one nautical mile (1.85 km) spacing between positions. This uniform grid layout provides 1 NM wide corridors in the east-west and north-south directions as well as 0.7 NM (1.3 km) wide corridors in the northwest-southeast and northeast-southwest directions. Figure 2 illustrates the grid pattern layout of New England Wind's WTGs and ESPs.

Phase 1 (Park City Wind) of New England Wind—Phase 1 will be developed immediately south of Vineyard Wind 1. The Phase 1 Envelope allows for 41 to 62 WTGs and one or two ESPs. Depending upon the capacity of the WTGs, Phase 1 will occupy 37,066 to 57,081 acres of the SWDA.

The Phase 1 Envelope includes two WTG foundation types: monopiles and piled jackets. Strings of WTGs will be connected to the ESP(s) via an offshore inter-array cable transmission system. The ESP(s) will include step-up transformers that increase the voltage of power generated by the WTGs prior to transmission and other electrical equipment. The ESP(s) will also be supported by a monopile or jacket foundation.

Phase 2 (Commonwealth Wind) of New England Wind—Phase 2, when constructed, will be immediately south of Phase 1 and will occupy the remainder of the SWDA. Phase 2 may include one or more projects, depending on the area available for development and market conditions. The footprint and total number of positions in Phase 2 depends upon the final footprint of Phase 1; Phase 2 could contain 64 to 88 WTG/ESP positions (up to three positions will be occupied by ESPs) within an area ranging from 54,857–74,873 acres. The Phase 2 Envelope includes three general WTG foundation types: monopiles, jackets, or bottom-frame foundations.

1.1.1 Wind Turbine Generators

The WTGs will be supported by monopile, jacket, or bottom-frame (for Phase 2 only) foundations. The WTGs will connect to the existing mainland electric grid via inter-array cables that connect WTGs to the ESP(s), then offshore cables from the ESP(s) that connect to the shore at landfall sites in Barnstable, unless technical, logistical, grid interconnection, or other unforeseen issues arise. All offshore cables will be submerged and will not be visible.[2] The Phase 1 onshore export cables and grid interconnection cables will be installed entirely underground and will not be visible, except for possibly at the Phase 1 Centerville River crossing as described in Section 3.3.1.10.2 of COP Volume I. The Phase 2 onshore cables will also be installed underground. New England Wind's onshore export cables will be located primarily within public roadway layouts or utility rights-of-way and will connect to onshore substation locations in the Town of Barnstable, Massachusetts unless technical, logistical, grid interconnection, or other unforeseen issues arise.

In accordance with Federal Aviation Administration (FAA) Advisory Circular 70/7460-1M, the color of the WTGs will be no lighter than RAL 9010 Pure White and no darker than RAL 7035 Light Grey; it is anticipated that the WTGs will be painted off-white/light grey to reduce their visibility against the horizon. The upper portion of the ESP(s) will also be a grey color which would appear muted and indistinct.

Although the SWDA falls outside of the FAA jurisdictional area, BOEM intends to follow FAA guidance until they develop new guidance. FAA guidance provides that two aviation obstruction lights (L-864) be installed on top of each nacelle. The L-864 unit is a red low intensity omni-directional light emitting 2,000 candelas (plus or minus 25%) (FAA, 2019). If the WTGs' total tip height is 213.36 meters (m) (699 feet [ft]) or higher, there will be at least three additional L-810 flashing red lights at a point approximately midway between the top of the nacelle and sea level. The current FAA circular states aviation obstruction lights will flash in unison at a rate of 30 flashes per minute (FAA, 2020). It is expected that an Aircraft Detection Lighting System (ADLS) will be used that automatically activates all aviation obstruction lights (any FAA lights on both the nacelle and tower) when aircraft approach the Phase 1 WTGs, subject to BOEM approval. For Phase 2, the same or similar approach would be used to reduce lighting used for Phase 1, including the use of an ADLS.

Additionally, to aid mariners navigating within and near the SWDA, each WTG and ESP will be maintained as a Private Aid to Navigation (PATON) in accordance with United States Coast Guard (USCG) PATON marking guidance for offshore wind facilities in First District-area waters. A uniform system of marine navigation lighting and marking will be implemented, which is currently expected to include yellow flashing lights on every WTG foundation and ESP. While the specific visibility of the lighting for each WTG and ESP position is yet to be determined, it is expected to be 5 nm or less.

Because the specific type of WTG for both Phases of New England Wind has not been determined at the time of this VIA, the largest potential WTG dimension with a jacket foundation is evaluated herein as the maximum potential visual impact scenario. The

[2] If sufficient burial cannot be achieved for offshore cables, cable protection on the seafloor may be used.

maximum dimensions of the WTGs anticipated to be commercially available for use within the Phase 1 and Phase 2 Envelopes are provided in Table 1 below.

Table 1 – Envelope of WTG Parameters

WTG Parameter	Phase 1 and Phase 2 Envelope
Maximum tip height	1,171 ft MLLW
Maximum top of the nacelle height	725 ft MLLW
Maximum hub height	702 ft MLLW
Maximum rotor diameter	935 ft
Minimum tip clearance	89 ft MLLW
Maximum blade chord	29.5 ft
Maximum tower diameter	33 ft

Notes:

1. Mean Lower Low Water (MLLW) is the average height of the lowest tide recorded at a tide station each day during the recording period. Elevations relative to Mean Higher High Water are approximately 3 ft lower than those relative to MLLW.
2. WTG tip height, hub height, tip clearance, and rotor diameter dimensions may not align perfectly due to rounding.

Figure 3 illustrates the visual characteristics of the Phase 1 and Phase 2 WTGs evaluated in this VIA.

1.1.2 Electrical Service Platforms

New England Wind, including Phase 1 and Phase 2, will include one to five ESPs that house step-up transformers and other electrical gear. The one or two Phase 1 ESPs and the up to three Phase 2 ESPs will have a maximum width of 197 ft, a maximum length of 328 ft, and a maximum height of topside of 230 ft above MLLW. The WTGs will be connected to the ESPs via offshore inter-array cables, and the ESPs may be connected to one another via offshore inter-link cables. The lighting scheme for each ESP will be similar to that of the WTGs, described above in Section 1.1.1 above. The largest potential Phase 1 or Phase 2 ESP dimension with a jacket foundation is evaluated herein as the maximum potential visual impact scenario because the specific type has not been determined at the time of this VIA. Figure 4 illustrates the general characteristics of an ESP.

1.1.3 Offshore Export Cables and Onshore Substations

The WTGs for New England Wind will connect to the existing mainland electric grid via inter-array cables that connect WTGs to the ESP(s), then offshore export cables from the ESPs that connect to the shore at landfall sites in Barnstable. Four to five offshore export cables—two for Phase 1 and two or three for Phase 2—will transmit electricity from the SWDA to onshore transmission systems in the Town of Barnstable, Massachusetts, unless technical, logistical, grid interconnection, or other unforeseen issues arise.

All offshore cables will be submerged and will not be visible. The Phase 1 onshore export cables and grid interconnection cables will be installed entirely underground and will not be visible, except for possibly at the Phase 1 Centerville River crossing as described in Section 3.3.1.10.2 of COP Volume I. The Phase 2 onshore cables will also be installed underground. For each Phase, proposed onshore underground cables are expected to primarily utilize existing public roadway layouts and utility rights-of-way to connect to new Phase 1 and Phase 2 onshore substations in Barnstable.

The electric grid connection for each Phase is proposed at an existing onshore substation in West Barnstable. The Phase 1 onshore substation will be constructed on a 6.7-acre privately-owned parcel located at 8 Shootflying Hill Road. The 8 Shootflying Hill Road onshore substation site is southwest of the Route 6-Route 132 highway interchange, located approximately 0.8 mi east of the West Barnstable Substation. An access road may be constructed to the onshore substation site on 6 Shootflying Hill Road, which is adjacent the onshore substation site. For Phase 1 and Phase 2, a 2.8-acre parcel of land (“Parcel #214-001”) may be used, located immediately southeast of the West Barnstable Substation. While this parcel will likely be utilized as the northern terminus of a trenchless crossing across Route 6, it also provides some flexibility regarding the proposed substation design[3]. An alternative is being considered that would involve relocating some of the onshore substation equipment (e.g., static synchronous compensators [STATCOMS], shunt reactors) from the 8 Shootflying Hill Road onshore substation site to Parcel #214-001.

The Phase 1 onshore substation site, which currently houses a motel, is in a residentially zoned area. An existing electric transmission corridor (ROW #343) is located immediately south of the site. It is expected that a vegetated screening on the western and northern boundaries of the substation site will be planted; the vegetated screening along the western edge would provide visual screening for existing residences and the northern vegetation will provide visual screening from Shootflying Hill Road. To the east, 6 Shootflying Hill Road may be graded and cleared for a potential access road; however, the abutting land is undeveloped and wooded. Since the southern property line extends into ROW #343, no vegetated screening will be

[3] Ground disturbing activities may occur up to 3 m (10 ft) beyond the boundaries of Parcel #214-001 to enable construction equipment access and account for minor disturbance associated with activities occurring near the perimeter of the parcel.

possible in that location, but the ROW already contains aboveground structures and utility lines. Photo simulations of the Phase 1 onshore substation are provided in Appendix E.

The Phase 2 onshore substation site(s) has not been identified at this time, but the site(s) will be located generally along the onshore routes illustrated on Figure 4.1-2 in COP Volume I within the Town of Barnstable.

1.1.4 WTG and ESP Specifications Used for Visual Impact Assessment

In conducting the visual simulations, the maximum potential size of the SWDA was assessed, assuming the full buildout of the 130 WTG/ESP positions (i.e., a total buildout of both Phases). The WTGs utilized for visual simulations are the tallest WTGs currently under consideration for each Phase (see Table 1). Additionally, this VIA assumes that Phase 1 includes one position occupied by an ESP. While Phase 2 includes up to three ESPs, it was determined that, due to the distance offshore and lower height of the ESPs, any ESPs would be less visually distinct than WTGs. Therefore, all Phase 2 positions were assumed to be occupied by WTGs to provide the maximum impact scenario for potential visual impact.

1.2 Zone of Visual Influence

The Zone of Visual Influence (ZVI) for New England Wind was defined through Geographic Information System (GIS) viewshed calculation. The ZVI identifies the geographic area within which there is a relatively high probability that some portion of New England Wind's offshore facilities would be visible above the horizon from land-based vantage points.

Maximum Theoretical Area of Nacelle Visibility - The ZVI extends to a maximum radius of 37.5 mi from Phase 1 and Phase 2 WTGs. This **maximum theoretical area of nacelle visibility** is based on the distance that the top of nacelle for the Phase 1 and Phase 2 WTGs (725 ft) would be visible above the horizon in clear air conditions assuming a 6 ft observer height at the shoreline and a coefficient of refraction of 1.088. Considering the slender form and low contrast coloration of the rotor blades combined with atmospheric conditions, views of the WTG above the nacelle are unlikely to be detected by coastal observers beyond this distance. Figure 5 illustrates the maximum theoretical area of nacelle visibility for New England Wind.

As already noted, the SWDA includes up to 130 WTG/ESP positions (one or two ESPs for Phase 1, and up to three ESPs for Phase 2). This VIA considers the largest WTGs for each Phase. A subset of 10 Phase 1 and 18 Phase 2 WTGs, which form the shoreward facing perimeter of the SWDA (i.e. northwestern and northeastern sides), were used as control points (study points representing WTGs) for the purpose of ZVI calculation. Interior and more distant WTGs were not used in ZVI calculation as they are redundant with visibility of perimeter WTGs.

ArcGIS 10.6 and ArcGIS Spatial Analyst software were then used to generate ZVI areas based on publicly available digital topographic and land cover datasets. A map of land cover is included in

Appendix F. Using these datasets to incorporate obstructing elements such as terrain, vegetation, and built structures, the computer scanned from each control point to identify individual grid cells (representing the earth's surface within the maximum theoretical blade tip visibility area) that would be hidden from view considering the screening value of intervening topography, vegetation, and built structures. A conservative offset of 6 ft was applied to each grid cell to simulate the height of a human observer.

Topographic, vegetation, and built structure data were obtained from MassGIS. This data is based on two Light Detection and Ranging (Lidar) surveys. The more recent 2013–2014 (the "Sandy" Lidar dataset) was used for Martha's Vineyard, Nantucket, the Elizabeth Islands and immediate coastal areas on Cape Cod. The 2011 (the "Lidar for the Northeast" dataset) was used for non-coastal areas of Cape Cod not covered by the 2013-2014 Sandy dataset. Both Lidar datasets are extremely fine-grained with point cloud densities of more than one point per square meter and are available from MassGIS as raster (grid-based) Digital Elevation Models at one-meter resolution.[4]

Topographic data was extracted from the MassGIS datasets and exported to a seamless single raster dataset to form a complete Digital Terrain Model representing the topography of the maximum ZVI. Vegetative land cover data was also extracted from the MassGIS datasets. The height of existing vegetation was estimated using landcover height attributes found in the Coastal Change Analysis Program Land Cover database from the National Oceanic and Atmospheric Administration's Office of Coastal Management. The heights assigned to each vegetation cover class are as follows:

Land Cover	Vegetation Height
Deciduous Forest	30 ft
Estuarine Scrub/Shrub	16 ft
Evergreen Forest	35 ft
Palustrine Forested Wetland	30 ft
Palustrine Scrub/Shrub	16 ft
Scrub/Shrub	16 ft

The screening value of existing buildings was incorporated using the statewide database of "roofprints" downloaded from MassGIS. A conservative height of 15 ft was used as the height of all structures as there was no attribute in the roofprint dataset to indicate height above ground for each structure. This height is likely lower than actual structure heights and therefore underestimates the extent of screening by buildings, resulting in a conservative

[4] Tests of the tradeoffs of computational efficiency and differences between results of viewshed analysis with various resolutions of the Digital Terrain Model determined that the magnitude of changes to viewshed areas were not significant enough to warrant the computational expense of conducting a viewshed at the native one-meter raster resolution. Therefore, the Digital Terrain Model was down-sampled, using bilinear interpolation to three-meter resolution.

viewshed. A composite digital surface model was created combining the screening attributes of topography, vegetation, and built structures.

One ZVI output layer was generated identifying land areas with theoretical visibility to the top of nacelle for the tallest potential Phase 1 and Phase 2 WTG (725 ft). A second ZVI output layer was generated identifying land areas with visibility to the blade tip (at apex of rotation) of the tallest potential Phase 1 and Phase 2 WTG (1,171 ft). Each output layer was masked to remove visible areas on open water, tops of vegetation, and tops of structures. Refer to ZVI mapping in Appendix A.

1.2.1 Martha's Vineyard and Nantucket ZVI

New England Wind may be visible from beachfront locations on Martha's Vineyard between Gay Head (25.5 mi to the nearest WTG) and Chappaquiddick Island (24.1 mi to the nearest WTG). The nearest point of land on Martha's Vineyard is Squibnocket Point (21.2 mi to the nearest WTG).

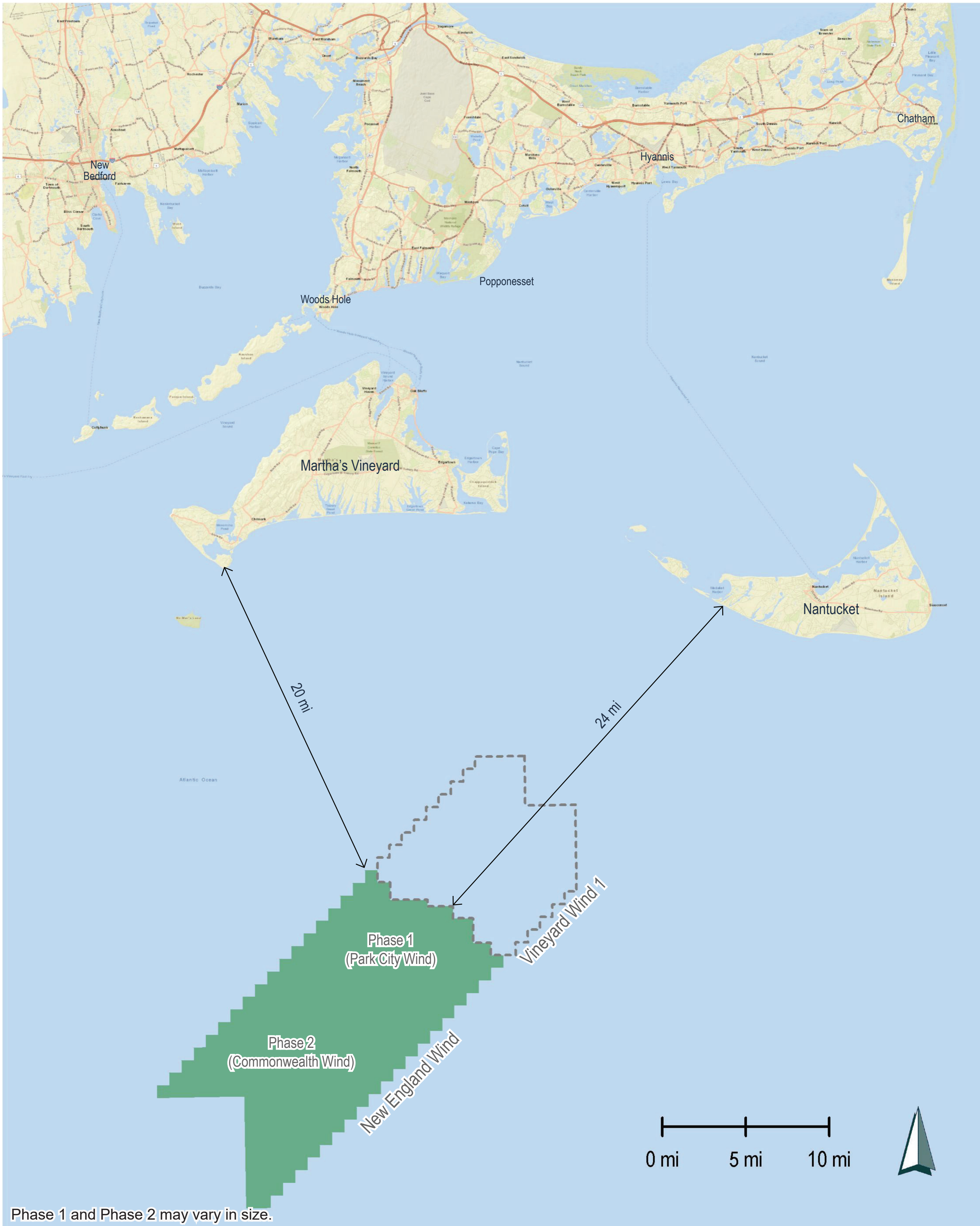
New England Wind WTGs may be visible from beachfront locations on Nantucket Island between Madaket (25.1 mi to the nearest WTG) and Low Beach (33.4 mi to the nearest WTG). The nearest point of land on Nantucket is Madaket (25.1 mi to the nearest WTG). Areas of theoretical visibility are also found on south-facing beaches and unvegetated inland areas on uninhabited Esther Island (24.6 mi to the nearest WTG), Tuckernuck Island (24.5 mi to the nearest WTG), Muskeget Island (25.4 mi to the nearest WTG), and Nomans Land Island (18.7 mi to the nearest WTG).

1.2.2 Cape Cod, Elizabeth Islands and Mainland ZVI

A portion of Cape Cod and the Elizabeth Islands fall behind Martha's Vineyard, substantially minimizing the degree of potential visibility in these areas. Most other portions of the mainland Cape Cod coastline fall beyond the maximum theoretical area of nacelle visibility, where the top of nacelle will fall below the horizon. A view of the top of nacelle is theoretically possible from the western portion of the Elizabeth Islands, including eastern Naushon Island (30.8 mi to nearest WTG), Pasque Island (31.3 mi to the nearest WTG), Nashawena Island (30.9 mi to the nearest WTG) and Cuttyhunk Island (31.9 mi to the nearest WTG). However, because atmospheric conditions reduce visibility, sometimes significantly, maximum theoretical viewing distances typically exceed what is experienced in reality. Moreover, due to earth curvature, the presence of ocean waves that obscure objects very low on the horizon, and the limits of visual acuity, the WTG nacelle will likely not be discernable from vantage points on the Cape and the mainland.

In most circumstances, the visibility of New England Wind will be quickly screened from inland vantage points by coastal topography and vegetation. As demonstrated by ZVI analysis, few publicly accessible vantage points with theoretical views of New England Wind are identified beyond immediate beachfront locations. Refer to ZVI mapping in Appendix A.

The majority of Cape Cod's south coast (excluding a small area of shoreline in the Towns of Falmouth and Mashpee), and all of mainland Massachusetts, Rhode Island (including Block Island), Connecticut and New York's Long Island fall beyond the maximum theoretical area of nacelle visibility (37.5 mi from the Phase 1 and Phase 2 WTGs). As described above, considering the slender form and low contrast coloration of the rotor blades combined with atmospheric conditions, views of the WTG above the nacelle are unlikely to be detected by coastal observers beyond this distance.



NEW ENGLAND WIND

FIGURE 1
NEW ENGLAND WIND
LOCATION MAP

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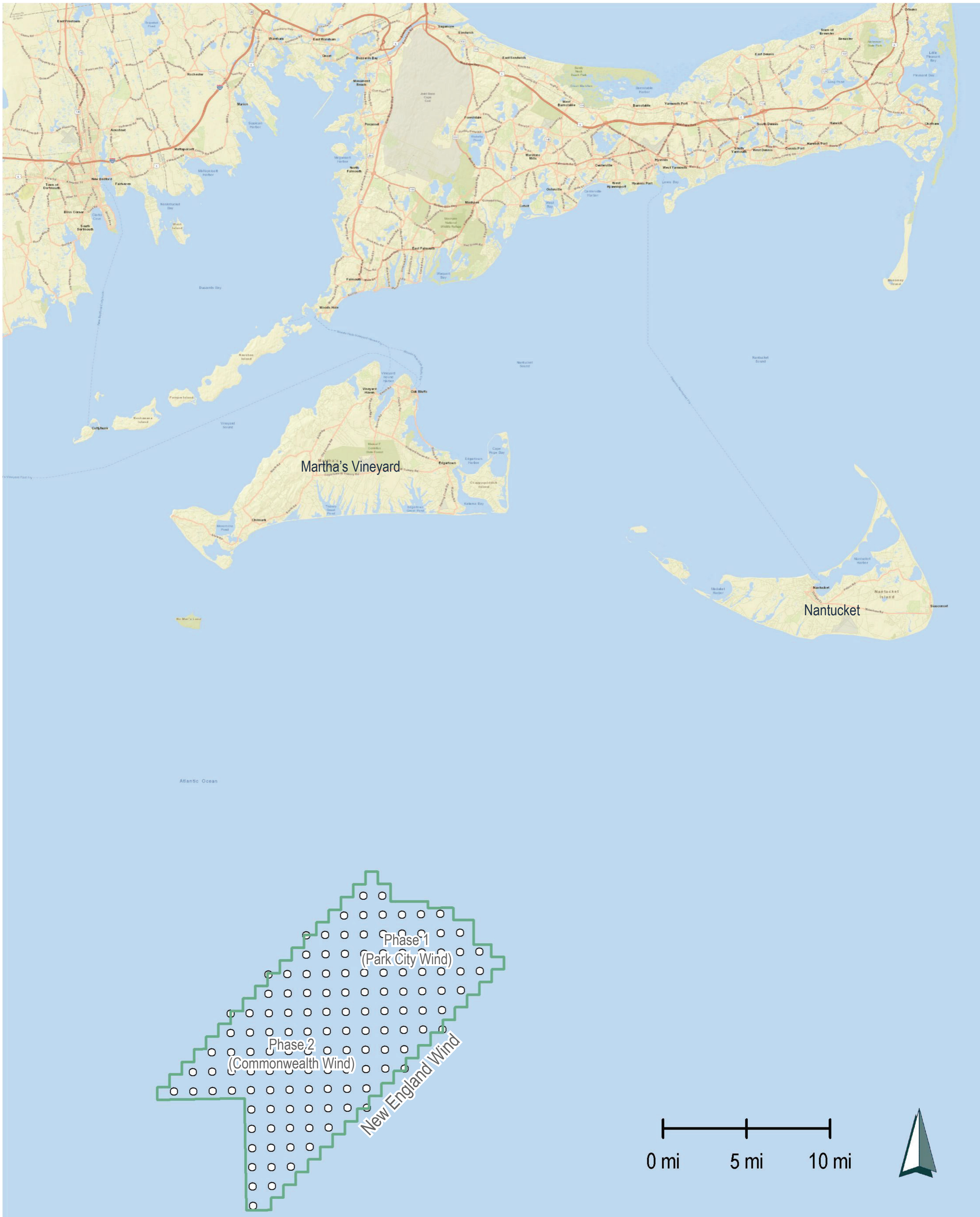

NEW ENGLAND WIND

FIGURE 2
NEW ENGLAND WIND
WIND TURBINE GENERATOR LAYOUT

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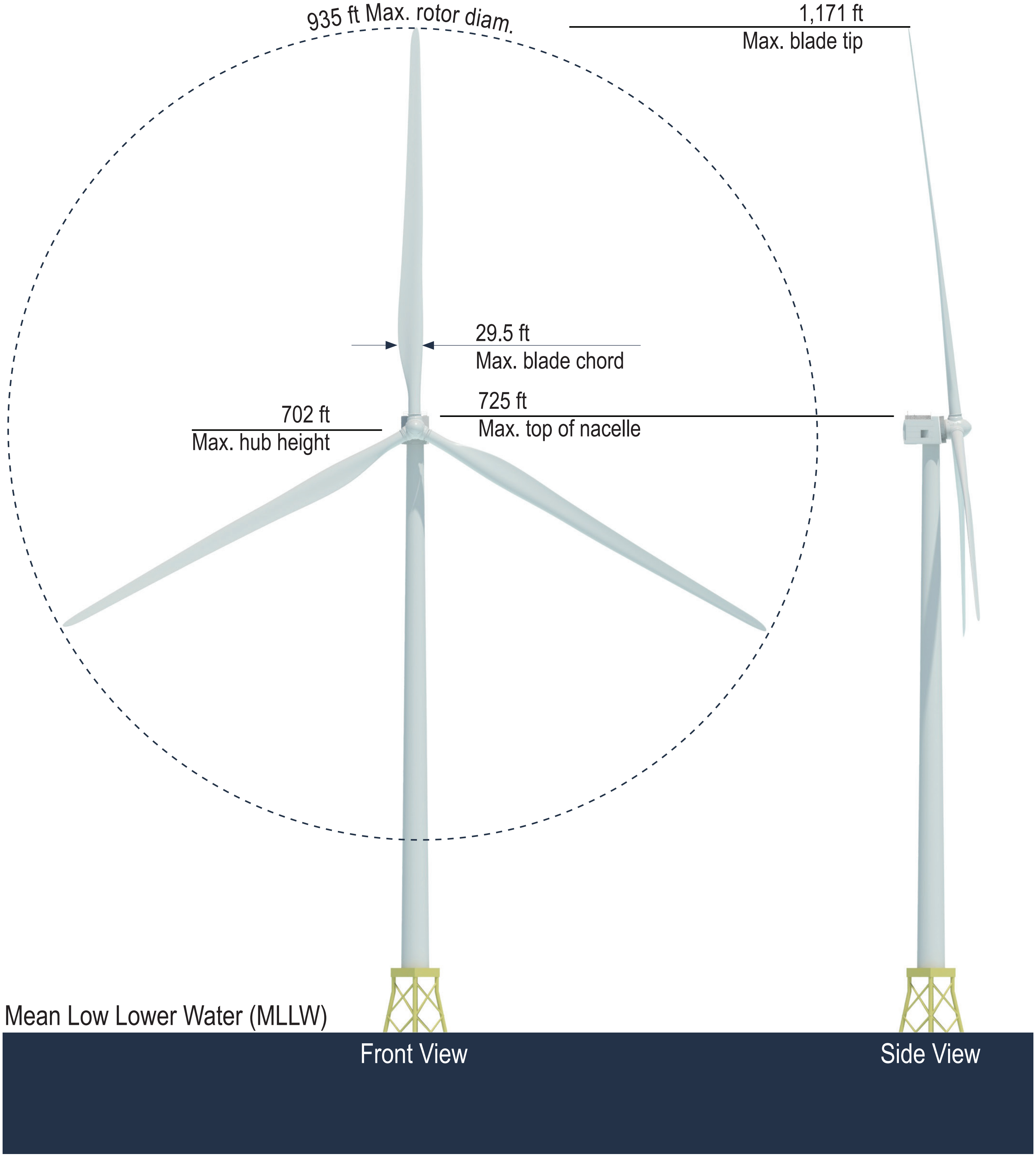

NEW ENGLAND WIND

FIGURE 3
PHASE 1 AND 2 WIND TURBINE GENERATOR EVALUATED

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FIGURE 4
REPRESENTATIVE ELECTRICAL SERVICE PLATFORM

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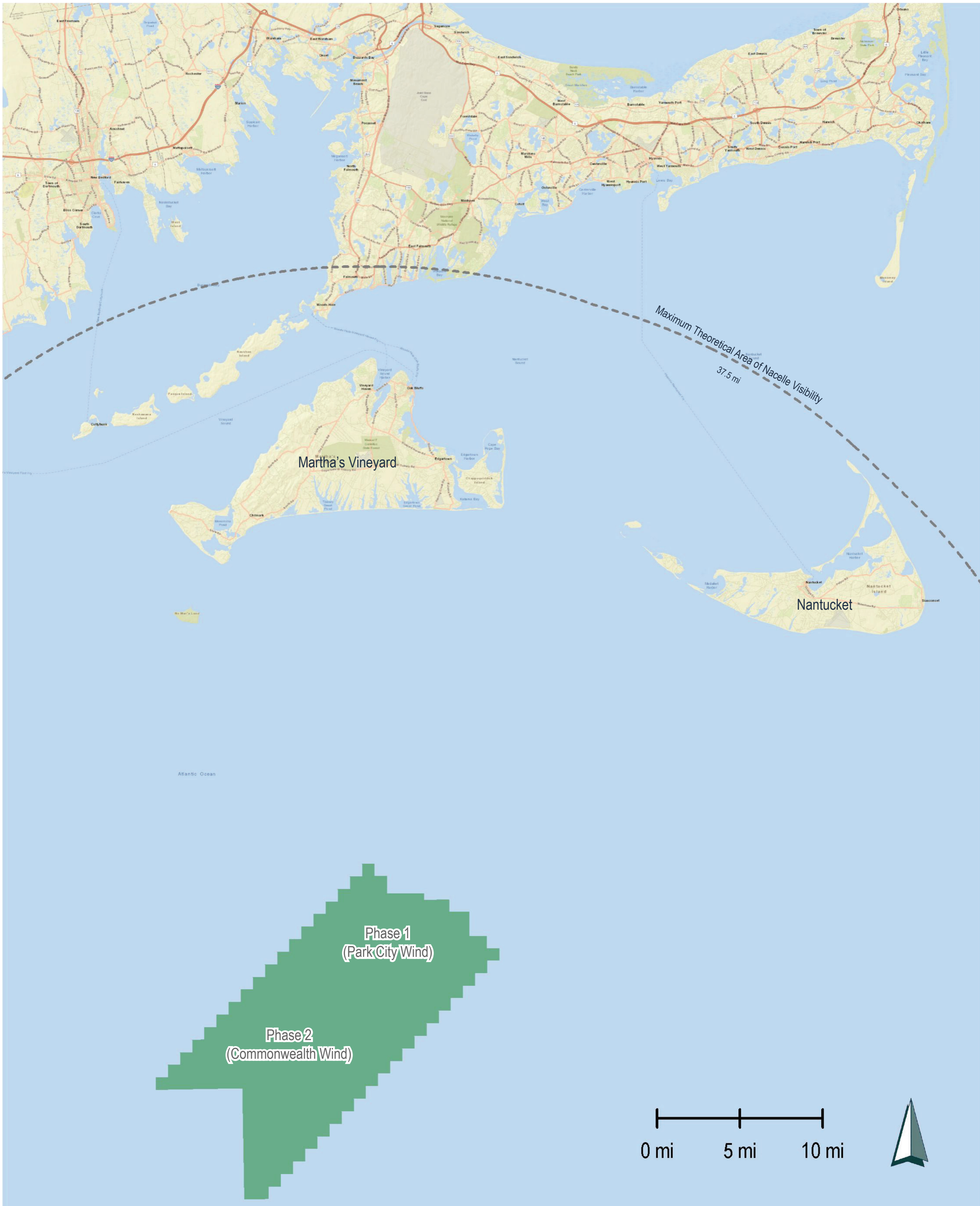


NEW ENGLAND WIND

FIGURE 5
MAXIMUM THEORETICAL NACELLE VISIBILITY DISTANCE

SARATOGA ASSOCIATES

2.0 LANDSCAPE CHARACTER/VISUAL SETTING

The maximum theoretical area of nacelle visibility includes Martha's Vineyard, Nantucket, the Elizabeth Islands, associated smaller islands, and a portion of Cape Cod. Martha's Vineyard is the largest island of the group, covering about 55,040 acres). Nomans Land Island, a small uninhabited island of about 640 acres located about 3 mi southwest of Martha's Vineyard, is protected as a National Wildlife Refuge. Nantucket is comprised of four islands: Nantucket, Esther Island, Tuckernuck Island, and Muskeget Island. Nantucket is the largest of the four islands and is approximately (31,360 acres) in size. The Elizabeth Islands are a chain of small islands extending southwest from the southern coast of Cape Cod at the outer edge of Buzzards Bay.

Martha's Vineyard and Nantucket are popular tourist destinations and summer resort communities. Access to both islands is limited to boat and air service. Most visitors and residents utilize ferry services that connect mainland Cape Cod to the islands. According to the US Census Bureau, the year-round population on Martha's Vineyard is approximately 17,332 residents (2019 estimated), although the summer population can swell to more than 100,000 (County of Dukes, n.d.). Nantucket has a year-round population of approximately 11,399 (2019 estimated). With tourists and seasonal residents, the population of the island increases to more than 50,000 during the summer (Town of Nantucket, n.d.).

Martha's Vineyard and Nantucket were formed by the last period of continental glaciation and the rise in sea level that followed. The islands are generally characterized by low elevation, with undulating hills and shallow depressions. Elevations range from sea level to approximately 110 ft above sea level in the central portion of Martha's Vineyard and Nantucket. Most of the oceanfront is fringed by barrier beaches and sand dunes. The western and northwestern parts of Martha's Vineyard are marked by ridges and hills that extend southwesterly and end at the high cliffs of Aquinnah (Gay Head), Nashaquitsa, and Squibnocket. The elevation of these hills averages about 200 ft above sea level but extends as high as 300 ft in some areas (SCS, 1993).

Vegetation within the maximum theoretical area of nacelle visibility is characterized by a mix of scrub forest, upland heaths, sand plain grasslands, salt marshes, and open fields (agricultural and successional). Developed features include village centers, year-round and vacation homes, roads, and harbors/ports.

The overall aesthetic character of Martha's Vineyard and Nantucket can generally be described as small-town landscapes with minimal urban development. The horizon, looking south towards the SWDA from the coast, is typically defined by a view of the open ocean. Because of development and infrastructure at some of the viewpoints, manmade lighting results in some light pollution, but most viewpoints are typical of beaches and natural areas without much development. Lights from vessels can be seen from all coastline locations along the ocean horizon on most nights, except in extremely foggy conditions. The intensity and size of the lights vary depending on the distance of the vessel from the shore, with lights remaining within view for different amounts of time depending on the direction and speed of the vessel (BOEM, 2014).

2.1 Landscape Units

Landscape units are areas with common characteristics of landform, water resources, vegetation, land use, and land use intensity. While a regional landscape may possess diverse features and characteristics, a landscape unit is a relatively homogenous, unified landscape (or seascape) of visual character. Landscape units are established to provide a framework for comparing and prioritizing the differing visual quality and sensitivity of visual resources in the study area.

The U.S. Geological Survey (USGS) National land Cover Dataset (NLCD) used to help define the locations of these units is illustrated in Appendix F. Table 2 summarizes the acreage and percent land area for each land cover type found within the maximum theoretical area of nacelle visibility.

Table 2 – Land Cover Classifications

Classification Description	Acres*	Percent
Forest/Scrub	57,104	43.1%
Agriculture/Open Developed	27,057	20.4%
Developed	17,141	12.9%
Exposed Sand/Soil	7,227	5.5%
Emergent Herbaceous Wetland	5,953	4.5%
Open Water (excluding ocean)	17,942	13.5%

* Acreages include land area and open water enclosed by land (ponds, bays, etc.). Excludes the open water area of the Atlantic Ocean.

<u>Open Ocean Unit</u>—The Open Ocean Unit includes the open water of the Atlantic Ocean, Nantucket Sound, Vineyard Sound, Buzzards Bay, and Rhode Island Sound. This unit is characterized by broad expanses of open water, which forms the dominant foreground element in all directions. From all vantage points, New England Wind will be viewed over open water. In general, the waters of the Atlantic Ocean appear dark bluish-gray, which is typical of northeastern US oceanic water (as compared to the light greenish blue colors common to southeastern US waters). Cloud cover, wind, sun reflectance, and surface glare affect the color of the water and often create patterns of color variation over the water's surface. The visible texture of the water is affected by movement of the water, such as the action of waves, which can include flat water, rolling swells, choppy white cap conditions, strong currents, and tidal conditions. Together, these factors contribute to an amalgam of shimmering colors and patterns of light that are of aesthetic interest and may command the attention of observers.

The waters off of Cape Cod, Martha's Vineyard, and Nantucket support a wide variety of human activities, including water sports, recreational boating (sail and power craft), recreational and commercial fishing, ferry services, and commercial shipping, among others uses. Navigation through the area includes ocean-going vessels headed to/from major ports (e.g., New York and Boston), commercial fishing vessels, ferry transport (primarily to Nantucket and Martha's Vineyard), pleasure craft, and recreational fishing boats. The ocean, sound, channels, harbors, and bays are marked with maritime aids (e.g., buoys, channel markers, warning lights, etc.).

Ocean Beach Unit—Miles of sand beaches are a defining aesthetic feature of Martha's Vineyard, Nantucket, and Cape Cod. Beaches are a significant attraction for sunbathers, surfers, fishermen, and beachcombers. During the summer season, certain stretches of the beach are at capacity; at other times of the year, they can be nearly deserted and appear in a seemingly pristine natural condition. As a daytime destination, visitors bring brightly colored umbrellas, coolers, folding chairs, towels, and recreational watercraft to the beach. Southerly views from south-facing beaches encompass views of the open water landscape across the Open Ocean Unit.

The beaches are both sandy (primarily on Nantucket, along the south coast of Cape Cod, the perimeters of the Elizabeth Islands, and the eastern portion of Martha's Vineyard) and rocky (primarily on the western portion of Martha's Vineyard). Breaking surf is a continuous and unique visual condition. Viewer activity is primarily recreational in nature including passive sunbathing, swimming, walking/beach combing, surf fishing, and surfing. Beaches are also used by recreational and commercial fishermen.

Views are almost always unobstructed and considered highly scenic. Views extend up and down the coast and across open water as one looks out to sea. Inland views include grassy dunes and coastal scrub vegetation. Manmade structures are frequently visible from beach locations, although extended stretches of beachfront on Martha's Vineyard and Nantucket are located within protected open space areas with little to no manmade development within immediate view.

Coastal Dunes Unit—The inland edge of the Ocean Beach Unit is defined by undulating sand dunes typically ranging in height from 10–20 ft. Dunes are typically vegetated with low grasses and low shrubs. Coastal dunes typically occur along the shoreline between the ocean beaches and more inland landforms are present throughout the study area on Cape Cod, especially in the easterly limit of the proposed ZVI, as well as on Martha's Vineyard and Nantucket. The dunes are typically traversed by narrow enclosed footpaths through the beach grass that provide public access to the beaches from inland roads and parking areas. Ocean views from the inland side of the Coastal Dune Unit are largely restricted by the dune terrain. Viewer activity is almost exclusively recreational, focused on walking/sightseeing, with beach access provided from inland roads and parking areas.

Coastal Bluffs Unit—Portions of the coastal area are defined by a distinctive topographic rise in elevation from the beach below, with coastal scrub vegetation at the top of the bluffs. Dramatic coastal bluffs occur at the western end of Martha's Vineyard at Gay Head in the Town of Aquinnah and in Chilmark where the land rises steeply from sand or rocky beaches to elevations of 30 m (100 ft) or more. Notable bluffs in this area include Gay Head Cliffs, Zack's Cliffs, Squibnocket Ridge, Nashaquitsa Cliffs, and Wequobaque Cliffs. Less dramatic bluffs are found at Wasque Point at the southern end of Chappaquiddick Island, where topography steeply rises 50–100 ft above beach elevation.

The Coastal Bluffs Unit is defined by scenic open vistas of the ocean and distant landscape from an elevated vantage point. Viewers frequently visit these areas specifically to enjoy scenic vistas over the ocean and long-distance views up and down the coastline. Bluff vistas also commonly include manmade development, including roads and vehicles, overhead utility lines, and residential development.

Salt Pond/Tidal Marsh Unit—Salt ponds and tidal marshes inland of the Ocean Beach Unit are common throughout the coastal area. Disconnected from the ocean except during flooding events, or connected to the ocean by narrow tidal channels, these areas are defined by shallow open water and buffered by herbaceous grasses and other salt tolerant vegetation. In salt ponds and tidal marshes with hydraulic connections to the ocean, water levels rise and fall with the tide, exposing mud flats. Views over the water body and flat marshland extend until interrupted by adjacent dunes and/or scrub vegetation. Residences often are present along the edges of the ponds, many with associated docks and boats. Recreational activities in this unit include walking, boating, clam digging, and bird watching.

Coastal Scrub Brush Unit—At varying distances inland from the Coastal Beach, Coastal Dunes, and Salt Pond/Tidal Marsh Units, the coastal landscape transitions into a more heavily vegetated scrub brush and low forest condition. The Coastal Scrub Brush Unit (and the Forest Unit described below) is characterized by low dense woody and herbaceous vegetation—the dominant forest is Pitch Pine-Oak forest, which occurs on Cape Cod, Martha's Vineyard, and Nantucket. Scrub vegetation is commonly found on upland dunes and plains above tidal conditions. Landform is often comprised of small hills and eroded hollows. Vegetation is often thick and nearly impenetrable, and views are frequently obstructed by dense foliage. Distant vistas may be limited to view corridors along roadways or where scrub brush transitions to open meadow. Viewer activity is typically limited to local travel and recreational use, such as walking and biking.

Forest Unit—Inland from various coastal units are extended wooded areas including both deciduous and coniferous species (e.g., oaks, hickories, and white pine). The understory is comprised of mixed shrubs, vines, and saplings. In areas exposed to coastal winds, trees are often irregular in form and stunted; trees located in better shielded inland areas are taller and more regular in form.

Although this landscape type once dominated the interior of Martha's Vineyard, Nantucket, and Cape Cod, various forms of human development extensively encroach upon this area, and only a patchwork of mature forest remains. A variety of land use activities exist in the Forest Unit, including residential development, roads, small open yards and fields, and other land uses. Such conditions are not specifically identified as separate units due to the visual dominance of the surrounding forest.

Topography in the Forest Unit is typically level to rolling with distinct ridges and gullies. Views are frequently restricted to openings in the forest canopy and axial views along roadways. Viewer activity includes residential uses and local travel. Recreational uses include walking and bicycling through the woods along local roads and trails.

Shoreline Residential Unit—Shoreline (or near shoreline) residential development is common in coastal areas not currently protected by public and private land conservation initiatives. Residential development ranges from small bungalow-style beach houses to large well-maintained vacation homes. The developments are a mix of densely developed areas, such as Falmouth Heights and Popponnesett (Mashpee) and Nantucket harbor, and low-density developments on the south shores of Martha's Vineyard and Nantucket. Although sometimes screened by coastal scrub vegetation, shoreline residences typically have panoramic views of the ocean, salt ponds/tidal marshes, and/or dune landscape. Architecture is a mixture of old and new construction and traditional/historic and contemporary styles.

The local landscape is gently rolling with a mix of coastal scrub, heath, and dunes surrounding maintained residential landscapes. Larger trees are generally not present in beachfront locations. Shoreline residential homes are often used seasonally by owners or offered as vacation rentals. Visitors to these properties enjoy views of the ocean or beachfront landscape and frequently walk or drive from the residential property to the beach and other scenic coastal locations as part of their vacation routine.

Village/Town Center Unit—The Village/Town Center Unit includes clearly identifiable population centers including Vineyard Haven, Oak Bluffs, and Edgartown on Martha's Vineyard; Woods Hole and West Falmouth on Cape Cod; and Nantucket Village on Nantucket. This zone is comprised of moderate to high density residential and commercial development in a village setting. Vegetation most commonly includes street trees and residential landscaping yard trees. Buildings (typically two to three stories tall) and other manmade features dominate the landscape. Architecture is highly variable in size, style, and arrangement. Each town center on Martha's Vineyard and Nantucket maintains an individual and distinctive New England character. Village/Town Centers are widely recognized as quaint small-town destinations and highly scenic places.

On Martha's Vineyard and Nantucket, village and town centers are small coastal seaports with clusters of historic buildings focused around clearly defined and thriving downtown commercial districts. Side streets are characterized by well-maintained residential structures adjacent to the village center. Buildings are most commonly of a traditional New England architectural style and arranged in an organized pattern focusing views along the streets. Buildings, street trees, and local landscaping enclose and prevent long distance views.

Rural Residential Unit—The Rural Residential Unit is found along the frontage of rural roads through Cape Cod, Martha's Vineyard, and Nantucket, outside of the Village/Town Center Unit and the Suburban Residential Unit and inland from coastal areas. Structures are typically single-family homes that vary widely in age and architectural style, from the traditional Cape style house to modern modular homes and historic farmhouses. Residences tend to be larger and well-maintained, often with a traditional New England character. Rural residences on Cape Cod vary in size from small Cape or ranch style homes to larger farmhouses. On Martha's Vineyard and Nantucket, older homes vary in size while newer, seasonal homes are larger estates located on large lots. Many rural roads on the islands are unpaved. Residential structures are often set back from the road and interspersed with hedgerows and small woodlots. Topography is characterized by relatively level to gently rolling landforms typical of inland areas on Cape Cod, Martha's Vineyard and Nantucket. Extended distance views are often restricted to open fields and axial views along roadways. Rural residential uses are not typically oriented toward ocean views. Viewer activity includes common residential uses, recreation, and local travel.

Suburban Residential Unit—Suburban residential development includes medium- to high-density single-family residential neighborhoods that typically occur on the outskirts of villages and town centers, along secondary roads and cul-de-sacs. The Suburban Residential Unit is most commonly found on Cape Cod and around the perimeter of Village/Town Center Units on Martha's Vineyard and Nantucket. Buildings are most often one- and two-story wood frame structures with peaked roofs and clapboard or shingle siding. House styles are primarily Capes, ranches, bungalows, salt boxes, and colonial residential structures.

Suburban Residential Units are also found in coastal areas in relatively new clusters of homes designed for year-round, seasonal, or vacation use in areas proximate to beaches and other scenic and recreational resources. Suburban residential developments generally have regularly spaced homes surrounded by landscaped yards. Residential subdivisions are commonly located within forest areas or have pockets of remnant forest vegetation within developed areas. Streets are well-organized in layout and are often curvilinear in form with well-defined access to collector streets. Activities include normal residential uses and local travel. Views are often limited by surrounding vegetation or adjacent structures. Suburban Residential Units are not typically oriented toward ocean views.

Agricultural/Open Field Unit—Agricultural land uses within the maximum theoretical area of nacelle visibility are limited to several small, generally level to gently sloping, pastures and crop fields. Livestock and working farm equipment add to the visual interest of the open fields. This unit occurs primarily in inland portions of the maximum theoretical area of nacelle visibility as a minor component of the landscape on both Martha's Vineyard and Nantucket. Many of the agricultural landscapes are protected open space, either by public agencies, private land trusts, or non-profit organizations. Agricultural lands may offer long distance views. Adjacent forest, coastal scrub, and structures commonly frame/enclose views and provide significant screening. Because this unit is largely inland, views to the ocean are relatively rare, with the exception of Bartlett's Farm on Nantucket and Allen Farm on Martha's Vineyard.

2.2 Viewer/User Groups

Viewers engaged in different activities while in the same setting are likely to perceive their surroundings differently. The description of viewer groups is provided to assist in understanding the sensitivity and probable reaction of potential observers to visual change resulting from a proposed project.

Tourists, Vacationers, Seasonal Residents, and Recreational Users—One of the coastal area's greatest assets is the view of the Atlantic Ocean and Nantucket Sound and its shoreline landscape. Martha's Vineyard and Nantucket have long been renowned tourist destinations offering a broad-spectrum of passive and active recreational pursuits focused on their scenic and upscale coastal setting. While some visit the islands for a few days or a week in the summer, others may spend the entire summer season in the area. Tourists, seasonal residents, vacationers, and recreational users are commonly involved in outdoor recreational activities at beaches, parks, and conservation areas. Typical activities include sunbathing, beach combing, swimming walking, bicycling, recreational boating, fishing, and other passive recreation.

While the sensitivity of these viewers will vary, tourists, seasonal residents, vacationers, and recreational users will be the most sensitive to built elements on the landscape since quality views of the ocean are likely a primary reason for their visit and an integral part of their recreational experience. Some visitors may find their experience would be worsened, primarily due to the visual disruption of the seascape. Other visitors may have a preference for areas providing views of WTGs and may visit the area primarily for the purpose of seeing WTGs. For other users, such as fishermen, the scenic quality of the coastal landscape may be less important. The potential impact of New England Wind on recreation and tourism is further discussed in Section 7.5 of COP Volume III.

Greater numbers of tourists, vacationers, and recreational users will be present in the coastal area during the summer and on sunny days, when the weather is often clear and warm as compared to overcast, rainy, or cold days. In addition, more recreational users will be present in the coastal area on weekends and holidays than on weekdays.

Year-round Residents—Local residents live, work, and travel in the ZVI. They generally view the landscape from their yards, homes, local roads, and places of employment. The highest population of local residents is in and around town center areas, but many live in more rural portions of the ZVI.

The coastal area also includes numerous private residential properties that are uniquely oriented to take advantage of scenic views. These properties are almost always of very high real estate value, due in large part to water views or proximity to the waterfront and are often cherished places for families who live or vacation there.

Local residents are likely to have the best understanding of the aesthetic character and existing conditions of the coastal area. Except when involved in local travel, these viewers are likely to be stationary and may have frequent and/or prolonged views of New England Wind. They know the coastline and may be sensitive to changes in particular views that are important to them.

Residents' sensitivity to visual quality varies and may be affected by the aesthetic setting of their neighborhood or place of employment. Those residing or working in village/community centers with views focused on the developed landscape may be less sensitive to landscape changes than those with views of a more natural landscape or seascape. However, all local residents are familiar with the coastal landscape and may be sensitive to aesthetic changes to varying degrees.

<u>Through Travelers</u>—This group includes non-local viewers with views of the ocean. Through travelers are typically moving, have a relatively narrow field of view oriented along the axis of the roadway, and are destination oriented. Through Travelers include driver and passenger automobile users. Drivers will generally be focused on the road and traffic conditions but do have the opportunity to observe roadside scenery. Passengers in moving vehicles will have greater opportunities for prolonged off-road views than will drivers, and therefore may be more aware of the quality of surrounding scenery.

Field observation found few roads with significant or extended views of the ocean.

Also included in this group are travelers that may transit the ocean on ferries from the mainland. Unlike automobile users, ferry passengers have extended periods of time where views of New England Wind would be of relatively long duration (one hour or more). These viewers include those engaged in passive enjoyment of the ocean ambiance as well as those who pass the travel time occupying themselves with business or other personal activities. At its closest, the Hyannis/Nantucket ferry passes within 20 mi of the SWDA. Views from the Hyannis/Nantucket ferry would occur within a narrow view corridor between Nantucket, Tuckernuck Island, Muskeget Island, and Martha's Vineyard. New England Wind will not be visible behind Martha's Vineyard from the Woods Hole/Martha's Vineyard ferries. New England Wind will not be visible behind Martha's Vineyard and the Elizabeth Islands from the New Bedford/Cuttyhunk Ferry.

<u>Commercial Mariners</u> —Commercial fishermen and seamen transiting the ocean would typically have low visual sensitivity to the presence of the offshore facilities of New England Wind. These viewers would be engaged in activities associated with their jobs with minimal focus on the aesthetic character of their surroundings. Moreover, commercial mariners would be more

accustomed to the presence of industrial activities and ocean-going vessels within their day-to-day environment than other viewer types.

2.2.1 Public Reaction

Regardless of viewer group, public reaction to New England Wind is likely to be variable. Not all viewers see WTGs as having an adverse visual impact. A number of research studies examining the visual impacts of offshore and onshore wind energy developments indicate that wind power enjoys strong support among members of the public and, unlike most large-scale energy facilities, WTGs are, in some cases, viewed as a positive visual impact by significant portions of the public (BOEM, 2007).

While strong support for wind power development generally exists, local concerns relating to the aesthetics of planned wind facilities are not uncommon. The perceptions of visual impacts associated with wind energy development vary among potential viewers and may be positive or negative, can change over time, and, in some cases, possibly trend toward more positive perceptions after the installation of wind energy facilities (BOEM, 2007).

Warren et al. (2005) assessed pre- and post-development attitudes toward visual impacts associated with two onshore wind facilities in Ireland. Their survey found, for one location, that more than 90% of survey respondents supported the concept of wind power, but 66% of respondents were initially opposed to a local proposed wind facility. Contrary to expectations, individuals living closest to the onshore wind facility, who had originally opposed it on aesthetic grounds, actually increased their acceptance of the visual impacts after construction, with 62% regarding the visual impact as positive. Similar results were observed for a second onshore wind facility. The results in both cases suggest that familiarity with the wind facilities decreased aesthetic objections. Stated reasons for changing perceptions of visual impacts varied among respondents—some felt the WTGs were attractive while others felt that the actual impacts were less than had been anticipated (BOEM, 2007).

2.3 Circumstances of View

View duration affects perceived visual impacts. Impacts that are viewed for a long period of time are generally judged to be more severe than those viewed briefly (BOEM, 2007)., such as from a place of residence or employment. Sites of short-term exposure include locations where a stationary observer is only visiting, such as beaches or other coastal recreation areas. The duration of visual impact remains at the discretion of the individual observer; however, short-term impacts diminish with repeated observations by the same observer (i.e., people become accustomed to common views).

