Appendix L – Visual Impact Assessment

Construction and Operation Plan
Appendix L
Visual Impact Assessment

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Acronyms and Abbreviations

ADLS	Aircraft Detection and Lighting System
APVI	Area of Potential Visual Impact
BOEM	Bureau of Ocean Energy Management
COP	Construction and Operation Plan
Ft	feet
GIS	Geographic Information System
GPS	global positioning system
HFOV	Horizontal field of view
km	kilometer
km^2	square kilometer
km/h	kilometer per hour
kHz	kilohertz
knot	nautical mile per hour
m	meter
mi	mile

MLLW	mean lower low water
NEPA	National Environmental Policy Act
NJ	New Jersey
nm	nautical mile
NOAA	National Oceanic and Atmospheric Administration
OCS	Outer Continental Shelf
OPAREA	Operations Area
PDE	Project Design Envelope
WEA	Wind Energy Area

1. Introduction

A Visual Impact Assessment (VIA) is a systematic analysis of 1) possible changes to the visible seascape and landscape resulting from the proposed Ocean Wind Project ("Project"), 2) potential effect on the viewing public, and 3) possible means to avoid, minimize or mitigate the adverse effects of the change. This process includes a series of interrelated steps that identify and consider the following elements:

- Project components
- Existing seascape and landscape character
- Visually sensitive public resources
- Viewer expectations and sensitivity
- Project visibility from publicly accessible locations
- Aesthetic impacts to the seascape and landscape and its viewers
- Mitigation measures

To determine the extent of potential Project visibility and visual impact, Orsted engaged Terrence J. DeWan & Associates (TJD&A) to prepare a VIA for the Project. The methodology used to develop the VIA is based on the professional experience of TJD&A in conducting VIAs for large-scale wind and other energy infrastructure Projects. The methodology is also informed by recent publications pertaining to offshore wind energy developments, e.g., *Guidelines to Landscape and Visual Impact Assessment (Third Edition)* by the Landscape Institute and Institute of Environmental Management and Assessment, and *Visual Impact Assessment (VIA) Methodology for Offshore Development* by the Cape Cod Commission (Technical Bulletin #12 – 001). This analysis was conducted for up to 99 turbines. The Project Design Envelope (PDE) was subsequently reduced to 98 turbines; because the PDE was reduced (not increased), the analysis was not changed.

The material presented in the VIA is intended to be used by Orsted in their review with public agencies, New Jersey stakeholders, and the general public, in compliance with applicable regulatory requirements.

2. Project Description

Ocean Wind LLC (Ocean Wind), a subsidiary of Orsted Wind Power North America LLC (Orsted) is proposing to construct and operate the Ocean Wind Offshore Wind Farm (OCW01, Offshore Wind Farm, or Project) off the coast of New Jersey. The Project is being developed pursuant to the Bureau of Ocean Management (BOEM) requirements for the Ocean Wind BOEM Lease Area OCS-A0498 Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (Lease).

Ocean Wind is developing the proposed Project to generate renewable power off the coast of New Jersey and transfer the electricity to load centers within New Jersey and the Mid-Atlantic region. The Project will include offshore wind turbines for power generation and associated infrastructure required to transmit electricity generated by the turbines to onshore interconnection points with the regional electric transmission system operated by PJM Interconnection L.L.C. (PJM).

The Lease Area is approximately 75,525 acres and is located approximately 13 nautical miles (nm) southeast of Atlantic City. The Project will be developed within the northeastern portion of the Lease Area. The Lease Area and the boundaries of the Project are depicted on **Figure 2.1**. The Project is expected to be operational by 2024.

The Project will include turbines and all infrastructure required to transmit power generated by the turbines to connection points with the Pennsylvania, Jersey, Maryland (PJM) electric transmission system or power pool.

Grid connections will be made at BL England and/or Oyster Creek. It will also include onshore and offshore infrastructure required for operation and maintenance.

The proposed project consists of offshore wind turbine generators (turbines or WTGs), offshore substations, cables to connect the WTGs to the offshore substations and to connect the offshore substations to each other, offshore and onshore export cables, onshore substations, connections to the existing grid, and operations and maintenance activities.

The Wind Farm Area is approximately 108 square miles (280 square kilometers) in size and approximately 13 nautical miles (15 statute miles) southeast of Atlantic City, New Jersey. The turbines will consist of typical offshore wind turbine design with a three-bladed rotor connected to a generator housed in a nacelle atop a tower structure and monopile foundation. The Project will include up to three offshore substations that will be constructed and connected by substation interconnector cables, and array cables that will connect to the turbines to the substations (See **Figure 2.2**).

The offshore substations will be connected to the onshore substations via offshore and onshore export cables. Offshore cables will connect to onshore cables at Transition Joint Bays (TJB) and onshore export cables will be buried.

Onshore substations are proposed at two substation sites: BL England and Oyster Creek. Each onshore substation location would require a permanent site for the substation equipment and buildings, energy storage, and associated landscaping. Overhead transmission lines or an underground duct bank will connect the new substations with the existing grid. The size of the building within the substations would vary. At the Oyster Creek substation, there would be two main buildings on a 31.5-acre site: GIS Hall A could be up to 166 feet in length x 50 feet in width and 40 feet in height. GIS Hall B could be up to 149 feet in length x 50 feet in width and 35 feet in height. A secondary building could be up to 66 feet in length x 57 feet in width and 33 feet in height. At the BL England substation the main building could be up to 81 feet in length x 67 feet in width and 33 feet in height on a 11.3-acre site. A secondary building could be up to 154 feet in length x 45 feet in width and 33 feet in height.

Power mast infrastructure would be up to 115 feet in height; lightning masts would be up to 98 feet in height at each substation. Substation components (transformers, HV reactors, SVC/statcoms, harmonic filters, bus ducts, etc.) would vary up to 49 feet in height. Orsted is using a PDE approach, which considers a reasonable range of project designs and components that represents the maximum design scenario for each resource (i.e., greatest impact). Selection of materials and finishes that will dictate the final appearance of each substation will be determined in conjunction with review of the site development plans by the municipalities. Discussions with local communities will emphasize the need for safety and reliability, which may affect certain material choices. The more detailed project description using the PDE approach is provided in Volume I.

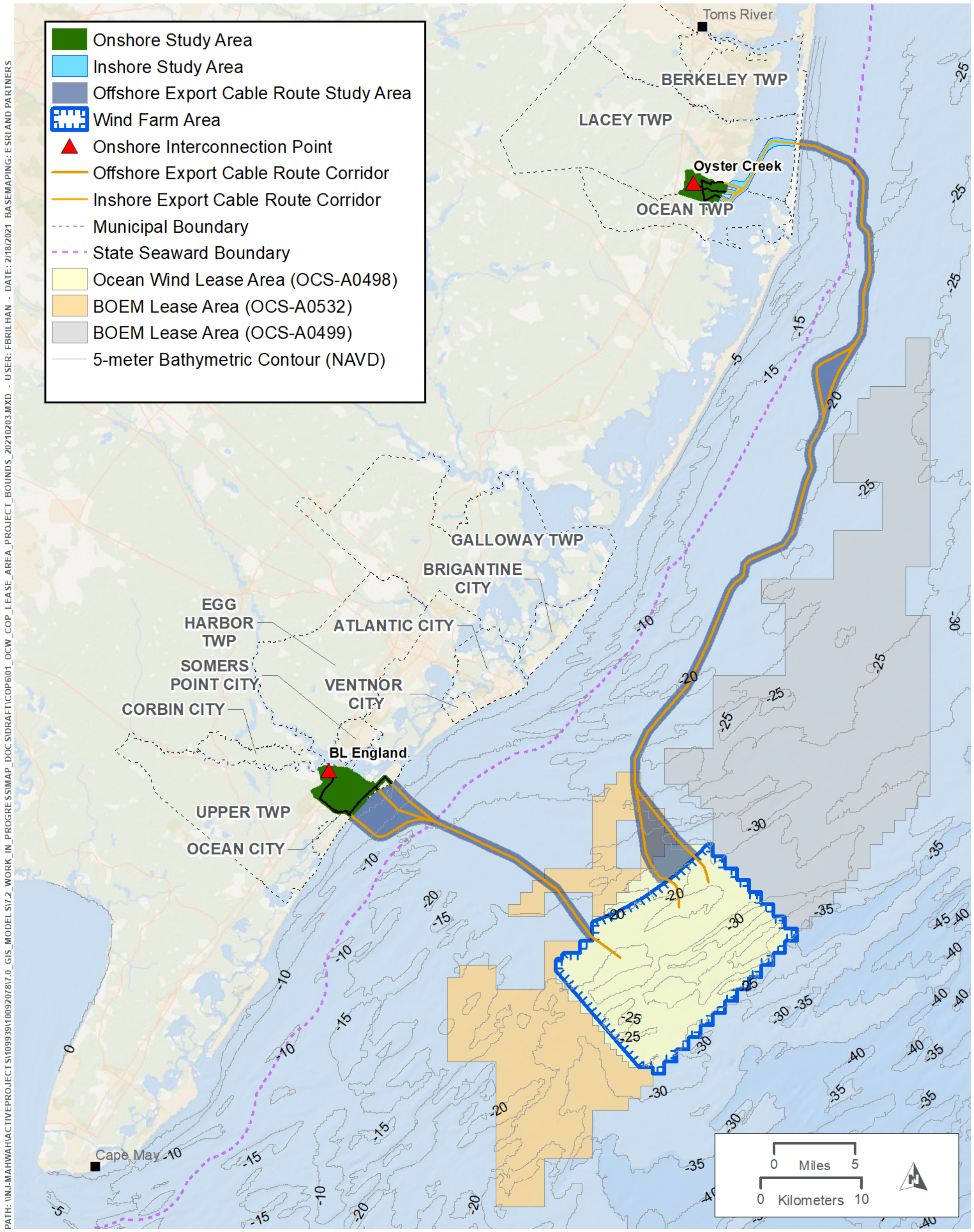

Figure 2.1 - Location Plat and Key Project Components.

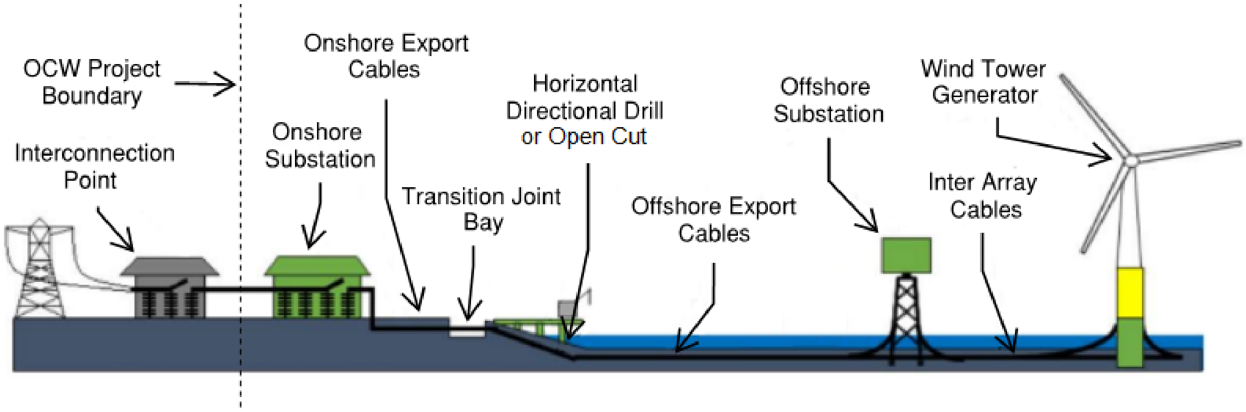

Figure 2.2 - Diagram of Project Components (Subject to Change).

3. Indicative Infrastructure

Orsted retained TJD&A to conduct a visual impact assessment of potential project facilities. Facility design will take place after BOEM approves the COP, therefore indicative facility dimensions that are typical of designs under consideration are used in this VIA. This section described the indicative facilities.

3.1. Turbine Infrastructure

The offshore components of the Project that would be visible include wind turbines generators, offshore substations, offshore accommodation platforms, underground array cables, underground export cables, and occasional service vessels. The distance from the shoreline to the nearest turbine is 15.2 mi (24.5 km). The size of the turbine layout area is 107 square miles (277 square kilometers). The height of the turbine hub above water level is 512 feet (156 m) and the height of the blade tip above water level is 906 feet (276 m). See elevation of the turbine in Figure 3.1 and a plan of the turbine layout in Figure 5.1.

