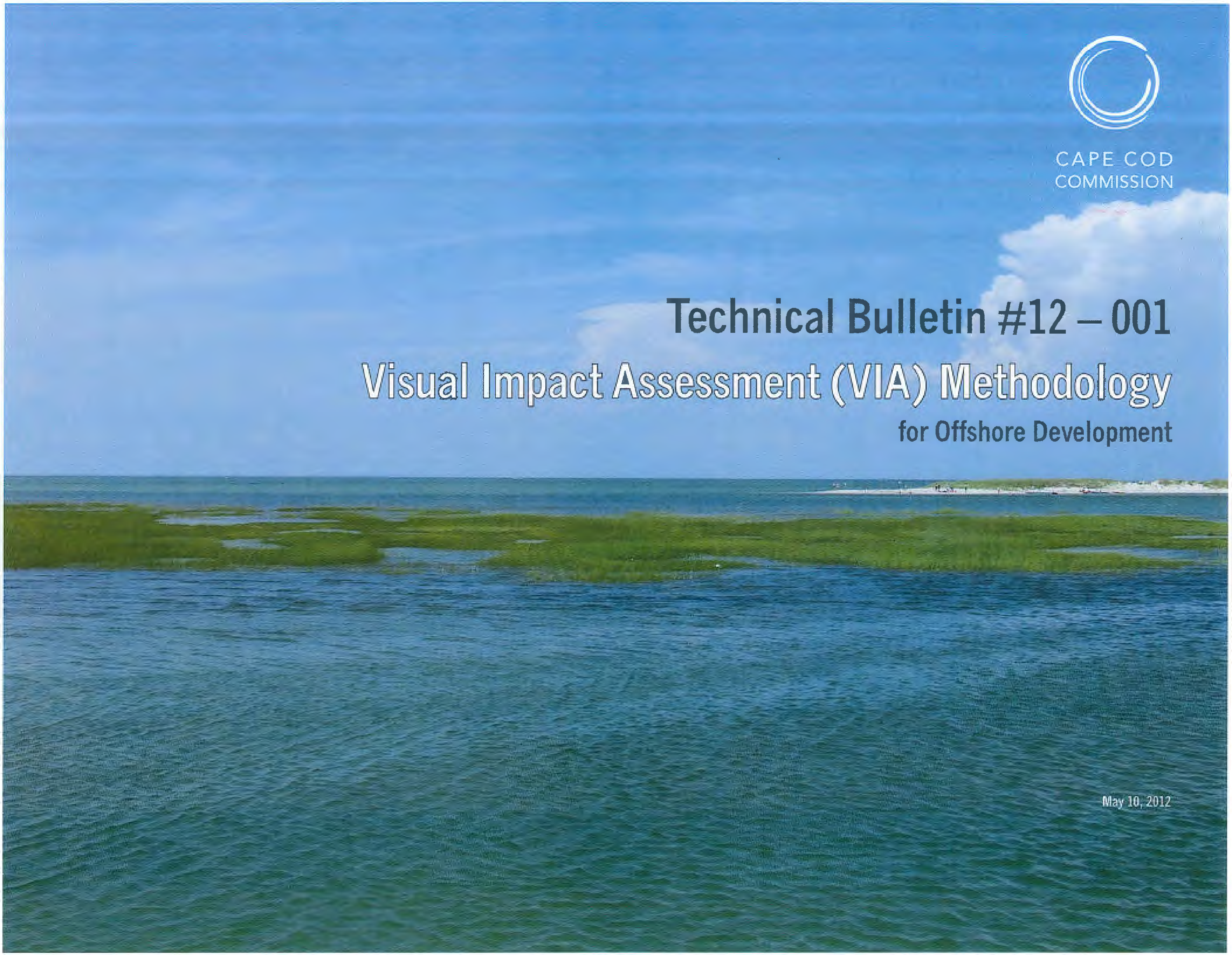
CAPE COD COMMISSION

Technical Bulletin #12 – 001

Visual Impact Assessment (VIA) Methodology

for Offshore Development

May 10, 2012



Acknowledgments

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Introduction and Purpose

Cape Cod has a wide variety of scenic resources that contribute to the region's unique sense of place. These resources can broadly be defined as the visible features that make up the landscape and seascape. The Cape's visual resources vary in their scenic quality, value and ability to absorb changes. Visual and scenic resources on Cape Cod play a direct role in people's enjoyment of Cape Cod and the success of efforts to preserve these visual assets have a direct impact on the continued economic strength of the region.

With 24 wind turbines allocated to the region under the State Ocean Management Plan, and the potential for other offshore development such as sand and gravel mining in the future, development of Cape Cod's ocean waters could alter the character and impact the Cape's scenic resources. The Cape Cod Ocean Management Plan (CCOMP), adopted by the Cape Cod Commission in October 2011, defines appropriate scale for renewable energy projects in Cape Cod waters as follows:

> Wind Energy Conversion Facilities (WECFs) are not of appropriate scale unless the development is sited and designed to avoid Adverse Visual Impacts to the Cape's scenic and cultural/historic resources, including structures listed or eligible for listing on the National or State Register of Historic Places and Historic or Cultural Landscapes.

The CCOMP also recommends that sand and gravel mining operations greater than 12 months in duration should complete a Visual Impact Assessment. Due to concerns about the potential Visual Impact from WECFs in close proximity to the shoreline, the CCOMP determined the following:

> WECFs are not of appropriate scale unless sited outside an area extending from the landward boundary of the planning area seaward 2 nautical miles (nm) due to the presence of natural resources (such as seagrass, intertidal flats, herring runs, tern habitat), commercial and recreational uses, and due to Adverse Visual Impact to scenic and historic resources and cultural landscapes.

In order for the Cape Cod Commission to determine whether WECFs sited in Cape Cod ocean waters are of appropriate scale and to evaluate the potential Visual Impact from other development, this Technical Bulletin describes what should be provided in a Development of Regional Impact (DRI) application to evaluate the scenic resources visible from a proposed development in Cape Cod ocean waters, and the process for completing a Visual Impact Assessment (VIA). The Technical Bulletin also provides design, siting, layout and mitigation strategies to incorporate into the project design to avoid or minimize visual impacts.

Applicants should refer to the Cape Cod Ocean Management Plan (CCOMP) for additional information on scenic and visual resources (http://www.capecodcommission.org/index.php?id=73), and consult the Prohibited Areas Map for WECFs (http://www.capecodcommission.org/resources/dcpc/map13.pdf), prior to scheduling a pre-application meeting with Commission staff. The Prohibited Areas Map for WECFs and Sand and Gravel Mining are included in Appendix A for reference.

Applicable Standards

Minimum Performance Standard (MPS) HPCC 2.3 in the 2009 Regional Policy Plan (RPP), as amended in 2011, states the following:

> New development shall be sited and designed to avoid Adverse Visual Impacts to visually sensitive areas, including those protected by HPCC 1.1 and 1.2. Visual impact assessments may be required as part of the project review. Development proposed adjacent to scenic roads or vistas shall protect distinctive resources including tree canopy, wooded road edges, stone walls, winding road character, and scenic views. Development adjacent to or within scenic vistas shall be clustered and designed to limit the visibility of the new development.
>
> (The standards cited in HPCC2.3 above require protection of historic structures, historic districts and their settings (HPCC1,1), and cultural landscapes (HPCC1.2))

De¿nitions

The definitions in the Act, the 2009 RPP and the 2011 Cape Cod Ocean Management Plan apply to this Technical Bulletin including the following:

Adverse Visual Impact: Where the degree of change in the scenic quality resulting from Development is expected to unreasonably impact or interfere with a scenic resource or otherwise unreasonably alter the character, setting or quality of a scenic resource.

Line-of-sight profile: A profile is a graphic depiction of the depressions and elevations one would encounter walking along a straight path between two selected locations shown in conjunction with a straight line depicting the path of light received by the eye of an imaginary viewer from the object being viewed.

Local Seascape Units: Subdivisions of regional seascape units defined by minor coastal features and extend inland a distance equivalent to the Zone of Visual Influence (ZVI).

Regional Seascape Units: Subdivisions of the coastline defined by major regional headlands, islands or coastal features that extend seaward to the ocean management plan boundary in the ocean, and to the highest landside topographical contour reached inland from the coast.

Scenery: the general appearance or features seen in a landscape/seascape.

Scenic Resources: Locations or areas that are recognized, utilized, and enjoyed by the public for their visual and scenic qualities and whose features, views, patterns, and characteristics contribute to a distinct sense of appreciation of the natural and cultural environment.

Scenic Road: A public road that has one or more of the following characteristics:

(1) Passes through an area of outstanding natural environmental features providing views of scenic elements such as salt marshes, rivers, bays, dunes and the ocean;

(2) Provides outstanding views of rural, agricultural landscapes including scenic elements such as panoramic or distant views, cropland, pastures, fields, streams, ponds, hedgerows, stone or wooden fences, farm buildings and farmsteads;

(3) Follows historic road alignments and provides views of historic resources;

(4) A large proportion of the road provides frontage for properties that are in a historic district or subject to perpetual or long-term agricultural, environmental or historic easements; or,

(5) Is designated by a municipality as a scenic road.

View: Portion of the seascape that is seen from a vantage point.

Visual Impact: The degree of change in scenic quality resulting from Development.

Visual Impact Assessment (VIA): The process for determining the degree of change in scenic quality resulting from Development, including but not limited to establishing the zone of visual influence, identifying Visual and Scenic Resources, preparing visual simulations, and assessing the magnitude of the proposed change.

Visual Resources: Visible features that make up the landscape and seascape, including points (e.g. lighthouses, cliffs, islands, buildings), linear elements (e.g. coastlines, landforms, beaches, ridgelines) or areas of interest (e.g. historic districts, natural areas, saltmarshes).

Zone of Visual Influence (ZVI): A geographic area from which a proposed development may potentially be seen, also referred to as a viewshed.

Visual Impact Assessment (VIA) Process

The following flowchart graphically represents the steps involved in completing a VIA from initial design of the project through the pre-application and application review stages.

This Technical Bulletin provides guidance on the VIA process and is applicable to all kinds of development in Cape Cod's ocean waters. However, Wind Energy Conversion Facilities are used to illustrate concepts throughout the document as these developments are required to conduct a VIA.

Pre-Application Meeting

In order to make the completion of the VIA process as streamlined as possible, the Applicant is strongly encouraged to consult with Cape Cod Commission staff at least once prior to submitting a DRI application. At this pre-application meeting, Commission staff will review the Zone of Visual Influence (ZVI) for the project and determine the appropriate number of visualizations to be conducted. The applicant is encouraged to consult with Cape Cod Commission staff during preparation of the VIA as needed.

The Applicant's project team should include professionals with experience in assessing the visual environment. The visual analysis and landscape inventory should be conducted by appropriately qualified individuals either with a bachelor's or master's degree in landscape architecture, architecture or similar, and/or a minimum of two years experience in conducting visual impact assessments. Prior to any visual assessment work being conducted, the Applicant shall submit the credentials of these individual(s) to the Commission staff to verify that they are appropriately qualified. The Commission may hire its own expert to peer review the results of the Applicant's analysis. Any conflicts in the results of the analysis will be reconciled by the Cape Cod Commission, or its designee.

General Application Requirements

An applicant is required to demonstrate through the information submitted that the project will not have adverse impacts on the region's scenic resources. In order to meet this standard of review, the applicant is required to provide the following information as part of their submittal. Additional guidance on these submittal requirements is provided on the following pages.

1. Design Narrative. A narrative that describes how the project has been configured or located and how it avoids or minimizes visual impacts. Maps and documentation of the ZVI analysis conducted shall accompany the narrative and be used to generally describe the anticipated visibility of the project. The narrative should provide details concerning alternative configurations or sites that were evaluated in the design process and the design/mitigation strategies employed to reduce any visual impact. The Mitigation section (p. 22) explains project siting and design strategies that should be considered by the applicant.

2. Inventory. An inventory and description of the scenic resources located within the viewshed of the proposed activity. The scope of this inventory is determined in consultation with Commission staff and based on the ZVI for the project.

3. Visualizations and simulations. Photo-simulations as determined in the pre-application meeting to describe the anticipated effect of the proposed project on the region's scenic resources. The number of simulations required will depend on the anticipated impact and the sensitivity of the resources in the ZVI. The VIA should include consideration of all parts of the project, including all associated infrastructure both in the ocean and on land. In the event that more than one alternative is being considered, the visual impact of all alternatives should be evaluated by the applicant.