<u>Moving Views</u>—Moving views are those experienced in passing, such as from moving land-based or water-based vehicles and craft, where the time available for a viewer to cognitively experience a particular view is limited. Typically, such views apply to motorists proceeding at a high rate of speed along a defined path through highly complex stimuli.

Traveling at a slower speed over open water, recreational boaters and ferry travelers may have greater opportunities to cognitively experience their surroundings. For sailboats and very slow-moving motor craft, visual recognition may be similar to that described for stationary viewers. For reasons of safety, including avoidance of other vessels and surface flotsam, a boater may nevertheless still tend to focus more on the direction of travel rather than other directions.

3.0 OTHER FACTORS AFFECTING VISIBILITY OF NEW ENGLAND WIND

In the case of long-distance views, theoretical visibility typically exceeds actual visibility. In seascapes, atmospheric conditions reduce the practical viewing limit, sometimes significantly. The presence of waves will obscure objects very low on the horizon. The limits of human visual acuity reduce the ability of an observer to discern objects at great distances, suggesting that some WTG components (e.g., blades) would not be discernible. The color, reflectivity, and other visual characteristics of the object, and its contrast with the visual background under varying lighting conditions, also affect its visibility (BOEM, 2007).

3.1 Viewer Distance

3.1.1 Distance Zones

Viewer distance from an area is a key factor in determining the level of visual impact, with perceived impact generally diminishing as distance between the viewer and the affected area increases (BOEM, 2007).

Distance can be discussed in terms of pre-defined distance zones: foreground, mid-ground, and background. Each zone represents a set of visual conditions that are predictive of how an object will appear to change from zone to zone. The following description of each distance zone is provided to assist in understanding the effect of distance on potential visual impacts (BLM, 2013; Jones and Jones; 1977; Litton, 1968).

<u>Foreground (0 to 1/2 mi)</u>—At a foreground distance, viewers typically recognize a very high level of detail. Contrast and color intensity are at their greatest and human scale is an important cognitive factor in judging spatial relationships and the relative size of objects. Visual impact is likely to be considered the greatest at a foreground distance.

With the nearest coastal vantage point over 21.2 mi from any WTG, only boaters passing within very close proximity of the SWDA will view New England Wind from the foreground distance zone.

<u>Mid-ground (1/2 mi to 3–5 mi)</u>—At this distance, elements begin to visually merge or join. Colors, intensity, and textures become muted by distance, but are still identifiable. Visual detail is reduced, although distinct patterns may still be evident. Viewers at mid-ground distances typically recognize surface features such as tree stands, building clusters, and small landforms. Scale is perceived in terms of identifiable features of development patterns. From this distance, the contrast between color and texture is identified in terms of their regional context rather than their immediate surroundings.

<u>Background (3–5 mi to horizon)</u>—At this distance, landscape elements lose detail and become less distinct. Even on the clearest of days, the sky is not entirely transparent because of the presence of atmospheric particulate matter. As the distance between an observer and a visible object increases the light scattering effect of particulate matter causes a reduction in color intensity and contrast between light and dark. Contrast depends upon the position of the sun

and the reflectance of the object among other conditions. The net effect is that objects appear "washed out" over great distances; referred to as atmospheric perspective, this phenomena changes colors to blue-grays, while surface texture characteristics are lost, and only broad landforms are discernible. With atmospheric perspective, visual emphasis is on the outline or edge of one landmass or water resource against another with a strong skyline element (NYSDEC, 2000).

All land-based vantage points will view New England Wind from the far background distance zone.

3.1.2 Point of Visual Extinction

From the nearest coastal vantage points, WTGs in the SWDA will range from over 21.2 mi (Squibnocket Point, Martha's Vineyard) to 25.1 mi (Madaket, Nantucket). Viewing distances increase as viewers move up or down the coast on Martha's Vineyard and Nantucket.

As an observer moves farther and farther from an object, the smaller the object appears. Beyond a certain distance, depending upon the size and degree of contrast between the object and its surroundings, the object may not be a point of interest for most people. At this hypothetical distance it can be argued that the object has little impact on the composition of the landscape of which it is a tiny part. Eventually, at even greater distances, the naked eye is incapable of seeing the object at all (NYSDEC, 2000).

Sullivan, in *Offshore Wind Turbine Visibility and Visual Impact Threshold Distances* (2013), concludes small- to moderately sized facilities were visible to the unaided eye at distances greater than 26 mi, with WTG blade movement visible up to 24 mi. At night, aerial hazard navigation lighting was visible at distances greater than 24 mi. The observed wind facilities were judged to be a major focus of visual attention at distances of up to 10 mi, were noticeable to casual observers at distances of almost 18 mi, and were visible with extended or concentrated viewing at distances beyond 25 mi. While New England Wind is larger in scale than the projects evaluated by Sullivan, these findings provide additional perspective concerning the effect of distance on human visibility of offshore wind energy facilities and further support the conclusion that the maximum theoretical area of nacelle visibility (35.7 mi and 37.5 mi for Phase 1 and Phase 2 WTGs, respectively) used in this visual analysis is highly conservative.

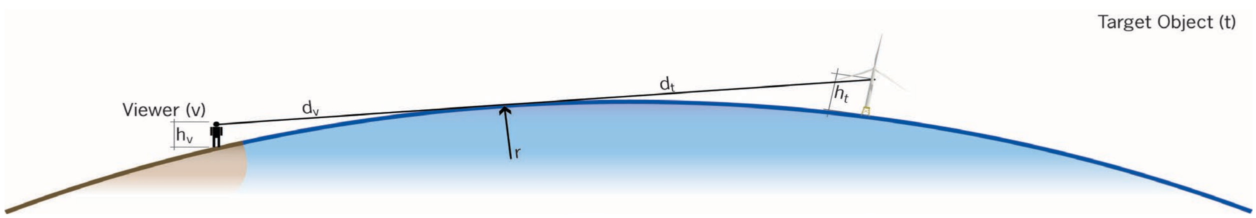
3.2 Curvature of the Earth

Due to the curvature of the earth's surface, objects viewed on the horizon are not seen in their entirety, because they begin to fall below the visible horizon. Therefore, as the distance from the viewing location to the object continues to increase, less of the object will be visible. The impact the earth's curvature has on views of objects on the horizon may be lessened by the refraction of light in the earth's atmosphere, which, at long distances, curves our line of sight downwards. As described below, the phenomenon of light refraction is based on a number of environmental factors that can affect the extent of distant visibility.

From all vantage points, New England Wind WTGs will be viewed over open water, as atmospheric conditions permit, at great distance (at or greater than 21.2 mi from any coastal vantage point for WTGs). At such extended distance, the curvature of the earth will affect the visibility of the offshore facilities in the SWDA. The degree of screening caused by earth curvature depends on the elevation of the viewer above sea level (denoted as "asl" in the below) and the distance of the viewer from the proposed object.

The degree of visibility above the visible horizon for any object can be geometrically calculated using the Pythagorean Theorem ($a^2+b^2=c^2$). The distance that the target object will become visible above the horizon from a known vantage point is the sum of the distance between from the viewer location to the visible horizon and the distance from the target object to the visible horizon.

Figure 6 – Geometric Horizon Diagram



The distance to the geometric horizon from any point is calculated as follows:

From the Pythagorean theorem:	Where:
$r^2+d^2=(r+h)^2$,	d=distance to horizon;
Simplifying;	h=elevation (asl) of viewer (eye level) or target object; and
d = square root of (h^2+2hr)	r=radius of the earth (3,963 miles = 20,924,640 ft)

The sightline distance between viewer (v) and target object (t) = dv+dt

<u>Atmospheric Refraction</u>—The distance to the optical horizon is slightly greater than the simple geometric calculation because the atmosphere bends light around the earth (atmospheric refraction) allowing a viewer to see farther. The exact amount of bending depends on several variables, including elevation and the composition of the atmosphere (which varies with location, weather, etc.). A commonly accepted rule of thumb is that the optical horizon is calculated by multiplying the radius of the earth by a factor of 1.088 in the above formula to adjust for this optical effect (BOEM, 2015).

All calculations used in this VIA include a coefficient of refraction of 1.088 to account for atmospheric refraction.

Table 3 below provides calculations for the extent to which the Phase 1 and Phase 2 WTGs would fall below the visible horizon at different distances and viewer elevations.

Due to distance (at or greater than 21.2 mi to the nearest WTG), there is no land-based vantage point that will view an entire WTG or ESP. Some portion of the structures will always fall below the visible horizon. Because atmospheric conditions reduce visibility, sometimes significantly, and the presence of waves obscure objects very low on the horizon, maximum theoretical viewing distances typically exceed what is experienced in reality. Furthermore, limits to human visual acuity reduce the ability to discern objects at great distances, suggesting that a WTG or ESP may not be discernible at the maximum distances, although they theoretically would be visible (BOEM, 2007).

Table 3 – Portion of Hypothetical Phase 1 and Phase 2 (1,171 ft Blade Tip) WTG Visible Above Horizon (ft)

Eye Level Elev. (ft)	Distance (mi)																															
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
6	1017	997	975	953	929	904	878	851	822	792	761	729	695	660	624	587	549	509	468	426	383	338	292	245	197	147	97	45					
10	1034	1015	995	974	951	927	902	876	848	819	789	758	726	692	657	621	584	545	505	464	422	379	334	288	241	192	143	92	40				
15	1050	1032	1013	993	971	949	925	900	873	846	817	787	755	723	689	654	618	580	542	502	460	418	375	330	284	236	188	138	87	35			
20	1063	1046	1028	1009	988	966	943	919	893	867	839	810	779	748	715	681	645	609	571	532	492	451	408	364	319	273	225	176	126	75	23		
25	1074	1058	1040	1022	1002	981	959	935	911	885	858	829	800	769	737	704	669	634	597	559	519	479	437	394	350	304	257	209	160	110	58	5	
30	1083	1068	1051	1033	1014	994	973	950	926	901	874	847	818	788	757	724	691	656	619	582	543	504	463	420	377	332	286	239	190	141	90	38	
35	1091	1076	1060	1043	1025	1006	985	963	940	915	889	863	834	805	774	743	710	675	640	603	565	526	486	444	401	357	312	265	218	169	119	67	14
40	1098	1084	1069	1052	1035	1016	996	974	952	928	903	877	849	820	791	759	727	693	659	622	585	547	507	466	424	380	336	290	243	194	145	94	42
45	1105	1091	1077	1061	1044	1025	1006	985	963	940	915	890	863	835	805	775	743	710	676	640	604	566	527	486	445	402	358	312	266	218	169	119	68
50	1110	1098	1083	1068	1052	1034	1015	995	973	951	927	902	875	848	819	789	758	725	692	657	621	583	545	505	464	422	378	334	288	241	192	143	92
55	1116	1103	1090	1075	1059	1042	1023	1004	983	961	938	913	887	860	832	803	772	740	707	672	637	600	562	523	482	441	398	353	308	261	214	165	114
60	1120	1109	1096	1081	1066	1049	1031	1012	992	970	947	923	898	872	844	815	785	754	721	687	652	616	578	539	499	458	416	372	327	281	234	185	136
65	1125	1114	1101	1087	1072	1056	1039	1020	1000	979	957	933	909	883	855	827	797	766	734	701	666	631	593	555	516	475	433	390	346	300	253	205	156
70	1129	1118	1106	1093	1078	1063	1046	1028	1008	988	966	943	918	893	866	838	809	779	747	714	680	645	608	570	531	491	450	407	363	318	272	224	175
75	1133	1122	1111	1098	1084	1069	1052	1034	1016	995	974	951	928	903	876	849	820	790	759	726	693	658	622	585	546	506	465	423	380	335	289	242	194
80	1136	1126	1115	1103	1089	1074	1058	1041	1023	1003	982	960	936	912	886	859	831	801	770	738	705	671	635	598	560	521	480	439	396	351	306	259	211
85	1139	1130	1119	1107	1094	1080	1064	1047	1029	1010	989	968	945	921	895	869	841	812	781	750	717	683	648	611	574	535	495	453	411	367	322	276	228
90	1142	1133	1123	1111	1099	1085	1070	1053	1035	1017	997	975	953	929	904	878	850	822	792	761	728	695	660	624	587	548	509	468	425	382	337	292	245
95	1145	1136	1126	1115	1103	1089	1075	1059	1041	1023	1003	982	960	937	912	887	860	831	802	771	739	706	672	636	599	561	522	481	440	397	352	307	260
100	1147	1139	1130	1119	1107	1094	1080	1064	1047	1029	1010	989	968	945	920	895	868	841	811	781	750	717	683	648	611	574	535	495	453	411	367	322	276
105	1150	1142	1133	1123	1111	1098	1084	1069	1053	1035	1016	996	975	952	928	903	877	849	821	791	760	727	694	659	623	586	547	507	466	424	381	336	290
110	1152	1145	1136	1126	1115	1102	1089	1074	1058	1041	1022	1002	981	959	936	911	885	858	830	800	769	737	704	670	634	597	559	520	479	437	394	350	305
115	1154	1147	1139	1129	1118	1106	1093	1078	1063	1046	1028	1008	988	966	943	919	893	866	838	809	779	747	714	680	645	608	571	532	491	450	407	363	318
120	1156	1149	1141	1132	1122	1110	1097	1083	1068	1051	1033	1014	994	972	950	926	901	874	847	818	788	757	724	690	655	619	582	543	503	462	420	377	332
125	1158	1151	1144	1135	1125	1113	1101	1087	1072	1056	1038	1020	1000	979	956	933	908	882	855	826	797	766	734	700	666	630	593	555	515	474	432	389	345
130	1159	1153	1146	1137	1128	1117	1104	1091	1076	1061	1044	1025	1006	985	963	940	915	890	863	835	805	775	743	710	676	640	603	566	526	486	444	402	358

Nacelle Top (725 ft) visible above horizon

Nacelle Top (725 ft) falls below horizon

3.3 Meteorological Visibility

Visibility can be reduced by fog, rain, snow, particulate matter, smog, or any combination of thereof as part of normal atmospheric conditions. To evaluate the effect of atmospheric conditions on views of New England Wind from Martha's Vineyard and Nantucket, a meteorological study was conducted that identifies common weather conditions and assesses visibility within the proposed ZVI. This meteorological analysis is included as Appendix D.

Visibility measurements from meteorological stations measure the "the greatest distance at which an observer can just see a black object viewed against the horizon sky" and are typically recorded in intervals ranging from ¼ to 10 statute miles (see Appendix D). Visibility was measured and recorded on a 1-minute basis, averaged across hours, and then binned to the following categories: less than ¼ mile, ¼ mile, ½ mile, ¾ mile, 1 mile, 1¼ miles, 1½ miles, 1¾ miles, 2 miles, 2½ miles, 3 miles, 3½ miles, 4 miles, 5 miles, 7 miles, and 10 miles or greater for the hourly reports. As shown in Table 4, analysis of the hourly data indicates majority of the hours yielded a visibility of 10 miles or greater.

Table 4 – Frequency of Reported and Truncated Visibility Ranges

	Less than 10 miles (percent)				10 miles or greater (percent)			
	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall
Martha's Vineyard	21%	24%	30%	20%	79%	76%	70%	80%
Nantucket	30%	34%	39%	26%	70%	66%	61%	74%

Based on the analysis reported in Table 4, approximately 70% of the hours reported visibility as 10 miles or greater. Because of this, visibility must be calculated directly to determine average visibility, the distribution of visibility, and maximum visibility using currently available data. To fill this data gap, daily typical visibility ranges and potential maximum and average visibility across seasons were calculated. Martha's Vineyard and Nantucket both report data on an hourly and minute basis for general weather observations.

This analysis focuses on the meteorological variables which affect visibility the most and does not equate to actual visibility of the wind turbines or associated structures. While meteorology will impact the ability of an observer to see the wind turbines or associated structures factors such as turbine color, scale, movement, distance, and observer geometry are also other critical considerations. For example:

- At 21.2 mi or greater from shore there is no land-based vantage point that will view an entire WTG. Some portion of each of the structures will always fall below the visible horizon, and the presence of waves further reduces the portion of structures visible.

Importantly, the Proponent's proposed actions will substantially mitigate the visibility of the ocean elements.

- Subject to approval from BOEM and the Federal Aviation Administration (FAA), it is expected that an Aircraft Detection Lighting System (ADLS) that automatically activates all aviation obstruction lights when aircraft approach the Phase 1 WTGs will be used. For Phase 2, it is expected that the same or similar approach as Phase 1 will be used to reduce lighting, including the use of an ADLS. The use of ADLS will reduce nighttime lighting and thus, minimize nighttime visibility of the ocean-based elements of New England Wind. Such a lighting system will only be activated a tiny fraction of the time (estimated at less than 1 hour/year). Accordingly, nighttime lighting will be almost eliminated, and in the absence of lighting, New England Wind will not be visible from shore at night.
- In accordance with FAA Advisory Circular 70/7460-1M, the WTGs will be painted no lighter than RAL 9010 Pure White and no darker than RAL 7035 Light Grey; however, it is anticipated that the WTGs will be painted off-white/light grey to blend into the horizon. The off-white/light grey color will reduce contrast with the sea and sky and thus minimize daytime visibility of the ocean-based elements of New England Wind. The conservative threshold for visibility is “the greatest distance at which an observer can just see a black object viewed against the horizon sky”. The WTGs will not be black; instead, the neutral off-white/light grey color will be highly compatible with the hue, saturation, and brightness of the background sky. This lack of contrast between the structures and the background means that the percentage of the time the structures might be visible is greatly reduced.

To account for the reduction in nighttime lighting Table 5 provides a breakdown of the airport-reported visibility during daytime and nighttime hours.

Table 5 – Frequency of Reported Visibility Ranges from Martha’s Vineyard and Nantucket Airports (Not Equivalent to Visibility of New England Wind from the Shoreline)

Percentage of Time Airport Visibility is 10 Statute Miles or Greater						
Location	Time	Winter	Spring	Summer	Fall	Annual
Martha's Vineyard Airport	Day	80%	80%	77%	83%	80%
	Night*	0%	0%	0%	0%	0%
	Total**	37%	47%	45%	38%	42%
Nantucket Airport	Day	71%	69%	66%	75%	70%
	Night*	0%	0%	0%	0%	0%
	Total**	33%	41%	38%	35%	37%

* Unlit objects will not be visible at >10 miles at night. The use of ADLS reduces expected nighttime lighting to less than 1 hour/year, which is <0.1% of annual nighttime hours and is rounded to 0% in this table.

** Seasonal results adjusted to reflect daylight hours.

However, for the reasons discussed above, the percentages in Table 5 should not be taken as times when New England Wind structures will be visible.

BOEM addressed one key limitation of the airport data – the fact that airports do not report visibility greater than 10 statute miles – in OCS Study BOEM 2017-037 “Visualization

Simulations for Offshore Massachusetts and Rhode Island Wind Energy Area - Meteorological Report." In Section 4.2 of that study, BOEM presents a method to calculate visibility distances past 10 statute miles using relative humidity data. BOEM developed the method by performing a regression analysis of Martha's Vineyard visibility and relative humidity observations.

Table 6 below applies the methodology from the BOEM study to Martha's Vineyard and Nantucket airport data. For Martha's Vineyard, Table 6 shows the amount of time WTG/ESP visibility is greater than or equal to 25.5 miles (the distance from Gay Head Lighthouse to the closest New England Wind WTG/ESP). For Nantucket, Table 6 shows the amount of time visibility is greater than 24.4 miles (the closest distance from the Nantucket Historic District to the closest New England Wind WTG/ESP).[5]

Table 6 – WTG/ESP Visibility Estimates using Algorithm in BOEM 2017-037

Percentage of Time Visibility is 24.4 Statute Miles or Greater for Nantucket, 25.5 Statute Miles or Greater for Martha's Vineyard using BOEM Methodology						
Location	Time	Winter	Spring	Summer	Fall	Annual
Martha's Vineyard (Gay Head Lighthouse)	Day	44%	42%	26%	35%	36%
	Night*	0%	0%	0%	0%	0%
	Total**	18%	24%	15%	15%	18%
Nantucket Historic District***	Day	37%	29%	16%	31%	27%
	Night*	0%	0%	0%	0%	0%
	Total**	16%	17%	9%	13%	14%

*Unlit objects will not be visible at >10 miles at night. The use of ADLS reduces expected nighttime lighting to less than 1 hour/year, which is less than 0.1% of annual nighttime hours and is rounded to 0% in this table.

** Seasonal results adjusted to reflect daylight hours.

***This distance is measured using the Nantucket Historic District boundary from the MassGIS Data: Massachusetts Historical commission (MHC) Historic Inventory. This boundary extends slightly offshore and thus, is not coincident with the shoreline of Nantucket.

Table 6 shows that, on average for all conditions, New England Wind WTGs/ESP(s) might be visible 18% of the time from Gay Head Lighthouse and might be visible 14% of the time from the closest location to the Nantucket Historic District. Again, because of sea spray, low-contrast paint color, and other factors, the actual amount of time structures would be visible is lower.

The methodology used by BOEM in the "Visualization Simulations for Offshore Massachusetts and Rhode Island Wind Energy Area - Meteorological Report" was used in Appendix D to describe visibility of New England Wind at the Gay Head Lighthouse at Martha's Vineyard and at the closest location to the Nantucket Historic District to determine the hourly visibility distances, and the distribution of visibility distances on an annual, seasonal, and day/night basis. As reported in Table 6, average daytime visibility for WTGs/ESP(s) at both locations is highest in the winter and lowest in the summer. Based on the results of this meteorological

[5] The Nantucket Historic District boundary is from the MassGIS Data: Massachusetts Historical commission (MHC) Historic Inventory. This boundary extends slightly offshore and thus, is not coincident with the shoreline of Nantucket.

assessment, due to atmospheric conditions New England Wind WTGs/ESP(s) will not be visible approximately 82% of the time from Gay Head Lighthouse at Martha's Vineyard and approximately 86% of the time from the closest location in the Nantucket Historic District.

Additionally, different factors affect visibility, including air quality, sea spray and salts over the ocean’s surface, and the angle of the sun. The presence of sea spray and salts affects visibility but is not likely captured by the measurements. Additionally, the WTGs will be painted using an off-white/light grey color, which will reduce the contrast with the sea and sky and thus minimize daytime visibility of the ocean-based elements of New England Wind. Therefore, calculated visibility should be considered conservative since they do not account for these light-reducing factors.

Based on the analysis described above, the structures will not be visible most of the time for viewers along the Martha’s Vineyard and Nantucket coastlines.

4.0 VISUALLY SENSITIVE RESOURCES

The scenic and aesthetic values of coastal areas play an important role in attracting visitors. Martha's Vineyard and Nantucket are both well-known tourist locations. Recreation and tourism-related industries provide almost one quarter of the employment and wages in Nantucket and Dukes Counties, which include Nantucket and Martha's Vineyard, respectively.

A mix of public, private, and residential beaches are located on Martha's Vineyard and Nantucket. Martha's Vineyard has 19 beaches: 14 are public, four are for town residents only, and one is off limits. Seven of these beaches are on the south side of Martha's Vineyard looking towards the SWDA. Nantucket has 10 public beaches, four of which are on the south side of the island looking towards the SWDA. Both Martha's Vineyard and Nantucket have walking and biking paths accessible to the public along the southern coasts of the islands.

There are five lighthouses on Martha's Vineyard, but only one is on the southern side of the island, the Gay Head Lighthouse, which is open to the public. Of the three lighthouses on Nantucket, none are on the south side of the island. Resorts, a golf course (near Miacomet on Nantucket), and natural areas on the southern coast of Nantucket and Martha's Vineyard have open views to the ocean (BOEM, 2014).

As a practical reality, the entire oceanfront within the maximum theoretical area of nacelle visibility is highly scenic and of great aesthetic importance to the social, cultural, and economic well-being of the region. For the purpose of this visual resource assessment, all public places with ocean views are considered to be of significance. This notwithstanding, man-made development is a common aspect of the visual landscape. Residential homes, commercial establishments, roads, above ground utility infrastructure, recreational and commercial marine uses, and other built features are readily apparent in most views.

An inventory of visually sensitive resources is found in New England Wind - Historic Properties Visual Impact Assessment (COP Appendix III-H.b).

4.1 Selection of Key Observation Points

Although the possibility of views of New England Wind exists throughout the oceanfront area, key observation points (KOPs) were selected from which more detailed analyses were conducted. Selected KOPs are listed in Table 7 – Summary of Key Observation Points Selected for Photo Simulation .

To show anticipated visual changes associated with New England Wind, high resolution computer enhanced image processing was used to create realistic daytime photographic simulations of the completed offshore facilities from eight KOPs on Martha's Vineyard and Nantucket. Locations of the KOPs selected for visual simulations are shown on Figure 7.

Table 7 – Summary of Key Observation Points Selected for Photo Simulation

Map ID	Name	Municipality	Resource Type	Landscape Unit	Viewer Groups	Distance Zone	Distance to nearest WTG	View Orientation
1	Aquinnah Cultural Center	Aquinnah	National Natural Landmark, National Register of Historic Places	Coastal Bluffs	Tourists, Vacationers,	Background	25.4 mi	Southeast
2	Long Point Beach	West Tisbury	Wildlife Refuge, Recreation, and Historic Resources	Ocean Beach, Coastal Dunes, Salt Pond/Tidal Marsh	Residents, Vacationers, Recreational	Background	22.8 mi	Southeast
3	South Beach	Edgartown	Recreation	Ocean Beach Coastal Dunes	Residents, Vacationers, Tourists, Recreational	Background	23.1 mi	South
4	Wasque Reservation	Edgartown	Recreation, Open Space Conservation	Ocean Bluffs, Coastal Bluffs, Forest	Vacationers, Recreational	Background	24.1 mi	South
5	Madaket Beach	Nantucket	Recreation, Historic Resources	Ocean Beach, Coastal Dunes Shoreline Residential	Residents Vacationers, Recreational	Background	25.1 mi	Southwest
6	Miacomet Beach and Pond	Nantucket	Recreation, Historic Resources	Ocean Beach, Coastal Dunes, Salt Pond/Tidal Marsh	Residents, Vacationers, Recreational	Background	26.8 mi	West-Southwest
7	Bartlett's Farm	Nantucket	Historic Resources	Agriculture/Open Field	Residents, Tourists, Vacationers	Background	26.9 mi	West-Southwest
8	Tom Nevers Field	Nantucket	Recreation	Coastal Bluffs, Coastal Scrub Maintained Recreation	Residents, Vacationers, Recreational	Background	30.9 mi	West-Southwest

4.1.1 Supplemental Visually Sensitive Resources

The Visual Impact Assessment prepared for Vineyard Wind 1 (also referred to as 501 North) (See Vineyard Wind 1 COP Volume III, Appendix III-H.a) evaluated 20 KOPs. For the purpose of this VIA, the number of evaluated KOPs was reduced to eight. The reason for this reduction is because many of the Vineyard Wind 1 KOPs have similar views, landscape units, viewer groups, and distances to the nearest WTG (e.g., Miacomet Beach and Pond and Nobadeer Beach Pond Road). The analyses done for Vineyard Wind 1 showed that additional KOPs and photo simulations do not diversify the assessment or assist in drawing conclusions due to the similarities in results. For that reason, the number of KOPs were reduced for New England Wind to simplify the analysis and eliminate redundancy.

Additionally, several KOPs assessed as part of the Vineyard Wind 1 VIA were not included in this VIA where New England Wind WTGs would not be visible due to increased distance or visual obstruction (e.g., vegetation).

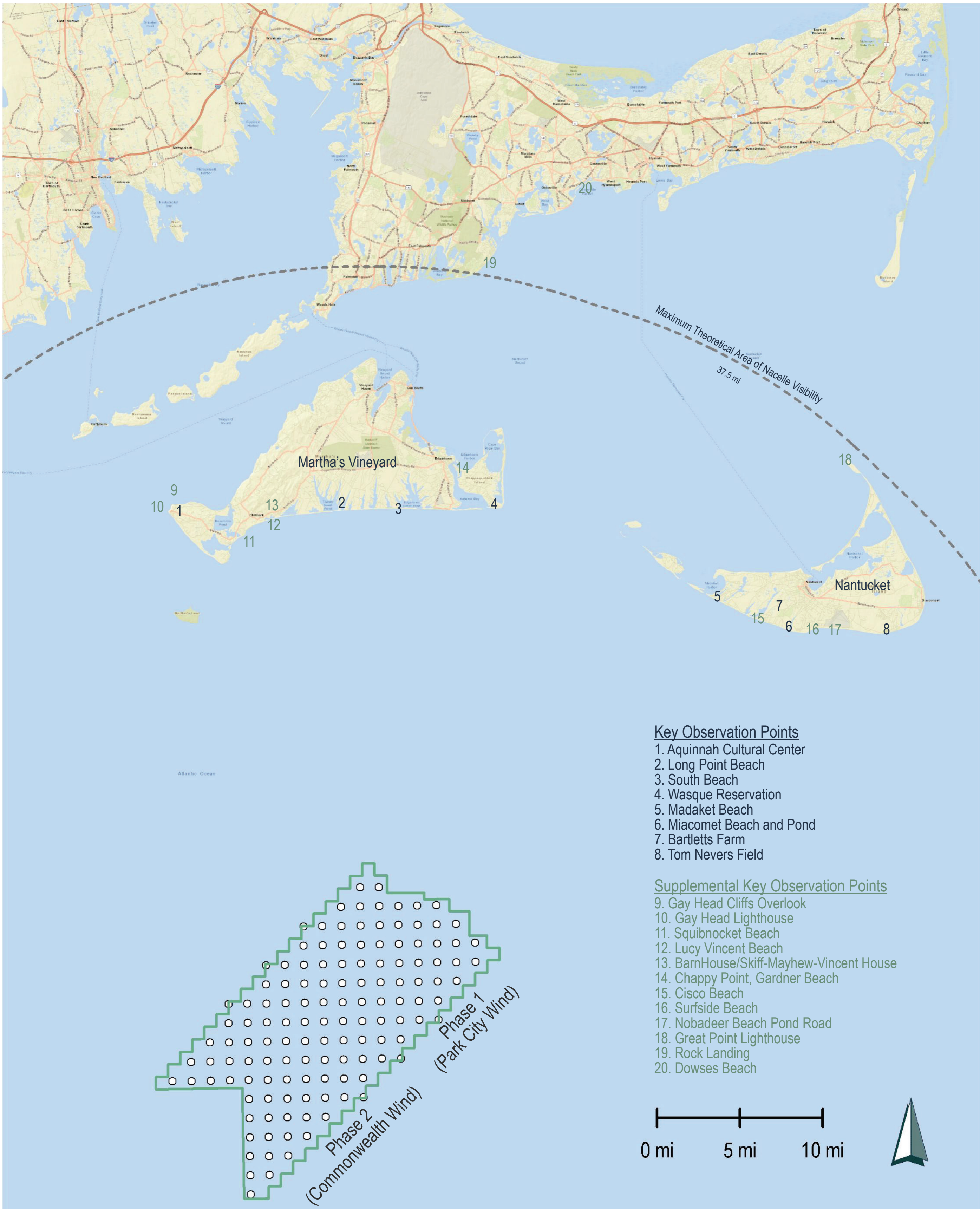
Table 8 lists the additional 12 KOPs evaluated in the Vineyard Wind 1 VIA and summarizes the potential New England Wind visibility and visual characteristics of each. Table 8 also provides a reference to a New England Wind simulation that best represents the visual condition from each supplemental Vineyard Wind 1 KOP. The 12 KOPs evaluated as part of the Vineyard Wind 1 VIA are also displayed on Figure 7.

Table 8 - Summary of Supplemental Key Observation Points

Map ID	Name	Municipality	Resource Type	Landscape Unit	Viewer Groups	Distance Zone	Distance to nearest WTG	View Orientation	Similar New England Wind KOP for Reference (Appendix B):
Supplemental KOPs from Vineyard Wind 1 VIA									
9	Gay Head Cliffs Overlook	Aquinnah	NNL NRHP	Coastal Bluffs	Tourists, Vacationers	Background	25.5mi	Southeast	Map ID 1: Aquinnah Cultural Center (refer to Figures B-1a to g)
10	Gay Head Lighthouse	Aquinnah	NNL NRHP	Coastal Bluffs	Tourists, Vacationers,	Background	25.5mi	Southeast	Map ID 1: Aquinnah Cultural Center (refer to Figures B-1a to g)
11	Squibnocket Beach	Aquinnah	Recreation, Historic Resources	Ocean Beach	Residents, Vacationers, Recreational	Background	21.2mi	Southeast	Map ID 2: Long Point Beach (refer to Figures B-2a to e) and Map ID 3: South Beach (refer to Figures B-3a to g)
12	Lucy Vincent Beach	Chilmark	Recreation, Historic Resources	Ocean Beach, Coastal Dunes	Residents, Vacationers, Recreational	Background	22.9mi	Southeast	Map ID 2: Long Point Beach (refer to Figures B-2a to e) and Map ID 3: South Beach (refer to Figures B-3a to g)
13	Barn House/Skiff-Mayhew-Vincent House	Chilmark	NRHP	Agricultural/Open Field	Residents Tourists	Background	23.1mi	Southeast	Map ID 7: Bartletts Farm (refer to Figures B-7a to c). 106 of 130 New England Wind WTGs are screened by foreground vegetation from this location.
14	Chappy Point, Gardner Beach	Chappaquiddick	Recreation, Near NRHP District	Village/Town Center	Residents, Tourists, Vacationers, Recreational	Background	26.3mi	South	New England Wind is not visible from this location. View of all WTGs/ESP(s) is screened by foreground landform and vegetation.
15	Cisco Beach	Nantucket	Recreation	Ocean Beach, Coastal Dunes, Salt Pond/Tidal Marsh	Residents, Vacationers, Recreational	Background	26.0mi	Southwest	Map ID 5: Madaket Beach (refer to Figures B-5a to e) and Map ID 6: Miacomet Beach and Pond (refer to Figures B-6a to g)
16	Surfside Beach	Nantucket	Recreation, Historic Resources	Ocean Beach, Coastal Dunes	Residents, Vacationers, Recreational	Background	28.0mi	West Southwest	Map ID 6: Miacomet Beach and Pond (refer to Figures B-6a to g)
17	Nobadeer Beach Pond Road	Nantucket	Recreation, Historic Resources	Ocean Beach, Coastal Dunes	Residents, Vacationers, Recreational	Background	28.4mi	West Southwest	Map ID 6: Miacomet Beach and Pond (refer to Figures B-6a to g)
18	Great Point Lighthouse	Nantucket	NRHP, Recreation	Ocean Beach, Coastal Dunes	Tourists, Vacationers, Recreational	Background	36.5mi	Southwest	Great Point at the northernmost point on Nantucket is beyond the maximum theoretical area of nacelle visibility. From this location blade tips only would be visible above the horizon at a distance of 36.5 miles from beach elevation.

Table 8 - Summary of Supplemental Key Observation Points

Map ID	Name	Municipality	Resource Type	Landscape Unit	Viewer Groups	Distance Zone	Distance to nearest WTG	View Orientation	Similar New England Wind KOP for Reference (Appendix B):
19	Rock Landing	Mashpee	Recreation, NRHP	Ocean Beach, Coastal Bluffs	Residents, Vacationers, Recreational	Background	38.1mi	South	Rock Landing on mainland Cape Cod is beyond the maximum theoretical area of nacelle visibility. From this location blade tips only would be visible above the horizon at a distance of 38.1 miles from beach elevation.
20	Dowses Beach	Barnstable	Recreation, NRHP	Ocean Beach, Coastal Dunes	Residents, Vacationers, Recreational	Background	43.4mi	South	Dowses Beach on mainland Cape Cod is beyond the maximum theoretical area of nacelle visibility. From this location blade tips only would be visible above the horizon at a distance of 43.4 miles from beach elevation.



NEW ENGLAND WIND

FIGURE 7
KEY OBSERVATION POINT (KOP) LOCATION MAP

SARATOGA ASSOCIATES

4.2 Baseline Photography

Between October 17 and 21, 2017 (inclusive), a visual analyst visited a number of coastal locations, including the eight KOPs, to document existing visibility in the direction of Lease Area OCS-A 0501 and OCS-A 0534. Supplemental photos were also taken on May 13, 2020 at the Aquinnah Cultural Center on Martha's Vineyard. All photographs were taken at a high megapixel resolution in uncompressed "RAW" format using a tripod mounted digital SLR camera (a 35-millimeter (mm) sensor [full frame]). A 50mm (full frame) "normal" lens was used to most closely approximate human perception of spatial relationships and scale in the landscape.

At each location, single frame photographs were taken in the direction of the SWDA. A series of overlapping photographs were also taken for development of panoramic scenes. Panoramic photos were taken using a robotic tripod head and capture a scene measuring a minimum of 124 degrees horizontally by 55 degrees vertically.

The location selected for each photograph was judged by the visual analyst to be the most unobstructed and representative line-of-sight to the SWDA from the subject resource. Effort was made to take photographs in a front- or side-lit conditions to maximize visual contrast while also capturing a variety of lighting conditions. Due to the prevailing southerly exposure, some photographs were taken under front-lit conditions. These conditions accurately represent variations in lighting conditions that will be commonly experienced at coastal locations at different times of day.

The precise coordinates of each photo location were recorded in the field using a handheld Global Positioning System (GPS) unit with sub-meter accuracy. The direction to the center of the SWDA was determined using the handheld GPS. Survey flags were placed along the identified bearing marking SWDA field so that the camera could be accurately aimed to capture the full spread of the SWDA photo field-of-view.

4.3 Photographic Simulations

A photo simulation of offshore facilities of New England Wind was prepared from each of the eight locations identified in Table 7 – Summary of Key Observation Points Selected for Photo Simulation . Locations of these KOPs are shown on Figure 7. Photo simulations were developed by superimposing a rendering of a 3-D computer model of New England Wind into a base photograph taken from each corresponding location. The 3-D computer model for the simulations is based on the New England Wind maximum impact scenario described in Section 1.1.4 above. The model was developed using *Autodesk Civil 3D®* and *3D Studio Max Design® software* (3-D Studio Max).

Simulated perspectives (camera views) were then matched to the corresponding base photograph for each simulated view by replicating the precise coordinates of the field camera position (as recorded by GPS) and the focal length of the camera lens used (e.g., 50mm). Precisely matching these parameters assures scale accuracy between the base photograph and the subsequent simulated view. The camera's target position is set to match the bearing of the corresponding existing condition photograph. With the existing conditions photograph displayed as a "viewport background", and the viewport properties set to match the photograph pixel dimensions, minor camera adjustments were made (horizontal and vertical positioning, and camera roll) to align the horizon in the background photograph with the corresponding features of the 3-D model.

To verify the camera alignment, the GPS coordinates of the survey flags placed in the field to identify the bearing to the center and left/right margins of the SWDA were imported into the 3-D model. A 3-D terrain model was also created (using Digital Elevation Model data) to replicate the existing site topography. The bearing of the 3-D model camera target was then rotated so that the survey flags visible in the baseline photo aligned with GPS points visible in the 3-D model.

Once the camera alignment was verified, a to-scale 3-D model of New England Wind was merged into the model space. Because the exact WTG model has not been determined at the time of this VIA, a hypothetical model was prepared for each Phase of New England Wind, using the maximum WTG size included in each Phase (See Section 1.1.1). The 3-D model of the WTGs and ESPs is intended to accurately convey the current design intent. To the extent practicable, and to the extent necessary to reveal impacts, design details of the proposed WTGs were built into the 3-D model and incorporated into the photo simulation. Consequently, the scale, alignment, elevations, and location of the visible elements of the proposed facilities are true to the conceptual design.

Because of the extreme distances at which the New England Wind WTGs will be viewed, development of photo simulations must account for earth curvature and atmospheric refraction. To address this issue, a spherical surface equal to 1.088 times the radius of the earth was created in 3-D Studio Max. All WTG model units were snapped to this surface for each specific camera view.

4.3.1 Daytime Simulations

With the model in place, a daylight system was then created based on the date and time of the photograph; inputs such as time zone and location were also applied to the daylight system. To accurately depict "reflected light," the spherical earth surface model element was assigned a gray-blue color allowing upward light refraction to affect the rendering model elements.

The rendered view was then imported into the baseline photo in Adobe Photoshop software for overlay. In addition, minor adjustments were made to the WTG and ESP color and contrast to match the lighting conditions of the baseline so that the final rendering appears as realistic as possible. Daytime Simulations are provided in Appendix B.

4.3.2 Atmospheric Condition Simulations

Recognizing that atmospheric conditions are not always clear, supplemental photos simulations were prepared for three KOPS illustrating the effect of reduced visibility under varying degrees of fog, haze, and/or marine conditions that may obscure distant views. These supplemental visualizations approximate a moderate and heavy haze condition. Atmospheric condition simulations are provided in Appendix B.

4.3.3 Vineyard Wind 1 and New England Wind Cumulative Simulations

The visual impact of Vineyard Wind 1 was previously evaluated in detail in Appendix III-H.a of the COP for Vineyard Wind 1, most recently submitted on June 3, 2020. Appendix III-H.a of the Vineyard Wind 1 COP includes a Visual Impact Assessment and a Visual Impact Assessment Addendum. Because Vineyard Wind 1 will likely be constructed prior to New England Wind, photo simulations illustrating both wind development areas together (i.e., the full buildout of Vineyard Wind 1 and both Phases of New England Wind) are also provided in Appendix B. For the photo simulations in Appendix B, all WTGs used to represent Vineyard Wind 1 are shown at 837 ft tall, all WTGs used to represent New England Wind Phase 1 and 2 are shown at are shown at 1,171 ft tall.

4.3.4 Panoramic Simulations

New England Wind occupies one of nine offshore wind energy lease areas in the Massachusetts/Rhode Island Wind Energy Area. As requested by BOEM, cumulative simulations are being developed to show the foreseeable future condition as these projects are built out. Additional details will be provided when the cumulative simulations are finalized.

4.3.5 Viewing Photo Simulations

Arm's Length Rule—The single frame photo simulations included in Appendix B have been formatted to be printed on an 11 x 17-inch page format. At this image size, the page should be held at approximately arm's length[6] so that the scene appears at the correct scale. Viewing the image closer would make the scene appear too large and viewing the image from a greater distance would make the scene appear too small compared to what an observer would actually see in the field.

For viewing photo simulations at other page sizes (i.e., computer monitor[7], projected image, or other hard copy output) the viewing distance/page width ratio is approximately 1.5/1. For example, if the simulation were viewed on a 42-inch-wide poster size enlargement, the correct viewing distance would be approximately 63 inches (5.25 ft).

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[6] Viewing distance is calculated based a 39.6 degree field-of-view for the 50mm camera lens used, and the 15.5-inches-wide image presented in Appendix A. "Arm's length" is assumed to be approximately 22.5 inches from the eye. Arm lengths vary for individual viewers.

[7] This assessment was developed by viewing the simulations from a computer monitor.

Panoramic simulations included in Appendix C are provided as reference to illustrate the complete visual context of the viewpoint. At 11 x 17-inch page format, the images cannot be viewed at a scale that represents a correct scale relative to normal human eyesight. These images should be printed at 73 x 38 inches and viewed at 20 inches for the scene to appear at the correct scale.

Monitor Calibration—Uncalibrated computer monitors vary in brightness, contrast, and color. Photo simulations were finalized using a color calibrated monitor. When viewing these simulations, digital monitor calibration is recommended to assure images appear with the intended brightness, contrast, and color clarity.

Field Viewing—The photo simulations present an accurate depiction of the appearance of proposed WTGs/ESP(s) suitable to provide a general understanding of how much of New England Wind may be visible, as well as the character of its visibility. However, these images are a two-dimensional representation of a 3-D landscape, and the human eye is capable of recognizing a greater level of detail than can be illustrated in a two-dimensional image. Decision makers and interested parties may benefit from viewing the photo simulations in the field from any or all of the simulated resources. In this manner, observers can directly compare the level of detail visible in the base photograph with actual field observed conditions.

5.0 POTENTIAL VISUAL IMPACTS OF NEW ENGLAND WIND

5.1 Construction and Installation[8]

Visual impact during construction and installation would be limited to partially built WTGs and ESP(s) and vessels working out in the Atlantic Ocean that are travelling back and forth between mainland ports. Construction of the WTGs and ESP(s) may require use of jack-up barges with mobile cranes and other large construction vessels. Structural components may be delivered via large watercraft. Construction-related visual impacts will be relatively brief and are not expected to result in adverse prolonged visual impact.

The larger construction vessels would be a visible feature within the maximum theoretical area of nacelle visibility. Construction is expected to occur during daylight hours, but nighttime activity may also occur. Construction vessels would have nighttime lights in accordance with USCG regulations. During dawn and dusk periods, particularly on cloudy days, work lights may be required for worker safety as well as to improve visibility on construction vessels. Work lights are generally downward directed and would not typically be oriented horizontally where visibility on shore would be increased.

Visual impact associated with construction and installation operations, in general, would be minor as construction equipment would only be in use temporarily during the construction and decommissioning periods.

5.2 Operations and Maintenance

New England Wind (excluding the two separate aliquots closer to shore) is located more than 21.2 mi from the nearest vantage point on land, thus its offshore facilities would appear in the far background distance zone. In this area, objects appear smaller than in the foreground or mid-ground distance zones. In the background distance zone, landscape elements lose detail and become less distinct. Atmospheric perspective changes colors to blue-grays, while surface texture characteristics are lost. As an observer moves farther and farther from an object, the smaller the object appears. Beyond a certain distance, depending upon the size and degree of contrast between the object and its surroundings, the object may not be a point of interest for most people. At distances at or beyond 21.2 mi (i.e., at distances at or beyond the closest land vantage point to any New England Wind WTG), visibility is diminished: blade tip movement is not as discernible as from closer distances, curvature of the earth becomes a factor in visibility, and objects become less prominent in the overall landscape due to their relative size, occupation of the horizon, and deterioration of visibility due to atmospheric conditions.

Visual impacts would result from the introduction of the numerous vertical lines of the WTGs into a strongly horizontal landscape defined by the horizon line at sea. The visible structures would potentially produce visual contrasts by virtue of their design attributes (form, color, and

[8] Refer to Section 4.2 COP Volume I for further information concerning construction and installation.

line) and by virtue of the reflectivity of their surfaces and resulting glare. Objects on or near the horizon tend to draw visual focus, particularly if they break the horizon line. Frontlighting of the WTGs may increase perceived impact by heightening contrast between the WTGs and the background, while backlighting would increase contrast at sunrise and sunset by silhouetting the WTGs against the bright sky. Visible rotor movement could attract visual attention as well. This effect could be noticeable at distances of about 24mi (Sullivan, 2013). Despite their relatively low profile, ESPs may be visible from shore. Their form and geometry will contrast with the WTGs.

For offshore viewers closer to New England Wind, potential visual impacts could be greater than for onshore viewers because boats could closely approach or potentially move through the offshore facilities. In a close approach, the large form, and geometric lines of both the individual WTGs and the array of WTGs would be visually dominant and the sweep of the moving rotors would attract visual attention. Structural details, such as surface textures, could become apparent, and the ESP(s) could be visible as well, as could specular reflections from the WTG towers and moving rotor blades (BOEM, 2007).

The following describes the compatibility of New England Wind with regional landscape patterns within which it is contained and viewed. This evaluation is based on views depicted in the visual simulations provided in Appendix B and Appendix C.

<u>Form</u>—The form of the regional landscape within the maximum theoretical area of nacelle visibility is primarily comprised of the Atlantic Ocean, coastline, and upland portions of Martha's Vineyard and Nantucket. The patterns of the open water are temporal, changing with the wind, sun angle, cloud cover, and other factors that affect the texture and colors of the surface. Visible shorelines (mainland and islands) may vary from a subtle linear form low on the horizon to a low undulating landform where the coastline recedes into the distance. The horizontal layering of the water and sky is visually appealing and draws viewers' attention.

The maximum build-out of New England Wind will be comprised of up to 130 WTG/ESP positions, which includes one or two ESP(s) for Phase 1 and up to three ESPs for Phase 2. Accordingly, the SWDA will include up to 129 thin, tapered, vertical structures topped with rotating blades viewed at great distance over the expanse of ocean, and one to five shorter, but wider, ESP structures. Although New England Wind is relatively small within this context, the introduction of man-made and kinetic structures can, depending on distance and meteorological conditions, create a minor visual contrast in the horizontal form of planar expanse of the ocean and sky.

<u>Line</u>—A WTG in a typical seascape could introduce a vertical line that would contrast with the horizon line and would introduce a geometrical manmade element into a natural landscape. However, the main concerns related to visual impacts of WTGs would be those presented by the foundation and nacelle (the widest and most substantial portions of the WTG) rather than

the relatively slender tower and rotor. Due to the curvature of the earth, the foundation will fall partially or completely below the horizon from many land-based vantage points.

From all coastal vantage points, WTGs appear low on the distant horizon and are difficult to perceive. At distances 21.2 mi or greater from the nearest coastal vantage point, WTGs appear as a distant field of fine vertical lines. When detectable, the somewhat regular vertical form of up to 139 tubular style towers will contrast with the horizontal form of the water/sky horizon.

New England Wind will include one to five ESPs that house step-up transformers and other electrical gear. The nearest possible ESP would be approximately 21.2 mi from the nearest coastal vantage point. At this distance the lower portion of the ESPs will fall partially over the visible horizon. When visible the upper portion of the ESP will appear low on the horizon as a small rectilinear form distinct from the horizontal form of the water/sky horizon.

Color—The neutral off-white/light grey color of the WTG tower, nacelle, and blades will always be viewed against the background sky. Under these conditions, the WTGs will be highly compatible with the hue, saturation, and brightness of the landscape. Frontlighting of the WTGs may increase perceived impact by heightening contrast between the WTGs and the background, while backlighting would increase contrast at sunrise and sunset by silhouetting the WTGs against the bright sky.

The upper portion of the ESP(s) will be a grey color which would appear muted and indistinct. Color contrast decreases as distance increases. Color contrast will diminish or disappear completely during periods of haze, fog, or precipitation.

Texture—The ocean is generally perceived as a broad expanse of dark open water that spans the view, with a sky that features a dynamic mix of partially illuminated cloud formations. The texture of the open water viewed out to the horizon is smooth.

Tubular style towers minimize textural contrast and provide a simple visual texture.

At a distance of 21.2 mi or greater from the nearest coastal vantage point, the ESPs will show minimal textural distinction and appear shadow-like low on the horizon.

Scale/Spatial Dominance—In the unexpected scenario that no other offshore wind projects have been constructed at the time of New England Wind construction, the proposed WTGs and ESP(s) will be the tallest visible elements on the horizon, albeit at great distance. From most foreground and mid-ground vantage points (from vessels on the ocean), the proposed WTGs will be perceived as a highly dominant visual element. When viewed from far background vantage points, the WTGs' perceived scale and spatial dominance would be considerably reduced. Even when visible under clear atmospheric conditions, New England Wind will be visually subordinate to the expansive Atlantic Ocean.

With regard to scale, exclusive of the effect of earth curvature and meteorological visibility, a broadside view of a WTG at a distance of 21.2 mi would measure only 0.017 degrees horizontally on the horizon and 0.37 degrees vertically to nacelle height. This is roughly equivalent to viewing an 8" pencil at a distance of about 103 ft. Similarly, with a maximum width of 29.5 ft, the rotor blades would measure only 0.015 degrees horizontally. This is roughly equivalent to the width of a drinking straw (0.25") viewed at 79 ft.

5.2.1 Nighttime Lighting

The WTGs will include an aviation obstruction lighting system in compliance with FAA and/or BOEM requirements. FAA aviation obstruction flashing red lights will be mounted on top of the nacelle of each constructed WTG and ESP. If a WTG's total tip height is 699 ft or higher, there will be at least three additional L-810 flashing red lights at a point approximately midway between the top of the nacelle and sea level. These lights may be visible from all coastal locations where daytime views of WTG nacelles occur. Inland views are typically screened by dunes, low hills, and existing vegetation. When visible from inland locations, nighttime views will include existing coastal light sources (including residential light sources, streetlights, and vehicle headlights), offshore vessels, and marine navigation aids.

The introduction of aviation obstruction lights in the night sky may be noticeable from beach areas and coastal bluffs, especially under clear weather conditions. The contrast of aviation obstruction lights in the night sky may be appreciable in the dark setting of the Martha's Vineyard and Nantucket shoreline where few manmade light sources currently exist. Viewer attention may be drawn by the slow flashing of the red lights.

Nighttime visibility of New England Wind will be most noticeable from beachfront areas in clear air conditions. Recreational beaches are primarily visited during daytime hours, minimizing the number of affected viewers.

The impact of FAA lighting is substantially limited by the distance of New England Wind from vantage points. At distances 21.2 mi or greater from the closest costal vantage point for the WTGs and ESP, aviation obstruction lights may be visible very low on the horizon and will appear to shimmer and vary in intensity due to the slow flash rate, intermittent shadowing as rotating blades pass in front of the light source, and atmospheric variations. Visibility can be frequently reduced or blocked by fog, snow, particulate matter, smog, or any combination of thereof. It is expected that an Aircraft Detection Lighting System (ADLS) will be installed that will only activate the required aviation obstruction lights at night when aircraft approach the Project Area. An assessment of the activation frequency of an ADLS indicates it would be activated less than one hour per year (Appendix III-K).

Marine navigation lighting will consist of yellow flashing lights that are expected to be mounted near the top of each WTG/ESP foundation (or on the corners of each ESP). While the specific visibility of the lighting for each WTG/ESP position is yet to be determined, it is expected to be 5 nm or less. The nearest coastal vantage point will be over 21.2 mi from the nearest WTG/ESP.

When not screened by the horizon, these low intensity lights would be inconspicuous to observers from coastal vantage points.

While ocean beaches on Nantucket and Martha's Vineyard are typically dark, they are not unaffected by manmade light sources. Existing lights from coastal residential and commercial properties, streetlights, boats, aircraft, and other sources contribute to existing light pollution. Upward dispersion of light generated from more densely populated areas also creates a distant sky glow to some degree depending on atmospheric conditions at any given time.