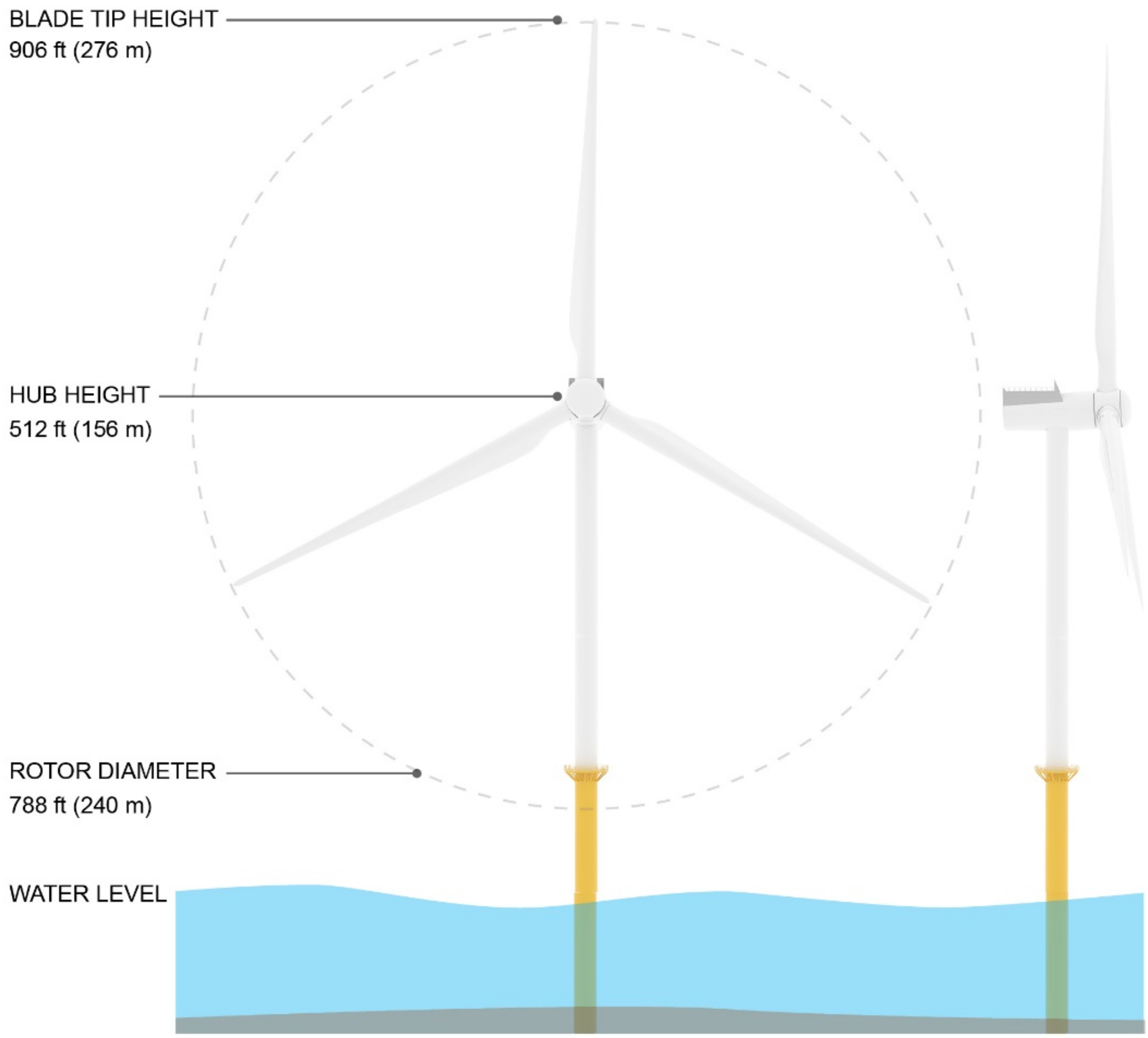

Figure 3.1 - Turbine Elevation.

3.2. Offshore Substation Infrastructure

There will be up to three offshore substations located in the offshore turbine array. The substations will stand 296 feet (90 m) above the MLLW (including the lightning rods on top of the substation structure). The substation topside is the main portion of the substation painted grey in **Figure 3.2**. The base of the topside will stand 98 feet (29.8 m) above MLLW and extend 130 feet (39.6 m) to 228 feet (69.5 m) above MLLW. See indicative images of an offshore substation in **Figure 3.2**.

Figure 3.2 - Indicative Images of Offshore Substations.

3.3. Lighting

The Project will incorporate an Aircraft Detection and Lighting System (ADLS) to control the aircraft warning lights mounted on each turbine hub, contingent on BOEM approval and compliant with Federal Aviation Administration (FAA) guidelines. The ADLS will only be active during low light and night conditions. They will come on in unison so that the entire wind farm is marked as a whole.

The Federal Aviation Administration (FAA) lighting and marking recommendations apply to wind turbines out to 12 Nautical Miles (NM) from the coast of the United States, which is the extent of the territorial seas. The Bureau of Ocean Energy Management (BOEM) maintains jurisdiction of land leases beyond 12 NM (13 miles). While the Project's turbines will be located beyond this distance, BOEM will be following the recommendations for lighting and/or marking in FAA Advisory Circular No. 70/7460-1L (2018): Obstruction Marking and Lighting until such time as they develop their own standards for lighting.

Under the current FAA Advisory Circular and US Coast Guard regulations, each turbine will be required to have three types of lighting:

- Two FAA L-864 aviation red flashing, strobe, or pulsed observation lights will be mounted on top of the hub and synchronized to flash simultaneously. For purposed of this VIA and the visualizations, we are assuming that each turbine would be lit, since the distance between individual turbines is greater than 0.5 mile.
- Four L-810 flashing red lights will be mounted at or near the mid-point on the base to ensure an aircraft pilot approaching from any direction has an unobstructed view of at least two of the lights. These lights would also be synchronized with the L-864 lights on the hub. FAA requires mid-mast lights where the rotor tip height at dead center is at or above 699 feet above ground (or in this case, sea) level.
- Aid to Navigational warning lights, as required by the US Coast Guard (USCG), will be installed on top of the foundation in accordance with USCG regulations IALA 0-139. In addition to the yellow lights, the USCG requires that the base of the tower be painted yellow from the level of Highest Astronomical

Tide (HAT) to 50 feet (15 m), or at least to the height of the Aid to Navigation, whichever is greater. The yellow base of the 12MW turbines is 111.6 feet (34 m) above water level.

3.4. Export Cable Route Corridors

Ocean Wind has not selected a single option for the onshore and offshore export cable routes, but rather, using the PDE approach, retains several options to allow for review of the Project through site specific field surveys, site investigations, agency coordination, and stakeholder outreach.

For the COP, the following offshore export cable route corridors were identified.

3.4.1. Oyster Creek Export Cable Corridors

Offshore Export Cable Route Corridor: The corridor begins within the Wind Farm Area and proceeds northwest to make landfall at the Atlantic Ocean side of Island Beach State Park (IBSP).

Inshore Export Cable Route Corridor: The corridor exits the Bay side of IBSP and crosses Barnegat Bay southwest, to make landfall near Oyster Creek in either Lacey or Ocean Township. See **Figure 3.3**.

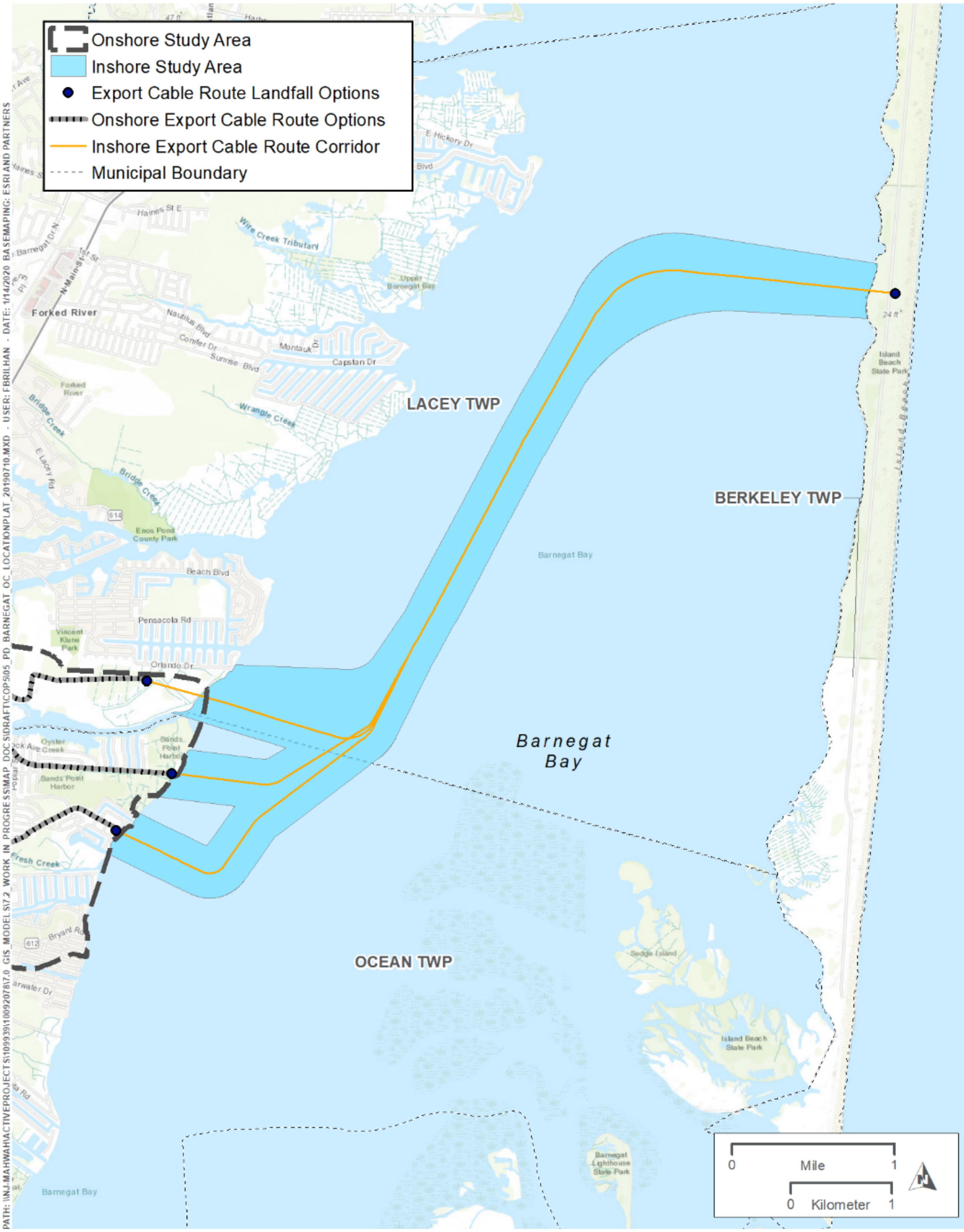

Figure 3.3 - Inshore Cable Routes for Barnegat Bay/Oyster Creek.

3.4.2. BL England Export Cable Corridors

Offshore Export Cable Route Corridor: The corridor begins within the Wind Farm Area and proceeds west to make landfall in Ocean City, New Jersey.

Inshore Export Cable Route Corridor: The corridor begins at the bay side of Ocean City and proceeds west to make landfall at BL England in Upper Township, New Jersey.

3.5. Onshore Infrastructure

The onshore infrastructure would consist of a buried onshore AC export cable system, an AC substation, and a connection to the existing electrical grid at each interconnection point. Ocean Wind has identified indicative onshore cable route options that are representative of the potential existing conditions and impacts within the onshore study area for Oyster Creek and BL England. Plans for the potential onshore cable routes and the onshore study areas are shown in **Figure 3.4,** Oyster Creek, and **Figure 3.5,** BL England. To minimize potential impacts, the parcels that are being considered for both Oyster Creek and BL England are in proximity to the interconnection point and have been previously developed, maintained, or disturbed. Section 3.8 of the VIA describes an option for using overhead grid connections between the onshore substation and interconnection point for Oyster Creek and BL England.

Figure 3.4 - Oyster Creek Project Location.

Figure 3.5 - BL England Project Location.