4. Mitigation. Proposed mitigation measures, as applicable.

5. Qualifications. The applicant shall include details about the qualifications and/or resumes of the project team.

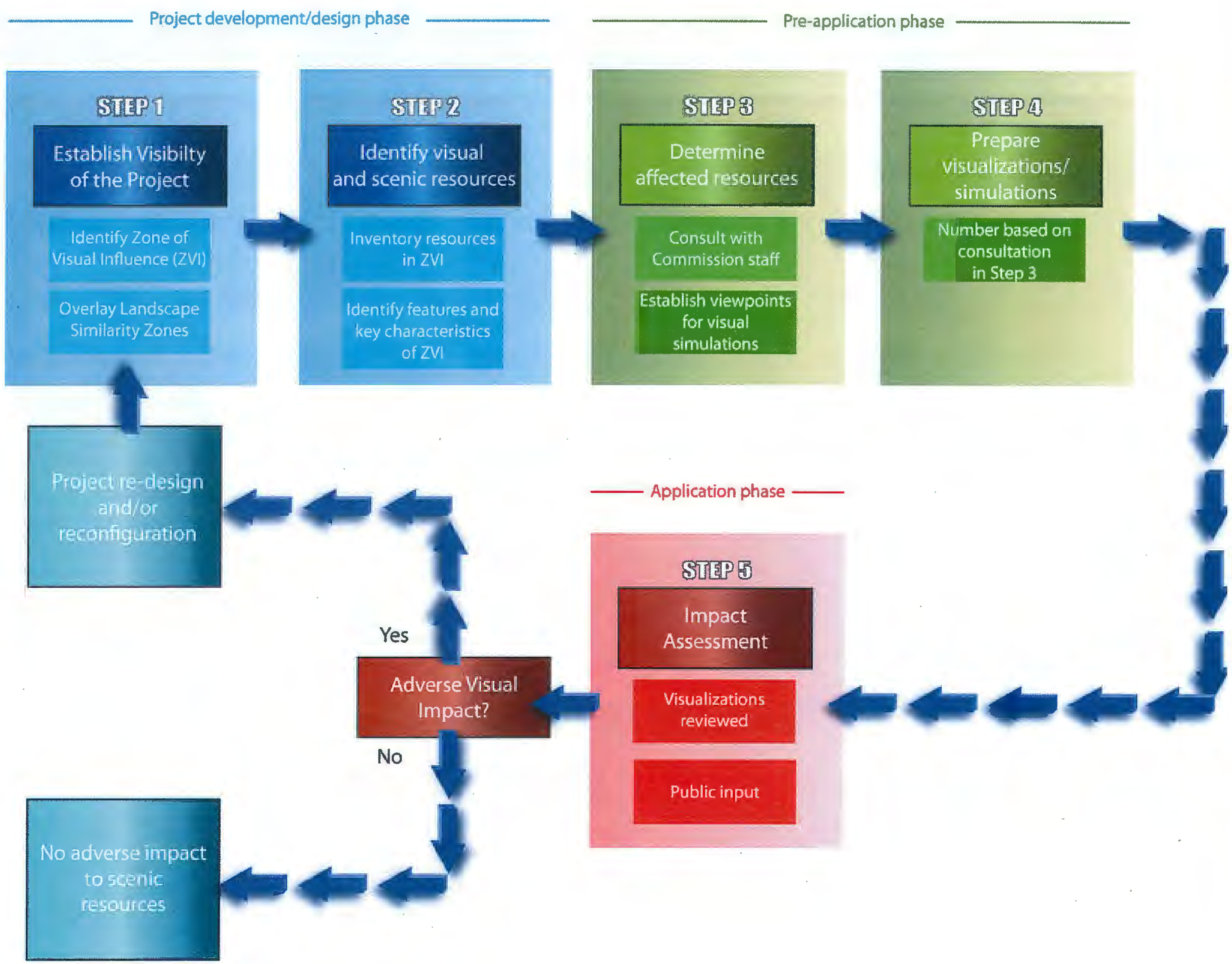


Figure 1: Visual impact assessment ﬂowchart

Step 1: Establishing Visibility of the Project

a. Identifying Zone of Visual Influence (ZVI)

Prior to the preparation of any simulations or submitting an application for review, the applicant should conduct an analysis of the potential visibility of the project. The locations from which a proposed development may be visible are established by determining the Zone of Visual Influence (ZVI). This analysis uses topography, and in some cases vegetation, to identify the points at which there is a potential line-of-sight to some portion of the development (i.e. if any part of it is visible). This step may be completed using a variety of software tools and Geographic Information Systems (GIS), such as ArcMap with a Spatial Analyst extension or other wind energy specific applications. This tool can also be used to identify locations with complete or partial views of an offshore development by conducting an analysis corresponding to the height of different parts of the structure (i.e. tip of wind turbine, nacelle height and base). Regardless of the software application used, the narrative should include detailed information concerning the inputs, assumptions and data layers used in the analysis in order that the Commission staff can verify the validity of the calculations, and field verify the results as needed.

The results of the ZVI analysis will be used to define the scope of the visual analysis and extent of the viewshed for the proposed development.

A detailed list of materials to be submitted with the application to document the ZVI is provided in Appendix B.

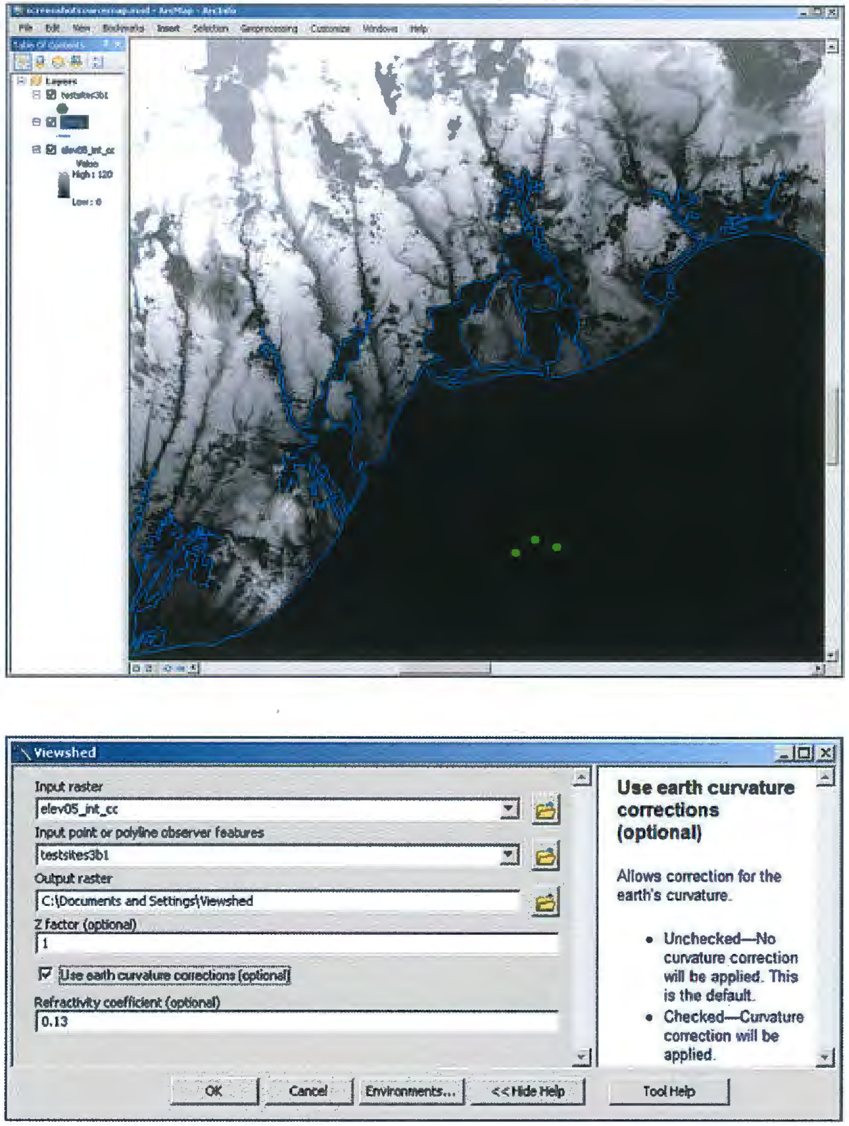


Figure 2: Screen shot of the Spatial Analyst extension to ArcMap used to generate the ZVI. Image shows some of the options available through the program, including accounting for the curvature of the earth.

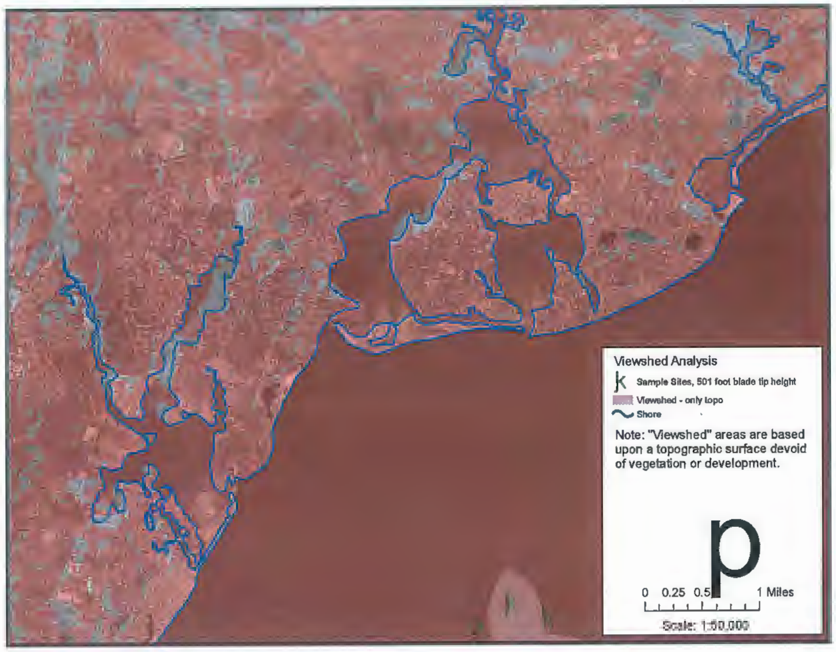


Figure 3a: Mapped ZVI for a hypothetical three turbine project located beyond the two mile prohibited area south of Cape Cod. The areas with a potential view of any part of the turbines (all red areas) are shown overlaid on a grey aerial photograph in this example.

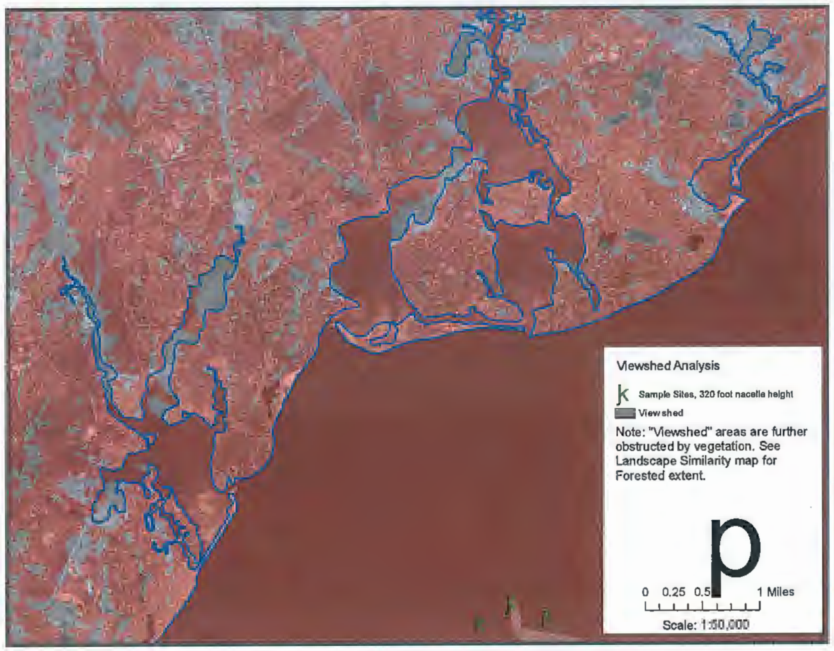


Figure 3b: Mapped ZVI for the same hypothetical three turbine project as in Figure 3a, but red areas illustrate the locations where the turbine nacelle can be seen. There are subtle differences in the extent of the red areas between Figure 3a and 3b, which illustrates the slightly smaller area of potential visibility resulting from the lower height modeled. The illustration also shows how tall objects are potentially visible from large numbers of locations on the Cape due to the low topography.

b. Overlay Landscape Similarity Zones

The next step in determining the areas of potential visibility is to overlay the Commission's Landscape Similarity Zones (LSZs) on the ZVI for the project. These LSZs broadly reflect landforms, features and environments with similar characteristics that are found on the Cape's land area and provide a broad indication of the degree of transparency (or views) that may be offered from these locations. The LSZs are not intended to be a definitive indicator of visibility because edges of the developed and wooded areas will likely have views to the development. This map, used in combination with the ZVI and verified in the field as necessary, will guide Commission staff to limit the areas for further inventory and analysis. The LSZs are available as a data layer on request from the Cape Cod Commission. A Cape-wide map is provided in Appendix C.

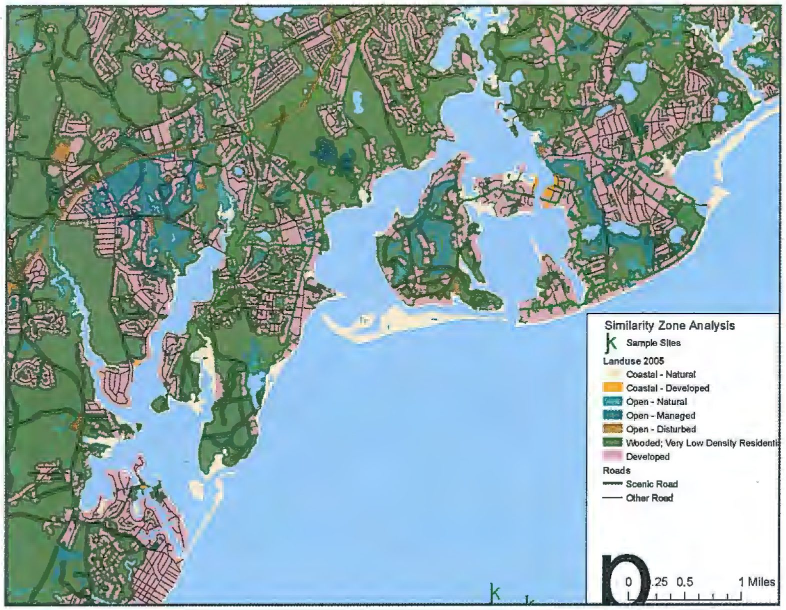


Figure 4a: Landscape Similarity Zone data layer, showing Coastal, Open, Wooded and Developed areas in the same area illustrated in Figures 3a and 3b.