5.2.2 Decommissioning Impacts

Decommissioning of each Phase of New England Wind would involve the dismantling and removal of WTGs, ESP(s), associated foundations and scour protection (if required), offshore export cables and cable protection (if required), and the shipment of these materials to shore for reuse, recycling, or disposal (see Sections 3.3.3 and 4.3.3 of COP Volume I). In terms of expected visual impacts, decommissioning activities would be similar to construction activities; however, activities would generally proceed in reverse order from construction, and may proceed more quickly than construction, thus any associated impacts may be shorter in duration. During decommissioning, WTGs and associated offshore facilities and equipment would be removed to below the waterline, and the SWDA would be returned to pre-construction condition. However, impacts associated with any new or expanded permanent onshore facilities resulting from New England Wind may remain, subject to discussions with the Town of Barnstable on the decommissioning approach that best meets the Town's needs and has the fewest environmental impacts.

5.2.3 Impact on Landscape Units and Viewer Groups

ZVI analysis indicates that approximately seven percent (7%)[9] of the land area within the Maximum Theoretical Area of Nacelle Visibility could have potential views of some portion of the Project. This limited visibility reflects the fact that forest land is the dominant land cover and will significantly screen outward views. Project visibility is largely limited to the ocean shoreline and tidal areas immediately inland. Throughout the coastal area, the ZVI is generally found within 400-1,000 feet of the shore. Beyond that distance visibility is found in small pockets of open land and tidal ponds. Visibility diminishes quickly farther inland as existing terrain and vegetation interrupts the line-of-sight.

Landscape Units - Landscape Units within the ZVI include Open Ocean, Ocean Beach, Coastal Dunes, Coastal Bluffs, Salt Pond/Tidal Marsh, Coastal Scrub Brush, Shoreline Residential, and Agricultural/Open Field. In these areas views often extend up and down the coast and across open water as one looks out to sea. Inland views include grassy dunes and coastal scrub vegetation. Manmade structures are frequently visible within and from these coastal areas, although extended stretches of beachfront on Martha's Vineyard and Nantucket are within

[9] Excluding the affected open land area within the boundaries of the Nantucket and Martha's Vineyard airports.

protected open space areas with little to no manmade development within immediate view. Within these Landscape Units views are almost always unobstructed and considered highly scenic.

As discussed previously, the nearest New England Wind WTG is 21.2 mi off the coast of Martha's Vineyard (Squibnocket Point) and 23.7 mi off the coast of Nantucket (Madaket). Given the narrow width of the WTG tower and rotor, combined with the distance from the viewpoints, these elements of the WTG would be minimally discernible by the naked eye in the best visibility conditions (a clear, low humidity day) and not detectable in the haze or fog typical for this marine landscape.

At 21.2 mi and farther from shore, there is no land-based vantage point that will view an entire WTG or ESP. Some portion of the structures will always fall below the visible horizon. Because atmospheric conditions reduce visibility, sometimes significantly, and the presence of waves obscure objects very low on the horizon, maximum theoretical viewing distances typically exceed what is experienced in reality. Furthermore, limits to human visual acuity reduce the ability to discern objects at great distances, suggesting that a WTG or ESP may not be discernible at the maximum distances, although they theoretically would be visible (BOEM, 2007).

Sullivan, in *Offshore Wind Turbine Visibility and Visual Impact Threshold Distances* (2013), concludes small- to moderately-sized facilities were visible to the unaided eye at distances greater than 26 mi, with WTG blade movement visible up to 24 mi. The observed wind facilities were judged to be a major focus of visual attention at distances up to 10 mi, were noticeable to casual observers at distances of almost 18 mi, and were visible with extended or concentrated viewing at distances beyond 25 mi. While New England Wind is larger in scale than the projects evaluated by Sullivan, these findings provide additional perspective concerning the effect of distance on human visibility of offshore wind energy facilities and further support the conclusion that the proposed maximum theoretical area of nacelle visibility is highly conservative.

Overall, any perceived change to the visual quality of any affected Landscape Unit would be expected to be minor.

Viewer Groups - Viewer groups in affected Landscape Units are most commonly Tourists, Vacationers, Seasonal Residents, and Recreational Users. Year-round residents would also be affected. Viewer activities are variable with different sensitivity to visual change. For example, beach goers participating in active recreational activities such as surfing, jogging, and group games may be somewhat less sensitive to the presence of man-made objects on the distant horizon than other viewers who visit the coastal areas for more passive pursuits such as sunbathing, walking, bird watching or other forms of quiet enjoyment of the natural landscape. These activities are not mutually exclusive. An individual observer may participate in both active and passive activities during a single visit to the coastal area. Similarly seasonal or year-round residents may be less sensitive when indoors or working around the yard than when quietly enjoying the seascape from their property. Therefore, an observer's sensitivity to visual change is based more on the activity of the moment than being part of a generalized user group. For the purpose of this visual assessment, given the high scenic quality of the coastal landscape, it is conservatively assumed that most viewers within the ZVI are visiting the area to enjoy the unique landscape setting and will have an above average sensitivity to the visual change.

Regardless of viewer group, public reaction to New England Wind is likely to be variable. Not all viewers see WTGs as having an adverse visual impact. A number of research studies examining the visual impacts of offshore and onshore wind energy developments indicate that wind power enjoys strong support among members of the public and, unlike most large-scale energy facilities, WTGs are, in some cases, viewed as a positive visual impact by significant portions of the public (BOEM, 2007).

While strong support for wind power development generally exists, local concerns relating to the aesthetics of planned wind facilities are not uncommon. The perceptions of visual impacts associated with wind energy development vary among potential viewers and may be positive or negative, can change over time, and, in some cases, possibly trend toward more positive perceptions after the installation of wind energy facilities (BOEM, 2007).

Warren et al. (2005) assessed pre- and post-development attitudes toward visual impacts associated with two onshore wind facilities in Ireland. Their survey found, for one location, that more than 90% of survey respondents supported the concept of wind power, but 66% of respondents were initially opposed to a local proposed wind facility. Contrary to expectations, individuals living closest to the onshore wind facility, who had originally opposed it on aesthetic grounds, actually increased their acceptance of the visual impacts after construction, with 62% regarding the visual impact as positive. Similar results were observed for a second onshore wind facility. The results in both cases suggest that familiarity with the wind facilities decreased aesthetic objections. Stated reasons for changing perceptions of visual impacts varied among respondents—some felt the WTGs were attractive while others felt that the actual impacts were less than had been anticipated (BOEM, 2007).

6.0 MITIGATION

The sheer distance of New England Wind from the nearest coastal vantage point—greater than 21 mi from the closest WTG to Martha's Vineyard—serves to minimize visibility of the offshore facilities of New England Wind from sensitive visual resources. Moreover, for a development of this type, mitigation options are limited due to the size and structural requirements of WTGs, the number of WTGs necessary to meet energy production requirements, and their location on an unscreened waterscape. However, New England Wind is applying important mitigation techniques such as color selection compatible with the marine landscape and ALDS lighting to minimize visual impacts to the maximum extent practicable.

<u>Visual Screening</u>—Nearly all views occur from beachfront vantage points or elevated overlooks where the existing landscape is highly scenic. Localized screening, such as berms, vegetative barriers, or fences, would not be practical for screening miles of beachfront views, or even welcomed in places where such screening would block scenic vistas.

<u>Design and Appearance</u>—The WTGs are uniform in shape, color, size of rotor blades, nacelles, and towers, which serve to minimize visual contrast. Tubular tower designs are similarly used throughout, and components are in proportion to one another. The design and appearance of New England Wind is consistent with best practices to minimize visual impact (BOEM, 2007).

<u>Color Selection or Camouflage</u>—Measures including alternate color selection or camouflaging WTGs are unlikely to reduce the visibility of New England Wind. The off-white/light gray color selected for all WTG components is designed to minimize contrast with the sky under most conditions. The yellow color of the WTG foundations (required by the USCG for safety) largely falls below the visible horizon and is nearly undetectable from onshore viewpoints. No commercial/advertising messages will be placed on WTGs.

<u>Reduction in Night Lighting</u>—Visual analysis demonstrates that the marine navigation lights will not be visible from any land-based vantage point and will not be an impact. Aviation warning lights on the WTGs contribute to their visual impact. However, such lighting is required as a safety measure and cannot be eliminated. Lighting-related impacts can be reduced by limiting WTG lighting to the minimum time duration allowable by the FAA. It is expected that ADLS will be used that automatically activates all aviation obstruction lights when aircraft approach the Phase 1 WTGs, subject to BOEM approval. For Phase 2, it is expected the same or similar approach as Phase 1 would be used to reduce lighting, including the use of an ADLS. An ADLS would only activate the required aviation obstruction lights at night when aircraft approach the SWDA. This technology would substantially reduce the amount of time such lights would be visible. An assessment of the activation frequency of an ADLS indicates that it would be activated less than one hour per year (Appendix III-K).

7.0 SUMMARY AND CONCLUSIONS

The nearest New England Wind WTG is 21.2 mi off the coast of Martha's Vineyard (Squibnocket Point) and 25.1 mi off the coast of Nantucket (Madaket). New England Wind will be developed in two Phases with a maximum of 130 WTG/ESP positions. Each Phase of New England Wind will be developed and permitted using a Project Design Envelope. This approach defines and brackets the characteristics of each Phase for the purposes of environmental review while maintaining a reasonable degree of flexibility with respect to the selection of key components, such as the WTGs, foundations, offshore cables, and ESP(s).

New England Wind Phase 1 will be developed immediately south of Vineyard Wind 1. The New England Wind Phase 1 Envelope allows for 41 to 62 WTGs. New England Wind Phase 2, which will be developed immediately south of Phase 1, will occupy the remainder of the SWDA. Phase 2 may include one or more projects, depending on the area available for development and market conditions. Phase 2 will contain 64-88 WTG/ESP positions (up to three positions will be occupied by ESPs). The maximum height of both the Phase 1 and Phase 2 WTGs under consideration is approximately 725 ft above MLLW to the top of nacelle and 1,171 ft to the blade tip at the apex of rotation.

New England Wind also includes one to five ESPs. The one or two Phase 1 ESP(s) and the up to three Phase 2 ESPs will have a maximum width of 197 ft, a maximum length of 328 ft, and a maximum topside height of 230 ft above MLLW. Consistent with current BOEM, FAA, and/or USCG guidance, New England Wind will include two aviation obstruction lights (L-864) on top of each nacelle and marine navigation lights mounted near the top of each WTG/ESP foundation (or on the corners of each ESP). If the WTGs' total tip height is 699 ft or higher, there will be at least three additional L-810 flashing red lights at a point approximately midway between the top of the nacelle and sea level. Subject to approval by BOEM and/or the FAA, it is expected that an ADLS will be used for Phase 1 and the same or similar approach for Phase 2 to minimize nighttime lighting.

Visual impacts are contingent on the distance from shore, earth curvature, and atmospheric conditions that could screen some or all of the New England Wind foundations, and portions of the WTG towers, nacelles, and rotors, depending on distance and viewer elevation. As shown in the daytime visual simulations, the widest portion of the WTG (foundation and deck) would be substantially below the visual horizon and would not be visible for most WTGs from most KOPs. In addition, given the narrow width of the WTG tower and rotor, combined with the distance from the viewpoints, these elements of the WTG would be minimally discernible by the naked eye in the best visibility conditions (a clear, low humidity day) and not detectable in the haze or fog typical for this marine landscape. Overall, visual impacts to onshore viewers of WTGs in daylight would be expected to be minor

FAA aviation obstruction lights on top of each nacelle would likely be discernible on clear nights from the shoreline; however, they are only estimated to be activated less than one hour per year (see Appendix III-K). Weather conditions such as fog, haze, and clouds would greatly limit the visibility of the WTGs and lighting from the shore. Therefore, the presence of a flashing light or lights on WTGs and ESPs at night would result in minor impacts (BOEM, 2007).

Zone of Visual Influence (ZVI) —The primary areas where WTGs and ESP(s) may be seen include the southern coastlines of Martha's Vineyard and Nantucket and the open ocean surrounding the SWDA. In most circumstances, visibility of New England Wind will be quickly screened from inland vantage points by coastal topography and vegetation. Most views of the offshore facilities will be limited to immediate waterfront locations. Few publicly accessible vantage points with views of the Atlantic Ocean are found in inland. Areas of theoretical visibility are also found on south-facing beaches and unvegetated inland areas on uninhabited Esther Island, Tuckernuck Island, Muskeget Island (all at distances greater than 24 mi to the nearest WTG), and Nomans Land Island (18.7 mi to nearest WTG).

A portion of Cape Cod and the Elizabeth Islands fall behind Martha's Vineyard, substantially minimizing the degree of potential visibility in these areas. Most other portions of the mainland Cape Cod coastline fall beyond the maximum theoretical area of nacelle visibility where the top of nacelle will fall below the horizon.

A very small area of potential nacelle visibility is found on mainland Cape Cod in the Town of Mashpee. A portion of WTG rotor blades are theoretically visible above the land mass of Martha's Vineyard from coastal vantage points in Towns of Falmouth and Mashpee at distances greater than 36.1 miles to the nearest WTG.

A view of the top of nacelle is theoretically possible from the western portion of the Elizabeth Islands, including eastern Naushon Island, Pasque Island, Nashawena Island and Cuttyhunk Island (all at distances greater than 30 mi to the nearest WTG). However, because atmospheric conditions reduce visibility, sometimes significantly, maximum theoretical viewing distances typically exceed what is experienced in reality. Moreover, due to earth curvature, the presence of ocean waves that obscure objects very low on the horizon, and the limits of visual acuity, the WTG nacelle will likely not be discernable from vantage points on the Cape or Elizabeth Islands.

The majority of Cape Cod's south coast (excluding a small area of shoreline in the Towns of Falmouth and Mashpee as described above), and all of mainland Massachusetts, Rhode Island (including Block Island), Connecticut and New York's Long Island fall beyond the maximum theoretical area of nacelle visibility and will not be affected by project views.

Open views toward the SWDA from locations within the Open Water/Ocean, Shoreline Beach, Shoreline Bluffs, Developed Waterfront, Coastal Dunes, Shoreline Residential, Salt Pond/Tidal Marsh, Coastal Scrub, Maintained Recreation Area, and Agricultural/Open Field Landscape

Units in the maximum theoretical area of nacelle visibility on Martha's Vineyard and Nantucket will be visually impacted by New England Wind, due to their proximity to the shoreline and/or lack of screening by vegetation and topography. These Landscape Units contain visually sensitive resources including historic sites, open space/wildlife conservation areas, public beaches, and recreation areas that will have views of New England Wind. Additionally, shoreline vacation homes and private residences which currently have ocean views will have distant views of New England Wind.

Greater numbers of tourists, vacationers, and recreational users will be present in the coastal area during the summer and on sunny days, when the weather is clear and warm as compared to overcast, rainy, or cold days. In addition, more recreational users will be present in the coastal area on weekends and holidays than on weekdays. Also, fewer visitors spend time at beachfront locations during the off-season.

<u>Meteorological Visibility</u>—Visibility is reduced by fog, snow, particulate matter, smog or any combination of thereof, and is a part of normal atmospheric phenomena. Meteorological analysis (refer to Appendix D) concludes average daytime visibility at Martha's Vineyard and Nantucket are highest in the winter and lowest in the summer. Due to atmospheric conditions New England Wind WTGs/ESP(s) will not be visible approximately 82% of the time from Gay Head Lighthouse at Martha's Vineyard and approximately 86% of the time from the closest location from the Nantucket Historic District.

Additionally, different factors affect visibility, including air quality, sea spray and salts over the ocean's surface, and the angle of the sun. The presence of sea spray and salts affects visibility but is not likely captured by the measurements. Additionally, it is expected that the WTGs will be painted using an off-white/light grey color, which will reduce the contrast with the sea and sky and thus minimize daytime visibility of the ocean-based elements of New England Wind. The upper portion of the ESP(s) will be a grey color which would also appear muted and indistinct. Therefore, calculated visibility should be considered conservative since they do not account for these light-reducing factors.

Due to reduced visibility caused by atmospheric conditions the WTG/ESP structure(s) will not be visible most of the time for viewers along the Martha's Vineyard and Nantucket coastlines.

<u>Distance of Visibility</u>—On Martha's Vineyard and Nantucket, the distance to the nearest WTG ranges from approximately 21.2 mi (Squibnocket Point, Martha's Vineyard) to 25.1 mi (Madaket, Nantucket). All land-based vantage points are in the far background distance zone where elements lose detail and become less distinct. Atmospheric perspective changes colors to blue-grays, and surface texture characteristics are lost.

At these extended distances, the curvature of the earth will affect visibility of New England Wind. As distance increases the portion of offshore facilities (i.e., WTGs and ESP[s]) visible above the horizon decreases exponentially. From the closest land point (21.2 mi to the nearest

WTG), for a standing observer at beach elevation (assume 9 ft above sea level), the lower 185 ft of the offshore facilities will fall below the visible horizon. At a distance of 33.4 mi, the lower 536 ft will be screened by the horizon.

As an observer moves along the coast farther from the SWDA, the smaller the WTGs will appear. Beyond a certain distance, depending upon the size and degree of contrast between the object and its surroundings, the object may cease to be a point of interest for most people or become indistinguishable.

Exclusive of the effects of earth curvature and meteorological visibility, a broadside view of a WTG at a distance of 21.2 mi would measure only 0.017 degrees horizontally on the horizon and 0.37 degrees vertically to nacelle height. This is roughly equivalent to viewing an 8" pencil at a distance of about 103 ft. Similarly, with a maximum width of 29.5 ft, the rotor blades would measure only 0.015 degrees horizontally. This is roughly equivalent to the width of a drinking straw (0.25") viewed at 79 ft.

At 21.2 mi and farther from shore, there is no land-based vantage point that will view an entire WTG or ESP. Some portion of the structures will always fall below the visible horizon. Because atmospheric conditions reduce visibility, sometimes significantly, and the presence of waves obscure objects very low on the horizon, maximum theoretical viewing distances typically exceed what is experienced in reality. Furthermore, limits to human visual acuity reduce the ability to discern objects at great distances, suggesting that a WTG or ESP may not be discernible at the maximum distances, although they theoretically would be visible (BOEM, 2007).

Sullivan, in *Offshore Wind Turbine Visibility and Visual Impact Threshold Distances* (2013), concludes small- to moderately-sized facilities were visible to the unaided eye at distances greater than 26 mi, with WTG blade movement visible up to 24 mi. At night, aerial hazard navigation lighting was visible at distances greater than 24 mi. The observed wind facilities were judged to be a major focus of visual attention at distances up to 10 mi, were noticeable to casual observers at distances of almost 18 mi, and were visible with extended or concentrated viewing at distances beyond 25 mi. While New England Wind is larger in scale than the projects evaluated by Sullivan, these findings provide additional perspective concerning the effect of distance on human visibility of offshore wind energy facilities and further support the conclusion that the proposed maximum theoretical area of nacelle visibility is highly conservative.

For offshore viewers closer to New England Wind, potential visual impacts could be much greater than for onshore viewers, because boats could approach or potentially move through the SWDA. In a close approach, the very large form, and strong geometric lines of both the individual WTGs and the array of WTGs could dominate views, and the large sweep of the moving rotors would command visual attention. Structural details, such as surface textures, could become apparent, and the ESP(s) could be visible as well, as could specular reflections from the towers and moving rotor blades (BOEM, 2007).

Visibility of Night Lighting—Night lighting may have an effect on residents and vacationers in beachfront settings where they currently experience dark skies. While many residences enjoy ocean views, most year-round and vacation homes within the proposed maximum theoretical area of nacelle visibility are located inland where intervening landforms and vegetation provide substantial or complete screening of the ocean.

The impact of FAA lighting will be substantially limited by the distance of New England Wind from coastal vantage points. At a minimum distance of 21.2 mi to the closest WTG, New England Wind's aviation obstruction lights may be visible very low on the horizon. Lights will appear to shimmer and vary in intensity due to the slow flash rate, intermittent shadowing as rotating blades pass in front of the light source, and atmospheric variations. Visibility will be frequently reduced or blocked by fog, snow, particulate matter, smog, or any combination of them. Subject to approval by BOEM, it is expected that an ADLS will be used for Phase 1 and the same or similar approach for Phase 2. An ADLS would automatically turn on aviation obstruction lights when an aircraft is within range and turn off the lights after the aircraft has departed the area. This technology would substantially reduce the amount of time such lights would be visible. An assessment of the activation frequency of an ADLS indicates that it would be activated less than one hour per year (Appendix III-K).

Marine navigation lights are expected to be visible only to distances of approximately 5 nm (5.75 mi). As the closest coastal vantage point is a minimum distance of 21.2 mi from the nearest WTG, marine navigation lights will not be visible from shore.

Human Perception—Public reaction to views of New England Wind is likely to be variable. Not all viewers see WTGs as having an adverse visual impact. While there is generally strong support for wind power development, there are often local concerns relating to the aesthetics of planned wind facilities. The perceptions of visual impacts associated with wind energy development vary among potential viewers and may be positive or negative. Perceptions can also change over time, in some cases possibly trending toward more positive perceptions after the installation of wind energy facilities (BOEM, 2007).

Mitigation—New England Wind includes a number of measures that serve to reduce or mitigate visual impact:

- New England Wind is located in the area identified by BOEM as suitable for offshore wind power development, sited far from shore to minimize visual impacts.
- The location of the nearest WTG/ESP more than 21.2 mi offshore eliminates all foreground, mid-ground, and even near background views from visually sensitive public resources and population centers.

- When viewed from ground level vantage points, the off-white color of the WTGs generally blends well with the sky at the horizon.
- Subject to approval by BOEM and/or the FAA, it is expected that an ADLS will be used for Phase 1 and the same or similar approach for Phase 2, which is estimated to be activated less than one hour per year (Appendix III-K).
- Marine navigation lights mounted near the top of each WTG/ESP foundation (or on the corners of each ESP) will have an expected designed visual range of 5 nm or less. These lights are not likely to be discernible from coastal vantage points.

Overall, New England Wind will result in minimal change to landscape conditions for viewers along the Martha's Vineyard and Nantucket coastlines. Viewers on the islands will have limited visibility of the WTGs when weather conditions allow. However, at distances at or greater than 21.2 mi for the WTGs and ESPs and viewed within the context of the ocean that includes the vast expanse of water, extended beach views and dunes, as well as the sights and sounds of breaking surf and wind, New England Wind would likely be considered visually subordinate to the wider landscape. New England Wind will be virtually undetectable from Cape Cod.

All offshore cables will be submerged and will not be visible. The Phase 1 onshore export cables and grid interconnection cables will be installed entirely underground and will not be visible, except for possibly at the Phase 1 Centerville River crossing as described in Section 3.3.1.10.2 of COP Volume I. The Phase 2 onshore cables are also expected to be installed underground. New onshore substations will be constructed in the Town of Barnstable. The Phase 1 onshore substation will include vegetative screening; the need for vegetative or other screening will be determined for the Phase 2 substation once the site is selected. The electric grid connection for each Phase is proposed at the existing onshore power substation in West Barnstable. The proposed improvements will be consistent in scale and visual character with the existing electric substation resulting in no new visual impact.

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Appendix A

ZONE OF VISUAL EFFECT (ZVI) MAPS

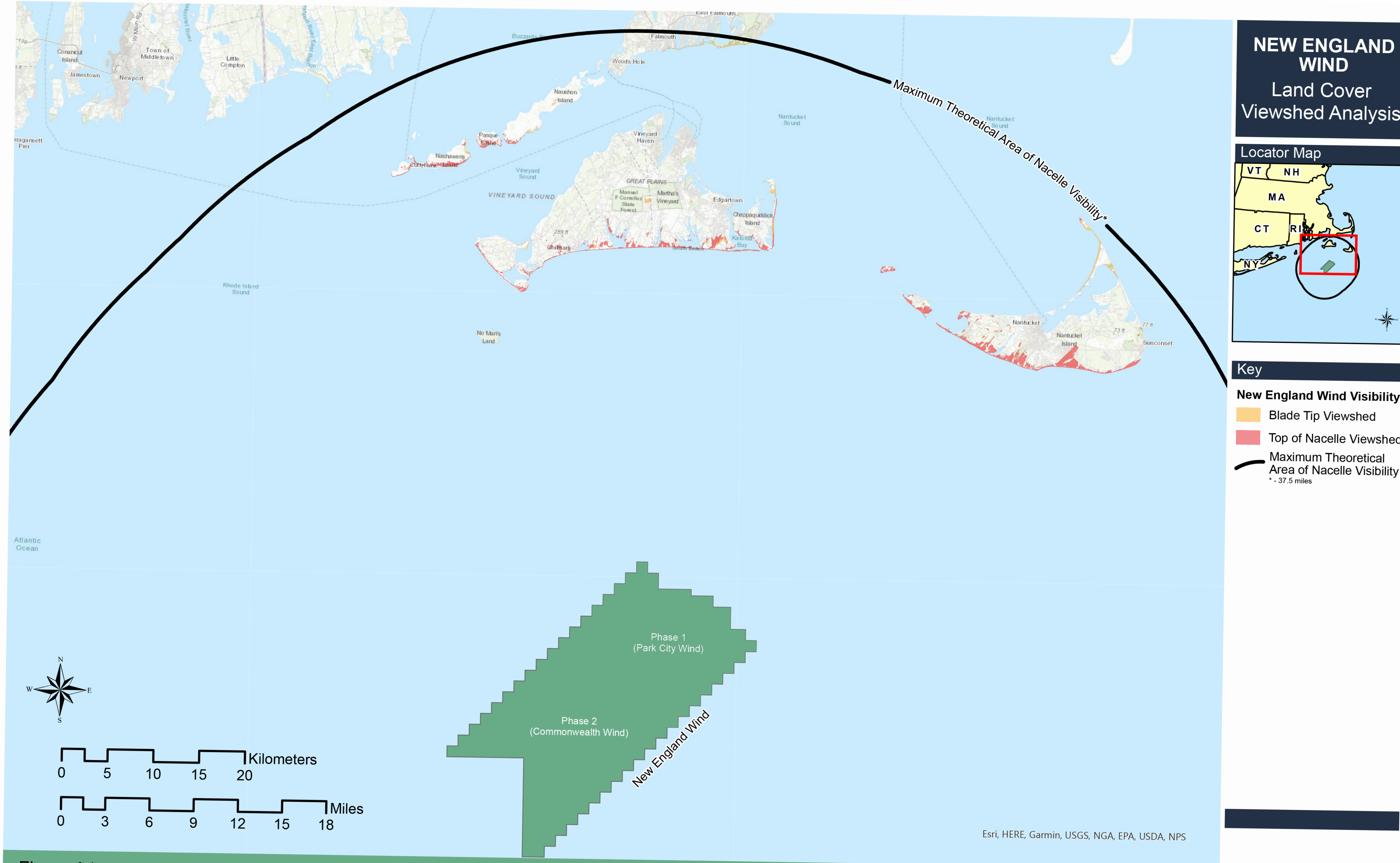
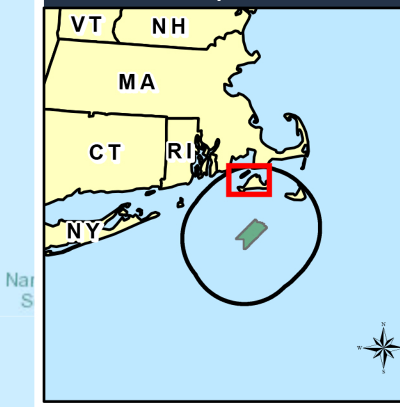


Figure A1
Zone of Visual Influence (ZVI)

SARATOGA ASSOCIATES

NEW ENGLAND WIND
Land Cover Viewshed Analysis

Locator Map



Key

New England Wind Visibility

- Blade Tip Viewshed
- Top of Nacelle Viewshed
- Maximum Theoretical Area of Nacelle Visibility
  * - 37.5 miles

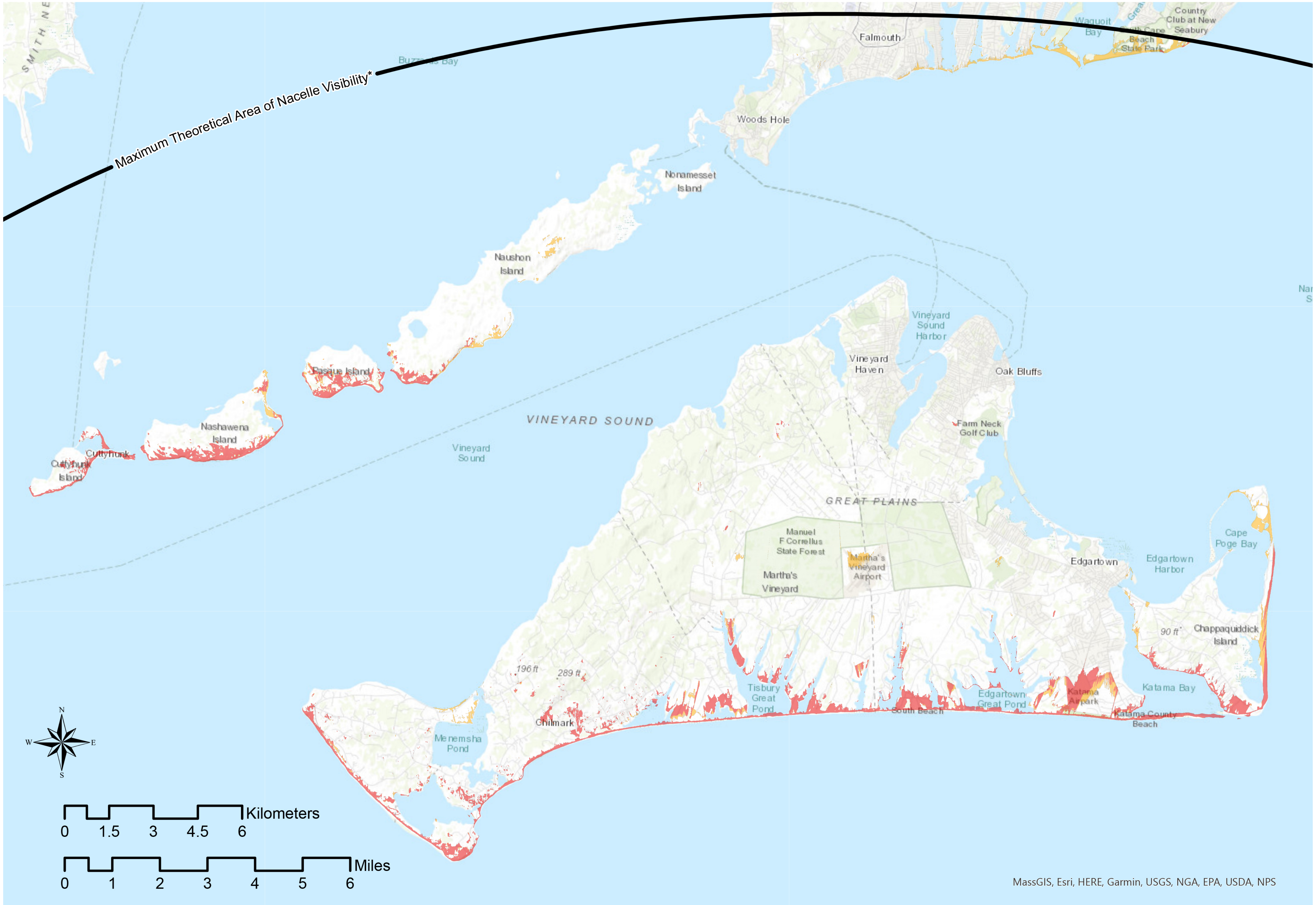
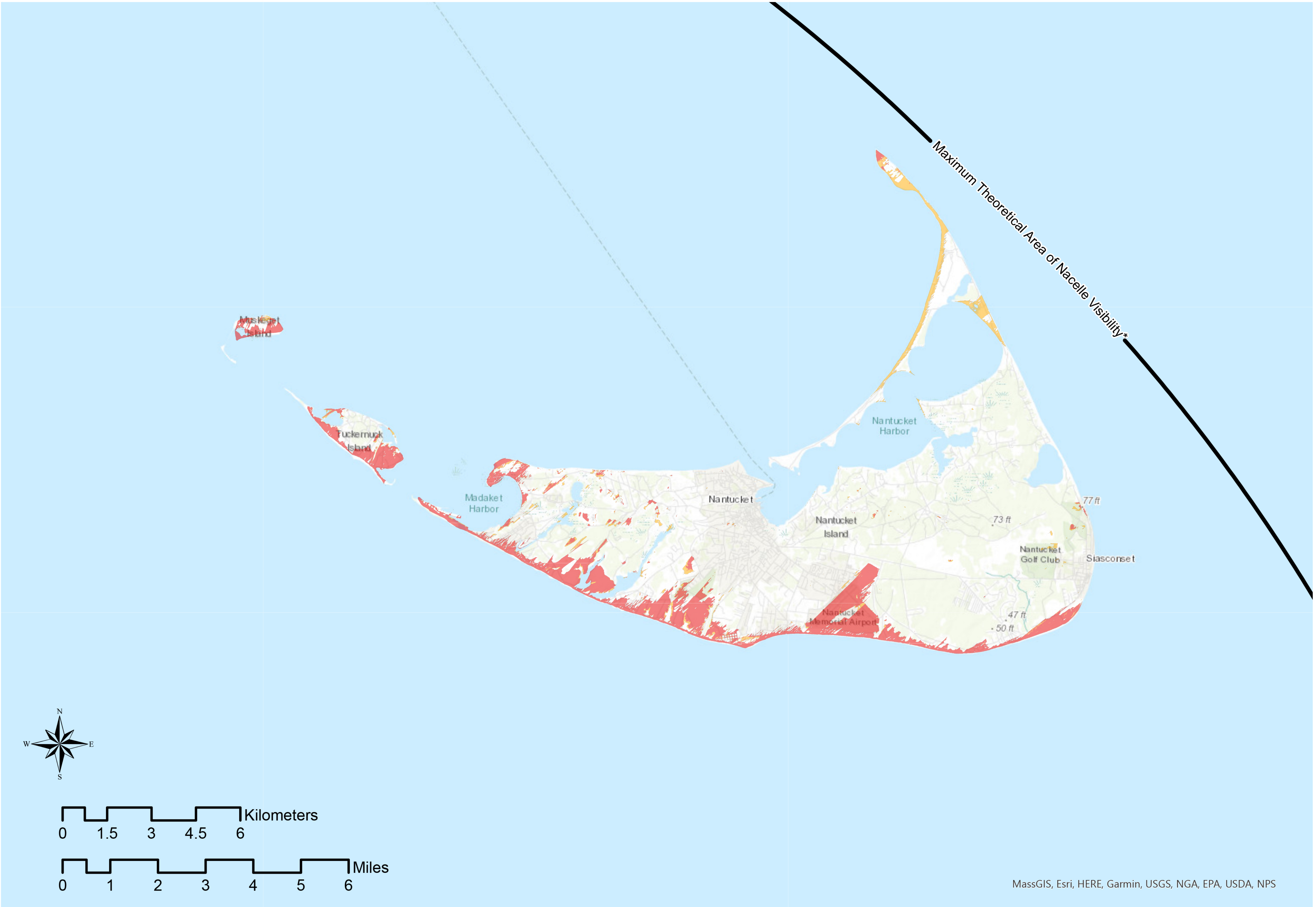


Figure A2
Martha's Vineyard ZVI

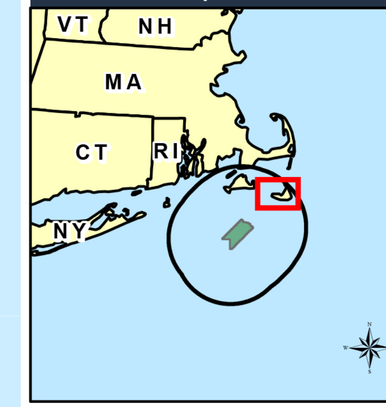
SARATOGA ASSOCIATES



NEW ENGLAND WIND

Land Cover Viewshed Analysis

Locator Map



Key

New England Wind Visibility

Blade Tip Viewshed

Top of Nacelle Viewshed

Maximum Theoretical Area of Nacelle Visibility

* - 37.5 miles

Figure A3

Nantucket Island ZVI

SARATOGA ASSOCIATES

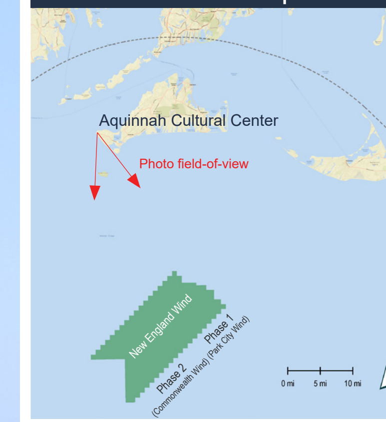
Appendix B

VISUAL SIMULATIONS – SINGLE FRAME VIEWS

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	13-May-2017/14:38
Light Condition:	Side Light
Camera:	Canon 6d Mark II
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41°20'45.497"N
Longitude:	70°50'08.169"W
Elevation(±):	105 ft
Nearest Turbine:	NA

Visual Setting

Resource Type:	NNL NRHP
Landscape Unit:	Coastal Bluffs
Viewer Groups:	Tourists, Vacationers
Circumstances of View:	Stationary

Figure B-1a

Aquinnah Cultural Center

Town of Aquinnah, Martha's Vineyard Island, MA

EXISTING VIEW

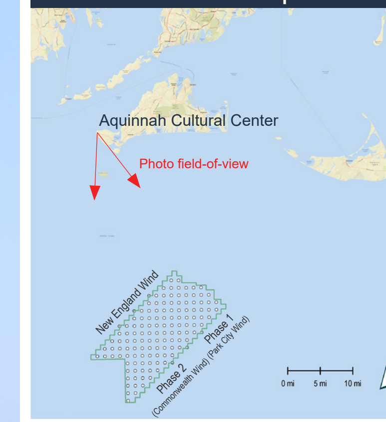
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	13-May-2017/14:38
Light Condition:	Side Light
Camera:	Canon 6d Mark II
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41°20'45.497"N
Longitude:	70°50'08.169"W
Elevation(±):	105 ft
Nearest Turbine:	25.4 mi

Visible Portion of Closest Turbine

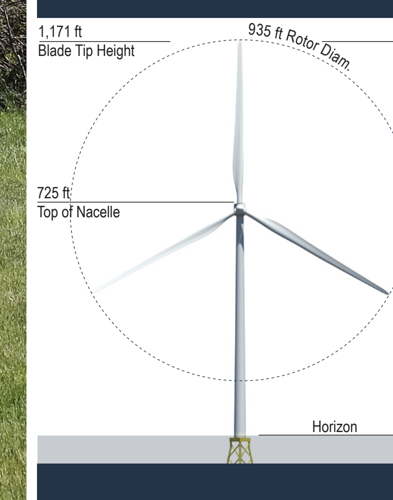


Figure B-1b

Aquinnah Cultural Center

Town of Aquinnah, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

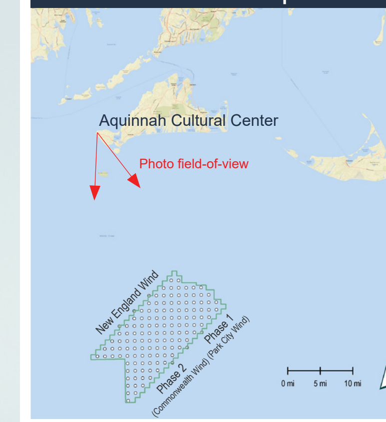
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	13-May-2017/14:38
Light Condition:	Side Light
Camera:	Canon 6d Mark II
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41°20'45.497"N
Longitude:	70°50'08.169"W
Elevation(±):	105 ft
Nearest Turbine:	25.4 mi

Visible Portion of Closest Turbine

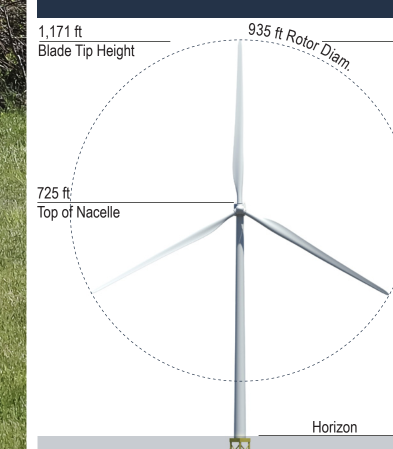


Figure B-1c

Aquinnah Cultural Center

Town of Aquinnah, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND - MODERATE HAZE

This visualization incorporates a simulated haze condition that reduces visibility of the WTGs to approximately 50%.

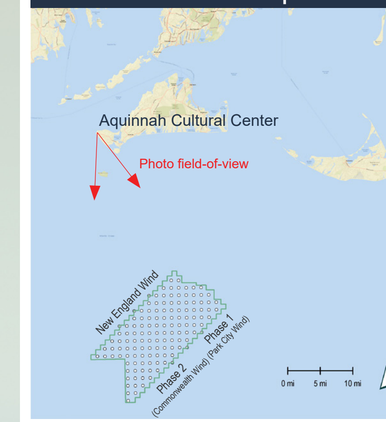
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	13-May-2017/14:38
Light Condition:	Side Light
Camera:	Canon 6d Mark II
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41°20'45.497"N
Longitude:	70°50'08.169"W
Elevation(±):	105 ft
Nearest Turbine:	25.4 mi

Visible Portion of Closest Turbine

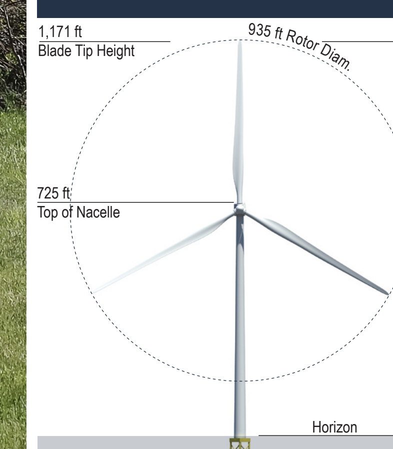


Figure B-1d

Aquinnah Cultural Center

Town of Aquinnah, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND - HEAVY HAZE

This visualization incorporates a simulated haze condition that substantially masks visibility of the WTGs.

The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

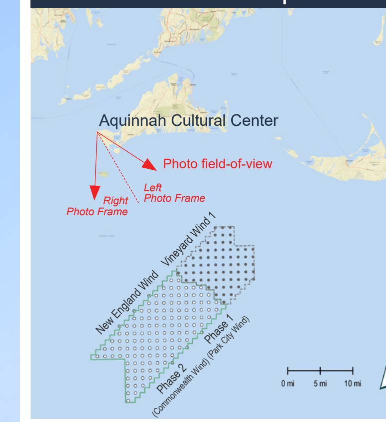
NEW ENGLAND WIND

Photographic Simulations

Vineyard Wind 1 and New England Wind Cumulative Field-of-View
LEFT PHOTO FRAME
(See photo enlargement Figure B-1f)

Vineyard Wind 1 and New England Wind Cumulative Field-of-View
RIGHT PHOTO FRAME
(See photo enlargement Figure B-1g)

Photo Location Map



Camera Data

Date / Time:	13-May-2017/14:38
Light Condition:	Side Light
Camera:	Canon 6d Mark II
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41°20'45.497"N
Longitude:	70°50'08.169"W
Elevation(±):	105 ft
Nearest Turbine:	23.2 mi

Figure B-1e
Aquinnah Cultural Center
Town of Aquinnah, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND AND VINEYARD WIND 1 CUMULATIVE CONDITION

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

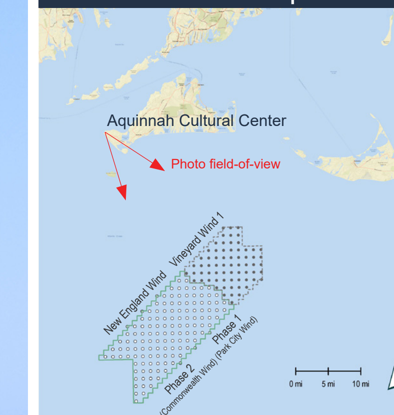
The above photograph is provided to illustrate the full field-of-view of New England Wind and Vineyard Wind 1 from this location. It is not intended to represent the scene as it would appear to normal human eyesight. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	13-May-2017/14:38
Light Condition:	Side Light
Camera:	Canon 6d Mark II
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41°20'45.497"N
Longitude:	70°50'08.169"W
Elevation(±):	105 ft
Nearest Turbine:	23.2 mi

Figure B-1f

Aquinnah Cultural Center

Town of Aquinnah, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND AND VINEYARD WIND 1 CUMULATIVE CONDITION

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

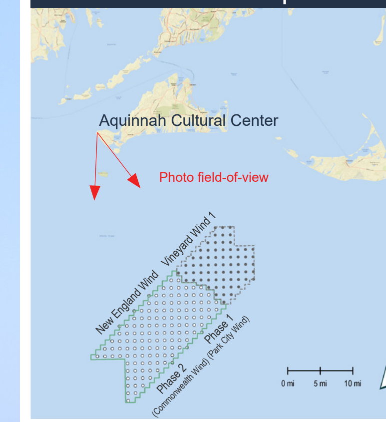
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	13-May-2017/14:38
Light Condition:	Side Light
Camera:	Canon 6d Mark II
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41°20'45.497"N
Longitude:	70°50'08.169"W
Elevation(±):	105 ft
Nearest Turbine:	23.2 mi

Figure B-1g

Aquinnah Cultural Center

Town of Aquinnah, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND AND VINEYARD WIND 1 CUMULATIVE CONDITION

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

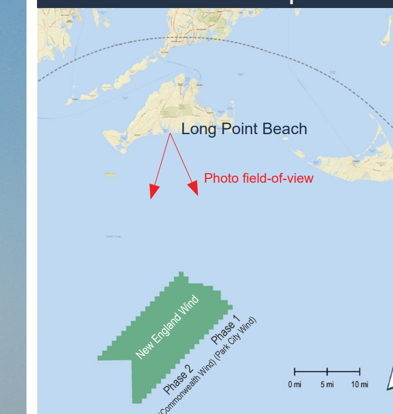
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	18-Oct-2017/10:11
Light Condition:	Back Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41°20'54.534"N
Longitude:	70°38'19.520"W
Elevation(±):	20 ft
Nearest Turbine:	NA

Visual Setting

Resource Type:	Wildlife Refuge, Recreation, Historic Resources
Landscape Unit:	Ocean Beach, Coastal Dunes, Salt Pond/Tidal Marsh
Viewer Groups:	Residents, Vacationers, Recreational

Figure B-2a

Long Point Beach

Town of West Tisbury, Martha's Vineyard Island, MA

EXISTING VIEW

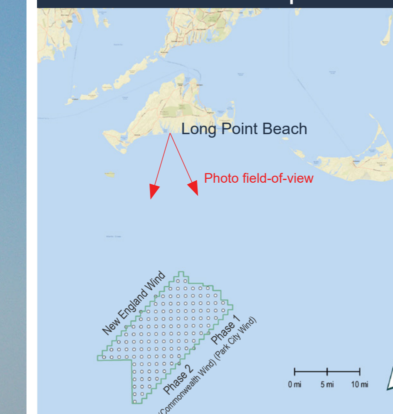
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	18-Oct-2017/10:11
Light Condition:	Back Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41°20'54.534"N
Longitude:	70°38'19.520"W
Elevation(±):	20 ft
Nearest Turbine:	22.8 mi

Visible Portion of Closest Turbine

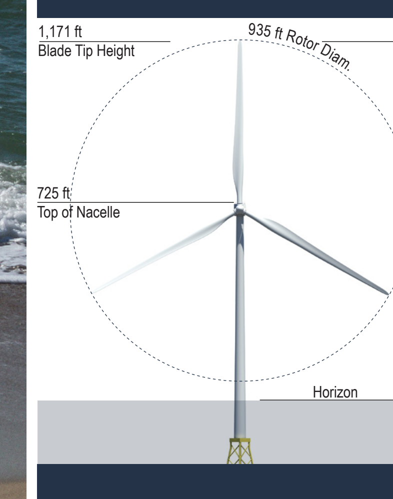


Figure B-2b

Long Point Beach

Town of West Tisbury, Martha's Vineyard Island, MA

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

SIMULATED VIEW: NEW ENGLAND WIND

The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

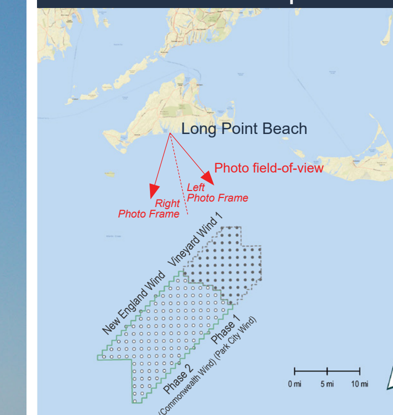
SARATOGA ASSOCIATES

NEW ENGLAND WIND
Photographic Simulations

Vineyard Wind 1 and New England Wind Cumulative Field-of-View
LEFT PHOTO FRAME
(See photo enlargement Figure B-3d)

Vineyard Wind 1 and New England Wind Cumulative Field-of-View
RIGHT PHOTO FRAME
(See photo enlargement Figure B-3e)

Photo Location Map



Camera Data

Date / Time:	18-Oct-2017/10:11
Light Condition:	Back Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41°20'54.534"N
Longitude:	70°38'19.520"W
Elevation(±):	20 ft
Nearest Turbine:	16.6 mi

Figure B-2c
Long Point Beach
Town of West Tisbury, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND AND VINEYARD WIND 1 CUMULATIVE CONDITION

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

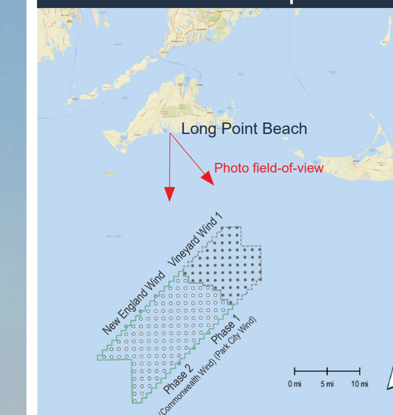
The above photograph is provided to illustrate the full field-of-view of New England Wind and Vineyard Wind 1 from this location. It is not intended to represent the scene as it would appear to normal human eyesight. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	18-Oct-2017/10:11
Light Condition:	Back Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41°20'54.534"N
Longitude:	70°38'19.520"W
Elevation(±):	20 ft
Nearest Turbine:	16.6 mi

Figure B-2d

Long Point Beach

Town of West Tisbury, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND AND VINEYARD WIND 1 CUMULATIVE CONDITION

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

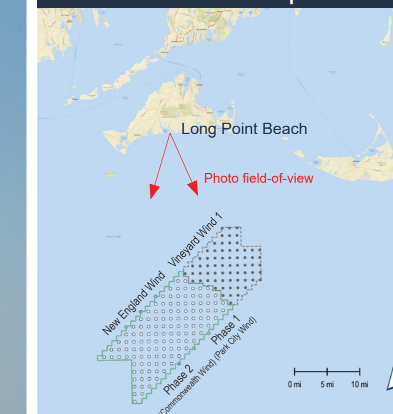
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	18-Oct-2017/10:11
Light Condition:	Back Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41°20'54.534"N
Longitude:	70°38'19.520"W
Elevation(±):	20 ft
Nearest Turbine:	16.6 mi

Figure B-2e

Long Point Beach

Town of West Tisbury, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND AND VINEYARD WIND 1 CUMULATIVE CONDITION

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

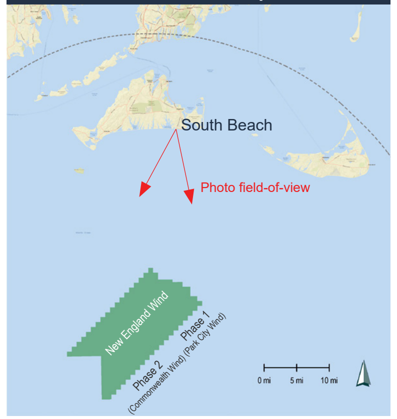
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	18-Oct-2017/8:48
Light Condition:	Side Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 20' 59.547"N
Longitude:	70° 31' 48.791"W
Elevation(±):	15 ft
Nearest Turbine:	NA

Visual Setting

Resource Type:	Recreation
Landscape Unit:	Ocean Beach, Coastal Dunes
Viewer Groups:	Residents, Vacationers, Recreational
Circumstances of View:	Stationary

Figure B-3a

South Beach

Town of Edgartown, Martha's Vineyard Island, MA

EXISTING VIEW

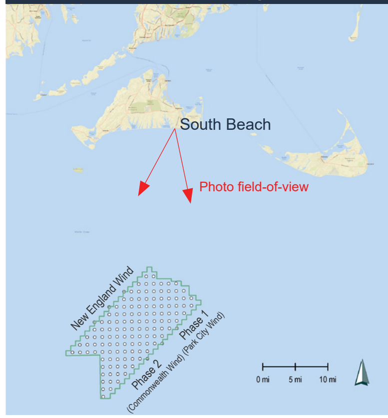
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	18-Oct-2017/8:48
Light Condition:	Side Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 20' 59.547"N
Longitude:	70° 31' 48.791"W
Elevation(±):	15 ft
Nearest Turbine:	23.1 mi

Visible Portion of Closest Turbine

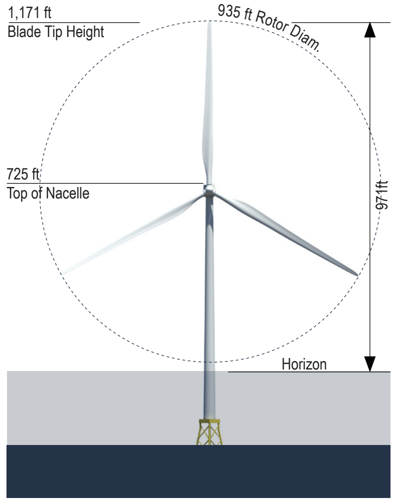


Figure B-3b

South Beach

Town of Edgartown, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

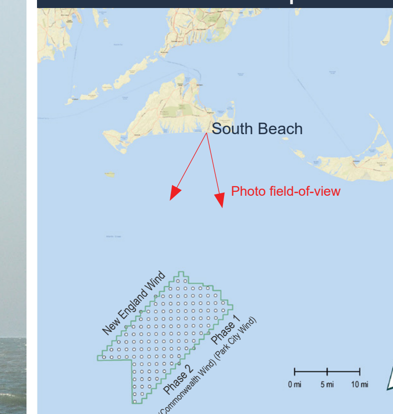
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	18-Oct-2017/8:48
Light Condition:	Side Light/Haze
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 20' 59.547"N
Longitude:	70° 31' 48.791"W
Elevation(±):	15 ft
Nearest Turbine:	23.1 mi

Visible Portion of Closest Turbine

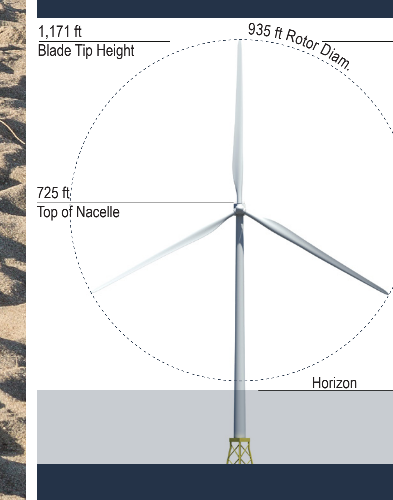


Figure B-3c

South Beach

Town of Edgartown, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND - MODERATE HAZE

This visualization incorporates a simulated haze condition that reduces visibility of the WTGs to approximately 50%.