3.6. Landfall Locations and Export Cable Routes

Ocean Wind has identified indicative landfall options for each of the export cable route options described above. Based on preliminary engineering the identified landfall options have been found suitable for trenchless technology methods, open trench, TJB, and cable installation. There would be no visible above ground infrastructure associated with the landfall locations. The landfall option locations are represented in **Figure 3.4** and **Figure 3.5**.

Ocean Wind has identified indicative onshore cable route options that are representative of the potential existing conditions and impacts within the onshore study area for Oyster Creek and BL England. There would be no visible above ground infrastructure associated with the onshore Export Cable Routes. However, there would be some areas where vegetation clearing may be necessary.

3.6.1. Oyster Creek Landfall Locations and Export Cable Routes

Oyster Creek Landfall Locations

- The Island Beach State Park landfall is located within a parking lot by the State Park office. The area is comprised of paved areas.
- The Exelon Property landfall is located at the shore of Barnegat Bay and targets previously disturbed areas where possible.
- The Bay Parkway landfall is located at the end of Bay Parkway within an existing road ROW.
- The Lighthouse Drive landfall is located at the end of Lighthouse Drive within an existing road ROW.

Oyster Creek Export Cable Routes

- The Bay Parkway and Lighthouse Drive routes are examples of an all-road route. Construction would be within existing ROW and previously disturbed areas.
- The Exelon Property route would make landfall and travel across the property, taking advantage of previously disturbed areas where possible, before following abandoned roadways associated with the existing confined disposal facility and Exelon property. The route would then follow existing roadways. In order to minimize potential impacts to wetlands, the route follows existing berms, paths, and trails.

3.6.2. BL England Landfall Locations and Export Cable Routes

BL England Landfall Locations

- The 5th street landfall in Ocean City is located in a paved municipal parking lot.
- The 13th Street landfall in Ocean City includes two landfalls, one at the ocean side and one at the bay side. The bay side landfall is needed to continue with an in-water route to the BL England landfall. The area is within an existing road ROW and would parallel an existing submarine cable. The area is within a neighborhood.
- The 35th Street landfall in Ocean City is located on the Atlantic Ocean side of the barrier island. The landfall is within existing road ROW.
- The Roosevelt Boulevard landfall is located within a dead-end municipal road and a paved parking lot for the crossing of Peck Bay using trenchless technology methods.

BL England Export Cable Routes

- The 5th and 13th Street routes would be within existing ROW of local streets and would then be within West Avenue to 35th Street (as described in the next bullet).

- 35th Street. After making landfall at 35th Street in Ocean City and travelling on local roads west, the Roosevelt Boulevard Bridge crossing would be by trenchless technology methods. Then the route would continue on Roosevelt Boulevard ROW turning north on Rte. 9 to the potential substation property at the decommissioned BL England Generating Station.

3.7. Onshore Substations

The following is a brief description of the indicative infrastructure proposed for the potential substation locations. Each substation would require a main building within the substation, plus secondary buildings that may be used to house reactive compensation, transformers, filters, a control room, and a site office. The external electrical equipment may include transformers, HV reactors, SVC/statcom, harmonic filters, bus ducts, and other auxiliary equipment. Power mast infrastructure would be installed above the tallest building at each substation location. Power from the substations would be transferred to an interconnect point, either through an overhead transmission line (i.e., overhead grid connection) or an underground duct bank. Firewalls would be installed to shield transformers and other electrical infrastructure.

The detailed design of substations and overhead transmission lines are still being developed and will be designed to comply with applicable municipal codes. During the design process, consideration will be given to visually adapt the buildings and other substation components into their physical context. The forms, lines, colors, and textures of these components will be influenced by the immediate surroundings and selected to minimize visual contrast and potential visual impact, where possible. A preliminary plan set for the potential substation design for Oyster Creek and BL England is included in the COP Appendix U.

3.7.1. Oyster Creek Substation

Location. The Oyster Creek substation would be located between the existing Oyster Creek Nuclear Generating Facility substation and the Oyster Creek tributary in Lacey, NJ. The site is located approximately 0.5 mile from Route 9 (the nearest public roadway).

Existing Conditions. The site has been previously cleared, with some existing successional tree and shrub growth. The site also contains existing electrical infrastructure associated with the existing Oyster Creek Generation Facility substation. The adjacent Oyster Creek Nuclear Generating Facility no longer produces power and is in the process of being decommissioned.

Public Access. There is no existing public access to the site. The access road is a private roadway associated with the Oyster Creek Generation Facility. There are gates located at the roadway entries on Route 9 and there are no amenities in the immediate vicinity of the substation that would encourage public visitation to the site.

Structures and Electrical Equipment. The tallest building (GIS Hall A) would be approximately 40 feet in height. There could be up to 27 98-foot tall lightning masts throughout the substation site. External electrical equipment could vary up to 49 feet in height. Firewalls would be approximately 82 feet in height. See **Figure 3.6** for an indicative computer-generated model of the substation. For additional information and indicative drawings please refer to COP Volume III Appendix U.

Fencing. The site would be surrounded by a 6-foot tall chain link fence with 1-foot of barbed wire at the top.

Maintenance Access. There would be two access points from the roadway on the northern side of the site. Both access points would be gated.

Vegetation. There is no landscaping proposed for the area around the substation. There appears to be approximately 50 feet between the proposed fencing and the existing roadway, allowing room for future vegetation between the roadway and the substation development.

Lighting. Security lighting would be down-shielded to mitigate light pollution.

3.7.2. BL England Substation

Location. The BL England substation would be located in Upper Township, on the western side of Clay Avenue, approximately 650 feet north of North Shore Road. Adjacent land use to the east on North Shore Road includes a town park, a jet ski rental, a parking lot, and a commercial building. The BL England Generating Station, which no longer produces power, is north of the site. The plan and timetable for decommissioning the plant are not part of the Ocean Wind Project and are currently ongoing.

Existing Conditions. The site was part of a larger recreation facility that included a golf course, pool, trails, ball fields, and a picnic area. Most of the site is a former golf course, with both clearings and forested areas that follow the patterns of golf course greens. There is a wooded buffer between the substation site and Clay Avenue.

Public Access. Clay Avenue is the primary access road to the former BL England Generation Station. Clay Avenue also provides access to a public parking lot and wooden fishing pier located on the Great Egg Harbor River.

Structures and Equipment. The tallest building within the substation would be approximately 82 feet in height. There could be up to 20 98-foot lightning masts located throughout the substation. External electrical equipment could vary up to 49 feet in height. For additional information and indicative drawings please refer to COP Volume III Appendix U.

Fencing. The site would be surrounded by a 6-foot tall chain link fence topped with 1 foot of barbed wire.

Maintenance Access. There would be a main entrance on Clay Avenue centrally located within the substation site. One additional entrance is shown on the north side of the substation. All access points would be gated.

Vegetation. Preliminary plans indicate that approximately 100 feet of existing vegetation would remain between the substation fence and Clay Avenue. Vegetation clearing along the roadway would be limited to the entry points and an additional section of clearing at the north end of the substation.

Lighting. Security lighting would be down-shielded to mitigate light pollution.

Figure 3.6 - Indicative Computer Generated Model of Oyster Creek Substation and Grid Connection

3.8. Onshore Grid Connection

Additional transmission cables would be required to connect the onshore substation to the existing grid. This section of cable will be similar in design to the onshore cable but must be at an appropriate voltage to connect to the grid at Oyster Creek and BL England. Length and the number of circuits of the grid connection will be optimized to reduce number of splice vaults/grounding link boxes, and electrical loses. Substations and overhead transmission lines are still being designed and will be designed to comply with applicable municipal codes.

3.8.1. Oyster Creek Transmission to Interconnect

At the proposed onshore substation, reactive compensation will occur, and the power will be stepped down to the regional transmission voltage to facilitate connection. From the export substation the power bank will be routed to the RTO substation.

The interconnection between the new substation and the existing Oyster Creek substation may be via a 138-kV overhead transmission line, supported by 6± transmission structures. The monopole transmission structures may be up to 115 feet in height, with six conductors on three jumper arms, and one shield wire at the top of the structure. The transmission structures would be spaced approximately 240 feet (73.2 m) apart and located entirely within the Oyster Creek site.

3.8.2. BL England Transmission to Interconnect

The interconnection between the new substation and the existing BL England substation may be via a 138-kV overhead transmission line, supported by 5± transmission structures. The monopole transmission structures may be up to 115 feet in height, with six conductors on three jumper arms, and one shield wire at the top of the structure. The transmission structures would be spaced approximately 240 feet (73.2 m) apart and located entirely within the BL England site.

4. Theoretical Visibility

The visibility of individual offshore Project components (wind turbines and offshore substations) will be a function of many variables:

- Distance from the observation point to the component.
- Height of the observation point.
- Height of the turbines (both the hub height and the height to the tip of an extended blade).
- Diameter of the turbine towers.
- Color and reflectivity of the Project components.
- Alignment of turbines relative to the viewpoint (where turbine towers are aligned only the base of the nearest turbine will be visible).
- Size, height, mass, and design of the offshore substations.
- Curvature of the earth.
- Atmospheric refraction (variable and dependent upon optical conditions, temperature, and barometric pressure).
- Meteorological conditions (haze, fog, rain, snow).
- Seasonal, time-of-day, and metrological lighting conditions.
- Artificial lighting in the vicinity of the observation point (especially along urbanized areas and boardwalks).
- Topography between the observation point and the ocean (this is a relatively minor factor in southern New Jersey where the landscape is typically very flat).
- Intervening vegetation between the observation point and the ocean.
- Community development patterns (single-family homes, multi-story buildings, amusement rides, etc.) that may block views.
- Visual acuity and concentration of the observer.

Within the 40-mile radius study area, the distance from coastal viewpoints to the Project vary from slightly more than 15 miles to nearly 40 miles to the nearest turbine. The area beyond 15 miles is considered the far background where distance, curvature of the earth, weather and atmospheric conditions, and other factors combine to greatly reduce an object's visibility. From the northerly end of the study area at Barnegat Light, the closest turbine will be over 38 miles to the south. At the midpoint of the study area in Atlantic City, the closest turbines will be slightly more than 15 miles due east. At the southern end of the study area in Cape May, the closest turbine will be over 33 miles to the northeast.

4.1. Distance Zones

Viewing distance between an observer and an offshore wind project is one of the key factors in determining the level of visual effect, which generally diminishes in proportion to increased distance (BOEM 2007b). The concept of distance zones is often used as a frame of reference to discuss the characteristics of the visible landscape and help to predict the visual effects that proposed human activities may have on the surrounding seascape / landscape. The concept is based upon USDA Forest Service (USFS) visual analysis criteria for forested landscapes and recognizes that the perceived visibility and visual characteristics of a proposed project will appear to change as the viewer approaches or moves away from it. Distance zones address the amount of detail and color contrast that an observer can differentiate at varying distances (USDA 1995). An understanding of viewing distances – typically foreground, midground, and background as described below –can provide a framework to evaluate the significance and scale of wind turbines, or clusters of turbines, in the larger seascape / landscape. The distance zones used for the Ocean Wind Project are defined as the proximity of the observer to closest part of the facility. For the Ocean Wind Project four distance zones were identified:

Foreground: The area visible within 0 to 0.5 mile from the observer. Within the foreground, observers are able to detect surface textures, details, and a full spectrum of color. For the substation and other onshore components, a foreground range of up to half-mile is appropriate, since infrastructure associated with the Project would not be highly visible beyond that distance. Within a half-mile, the details of the turbines (blades, hubs, support towers) will be readily apparent. For the offshore components, the only observers within the foreground of the turbine arrays would be boaters passing near the Project, as well as construction and maintenance workers, fishermen, and others who depend upon the ocean for their livelihood.

Midground: Greater than 0.5 mile to 5.0 miles from the observer. The midground is a critical part of the natural landscape, where details become subordinate to the whole. On land, individual trees lose their identities and become forests; buildings are seen as simple geometric forms; roads and rivers become lines. Edges define patterns on the ground and hillsides. Development patterns are readily apparent, especially where there is noticeable contrast in scale, form, texture, or line. Colors of structures become somewhat muted and the details become subordinate to the whole. This effect is intensified in hazy weather conditions, which tend to mute colors and de-sharpen outlines even further. In panoramic views, the midground landscape is the most important element in determining visual impact.