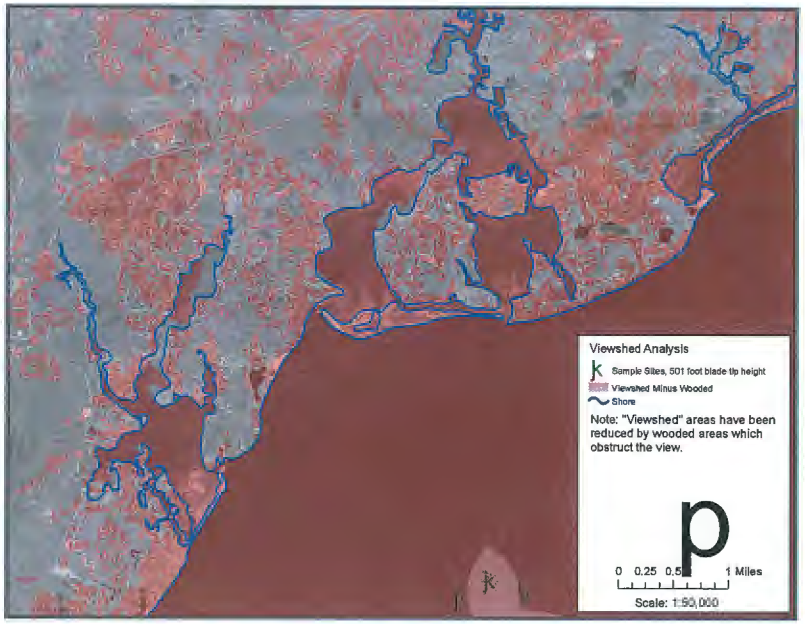


Figure 4b: Mapped ZVI for the same hypothetical three turbine project shown in Figures 3a, 3b and 4a, but the visible areas (red) have been reduced by excluding the "wooded" LSZs due to their limited transparency.

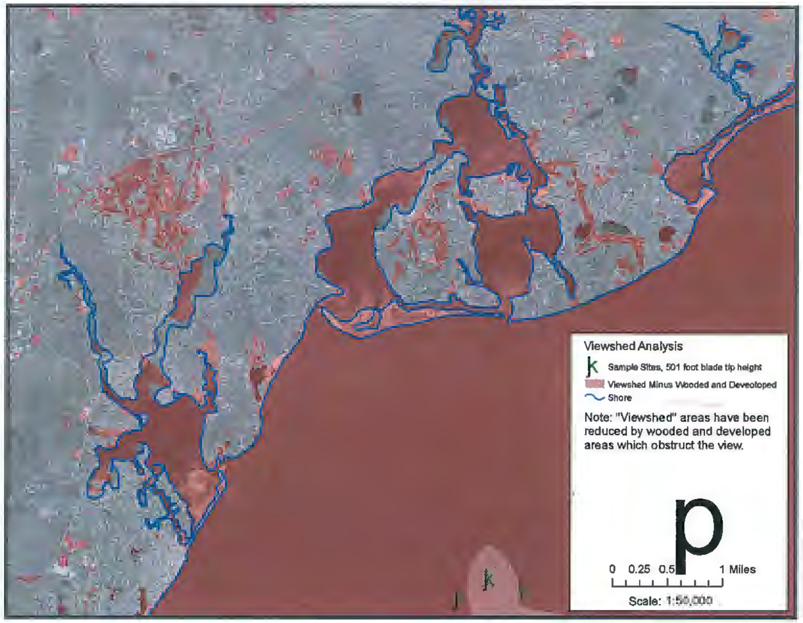


Figure 4c: Mapped ZVI for the same hypothetical three turbine project shown in Figures 3a, 3b, 4a and 4b but the visible areas (red) have been reduced by excluding the "wooded" and "developed" LSZs due to their limited transparency.

Step 2: Identify Visual/Scenic Resources and Key Characteristics

The character of scenic resources results from the interplay of geology, landform, soils, vegetation, land use and settlement patterns and is made up of a wide variety of features, patterns and characteristics. Open ocean waters, natural areas, cliffs, dunes, historic resources, and scenic roadways may all be considered scenic resources.

a. Complete Inventory of Scenic and Visual Resources in ZVI

The applicant should complete an inventory of scenic and visual resources within the ZVI to understand the extent that these resources may be affected by the development. Scenic and visual resources do not need a formal designation to be included and should include any publicly accessible area that can be visited for the purpose of enjoying its visual quality and valued for its natural character, cultural importance or uniqueness. The number of locations to be inventoried will be determined at the pre-application meeting with Commission staff. The applicant should begin the inventory by completing a desk survey of scenic resources in the ZVI using maps, local comprehensive plans, and state, regional or local data sets that will be used for subsequent field work.

To assist the applicant, scenic resources on Cape Cod include, but are not limited to:

- National, State and Regional Parks, marine sanctuaries and wildlife refuges from the U.S. Geological Survey, U.S. Fish and Wildlife, Massachusetts Department of Environmental Management and Massachusetts GIS.
- Historic Districts listed by the Massachusetts Historical Commission in the State Register of Historic Places, Old King's Highway and other Historic Districts, as well as other individually listed properties. Information about individual properties, both within and outside of historic districts is also compiled on MACRIS (Massachusetts Cultural Resources Inventory System).
- Municipally designated scenic roads.
- Scenic vistas or viewpoints, e.g. scenic canal overlooks in Bourne; Nobska Light, Falmouth; and Scargo Tower, Dennis.

Many of these resources are identified in a series of map layers, available from MassGIS or from the Commission upon request.

Furthermore, to assist in identifying scenic resources, the Applicant should use data prepared for the Massachusetts Ocean Resource Information System (MORIS) by the Massachusetts Office of Coastal Zone Management (CZM), Executive Office of Energy and Environmental Affairs, available from http://www.mass.gov/czm/mapping/index.htm. The data characterizes marine and estuarine environments and includes information for three main components: shoreline habitats; biological resources; and human-use resources. This data set includes: socio-economic data (such as airports, access (to shore), aquaculture, beaches, boat ramps, commercial fishing, Coast Guard properties, ferry docks, historical sites, locks or dams, marinas, managed areas, parks, recreational fishing areas, water intake points, and washover points); waterfront type (such as wetlands, vegetated low banks, sheltered rocky shores, riprap, etc); habitat types (such as locations of animals, reptiles, marine mammals, invertebrates, fish, and birds).

b. Identify Key Features and Characteristics in ZVI

Following completion of the desk survey, the applicant should conduct site visits to each viewpoint identified by staff within the ZVI to assess its landscape character and key characteristics. The applicant should complete an inventory form for each location that has not already been inventoried by Commission staff as described below. A sample inventory form can be found in Appendix D, p.34.

The Cape Cod Ocean Management Plan includes an initial assessment of the region's visual and scenic resources by establishing both Regional and Local Seascape Units, consisting of the coastal landscape and adjoining areas of water. A more detailed description of this assessment can be found in Section 1B.3 of the CCOMP (http://www.capecodcommission.org/index.php?id=73). Commission staff has completed a baseline inventory for 36 publicly accessible locations within the Cape Cod Bay and Nantucket Sound Regional Seascape Units. These baseline inventories should be utilized within the applicant's analysis and should be augmented by additional inventory work conducted by the applicant and as identified by the Commission staff in the pre-application meeting. These baseline inventories and supporting information are available to the applicant upon request.

Inventory Form Guidance

Guidance on completion of the inventory form is provided in the following pages, including annotated maps similar to those that might be gathered via a desk survey, and photos illustrative of the view in the field.

Page 1: Meta Data (Figure 5)

The information collected here relates specifically to conditions at the time of the assessment and the location of the inventory.

Page 1: Physical Form (Figure 6)

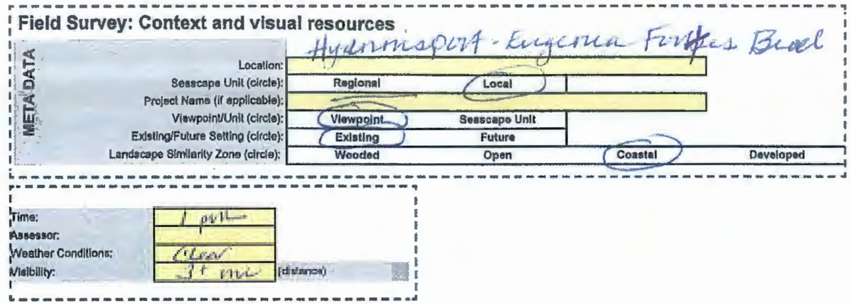
The capacity of the viewpoint to accommodate change is based in part on the landform, tree/vegetation cover and land use in the surrounding area. Because of the importance of the landform in determining the seascape's ability to absorb changes, information about the physical form is collected.

Information collected here relates to the sea itself, and its coastal and landward components at each location. Under each heading are a series of categories to prompt the analyst, with space provided for additional observations. The purpose of this section is to identify the prominent features and shapes that contribute to the overall form of the seascape. See Figure 5 through 9, and Boxes 1 through 5 opposite for an example.

Page 1: Sketch of viewpoint/Summary Description (Figure 7)

The form leaves an area for a simple line sketch to be inserted, although a photograph may be attached as an alternative. The Sum-

Figure 5: Page 1 Meta Data, Eugenia Fortes Beach, Hyannisport



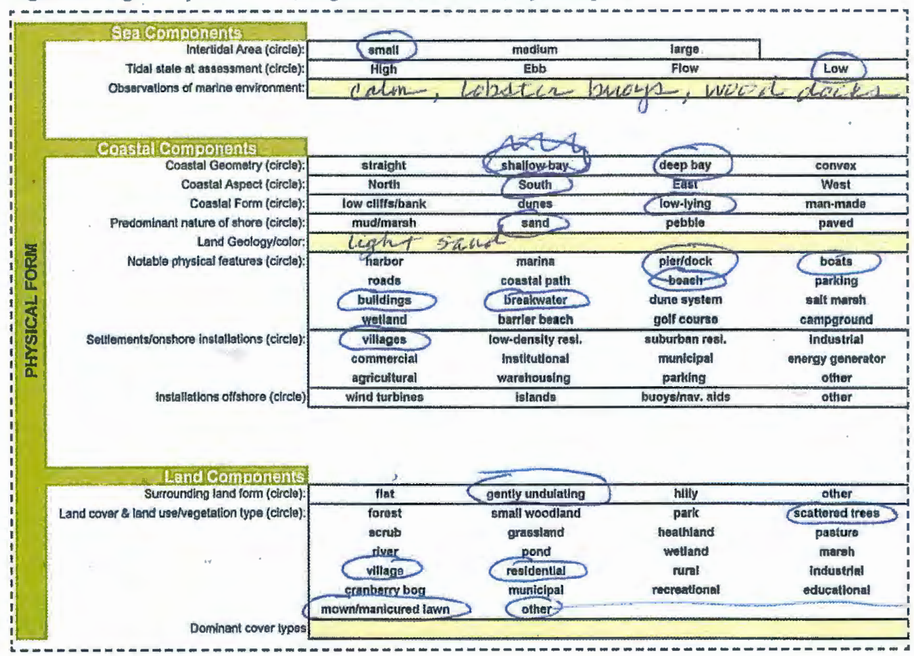
Field Survey: Context and visual resources

META DATA

Location:	Hyannisport - Eugenia Fortes Beach			
Seascape Unit (circle):	Regional	Local		
Project Name (if applicable):				
Viewpoint/Unit (circle):	Viewpoint	Seascape Unit		
Existing/Future Setting (circle):	Existing	Future		
Landscape Similarity Zone (circle):	Wooded	Open	Coastal	Developed

Time:	1 pm
Assessor:	
Weather Conditions:	Clear
Visibility:	3+ mi (distance)

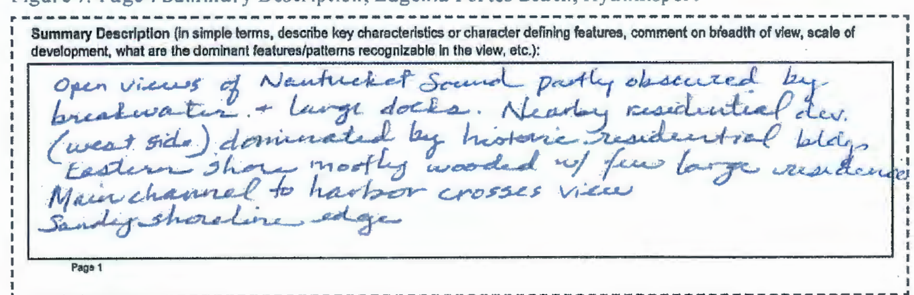
Figure 6: Page 1 Physical Form, Eugenia Fortes Beach, Hyannisport