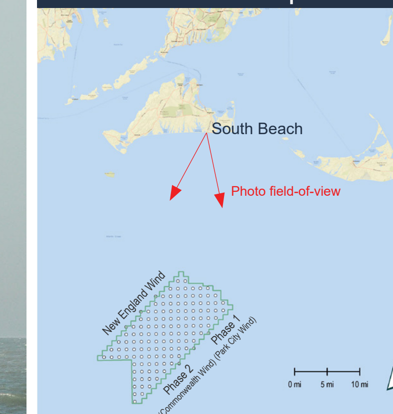
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	18-Oct-2017/8:48
Light Condition:	Side Light/Haze
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 20' 59.547"N
Longitude:	70° 31' 48.791"W
Elevation(±):	15 ft
Nearest Turbine:	23.1 mi

Visible Portion of Closest Turbine

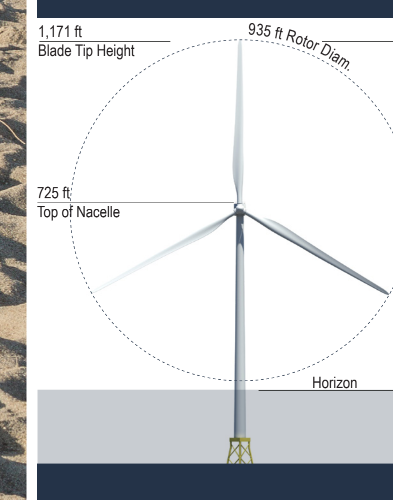


Figure B-3d

South Beach

Town of Edgartown, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND - HEAVY HAZE

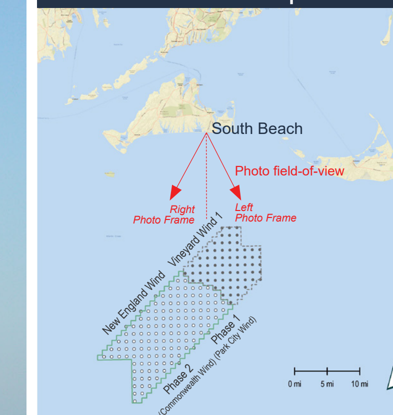
This visualization incorporates a simulated haze condition that substantially masks visibility of the WTGs.

The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND
Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	18-Oct-2017/8:48
Light Condition:	Side Light/Haze
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 20' 59.547"N
Longitude:	70° 31' 48.791"W
Elevation(±):	15 ft
Nearest Turbine:	14.9 mi

Vineyard Wind 1 and New England Wind Cumulative Field-of-View
LEFT PHOTO FRAME
(See photo enlargement Figure B-4f)

Vineyard Wind 1 and New England Wind Cumulative Field-of-View
RIGHT PHOTO FRAME
(See photo enlargement Figure B-4g)

Figure B-3e
South Beach
Town of Edgartown, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND AND VINEYARD WIND 1 CUMULATIVE CONDITION

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

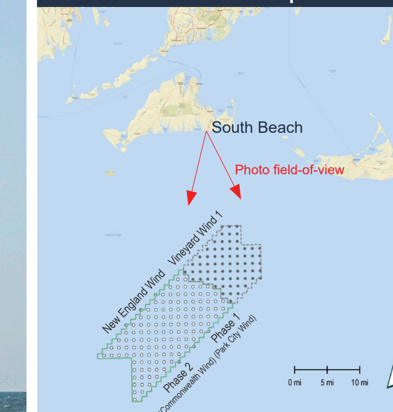
The above photograph is provided to illustrate the full field-of-view of New England Wind and Vineyard Wind 1 from this location. It is not intended to represent the scene as it would appear to normal human eyesight. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	18-Oct-2017/8:48
Light Condition:	Side Light/Haze
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 20' 59.547"N
Longitude:	70° 31' 48.791"W
Elevation(±):	15 ft
Nearest Turbine:	14.9 mi

Figure B-3f

South Beach

Town of Edgartown, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND AND VINEYARD WIND 1 CUMULATIVE CONDITION

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

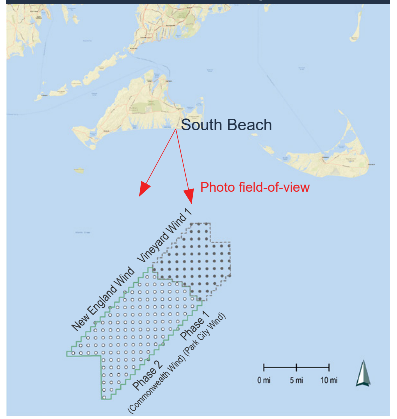
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	18-Oct-2017/8:48
Light Condition:	Side Light/Haze
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 20' 59.547"N
Longitude:	70° 31' 48.791"W
Elevation(±):	15 ft
Nearest Turbine:	14.9 mi

Figure B-3g

South Beach

Town of Edgartown, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND AND VINEYARD WIND 1 CUMULATIVE CONDITION

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

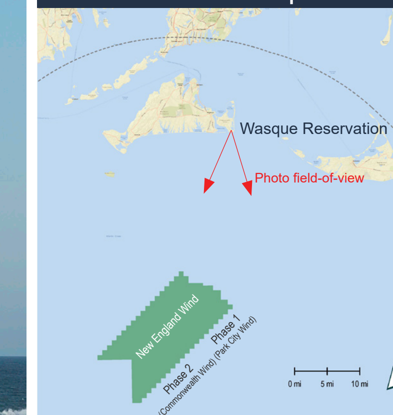
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	19-Oct-2017/8:40
Light Condition:	Side Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41°21'05.109"N
Longitude:	70°27'17.701"W
Elevation(±):	35 ft
Nearest Turbine:	NA

Visual Setting

Resource Type:	Recreation, Open Space Conservation
Landscape Unit:	Ocean Beach, Coastal Bluffs, Forest
Viewer Groups:	Vacationers, Recreational
Circumstances of View:	Stationary

Figure B-4a

Wasque Reservation

Town of Edgartown, Martha's Vineyard Island, MA

EXISTING VIEW

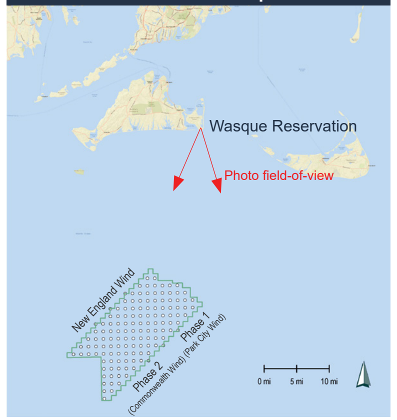
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	19-Oct-2017/8:40
Light Condition:	Side Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41°21'05.109"N
Longitude:	70°27'17.701"W
Elevation(±):	35 ft
Nearest Turbine:	24.1

Visible Portion of Closest Turbine

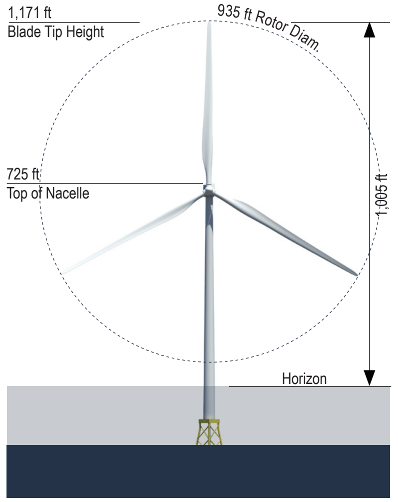


Figure B-4b

Wasque Reservation

Town of Edgartown, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Vineyard Wind 1 and New England Wind Cumulative Field-of-View

LEFT PHOTO FRAME

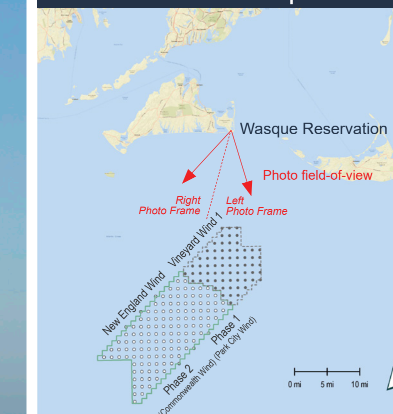
(See photo enlargement Figure B-5d)

Vineyard Wind 1 and New England Wind South Cumulative Field-of-View

RIGHT PHOTO FRAME

(See photo enlargement Figure B-5e)

Photo Location Map



Camera Data

Date / Time:	19-Oct-2017/8:40
Light Condition:	Side Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41°21'05.109"N
Longitude:	70°27'17.701"W
Elevation(±):	35 ft
Nearest Turbine:	14.1

Figure B-4c

Wasque Reservation

Town of Edgartown, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND AND VINEYARD WIND 1 CUMULATIVE CONDITION

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

The above photograph is provided to illustrate the full field-of-view of New England Wind and Vineyard Wind 1 from this location. It is not intended to represent the scene as it would appear to normal human eyesight. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map

Camera Data

Date / Time:	19-Oct-2017/8:40
Light Condition:	Side Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41°21'05.109"N
Longitude:	70°27'17.701"W
Elevation(±):	35 ft
Nearest Turbine:	14.1

Figure B-4d

Wasque Reservation

Town of Edgartown, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND AND VINEYARD WIND 1 CUMULATIVE CONDITION

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

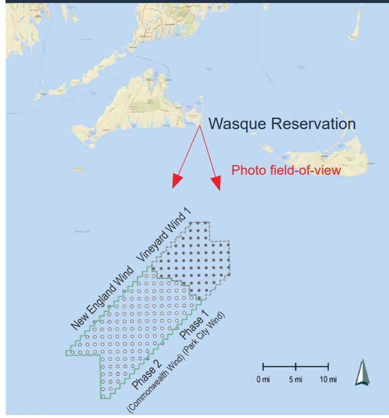
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	19-Oct-2017/8:40
Light Condition:	Side Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41°21'05.109"N
Longitude:	70°27'17.701"W
Elevation(±):	35 ft
Nearest Turbine:	14.1

Figure B-4e

Wasque Reservation

Town of Edgartown, Martha's Vineyard Island, MA

SIMULATED VIEW: NEW ENGLAND WIND AND VINEYARD WIND 1 CUMULATIVE CONDITION

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

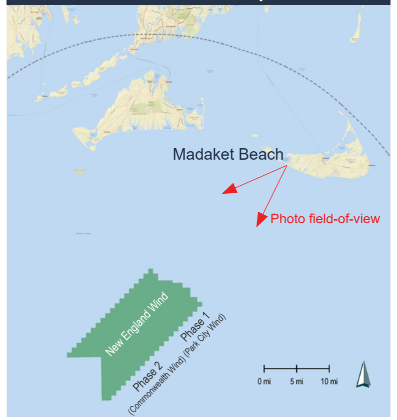
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	20-Oct-2017/7:50
Light Condition:	Side Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 16' 12.833"N
Longitude:	70° 12' 05.262"W
Elevation(±):	24 ft
Nearest Turbine:	NA

Visual Setting

Resource Type:	Recreation, Historic Resources
Landscape Unit:	Ocean Beach, Coastal Dunes Shoreline Residential
Viewer Groups:	Residents Vacationers, Recreational
Circumstances of View:	Stationary

Figure B-5a

Madaket Beach

Town of Nantucket, Nantucket Island, MA

EXISTING VIEW

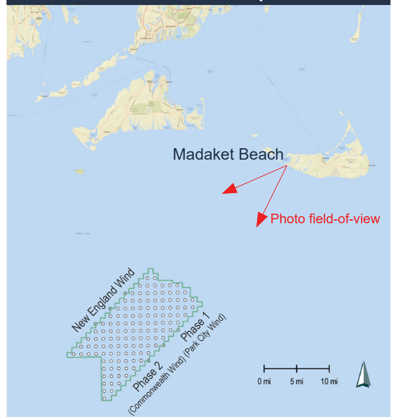
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	20-Oct-2017/7:50
Light Condition:	Side Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 16' 12.833"N
Longitude:	70° 12' 05.262"W
Elevation(±):	24 ft
Nearest Turbine:	25.1 mi

Visible Portion of Closest Turbine

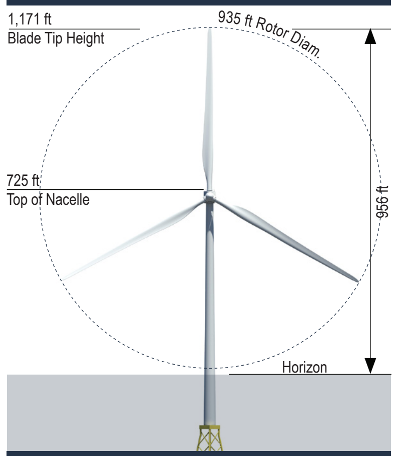


Figure B-5b

Madaket Beach

Town of Nantucket, Nantucket Island, MA

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

SIMULATED VIEW: NEW ENGLAND WIND

The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

Figure B-5c

Madaket Beach

Town of Nantucket, Nantucket Island, MA

SIMULATED VIEW: NEW ENGLAND WIND - MODERATE HAZE

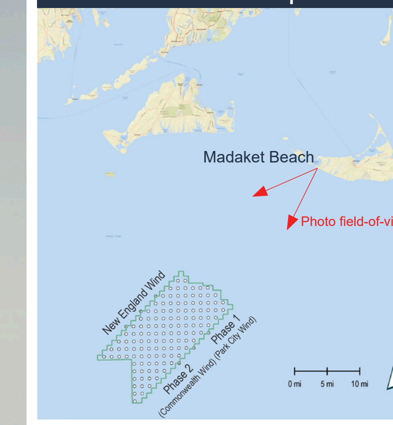
This visualization incorporates a simulated haze condition that reduces visibility of the WTGs to approximately 50%.

The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



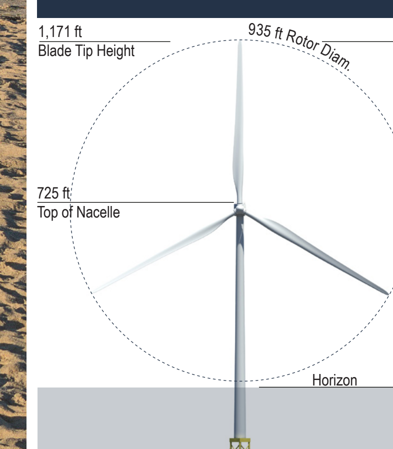
Camera Data

Date / Time:	20-Oct-2017/7:50
Light Condition:	Side Light/Haze
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 16' 12.833"N
Longitude:	70° 12' 05.262"W
Elevation(±):	24 ft
Nearest Turbine:	25.1 mi

Visible Portion of Closest Turbine

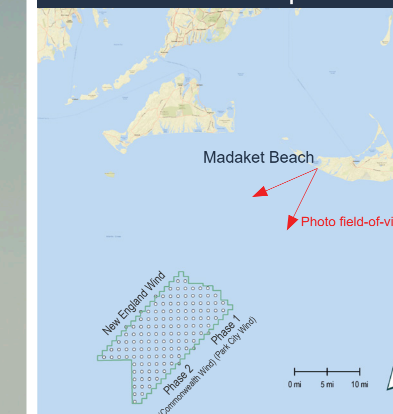


SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	20-Oct-2017/7:50
Light Condition:	Side Light/Haze
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 16' 12.833"N
Longitude:	70° 12' 05.262"W
Elevation(±):	24 ft
Nearest Turbine:	25.1 mi

Visible Portion of Closest Turbine

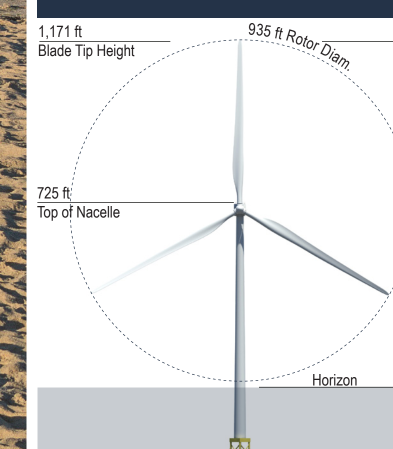


Figure B-5d

Madaket Beach

Town of Nantucket, Nantucket Island, MA

SIMULATED VIEW: NEW ENGLAND WIND - HEAVY HAZE

This visualization incorporates a simulated haze condition that substantially masks visibility of the WTGs.

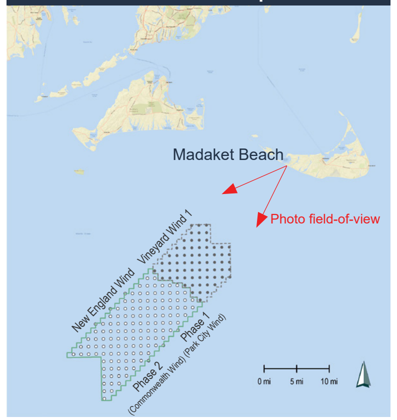
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	20-Oct-2017/7:50
Light Condition:	Side Light/Haze
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 16' 12.833"N
Longitude:	70° 12' 05.262"W
Elevation(±):	24 ft
Nearest Turbine:	15.5 mi

Figure B-5e

Madaket Beach

Town of Nantucket, Nantucket Island, MA

SIMULATED VIEW: NEW ENGLAND WIND AND VINEYARD WIND 1 CUMULATIVE CONDITION

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

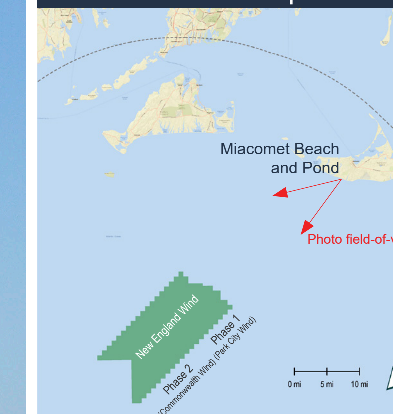
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	20-Oct-2017/10:17
Light Condition:	Side Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 14' 34.724"N
Longitude:	70° 07' 03.322"W
Elevation(±):	12 ft
Nearest Turbine:	NA

Visual Setting

Resource Type:	Recreation, Historic Resourc-es
Landscape Unit:	Ocean Beach, Coastal Dunes, Salt Pond/Tidal Marsh
Viewer Groups:	Residents Vacationers, Recreational
Circumstances of View:	Stationary

Figure B-6a

Miacomet Beach and Pond

Town of Nantucket, Nantucket Island, MA

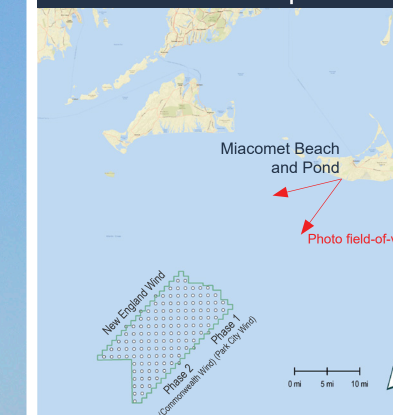
EXISTING VIEW

The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND
Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	20-Oct-2017/10:17
Light Condition:	Side Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 14' 34.724"N
Longitude:	70° 07' 03.322"W
Elevation(±):	12 ft
Nearest Turbine:	26.8 mi

Visible Portion of Closest Turbine

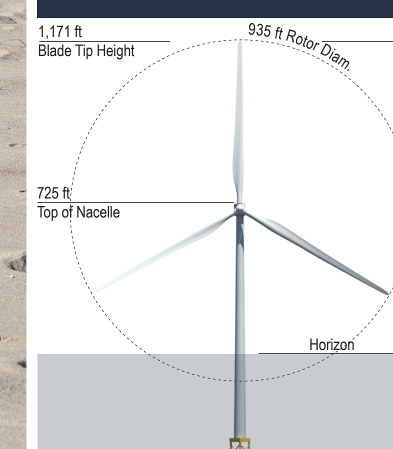


Figure B-6b

Miacomet Beach and Pond

Town of Nantucket, Nantucket Island, MA

SIMULATED VIEW: NEW ENGLAND WIND

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

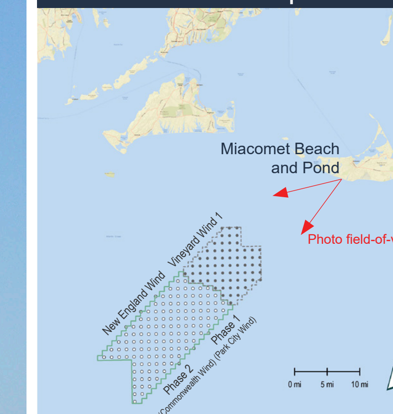
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	20-Oct-2017/10:17
Light Condition:	Side Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 14' 34.724"N
Longitude:	70° 07' 03.322"W
Elevation(±):	12 ft
Nearest Turbine:	17.2 mi

Figure B-6c

Miacomet Beach and Pond

Town of Nantucket, Nantucket Island, MA

SIMULATED VIEW: NEW ENGLAND WIND AND VINEYARD WIND 1 CUMULATIVE CONDITION

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

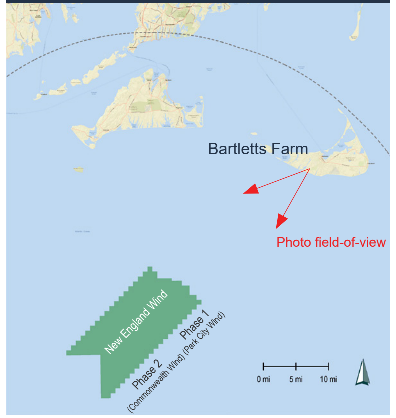
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	20-Oct-2017/11:05
Light Condition:	Side Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 15' 23.806"N
Longitude:	70° 07' 56.236"W
Elevation(±):	13 ft
Nearest Turbine:	NA

Visual Setting

Resource Type:	Historic Resources
Landscape Unit:	Agriculture/Open Field
Viewer Groups:	Residents, Tourists, Vacationers
Circumstances of View:	Stationary

Figure B-7a

Bartletts Farm

Town of Nantucket, Nantucket Island, MA

EXISTING VIEW

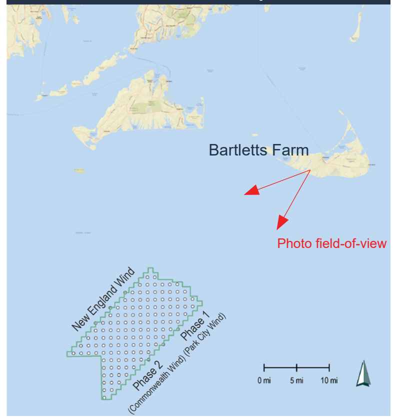
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	20-Oct-2017/11:05
Light Condition:	Side Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 15' 23.806"N
Longitude:	70° 07' 56.236"W
Elevation(±):	13 ft
Nearest Turbine:	26.9 mi

Visible Portion of Closest Turbine

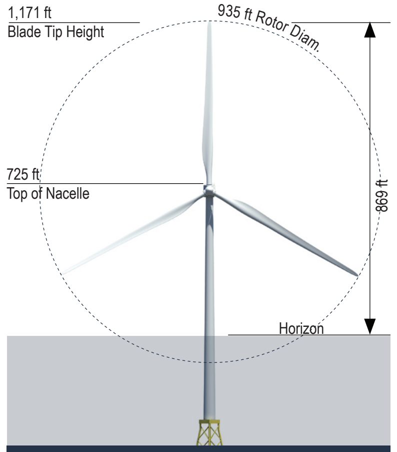


Figure B-7b

Bartletts Farm

Town of Nantucket, Nantucket Island, MA

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

SIMULATED VIEW: NEW ENGLAND WIND

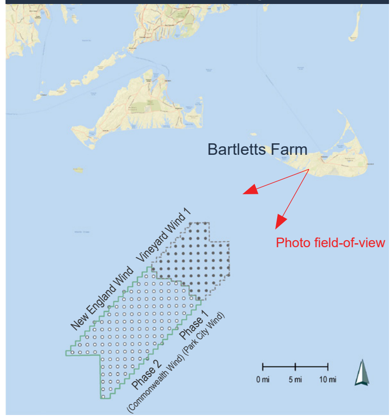
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	20-Oct-2017/11:05
Light Condition:	Side Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 15' 23.806"N
Longitude:	70° 07' 56.236"W
Elevation(±):	13 ft
Nearest Turbine:	17.2 mi

Figure B-7c

Bartletts Farm

Town of Nantucket, Nantucket Island, MA

SIMULATED VIEW: NEW ENGLAND WIND AND VINEYARD WIND 1 CUMULATIVE CONDITION

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

Figure B-8a

Tom Nevers Field

Town of Nantucket, Nantucket Island, MA

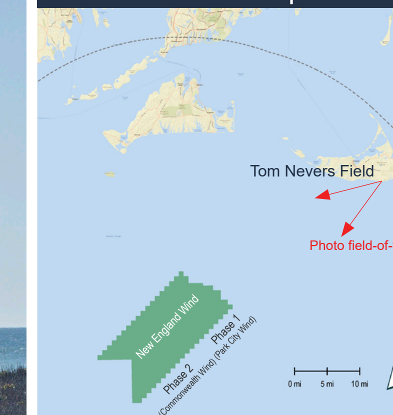
EXISTING VIEW

The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	20-Oct-2017/14:45
Light Condition:	Back Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 14' 23.522"N
Longitude:	70° 00' 33.675"W
Elevation(±):	55 ft
Nearest Turbine:	NA

Visual Setting

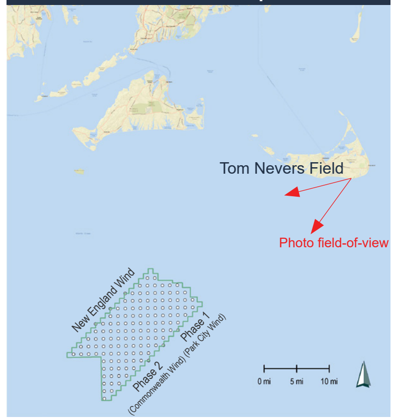
Resource Type:	Recreation
Landscape Unit:	Maintained Recreation, Coastal Bluffs, Coastal Scrub
Viewer Groups:	Residents Vacationers, Recreational
Circumstances of View:	Stationary

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time:	20-Oct-2017/14:45
Light Condition:	Back Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 14' 23.522"N
Longitude:	70° 00' 33.675"W
Elevation(±):	55 ft
Nearest Turbine:	30.9 mi

Visible Portion of Closest Turbine

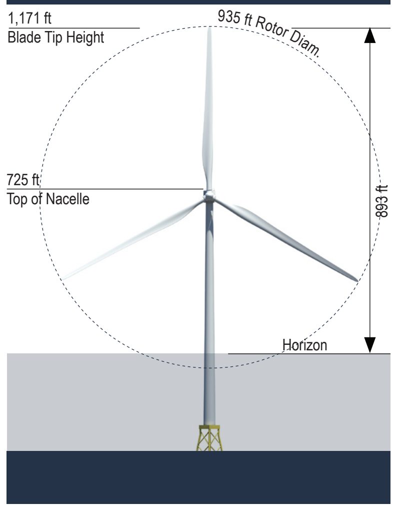


Figure B-8b

Tom Nevers Field

Town of Nantucket, Nantucket Island, MA

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

SIMULATED VIEW: NEW ENGLAND WIND

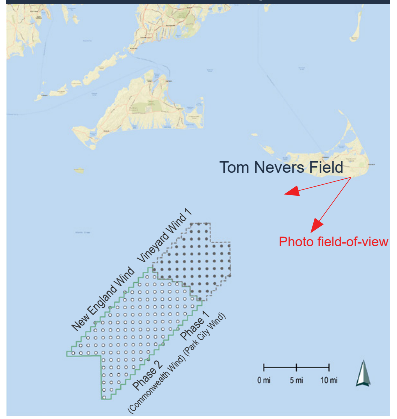
The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Photographic Simulations

Photo Location Map



Camera Data

Date / Time	20-Oct-2017/14:45
Light Condition:	Back Light
Camera:	Canon 5d Mark IV
Focal Length:	50mm (full frame)

Camera Location

Latitude:	41° 14' 23.522"N
Longitude:	70° 00' 33.675"W
Elevation(±):	55 ft
Nearest Turbine:	21.7 mi

Figure B-8c

Tom Nevers Field

Town of Nantucket, Nantucket Island, MA

SIMULATED VIEW: NEW ENGLAND WIND AND VINEYARD WIND 1 CUMULATIVE CONDITION

This photo simulation conservatively presents project visibility under clear weather conditions. Minimal atmospheric haze is applied to simulated elements to account for sea spray and sea salt typical of atmospheric conditions over the ocean.

The above photograph is intended to be viewed 20 inches from the reader's eye when printed on 11"x17" paper and 13 inches from the reader's eye when printed on 8 1/2" x 11" paper. Viewing on an uncalibrated video monitor can alter intended lightness, color and/or contrast of the image.

SARATOGA ASSOCIATES

Appendix C

VISUAL SIMULATIONS – PANORAMA VIEWS

TO BE PROVIDED AT A LATER DATE

Appendix D

METEOROLOGICAL ANALYSIS

New England Wind

Meteorological Analysis

Prepared for:

Park City Wind LLC

Prepared by:

Epsilon Associates, Inc.

June 2022

TABLE OF CONTENTS

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1.0 INTRODUCTION

New England Wind is the proposal to develop offshore renewable wind energy facilities in Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0534 along with associated offshore and onshore cabling, onshore substations, and onshore operations and maintenance (O&M) facilities. Lease Area OCS-A 0534 is within the Massachusetts Wind Energy Area identified by BOEM, following a public process and environmental review, as suitable for wind energy development. Park City Wind LLC, a wholly owned subsidiary of Avangrid Renewables, LLC, is the Proponent of this Construction and Operations Plan (COP) and will be responsible for the construction, operation, and decommissioning of New England Wind.

New England Wind's offshore renewable wind energy facilities are located immediately southwest of Vineyard Wind 1, which is located in Lease Area OCS-A 0501. New England Wind will occupy all of Lease Area OCS-A 0534 and potentially a portion of Lease Area OCS-A 0501 in the event that Vineyard Wind 1 does not develop "spare" or extra positions included in Lease Area OCS-A 0501 and Vineyard Wind 1 assigns those positions to Lease Area OCS-A 0534. For the purposes of the COP, the Southern Wind Development Area (SWDA) is defined as all of Lease Area OCS-A 0534 and the southwest portion of Lease Area OCS-A 0501, as shown in Figure 1.1-1 of COP Volume I. New England Wind will be developed in two Phases with a maximum of 130 wind turbine generator (WTG) and electrical service platform (ESP) positions. The SWDA may be 411–453 square kilometers (km^2) (101,590–111,939 acres) in size depending upon the final footprint of the Vineyard Wind 1 project. At this time, the Proponent does not intend to develop the two positions in the separate aliquots located along the northeastern boundary of Lease Area OCS-A 0501 as part of New England Wind. The SWDA (excluding the two separate aliquots that are closer to shore) is just over 32 kilometers (km) (20 miles [mi]) from the southwest corner of Martha's Vineyard and approximately 38 km (24 mi) from Nantucket. In accordance with US Coast Guard (USCG) recommendations, the WTGs and ESP(s) in the SWDA will be oriented in fixed east-to-west rows and north-to-south columns with one nautical mile (1.85 km) spacing between positions. This uniform grid layout provides 1 NM wide corridors in the east-west and north-south directions as well as 0.7 NM (1.3 km) wide corridors in the northwest-southeast and northeast-southwest directions.

As a supplement to the visibility assessment, a meteorological analysis was conducted to identify the common weather conditions and assess visibility within the SWDA, as meteorological and atmospheric conditions play a role in providing the opportunity for New England Wind to be visible.

The meteorological analysis was modeled after BOEM's "Renewable Energy Viewshed Analysis and Continental Shelf Call Area: Compendium Report, Meteorological Conditions Assessment" and included the following steps:

1. A descriptive analysis of meteorological conditions, such as winds, common weather conditions, reported visibilities, and average daily high and low temperatures, as well as average relative humidity on an annual, seasonal, and daily basis; and

2. The development of a method to assess visibility beyond 10 miles, which is the extent of visibility predictions typically provided by airports.

2.0 METHODS

For this analysis, seasons are defined as follows:

1. Spring: March 22 – June 21;
2. Summer: June 22 – September 21;
3. Fall: September 22 – December 21; and
4. Winter: December 22 – March 21.

Unless otherwise noted, daytime hours are assumed to be 7:00 am through 6:59 pm, while nighttime hours are assumed to be 7:00 pm through 6:59 am.

This methodology captures average annual day and night conditions.

2.1 Meteorological Station Selection

Two meteorological stations in Massachusetts— (1) the Martha's Vineyard Airport on Martha's Vineyard Island and (2) the Nantucket Memorial Airport on Nantucket Island—were identified as being the closest and most representative stations to the SWDA. There are no other locations closer to the Offshore Development Area with meteorological stations that have collected data on an hourly basis for over 10 years.

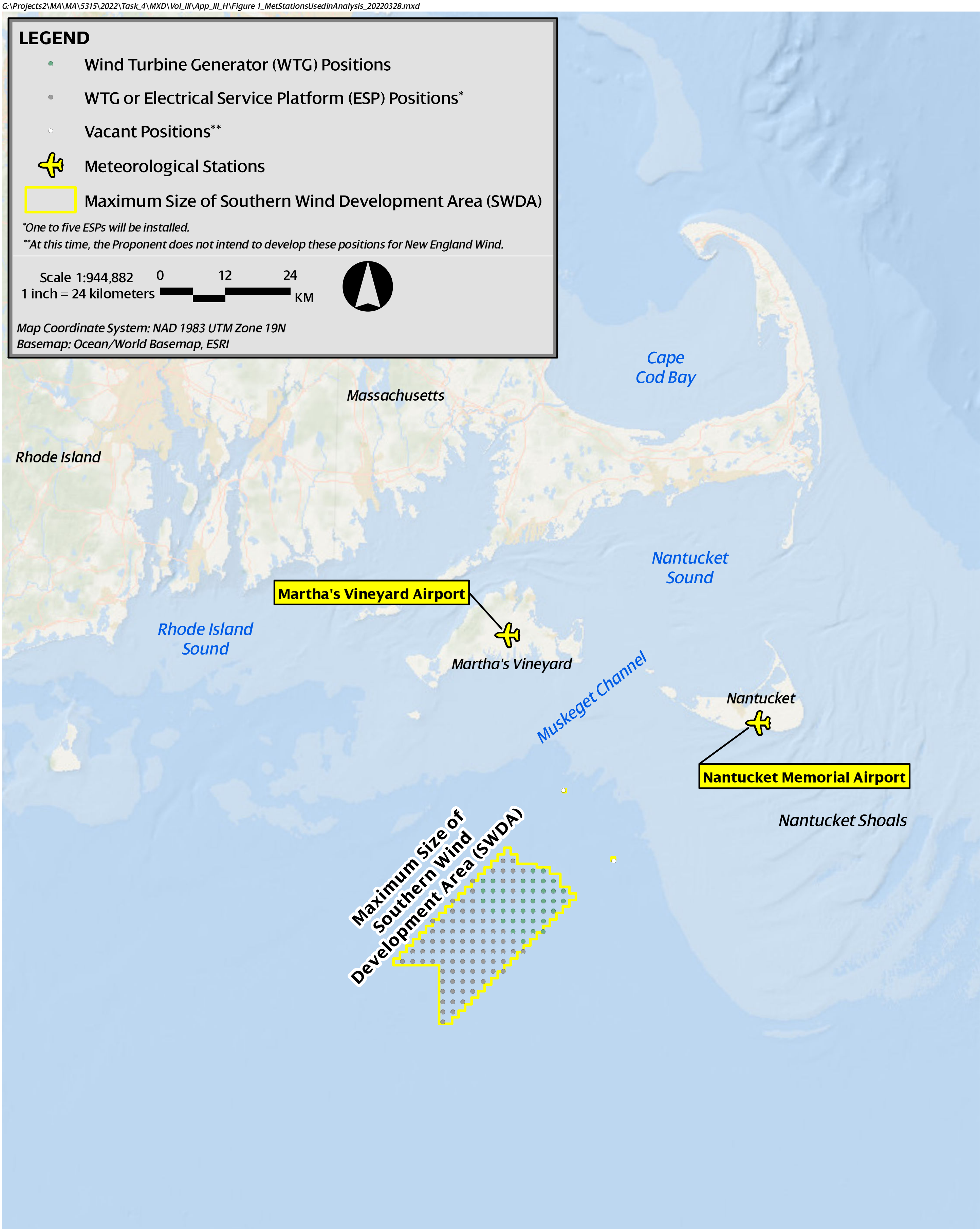
Data from the Local Climatological Data (LCD) data set, available from the National Climatic Data Center (NCDC), were selected as suitable data sources for this analysis. LCD data comprises hourly meteorological data for approximately 1,600 currently active stations in the US and includes Automated Surface Observing System (ASOS) and Automated Weather Observing System (AWOS) observations. Both selected stations are ASOS stations and therefore collect data on temperature, dew point, wind direction, wind speed, precipitation, present weather, visibility, and pressure on at least an hourly basis.

Both selected stations were evaluated for the 11-year period of 2006-2016, where hourly data were available for both locations. Figure 1 shows the location of both stations in relation to the locations of the WTGs/ESP(s) within the Offshore Development Area.

2.2 LCD Data Validation and Processing

Hourly data were imported into Microsoft Excel for processing and validation. It was discovered that the data contained many more records (with each record representing one observation) than the number of hours in each time period, indicating duplicate records. A total of 22.6% of the hours (93,393 hours) contained more than one record. Inspection of duplicates indicated that both a special observation and a standard automated observation were often recorded in a

G:\Projects2\MA\MA\5315\2022\Task_4\MXD\Vol_III\App_III_H\Figure 1_MetStationsUsedinAnalysis_20220328.mxd



New England Wind
AVANGRID RENEWABLES

Figure 1
Meteorological Stations Used in the Analysis

given hour. Special observations are recorded if weather conditions are changing rapidly or crossing specific aviation thresholds. Where this occurred, the automated observation was retained, and the special observation was removed. This approach maximized consistency across records as most records were automated. Some "Summary of Day" and "Summary of Month" records were also removed because these were inconsistent with the hourly data. In total, 53% of the initial raw data (219,710 records) were removed as non-hourly data.

A total of 192,690 records remained in the validated data set, representing two stations as detailed in Table 1.

Table 1 Total Records Retained by Station

Station Name	Number of Records
Martha's Vineyard Airport	96,354
Nantucket Memorial Airport	96,336
TOTAL	**192,690**

Validation for data completeness consisted of comparing the number of remaining records to the number of possible records each year or season. Seasonal completeness is important to ensure that a given year's data (and thus study results) were not biased toward a time of year. As shown in Table 2 and Table 3, all selected sites exceeded 80% completeness for each year and season.

Table 2 Annual Completeness by Station (percent)

Station Name	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Martha's Vineyard Airport	99.9%	100%	100%	100%	100%	100%	100%	99.9%	99.9%	99.8%	99.9%
Nantucket Memorial Airport	99.4%	99.9%	100%	99.9%	100%	100%	100%	100%	100%	100%	99.9%

Table 3 Seasonal Completeness by Station (percent)

Station Name	Winter	Spring	Summer	Fall
Martha's Vineyard Airport	99.8%	100.0%	99.9%	99.9%
Nantucket Memorial Airport	99.9%	99.9%	99.9%	99.9%

In addition to the hourly LCD, ASOS 1-minute "Page 1 data" (DSI-6405) were downloaded for both the Martha's Vineyard and Nantucket stations for the period of 2006 through 2016. This data contained measurements of visibility extinction coefficient, wind speed, and wind direction and were included because they contained more detailed measurements of visibility.

3.0 DESCRIPTIVE DATA ANALYSIS

3.1 Wind Patterns

Prevailing weather at any given site can be understood by typical wind patterns. This relationship is illustrated by wind roses, which display the frequency with which the wind blows from a given direction on a polar plot representing all compass directions. Longer barbs indicate more frequent winds from that direction. Within each barb, different levels of wind speed are broken down, showing typical wind speeds originating from a direction. Collectively, wind direction and speed indicate approaching weather, such as warm and humid tropical air masses or cooler and drier continental air masses. Calm winds were defined as reported winds less than 0.5 meters per second and are not included in the wind roses.

Wind roses for each site, dating from 2006–2016, are shown in Figures 2 through 3. Prevailing winds at each site are generally from the southwest for the Martha's Vineyard weather station and west for Nantucket. The percent of hours with calm winds ranged from about 8.5% on Martha's Vineyard to 3.7% on Nantucket. Variation in wind directions and speed at each site is likely due to the location of the site relative to water, both in terms of cardinal direction and distance, and local geographic variations.

Wind roses are provided for each site by month (e.g., average January winds for all January months in the data set) in Appendix B. On Martha's Vineyard and Nantucket, winds generally originate from the southwest in the spring and summer, shifting to northerly and westerly in the fall and winter. Spring and fall are transitional periods with more variation in wind direction. The highest wind speeds and fewest calm winds occur in winter, with the passage of winter storms, while the lowest speeds and most calm winds occur in the more often stagnant conditions of summer.

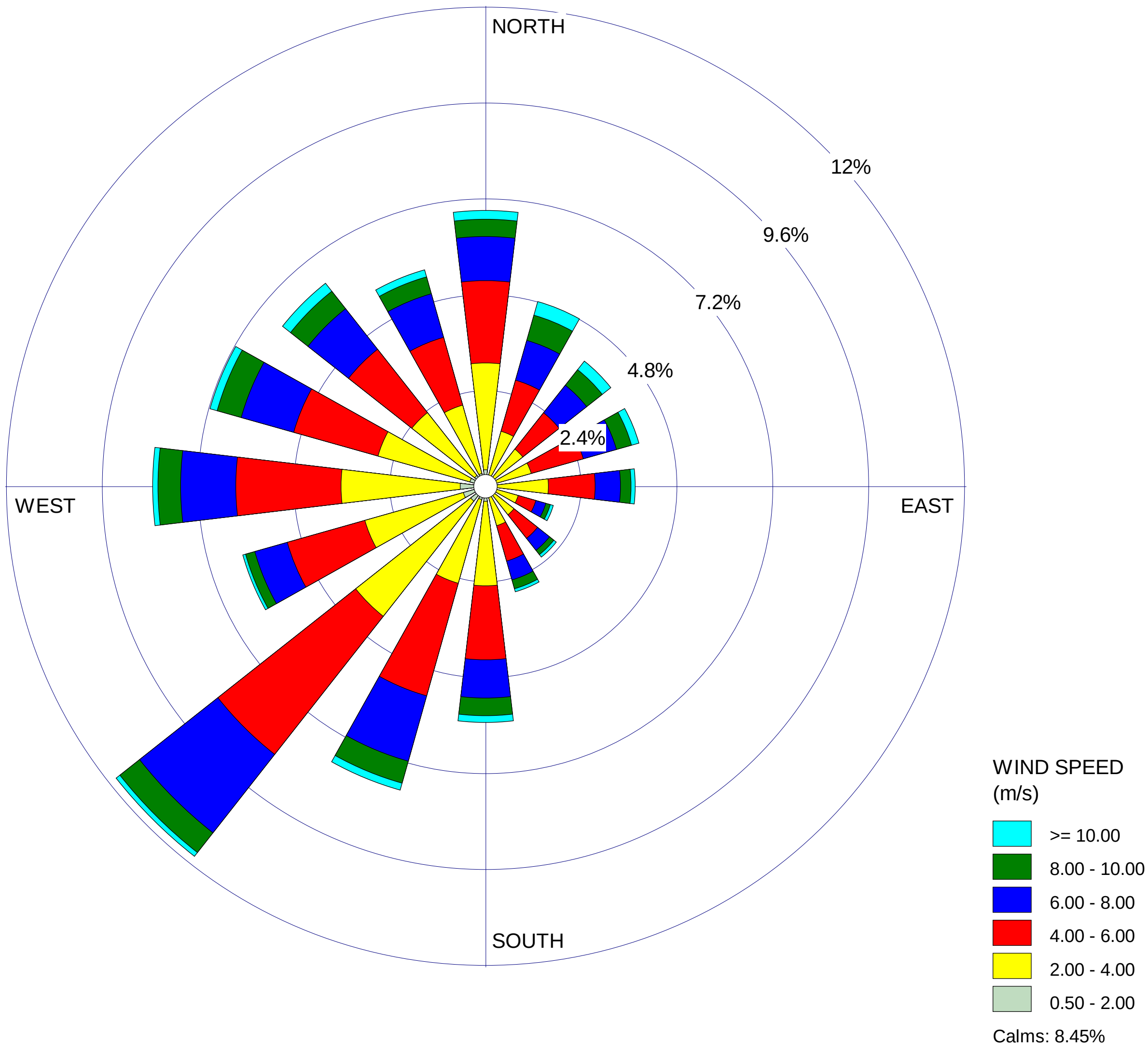
3.2 Average Temperature and Humidity

Average temperature and humidity are other metrics that are typically used to help understand visibility at given locations.

Both Martha's Vineyard and Nantucket display patterns of temperature change throughout the year, with warmer temperatures occurring during the springtime and summer periods and colder temperatures occurring during the fall and winter periods, as shown in Figure 4. Similar patterns between the stations were observed, as illustrated in Figures 5 and 6, with Nantucket having slightly lower daily maximum temperatures and slightly higher daily low temperatures. Histograms of the temperature distribution for each season and station are provided in Appendix C, Temperature Distribution.