With offshore wind turbines, the midground is the area where the patterns created by individual turbines starts to become apparent. Turbines are smooth textured and monochromatic, and it is often difficult to differentiate viewing distances due to the lack of vertical objects or recognizable scaling elements (such as human figures) for reference. Within the midground (especially at the far midground) atmospheric conditions start to mute colors (from white to light gray), especially in hazy or foggy weather conditions. The Atlantic Ocean is the only scenic resource within the midground of the offshore components. The only observers who will encounter the Project in the midground distance zone are boaters near the Project, as well as construction and maintenance workers, fishermen, and others who depend upon the ocean for their livelihood.

Background: the area greater than 5.0 miles and up to 15.0 miles from the observer. Background distances provide the setting for panoramic views that give the observer the greatest sense of the larger landscape. However, the effects of distance and atmospheric haze will often obliterate the surface textures, detailing, and form of Project components. Viewing distance can also play a significant role in color contrast, as atmospheric haze, especially over ocean waters, dulls the color of project components.

Objects in the background will be most visible if they present a noticeable contrast in form or line, and when weather and lighting conditions are favorable. The color and reflectivity turbine components may present visual contrast to shore-side observers under certain lighting and weather conditions. Due to the thinness of the design, the outer ends of the turbine blades tend to be minimally visible in the background.

As is the case with foreground and midground viewing distances, the only observers who will encounter the Project in their travels in the background distance zone are boaters near the Project, as well as construction and maintenance workers, fishermen, and others who depend upon the ocean for their livelihood. Since the offshore components of the Project are all located greater than 15 miles from the shoreline, no one on land will have foreground, midground, or background views of the turbines or offshore substations.

Far Background: The area beyond the background (15 miles) where distance, curvature of the earth, weather and atmospheric conditions, and other factors combine to greatly reduce an object's visibility. All of the offshore components of the Project are located within the far background; at its closest point, the Project will be at least 15 miles from the shoreline at the midpoint of the study area, i.e., between Atlantic City and Ocean City.

BLM considers objects greater than 15 miles from an observer to be "seldom seen", partially due to topographic features that tend to obscure visibility, but also due to the effect of distance and atmospheric perspective (BLM, 2013). In a 2012 study sponsored by the BLM, observations of five onshore wind facilities in Wyoming and Colorado were made under various lighting and weather conditions to determine the extent of visibility.

"The facilities were found to be visible to the unaided eye at >58 km (36 mi) under optimal viewing conditions, with turbine blade movement often visible at 39 km (24 mi). Under favorable viewing conditions, the wind facilities were judged to be major foci of visual attention at up to 19 km (12 mi) and likely to be noticed by casual observers at >37 km (23 mi). A conservative interpretation suggests that for such facilities, an appropriate radius for visual impact analyses would be 48 km (30 mi), that the facilities would be unlikely to be missed by casual observers at up to 32 km (20 mi), and that the facilities could be major sources of visual contrast at up to 16 km (10 mi)" (Sullivan, 2012).

While the results of the Wyoming and Colorado study are informative, there are some key differences that should be considered. The scale of the proposed Ocean Wind structures is considerably greater than the turbines typically found in landscapes managed by the BLM. Most of the turbines in the BLM study had hub heights of 260± feet, approximately half the height that being proposed by the Ocean Wind Project. Weather and atmospheric conditions in the relatively dry Southwest are considerably different than the Atlantic Ocean, where haze and salt spray tend to obscure visibility over great distances. In open ocean waters, there are no features to act as distance references or add visual interest or complexity to the scene.

To address the issue of visibility of offshore wind projects, BOEM sponsored a study by Argonne National Laboratory's Environmental Science Division (EVS) and the University of Arkansas Center for Advanced Spatial Technology (CAST) to assess the visibility of existing offshore wind facilities in the United Kingdom. The study was designed to identify the maximum distances at which offshore wind turbines could be seen in both daytime and nighttime views and assess the effect of distance on the visual contrasts associated with these facilities.

Results showed that under favorable viewing conditions, offshore wind projects with relatively small to moderately number of turbines (25 to 100) were visible to the unaided eye at distances greater than 26 mi, with turbine blade movement visible up to 24 mi. At night, aviation 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.

However, the turbines that were evaluated in the UK were considerably smaller than those being proposed for the Ocean Wind project. Two of the projects that were included in the report have the following dimensions (Sullivan 2013):

- Thanet: hub height: 230 feet; rotor diameter: 295 feet; height to blade tip: 377 feet
- Burbo: hub height: 274 feet; rotor diameter: 351 feet; height to blade tip: 449 feet

By comparison the turbines being considered for Ocean Wind have the following dimensions:

- Proposed: hub height: 512 feet; rotor diameter: 788 feet; height to blade tip: 906 feet

Compared with the Burbo turbines (that had the larger turbines of the two projects that were evaluated), the proposed indicative turbines would have a hub height that is 187% taller; a rotor diameter that is 225% greater; and a total height above sea level that is 202% taller.

As noted above, there is a relationship between turbine visibility and turbine height; therefore, the distances and visual effects observed by Sullivan et al. should be increased proportionately with the increased dimensions of the Project turbines. Thus, under optimal weather and viewing conditions, the closest turbines could be a major focus of visual attention at distances up to 18 miles. Turbines may be noticeable to casual observers – under optimal weather and viewing conditions – at distances up to up to 30 miles. Beyond that point, turbines would only be visible under optimal weather and viewing conditions to an observer with concentrated attention to the horizon.

4.2. Limits of Visibility

The theoretical limit of visibility is a function of distance from the observer to the offshore wind turbine, the elevation of the observer, the height of the turbine, curvature of the earth, and atmospheric refraction. The Viewshed Maps in **VIA Appendix A** illustrate the theoretical area that may be exposed to views of the Project, based upon these variables. In reality, the actual Project visibility will be considerably less, due to the number of variables that affect an observer's ability to detect objects at great distances, such as weather conditions, atmospheric haze, lighting, or observer's visual acuity. The visualizations provided in **VIA Appendix D** represent a variety of atmospheric and lighting conditions. The effects of viewing distances, changes in viewer elevation, and variability in weather conditions are represented in the collection of visualizations.

Atmospheric refraction is the bending of light rays resulting from temperature differences in the atmosphere allowing a viewer to see further. The exact amount of bending depends on several variables including elevation, atmospheric composition, optical conditions, temperature, and barometric pressure. Although it is theoretically possible that refraction could have some impact on Project visibility in certain conditions, refraction is anticipated to have minimal impact on overall potential visibility.

Theoretical visibility does not account for refraction, visual acuity, or atmospheric conditions. While the turbines components would theoretically be visible at some distance from the shore, there are many factors – including earth curvature, atmospheric conditions, the thinness of the blades – that make it difficult for the average observer to recognize turbine blades at distances >15 miles). **Table 4.1** provides the theoretical limit of visibility at various heights above mean sea level, taking into account the heights of the turbines being considered, the distance from the viewpoint (in miles), and the height of the observer[1]. For an observation elevation of 25 feet (typical of views from the boardwalks within the Study Area), the theoretical limit of turbine hub visibility would be 37.3 miles. While the table indicates that the blade tips could theoretically be visible beyond this range, they are unlikely to be detected by observers with 20/20 vision at these distances due to the limits of visual acuity (BOEM 2012).

[1] Table 4.1 is derived from the Visibility Table in BOEM 2007b. The values in the BOEM 2007b table were expressed in nautical miles; the distances in Table 4.1 are expressed in statute miles.

Table 4.1 - Theoretical Limits of Visibility.

Indicative Turbine: Hub Height: 512 ft (156 m) / Blade Tip Height: 906 ft (276 m)			
VIEWER ELEVATION	DISTANCE TO HORIZON	DISTANCE TO DISAPPEARANCE OF HUB	DISTANCE TO DISAPPEARANCE OF BLADE TIP
5 ft	3.0 mi	33.5 mi	43.5 mi
10 ft	4.3 mi	34.8 mi	44.8 mi
15 ft	5.2 mi	35.7 mi	45.7 mi
20 ft	6.0 mi	36.5 mi	46.5 mi
25 ft	6.8 mi	37.3 mi	47.3 mi
30 ft	7.4 mi	37.9 mi	47.9 mi
40 ft	8.5 mi	39.0 mi	49.0 mi
50 ft	9.6 mi	40.1 mi	50.1 mi

NOTE: The motion of the rotating blades may be visible up to a distance of 25 to 30 miles (Sullivan 2013). The average viewer is likely to lose sight of the blades well before they disappear below the horizon at the distances provided in the above table. The effect of earth curvature on the theoretical visibility of the turbines is represented in a cross section in **Figures 7.2 to 7.4** and further discussed in **Section 7**.

5. Methodology

The purpose of this VIA is a systematic analysis of the visual effects that may be caused the proposed Project. The analysis includes identifying: 1) visual changes to the existing seascape and landscape (the place); 2) potential effects on the viewing public (the people); and 3) possible means to avoid, minimize or mitigate the adverse effects of these changes.

The VIA methodology engages a team of visual resource professionals to conduct an in-depth analysis of the existing landscape/seascape character and to determine the significance of the visual effects on the place and the people.

The VIA methodology is based on recent professional publications pertaining to visual impact assessment procedures for offshore wind development and a review of the VIAs prepared for other offshore wind Projects submitted to BOEM.

The methodology uses the following steps to arrive at an assessment of the visual impact of the proposed Project.

1. **Study Area Identification**: The *theoretical* extent of Project visibility based on turbine height, Project location, and earth curvature.
2. **Computer-Based Viewshed Analysis:** A determination of where there is the potential for Project visibility, according to computer-based viewshed analyses.
3. **Scenic Resource Identification**: The identification and mapping of publicly accessible scenic resources that are visited by the public and where viewers may have an elevated sensitivity to visual change.

4. **Fieldwork**: The physical documentation of the study area to gain a better understanding of the landscape, seascape, user groups, and areas of potential visibility. Conducted through site visits, personal observations, photography, and written documentation.
5. **Landscape Character Assessment**: The classification of the landscape within the study area into defined Landscape Similarity Zones (LSZ) as part of a comprehensive analysis of potential impacts across a large land area.
6. **User Group Identification**: The identification of current human use in the seascape/landscape and a characterization of people who may have views of the Project components.
7. **Representative Viewpoints**. A selection of individual locations to represent views from various landscape similarity zones where the Project may be visible. At least one visualization is provided for each representative viewpoint.
8. **Individual Site Assessments**. An assessment of visual change to the landscape/seascape and on viewers that will result from the Project at each representative viewpoint.
9. **Mitigation Measures**. The discussion of mitigation measures that have been or will be taken to address the potential visual impact of the Project on the seascape/landscape and their user groups.
10. **Overall Impact Assessment**. The summary analysis of the anticipated visual change to the seascape/landscape, based upon Project visibility, the sensitivity of viewers to change, the seascape/ landscape's capacity to absorb visual change, and the compatibility between the visual character of the Project and the existing seascape/landscape.

5.1. Study Area Identification

The study area represents the area of theoretical Project visibility, based upon the maximum height of Project components, the location of the Project relative to the observer (distance zones), the effects of curvature of the earth, and topographic variability. The study area does not represent places where the Project would necessarily be visible, but rather is a starting point for further investigation through computer-based viewshed analyses, field observations, and visualizations to more accurately define the limits of Project visibility. The study area is used to define the area for fieldwork, scenic resource identification, computer-based viewshed analyses, and landscape character assessment.

There are three individual study areas identified in this VIA: 1) the Offshore Study Area; 2) the Onshore Study Area for the Oyster Creek Substation, underground cable routes, and above-ground transmission line; and 3) the Onshore Study Area for the BL England Substation, underground cable routes, and above-ground transmission line.

5.1.1. Offshore Infrastructure Study Area

For the Offshore Study Area, the theoretical limit of Project visibility is based on the proposed turbine hub height (where the FAA aviation warning lights would be located) and the screening effect caused by the curvature of the earth. A highly conservative 40-mile (64.4 km) radius around the turbine layout was used to define the theoretical limit of Project visibility (study area).

The turbine layout occupies 108 square miles (280 square kilometers). Based upon an indicative turbine hub height of 512 feet (156 meters) above sea level, to a person standing at elevation 0.0 (i.e., the water's edge) the turbine hubs (and the aviation warning lights) would disappear from view when the observer was approximately 33.5 miles (54 km) from the Project. To a person 50 feet above sea level, the turbine hubs would disappear when the observer was approximately 40.1 miles (64.5 km) from the Project.