PHYSICAL FORM

Sea Components				
Intertidal Area (circle):	small	medium	large	
Tidal state at assessment (circle):	High	Ebb	Flow	Low
Observations of marine environment:	calm, lobster buoys, wood docks			
Coastal Components				
Coastal Geometry (circle):	straight	shallow bay	deep bay	convex
Coastal Aspect (circle):	North	South	East	West
Coastal Form (circle):	low cliffs/bank	dunes	low-lying	man-made
Predominant nature of shore (circle):	mud/marsh	sand	pebble	paved
Land Geology/color:	light sand			
Notable physical features (circle):	harbor	marina	pier/dock	boats
	roads	coastal path	beach	parking
	buildings	breakwater	dune system	salt marsh
	wetland	barrier beach	golf course	campground
Settlements/onshore installations (circle):	villages	low-density resi.	suburban resi.	industrial
	commercial	institutional	municipal	energy generator
	agricultural	warehousing	parking	other
Installations offshore (circle)	wind turbines	islands	buoys/nav. aids	other
Land Components				
Surrounding land form (circle):	flat	gently undulating	hilly	other
Land cover & land use/vegetation type (circle):	forest	small woodland	park	scattered trees
	scrub	grassland	heathland	pasture
	river	pond	wetland	marsh
	village	residential	rural	industrial
	cranberry bog	municipal	recreational	educational
	mown/manicured lawn	other		
Dominant cover types				

Figure 7: Page 1 Summary Description, Eugenia Fortes Beach, Hyannisport



Summary Description (in simple terms, describe key characteristics or character defining features, comment on breadth of view, scale of development, what are the dominant features/patterns recognizable in the view, etc.):

Open views of Nantucket Sound partly obscured by breakwater + large docks. Nearby residential dev. (west side) dominated by historic residential bldgs. Eastern shore mostly wooded w/ few large residence Main channel to harbor crosses view Sandy shoreline edge

Page 1

Figure 8: Sample of features, forms and activities mapped in the vicinity of Eugenia Fortes Beach, Hyannisport to inform the inventory process

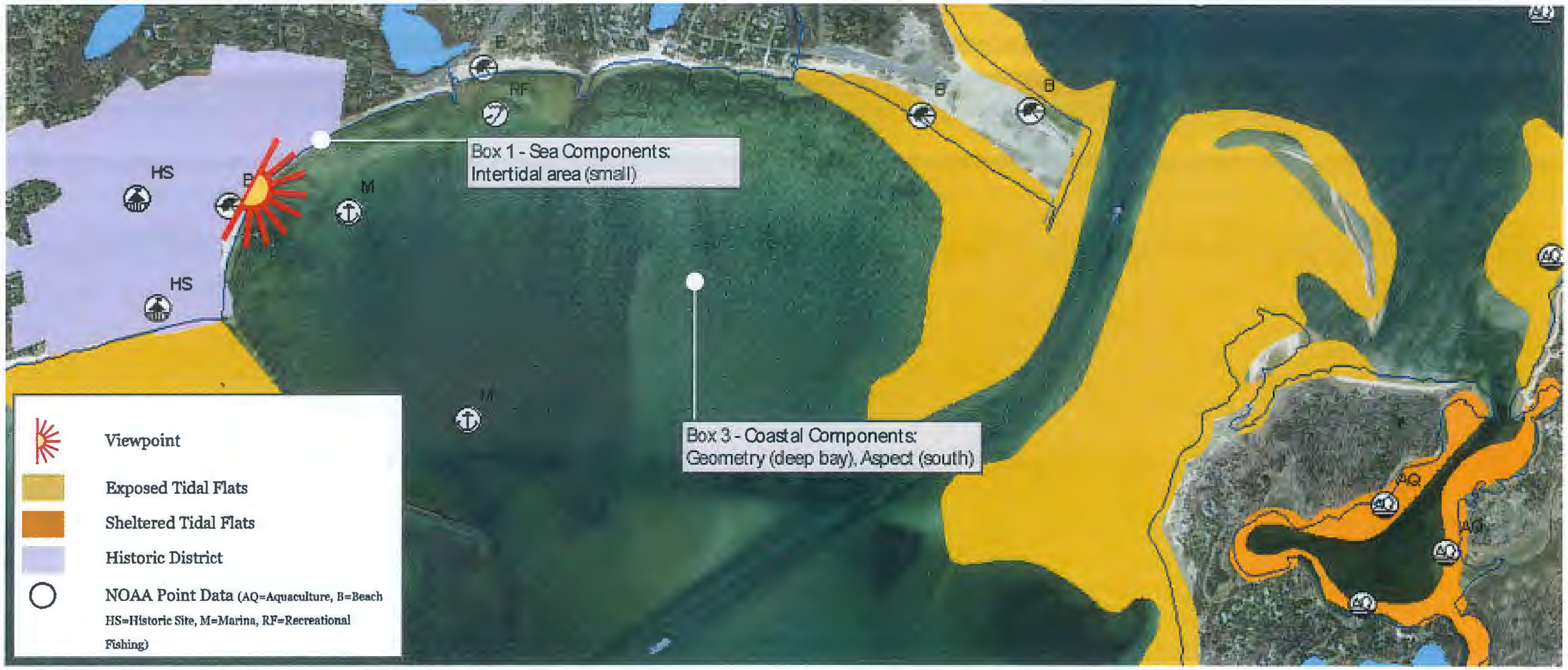
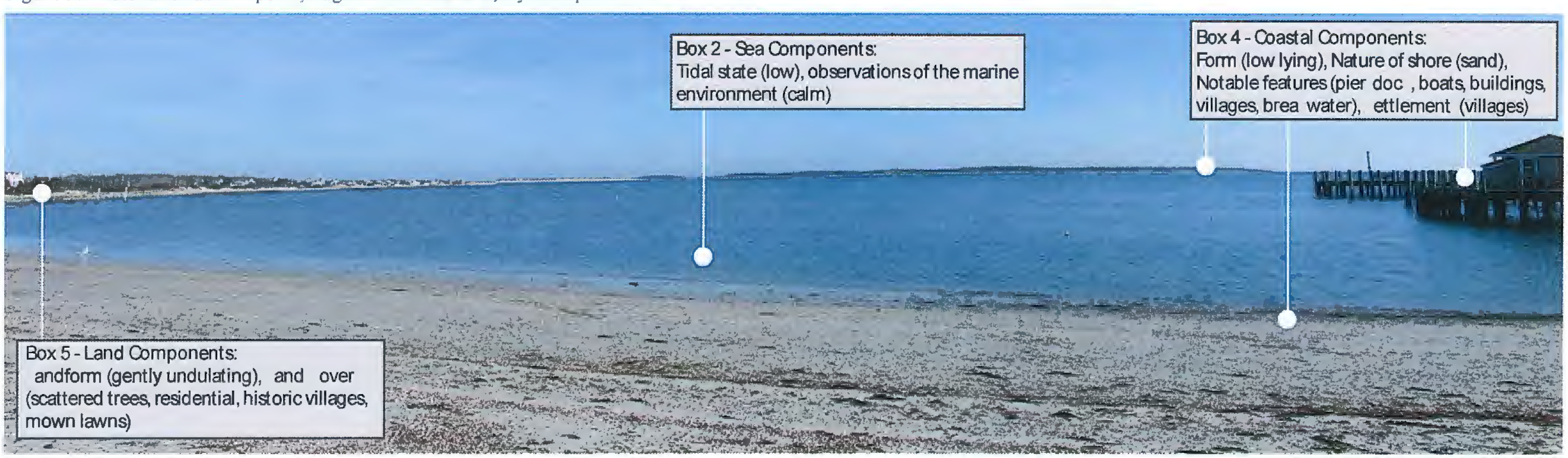


Figure 9: Photo taken at viewpoint, Eugenia Fortes Beach, Hyannisport



mary Description should capture the essence of the view by identifying key character defining elements and by describing the dominant patterns or features present. The observer should ensure that information about the breadth of view and scale of development visible is incorporated into this section.

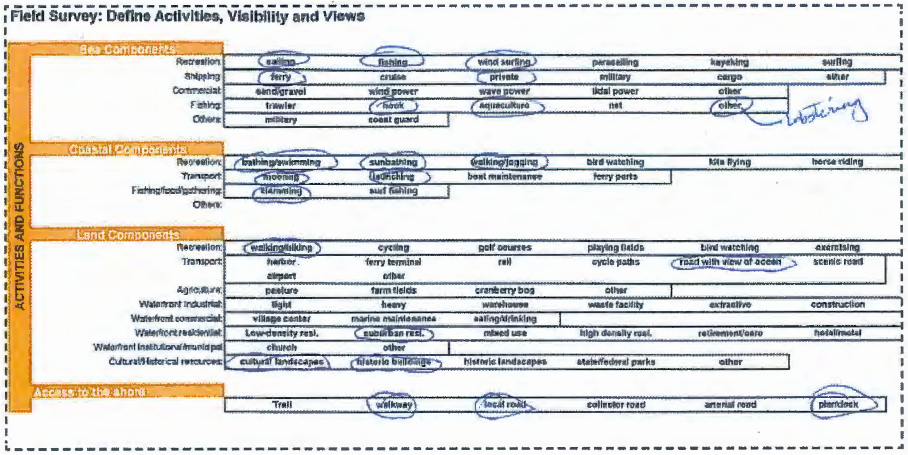
Page 2: Activities and Functions (Figure 10)

This section is used to identify all the activities and potential users of the scenic resource and seascape being inventoried. Many examples are provided that can be circled, although space is available to collect additional information. The activities are broken down into those occurring on the sea, coastal and land components of the seascape. For each group, the observer should circle the appropriate letter for the expected duration of the activity, whether seasonal or year round, and the frequency of the activity. See Figures 10, 12 and 13, and Boxes 6 through 8 opposite for an example.

Page 2: Views (Figure 11)

This section allows for the identification of particular visual resources that either detract from the scenic quality of the view, or are attractive elements in the view. There is a section for views of open ocean, and views where land masses may provide a backdrop. See Figures 11, 12 and 13, and Box 9 opposite for an example.

Figure 10: Page 2 Activities, Eugenia Fortes Beach, Hyannisport

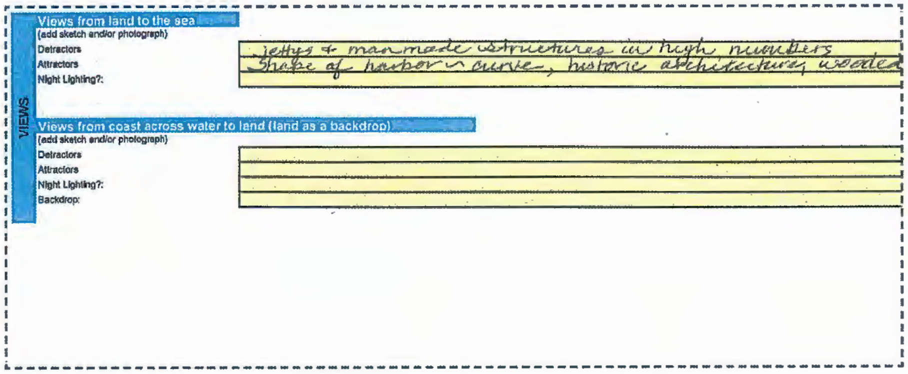


Field Survey: Define Activities, Visibility and Views

ACTIVITIES AND FUNCTIONS

Sea Components						
Recreation:	sailing	fishing	wind surfing	parasailing	kayaking	surfing
Shipping:	ferry	cruise	private	military	cargo	other
Commercial:	sand/gravel	wind power	wave power	tidal power	other	
Fishing:	trawler	hook	aquaculture	net	other	lobstering
Others:	military	coast guard				
Coastal Components						
Recreation:	bathing/swimming	sunbathing	walking/jogging	bird watching	kite flying	horse riding
Transport:	mooring	launching	boat maintenance	ferry ports		
Fishing/food/gathering:	clamming	surf fishing				
Others:						
Land Components						
Recreation:	walking/hiking	cycling	golf courses	playing fields	bird watching	exercising
Transport:	harbor	ferry terminal	rail	cycle paths	road with view of ocean	scenic road
	airport	other				
Agriculture:	pasture	farm fields	cranberry bog	other		
Waterfront industrial:	light	heavy	warehouse	waste facility	extractive	construction
Waterfront commercial:	village center	marine maintenance	eating/drinking			
Waterfront residential:	Low-density resl.	suburban resl.	mixed use	high density resl.	retirement/care	hotel/motel
Waterfront institutional/municipal:	church	other				
Cultural/historical resources:	cultural landscapes	historic buildings	historic landscapes	state/federal parks	other	
Access to the shore						
	Trail	walkway	local road	collector road	arterial road	pier/dock

Figure 11: Page 2 Views, Eugenia Fortes Beach, Hyannisport



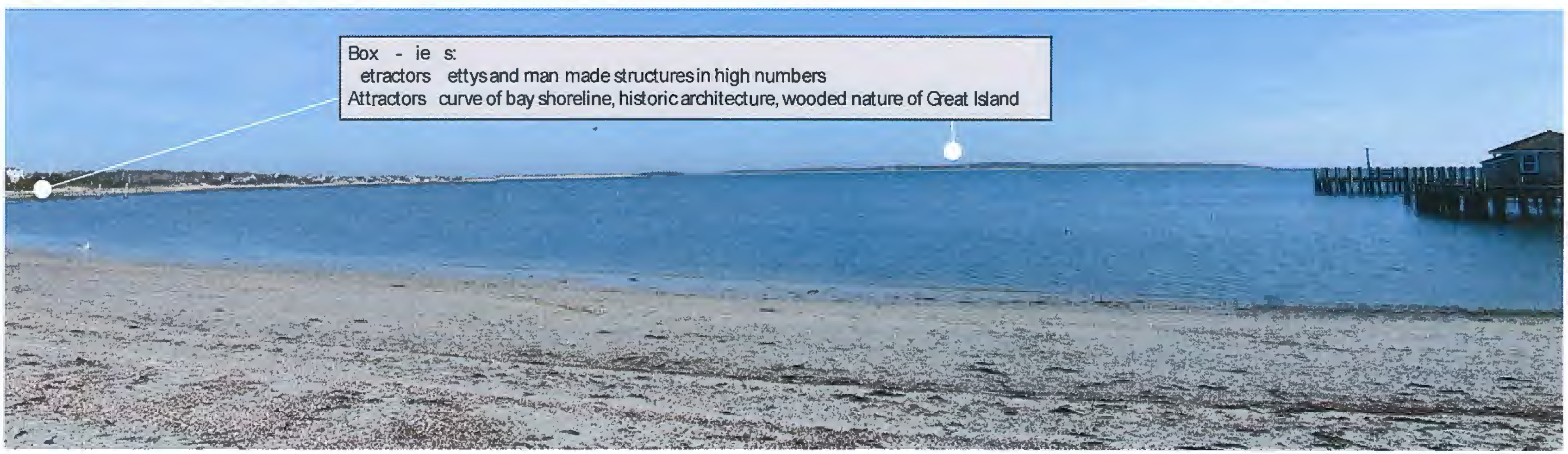
VIEWS

Views from land to the sea
(add sketch and/or photograph)
Detractors: jetties + man-made structures in high numbers
Attractors: Shape of harbor ~ curve, historic architecture, wooded
Night Lighting?:

Views from coast across water to land (land as a backdrop)
(add sketch and/or photograph)
Detractors:
Attractors:
Night Lighting?:
Backdrop:

Figure 12: Sample map of features, forms and activities mapped in the vicinity of Eugenia Fortes Beach, Hyannisport to inform the inventory process

Figure 13: Photo taken at viewpoint, Eugenia Fortes Beach, Hyannisport



Page 3: Ranking Landscape Quality, Value and Absorption Capacity

The final page of the inventory form is used to gather information on the quality, value and capacity of the viewpoint to absorb change using information gathered on page 1 and 2 of the inventory form (Appendix D). The following guidance is provided to assist the applicant with this determination, with more detailed guidance provided in Table 4A below.