Figure 2

WIND ROSE PLOT:	DISPLAY:
Martha's Vineyard Airport, Vineyard Haven, MA **10 Year Wind Rose, 2006-2016**	**Wind Speed** **Direction (blowing from)**

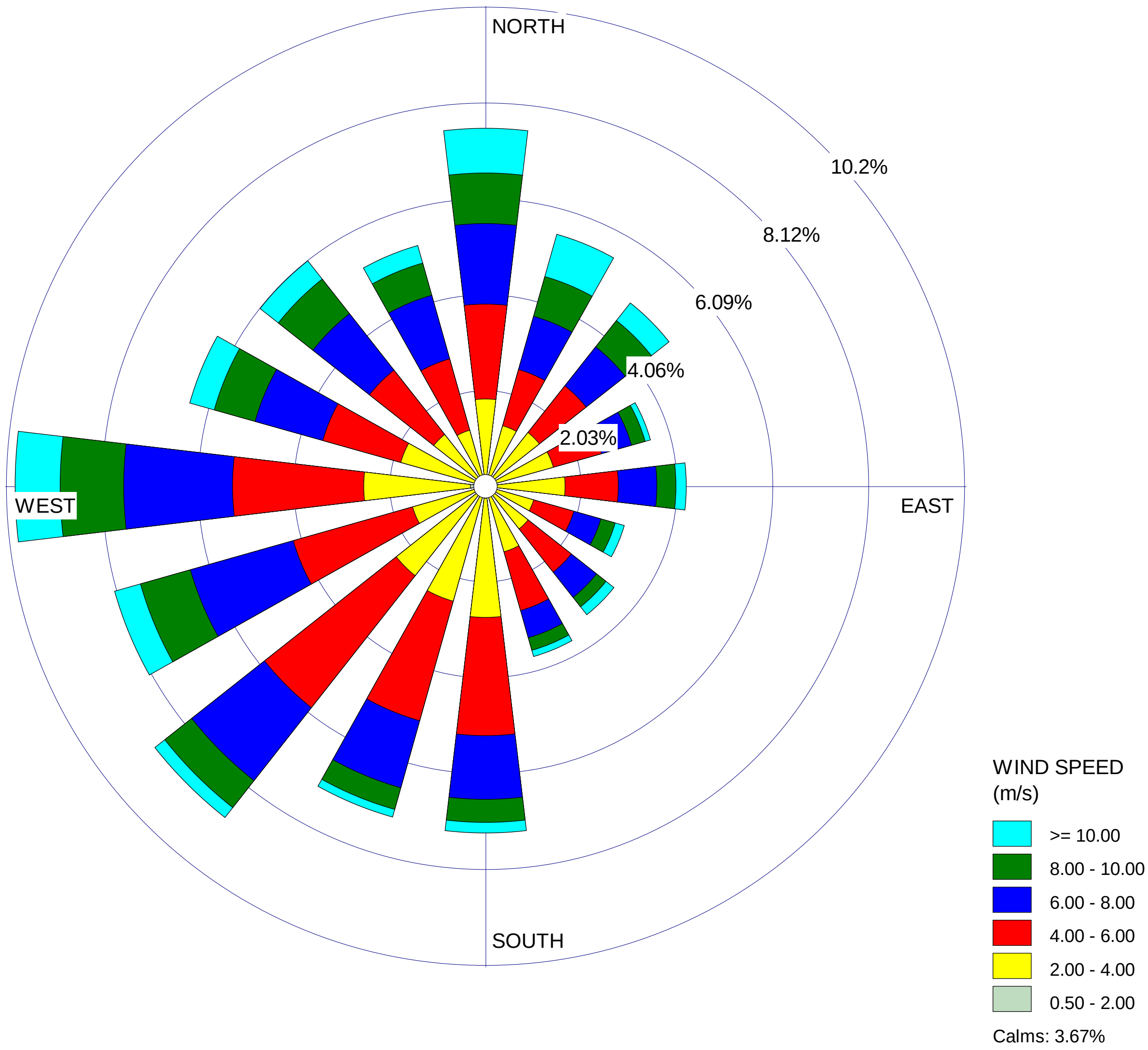


COMMENTS:	DATA PERIOD:	COMPANY NAME:
	Start Date: 1/1/2006 - 00:00 **End Date: 12/31/2016 - 19:00**	**Epsilon Associates**
	CALM WINDS: **8.45%**	TOTAL COUNT: **94460 hrs.**
	AVG. WIND SPEED: **4.44 m/s**	DATE: **11/3/2017**

WRPLOT View - Lakes Environmental Software

Figure 3

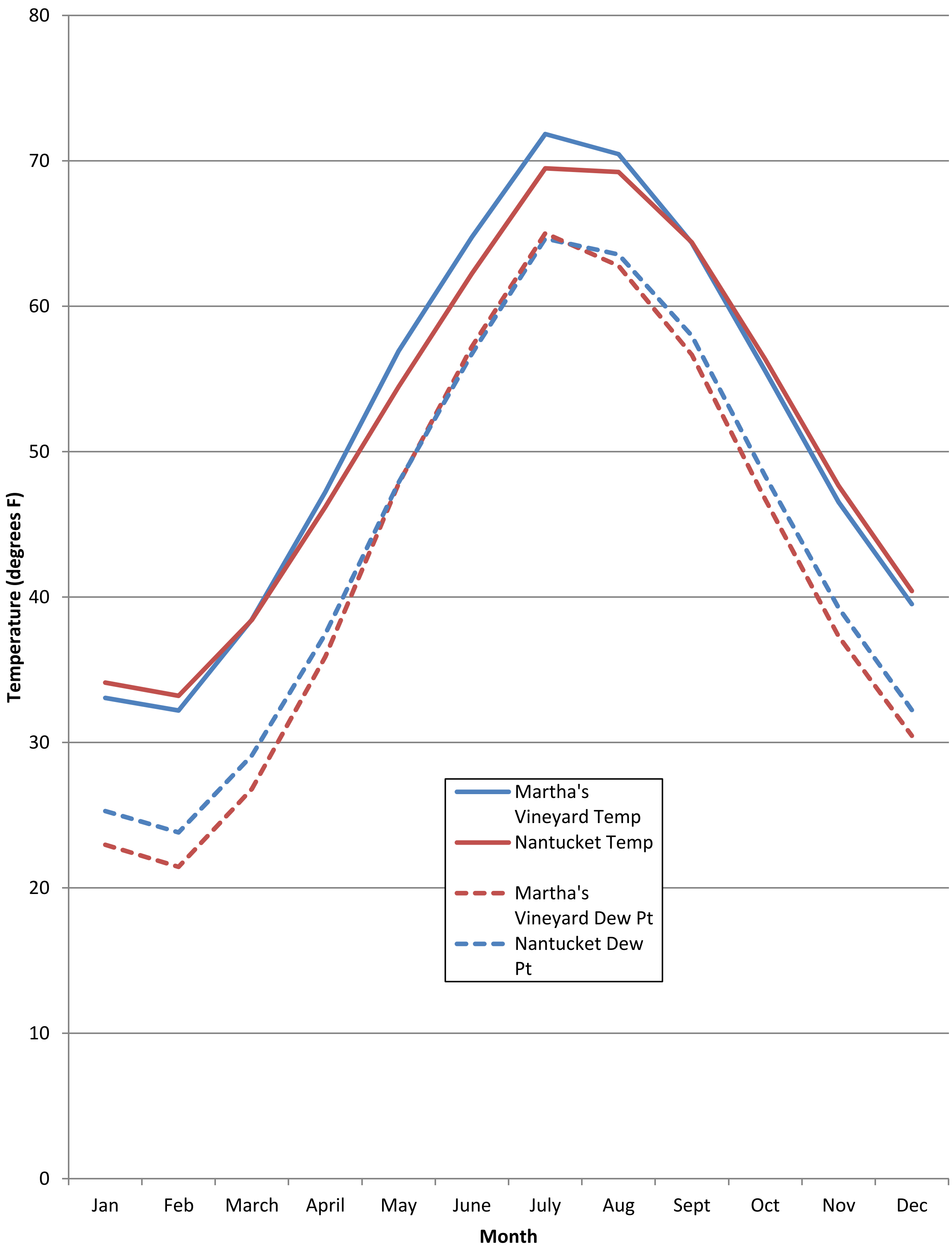
WIND ROSE PLOT: **Nantucket Memorial Airport, Nantucket, MA** **10 Year Wind Rose, 2006-2016**	DISPLAY: **Wind Speed** **Direction (blowing from)**



COMMENTS:	DATA PERIOD: **Start Date: 1/1/2006 - 00:00** **End Date: 12/31/2016 - 19:00**	COMPANY NAME: **Epsilon Associates**
	CALM WINDS: **3.67%**	TOTAL COUNT: **95669 hrs.**
	AVG. WIND SPEED: **5.43 m/s**	DATE: **11/3/2017**

WRPLOT View - Lakes Environmental Software

Figure 4: Monthly Average Temperature and Dewpoint at All Stations



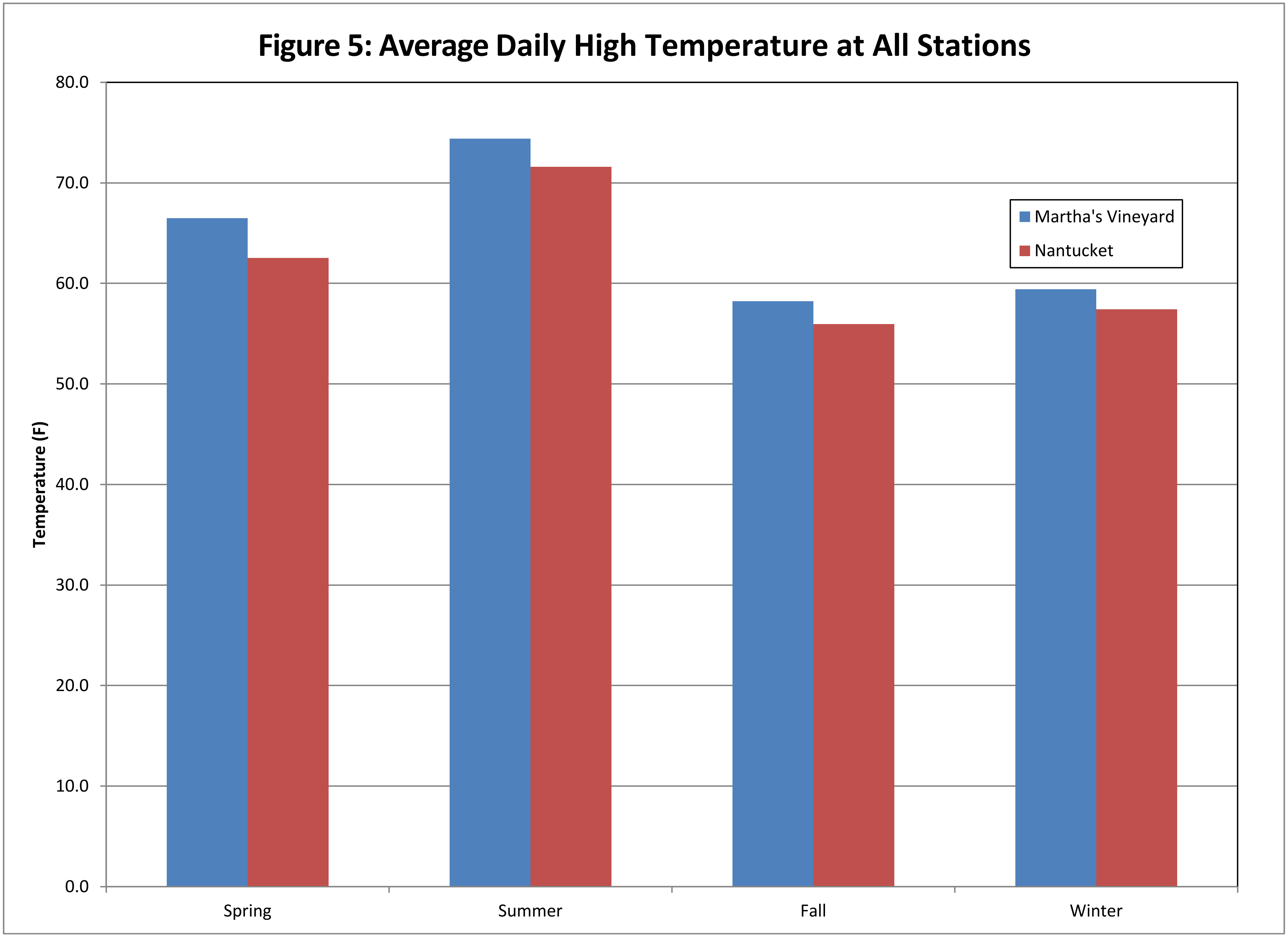


Figure 5: Average Daily High Temperature at All Stations
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Temperature (F)
Martha's Vineyard
Nantucket
Spring
Summer
Fall
Winter

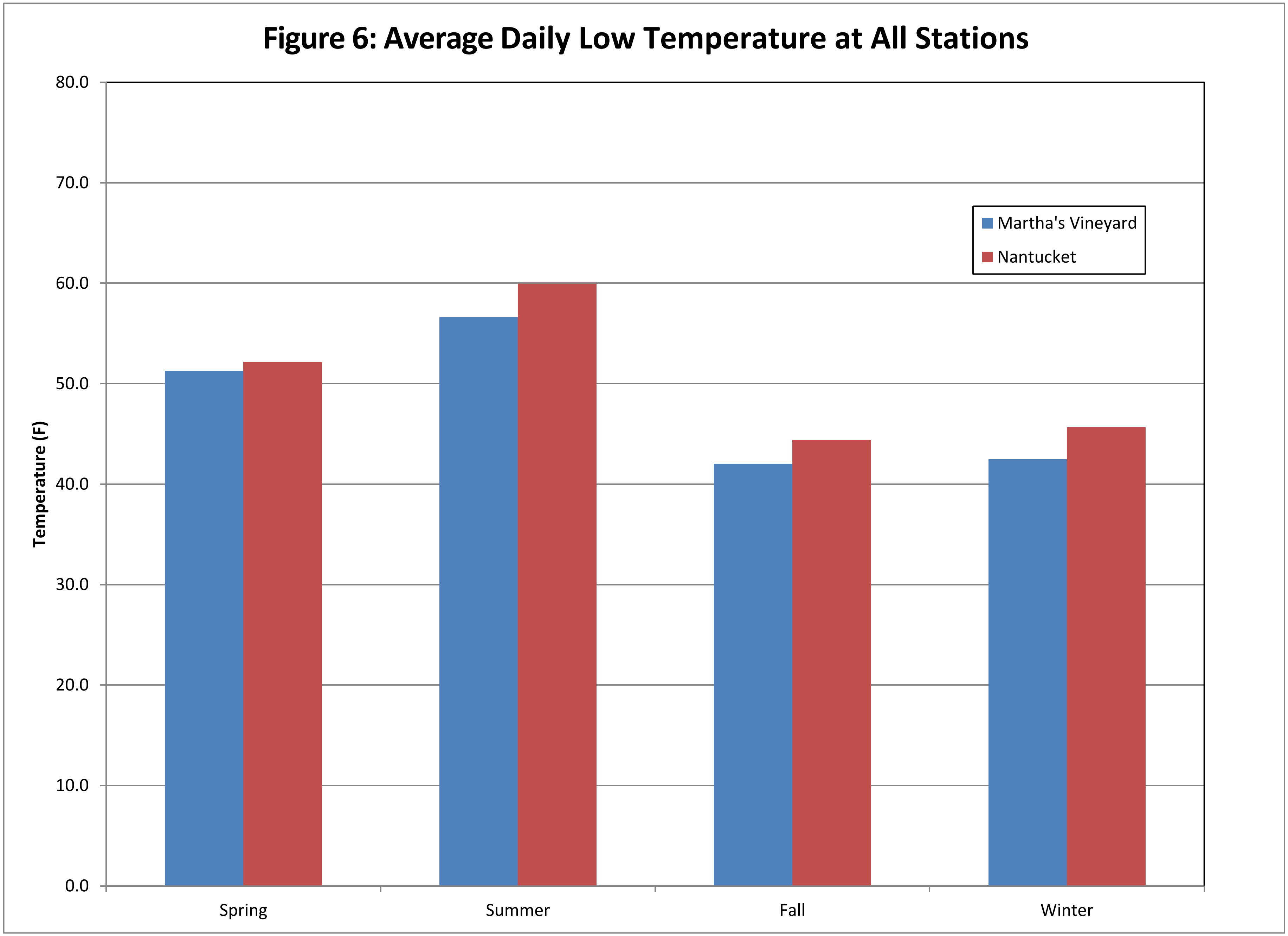


Figure 6: Average Daily Low Temperature at All Stations
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Temperature (F)
Martha's Vineyard
Nantucket
Spring
Summer
Fall
Winter

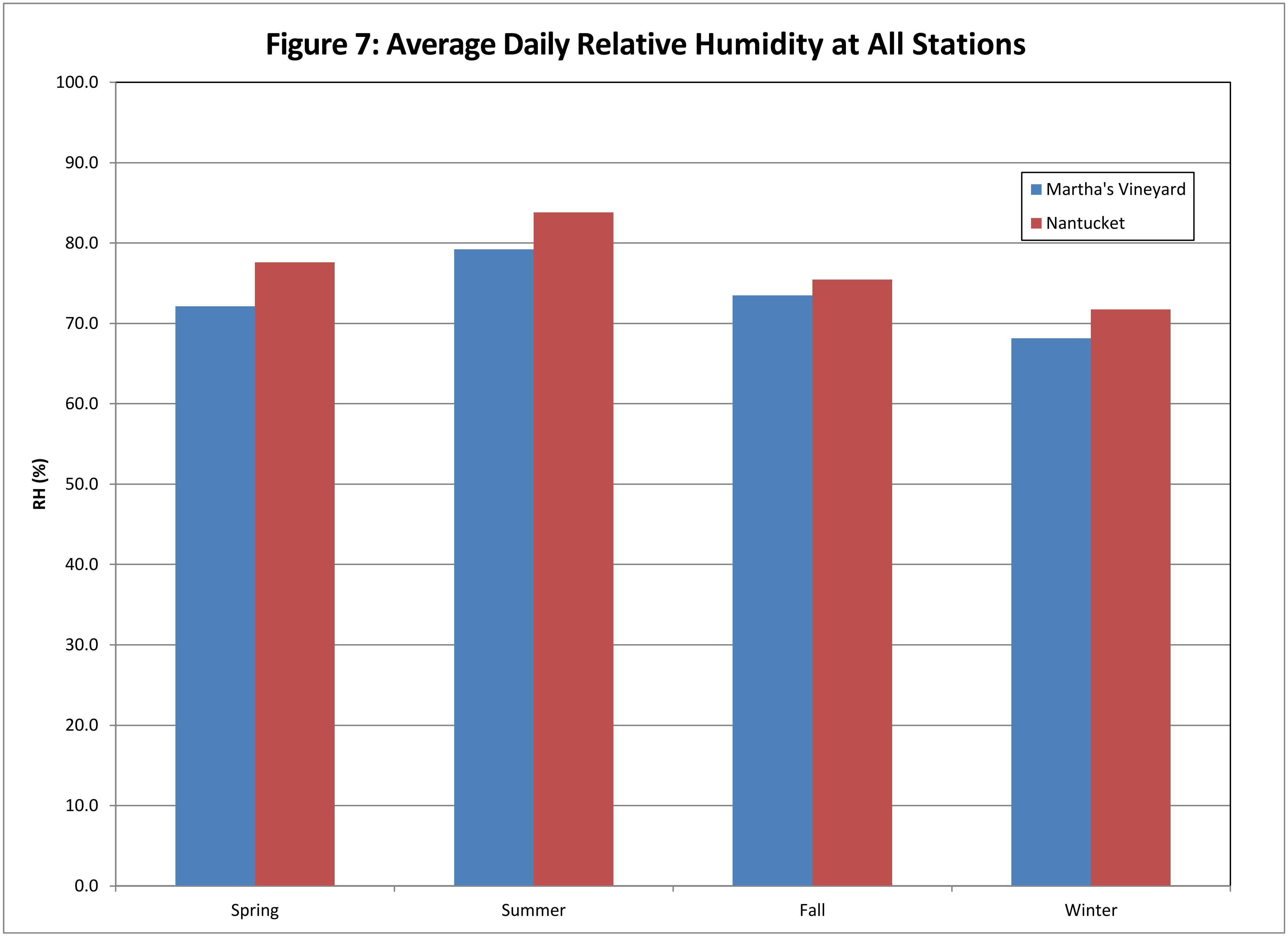


Figure 7: Average Daily Relative Humidity at All Stations
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
RH (%)
Martha's Vineyard
Nantucket
Spring
Summer
Fall
Winter

Relative humidity has been shown to have a strong effect on visibility (Zhang et al. 2015; Malm 1999). Water vapor condenses on particles in the air, thereby increasing their size and the corresponding amount of light scattered or absorbed. Figure 7 shows the seasonal changes in relative humidity amongst the two stations with Nantucket having slightly higher average relative humidity.

3.3 Reported Visibilities

Visibility measurements from meteorological stations measure the "the greatest distance at which an observer can just see a **black** object viewed against the horizon sky" and are typically recorded in intervals ranging from ¼ to 10 statute miles (Malm 1999). For the LCD data set, visibility was measured and recorded on a 1-minute basis, averaged across hours, and then binned to the following categories: less than ¼ mile, ¼ mile, ½ mile, ¾ mile, 1 mile, 1¼ miles, 1½ miles, 1¾ miles, 2 miles, 2½ miles, 3 miles, 3½ miles, 4 miles, 5 miles, 7 miles, and 10 miles or greater for the hourly reports. As shown in Table 4, analysis of the hourly data indicates majority of the hours yielded a visibility of 10 miles or greater.

Table 4 Frequency of Reported and Truncated Visibility Ranges

Station Name	Less than 10 miles (percent)				10 miles or greater (percent)			
	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall
Martha's Vineyard Airport	21%	24%	30%	20%	79%	76%	70%	80%
Nantucket Memorial Airport	30%	34%	39%	26%	70%	66%	61%	74%

3.4 Common Weather Conditions

In addition to recording information on temperature, dew point, relative humidity, and visibility, meteorological stations also capture the current meteorological condition(s); these types of observations are referred to as "present weather." Present weather conditions include events such as haze, fog, various forms and intensities of precipitation, and even more obscure events such as smoke or dust storms. Several conditions may be reported at any time. Conditions that may be considered notable, such as extreme heat or high winds, are adequately captured by the measured parameters and are not included as present weather codes.

For the purposes of this analysis, the conditions most likely to affect visibility are those that would be included in the "Present Weather" field of an observation. For many records, no present weather is reported. In other words, conditions were clear, and no "events" (such as haze, fog, and various forms and intensities of precipitation) occurred during that hourly observation. This is expected as weather conditions, such as haze or fog, typically occur infrequently compared to fair weather conditions. However, these data do not indicate periods of high visibility, such as those that may occur under low humidity and temperature. Likewise, these data do not indicate periods of lower visibility, such as those that may occur under periods of high humidity and temperature. The percentage of hours for which present weather is reported or not reported is shown in Table 5. The remaining discussion of present weather will focus on hours for which one or more present weather condition is reported.

Table 5 Frequency of Present Weather Reports (percent)

Station Name	Present Weather Not Reported				Present Weather Reported			
	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall
Martha's Vineyard Airport	81%	78%	78%	83%	19%	21%	22%	17%
Nantucket Memorial Airport	78%	73%	72%	80%	22%	27%	28%	21%

At Martha's Vineyard airport, when present weather was reported, the most common conditions were mist and rain. This was consistent across each season and under day and night conditions. At Nantucket airport, the common weather conditions were generally mist and rain as well. However, during the summer months, fog was slightly more common than rain. Mist was the most common condition in all seasons. The average distribution of these conditions is provided in Appendix D, Common Weather Conditions.

Figures 8 and 9 show the frequency of common weather conditions at each site, by season and day/night hours. Any condition that constituted 2% or more of the present weather reports in any season/time of day grouping was included in the charts.

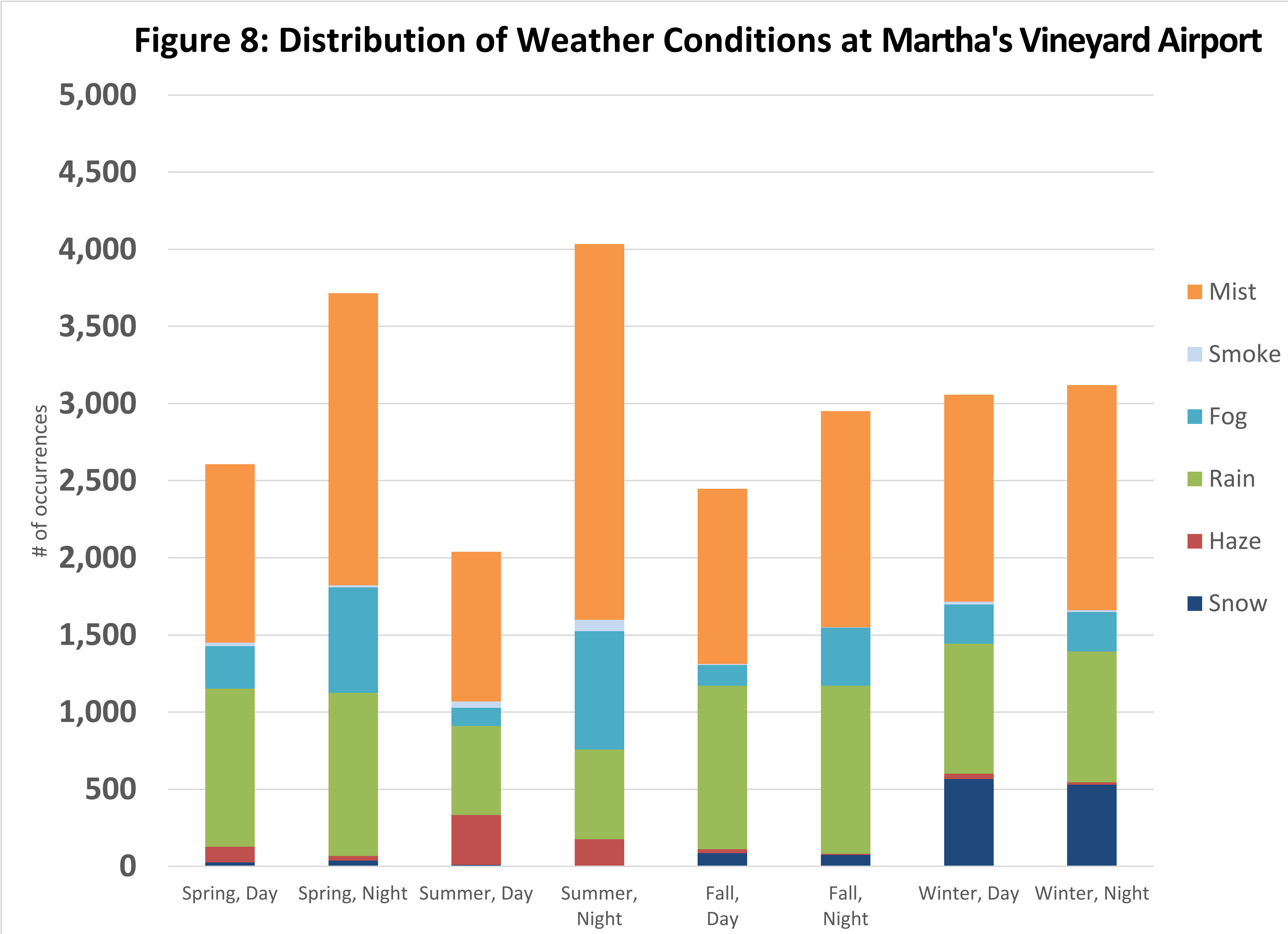


Figure 8: Distribution of Weather Conditions at Martha's Vineyard Airport
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
# of occurrences
Spring, Day
Spring, Night
Summer, Day
Summer, Night
Fall, Day
Fall, Night
Winter, Day
Winter, Night
Mist
Smoke
Fog
Rain
Haze
Snow

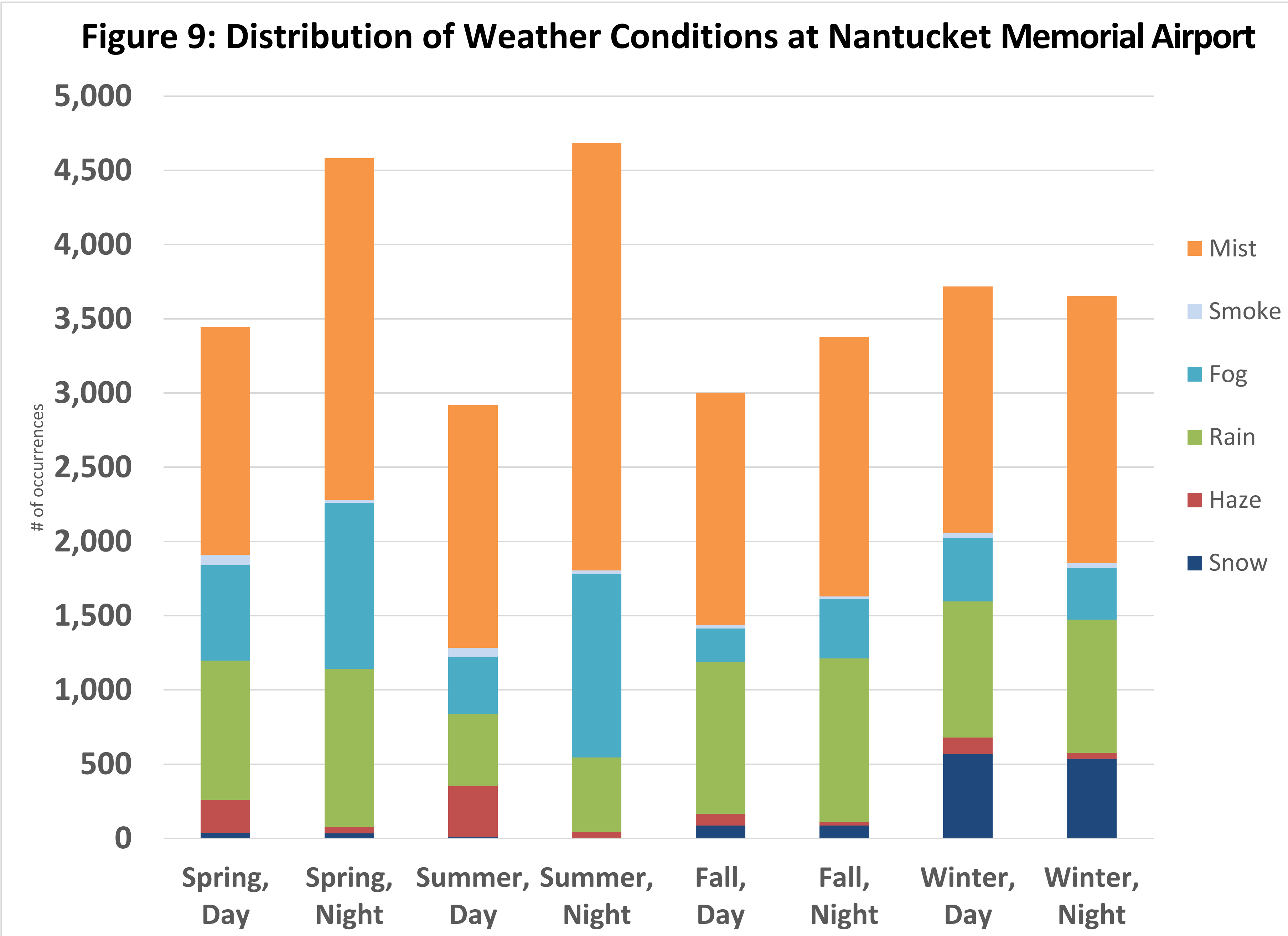


Figure 9: Distribution of Weather Conditions at Nantucket Memorial Airport
# of occurrences
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Spring, Day
Spring, Night
Summer, Day
Summer, Night
Fall, Day
Fall, Night
Winter, Day
Winter, Night
Mist
Smoke
Fog
Rain
Haze
Snow

4.0 VISIBILITY ASSESSMENT

4.1 Introduction

Based on the analysis reported in Table 4, approximately 70% of the hours reported visibility as 10 miles or greater. Because of this, visibility must be calculated directly to determine average visibility, the distribution of visibility, and maximum visibility using currently available data. To fill this data gap, daily typical visibility ranges and potential maximum and average visibility across seasons were calculated. Martha's Vineyard Airport and Nantucket Memorial Airport both report data on an hourly and minute basis for general weather observations.

This analysis focuses on the meteorological variables that affect visibility the most and does not equate to actual visibility of the wind turbines or associated structures. While meteorology will impact the ability of an observer to see the wind turbines or associated structures, factors such as turbine color, scale, movement, distance, and observer geometry are also other critical considerations. For example:

- At a distance of over 21 miles from the closest shoreline (on Martha's Vineyard), there is no land-based vantage point that will view an entire WTG. Some portion of each of the structures will always fall below the visible horizon, and the presence of waves further reduces the portion of the structures that is visible.

Importantly, the Proponent's proposed actions will substantially mitigate the visibility of New England Wind's offshore facilities.

- The Proponent expects to use an Aircraft Detection Lighting System (ADLS) that automatically activates all aviation obstruction lights when aircraft approach the Phase 1 WTGs, subject to BOEM approval. For Phase 2, the Proponent would expect to use the same or similar approaches to reduce lighting used for Vineyard Wind 1 and/or Phase 1, including the use of an ADLS. If necessary, the ESP(s) will also include an aviation obstruction lighting system in compliance with FAA and/or BOEM requirements, which would be activated by New England Wind's ADLS system, subject to BOEM approval. Using ADLS, the aviation obstruction lighting system will only be activated a tiny fraction of the time (estimated at less than 1 hour/year). Accordingly, nighttime lighting will be almost eliminated, and in the absence of lighting, New England Wind will not be visible from shore at night.

- In accordance with Federal Aviation Administration (FAA) Advisory Circular 70/7460-1M, the Proponent expects to paint the WTGs no lighter than RAL 9010 Pure White and no darker than RAL 7035 Light Grey; however, it is anticipated that the WTGs will be painted off-white/light grey to blend into the horizon. The off-white/light grey color will reduce contrast with the sea and sky and thus minimize daytime visibility of the WTGs. The conservative threshold for visibility is "the greatest distance at which an observer can just see a black object viewed against the horizon sky." The WTGs will not be black; instead, the neutral off-white/light grey color will be highly compatible with the hue, saturation, and brightness of the background sky. This lack of contrast between the structures and the background means that the percentage of the time the structures might be visible is greatly reduced. Additionally, the upper portion of the ESP(s) will be a grey color which would appear muted and indistinct.

4.2 Visibility

To account for the reduction in nighttime lighting described in Section 4.1, Table 6 provides a breakdown of the airport-reported visibility during daytime and nighttime hours. However, for the reasons discussed above, the percentages in Table 6 should not be taken as times when New England Wind structures will be visible.

Table 6 Frequency of Reported Visibility Ranges from Martha's Vineyard and Nantucket Airports (Not Equivalent to Visibility of New England Wind from the Shoreline)

Percentage of Time Airport Visibility is 10 Statute Miles or Greater						
Station Name	**Time**	**Winter**	**Spring**	**Summer**	**Fall**	**Annual**
Martha's Vineyard Airport	Day	80%	80%	77%	83%	80%
	Night*	0%	0%	0%	0%	0%
	Total**	37%	47%	45%	38%	42%
Nantucket Memorial Airport	Day	71%	69%	66%	75%	70%
	Night*	0%	0%	0%	0%	0%
	Total**	33%	41%	38%	35%	37%

* Unlit objects will not be visible at >10 miles at night. The use of ADLS reduces expected nighttime lighting to less than 1 hour/year, which is <0.1% of annual nighttime hours and is rounded to 0% in this table.
** Seasonal results adjusted to reflect daylight hours.

BOEM addressed one key limitation of the airport data—the fact that airports do not report visibility greater than 10 statute miles—in OCS Study BOEM 2017-037 "Visualization Simulations for Offshore Massachusetts and Rhode Island Wind Energy Area - Meteorological Report." In Section 4.2 of that study, BOEM presents a method to calculate visibility distances past 10 statute miles using relative humidity data. BOEM developed the method by performing a regression analysis of Martha's Vineyard visibility and relative humidity observations.

Table 7 below applies the methodology from the BOEM study to Martha's Vineyard and Nantucket Memorial airport data to the nearest WTG/ESP. For Martha's Vineyard, Table 7 shows the amount of time that visibility is greater than or equal to 23.1 miles (the distance from the Chappaquiddick Island TCP/Nantucket Sound TCP to the nearest WTG/ESP), 25.5 miles (the distance from Gay Head Lighthouse to the nearest WTG/ESP) and 28.6 miles (the distance from Cape Poge Light to the nearest WTG/ESP). For Nantucket, Table 7 shows the amount of time visibility is greater than 24.4 miles (the distance from the **closest** location within the Nantucket Historic District to the nearest WTG/ESP).

Table 7 Visibility Estimates using Algorithm in BOEM 2017-037 for the Nearest WTG/ESP

Percentage of Time Visibility is ≥24.4 miles for Nantucket Historic District*, ≥23.1 miles for the Chappaquiddick Island TCP/Nantucket Sound TCP, ≥25.5 miles for Gay Head Lighthouse, and ≥28.6 miles for Cape Poge Light using BOEM Methodology						
Location	**Time**	**Winter**	**Spring**	**Summer**	**Fall**	**Annual**
Martha's Vineyard (Chappaquiddick Island TCP/Nantucket Sound TCP)****	Day	50%	48%	34%	42%	43%
	Night**	0%	0%	0%	0%	0%
	Total***	21%	28%	20%	17%	22%
Martha's Vineyard (Gay Head Lighthouse)	Day	44%	42%	26%	35%	36%
	Night**	0%	0%	0%	0%	0%
	Total***	18%	24%	15%	15%	18%
Martha's Vineyard (Cape Poge Light)	Day	37%	36%	19%	28%	30%
	Night**	0%	0%	0%	0%	0%
	Total***	16%	21%	11%	12%	15%
Nantucket (Closest Point on Nantucket Historic District)	Day	37%	29%	16%	31%	27%
	Night**	0%	0%	0%	0%	0%
	Total***	16%	17%	9%	13%	14%

*This distance is measured using the Nantucket Historic District boundary from the MassGIS Data: Massachusetts Historical Commission (MHC) Historic Inventory. This boundary extends slightly offshore and thus, is not coincident with the shoreline of Nantucket.
**Unlit objects will not be visible at >10 miles at night. The use of ADLS reduces expected nighttime lighting to less than 1 hour/year, which is less than 0.1% of annual nighttime hours and is rounded to 0% in this table.
***Seasonal results adjusted to reflect daylight hours.
****Per BOEM guidance on April 12, 2022, views from the Wasque Reservation, which is within the Chappaquiddick Island TCP, are also representative of the views from the Nantucket Sound TCP.

Table 7 shows that, on average for all conditions, New England Wind WTGs/ESP(s) **might** be visible 22% of the time from Chappaquiddick Island TCP/Nantucket Sound TCP, **might** be visible 18% of the time from Gay Head Lighthouse, **might** be visible 15% of the time from Cape Poge Light, and **might** be visible 14% of the time from the **closest** location within the Nantucket Historic District. Again, because of sea spray, low-contrast paint color, and other factors, the actual amount of time structures would be visible is lower.

5.0 CONCLUSION

The methodology used by BOEM in the "Visualization Simulations for Offshore Massachusetts and Rhode Island Wind Energy Area - Meteorological Report" was applied in this analysis to describe visibility of New England Wind's WTG/ESP structures from the Gay Head Lighthouse and Cape Poge Light on Martha's Vineyard and from the closest location within the Nantucket Historic District. The BOEM methodology was used to determine the hourly visibility distances and the distribution of visibility distances on an annual, seasonal, and day/night basis. As reported in Table 7, average daytime visibility at all three locations is highest in the winter and lowest in the summer. Based on the results of this meteorological assessment, New England Wind WTGs/ESP(s) will not be visible approximately 78% of the time from Chappaquiddick Island TCP/Nantucket Sound TCP on Martha's Vineyard, 82% of the time from Gay Head Lighthouse on Martha's Vineyard, 85% of the time from Cape Poge Light on Martha's Vineyard, and approximately 86% of the time from the closest location within the Nantucket Historic District due to atmospheric conditions.

Additionally, different factors affect visibility, including air quality, sea spray, and salts over the ocean's surface, and the angle of the sun. The presence of sea spray and salts affects visibility but is not likely captured by the measurements. Additionally, the Proponent expects to paint the WTGs using an off-white/light grey color, which will reduce the contrast with the sea and sky and thus minimize daytime visibility of the WTGs. Likewise, the upper portion of the ESP(s)will be a grey color which would appear muted and indistinct. Therefore, calculated visibility should be considered conservative since they do not account for these light-reducing factors.

Based on the analysis described above, the structures will not be visible most of the time for viewers along the Martha's Vineyard and Nantucket coastlines.

6.0 REFERENCES

Malm WC. 1999. Introduction to visibility. Air Resources Division, National Parks Service. https://www.epa.gov/sites/production/files/2016-07/documents/introvis.pdf

OCS Study BOEM 2017-037. Visualization simulations for offshore Massachusetts and Rhode Island Wind Energy Area - Meteorological Report. Prepared by: Wood, Perdum and Egan. January 15th, 2014. https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/MA/MeteorologicalReportFinal.pdf

URS Group, Inc., Truescape. 2015. Renewable energy viewshed analysis and visualization simulation for the New York Outer Continental Shelf Call Area: Compendeium report. Prepared by URS Group, Inc. and Truescape, for the U.S, Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2015-044. 85 pp. + appendices.

Zhang L, Sun JY, Shen XJ, Zhang M, Che H, Ma QL, Zhang YW, Zhang XY, Ogren JA. 2015. Observations of relative humidity effects on aerosol light scattering in the Yangtze River Delta of China. Atmospheric Chemistry and Physics. 15*:* 8439-8454.

Appendix A

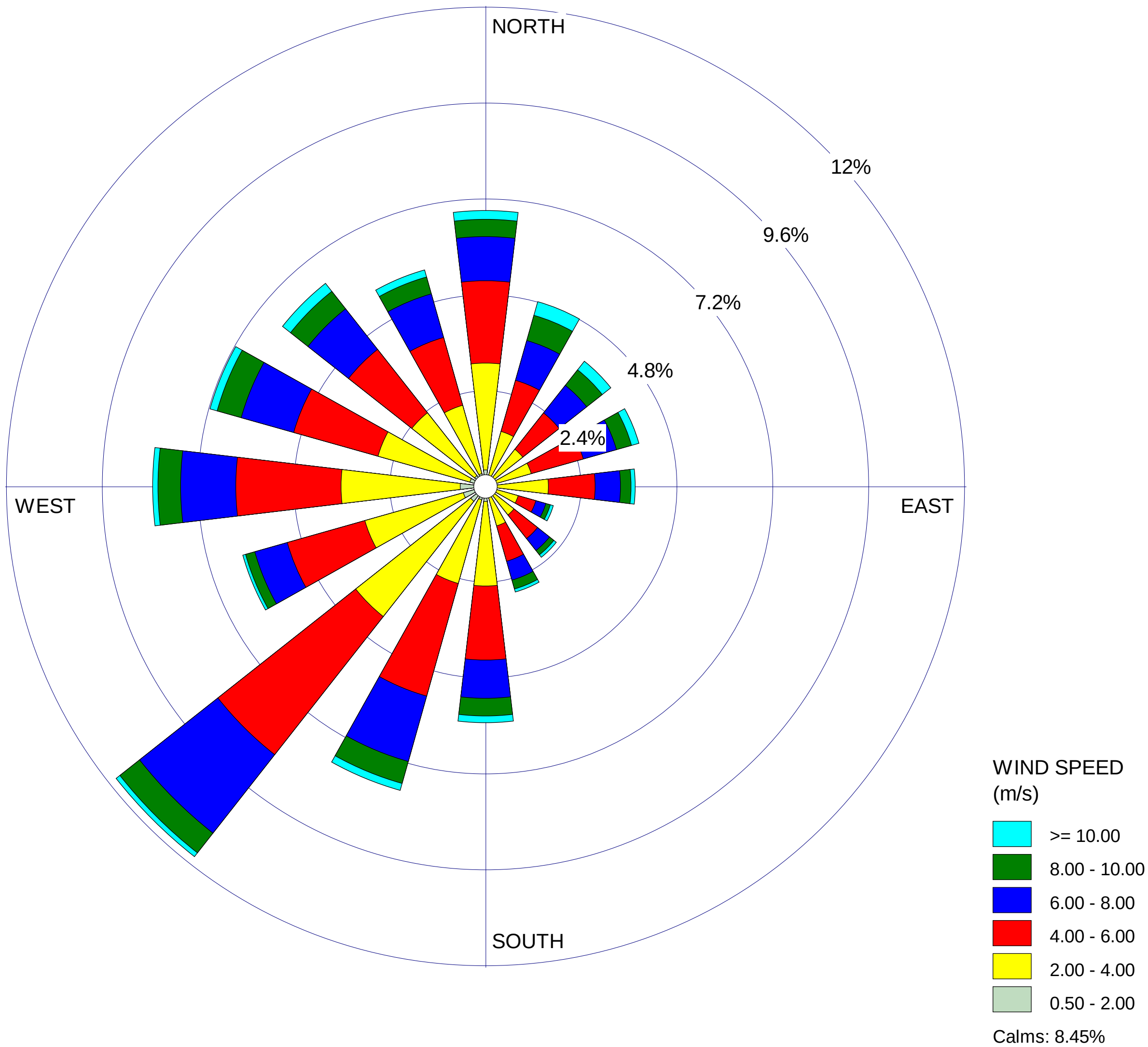
Wind Roses by Month for Martha's Vineyard and Nantucket

WIND ROSE PLOT:

Martha's Vineyard Airport, Vineyard Haven, MA
10 Year Wind Rose, 2006-2016

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD: **Start Date: 1/1/2006 - 00:00** **End Date: 12/31/2016 - 19:00**	COMPANY NAME: **Epsilon Associates**
	CALM WINDS: **8.45%**	TOTAL COUNT: **94460 hrs.**
	AVG. WIND SPEED: **4.44 m/s**	DATE: **11/3/2017**

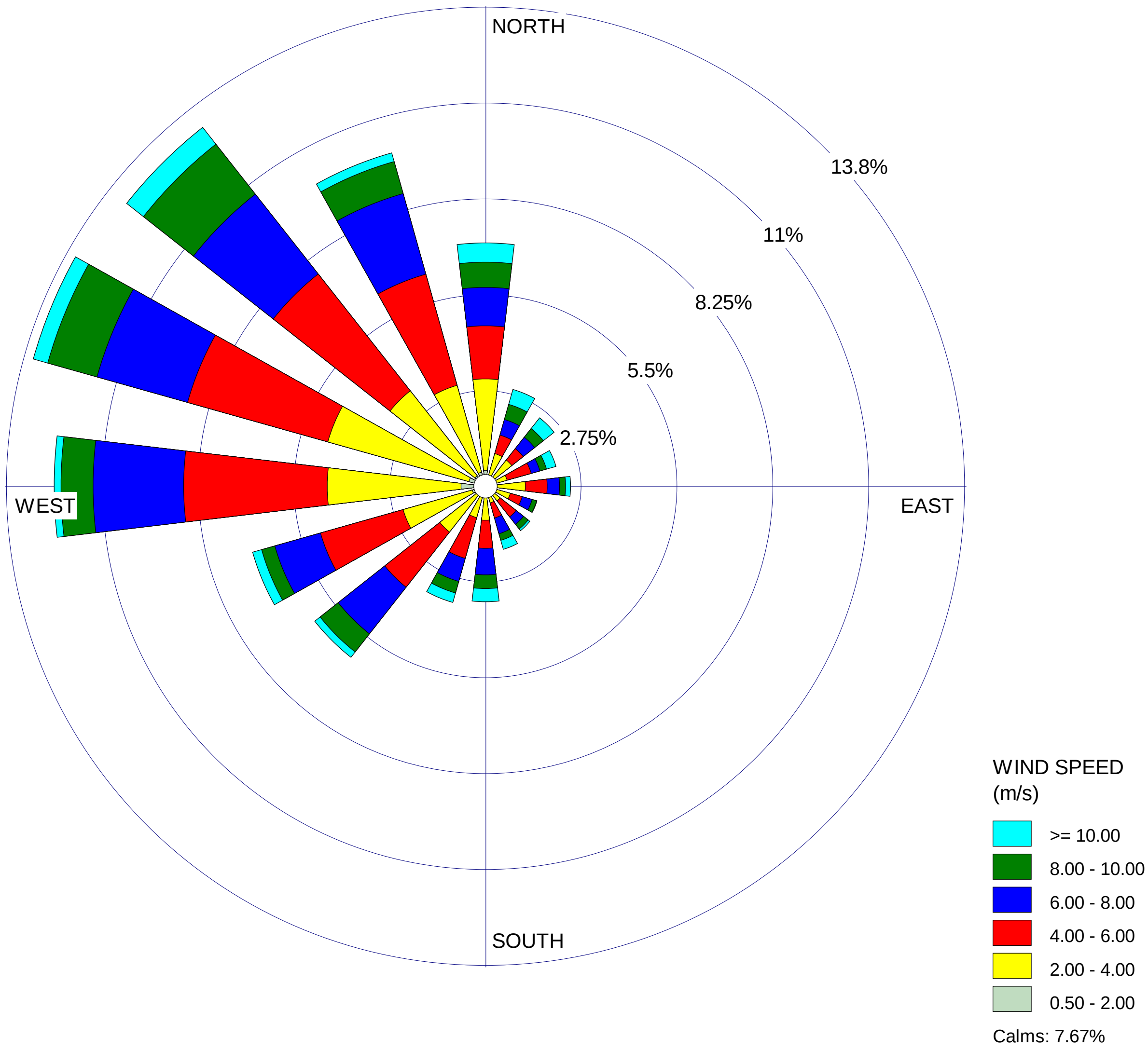
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Martha's Vineyard Airport, Vineyard Haven, MA
January Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



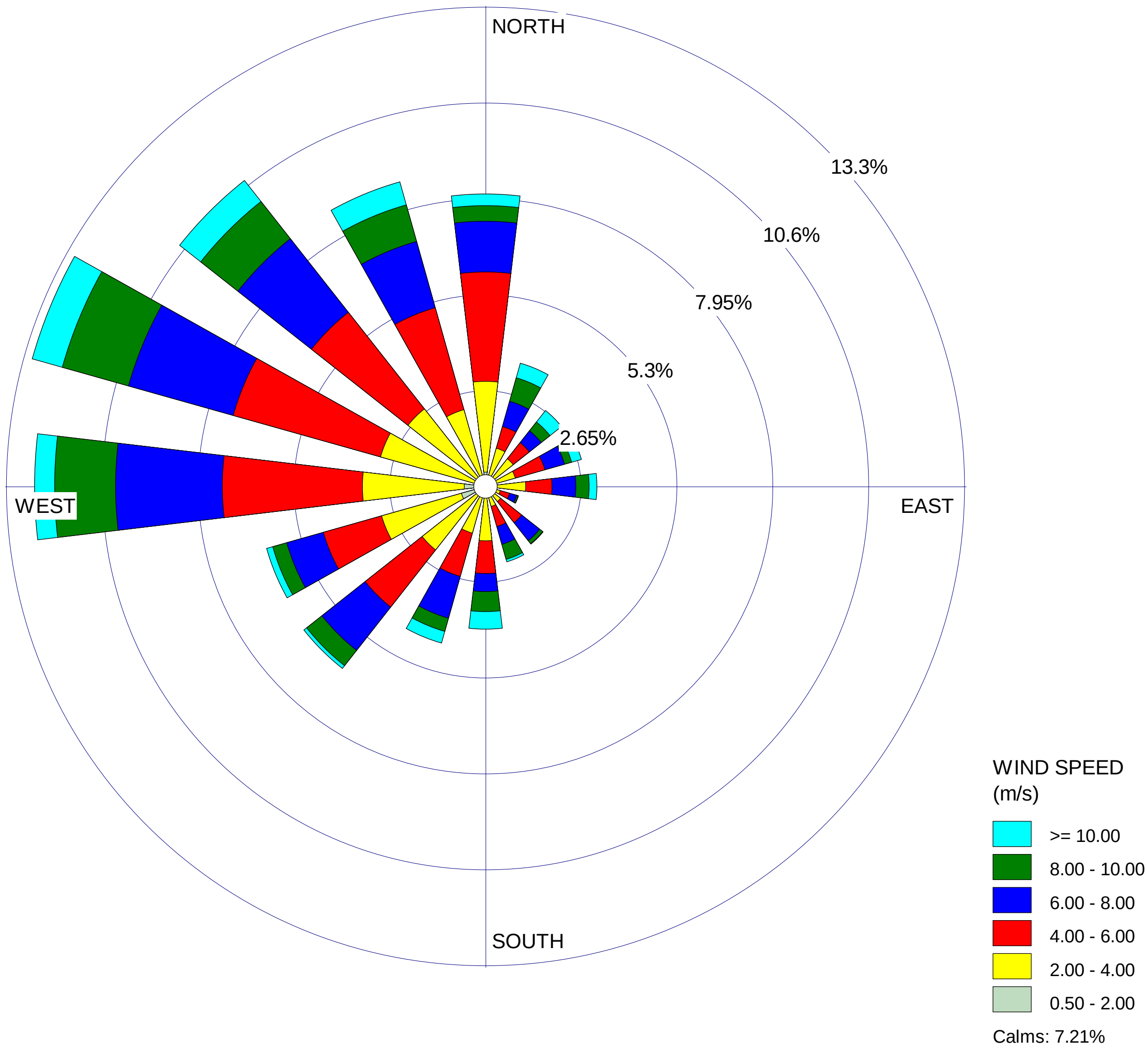
COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 1/1/2006 - 00:00 **End Date: 1/31/2016 - 23:00**	**Epsilon Associates**	
	CALM WINDS: **7.67%**	TOTAL COUNT: **8045 hrs.**	
	AVG. WIND SPEED: **4.87 m/s**	DATE: **11/3/2017**	

WIND ROSE PLOT:

Martha's Vineyard Airport, Vineyard Haven, MA
February Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 2/1/2006 - 00:00 **End Date: 2/29/2016 - 23:00**	**Epsilon Associates**	
	CALM WINDS: **7.21%**	TOTAL COUNT: **7323 hrs.**	
	AVG. WIND SPEED: **5.08 m/s**	DATE: **11/3/2017**	

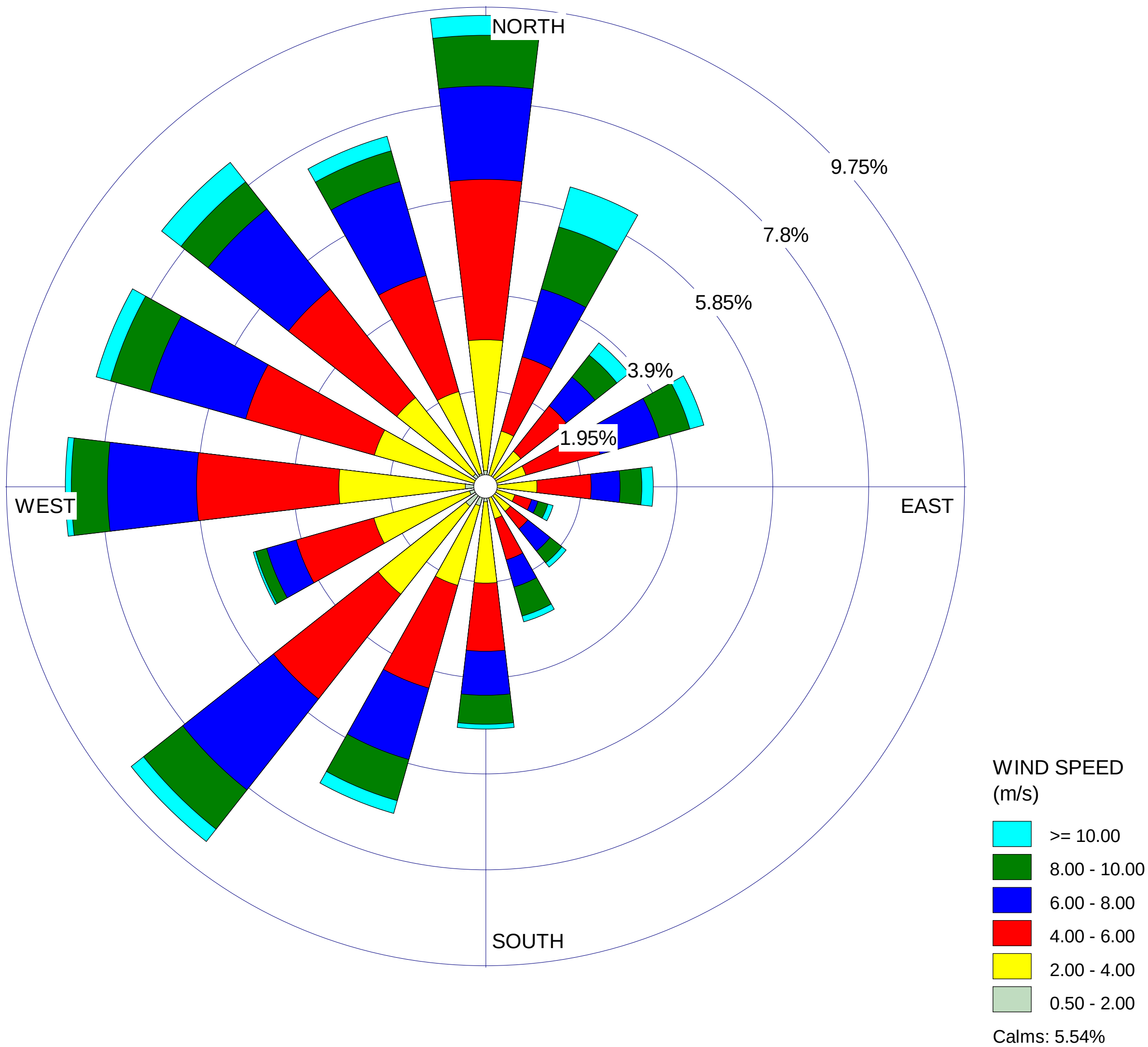
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Martha's Vineyard Airport, Vineyard Haven, MA
March Wind Rose

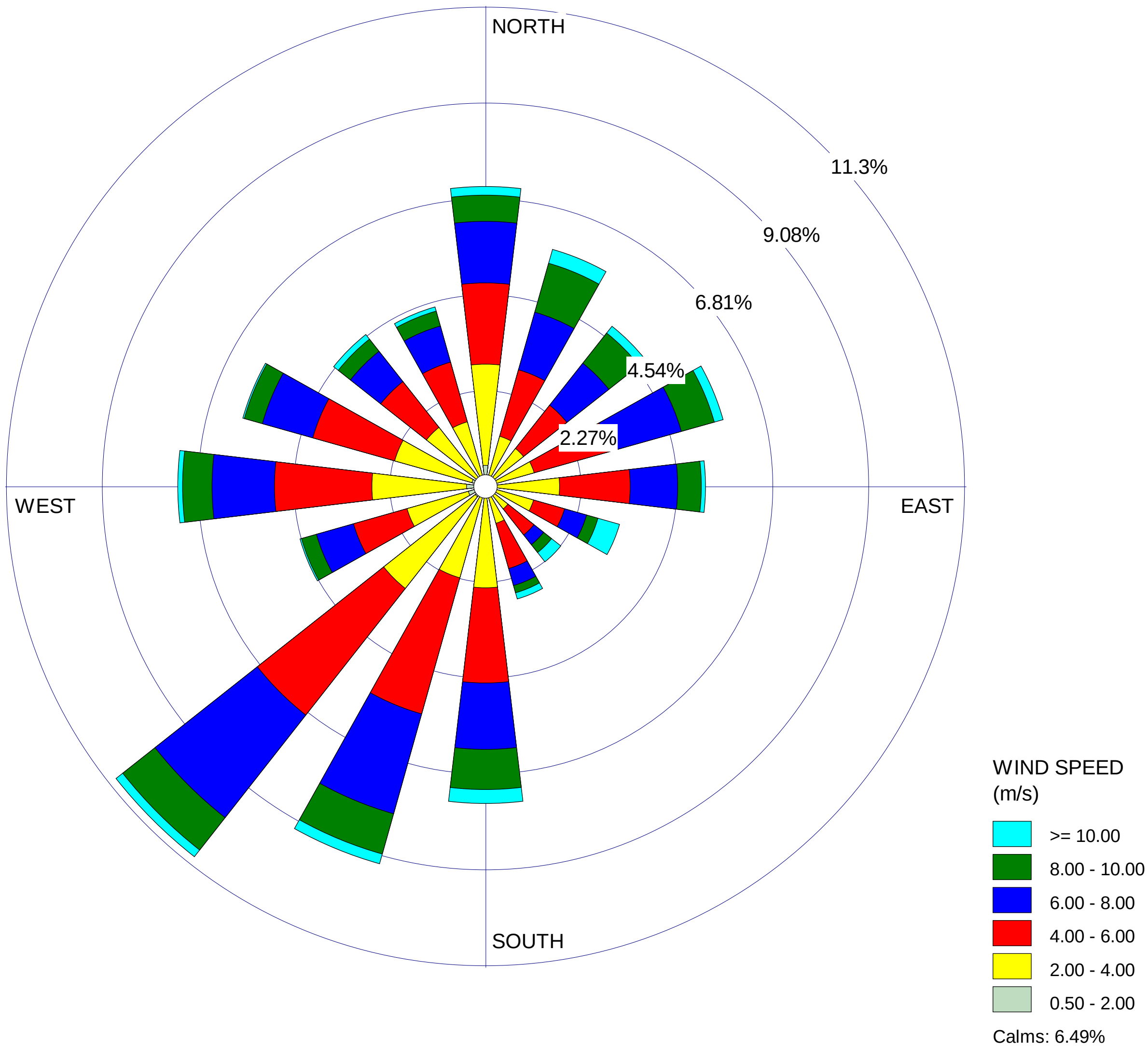
DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 3/1/2006 - 00:00 **End Date: 3/31/2016 - 23:00**	**Epsilon Associates**	
	CALM WINDS: **5.54%**	TOTAL COUNT: **8011 hrs.**	
	AVG. WIND SPEED: **5.09 m/s**	DATE: **11/3/2017**	

WIND ROSE PLOT:	DISPLAY:
Martha's Vineyard Airport, Vineyard Haven, MA **April Wind Rose**	**Wind Speed** **Direction (blowing from)**



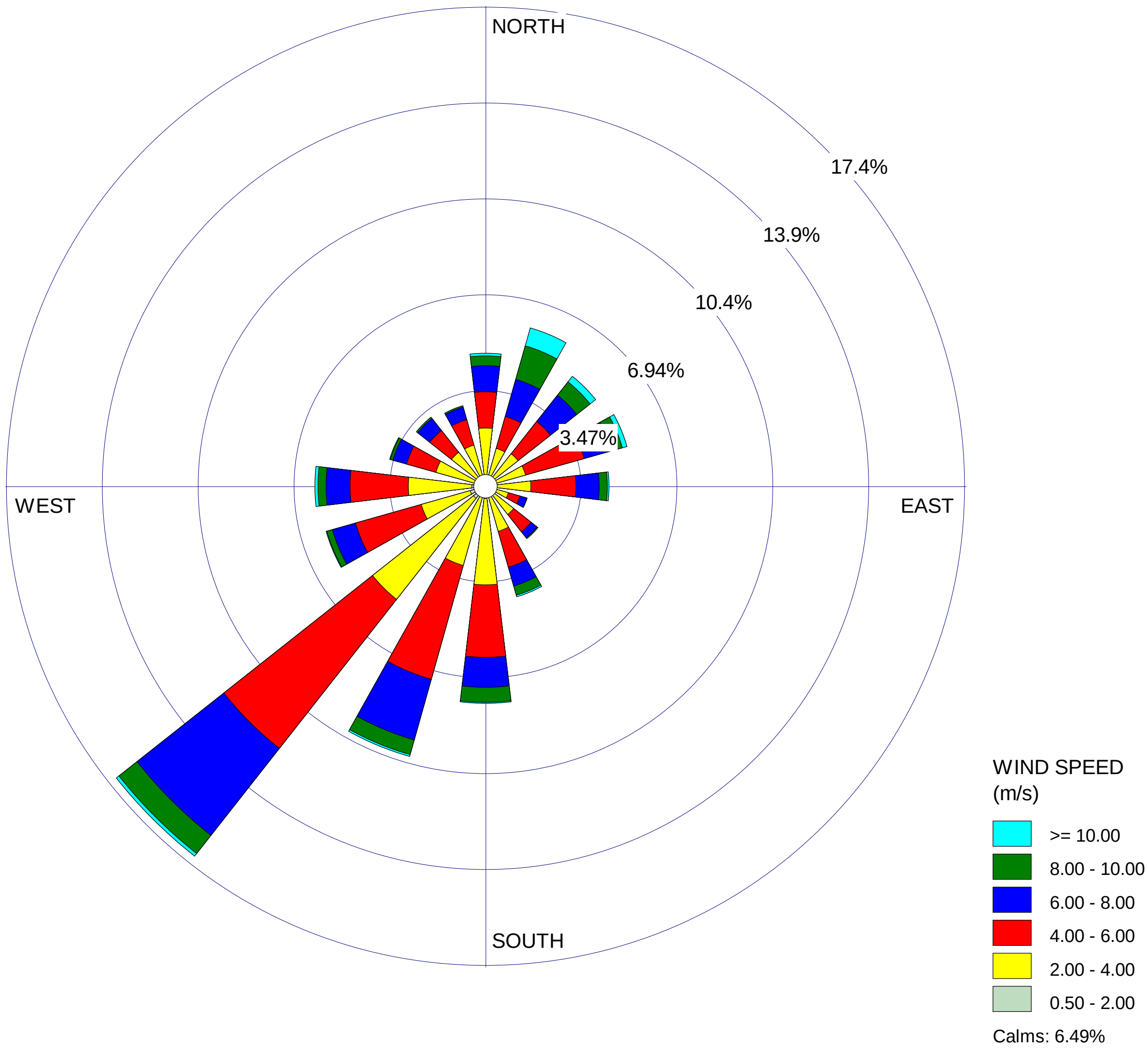
COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 4/1/2006 - 00:00 **End Date: 4/30/2016 - 23:00**	**Epsilon Associates**	
	CALM WINDS: **6.49%**	TOTAL COUNT: **7779 hrs.**	
	AVG. WIND SPEED: **4.92 m/s**	DATE: **11/3/2017**	

WIND ROSE PLOT:

Martha's Vineyard Airport, Vineyard Haven, MA
May Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:

Start Date: 5/1/2006 - 00:00
End Date: 5/31/2016 - 23:00

COMPANY NAME:

Epsilon Associates

CALM WINDS:

6.49%

TOTAL COUNT:

7957 hrs.