The study area extends along the New Jersey coastline from Barnegat Light in the north to Cape May in the south, and extends inland as far west as Vineland, NJ (See **Figure 5.1**). The total size of the study area is 6,769 square miles (17,532 square kilometers). This includes 1,219 square miles (3,157 square kilometers) of land area and 5,550 square miles (14,374 square kilometers) of water, including open ocean, coastal bays, and major rivers).

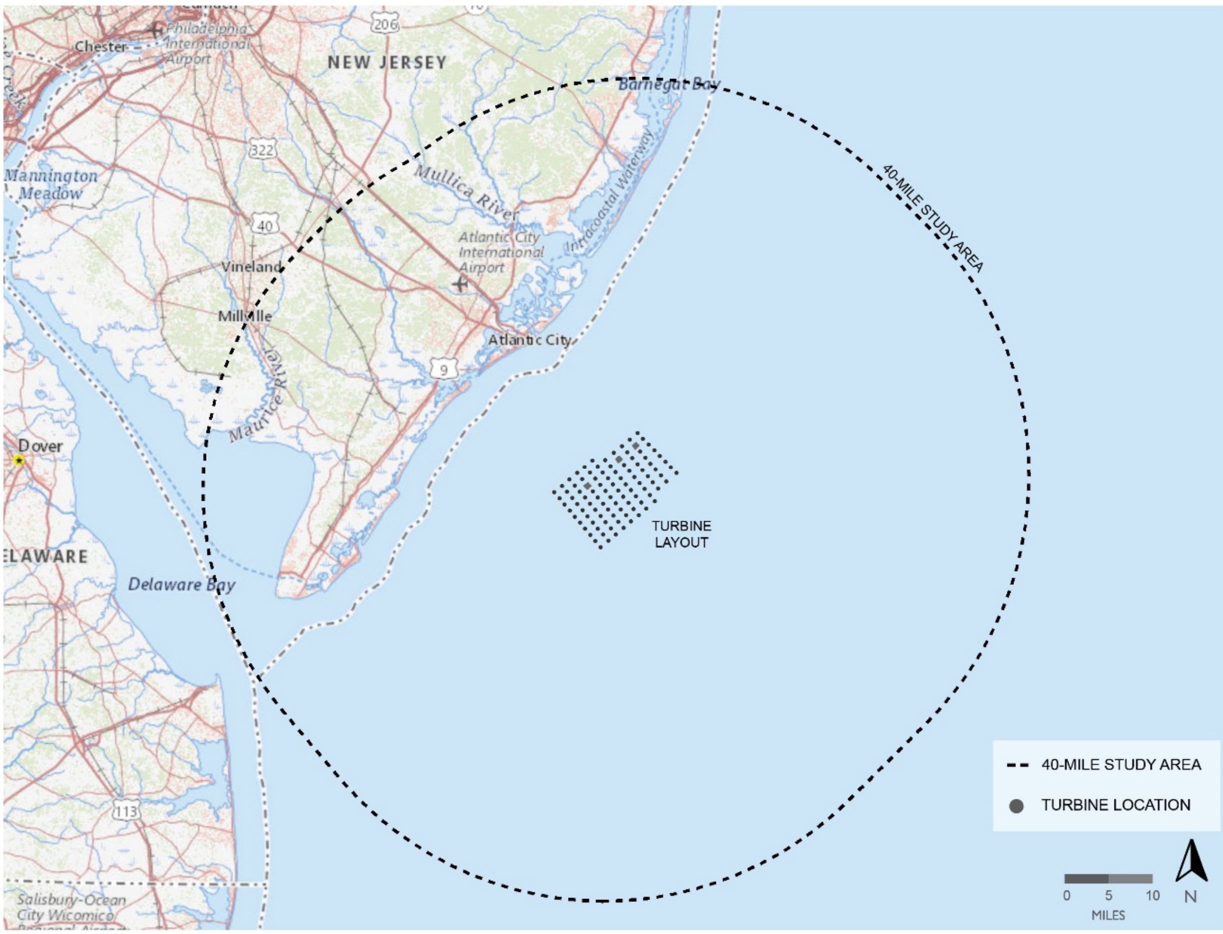

Figure 5.1 - Offshore Turbine Layout in Relation to Study Area.

5.1.2. Onshore Infrastructure Study Areas

The visual assessment study area for the export cable route options extends one-quarter mile from the centerline of the proposed routes, where relatively small changes to the landscape might be noticeable. Visual changes to the landscape resulting from the installation of underground cables, splice boxes, or other infrastructure, may include removal of trees and other vegetation, or changes to existing site features.

The study area for the onshore substations includes the land within a one-mile radius around the boundaries of the BL England Substation and the Oyster Creek Substation. This distance was based on field evaluations and considered the height and character of the substation components (buildings, transmission structures, firewalls, and lightning masts), existing conditions in the immediate vicinity of each site, existing vegetation that could screen project components, and land use patterns in the area surrounding the sites. BL England's proximity to the Great Egg Harbor River may result in visibility from the river beyond 1-mile study area. The study area boundary for both the aboveground and underground onshore infrastructure components for Oyster Creek and BL England is depicted in **Figure 5.2** and **Figure 5.3** respectively. See COP Appendix U for detailed plans of the onshore substations.

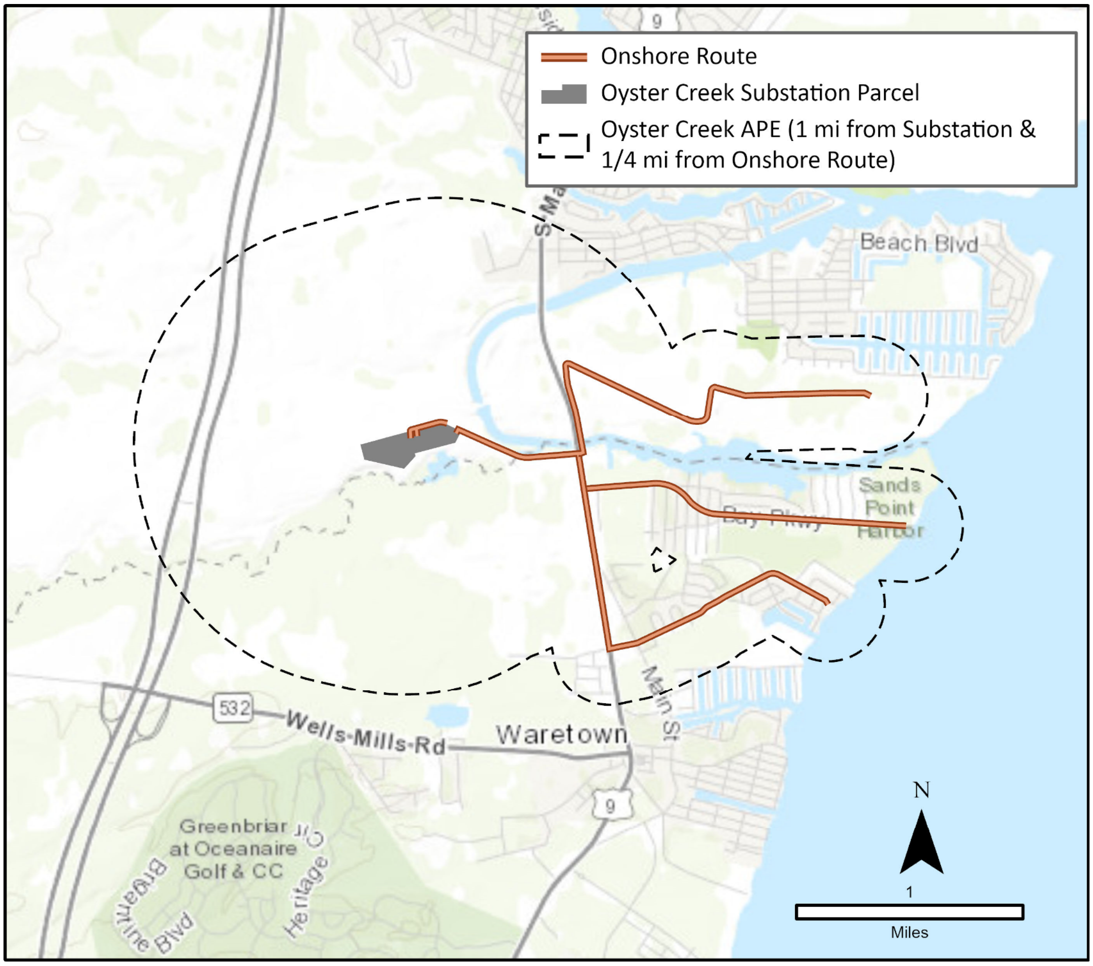

Figure 5.2 - Oyster Creek Onshore Study Area.

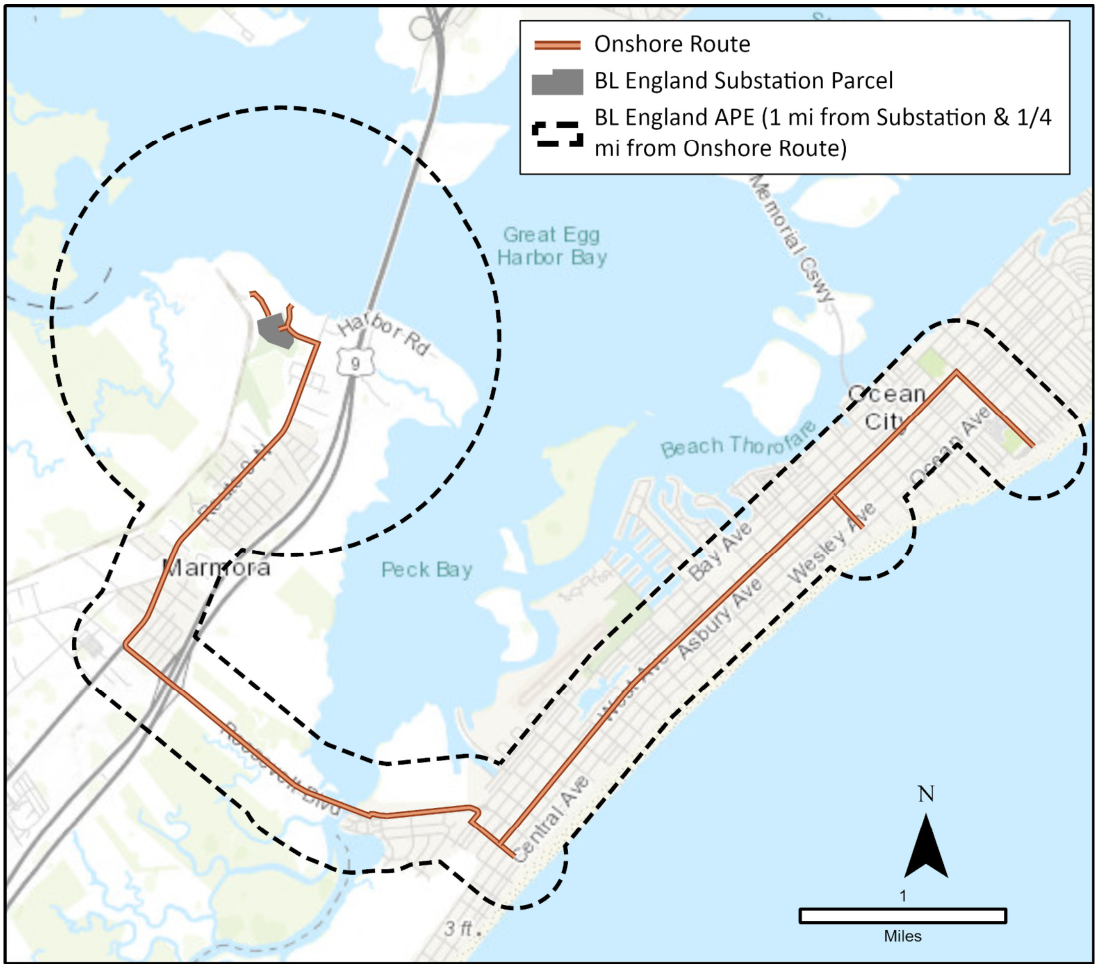

Figure 5.3 - BL England Onshore Study Area.

5.2. Computer-Based Viewshed Analysis

A computer-based viewshed analysis examines potential visibility of offshore and onshore Project components using topography and surface models of the study area landscape. The analysis is a predictive screening tool used to identify areas where Project components may be potentially visible.