The assessment team (consisting of 2 or more people) should indicate where on the five point scale they believe the viewpoint falls with regard to the following factors:

Quality: Scenic quality refers to the degree to which the features present are well defined, not fragmented, are in good condition, are representative, and the extent to which the seascape unit is an integrated whole. Categories measuring quality include:

- Integrity
- Detractors
- Clarity/visual diversity
- Rarity
- Distinctiveness

If the essential elements of an area's character or character type are present, and are unaltered or in their natural condition, there is an indication that the seascape is of higher quality. Conversely, if there are elements that detract from these essential elements, or if the elements are fragmented, missing or altered, there is an indication of a poorer quality seascape. It is important to note that a lower quality seascape does not necessarily indicate low value, because even if a seascape is of low quality with respect to its integrity, it may be a rare and highly valued type. A summary evaluation of the quality of the view/scenic resource can be recorded on the form.

Value: Establishing the value of landscapes involves aspects of landscape character that are more subjective in nature but are representative of why people value these landscapes. The purpose is to identify the relative degree of importance attached to the subject landscape or seascape. The categories for judging value include:

- Naturalness
- Remoteness
- Tranquility
- Sense of place
- Popularity
- Recreation and amenity
- Historic and cultural
- Tourism and economy
- Conservation value/designation

A summary evaluation on the value of the view/scenic resource can be recorded on the form.

Absorption Capacity: This section includes an opportunity to record information about the ability of the seascape to absorb the changes resulting from development. Absorption capacity is determined by the visibility from the viewpoint as well as user sensitivity. These factors are further described below.

Visibility

Views of the ocean are affected by the shape of the landform and its aspect relative to the viewer. For example, a more complex coastline with numerous bays and inlets results in fewer clear, unobstructed views to the ocean. In other cases, a land mass such as a headland or coastal bank may enclose a water view. The form and elevation of the land adjacent to the coast play a role in the ability of the seascape unit to absorb change, with higher elevation and steep topography allowing greater visibility to the sea. The following categories should be evaluated on the inventory form to assess the visibility of the viewpoint:

- Landform shape
- Elevation of land
- Settlement patterns
- Topography

User Sensitivity

The user's sensitivity to changes in the environment will depend on the number of users and their reasons for being within the environment. Based on available information, the inventory form should include an assessment of resident and visitor usage, and the usage by the traveling public (e.g. based on proximity of roadways to the shoreline). A summary evaluation of the viewpoint's absorption capacity and user sensitivity should be made at the end of the inventory.

Table 4A: Viewpoint Inventory Guidance

This grid has been developed to provide additional guidance for ranking viewpoints. The highest ranking viewpoints have least absorption capacity.

		VIEWPOINT RANKING				
		Highest	High	Average	Low	Lowest
FACTORS	SUB CATEGORY					
LANDFORM	Coastline Shape and aspect	Highly complex coastline or landform.	Complex coastline or landform.	Coastline or landform of moderate complexity.	Simple coastline or landform.	Very simple or straight coastline or landform.
	Elevation	High elevation.	Moderate elevation.	Some elevation.	Slight elevation.	No elevation.
VIEW		Panoramic/expansive views of the ocean, greater than 180 degree vista.	Extensive views of the ocean and wide vista.	Moderate views of the ocean or vista.	Limited views of the ocean and narrow vistas.	Little or no view of the ocean or little or no vista.
KEY FOCAL POINTS OR FEATURES	Natural and man-made	Focal points or features in the viewshed that are either natural or man-made and are: Very unusual, unique or very rare, of national or statewide importance/value, or are key character defining features or very distinctive.	Focal points or features in the viewshed that are either natural or man-made and are: Unusual or rare, of regional importance/value, or make a major contribution to the character of the seascape, or are somewhat distinctive.	Focal points or features in the viewshed that are either natural or man-made and are: Somewhat commonly found, of local importance/value, or make a minor contribution to the character of the seascape.	Focal points or features in the viewshed that are either natural or man-made and are: Commonly found, of minimal local importance/value, or contribute little to the character of the seascape, or are indistinct.	Focal points or features in the viewshed that are either natural or man-made and are: Absent or very common, of little or no significance, and do not contribute to the character of the seascape or may detract from it.
SETTLEMENT FORM/LAND USE PATTERN	Dominant Natural Pattern	Very remote, isolated natural area of national/statewide significance. Man made structures or features inconspicuous or absent.	Remote, natural areas of regional significance. Man-made structures and features limited and scattered.	Natural areas of local significance. Man-made structures widespread but not dominant in the view.	Small natural or vegetated areas. Man-made structures dominate view.	Few or absence of natural areas. Heavily developed areas. Man-made structures very dominant in the view.
	Dominant Man-made Pattern	Minimal or no man-made development, such as tightly knit, nationally or state designated historic properties, villages or cultural landscapes. Large-scale infrastructure or structures inconspicuous or absent.	Clustered development surrounded by rural, scattered development. Large-scale infrastructure or structures limited and scattered.	Suburban or mostly developed areas, with elements of local importance. Large-scale infrastructure or structures may be visible but not dominant.	Developed areas, including commercial development. Large-scale infrastructure or structures may be common and more dominant.	Heavily developed or industrialized/commercialized development pattern. Large-scale infrastructure or structures common and dominant.
USAGE		Very high resident, visitor and/or recreational usage.	High resident, visitor and/or recreational usage.	Moderate resident, visitor and/or recreational usage or some commercial usage.	Low resident, visitor and/or recreational. Commercial or industrial usage common.	Very low resident, visitor and/or recreational usage. Heavy commercial or industrial use.

Step 3: Determine Affected Resources

The applicant should identify those scenic and visual resources most likely to be affected and propose locations for visualizations/ simulations. Final locations for visualizations will be determined in consultation with Commission staff, and will be informed by the inventory work completed by the applicant and Cape Cod Commission, particularly the assessment of the quality, value and user information gathered as part of step 2.

The number of simulations needed will be based on the area within the ZVI and the number of scenic resources affected. Therefore, projects potentially affecting large areas would be required to analyze a greater number of locations. However, a minimum of two visualizations will be required for every project regardless of scale.

Once representative viewpoints have been established, the applicant should prepare before and after photo-simulations, wireframe diagrams and line-of-sight profiles to illustrate the visual impact on the viewpoints selected. Where several alternatives are proposed, each alternative should be presented in a set of simulations for comparison to other alternatives.

Step 4: Prepare Visualizations/Simulations

The purpose of the visualizations is to represent an observer's view of the proposed project, and will require photographs, computer-generated renderings, wireframe diagrams or other similar representations. In each case, the applicant should include a photograph of the existing setting for easy comparison to the proposed view and provide the before and after images with one above the other (rather than side by side).

In order to allow a thorough evaluation of the potential impacts, all visualizations should follow the same general procedure. The applicant should provide detailed information on the process followed and techniques employed for their simulations. Detailed guidance on the techniques to be used and the options available for presentation of this information is contained in Appendix E.

Step 5: Impact Assessment

This step is completed by Commission staff, with input from the applicant, Commission members, and the public. To assist in determining the magnitude of change to visual and scenic resources, the following indicators will be used to guide an evaluation of the project's impact. An adverse or negative impact is presumed when an activity either introduces a new element into a scenic view that is discordant with the existing character, or impairs the character or quality of the visual resources of the area.

The evaluation process takes into account:

- The proposal's <u>compatibility</u> with its surroundings, i.e. whether the proposal contrasts with its surroundings, or if its shape or form is incompatible with existing features;
- The proposal's <u>scale</u>, i.e. whether the size or spread of the project is significant or incompatible with the surrounding Seascape Unit;
- The proposal's <u>dominance</u>, i.e. whether the project is dominant or prominent in the view.

The following factors are taken into account in making this evaluation:

- the ability of the landscape to absorb changes due to its form or variability;
- the number of people affected and their sensitivity to change; the amount of the horizon affected;
- the duration of the impacted view; and,
- the degree of contrast between the existing character and the proposed activity (see Table 4B following).

Using these indicators, the potential magnitude of the change anticipated from the project will be determined by the Commission on a scale that ranges from dominant to faint/inconspicuous. It is important to understand that the examples listed in the chart are representative of a variety of situations that may not be applicable to each project. A project may not present all the features included in each category. In cases where a proposed project appears to fall into more than one category, the higher category shall be presumed to be the estimated magnitude of change.

After weighing these factors, any project that has a "moderate" or greater magnitude of change will be considered to have an adverse impact on that viewshed and required to re-evaluate the project design and incorporate mitigation methods to reduce the project's visual impacts.

Table 4B: Magnitude of Change Indicators

	INDICATORS OF MAGNITUDE OF CHANGE				
SCALE	Very Large	Large	Moderate	Small	Very Small
DESCRIPTORS	Dominant	Prominent	Conspicuous	Apparent	Faint/inconspicuous
APPEARANCE IN VIEW	Project commands or controls the view, either due to its proximity, massing, width, height, number of structures, duration of view, scale, visibility or contrast with the surrounding seascape.	Project stands out or is striking in the view, either due to its proximity, massing, width, height, number of structures, duration of view, scale, visibility or contrast with the surrounding seascape.	Project is clearly visible and noticeable within the view, either due to its proximity, massing, width, height, number of structures, duration of view, scale, visibility or contrast with the surrounding seascape.	Project visible or evident within the view, either due to its proximity, massing, width, height, number of structures, duration of view, scale, visibility or contrast with the surrounding seascape.	Project indistinct or not obvious within the view, either due to its proximity, massing, width, height, number of structures, duration of view, scale, visibility or contrast with the surrounding seascape.
DEFINITION	Project causes a very large alteration to the seascape character, or features within the seascape, such that there is a fundamental change from the pre-existing condition.	Project causes a large alteration to the seascape character, or features within the seascape, such that there is an unmistakable change from the pre-existing condition.	Project causes a moderate alteration to the seascape character, or features within the seascape, such that there is a distinct change from the pre-existing condition.	Project causes a small alteration to the seascape character, or features within the seascape, such that there is a perceptible change from the pre-existing condition.	Project causes a very small alteration to the seascape character, or features within the seascape, such that there is a de minimis change from the pre-existing condition.