AVG. WIND SPEED:

4.44 m/s

DATE:

11/3/2017

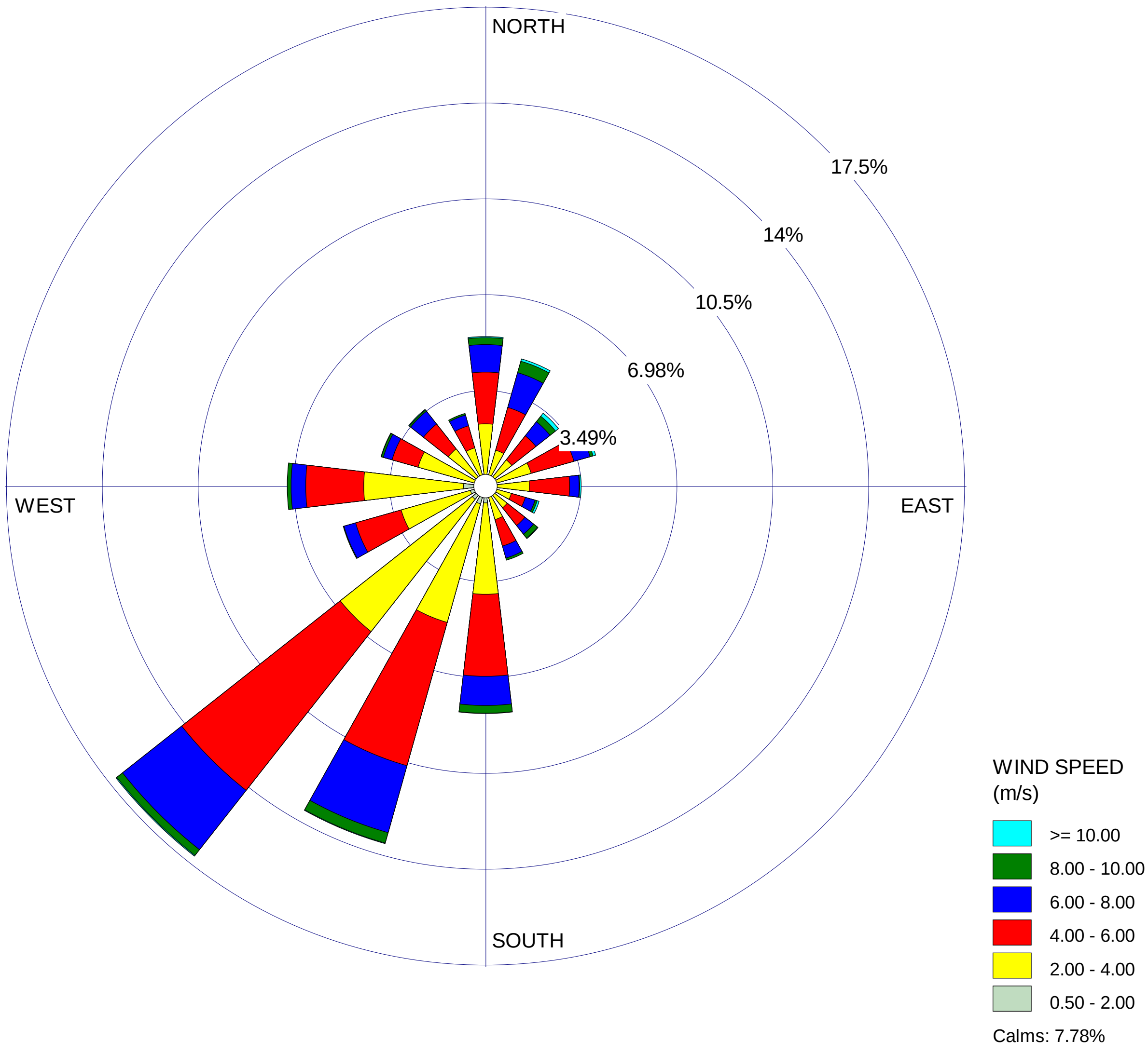
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Martha's Vineyard Airport, Vineyard Haven, MA
June Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



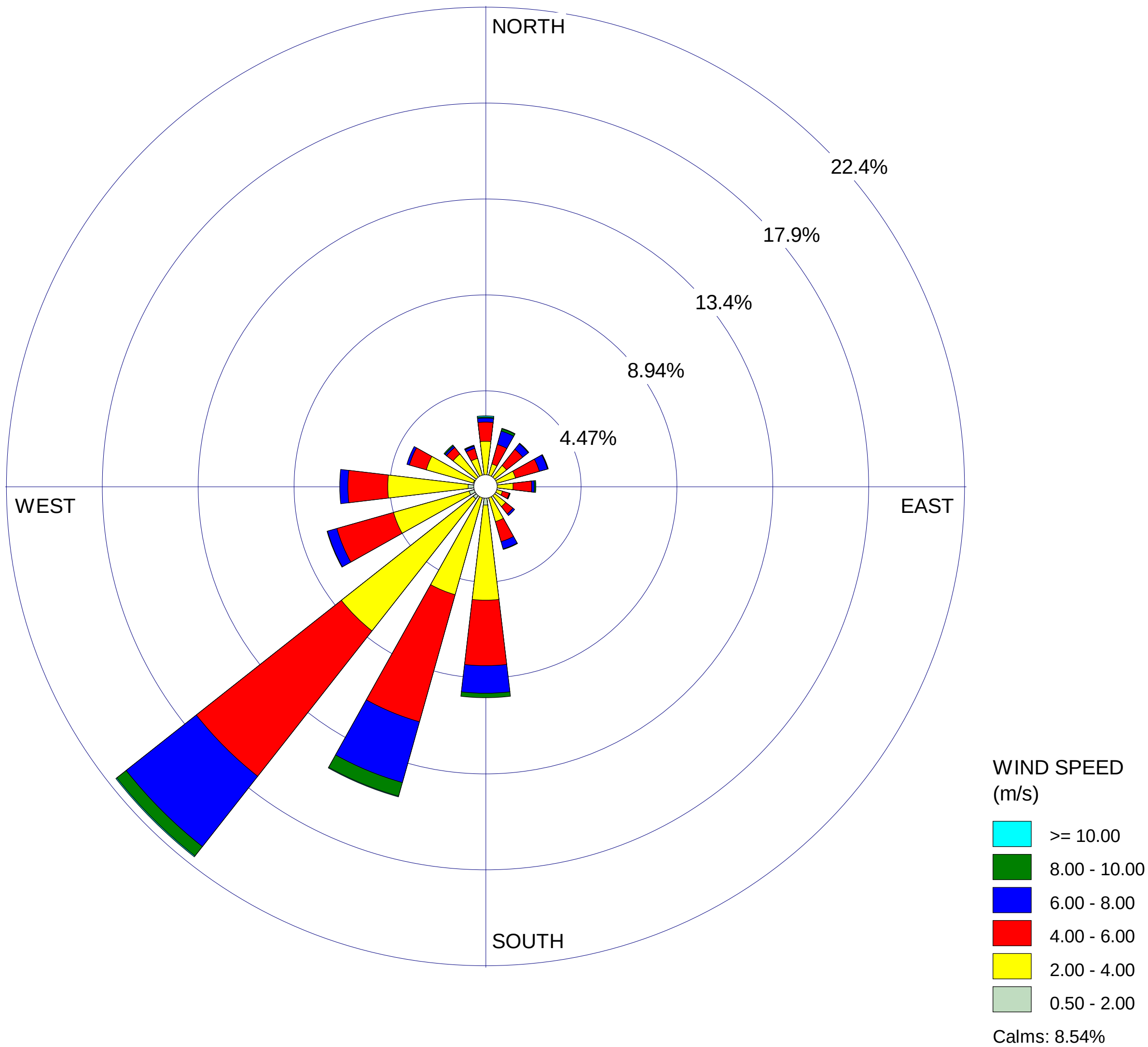
COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 6/1/2006 - 00:00 **End Date: 6/30/2016 - 23:00**	**Epsilon Associates**	
	CALM WINDS: **7.78%**	TOTAL COUNT: **7767 hrs.**	
	AVG. WIND SPEED: **3.94 m/s**	DATE: **11/3/2017**	

WIND ROSE PLOT:

Martha's Vineyard Airport, Vineyard Haven, MA
July Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 7/1/2006 - 00:00 **End Date: 7/31/2016 - 23:00**	**Epsilon Associates**	
	CALM WINDS: **8.54%**	TOTAL COUNT: **8033 hrs.**	
	AVG. WIND SPEED: **3.71 m/s**	DATE: **11/3/2017**	

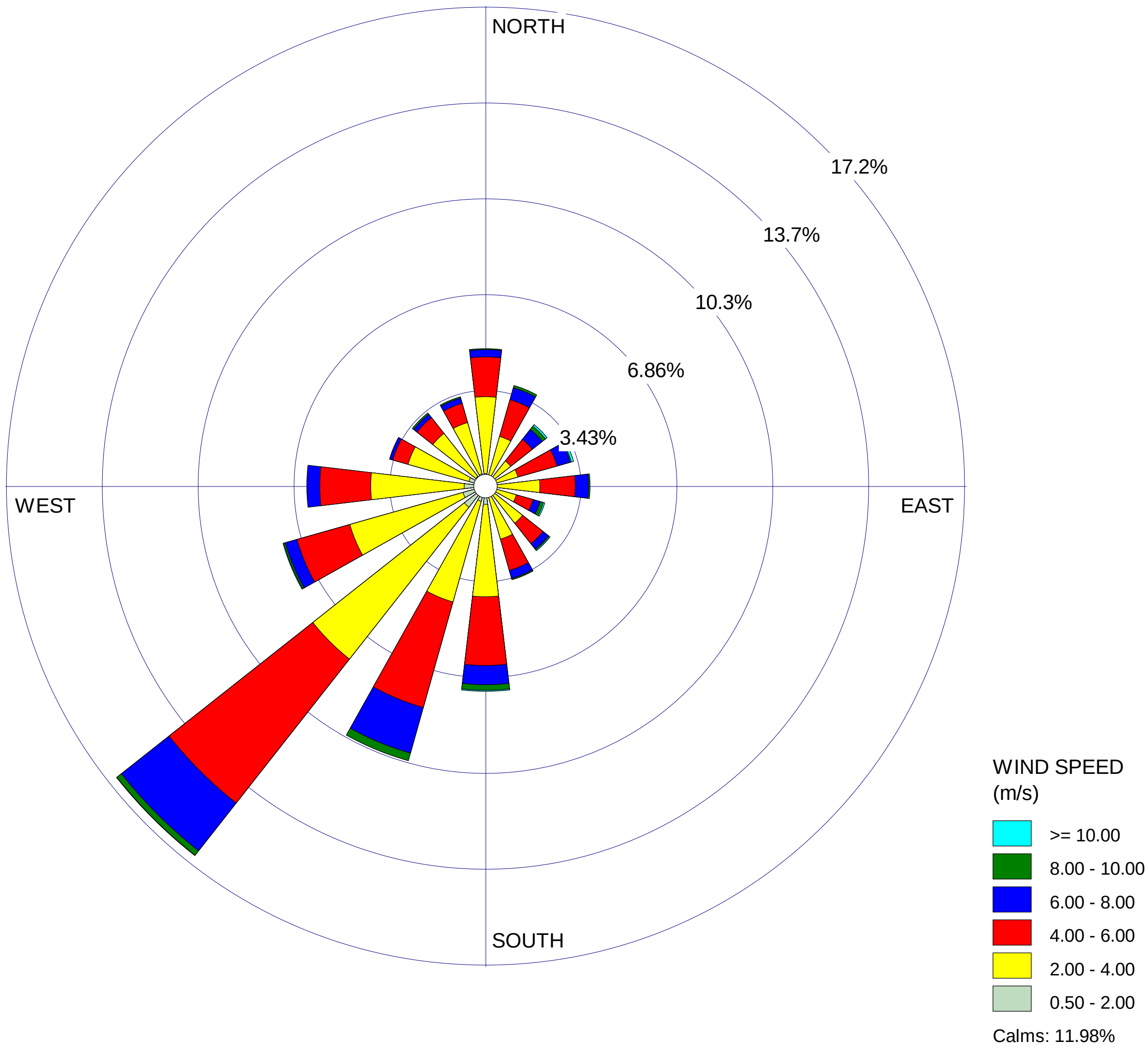
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Martha's Vineyard Airport, Vineyard Haven, MA
August Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD: **Start Date: 8/1/2006 - 00:00** **End Date: 8/31/2016 - 23:00**	COMPANY NAME: **Epsilon Associates**
	CALM WINDS: **11.98%**	TOTAL COUNT: **7954 hrs.**
	AVG. WIND SPEED: **3.39 m/s**	DATE: **11/3/2017**

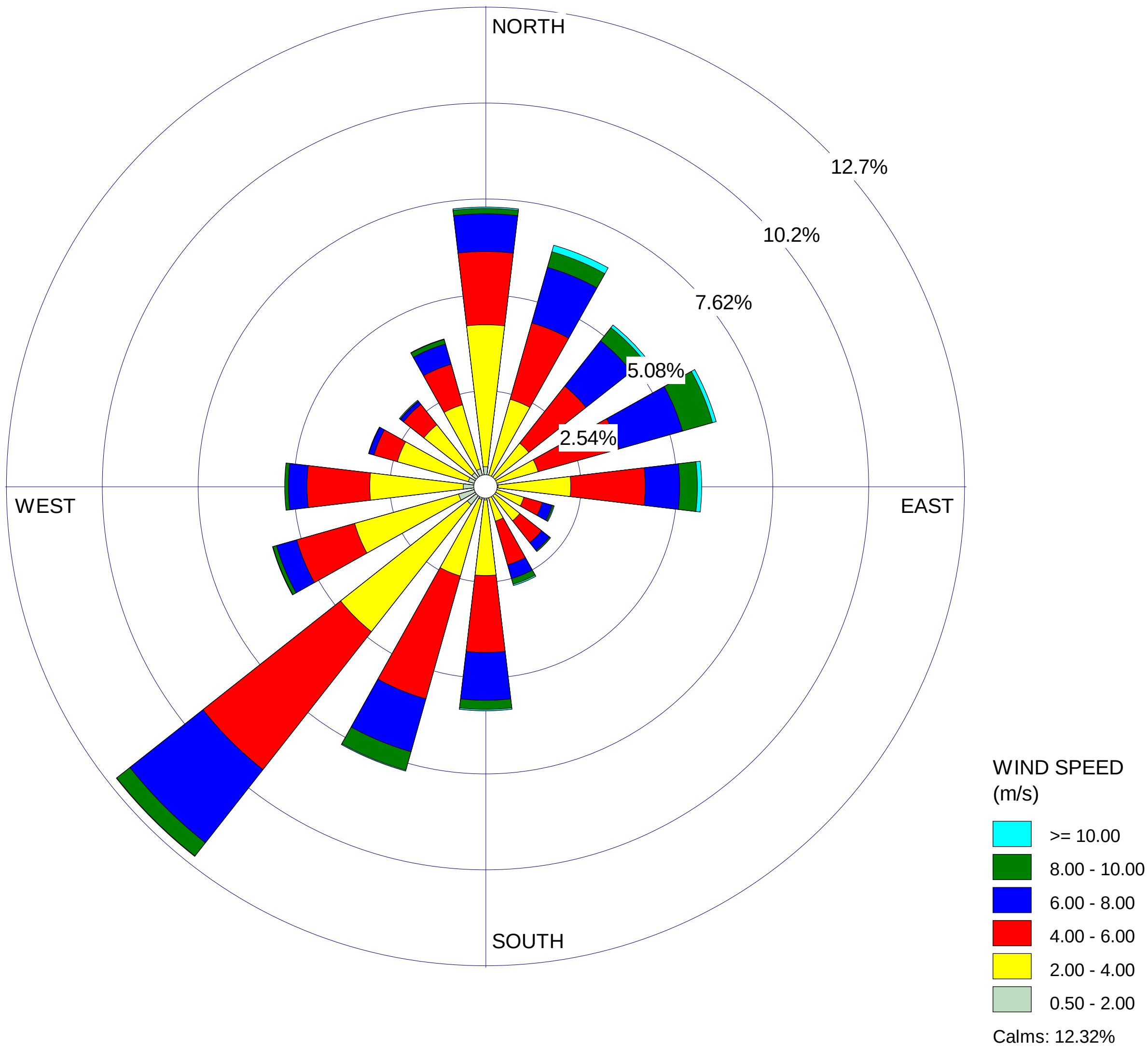
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Martha's Vineyard Airport, Vineyard Haven, MA
September Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



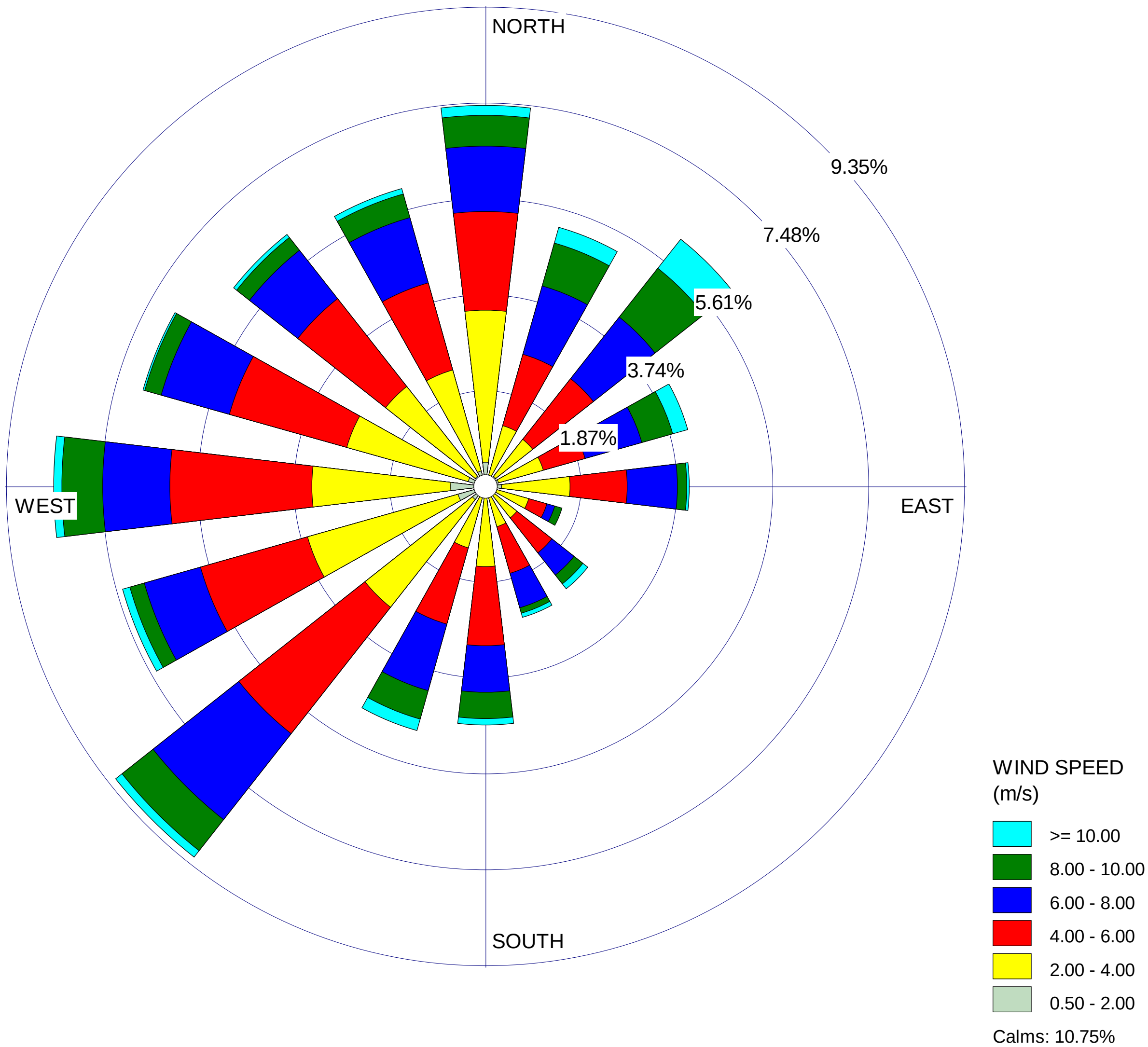
COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 9/1/2006 - 00:00 **End Date: 9/30/2016 - 23:00**	**Epsilon Associates**	
	CALM WINDS: **12.32%**	TOTAL COUNT: **7777 hrs.**	
	AVG. WIND SPEED: **3.85 m/s**	DATE: **11/3/2017**	

WIND ROSE PLOT:

Martha's Vineyard Airport, Vineyard Haven, MA
October Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



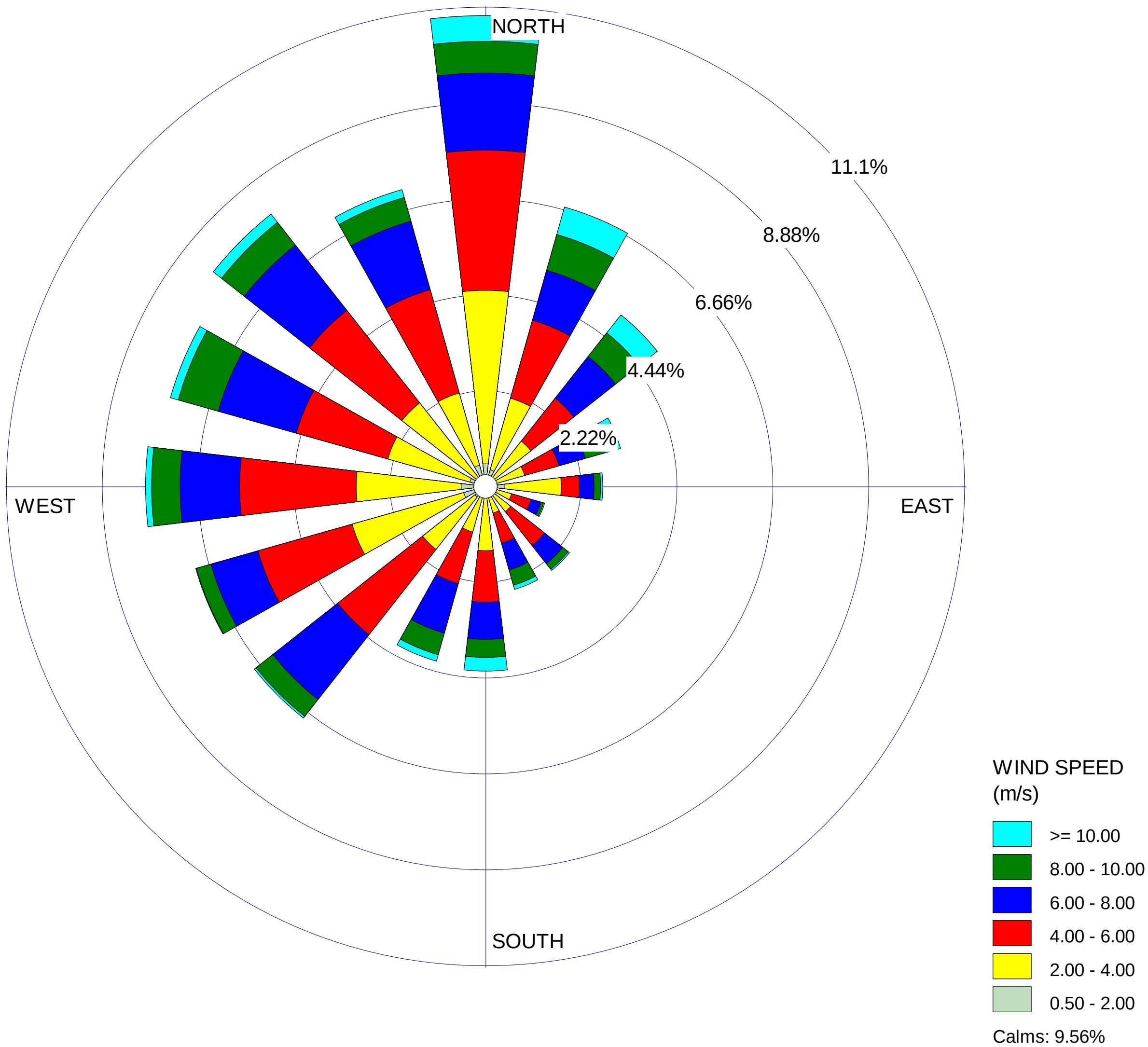
COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 10/1/2006 - 00:00 **End Date: 10/31/2016 - 23:00**	**Epsilon Associates**	
	CALM WINDS: **10.75%**	TOTAL COUNT: **8025 hrs.**	
	AVG. WIND SPEED: **4.50 m/s**	DATE: **11/3/2017**	

WIND ROSE PLOT:

Martha's Vineyard Airport, Vineyard Haven, MA
November Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 11/1/2006 - 00:00 **End Date: 11/30/2016 - 23:00**	**Epsilon Associates**	
	CALM WINDS: **9.56%**	TOTAL COUNT: **7705 hrs.**	
	AVG. WIND SPEED: **4.65 m/s**	DATE: **11/3/2017**	

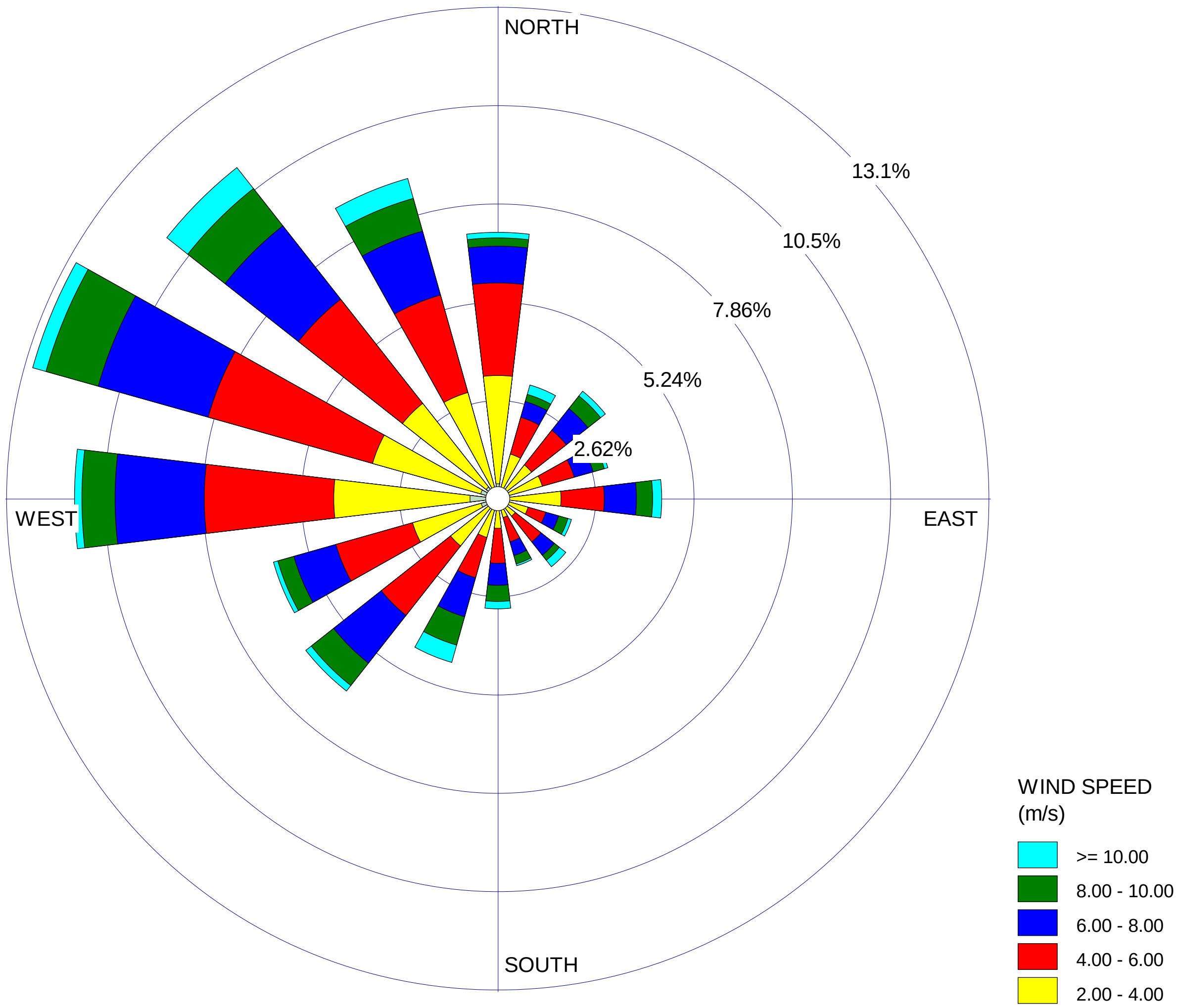
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Martha's Vineyard Airport, Vineyard Haven, MA
December Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



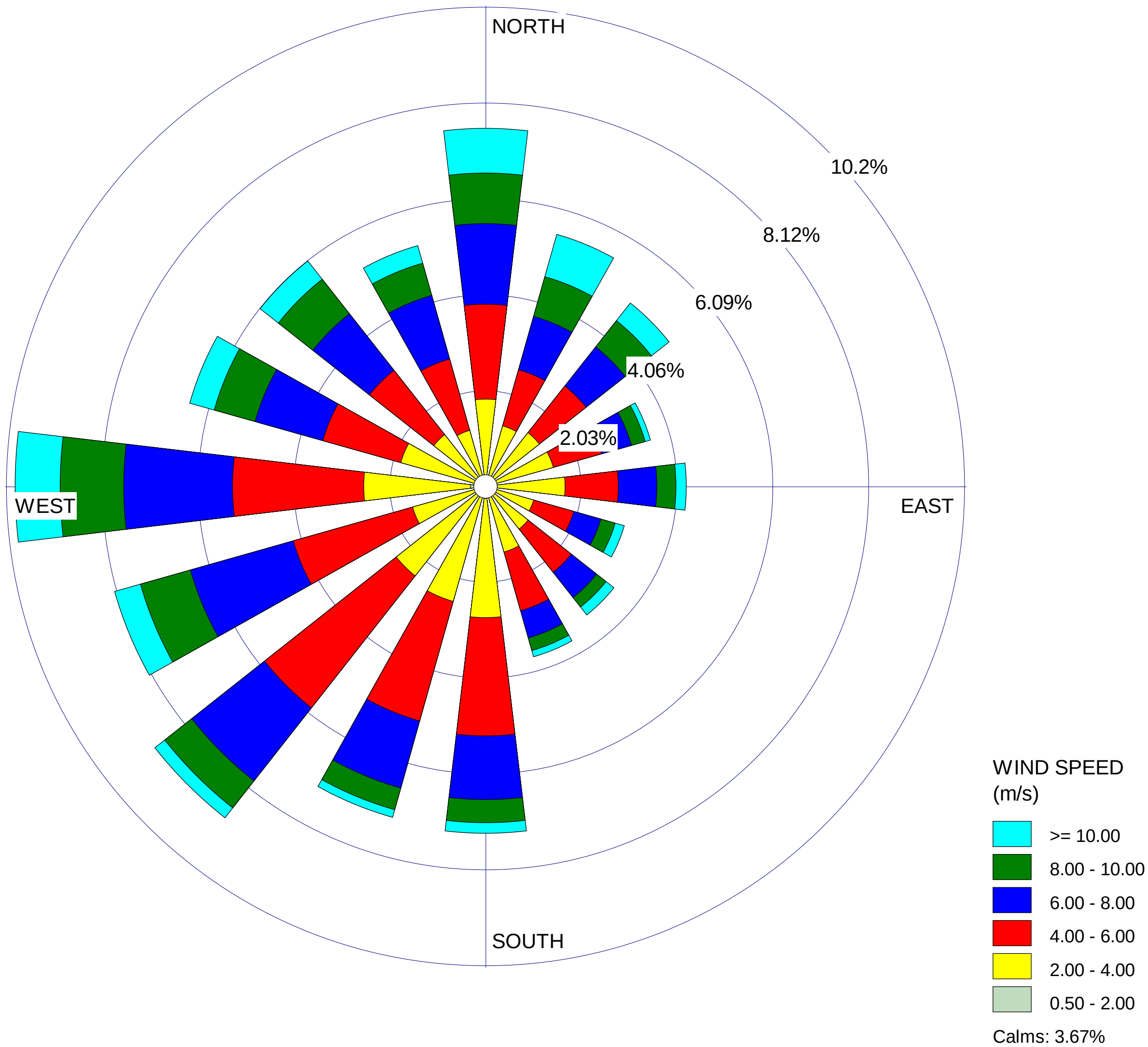
COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 12/1/2006 - 00:00 **End Date: 12/31/2016 - 19:00**	**Epsilon Associates**	
	CALM WINDS: **7.08%**	TOTAL COUNT: **8084 hrs.**	
	AVG. WIND SPEED: **4.86 m/s**	DATE: **11/3/2017**	

WIND ROSE PLOT:

Nantucket Memorial Airport, Nantucket, MA
10 Year Wind Rose, 2006-2016

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:

Start Date: 1/1/2006 - 00:00
End Date: 12/31/2016 - 19:00

COMPANY NAME:

Epsilon Associates

CALM WINDS:

3.67%

TOTAL COUNT:

95669 hrs.

AVG. WIND SPEED:

5.43 m/s

DATE:

11/3/2017

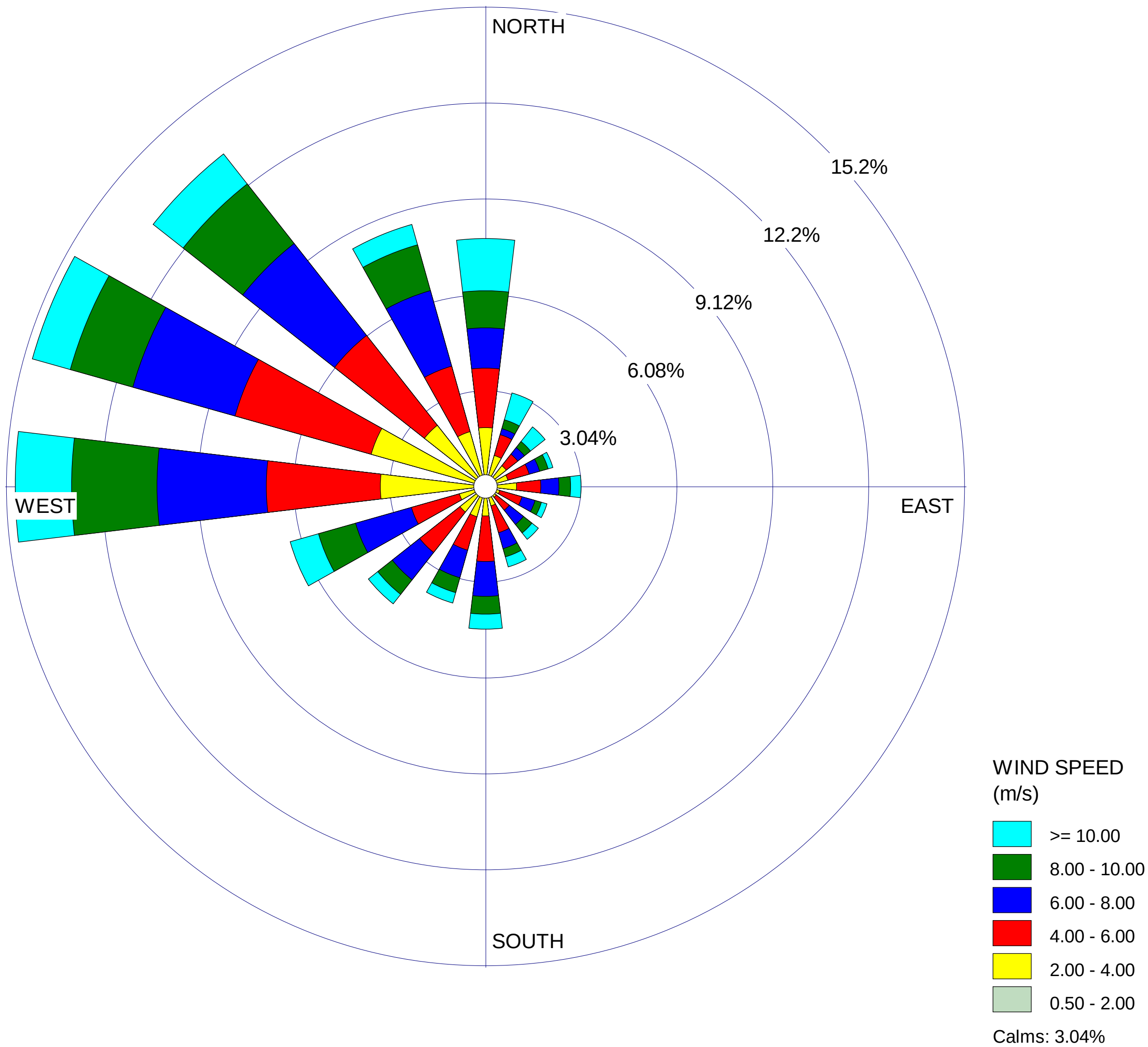
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Nantucket Memorial Airport, Nantucket, MA
January Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD: **Start Date: 1/1/2006 - 00:00** **End Date: 1/31/2016 - 23:00**	COMPANY NAME: **Epsilon Associates**
	CALM WINDS: **3.04%**	TOTAL COUNT: **8163 hrs.**
	AVG. WIND SPEED: **6.12 m/s**	DATE: **11/3/2017**

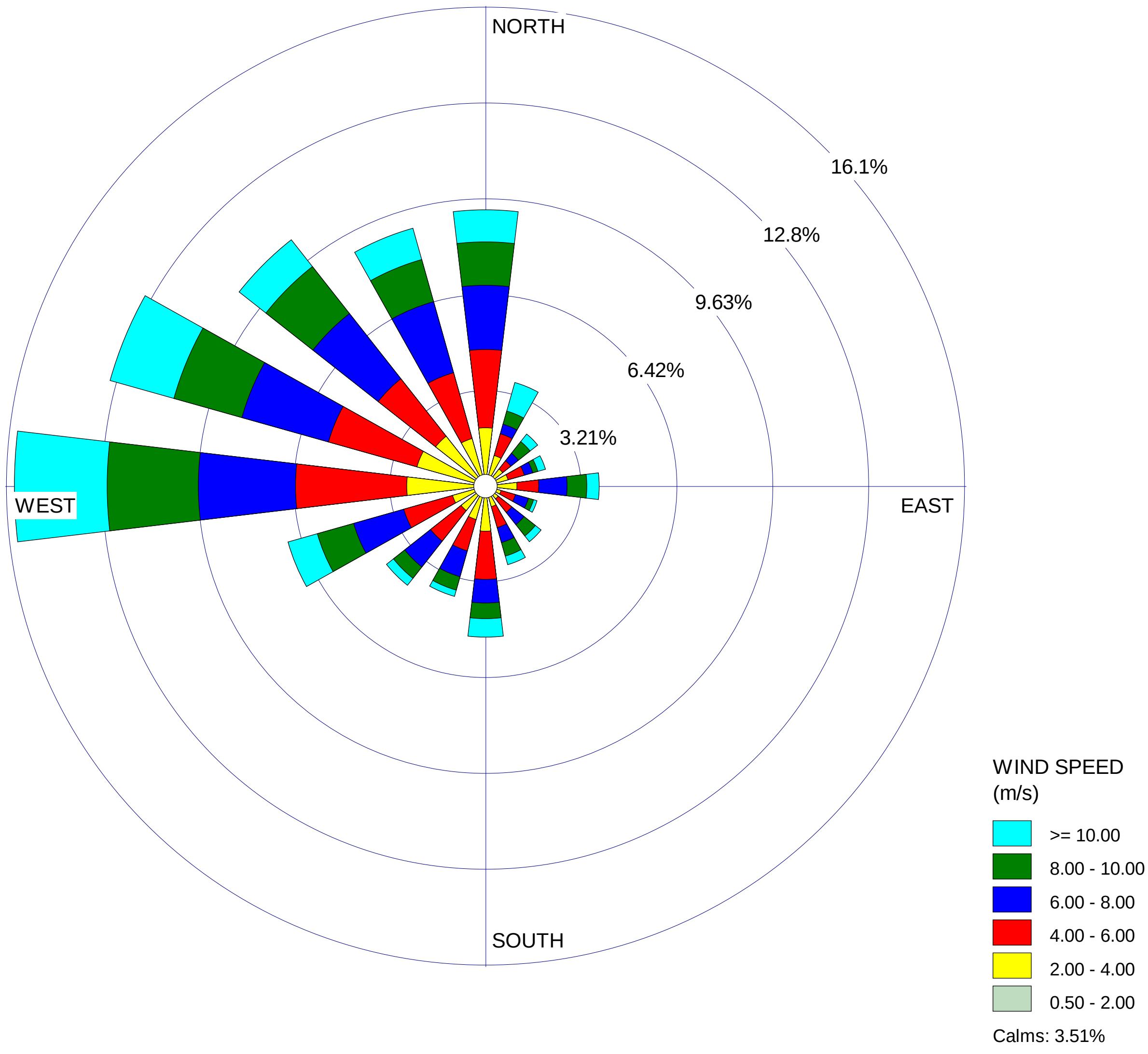
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Nantucket Memorial Airport, Nantucket, MA
February Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



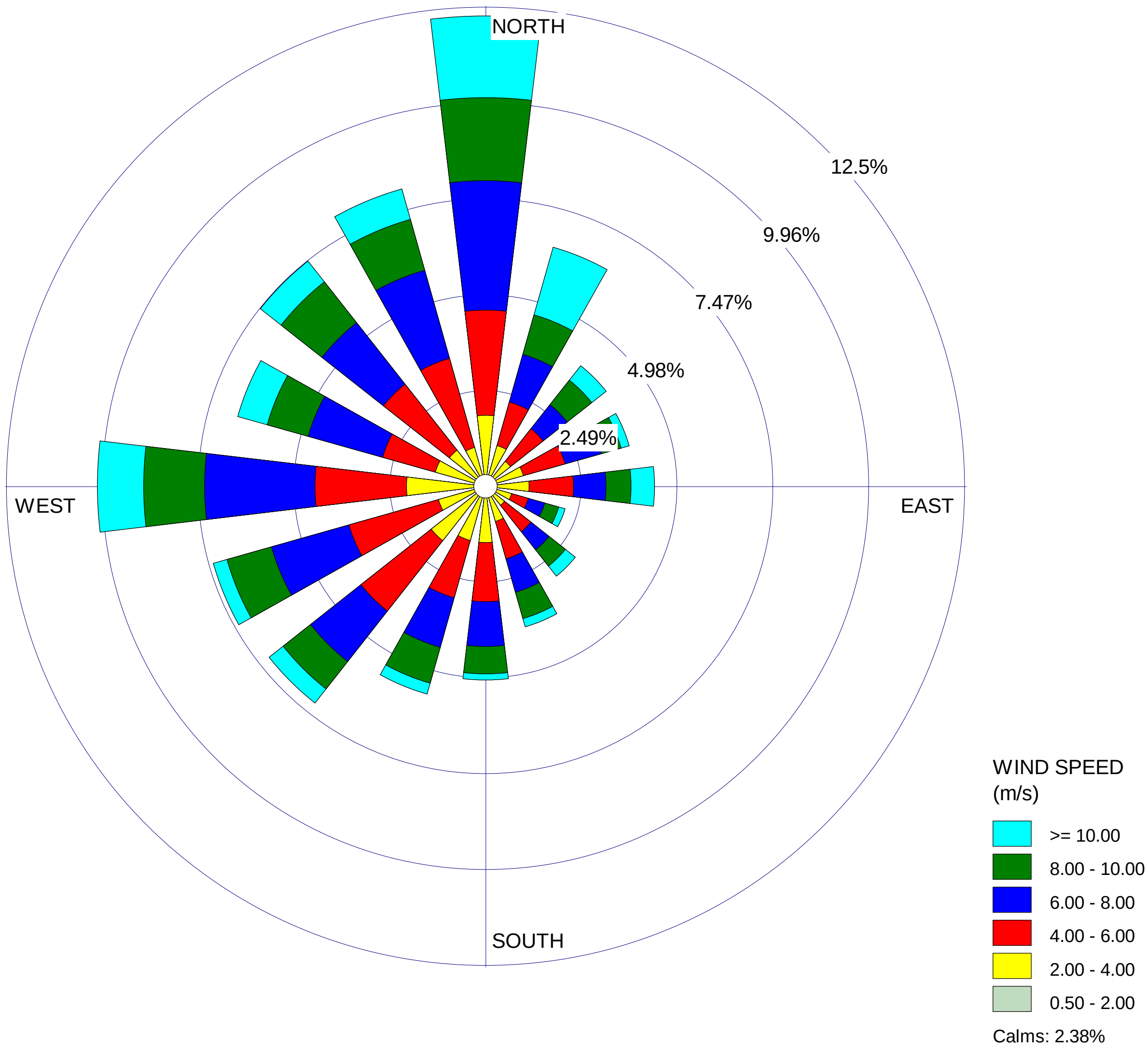
COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 2/1/2006 - 00:00 **End Date: 2/29/2016 - 23:00**	**Epsilon Associates**	
	CALM WINDS: **3.51%**	TOTAL COUNT: **7427 hrs.**	
	AVG. WIND SPEED: **6.31 m/s**	DATE: **11/3/2017**	

WIND ROSE PLOT:

Nantucket Memorial Airport, Nantucket, MA
March Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 3/1/2006 - 00:00 **End Date: 3/31/2016 - 23:00**	**Epsilon Associates**	
	CALM WINDS: **2.38%**	TOTAL COUNT: **8136 hrs.**	
	AVG. WIND SPEED: **6.24 m/s**	DATE: **11/3/2017**	

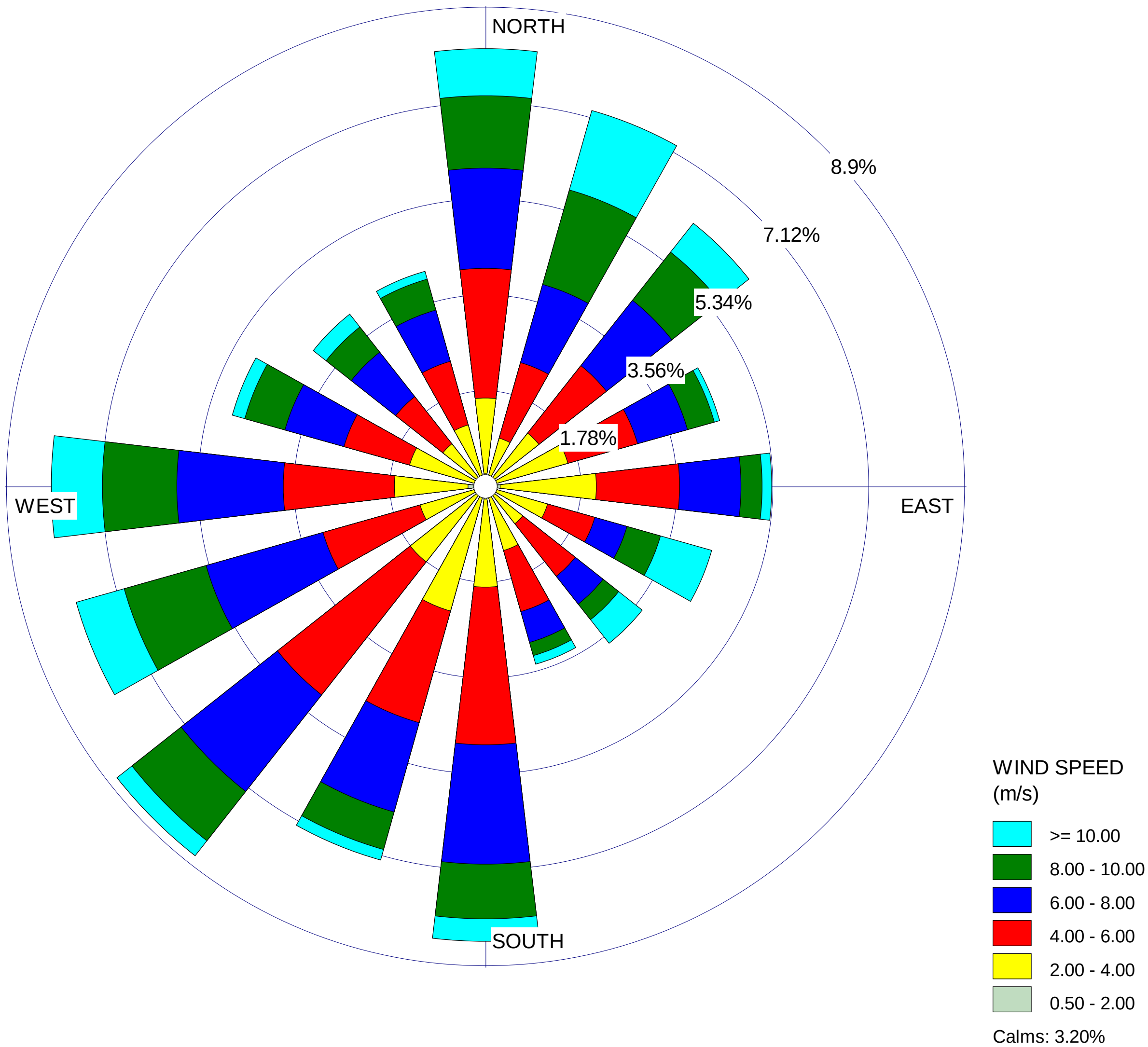
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Nantucket Memorial Airport, Nantucket, MA
April Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