The analysis relied on a Digital Terrain Model (DTM) to represent topography (i.e., bare earth conditions), as well as a Digital Surface Model (DSM) to represent vegetation, buildings, and other structures in the landscape. A diagrammatic cross section of the viewshed analysis is provided in **Figure 5.4.** The section depicts how various points in the landscape may or may not have views of an offshore turbine based on the surface modeling and vegetative cover.

The viewshed analysis was conducted using ESRI ArcGIS Pro software. The DTM and DSM used to represent the landscape in the viewshed analysis are derived from LiDAR point cloud data, which was taken from The National Map produced by the U.S. Geological Survey (USGS)[2]. The point cloud data was processed to create

[2] The National Map produced by the U.S. Geological Survey is available here: https://viewer.nationalmap.gov/basic/

10-foot square resolution surface raster models. A viewer height of 5 feet above the terrain was assigned to represent the eye level of a typical viewer in the landscape.

In the viewshed analysis, Project components are counted as ‘visible’ if the computer determines that the line of sight from a single point on the component is unobstructed from a point on the ground and not blocked by topography, vegetation, or buildings. This analysis also accounts for the variable effect of refraction.

There are shortcomings to computer-based viewshed analysis. It does not determine the degree of visibility based on distance, weather, or other atmospheric conditions. As an initial screening tool, it is used to determine the geographic extent of potential visibility, identify visually sensitive resources with potential visibility, and select places to conduct field investigations to further our understanding of Project visibility.

The viewshed analysis was not completed for the open ocean because there is no surface data available for the ocean and it is understood that the offshore Project components will be theoretically visible from all areas of open water within the study area east of the barrier islands.

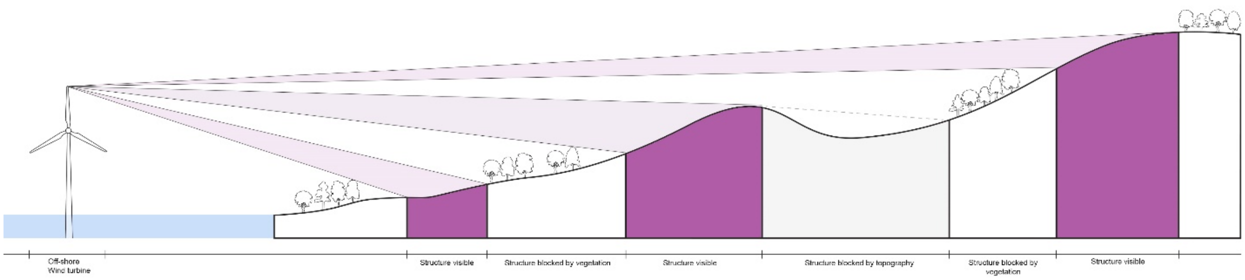

Figure 5.4 - Diagrammatic Viewshed Analysis Cross Section.

5.2.1. Offshore Infrastructure Viewshed Analyses

Three computer-based viewshed analyses were produced for the offshore turbine layout. The three analyses include: 1) potential visibility of turbine blade tips based on a topographic model analysis; 2) potential visibility of the turbine blade tips based on topographic and surface models; and 3) potential visibility of turbine hubs (and the aircraft warning lighting) based on topographic and surface models. The Area of Potential Visual Impact (APVI) is the area in the landscape where turbine hubs may be potentially visible when using both topographic and surface data. This area is identified on **Viewshed Map 3,** located in **VIA Appendix A.**

Topographic Model Viewshed Analysis of Blade Tips. This viewshed analysis modeled the potential visibility of the blade tips based only on the topographic model (DTM). This analysis presents a worst-case scenario, illustrating potential areas of visibility based on bare-earth conditions, i.e., if there were no intervening vegetation or structures in the landscape. The model also assumes that turbine blades would be visible throughout the 40-mile study area. While this may be true in theory, the thinness of the blades, especially the blade tips, makes it very difficult for the average observer to recognize at most distances in the far background (i.e., greater than 15 miles). The motion rotating blades may be visible up to a distance of 25 to 30 miles (Sullivan 2013). Even though this analysis presents an unrealistic representation of potential visibility, it does identify areas where topography alone may block views of the Project. See **Viewshed Map 1**, located in **VIA Appendix A.**

Surface Model Viewshed Analysis of Blade Tips. The second viewshed analysis modeled the potential visibility of the turbine blades based upon both the DTM (topography) and DSM (structures and vegetation). This is a more accurate analysis, as it takes into account features in the landscape beyond topography that would block views of the turbines. Intervening buildings and vegetation in the relatively flat landscape that is characteristic of southern New Jersey play an important role in screening the Project, making the DSM essential to include in the computer-based analysis. See **Viewshed Map 2**, located in **VIA Appendix A.**

Viewshed Analysis of Hubs. The third viewshed analysis modeled the potential visibility of the hubs and the FAA warning lights, based upon both the DTM (topography) and DSM (structures and vegetation). This is the most realistic depiction of potential Project visibility, since the hubs and the aviation lighting will be more visible than the blades, due to the greater mass of the hub and the color contrast of the lighting. Since this the best representation of potential visibility, it is also to referred as the Area of Potential Visual Impact (APVI).

The viewshed data for the turbine hubs and the blade tips was combined into a single map to illustrate the difference between the areas of potential visibility. Areas with potential visibility of the blades but not the turbine hubs (and FAA warning lights) is represented in purple; areas where there is potential visibility of both turbine hubs and blade tips is represented in pink. See **Viewshed Map 3**, located in **VIA Appendix A.**

5.2.2. Onshore Infrastructure Viewshed Analysis

A surface model viewshed analysis was completed for the transmission line structures (up to 115 feet (33.5 m) in height) that make up the transmission to interconnect infrastructure at the Oyster Creek and BL England Substations. The viewshed analysis also includes the lightning masts that would be installed in the substation to protect the electrical equipment. The computer-based viewshed analysis relied on both topographic and surface model viewshed data. See **Viewshed Map 4** and **Viewshed Map 5,** located in **VIA Appendix A**.

There will be up to 27 lightning masts at each substation extending 98 feet (29.9 m) above the ground. The lightning masts are galvanized metal poles extending above the substation infrastructure. While the height of the masts is taller than structures and vegetation in the vicinity of the substations, the thin shape and galvanized color of the masts will make them difficult to detect over long distances.

No computer-based viewshed analyses were completed for the other onshore substation components (i.e., the buildings and electrical infrastructure) because their heights in relation to the surrounding landscapes did not warrant this type of mapping analysis. The height of the tallest electrical infrastructure at BL England and Oyster Creek is 49 feet (14.9 m), which is typically less than the height of adjacent building and surrounding trees, making the computer-based viewshed analysis of these components a less effective tool. Site evaluations and context images were collected to provide a more accurate understanding of the extent of potential visibility.

The underground cable routes and onshore landing points have no aboveground infrastructure that would show up in the viewshed map. It is not possible to develop a computer-based viewshed analysis for underground infrastructure.

5.3. Scenic Resource Identification

The identification of scenic resources that may be affected by the Project is an essential component to all VIAs. Scenic resources are formally designated public places that are visited by the public in part for the observation and enjoyment of natural or cultural visual qualities. Scenic resources include public beaches, conservation areas, scenic byways, historic sites, scenic overlooks, accessible waterbodies, community parks, and other areas identified by national, state, or local governments and organizations as having visual or cultural significance.

The state of New Jersey does not define or regulate scenic resources and does not maintain a specific database of scenic resources. To develop a comprehensive list of resources within the study area, data was collected from a variety of national and state databases. Scenic resources were also identified through a review of state, county, and municipal planning documents, tourist information, and internet searches of important places and communities in the study area.

A total of 1,187 scenic resources were identified in the study area for the offshore Project Components. The onshore inventory (including both underground cable routes and the substation components) identified 2 scenic resources in the Oyster Creek Study Area and 31 scenic resources for the BL England Study Area. All scenic resources were spatially mapped and included in the Scenic Resource Table in **VIA Appendix B**. A summary of the scenic resources is provided in **Section 6.3**. Scenic Resources. A spatial analysis was conducted using ERSI ArcMap software to identify the location of those resources within the APVI.

5.4. Field Investigations

Field investigations were conducted within the offshore and onshore study areas to document and photograph existing conditions. The viewshed maps indicating the APVI served as a guide for places to document potential views of offshore Project components. The majority of the fieldwork was concentrated along the coastline within 40 miles of the Project turbines, where views of Project components would not be obstructed by topography, vegetation, or structures.

TJD&A professionals conducted fieldwork in the summer and fall of 2018 on July 26-27, August 14-16, September 19-20, and December 12-14. Fieldwork was also conducted in winter 2020 during February 5-7. Over the five trips, each two-person team spent a total of 18 days in the field, documenting a total of 364 scenic resources and other publicly accessible locations within the APVI.

5.4.1. Photography

A total of 14,450 photographs (in jpeg format) were taken within the study areas, using a Nikon D750 (24.3-megapixel, full frame camera), a Nikon D5500 (24.2-megapixel), and a Nikon D7100 (24.1-megapixel). Each camera was equipped with a GPS unit (Solameta GMAX GPS Geotagger) to record latitude and longitude, elevation, and bearing for each image.

Two types of photographs were taken during field visits: 1) context photographs to illustrate site conditions and community character in the vicinity of the scenic resource; scenic views from and to the resource; vegetation patterns that may affect Project visibility; and significant structures that contribute to the character of the resource or may affect Project visibility; and 2) visualization photographs used to develop computer-generated images representing views of the Project.

For visualization photographs, the camera was mounted on a tripod and set to record at a “normal” focal length (i.e., equivalent to that found on a 50mm SLR camera), which matches the image seen by the human eye. A series of overlapping photographs at 15º increments were taken at each site to create panoramic views to illustrate land uses and activities in the vicinity of the scenic resource. Panoramas give a more accurate view of how we actually see a landscape. Although a 50mm focal length (normal lens equivalent) mimics what the eye sees, panoramic views are better at documenting the head-moving scanning technique people use when viewing a landscape. Images were often taken from several locations, based on potential Project visibility, accessibility, evidence of public use, and site conditions.

Context photographs are presented and mapped in the study area Photo Collection in **VIA Appendix C** and on the first page of each visualization in **VIA Appendix D**.

5.4.2. Written Documentation

Field notes were digitally documented in the field on iPads using an ESRI Collector application with a customized fieldwork collection table. As each site was documented, the Collector application generated a point and unique identification number for each location. In addition to the latitude/longitude and ID number, the field team also recorded the following:

- Date
- Time
- City
- Scenic Resource
- Viewpoint Type
- Staff Name
- Camera
- Photo numbers collected at the site
- Extent of ocean view
- Potential Project visibility
- Weather conditions
- Ocean conditions
- Landscape Similarity Zone (LSZ)
- Shoreline access
- Beach shape and aspect
- Vegetation
- Land use
- Structures and amenities
- Use and activities observed
- Lighting
- General observation notes

While in the field, teams had access to a digital ESRI map showing their GPS location, the offshore Project Area, scenic resources, municipal boundaries, aerial imagery, and the APVI, which enabled them to identify their location in relation to the Project and nearby scenic resources. Teams were also able to see whether or not they were within the APVI, which allowed them to verify the accuracy of the viewshed mapping.

5.5. Landscape Character Assessment

The 6,769 square-mile study area for the offshore Project components is a vast area composed of a variety of landscape and seascape typologies. The classification of the landscape into smaller subsets according to existing conditions allows for a more detailed visual assessment of the potential impact on the landscape. The study area is classified by broadly defined Physiographic Areas and more specific Landscape Similarity Zones (LSZ). Physiographic Areas are based on major differences in landscape structure that define the physical character of the study area. Four Physiographic Areas have been identified within the study area: Open Ocean, Shoreline, Marsh and Bay, and Inland. See a map of the Physiographic Areas in **Figure 5.5**.

Each Physiographic Area was subdivided into Landscape Similarity Zones (LSZ), areas of similar land use patterns, topography, ecological characteristics, and proximity to the ocean. LSZs provide a more specific description of the existing landscape and provide a framework to systematically analyze potential visual effects throughout the study area. The geographic extent of the LSZs was based on fieldwork observations and interpretation of aerial imagery. The Shoreline and Marsh and Bay Physiographic Areas were subdivided into multiple LSZs in recognition of the wide variety of physical conditions and Project viewing opportunities along and near the coastline. The Open Ocean has unlimited viewing opportunities and thus is a single LSZ. The Inland Physiographic Area, while comprised of a variety of different landscape typologies, has minimal viewing opportunities beyond the Marsh and Bay. A single LSZ was used, with differences in land use patterns, topography, and ecological characteristics noted in the viewpoint descriptions.