Table 4B (continued): Magnitude of Change Indicators

	INDICATORS OF MAGNITUDE OF CHANGE				
SCALE	Very Large	Large	Moderate	Small	Very Small
DESCRIPTORS	Dominant	Prominent	Conspicuous	Apparent	Faint/inconspicuous
EXAMPLES	• Major changes that introduce a new and discordant and highly intrusive element into the seascape. • Changes in views from very important viewpoints or districts, such as national or state cultural or historic landscapes. • Changes that occur at the major focus points of view, where the focus is of national or state significance. • Changes affecting very large numbers of people. • Changes where very large proportions of the horizon are occupied. • Changes that occur at very short distances from the viewpoint. • Changes that are highly contrasting in terms of scale, color, form, line and texture. • Changes that are viewed for extended periods from scenic roads, scenic byways or US/state numbered highways. • Changes that affect very long stretches of the coastline, and/or many communities and/or a considerable part of the land and sea area of the region. • Changes that visually connect separate land masses • Changes where associated infrastructure results in very large alterations to the grade, vegetation or form of the landscape	• Large changes that introduce a new and dissimilar and intrusive element into the seascape. • Changes in views from important regional viewpoints, routes or districts, such as cultural or historic landscapes. • Changes that occur at the focus points of key or character defining views, where the focus is of regional significance. • Changes affecting large numbers of people. • Changes where large proportions of the horizon are occupied. • Changes that occur at short distances from the viewpoint. • Changes that are contrasting in terms of scale, color, form, line and texture. • Changes that are viewed in glimpses from scenic roads, scenic byways or US/state numbered highways. • Changes that affect long stretches of the coastline, and/or several communities and/or a major part of the land and sea area of the region. • Changes that partially visually connect otherwise separate landmasses • Changes where associated infrastructure results in large alterations to the grade, vegetation or form of the landscape	• Changes that introduce a new and noticeable and distinct element into the seascape. • Changes in views from important local viewpoints, routes or districts, such as cultural or historic landscapes. • Changes that occur at the focus points of key or character defining views, where the focus is of local significance. • Changes affecting moderate numbers of people. • Changes where moderate proportions of the horizon are occupied. • Changes that occur at moderate distances from the viewpoint. • Changes that are moderately contrasting in terms of scale, color, form, line and texture. • Changes that are viewed for extended periods from regional roadways. • Changes that affect stretches of the coastline, and/or multiple communities and/or a moderate part of the land and sea area of the region.	• Small changes that involve features already present in seascape. Small changes that affect less important viewpoints, routes or districts. • Changes that occur well away, or outside of, the focus points of view. • Changes affecting relatively small numbers of people. • Changes affecting users that are working in commercial/working seascapes. • Changes where small proportion of the horizon are occupied. • Changes that occur at long distances from the viewpoint. • Changes that are minimally contrasting in terms of scale, color, form, line and texture. • Changes that are glimpsed from regional roadways or viewed for extensive periods from local roads. • Changes that affect small stretches of the coastline, and/or a limited number of communities and/or a minor part of the land and sea area of the region.	• Very small changes that involve features already present in seascape. • Small changes that affect less important viewpoints, routes or districts. • Small changes that occur well away, or far outside, the focus points of view. • Changes affecting relatively small numbers of people. • Changes affecting users that are working in industrialized seascapes. • Changes where very small proportion of the horizon is occupied. • Changes that occur at very long distances from the viewpoint. • Changes that are not contrasting in terms of scale, color, form, line and texture. • Changes that are glimpsed from local or private roads. • Changes that affect very small stretches of the coastline, and/or a single community and/or a small part of the land and sea area of the region.

Mitigation

Options available to avoid, minimize and mitigate the effects of off-shore development are discussed below. Section 1 "Siting, layout and design" applies to offshore renewable energy development only.

Because the ocean is a flat and generally empty surface, development introduced into a viewshed is likely to present a stark contrast to the ocean environment. The focus of the design should be on its location and layout and its relationship to the landscape and the people who are viewing it.

An applicant should demonstrate that the public's enjoyment and appreciation of the qualities of the aesthetic resource are not compromised and that all efforts have been made through siting, layout and design to minimize the visual impacts. All mitigation options selected or considered should be described fully in the application.

1. Siting, layout and design

The following is a discussion of the major design strategies that should be evaluated and considered for any offshore wind turbine installation. A variety of siting, layout and design strategies can be implemented in order to reduce, eliminate or mitigate the visual effects of development in the ocean. The appropriate techniques and degree to which these strategies can be implemented will vary depending on the location, resources affected and the scale of the proposed project.

a. Siting

The siting of a proposed development is perhaps the most important factor to consider in avoiding visual impact. The following are siting considerations that should be addressed by the applicant in the design narrative.

Siting – Distance off-shore

The degree of visual impact is often directly related to the distance of the activity from the scenic resource or from the observer (Bishop (2002)). The greater the distance from these receptors, the less visible and smaller the activity is likely to appear (see Figure 14). Economic and environmental considerations will affect the siting of any offshore development. The design narrative should address the site selection process and describe how the proposed project minimizes visual impact by locating the project farther from shore.

Figure 14: Rendering of group of 24 turbines, arranged in three rows of eight turbines

Siting – Away from sensitive land-based resources

As part of the inventory process undertaken by the applicant, the most sensitive scenic and visual resources should be identified. Once established, the project should be sited as far from these most sensitive visual and scenic resources as possible and ensure that the setting of these visual resources is not negatively impacted.

Siting – Away from focal points

When people view the ocean, the distant horizon line forms a flat horizontal plane. The human eye is drawn to elements that break this horizontal plane. Because of this, the most visually sensitive location in a seascape view is often the point at which the land, sea and coastline meet (such as a headland), although other focal points may be equally sensitive (i.e. lighthouses or marsh areas). Therefore, sites should be selected that place development away from these focal points.

In cases where there are small bays or views with highly enclosed viewsheds, it will be very difficult to locate development in a manner that places the structures away from these sensitive focal points and does not alter the setting. For example, placing a wind turbine array in the ocean in these enclosed environments will likely result in the development visually connecting otherwise separate landforms (i.e. headlands on either side) that would significantly alter the character of the view (see Figures 15 and 16).

Figure 15: Enclosed view with narrow view to ocean between two headlands

Figure 16: Placing turbines in the center of the view visually connects the two previously separate headlands, altering the character of the view signi¿cantly.

Siting – Relationship to existing ocean and coastal developments

The introduction of a new activity on the scale of modern wind turbines into an otherwise undeveloped seascape is likely to be significant in terms of the structure's dominance in the setting and its potential to alter the setting's character. On the other hand, existing development can set a design precedent and context from which the turbine configuration can draw from.

In some cases, it may be desirable to locate offshore development in close proximity to existing facilities, such as existing offshore WECFs, or existing areas of industrial development along the coast, due to the potential to share infrastructure and the ability of some developed seascapes to accommodate additional development without increased visual impacts. However, the impact will depend greatly on the size and scale of the existing facilities and the proposed project. The applicant should examine the cumulative impacts of their proposal with all existing development and any projects in the review or permitting stages.

b. Layout

A scenic view is often composed of many natural features and complex landscape patterns. Large-scale development can sharply contrast with these landscape patterns because it generally appears more uniform in its design. The character of the scenic view should guide the most appropriate layout for any new ocean development.

Because the ocean itself offers little in the way of complexity, the coastline shape and form tend to be the most important elements in defining the character of a viewshed. Understanding the existing landscape pattern will inform the project layout and aid in complimenting or echoing the established character. Offshore wind farm layout should be designed in response to this character through the study of the qualities and characteristics of the scenic resources.

In order to minimize the appearance of turbines on the horizon, the applicant should explore alternate designs such as variations in the spacing between turbines, height and swept area of the turbines, configuration of the turbines, and in some circumstances, reduced numbers or alternate locations.

Layout – Spread along the horizon

The degree to which the project spreads across the horizon is a key factor in determining the magnitude of change, and therefore its potential impact. The greater the area of the horizon occupied by the turbine array, the less open ocean is available to the viewer, thereby altering the character of that seascape.

Turbine layouts should be designed in order to minimize both the horizontal and vertical spread of the development along the horizon. This will partly be a result of the size and scale of the development, but also the distance from the viewpoints and the breadth of view available from a given viewpoint.

When a turbine array can be viewed from multiple angles, it may be difficult to minimize the spread of the project along the horizon from each viewpoint (see Figure 17 and 18). In these cases, the applicant should consider alternate configurations with the aim of minimizing the visual impact from the most sensitive locations.

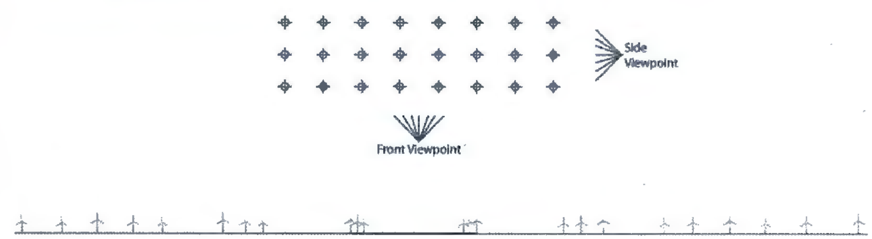


Figure 17: 24 turbine grid arrangement, with 3 rows of 8 turbines shown in plan view (top), and from the front.

Figure 18: the same 24 turbine array viewed from the side, showing signi¿cantly smaller horizon spread.

Layout – Pattern/arrangement

The design of a development should be responsive to the predominant visual receptors, and be of a similar scale and/or prominence. Layout choices should pay particular attention to aligning the least intrusive design profile to the most sensitive viewpoint, i.e. historic or cultural landscapes, or national/state designated scenic viewpoints.

Wind turbine arrays are typically arranged in a linear grid pattern (Figures 19 and 20). Other configurations may be less desirable from a navigational or search and rescue perspective, but may allow for more flexibility in configuring the array to present its narrowest profile to the most sensitive and key receptors. The applicant may be required to create a design that relates to the pattern and form of its surroundings in specific locations.

Arranging the turbines in a single line limits their profile to a single turbine. A single linear or curvilinear arrangement may retain its sense of organization when viewed from a greater number of angles (see Figure 21 and 22). Similarly, a circular arrangement would be seen in a similar arrangement regardless of the angle of view (see Figure 23).

In some circumstances, a curve or arc can be incorporated into the design that reflects the geometry of the coastline or elements

Figure 24: Photograph of the Middelgrunden, Denmark with gentle arc
(photo credit: andjohan)

Figure 19: 25 turbines arranged in 5 rows of 5 turbines; when viewed straight on, the grid pattern is easily seen

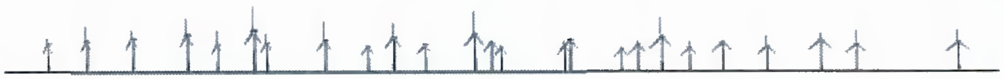


Figure 20: 25 turbines arranged in 5 rows of 5 turbines; when viewed from the side, a more random and less-uniform pattern is seen.

Figure 21: a line of 17 turbines viewed in a single row

Figure 22: a line of 17 turbines arranged along a gentle arc

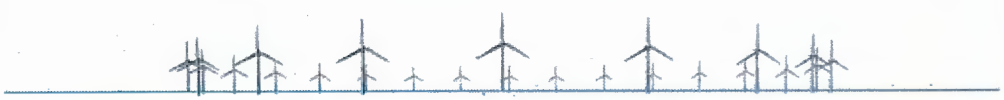


Figure 23: a line of 17 turbines in a circular arrangement

found in the surrounding landscape patterns. Such a strategy has been successful in the Middelgrunden offshore wind farm in Copenhagen, Denmark (http://www.middelgrunden.dk/middelgrunden/?q=en/node/35). Originally configured as a 27 turbine project with three rows, it was re-designed as a gently curving arc of 20 turbines that closely matches the form of the harbor.

Layout –Turbine scale and spacing

The height, rotor size, bulk and number of turbines selected will all contribute to the visual impact from the facility. Smaller sized turbines spaced more closely together have a smaller profile and less visual impact (see Figures 25 through 27). The design narrative should discuss the selection of spacing between turbines to address the overall profile of a project.

Figure 25: Arrangement of 24 turbines: 435 ft turbines spaced 0.5 miles apart

Figure 26: Arrangement of 24 turbines: 435 ft turbines spaced 0.25 miles apart

Figure 27: Arrangement of 24 turbines: 325 ft turbines spaced 0.25 miles apart

c. Design

In the ocean environment, wind turbines are most commonly viewed against the sky. Ephemeral changes in the weather and atmosphere as well as changes in air quality will change the visibility of any structure. It is unlikely that changes in the appearance of turbines will have a significant effect on minimizing the visual impact of moderate or large-scale wind farm developments, but smaller installations may be able to utilize minor changes to the turbine's appearance that help to minimize any visual impact (e.g. changes in color).

Design – Color/contrast with background

Turbines will appear to be more visible and prominent when there is a larger contrast between the object and its background. These factors should be carefully considered, as the contrast between the turbine and its background would likely change significantly depending on whether the turbine is viewed against the sea, sky or land (see Figures 28 through 30). The elevation of the viewpoint would in part dictate the backdrop to the development.

Figure 28: Turbines 0.5 Miles from the viewpoint from sea level to open water

Figure 29: Turbines from an elevation of 328 feet above sea level

Figure 30: Turbines 0.5 miles from the viewpoint from sea level with land mass behind

Design – Color/predominant weather and light conditions

Color choice should be informed by the predominant weather and light conditions (see Figure 31), and therefore the prevailing weather conditions at the coast should be reviewed. Generally, lighter tones such as off-white and light gray would be suitable choices, especially if the prevailing weather patterns of the coastal environment result in diffuse lighting conditions (such as haze, fog or other atmospheric conditions). The appearance of the turbines may also be minimized by the use of non-reflective finishes.

The position of the turbine field in relation to the sunrise and sunset is also of importance. At sunrise and sunset, the low angle of the sun would create the greatest contrast between the object and the background. When the project is "front lit" by the sun, the color of the turbines will be visible. However, in backlit conditions, where the sun is seen behind the turbines, color choice will be less important as a silhouette is created. Under these conditions a higher contrast exists.

The applicant's design narrative should include a color and finish palette and discuss how this minimizes the visual impact of the proposed project.

Figure 31: Turbines seen under different lighting and weather conditions

Design – Navigational lighting

Navigational lighting for both marine users and aircraft are generally required for structures as large as modern-day wind turbines. These lights are generally in operation both day and night, however, it is possible that the greatest potential visual impact could occur at nighttime where the project may present a new element in a previously dark sky.

Navigational lighting and markings for shipping tend to be located near the base of the turbine (US Coast Guard should be consulted for specific requirements). The best form of mitigation would be to place the turbines as far from shore as possible such that the curvature of the earth obscures any direct line-of-sight to the lights when viewing from shore.

Aviation lighting is usually required at the nacelle of the turbine, and may be limited to the extreme corners of the array. Provided they meet with FAA approval, these aviation lights should be shielded so that they are visible to pilots but do not shine toward land. FAA guidance may be found by consulting USDOT FAA Advisory Circular AC70/7460-1K:Obstruction Marking and Lighting, or subsequent version.