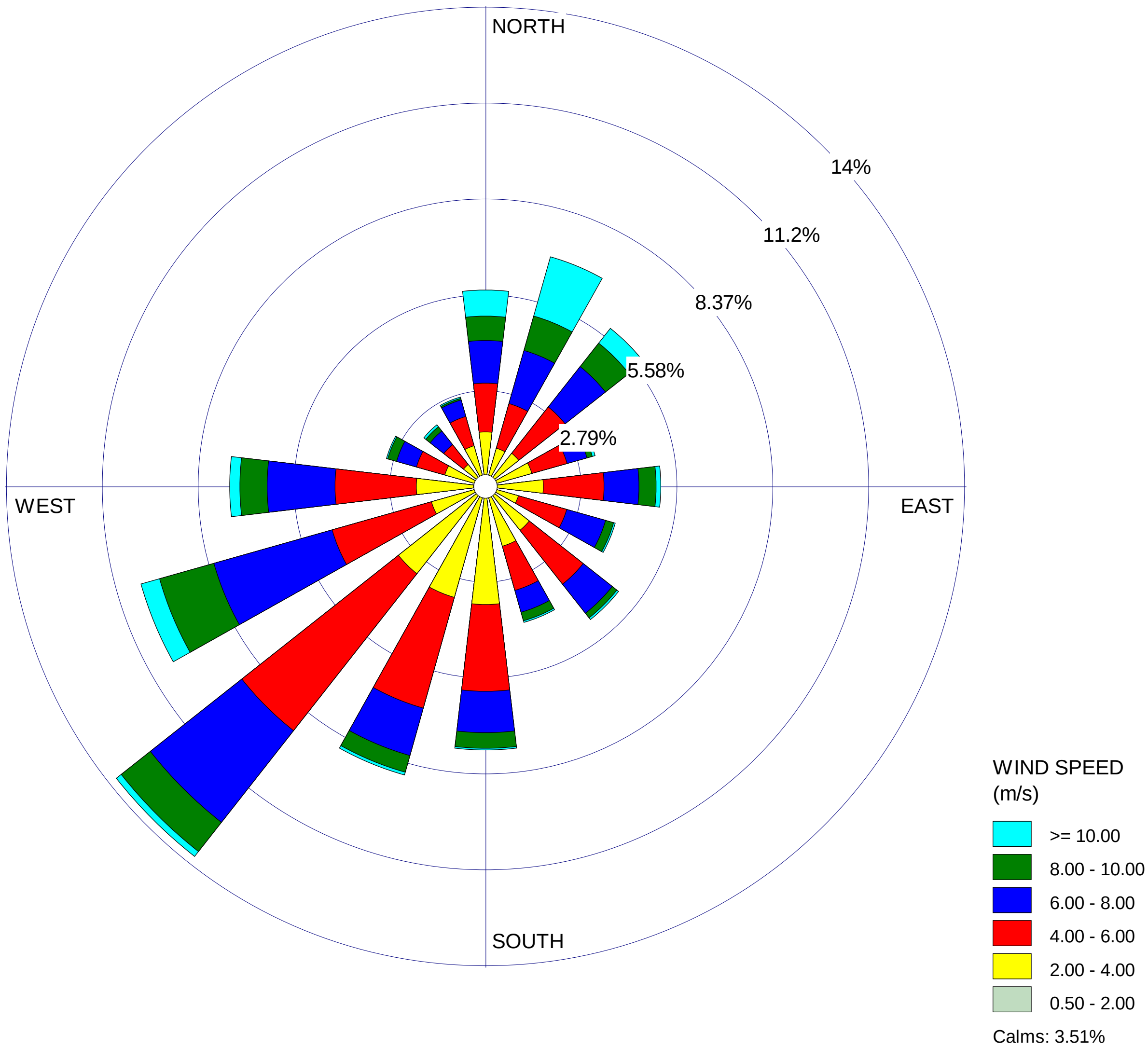
COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 4/1/2006 - 00:00 End Date: 4/30/2016 - 23:00	Epsilon Associates	
	CALM WINDS: 3.20%	TOTAL COUNT: 7868 hrs.	
	AVG. WIND SPEED: 5.82 m/s	DATE: 11/3/2017	

WIND ROSE PLOT:

Nantucket Memorial Airport, Nantucket, MA
May Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 5/1/2006 - 00:00 **End Date: 5/31/2016 - 23:00**	**Epsilon Associates**	
	CALM WINDS: **3.51%**	TOTAL COUNT: **8116 hrs.**	
	AVG. WIND SPEED: **5.21 m/s**	DATE: **11/3/2017**	

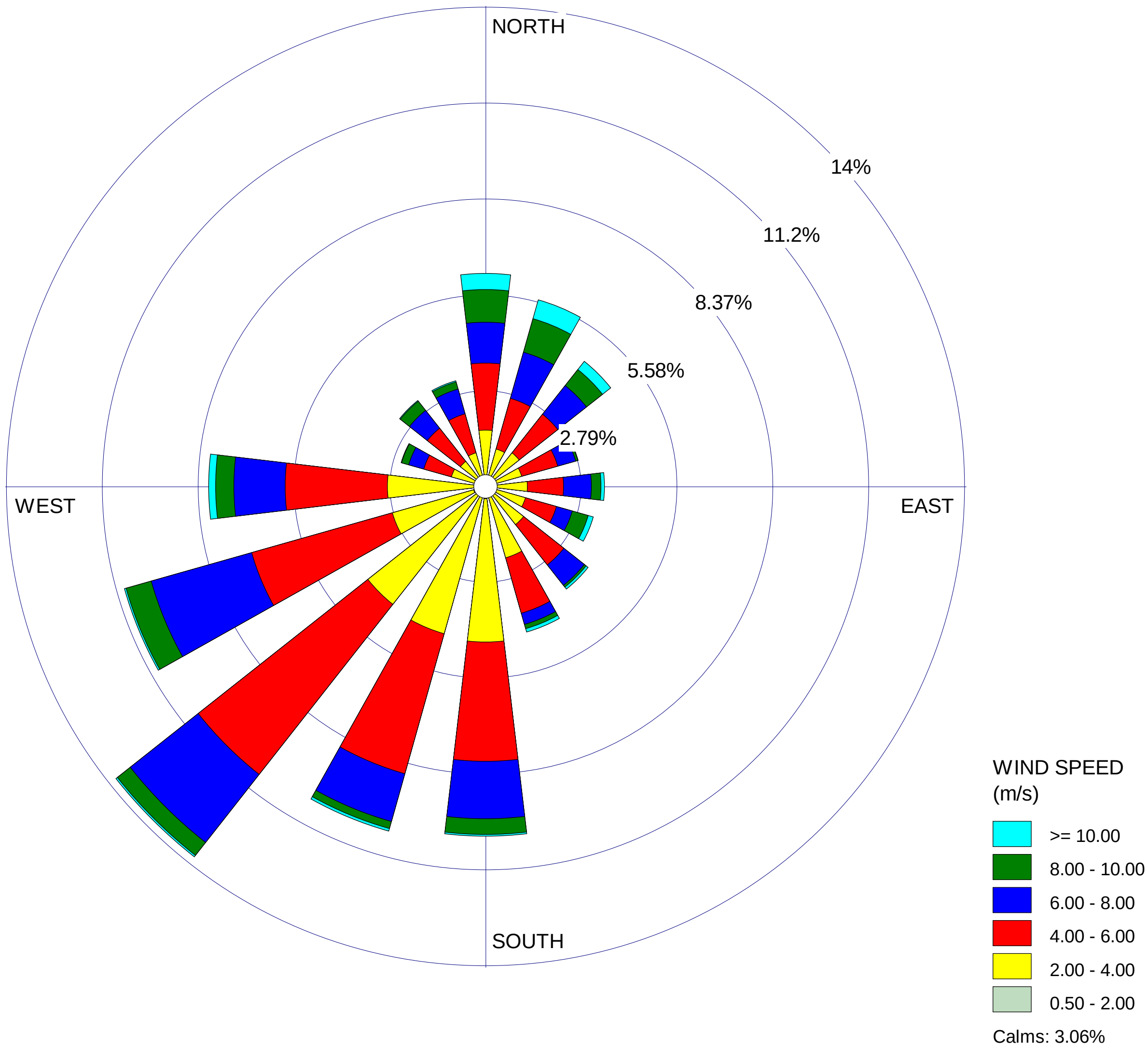
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Nantucket Memorial Airport, Nantucket, MA
June Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



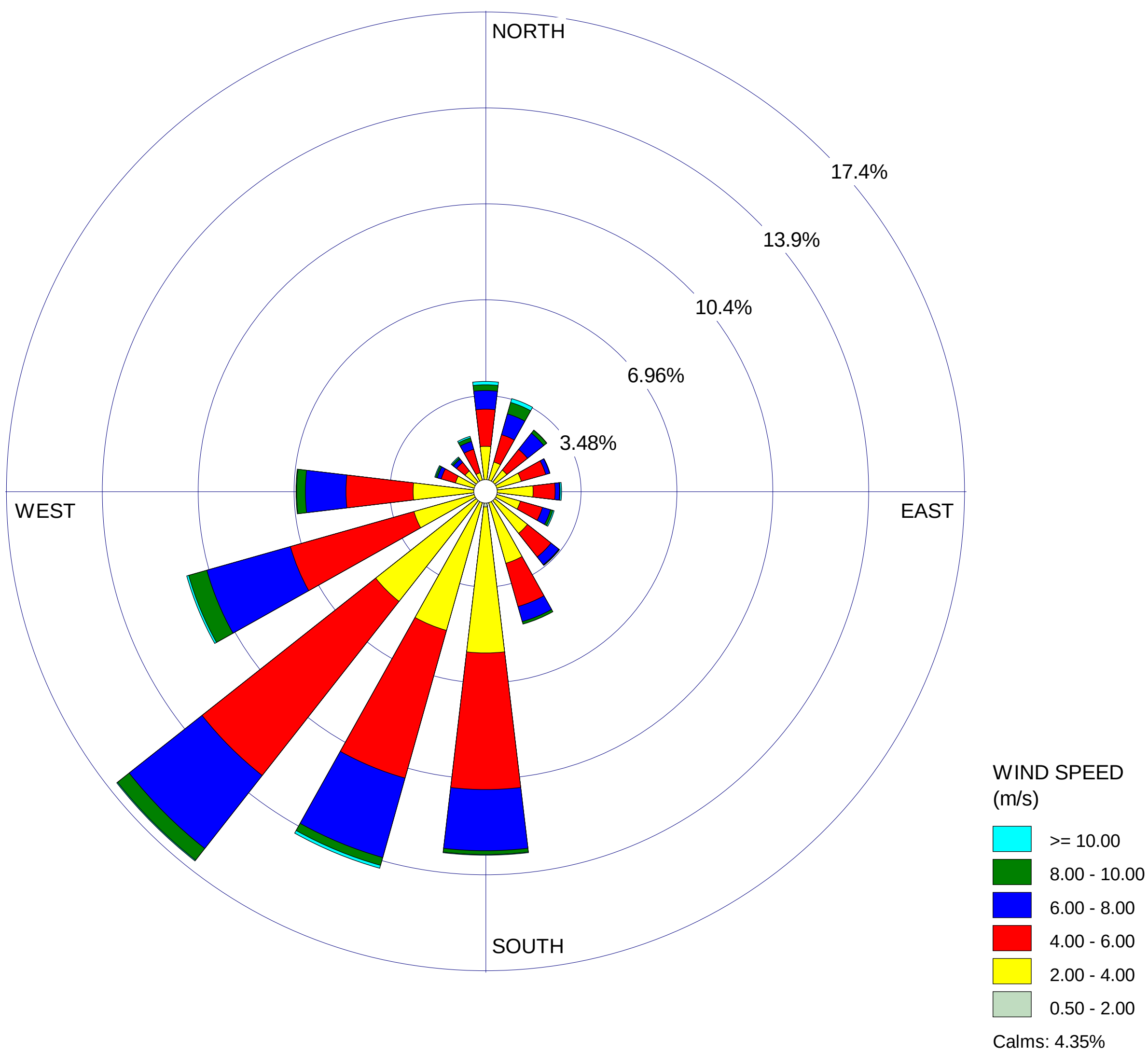
COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 6/1/2006 - 00:00 **End Date: 6/30/2016 - 23:00**	**Epsilon Associates**	
	CALM WINDS: **3.06%**	TOTAL COUNT: **7865 hrs.**	
	AVG. WIND SPEED: **4.78 m/s**	DATE: **11/3/2017**	

WIND ROSE PLOT:

Nantucket Memorial Airport, Nantucket, MA
July Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:

Start Date: 7/1/2006 - 00:00
End Date: 7/31/2016 - 23:00

COMPANY NAME:

Epsilon Associates

CALM WINDS:

4.35%

TOTAL COUNT:

8093 hrs.

AVG. WIND SPEED:

4.35 m/s

DATE:

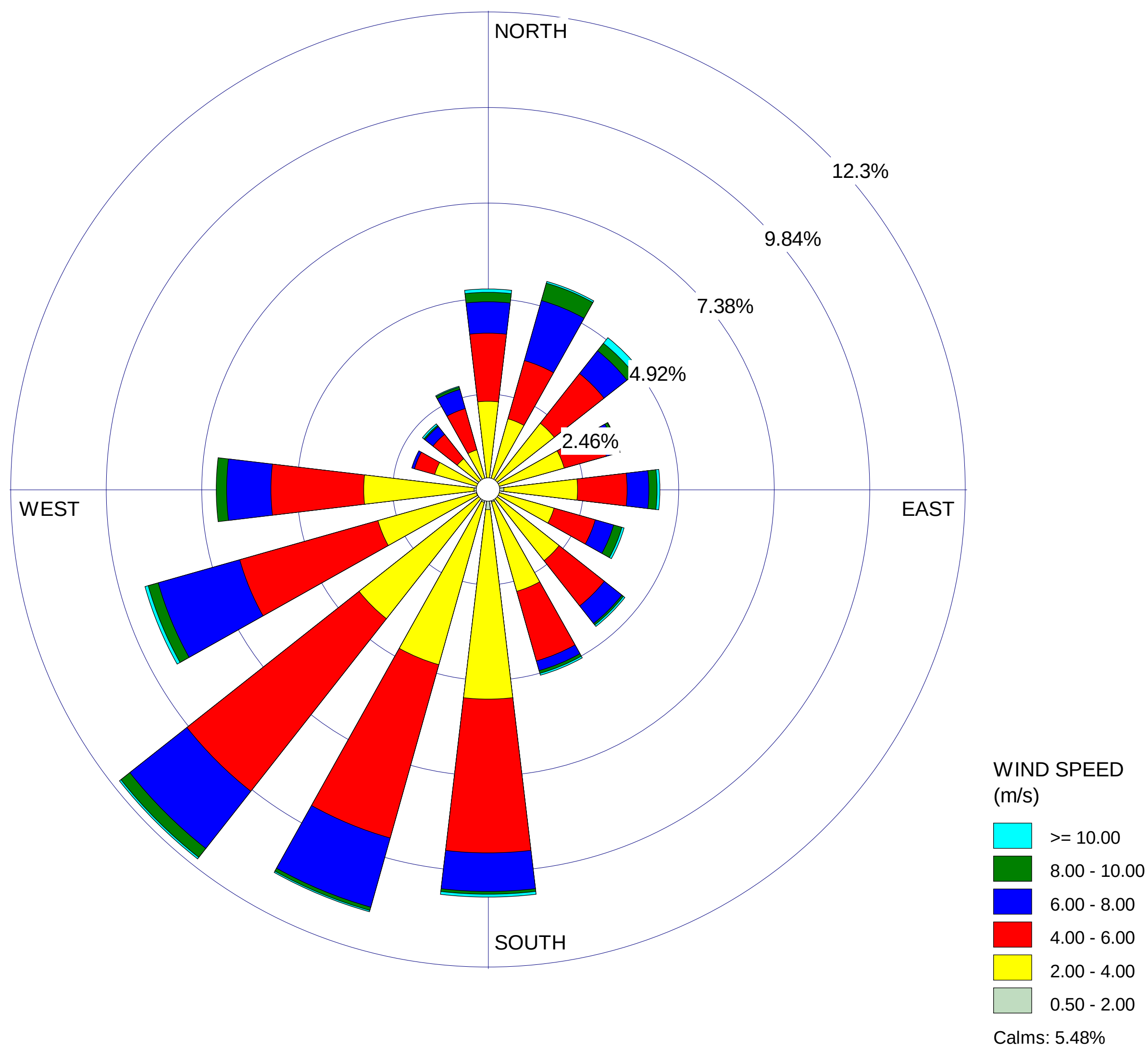
11/3/2017

WIND ROSE PLOT:

Nantucket Memorial Airport, Nantucket, MA
August Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD: **Start Date: 8/1/2006 - 00:00** **End Date: 8/31/2016 - 23:00**	COMPANY NAME: **Epsilon Associates**
	CALM WINDS: **5.48%**	TOTAL COUNT: **8112 hrs.**
	AVG. WIND SPEED: **4.13 m/s**	DATE: **11/3/2017**

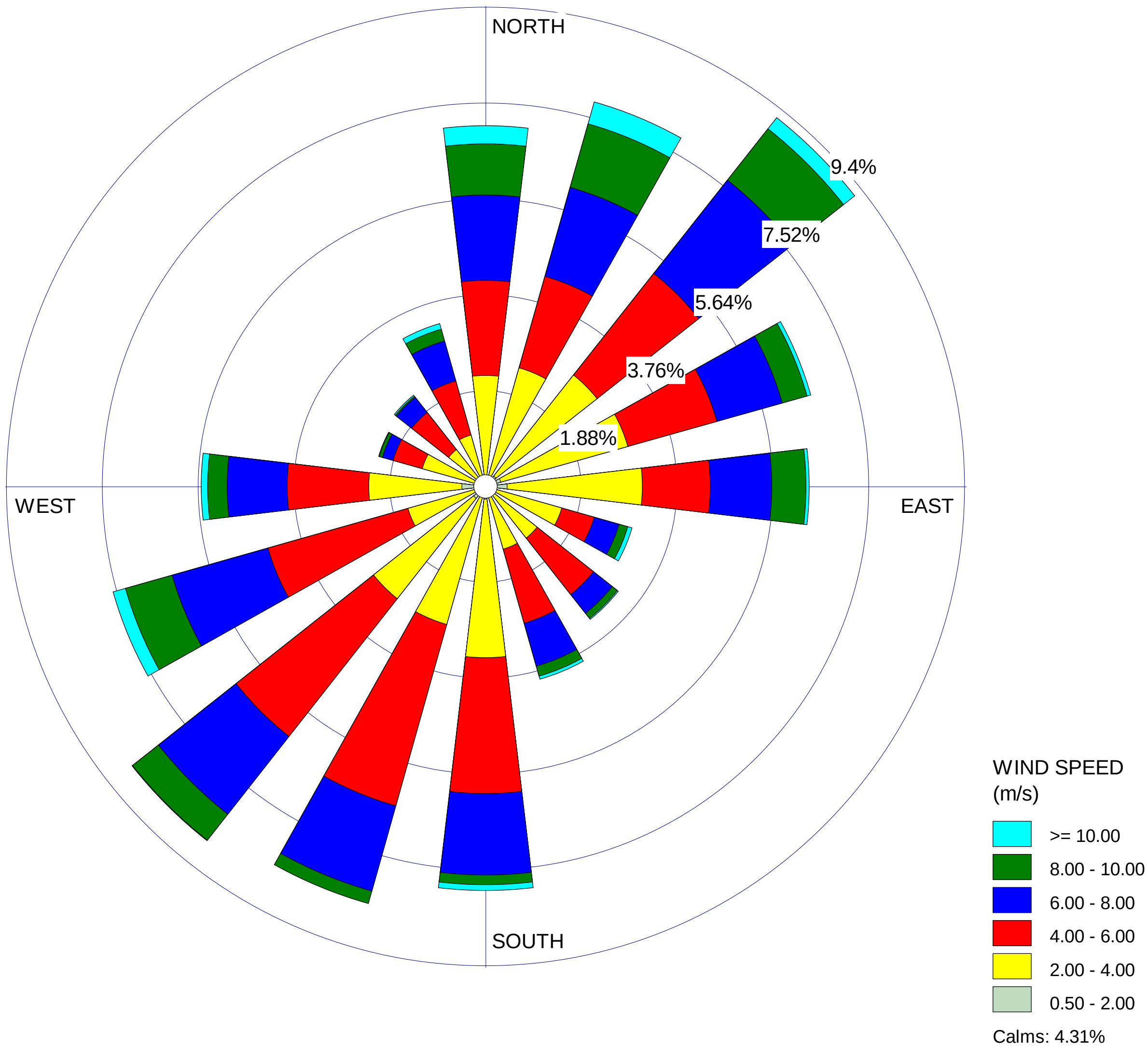
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Nantucket Memorial Airport, Nantucket, MA
September Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



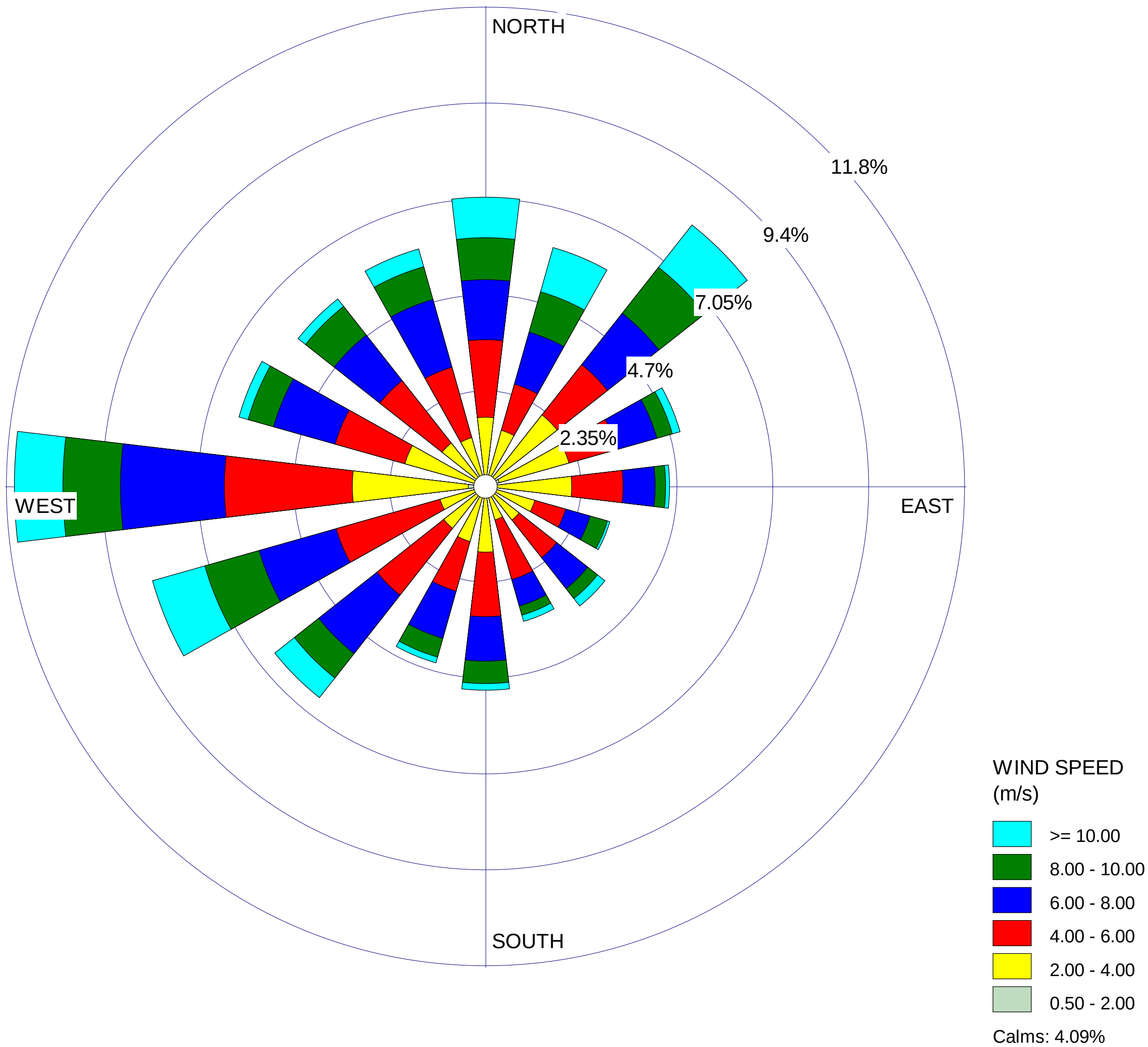
COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 9/1/2006 - 00:00 **End Date: 9/30/2016 - 23:00**	**Epsilon Associates**	
	CALM WINDS: **4.31%**	TOTAL COUNT: **7721 hrs.**	
	AVG. WIND SPEED: **4.76 m/s**	DATE: **11/3/2017**	

WIND ROSE PLOT:

Nantucket Memorial Airport, Nantucket, MA
October Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:

Start Date: 10/1/2006 - 00:00
End Date: 10/31/2016 - 23:00

COMPANY NAME:

Epsilon Associates

CALM WINDS:

4.09%

TOTAL COUNT:

8131 hrs.

AVG. WIND SPEED:

5.64 m/s

DATE:

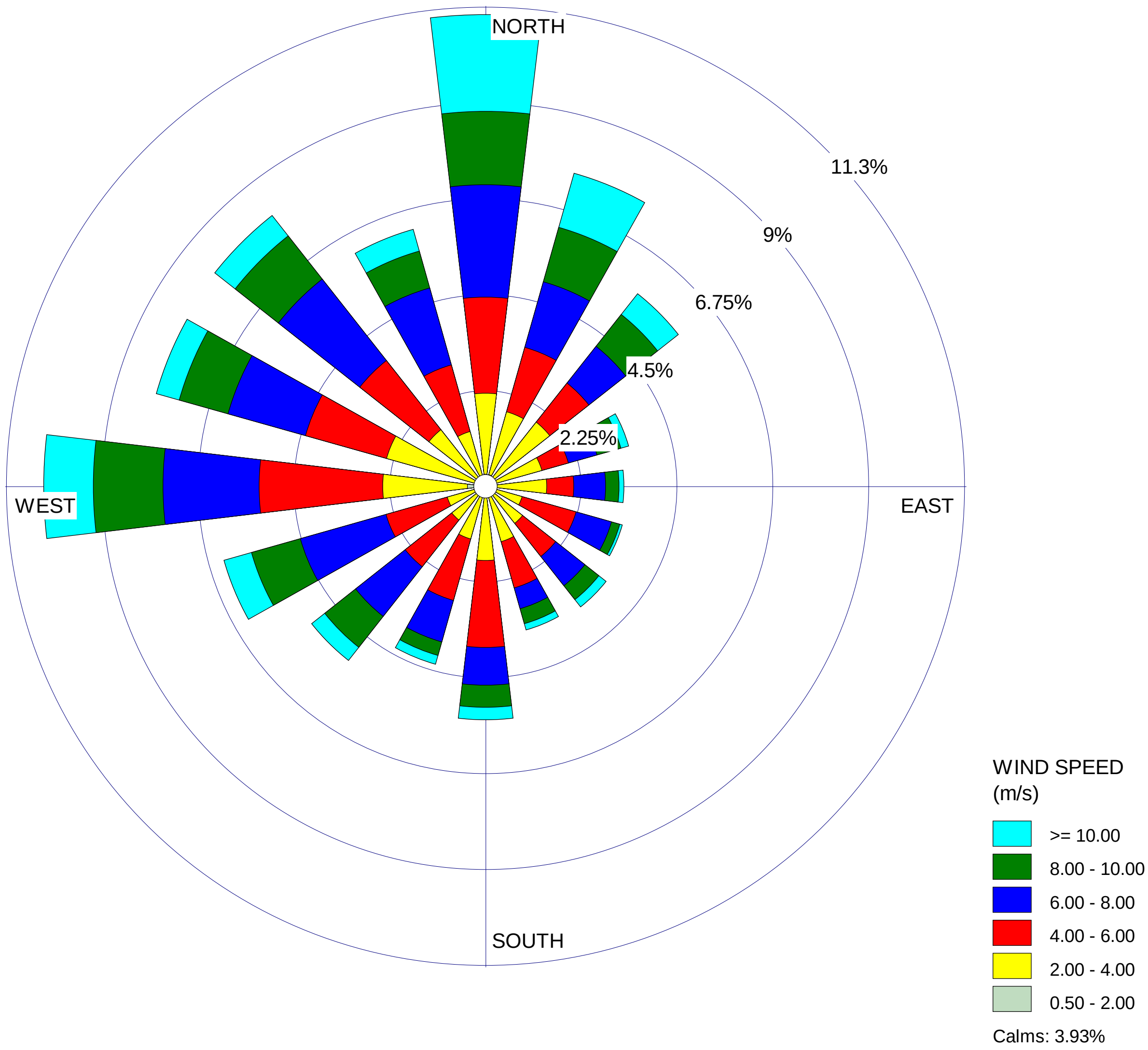
11/3/2017

WIND ROSE PLOT:

Nantucket Memorial Airport, Nantucket, MA
November Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 11/1/2006 - 00:00 **End Date: 11/30/2016 - 23:00**	**Epsilon Associates**	
	CALM WINDS: **3.93%**	TOTAL COUNT: **7880 hrs.**	
	AVG. WIND SPEED: **5.83 m/s**	DATE: **11/3/2017**	

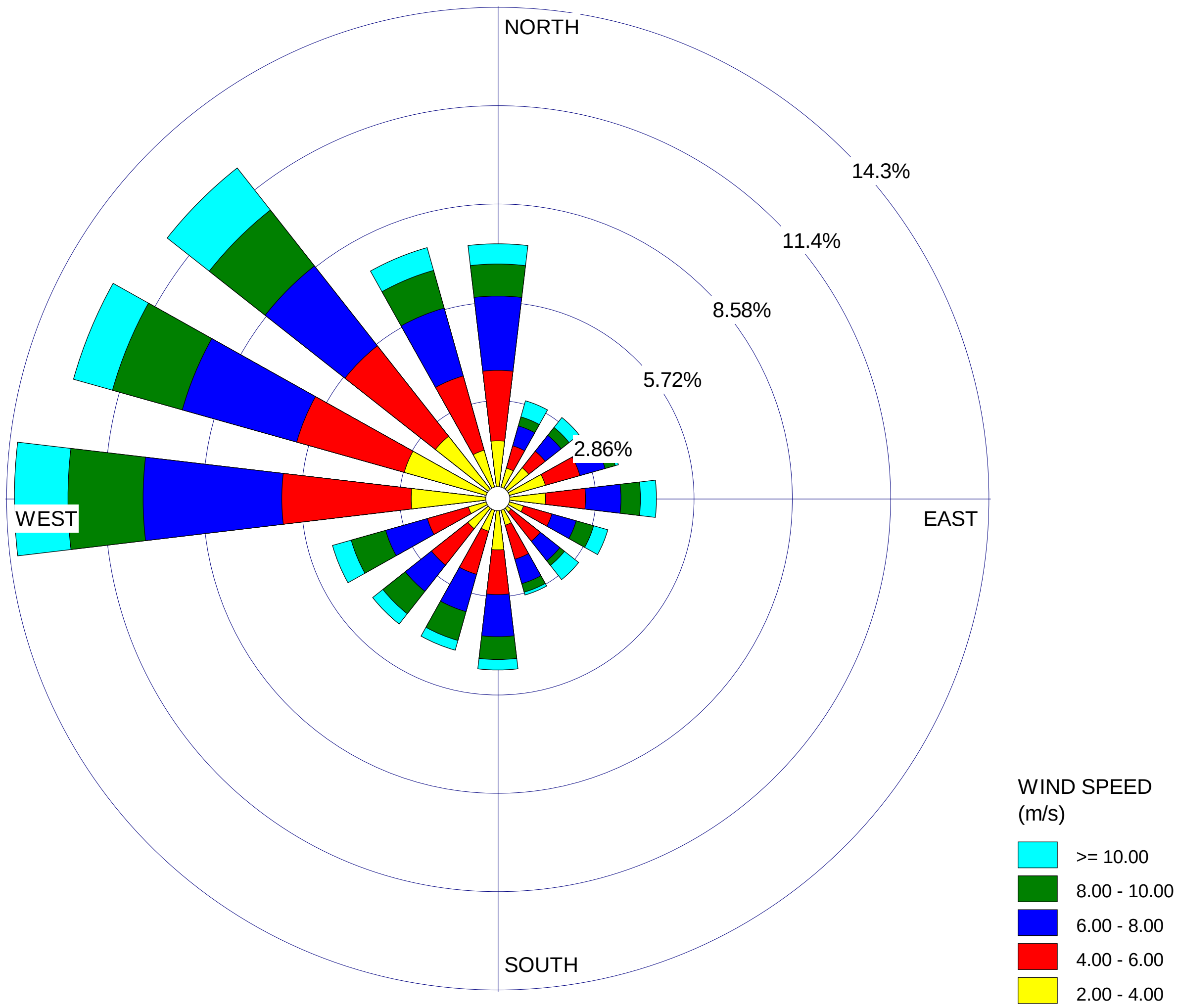
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Nantucket Memorial Airport, Nantucket, MA
December Wind Rose

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:

Start Date: 12/1/2006 - 00:00
End Date: 12/31/2016 - 19:00

COMPANY NAME:

Epsilon Associates

CALM WINDS:

3.12%

TOTAL COUNT:

8157 hrs.

AVG. WIND SPEED:

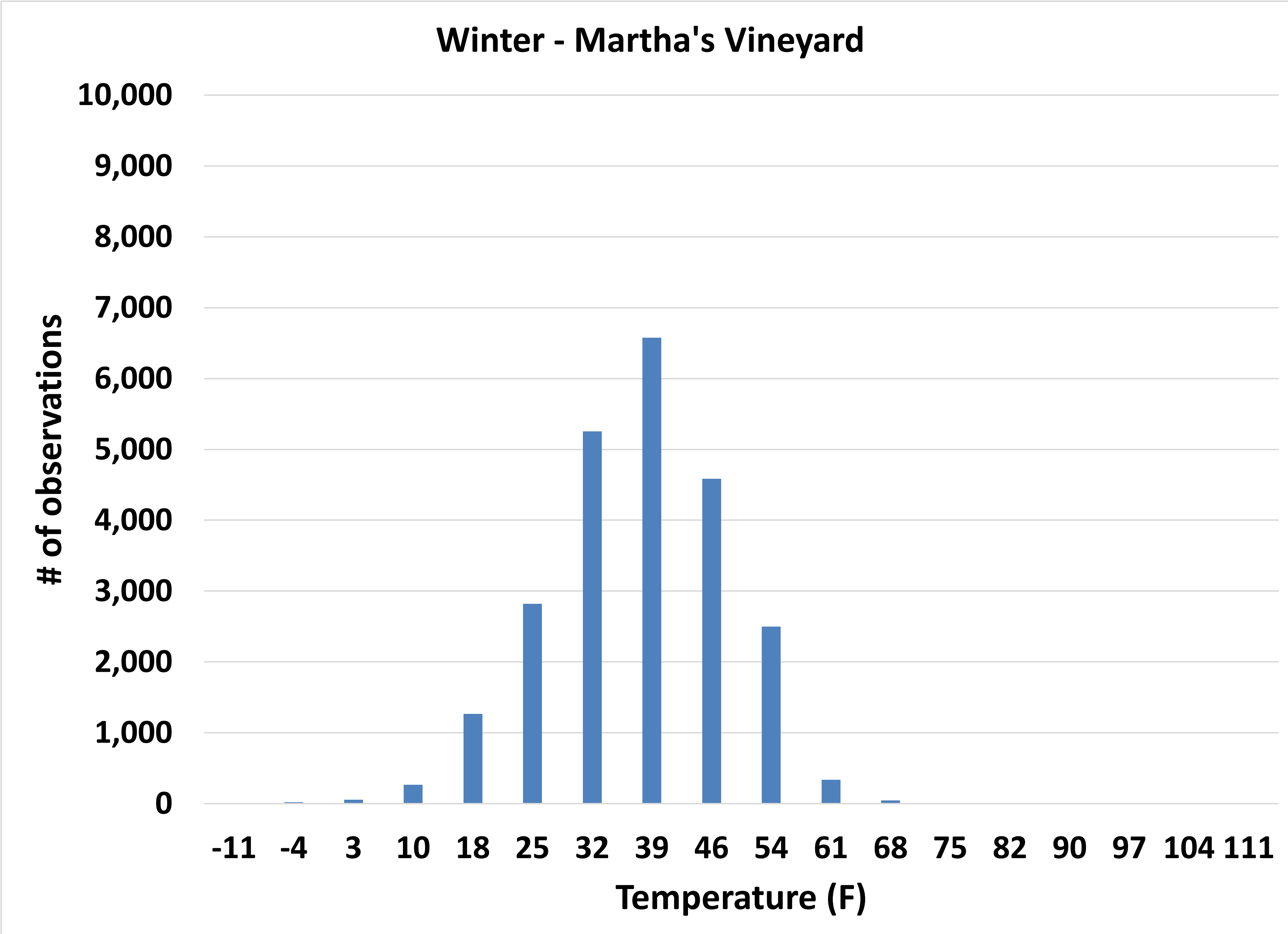
5.98 m/s

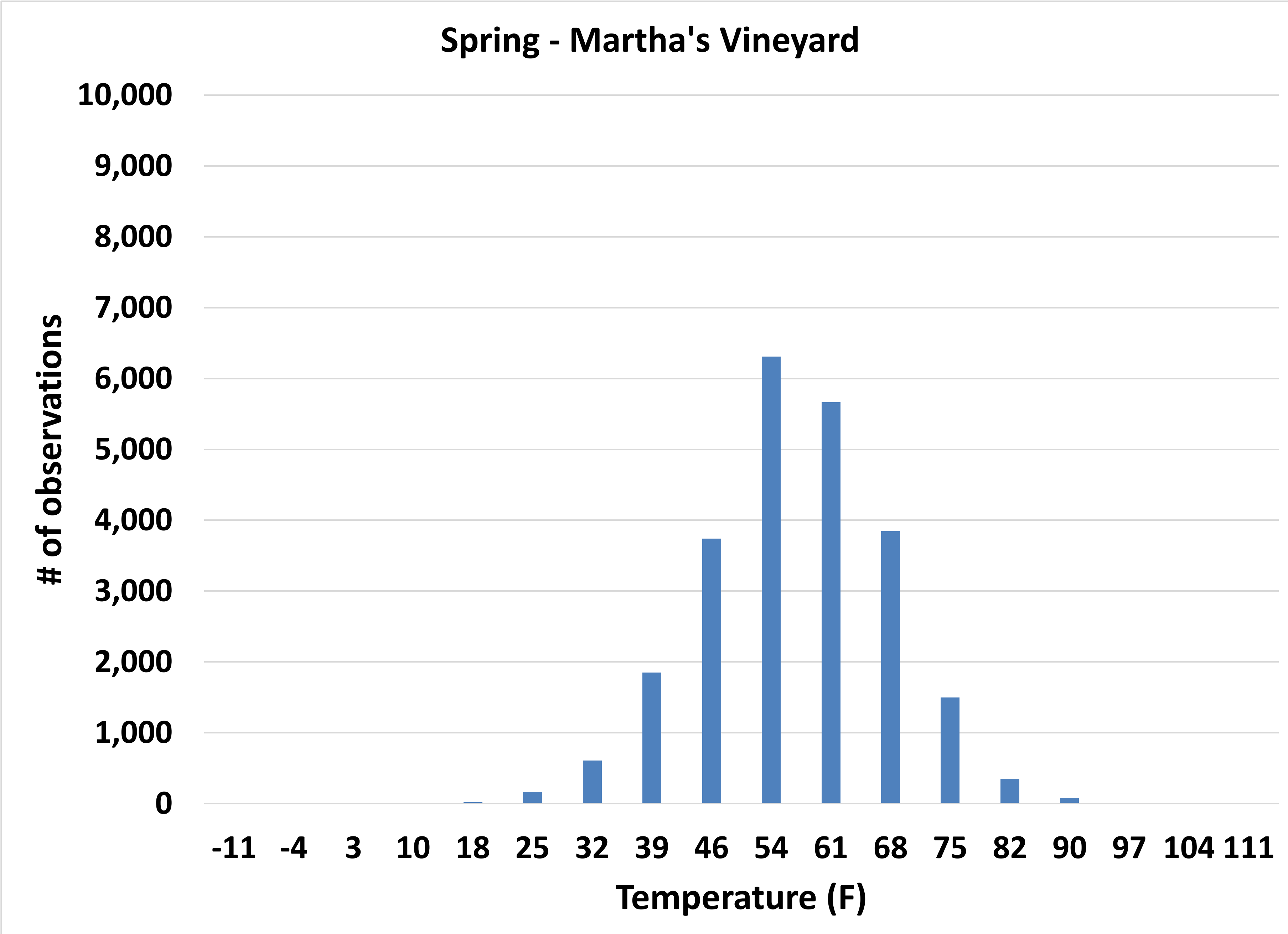
DATE:

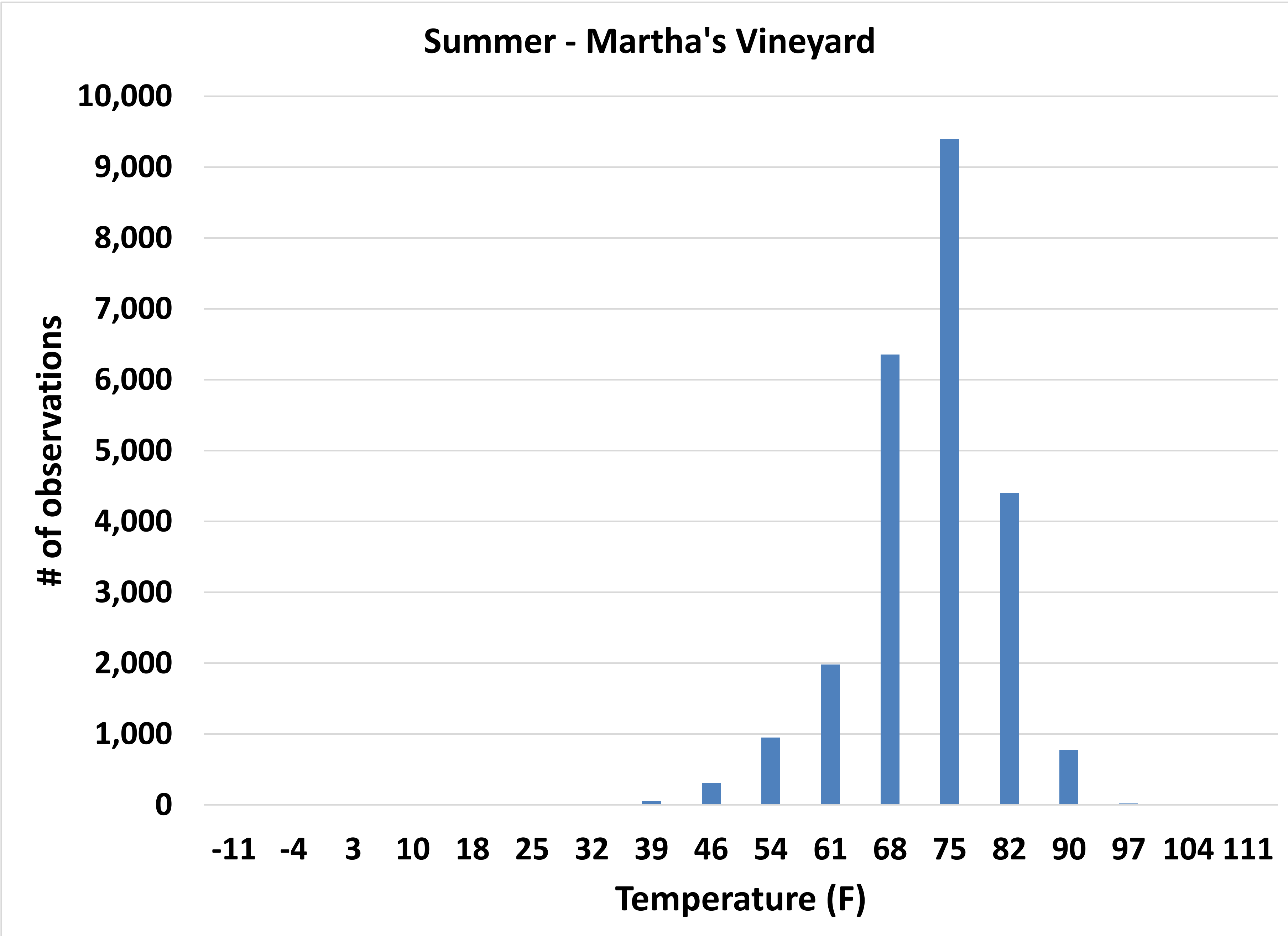
11/3/2017

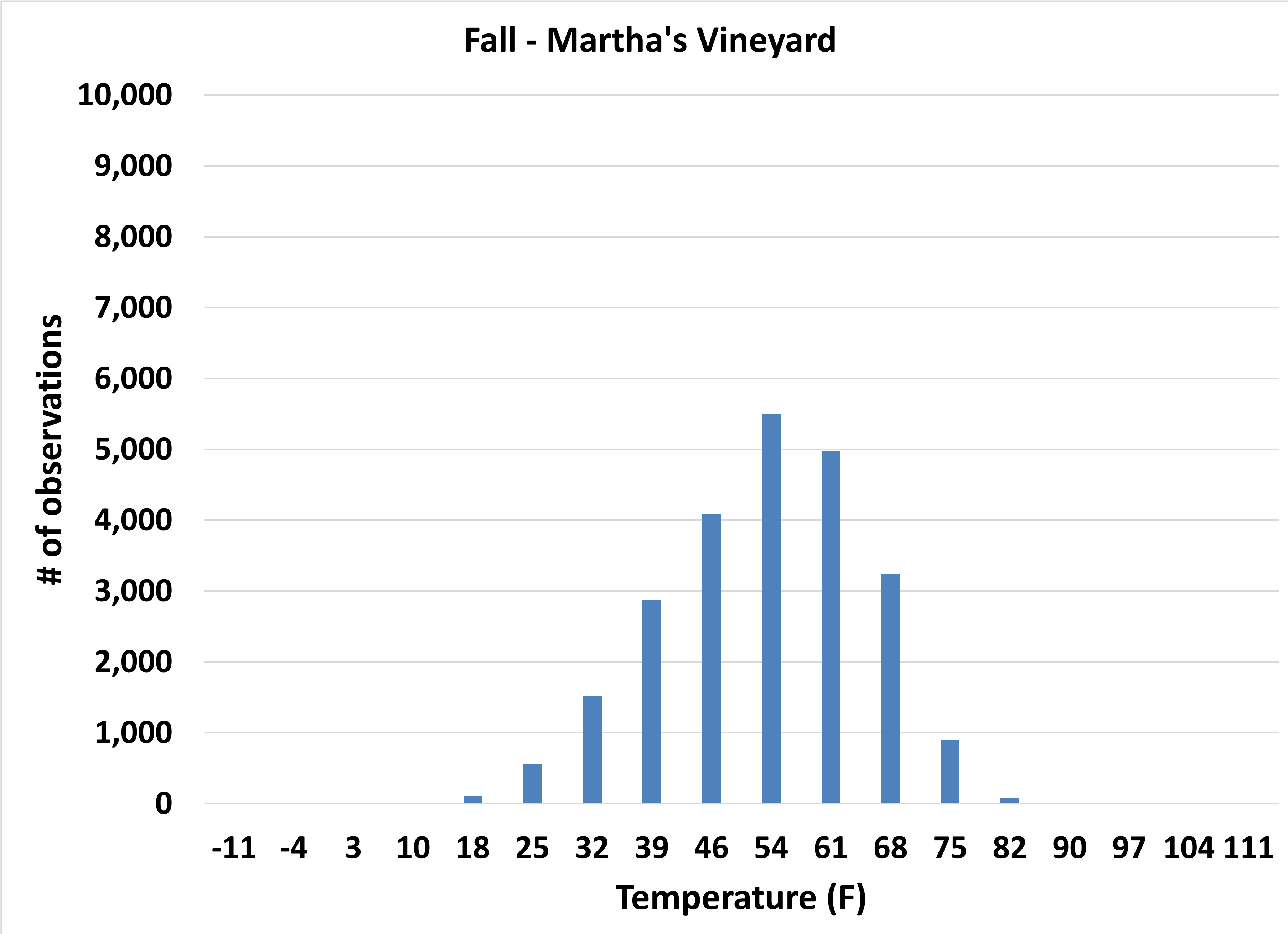
Appendix B

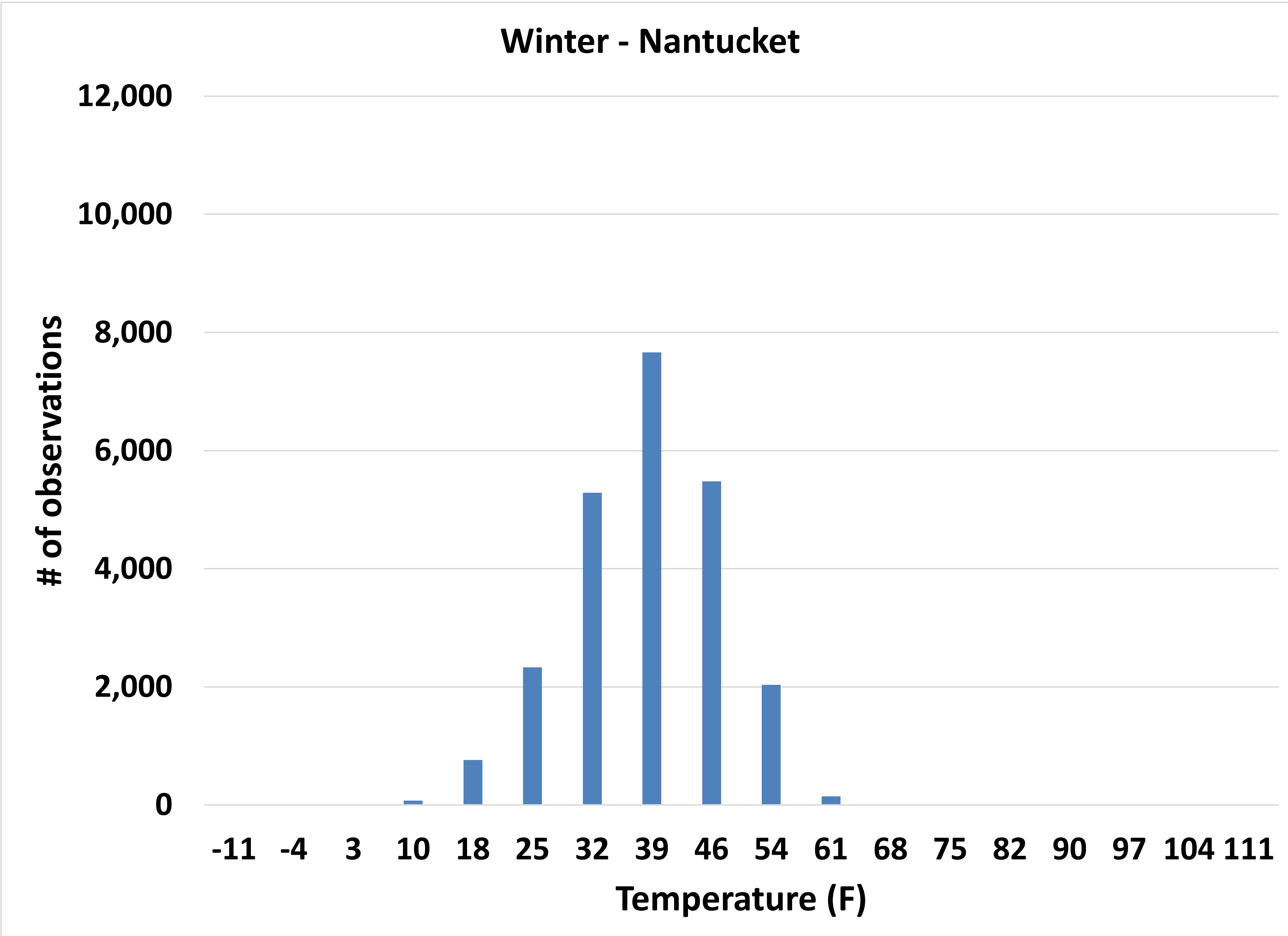
Histograms of Temperature Distributions for Martha's Vineyard and Nantucket