A list of the Physiographic Areas and LSZs are provided in **Table 5.1**. A detailed characterization of each LSZ is provided in **Section 6.3**.

Table 5.1 - Landscape Classifications.

Physiographic Areas	Landscape Similarity Zones
Atlantic Ocean	Open Ocean
Shoreline	Jetty/Seawall
	Beachfront
	Coastal Dune
	Boardwalk
	Island Community
Marsh and Bay	Marshland
	Bay/Shoreline
	Bridges
Inland	Mainland

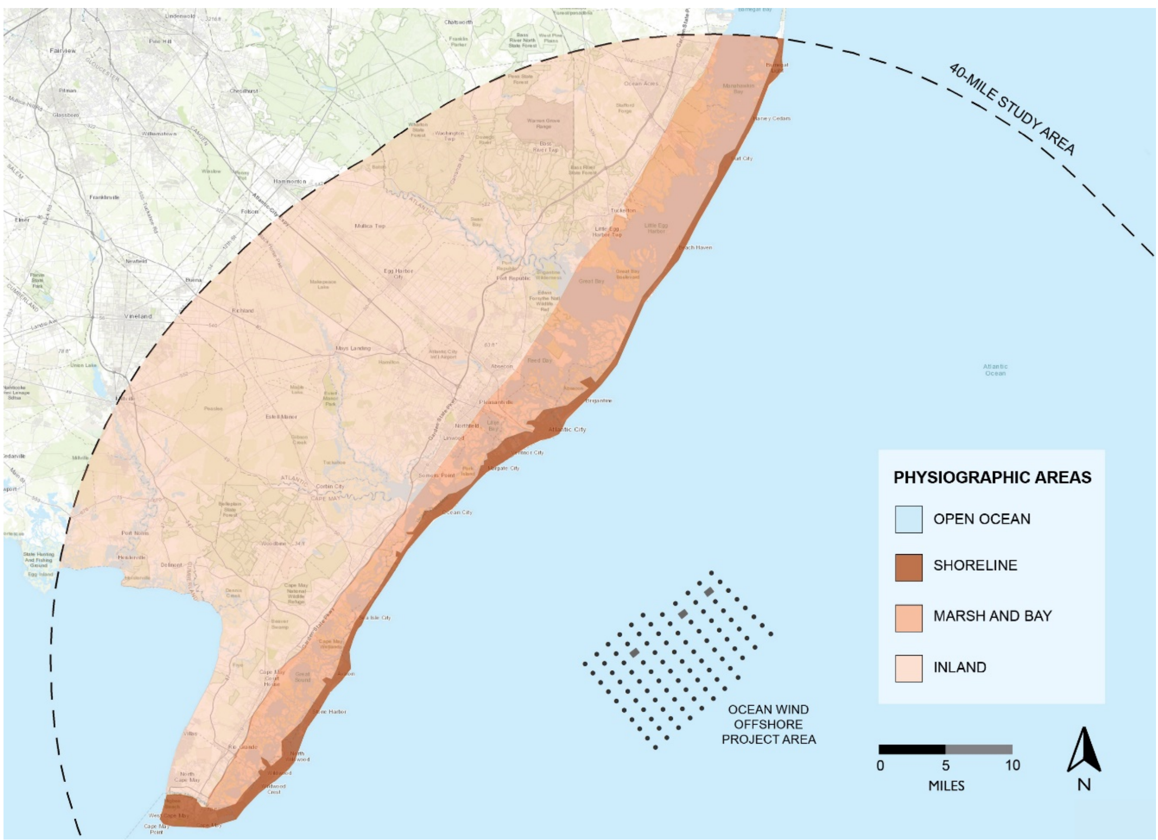

Figure 5.5 - Map of Physiographic Areas.

5.6. User Group Identification

User groups describe the various types of viewers who live, work, visit, or recreate in the study area. The identification of user groups defines the variations in potential sensitivity to visual change. The way in which a person uses the landscape impacts their perception and awareness of their surroundings. The four categories of user groups are recognized: **Year-round Residents, Visitors** (summer residents / tourists), **Through Travelers, and Mariners.**

5.7. Representative Viewpoints

A total of 30 viewpoints were selected to illustrate the visual change to the public landscape anticipated throughout the study area. Two of the 30 viewpoints illustrate the changes anticipated from the construction of the on-shore substations. The selection was made by visual resource specialists from TJD&A following conversations with NJ Office of Historic Preservation and BOEM, a desktop evaluation of scenic resources, and a review of photography collected during fieldwork. Viewpoints were selected to provide representative images from 1) a well-distributed range of locations, especially along the shoreline; 2) varying viewing distances; 3) different viewer elevations, starting at sea level; and 4) all the landscape similarity zones (LSZs) that were identified. A map of the selected representative viewpoints is provided in **Figure 5.6**.

Landscape features within the LSZs can be classified as vantage points, linear features, or scenic areas. The following considerations were made when selecting representative viewpoints to illustrate Project visibility:

- **Vantage Points:** relatively small but easily recognizable areas in the landscape, (e.g., a scenic overlook, wildlife observation platform, or hilltop). A single vantage point may suffice to illustrate the effect of the Project. A vantage point may be a feature within a larger landscape (e.g., a lighthouse within a State park) that attracts visitors by its prominence, location as a destination, or cultural or natural significance.
- **Linear Features:** distinct natural or cultural features where people are able to move in a linear fashion through the landscape at varying paces (e.g., scenic byways, boardwalks, promenades, coastal beaches). Linear resources often offer sequential opportunities to experience the landscape from multiple viewpoints along a shoreline, roadway, or path. Representative viewpoints are generally places where the public is most likely to congregate (e.g., the end of pier, a rest area along a scenic byway, or a beach access point).
- **Scenic Areas:** larger geographic places often known for their visual or cultural qualities (e.g., conservation areas, state or municipal parks, historic districts). Scenic areas usually offer multiple vantage points to experience the landscape. Representative viewpoints may be characteristic of views within the area, or noteworthy views in areas of public concentration (e.g., viewing platforms, trail heads), or historic properties open to the public.

The evaluation of each viewpoint includes an existing photograph and a visualization of the offshore turbines to illustrate the effect of the Project on the seascape/landscape. A total of 30 visualizations are included in the VIA from 28 viewpoints (two viewpoints include both day and night conditions). Three of the 30 visualizations illustrate the potential visibility of FAA aviation warning lights. The evaluation of each viewpoint also includes a context map, site map, narrative description, and context photographs to illustrate the landscape and use patterns around the viewpoint.

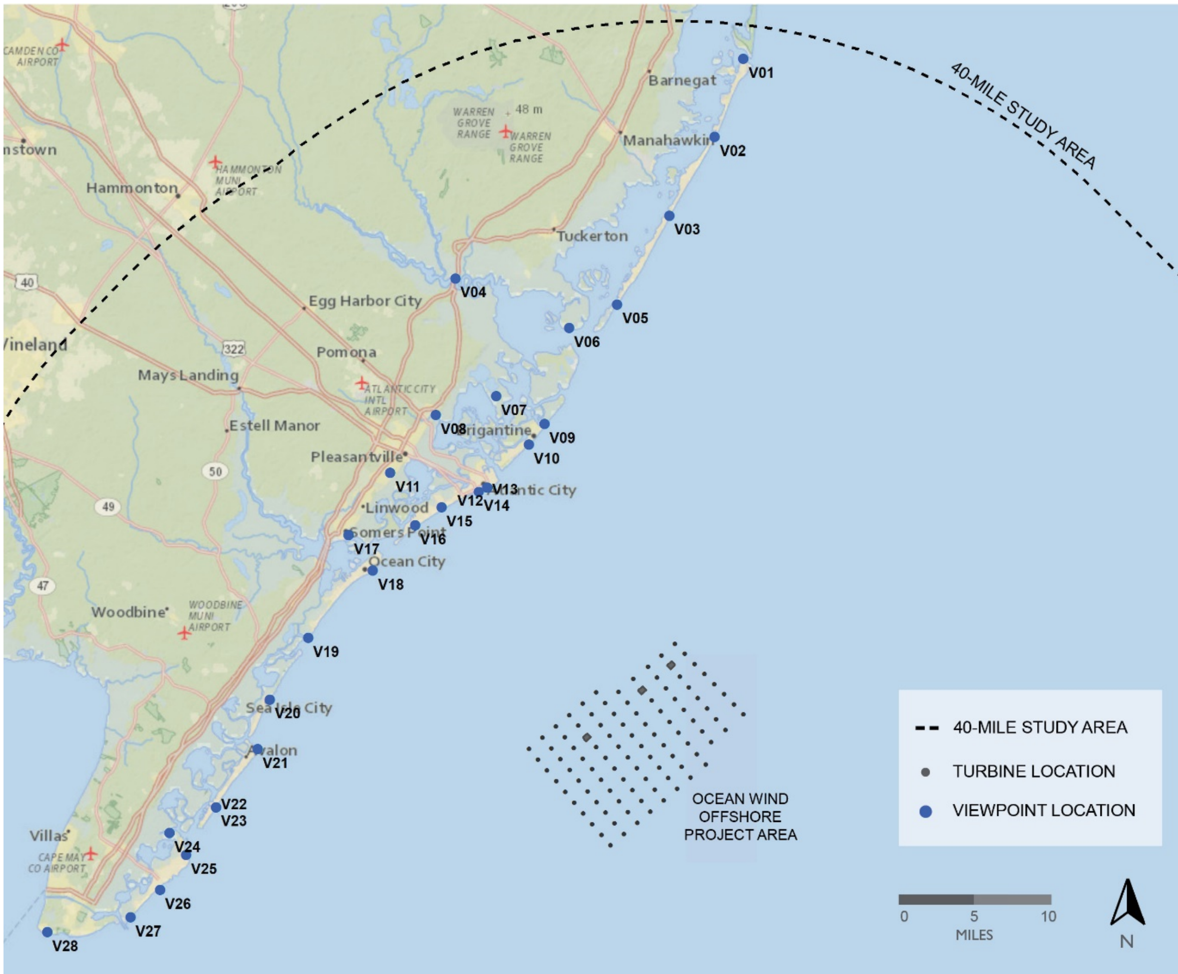

Figure 5.6 - Representative Viewpoints (Visualization Locations) of Offshore Project Area.

5.8. Visualizations

Visualizations (also known as photosimulations) combine photographs of the view from the selected viewpoint with computer-generated models to illustrate how the Project will appear from representative viewpoints and the surrounding landscape. These are accurate representations of proposed future conditions that take into account topography, vegetation, structures/buildings, and other factors to help reviewers understand the visual effect that the Project may have on the landscape/seascape. The following describe the process used to develop the visualizations:

Photography. The camera was set to record at a "normal" focal length (i.e., equivalent to that found on a 50mm SLR camera), which closely matches the image seen by the human eye. Cameras were set at the highest quality level and the largest image size. A series of overlapping photographs at 15º increments were taken at each site to create panoramic views that illustrate actual viewing conditions.

Normal Image. Most of the viewpoints represent the Project in a single image; others require two images to show its horizontal extent. Each photograph was edited to account for lens distortion captured in the original photograph to match the rendered image. Images taken with Nikon D750 (24.3-megapixel, full frame camera) required lens correction for each photograph. Images taken with the Nikon D5500 (24.2-megapixel) did not require lens correction prior to align with the 3D model.

Panoramic Image. In addition to "normal" images, each viewpoint also includes a panoramic visualization of the Project that provides a contextual view of the landscape/seascape and illustrates the full extent of the Project in a single image.

Project Infrastructure Modeling. 3D models of the proposed Project components (i.e., offshore turbines and substations and onshore substations) were developed using Autodesk 3D Studio Max Design software (3ds Max) based on technical specifications provided by Orsted. For each visualization the turbines were positioned to face southwest in accordance with the prevailing winds.[3] The turbine blades were also rotated by the computer to various positions to represent the random blade patterns at any point in time.