2. Screening

Typically, screening in the form of plantings, berms or landscaping will occur on land and will have limited ability to shield ocean development except in certain closely defined views. In some locations where very sensitive viewpoints are impacted by development and viewsheds are narrow, screening may be an appropriate strategy to augment siting and layout strategies to minimize visual impacts of offshore turbines. Screening may also be an appropriate strategy in limiting the visual impact of any landside infrastructure associated with the offshore components. The application should include proposed landscape plans to address screening of landside infrastructure and disturbance during construction, as well as screening of views as necessary.

3. Offsets

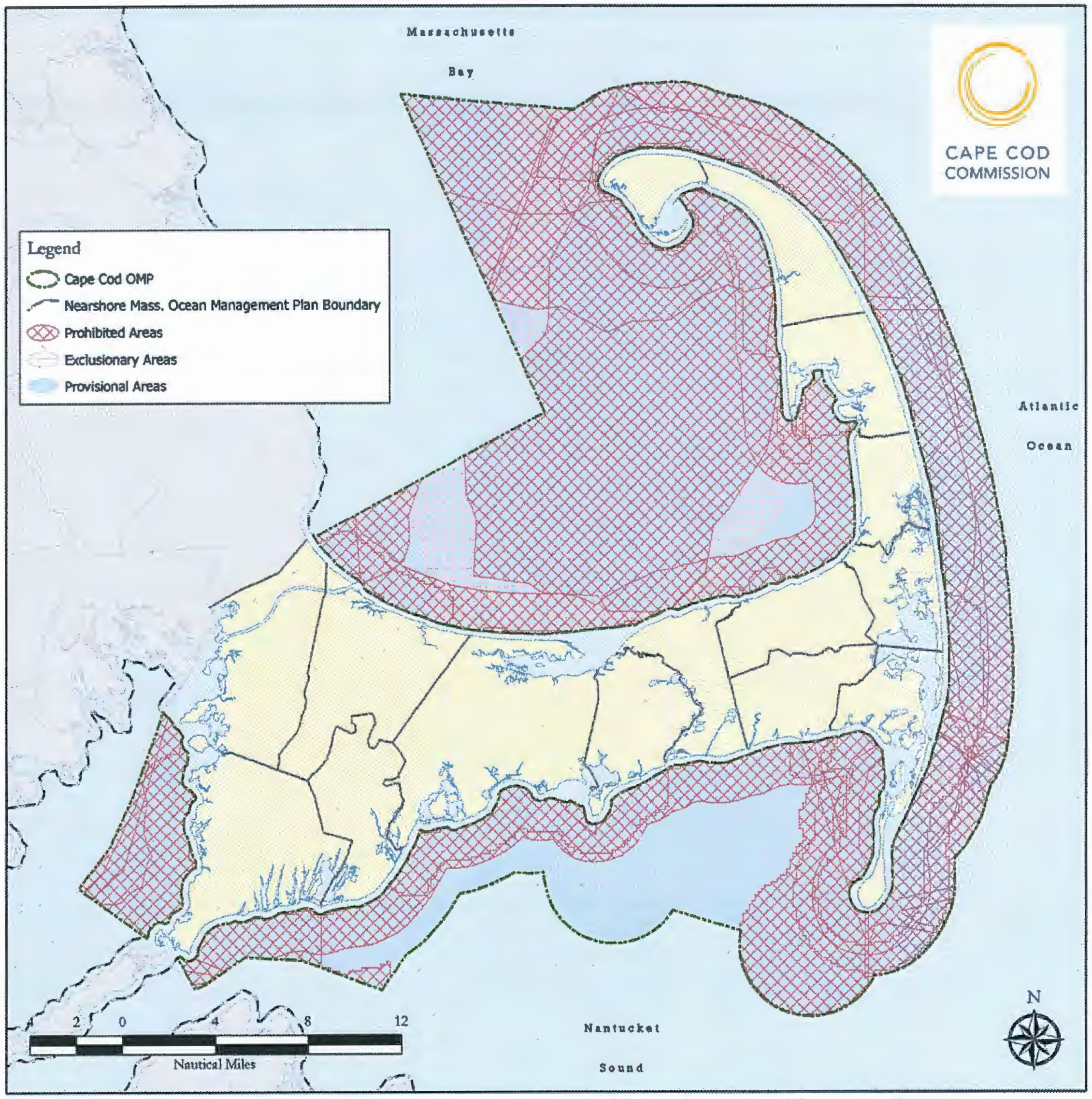
Some degree of visual impact may be unavoidable. Where proposed offshore development would result in a negative visual impact, it may be appropriate for the applicant to propose offsets to correct or improve the existing scenic viewshed provided there is a nexus and that they directly relate to the impact. Examples of potential offsets include undergrounding utility cables in the viewshed, removing existing negative visual elements, or providing improved public access to other viewsheds where the scenic and visual resources are less affected by the project. The application should include documentation of agreements with local officials where offsets are proposed on public property.

Decommissioning

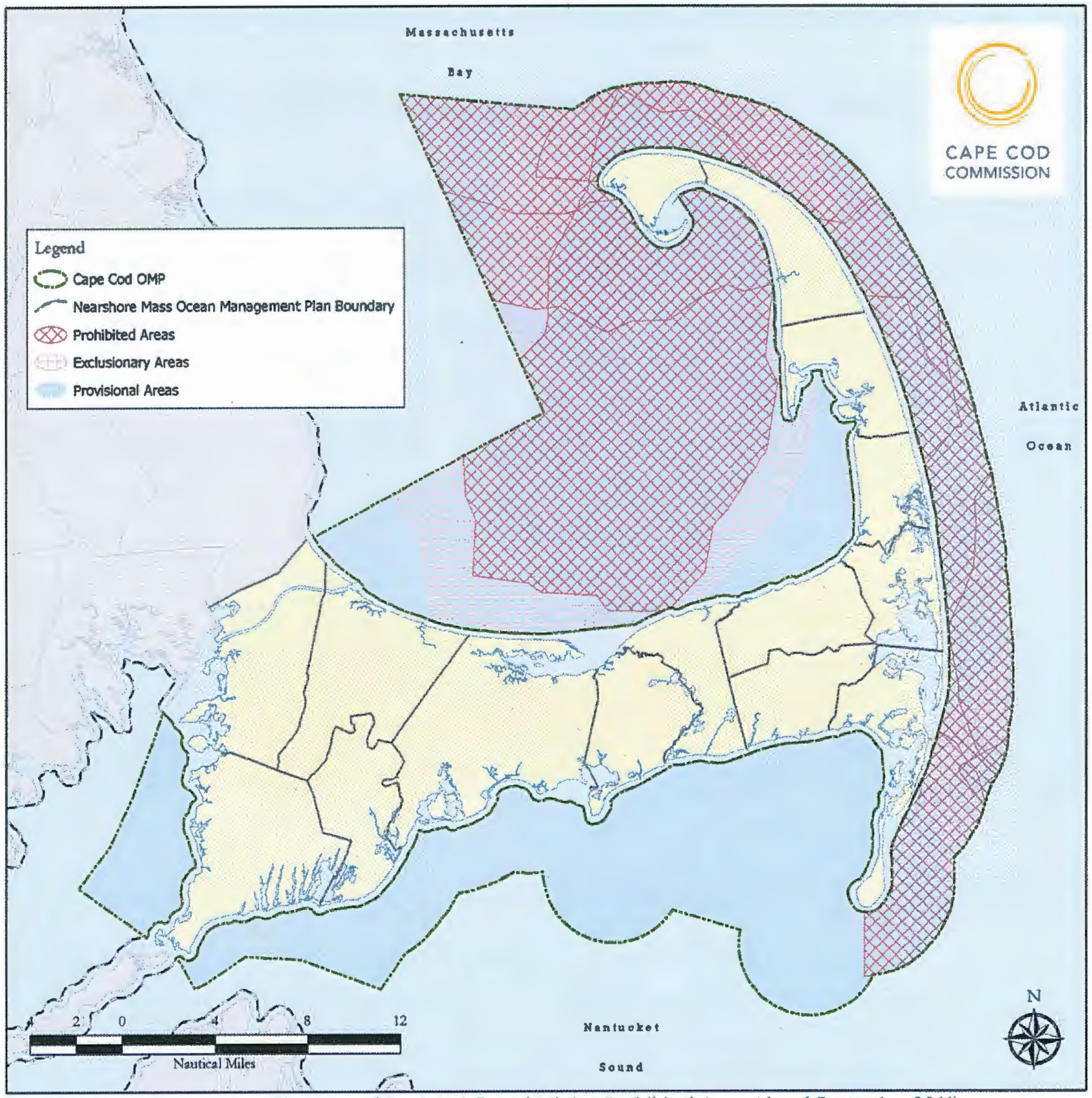
Decommissioning may be required at the end of a facility's useful life or when a facility is no longer operational due to damage or other reasons. To eliminate a project's visual impacts either partial or total removal of the facility may be required, including but not limited to the rotor, nacelle, tower, and foundation, scour protection materials, and converter stations. Decommissioning is particularly important in the case of infrastructure that extends well above the water line and is visible from many points on land. On land, decommissioning would typically require that the site be returned to its former condition. In the ocean environment, this determination should be based on environmental, navigational and safety issues. Decommissioning requirements, including submission of a decommissioning plan for review and approval by the Cape Cod Commission, will be addressed as part of the DRI review for the project.

Appendix A

The Cape Cod Ocean Management Plan Wind Energy Facility Prohibited Areas map dated September 2011 is shown below, and the Cape Cod Ocean Management Plan Sand and Gravel Mining Prohibited Areas map dated September 2011 is shown opposite. These maps are subject to revision. For the latest version, Applicants should refer to the Cape Cod Ocean Management Plan.



Cape Cod Ocean Management Plan Map of Wind Energy Facility Prohibited Areas (dated September 2011)



Cape Cod Ocean Management Plan Map of Sand And Gravel Mining Prohibited Areas (dated September 2011)

Appendix B
Zone of Visual Influence (ZVI) Minimum Requirements

The minimum requirements for the ZVI analysis are as follows:

1. A ZVI map should be produced at a scale of 1:50,000 or larger. Smaller scales may be used to show the overall ZVI for context and may accompany the larger scale illustration. For offshore wind turbines, two ZVI maps shall be produced. One ZVI calculation should be completed to establish the visibility based on the overall height of the turbine(s). A second ZVI calculation should be completed to establish the visibility based on the height of the nacelle of the turbine(s). This will allow a comparison between areas where the entire turbine may be visible, versus areas where only the blades may be visible.

2. The ZVI information should be illustrated on a map, with areas of visibility shown in color, slightly transparent, and overlaid on an aerial photograph (greyscale). The location of the development shall be shown on the map, with individual locations of each turbine shown in the case of an offshire wind turbine project.

3. Generally, software applications used to generate a ZVI will need either a Digital Terrain Model (DTM) or Digital Raster to conduct the analysis. Whichever is used, 3 meter or better resolution imagery/data should be used. In addition, the process used to conduct a ZVI analysis with topography can be refined to account for screening resulting from vegetation. In this case, a nominal height of 25 ft should be assigned to the vegetation layer to be included in the line-of-sight calculations for the ZVI, unless based on discussion with Commission staff the local circumstances suggest an alternative height.

4. The distance that the ZVI extends away from the development should be determined on a case by case basis and should be measured from the outer perimeter of the development. For offshore wind turbine development, a recommended rule of thumb is to extend at least 20 miles from the perimeter of the turbine array. Beyond this distance, an object of the size and profile of a wind turbine is likely to be of limited visual significance.