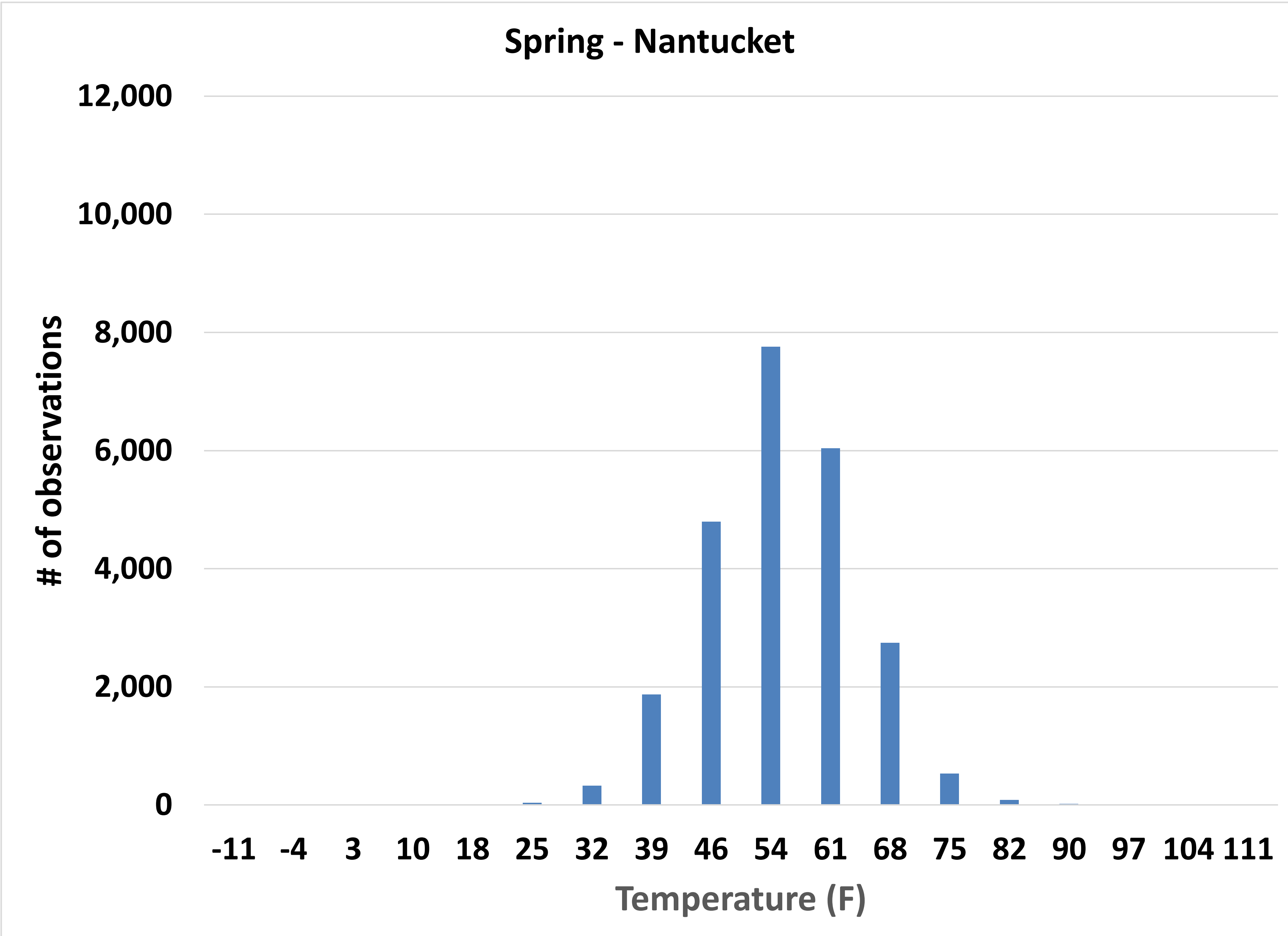

Winter - Martha's Vineyard
# of observations
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
-11
-4
3
10
18
25
32
39
46
54
61
68
75
82
90
97
104
111
Temperature (F)

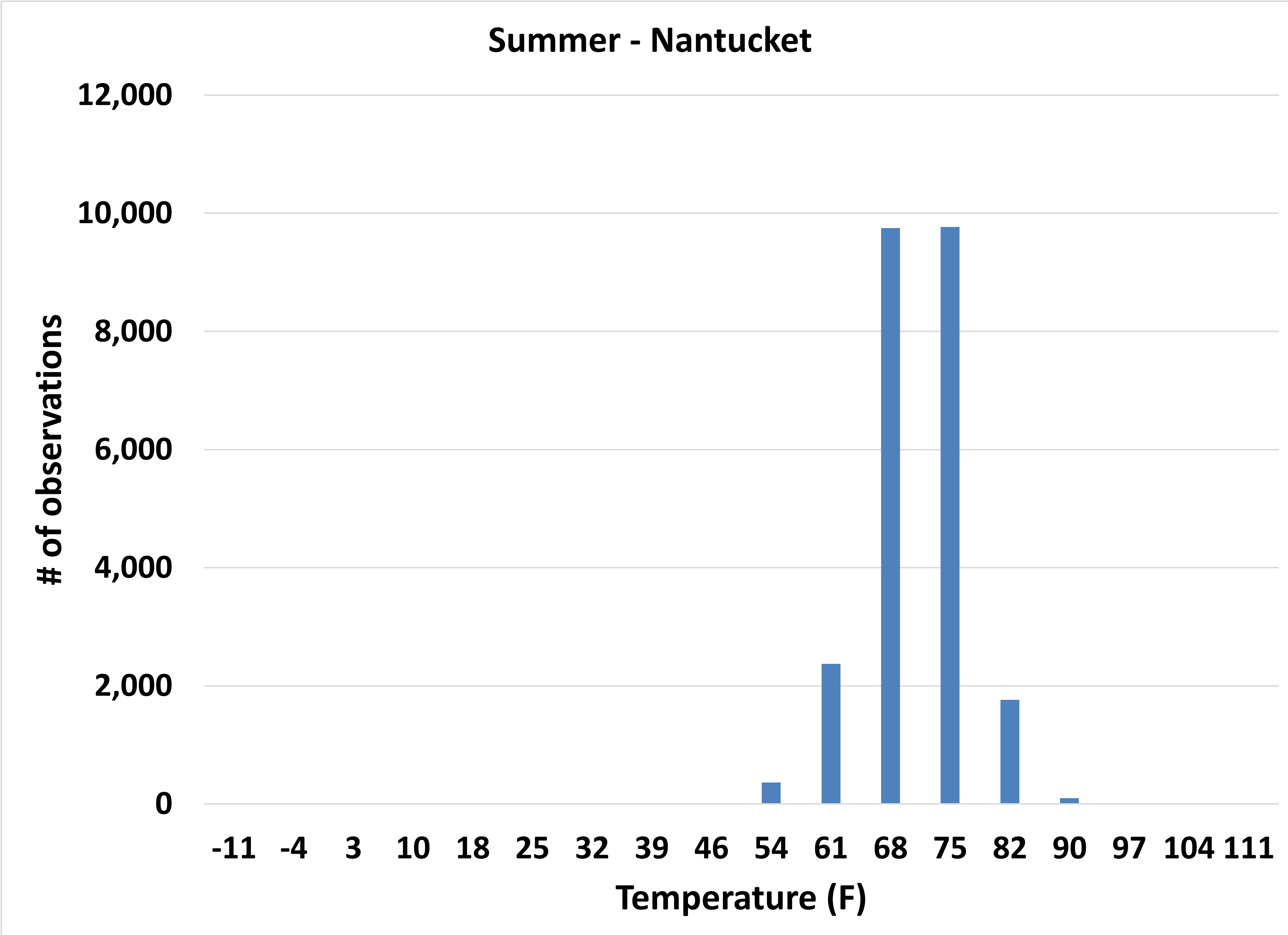

Spring - Martha's Vineyard
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
# of observations
-11
-4
3
10
18
25
32
39
46
54
61
68
75
82
90
97
104
111
Temperature (F)

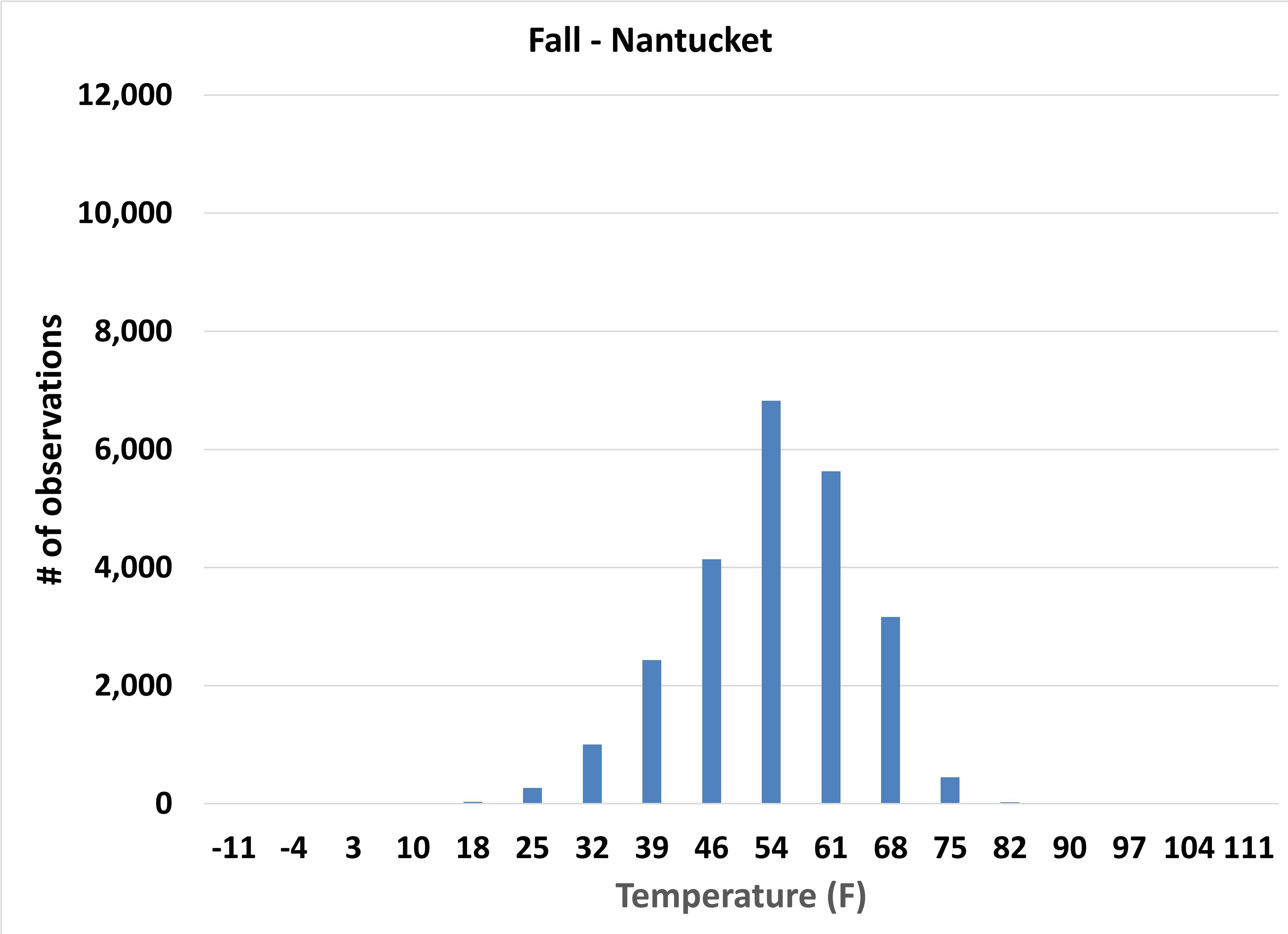

Summer - Martha's Vineyard
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
# of observations
-11 -4 3 10 18 25 32 39 46 54 61 68 75 82 90 97 104 111
Temperature (F)


Fall - Martha's Vineyard
# of observations
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
-11
-4
3
10
18
25
32
39
46
54
61
68
75
82
90
97
104
111
Temperature (F)


Winter - Nantucket
12,000
10,000
8,000
6,000
4,000
2,000
0
# of observations
-11
-4
3
10
18
25
32
39
46
54
61
68
75
82
90
97
104
111
Temperature (F)


Spring - Nantucket
12,000
10,000
8,000
6,000
4,000
2,000
0
# of observations
-11 -4 3 10 18 25 32 39 46 54 61 68 75 82 90 97 104 111
Temperature (F)

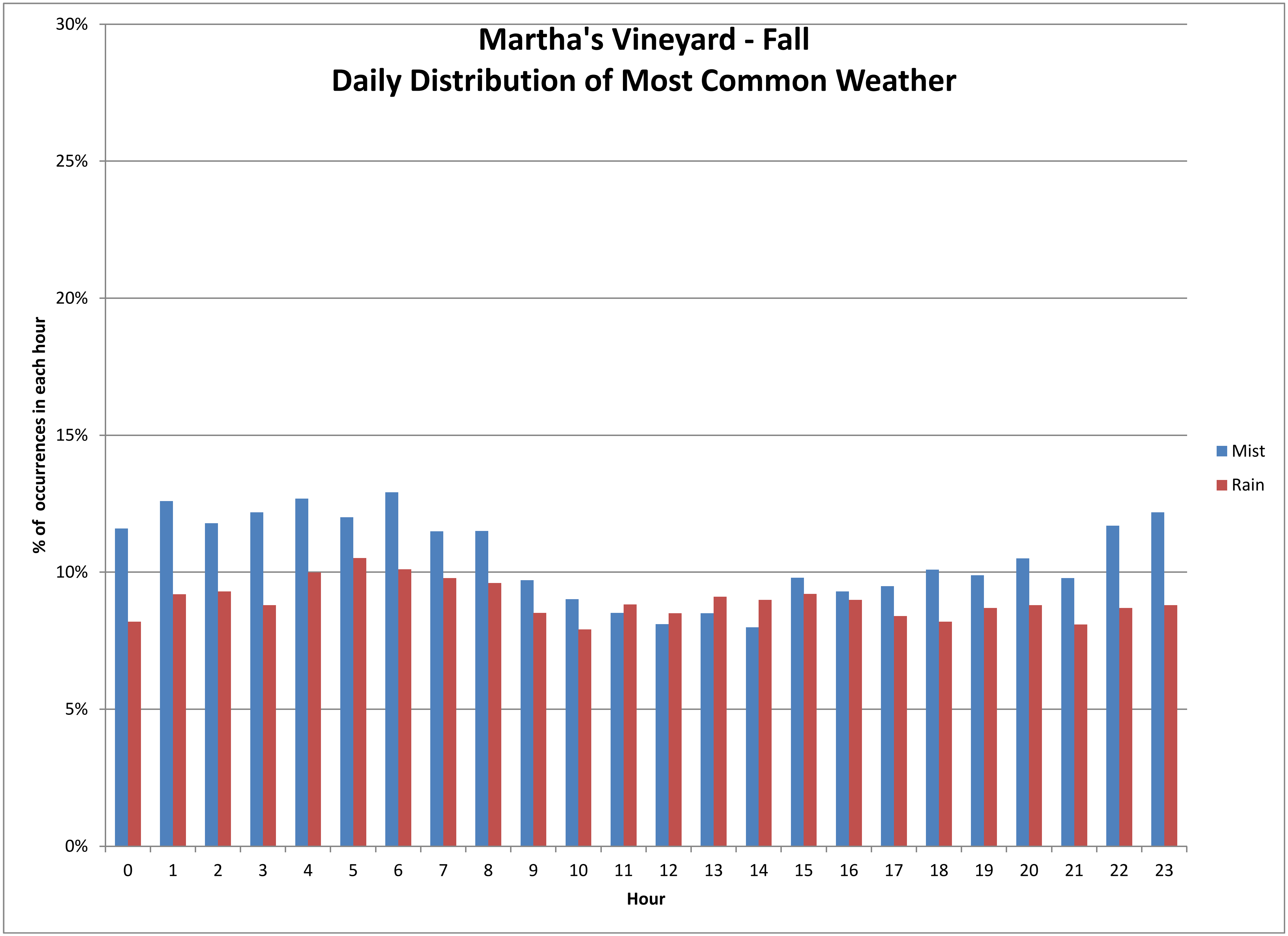

Summer - Nantucket
12,000
10,000
8,000
6,000
4,000
2,000
0
# of observations
-11
-4
3
10
18
25
32
39
46
54
61
68
75
82
90
97
104
111
Temperature (F)

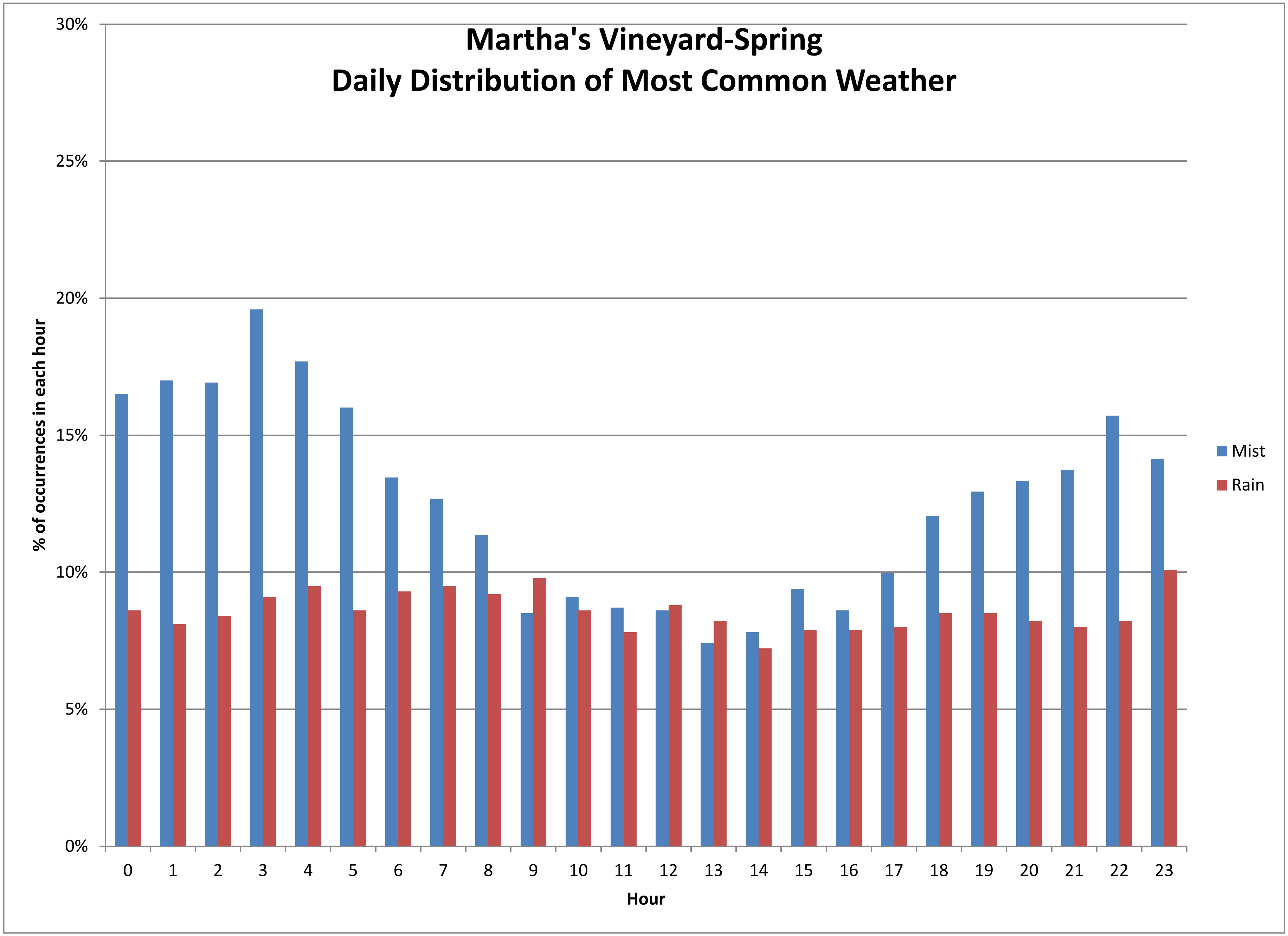


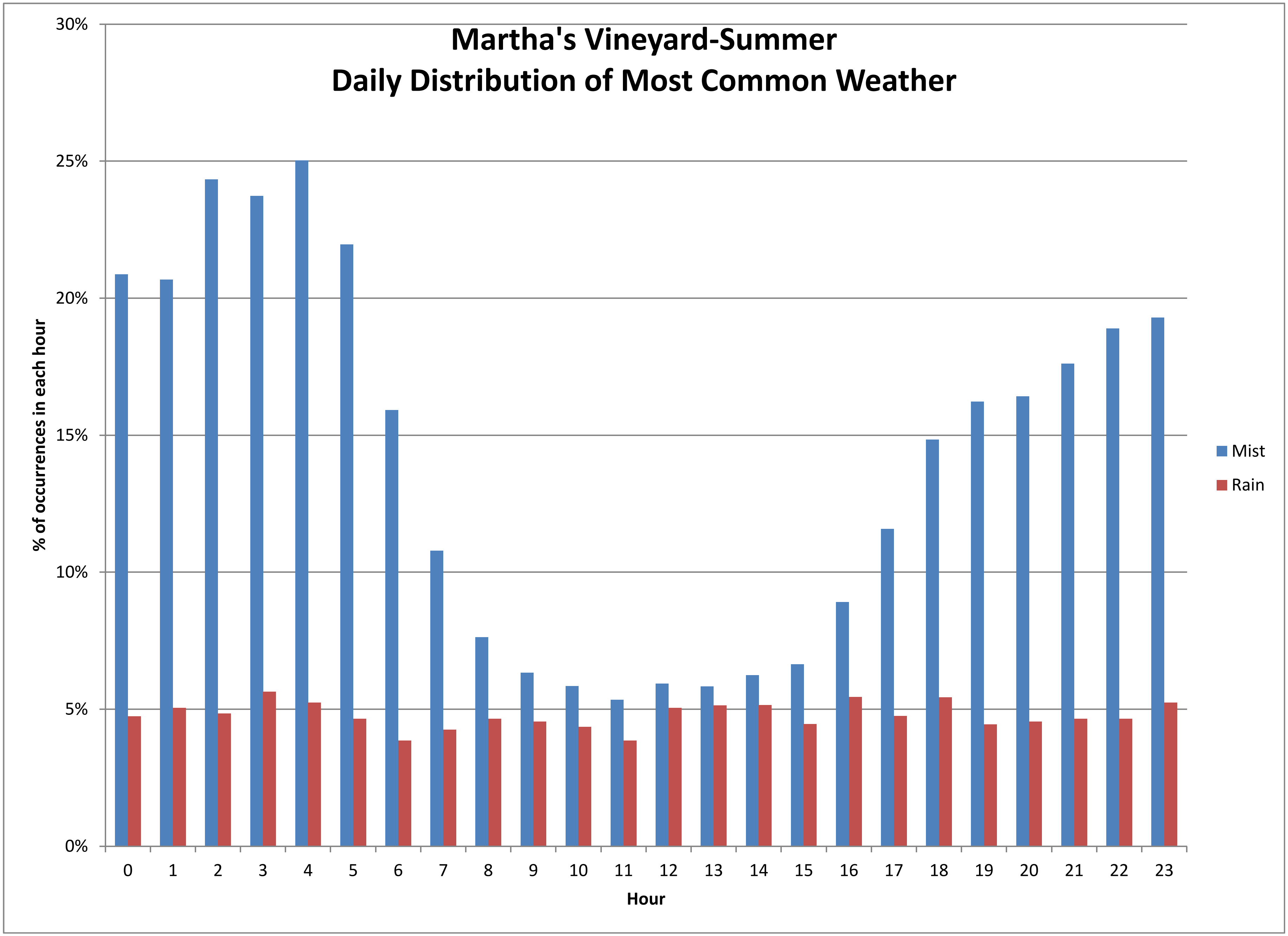
Fall - Nantucket
12,000
10,000
8,000
6,000
4,000
2,000
0
# of observations
-11
-4
3
10
18
25
32
39
46
54
61
68
75
82
90
97
104
111
Temperature (F)

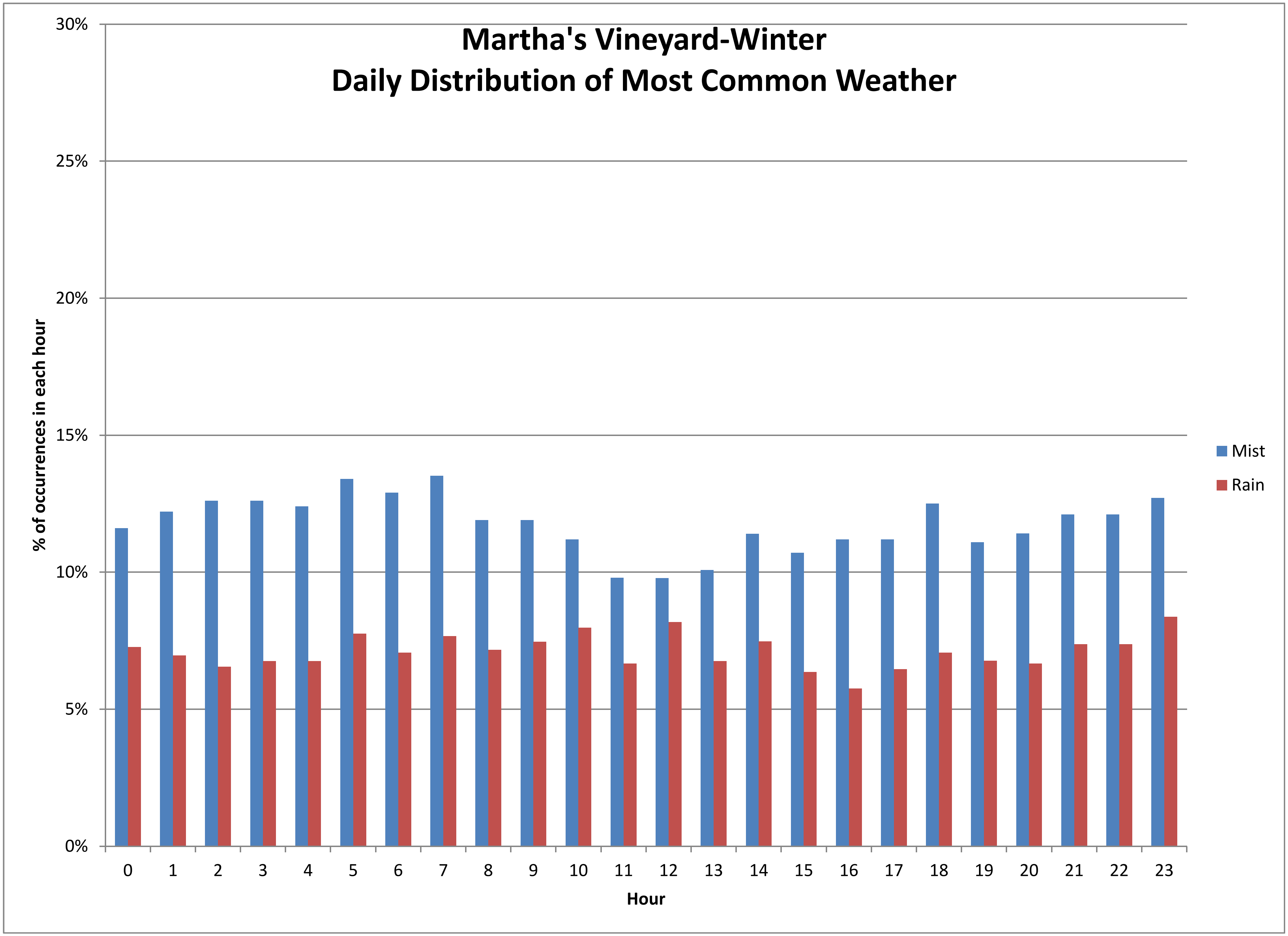
Appendix C

Common Weather Conditions at Martha's Vineyard and Nantucket

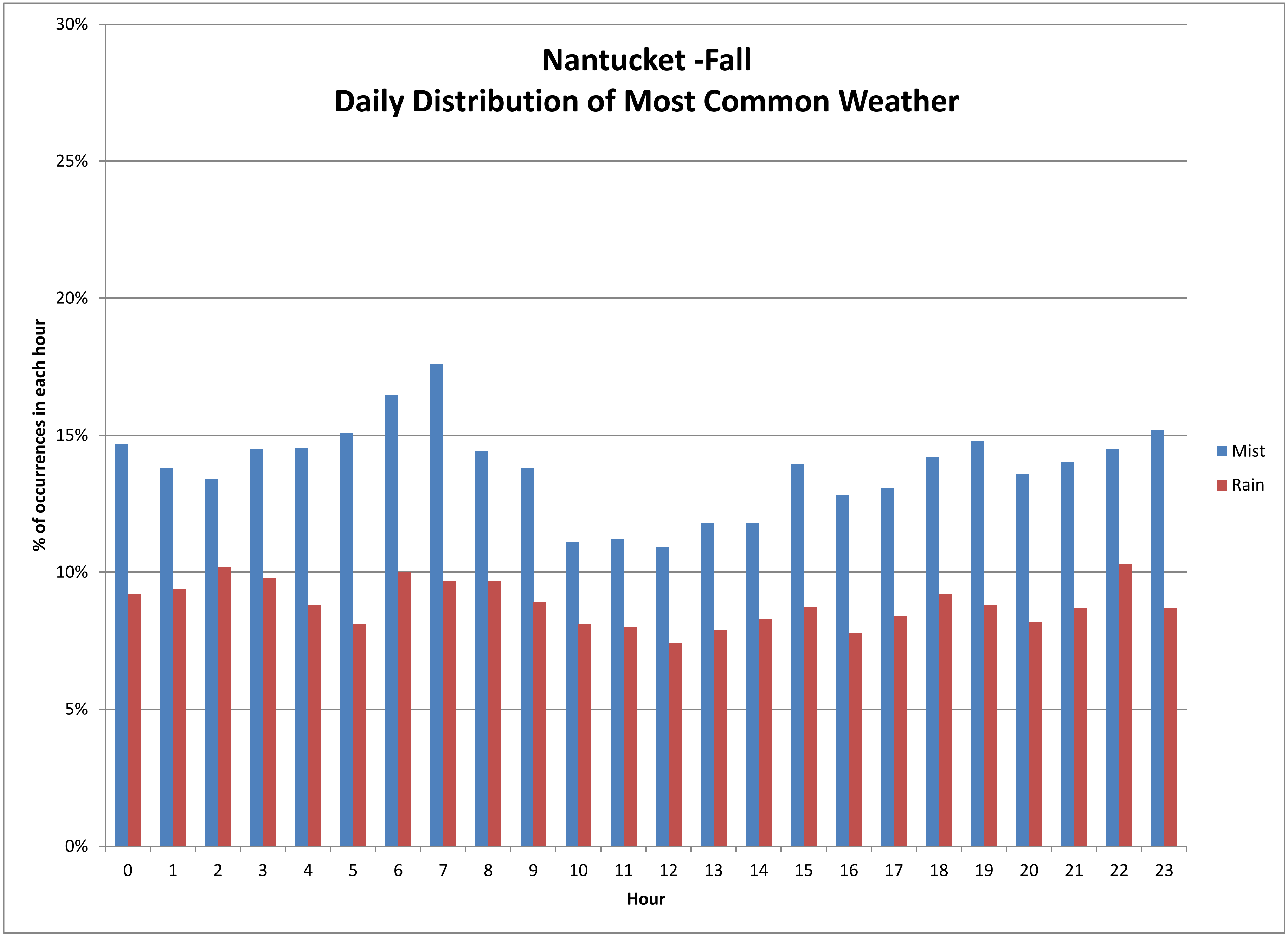

Martha's Vineyard - Fall
Daily Distribution of Most Common Weather
30%
25%
20%
15%
10%
5%
0%
% of occurrences in each hour
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
Hour
Mist
Rain

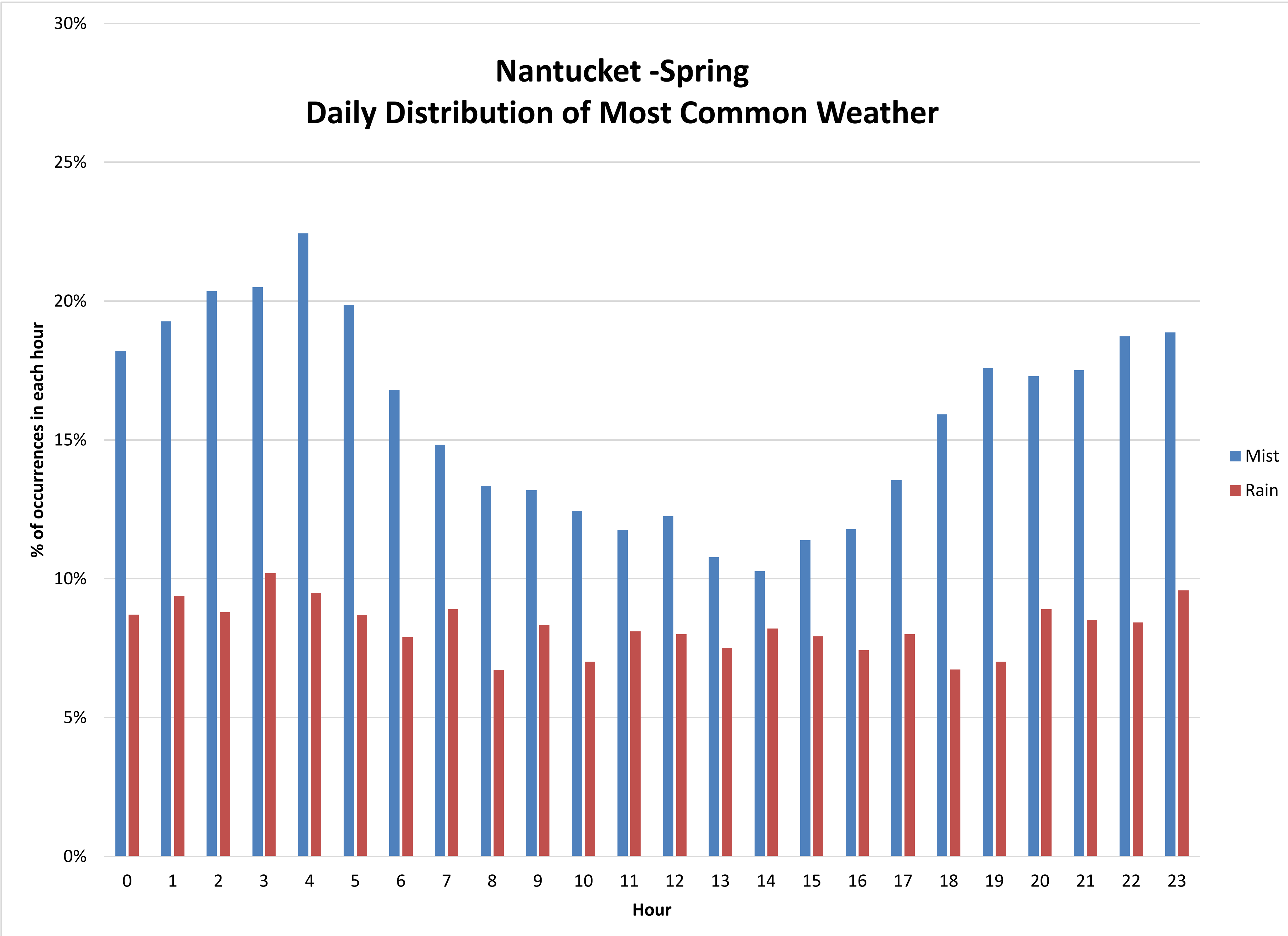

Martha's Vineyard-Spring
Daily Distribution of Most Common Weather
% of occurrences in each hour
Hour
30%
25%
20%
15%
10%
5%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Mist
Rain


Martha's Vineyard-Summer
Daily Distribution of Most Common Weather
% of occurrences in each hour
30%
25%
20%
15%
10%
5%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour
Mist
Rain

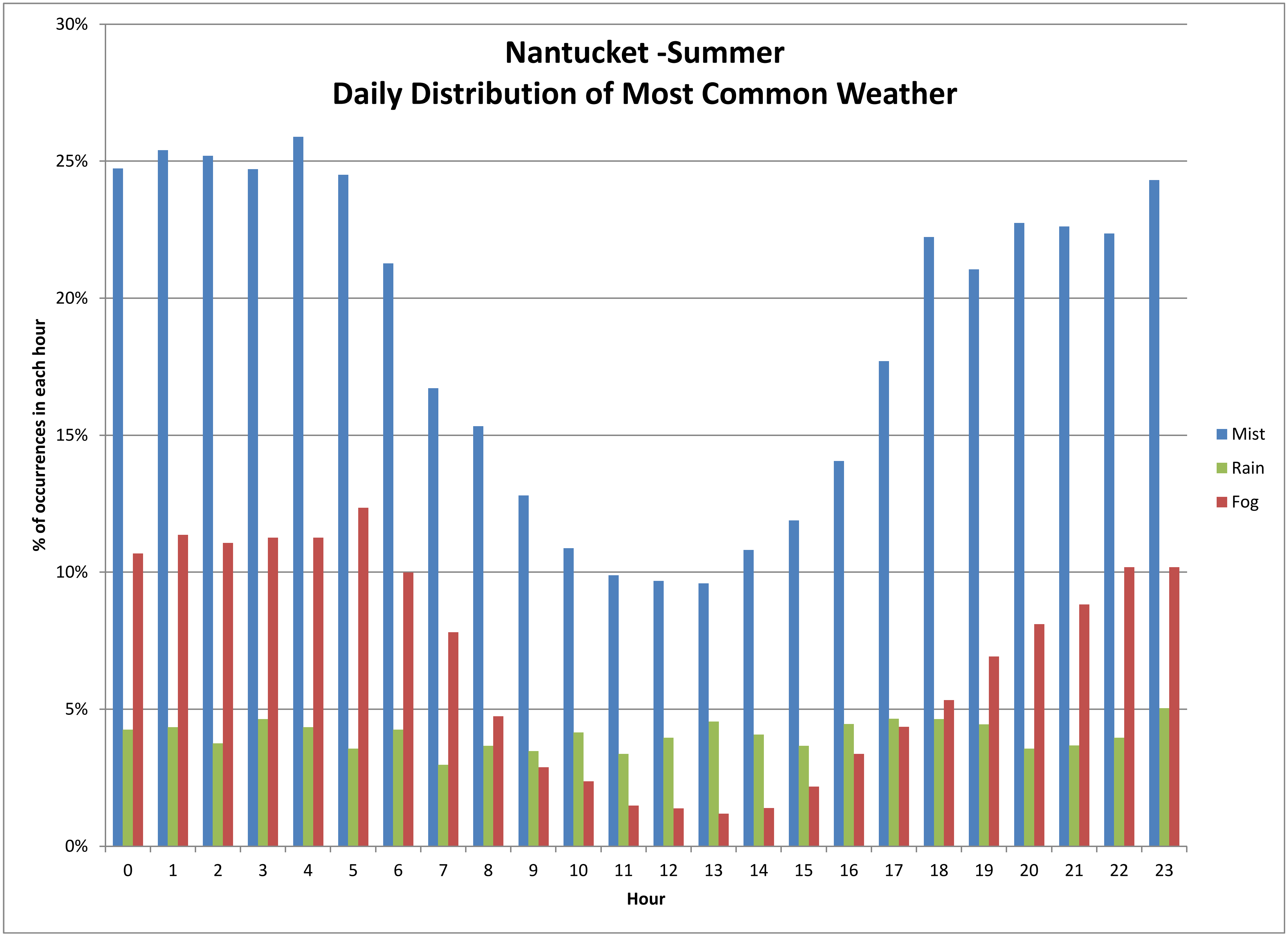


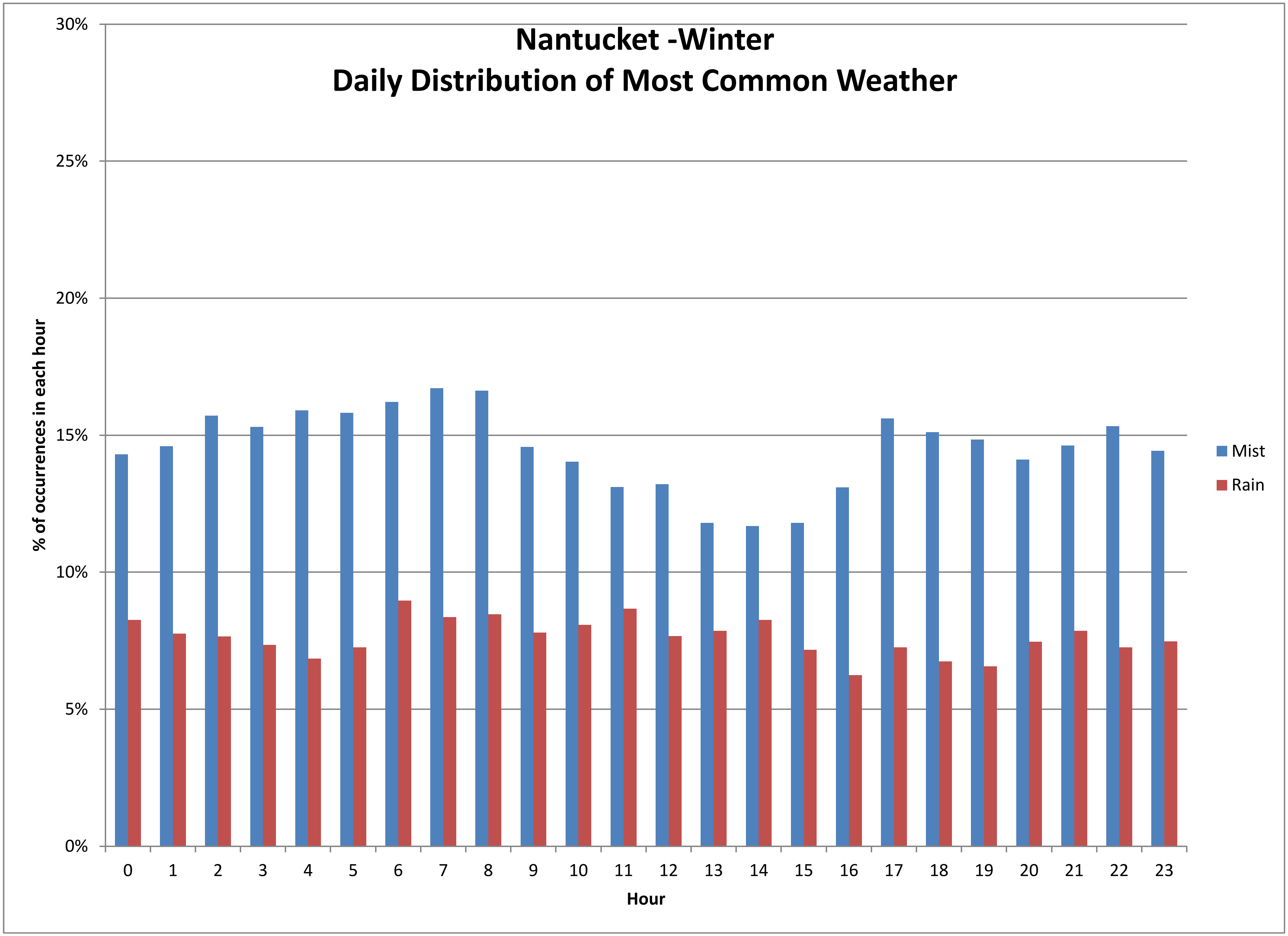
Martha's Vineyard-Winter
Daily Distribution of Most Common Weather
% of occurrences in each hour
30%
25%
20%
15%
10%
5%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour
Mist
Rain


Nantucket -Fall
Daily Distribution of Most Common Weather
30%
25%
20%
15%
10%
5%
0%
% of occurrences in each hour
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
Hour
Mist
Rain



Nantucket -Spring
Daily Distribution of Most Common Weather
30%
25%
20%
15%
10%
5%
0%
% of occurrences in each hour
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
Hour
Mist
Rain


Nantucket -Summer
Daily Distribution of Most Common Weather
30%
25%
20%
15%
10%
5%
0%
% of occurrences in each hour
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
Hour
Mist
Rain
Fog


Nantucket -Winter
Daily Distribution of Most Common Weather
% of occurrences in each hour
30%
25%
20%
15%
10%
5%
0%
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
Hour
Mist
Rain

Appendix E

PHASE 1 ONSHORE SUBSTATION – PHOTO SIMULATIONS

PHOTO LOCATION MAP

FIGURE B-1

PHOTOGRAPHIC SIMULATIONS

NEW ENGLAND WIND CONNECTOR 2

On-Shore Substation

Barnstable, MA

SARATOGA ASSOCIATES

VP1 - Shootflying Hill Road at Route 6 Eastbound Exit Ramp

VP2 - Shootflying Hill Road at Existing Motel

PHOTO LOG

FIGURE B-2

PHOTOGRAPHIC SIMULATIONS

NEW ENGLAND WIND CONNECTOR 2

On-Shore Substation

Barnstable, MA

SARATOGA
ASSOCIATES

VP3 - Shootflying Hill Road at Service Road

VP4 - Shootflying Hill Road at North Side of Transmission Corridor

PHOTO LOG

FIGURE B-3

PHOTOGRAPHIC SIMULATIONS

NEW ENGLAND WIND CONNECTOR 2

On-Shore Substation

Barnstable, MA

SARATOGA ASSOCIATES

VP5 - Shootflying Hill Road at Center of Transmission Corridor

VP6 - Cape Cod Welcome Center

PHOTO LOG

FIGURE B-4

PHOTOGRAPHIC SIMULATIONS

NEW ENGLAND WIND CONNECTOR 2

On-Shore Substation

Barnstable, MA

SARATOGA ASSOCIATES

VP7 - Exit 6 Park & Ride Lot

VP8 - Exit 6 Highway Rest Area

PHOTO LOG

FIGURE B-5

PHOTOGRAPHIC SIMULATIONS

NEW ENGLAND WIND CONNECTOR 2

On-Shore Substation

Barnstable, MA

SARATOGA ASSOCIATES

NEW ENGLAND WIND
Connector 2
Photographic Simulations

FIGURE C-1A
EXISTING VIEW
SHOOTFLYING HILL ROAD AT EXISTING MOTEL

Camera Data

Date:	18-Sept 2020
Time:	2:53 pm
Camera:	Canon 6d Mark II
Focal Length:	24mm (full frame)

Camera Location

Latitude:	41° 41' 11.6463" N
Longitude:	70° 20' 15.0055" W

The above photograph was taken using a 24mm lens and is intended to be viewed approximately 11 inches from the reader's eye when printed on 11"x17" paper

SARATOGA ASSOCIATES

NEW ENGLAND WIND
Connector 2
Photographic Simulations

Figure C-1b
SIMULATED VIEW - landscape planting 1 yr growth
Shootflying Hill Road at Existing Motel

Camera Data	
Date:	18-Sept 2020
Time:	2:53 pm
Camera:	Canon 6d Mark II
Focal Length:	24mm (full frame)

Camera Location	
Latitude:	41° 41' 11.6463" N
Longitude:	70° 20' 15.0055" W

The above photograph was taken using a 24mm lens and is intended to be viewed approximately 11 inches from the reader's eye when printed on 11"x17" paper

SARATOGA ASSOCIATES

NEW ENGLAND WIND
Connector 2
Photographic Simulations

FIGURE C-1C
SIMULATED VIEW - LANDSCAPE PLANTING 5 YR GROWTH
SHOOTFLYING HILL ROAD AT EXISTING MOTEL

Camera Data

Date:	18-Sept 2020
Time:	2:53 pm
Camera:	Canon 6d Mark II
Focal Length:	24mm (full frame)

Camera Location

Latitude:	41° 41' 11.6463" N
Longitude:	70° 20' 15.0055" W

The above photograph was taken using a 24mm lens and is intended to be viewed approximately 11 inches from the reader's eye when printed on 11"x17" paper

SARATOGA ASSOCIATES

NEW ENGLAND WIND
Connector 2
Photographic Simulations

FIGURE C-2A
EXISTING VIEW
SHOOTFLYING HILL ROAD AT TRANSMISSION CORRIDOR

Camera Data	
Date:	18-Sept 2020
Time:	3:11 pm
Camera:	Canon 6d Mark II
Focal Length:	24mm (full frame)

Camera Location	
Latitude:	41° 41' 06.3688" N
Longitude:	70° 20' 24.8117" W

The above photograph was taken using a 24mm lens and is intended to be viewed approximately 11 inches from the reader's eye when printed on 11"x17" paper

SARATOGA ASSOCIATES

NEW ENGLAND WIND
Connector 2
Photographic Simulations

FIGURE C-2B
SIMULATED VIEW
SHOOTFLYING HILL ROAD AT TRANSMISSION CORRIDOR

Camera Data	
Date:	18-Sept 2020
Time:	3:11 pm
Camera:	Canon 6d Mark II
Focal Length:	24mm (full frame)

Camera Location	
Latitude:	41° 41' 06.3688" N
Longitude:	70° 20' 24.8117" W

The above photograph was taken using a 24mm lens and is intended to be viewed approximately 11 inches from the reader's eye when printed on 11"x17" paper

SARATOGA ASSOCIATES

NEW ENGLAND WIND
Connector 2
Photographic Simulations

FIGURE C-3A
EXISTING VIEW
EXIT 6 PARK & RIDE/ HIGHWAY REST AREA

Camera Data	
Date:	18-Sept 2020
Time:	3:46 pm
Camera:	Canon 6d Mark II
Focal Length:	24mm (full frame)

Camera Location	
Latitude:	41° 41.30638' N
Longitude:	70° 20.27699' W

The above photograph was taken using a 24mm lens and is intended to be viewed approximately 11 inches from the reader's eye when printed on 11"x17" paper

SARATOGA ASSOCIATES

NEW ENGLAND WIND
Connector 2
Photographic Simulations

FIGURE C-3B
SIMULATED VIEW - LANDSCAPE PLANTING 1 YR GROWTH
EXIT 6 PARK & RIDE/ HIGHWAY REST AREA

Camera Data	
Date:	18-Sept 2020
Time:	3:46 pm
Camera:	Canon 6d Mark II
Focal Length:	24mm (full frame)

Camera Location	
Latitude:	41° 41.30638' N
Longitude:	70° 20.27699' W

The above photograph was taken using a 24mm lens and is intended to be viewed approximately 11 inches from the reader's eye when printed on 11"x17" paper

SARATOGA ASSOCIATES

NEW ENGLAND WIND

Connector 2

Photographic Simulations

FIGURE C-3C
SIMULATED VIEW - LANDSCAPE PLANTING 5 YR GROWTH
EXIT 6 PARK & RIDE/ HIGHWAY REST AREA

Camera Data	
Date:	18-Sept 2020
Time:	3:46 pm
Camera:	Canon 6d Mark II
Focal Length:	24mm (full frame)

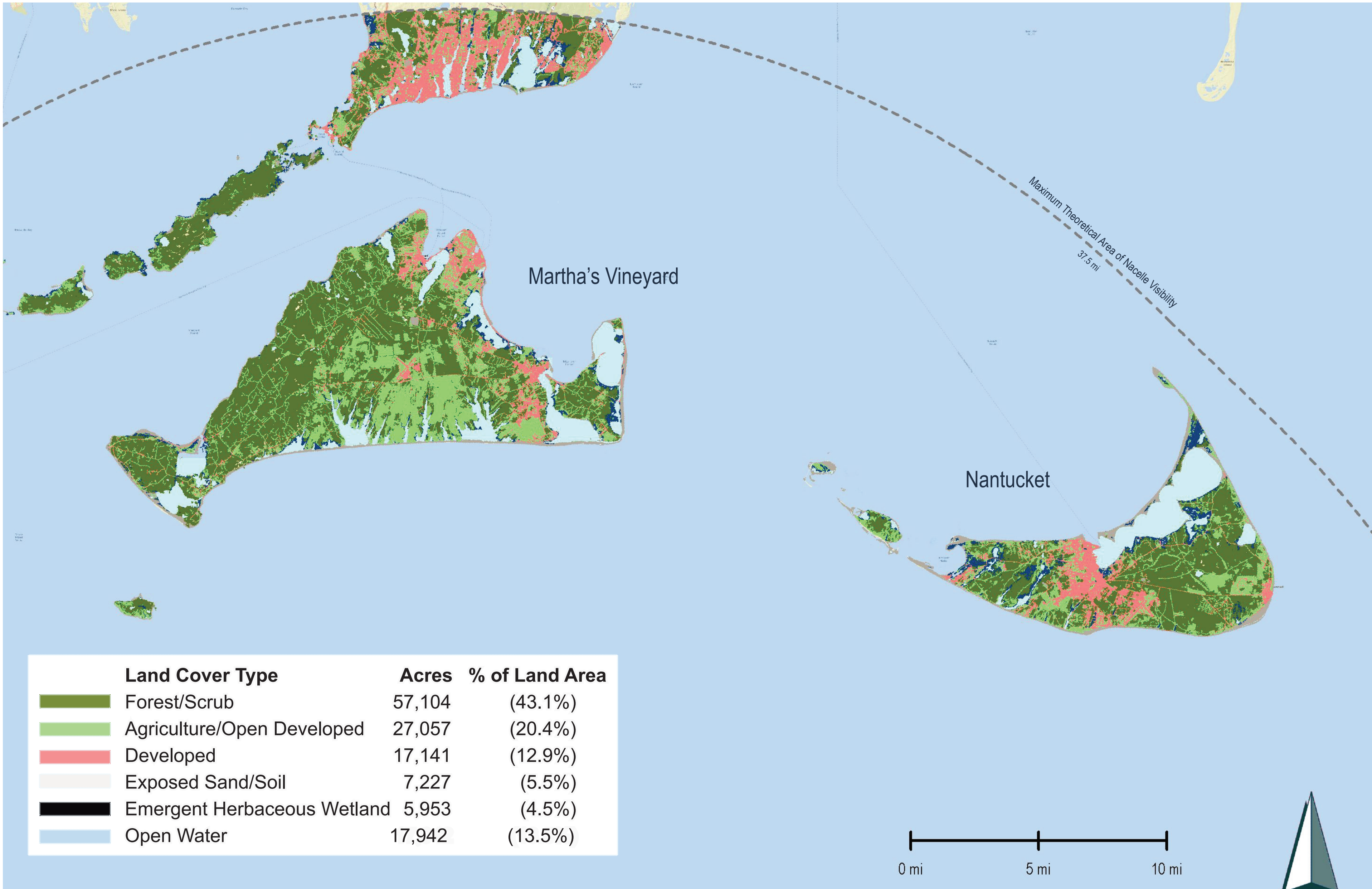
Camera Location	
Latitude:	41° 41.30638' N
Longitude:	70° 20.27699' W

The above photograph was taken using a 24mm lens and is intended to be viewed approximately 11 inches from the reader's eye when printed on 11"x17" paper

SARATOGA ASSOCIATES

Appendix F

LAND COVER MAP



	Land Cover Type	Acres	% of Land Area
	Forest/Scrub	57,104	(43.1%)
	Agriculture/Open Developed	27,057	(20.4%)
	Developed	17,141	(12.9%)
	Exposed Sand/Soil	7,227	(5.5%)
	Emergent Herbaceous Wetland	5,953	(4.5%)
	Open Water	17,942	(13.5%)

NEW ENGLAND WIND

FIGURE F-1
LAND COVER MAP

SARATOGA ASSOCIATES