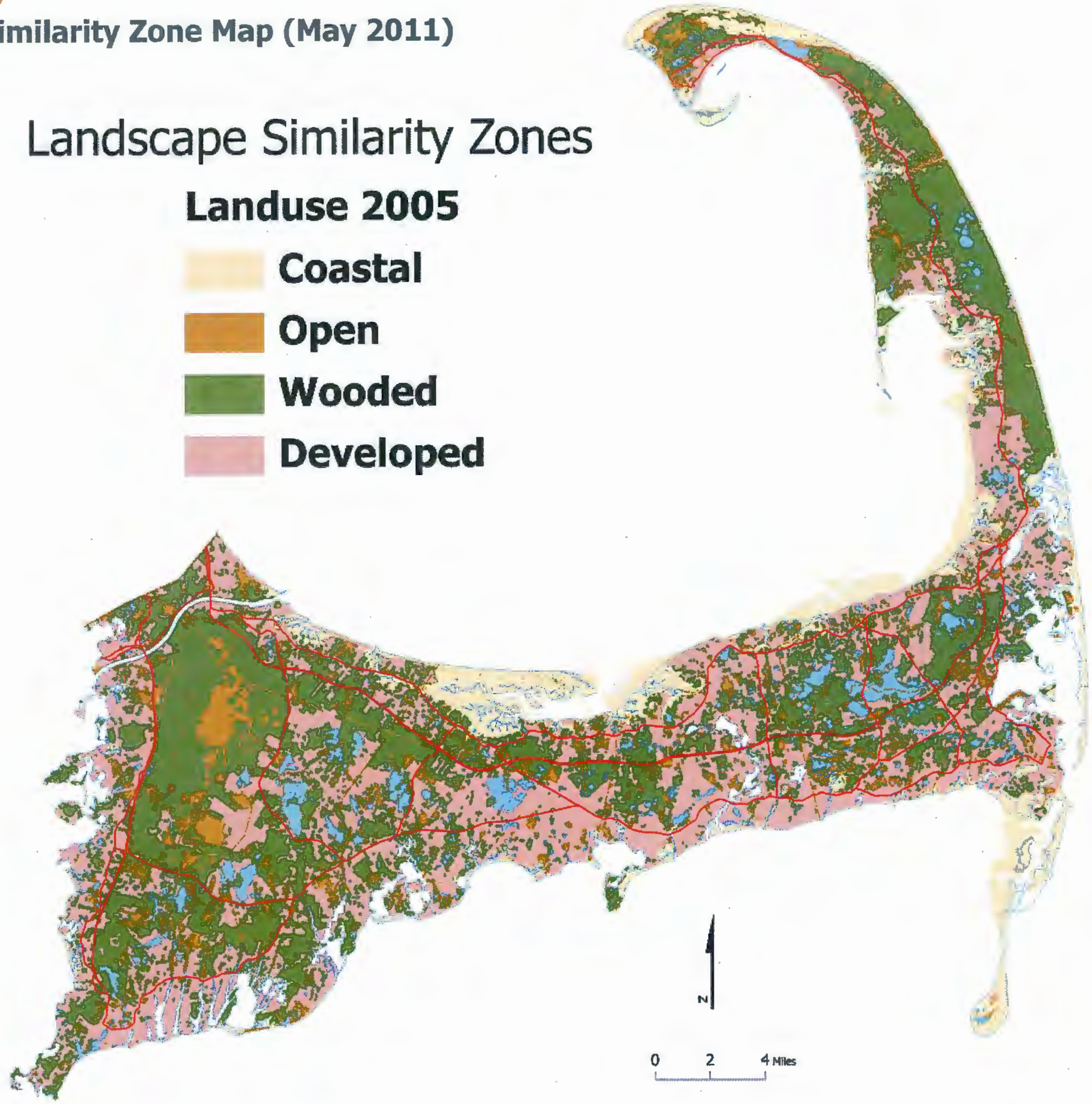
5. The ZVI analysis should be conducted to account for the curvature of the earth.

6. The ZVI analysis should be conducted based on a standard viewpoint above the ground elevation of 6 ft (1.82 m).

7. A narrative including metadata of all visibility inputs, assumptions, data layers and parameters used in the analysis.

Appendix C

Landscape Similarity Zone Map (May 2011)



Appendix D
Sample Inventory Form

PAGE 1 – CONTEXT AND VISUAL RESOURCES

Seascape Character Assessment Worksheet

Field Survey: Context and visual resources

META DATA

Location:				
Seascape Unit (circle):	Regional	Local		
Project Name (if applicable):				

Time:		
Assessor:		
Weather Conditions:		
Visibility:		(distance)

PHYSICAL FORM

Sea Components

					Observations:	Explanation:
Intertidal Area (circle):	small	medium	large			based on observation/presence of sand flat
Tidal state at assessment (circle):	High	Ebb	Flow	Low		tide at time of observation
Observations of marine environment:						state of sea i.e. calm, wavy; plus other features of note

Coastal Components

					Observations:	Explanation:
Coastal Geometry (circle):	straight	shallow bay	deep bay	convex		shape of coastal edge
Coastal Aspect (circle):	North	South	East	West		direction coast facing - generalized
Coastal Form (circle):	low cliffs/bank	dunes	low-lying	man-made		topographic typology of edge of the land at immediate coast
Predominant nature of shore (circle):	mud/marsh	sand	pebble	paved		characteristics of shore area and immediate coast
Notable physical features (circle):	harbor	marina	pier/dock	boats		significant elements at coast edge
	roads	coastal path	beach	parking	(attach map, aerial photo, etc.)	
	buildings	breakwater	dune system	salt marsh		
	wetland	barrier beach	golf course	campground		
Settlements/onshore installations (circle):	villages	low-density resi.	suburban resi.	industrial		settlement and elements at the coast edge
	commercial	institutional	municipal	energy generator	(attach map, aerial photo, etc.)	
	agricultural	warehousing	parking	other		
Installations offshore (circle)	wind turbines	islands	buoys/nav. aids	other		beyond seascape unit, but visible
					(attach map, aerial photo, etc.)	

Land Components

						Explanation:
Surrounding land form (circle):	flat	gently undulating	hilly	other		surrounding land components
Land cover & land use/vegetation type (circle):	forest	small woodland	park	scattered trees		surrounding land cover and use
	scrub	grassland	heathland	pasture		
	river	pond	wetland	marsh		
	village	residential	rural	industrial		
	cranberry bog	municipal	recreational	educational		
	mown/manicured lawn	other				

Sketch of view:

Summary Description (in simple terms, describe key characteristics or character defining features, comment on breadth of view, scale of development, what are the dominant features, patterns and vegetation recognizable in the view, etc.):

Page 1

PAGE 2 – ACTIVITIES, VISIBILITY AND VIEWS

Seascape Character Assessment Worksheet

Field Survey: Define Activities, Visibility and Views

ACTIVITIES AND FUNCTIONS

Sea Components								Other	Duration: Circle all applicable
Recreation:	sailing	fishing	wind surfing	parasailing	kayaking	surfing	other		I O F S Y
Shipping:	ferry	cruise	private	military	cargo	other			I O F S Y
Commercial:	sand/gravel	wind power	wave power	tidal power	other				I O F S Y
Fishing:	trawler	hook	aquaculture	net	other				I O F S Y
Others:	military	coast guard							I O F S Y

Coastal Components								Other	Duration
Recreation:	bathing/swimming	sunbathing	walking/jogging	bird watching	kite flying	horse riding	ORV-ing		I O F S Y
Transport:	mooring	launching	boat maintenance	ferry ports					I O F S Y
Fishing/food/gathering:	clamming	surf fishing							I O F S Y
Others:									

Land Components								Other	Duration
Recreation:	walking/hiking	cycling	golf courses	playing fields	bird watching	exercising	other		I O F S Y
Transport:	harbor	ferry terminal	rail	cycle paths	road with view of ocean	scenic road			I O F S Y
	airport	other							I O F S Y
Agriculture:	pasture	farm fields	cranberry bog	other					I O F S Y
Waterfront Industrial:	light	heavy	warehouse	waste facility	extractive	construction	energy production		I O F S Y
Waterfront commercial:	village center	marine maintenance	eating/drinking						I O F S Y
Waterfront residential:	Low-density resi.	suburban resi.	mixed use	high density resi.	retirement/care	hotel/motel	other		I O F S Y
Waterfront institutional/municipal	church	other							I O F S Y
Cultural/Historical resources:	cultural landscapes	historic buildings	historic landscapes	state/federal parks	other				I O F S Y

Access to the shore									
	Trail	walkway	local road	collector road	arterial road	pier/dock			

Key for duration

I = Infrequent
O = Occasional
F= Frequent
S = Seasonal
Y = Year-round

VIEWS

Views from land to the sea
(add sketch and/or photograph)

Detractors		elements with a negative effect
Attractors		elements with a positive effect
Night Lighting?:		describe objects that may have night lighting

Views from coast across water to land (land as a backdrop)
(add sketch and/or photograph)

Detractors		elements with a negative effect
Attractors		elements with a positive effect
Night Lighting?:		describe objects that may have night lighting
Backdrop:		Describe if land is visible, degree to which it occupies horizon/view

PAGE 3 – ASSESSING OVERALL SENSITIVITY

Seascape Character Assessment Worksheet

Field Survey: Assessing quality, value and absorption

Rank each along the scale provided (can place marks on borders if needed). Account for ephemeral changes where appropriate

QUALITY								Guidance:
Integrity	complete						remnant	What patterns are evident, are sections missing and to what extent?
Detractors	none						many	Are there elements out of place?
Clarity/visual diversity	clear						muddled	Too many patterns overlapping? Too many detractors to see the real character?
Rarity	rare						common	Are there many examples of this type of seascape in region/nation?
Distinctiveness	bold						indistinct	Easy to remember the seascape? Patterns dramatic or take some finding?
Summary								Summarize the prior ranking

VALUE								
Naturalness	natural						man influenced	Is there a strong sense of human activity?
Remoteness	remote						crowded	how far from pop. Centers?
Tranquility	calm						busy	lack of background noise, traffic, night lighting or development?
Sense of Place	strong						weak	Is there a distinctive character?
Popularity	high						low	Is area heavily or frequently used?
Recreation amenity	high						low	Facilities available for use?
Historic & cultural	high						low	Are there structures or resources that help define character of area?
Tourism & economy	high						low	Do facilities, amenities or business cater mostly to tourists or visitors?
Conservation designation	high						low	Are there formally designated federal/state/local conservation/scenic areas?
Summary								Summarize the prior ranking

Absorption								
Resource sensitivity								
Shape of coastline	complex						simple	Large number of inlets/bays or not?
Elevation of land	high						low	At sea level or above? Height?
Settlement	small scale						large scale	small bulidlings isolated or in compact villages? Large strcutures or infrastructure dominant?
Flatness	flat						sloping	Any topography and what extent?
								Summarize the prior ranking
User sensitivity								
Visitor usage	high						low	Account for the number of users and duration of visit, size of paarking areas can be indicator or numbers
Resident usage	high						low	Account for the number of resident users and duration of visit
Travelling public usage	high						low	Account for the number people travelling through area with views, and duration of visit
Summary								Summarize the prior ranking

Notes/comments (identify which assessment it relates to):

Appendix E
Visualization/Simulation Guidance

a. Photography

Photographs are essential to illustrating the existing setting and preparing simulations. Key factors that should be considered before preparation of any simulations are the field of view to be captured in the photograph, and the viewing distance to the project (discussed below). These factors will be partly influenced by the size of the images to be printed, and the distance from which viewers will see the project.

Photographs should be taken at eye level, using standard photographic techniques. The location (using GPS or similar), the height, lens, aperture, focal length, bearing, time, date and lighting conditions should be recorded for all locations. A tripod should be used, and leveled with the focus set to infinity. Additional technical guidance for the preparation of photographic simulations can be reviewed in Visual Representation of Wind Farms: Good Practice Guidance (Honor-McLennan and envision, (2006)), website http://www.snh.gov.uk/docs/A305436.pdf.

b. Field of View

The field of view describes the height and width of a view represented in a photograph.

The potential extreme horizontal field of view of the human eye is approximately 200 degrees; however, only a fairly small area (between 6-10 degrees) will be in focus at any one time. A viewer will move their eyes and head to see over a wider area. It is commonly considered that in photography a representative field of view for the human eye falls between 45 and 60 degrees. In order to capture the broader visual context, the applicant should prepare panoramic images with a field of view between 60 and 110 degrees.

A photographic simulation that provides enough information to give the experience of a view can consist of a single frame or a series of photographs arranged in a panorama. The choice of which to use should primarily be guided by judgment as to what is needed to fully illustrate the key characteristics of the visual resources in proximity to the project. The proposed facility should generally be located such that it appears centrally in the horizontal field of view of the photograph, although in some cases it may be more appropriate to locate key focal points in the center of the image so long as the proposed wind farm does not appear at the edge of the image.

Generally, images for simulations presented with the application should be between 5 and 8 inches high to allow 2 photo-simulations per page to ensure that sufficient detail can be seen and that sufficient vertical field of view is available. Larger format images may be desired, both as part of an application and for presentation at public hearings and/or site visits.

With a 35 mm or equivalent camera lens, a 50 mm focal length is generally acceptable to balance the level of detail captured and appropriate field of view.

Additional information and guidance for appropriate fields of view for visualizations can be reviewed in Visual Representation of Wind Farms: Good Practice Guidance (Honor-McLennan and envision, (2006)), website http://www.snh.gov.uk/docs/A305436.pdf, and Chapters 3 and 4 of Foundations for Visual Project Analysis (http://www.esf.edu/via)

c. Viewing distance

It is essential that once simulations have been prepared, they are viewed at the correct "viewing distance". The distance from the viewer's eye to the page must match the perspective seen at the real-life scene it is trying to show. If the image is viewed too close, the elements within it will appear smaller than they are in the real world, and if held too far away the elements will appear too large. The printed image should also be designed to be viewed at no more than arm's length, and this viewing dimension should be included and clearly visible on each simulation and consistent throughout the application. Generally, images should be presented on tabloid sized paper (11 inches by 17 inches) that are designed to be held at arm's length).

Additional information and guidance for appropriate viewing distances for visualizations can be reviewed in Visual Representation of Wind Farms: Good Practice Guidance (Honor-McLennan and envision, (2006)), website http://www.snh.gov.uk/docs/A305436.pdf, and Chapters 3 and 4 of Foundations for Visual Project Analysis (http://www.esf.edu/via)

d. Visualizations

For each visualization, the existing setting should be presented above the simulation for the proposed project to allow easy comparison between the existing and built conditions. A plan showing all simulation locations and their relationship to the project site should be provided in the application.

Each visualization should include the following:

- Location, altitude, field of view
- Pitch of camera if not horizontal
- Bearing of center of image
- Correct viewing distance (i.e. how far away from the eye the image should be viewed)
- Distance to nearest point of the development, i.e. nearest proposed visible turbine
- Reference to detailed photographic information (should be contained elsewhere or as an appendix with information concerning date, time, weather)

The rendering of the proposed project should match the lighting of photographs based on time of day and month of year and should show the proposed color choices for the facility.

Additional information and guidance on presenting visualizations can be reviewed in Visual Representation of Wind Farms: Good Practice Guidance (Honor-McLennan and envision, (2006)), website http://www.snh.gov.uk/docs/A305436.pdf, and Chapter 11 of Foundations for Visual Project Analysis (http://www.esf.edu/via).

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