Prevailing winds in this part of New Jersey are from the southwest. This means that viewpoints southwest of the project area will show a full frontal view of the blades, while the areas to the northwest will show the turbines with the blades in side profile.

Surface Modeling. The digital surface model (DSM) of the landscape was developed using LiDAR point cloud data taken from The National Map produced by the U.S. Geological Survey (USGS)[4]. The point cloud data was processed in ArcView to create surface models with 3-foot resolution. LiDAR data is limited to land and waterbodies west of the ocean shoreline; there is no LiDAR data for the open ocean. Because the Project is located at considerable distance from the mainland, curvature of the earth was taken into account to determine how much of the turbines and substations would be visible above the horizon from each of the viewpoints. Curvature of the earth was included in the development of the 3D computer surface modeling. Refraction was not accounted for in the development of the visualizations because it is variable phenomenon, dependent upon optical conditions, temperature, and barometric pressure.

Model-Image Alignment. The photographs used for the visualizations were aligned to the 'camera view' in the 3D computer-generated model. The *location* coordinates of each photograph were set to the location coordinates recorded by the camera's GPS device. The 'camera view' was set using the *focal length* of lens used in the original photograph (e.g., 50mm for the Nikon D750). The *camera height* was aligned by adding five feet to the digital surface terrain (to reflect the height of camera mounted on the tripod). The *view direction* or bearings was set to match the existing photograph by using vertical and horizontal control points visible in both the image and the aerial photographs. For example, the edge of recognizable landscape features (e.g., fences, life-guard stands) in the photograph were geolocated and modeled to accurately align the bearing of the photograph with the 3D model. The alignment was done in both GoogleEarth Pro and 3ds Max to ensure maximum accuracy and quality control.

Rendering. The Project components were rendered in 3ds Max, which takes into account the surface materials of the turbines and substations, sun position and intensity, day of the year, time of day, weather conditions, distance from the observer, and other variables that may affect the appearance and visibility of the Project.

Image merging. The rendered image of the Project was overlaid with the existing photograph in Adobe Photoshop and blended to create the final visualization. The final editing removed turbines or portion of turbines where buildings, vegetation, or other features in the landscape would block the view. In addition, the portions of turbines that are not visible below the horizon line (usually the waterline) due to curvature of the

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[3] Wind rose data collected during the times of fieldwork: https://www.climate.gov/maps-data/dataset/wind-roses-charts-and-tabular-data

[4] USGS National Map: https://viewer.nationalmap.gov/basic/

earth were removed. Minor adjustments were also made to create a highly realistic image that accurately represents Project visibility.

Lighting. Lights were represented on the turbines and substations in accordance with the lighting specifications identified by the FAA, BOEM, and the US Coast Guard. The Project is proposing to use an Aircraft Detection and Lighting System on the turbines, which would only activate the lights if an approaching aircraft was detected by the radar system. Thus, the lighting effects from the Project, as illustrated in the visualizations, should be considered worst-case scenarios.

Viewing Distance. When printed on 11”x17” inch paper, the size of a single “normal” image is 9.3" by 13.9" inches. The viewer should hold this image approximately 21 inches from the eye to replicate actual view. When viewing the normal image (i.e., not the panoramic image) at its full extent on a digital device, the reviewer’s eye should be back from the screen approximately 1.5 times the width of the image. For example, if the visualization measures 10 inches in width, the eye should be approximately 15 inches from the screen.

5.9. Cross Sectional Analysis

Representative cross sections were developed to demonstrate the theoretical vertical extent of turbine visibility of both the nearest and furthest turbines. The cross sections show the impact of earth curvature, viewer elevation, and intervening surface building and vegetation. They do not demonstrate the effect that visual acuity or atmospheric conditions would have on visibility.

The cross sections were developing using earth curvature dimensions and the Digital Surface Model (DTM) to represent surface elements (vegetation and buildings). Three cross sections are provided to illustrate the relationship between the computer-based viewshed analysis and the visualizations from the representative viewpoints.

5.10. Individual Site Assessments

Individual site assessments provide a representative sample of the Project’s visual effect on the seascape/landscape within the APVI. Each assessment is essentially a VIA for a specific location in the landscape (**VIA Appendix E**). The 28 assessments, corresponding to the 28 representative views, identify and describe the range of potential visual effects throughout the APVI. The individual assessments provide the basis for the description of the overall visual impact on LSZs and the user groups who may be affected.

5.10.1. Assessment Process

Individual site assessments were conducted by a professional review panel for each representative viewpoint. This assessment follows the process identified in **Figure 5.7**. Each assessment examined existing conditions in the vicinity of the viewpoint (documented through narrative and photography) and the proposed visual change (as determined by the visualizations) from the viewpoint to determine visual impact on the seascape/landscape and its viewers.

This process qualitatively assessed the *Sensitivity to Change* and the *Magnitude of Landscape Effects* to determine the visual impact at each representative viewpoint. This evaluation was completed using a series of four qualitative and highly descriptive matrices.

The *Sensitivity to Change* assessment was based on an evaluation of the landscape’s capacity to absorb change and the sensitivity of the viewers. This portion of the assessment based on the documentation of existing conditions, research into the site, and the physical experience of being at the site.

The *Magnitude of Landscape Effects* was based on an evaluation of the physical factors of the Project in the landscape and the Project's compatibility with the landscape/seascape. This portion of the assessment was based on the visualization completed for the viewpoint.

The qualitative assessments from each matrix were used to arrive at a *Summary of Visual of Effect*, which is a summary assessment for each viewpoint.

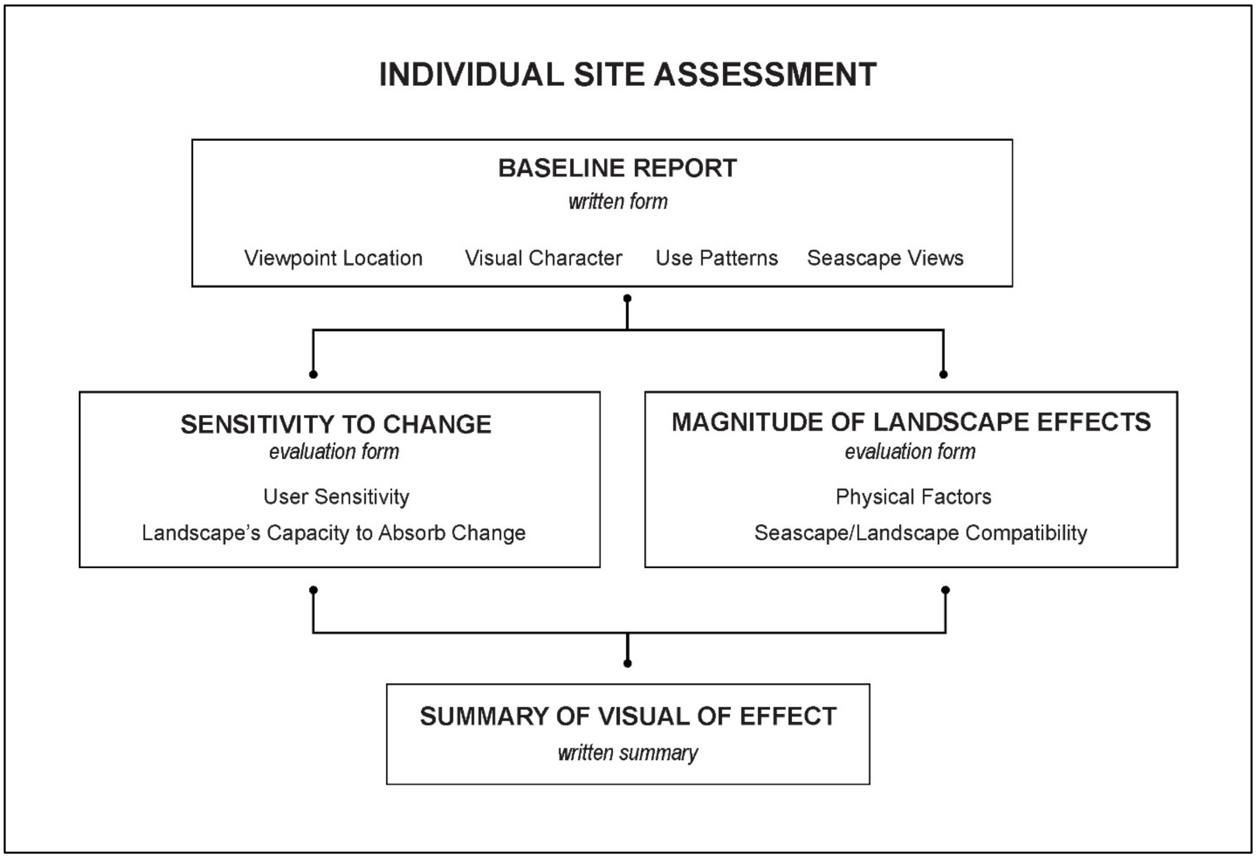

Figure 5.7 - Individual Site Assessment Methodology.

5.10.2. Review Panel

The individual site assessment process was conducted by a professional review panel made of visual resource professionals with experience in conducting visual impact assessments for large infrastructure Projects. All reviewers are licensed landscape architects experienced in review panels and in preparing VIAs for other large infrastructure projects (see resumes of the reviewers in **VIA Appendix F**). Each reviewer independently completed an individual site assessment for the representative viewpoints. Upon completion of the independent assessments, the team met to discuss the assessment ratings in both the *Sensitivity to Change* and *Magnitude of Landscape Effects* matrices. The review panel discussed differences in the independent matrices and collectively arrived at findings for the components in each matrix. The review panel discussed the assessment and collectively arrived at a S*ummary of Visual Effect* for each viewpoint, using the material provided in baseline report, visualizations, and evaluation matrices.

5.10.3. Review Materials

Each individual site assessment was based on a thorough review of the following components:

- **Visualization Document.** Location map, context images, photograph of existing conditions, computer-generated visualization of Project, technical data, and a description of Project visibility. All visualization documents are included in **VIA Appendix D**.
- **Baseline Report.** A description of the viewpoint location, the visual character of the area surrounding the viewpoint, and use patterns for those who may have a view of the Project from the viewpoint. The criteria in each Baseline Report is shown in **Table 5.2.**
- **Additional Context Images**. Additional context images from each viewpoint were used. The study area Photo Collection are included in **VIA Appendix C**.

Table 5.2 - Baseline Report Criteria.

Viewpoint Location
Field ID #
Municipality / County
Location Description
Physiographic Area
Landscape Similarity Zone (LSZ)
Scenic Resources
Visual Character
Vegetation
Land Use
Topography
Site Infrastructure
Use Patterns
Types of Activities
Extent of Use
Duration of Use
Seascape Views
Ocean view (in degrees)
Contextual Features

Using the review material described above, individual site assessments were conducted using the matrices provided in **Table 5.3** through **Table 5.6**. The qualitative assessments from each matrix were used to develop a summary assessment for each viewpoint.

5.10.4. Sensitivity to Change

The *Sensitivity to Change* analysis uses matrices to evaluate the *Landscape's Capacity to Absorb Change* (see **Table 5.3**) and *User Sensitivity* (see **Table 5.4**). Viewpoints with a low capacity to absorb change and high user sensitivity are considered most sensitive to visual change. Likewise, viewpoints with a high capacity to absorb change and low user sensitivity are considered least sensitive to visual change.

- **Landscape's Capacity to Absorb Change**. High quality landscapes that may be unique, rare, or visually interesting may have a lower capacity to absorb visual change than landscapes that are heavily developed, very common, or utilitarian. The indicators of a landscape's ability to absorb change include shoreline complexity, topographic features, expanse of view, landscape distinctiveness, natural patterns, and development patterns.
- **User Sensitivity**. Viewpoints from well-known scenic resources with a focus on recreation/scenic uses may have a greater sensitivity to visual change than viewpoints with no scenic resource designation, heavy commercial/industrial use, or no scenic/recreational opportunities. The indicators of user sensitivity include scenic resource value, primary uses, value of public ocean view, use level, visitor expectations, duration of view, and viewer elevation.

5.10.5. Magnitude of Landscape Effects

The *Project Visibility* summarizes the physical factors that influence Project visibility and the potential effect they may have on its compatibility with the seascape/landscape.

- **Physical Factors Affecting Visibility**. The matrix presented in Table 5.5 is based upon measurable physical factors that contribute to Project visibility: distance to the nearest turbine, Vertical Field of View (apparent height), visual obstructions, approximate percentage of turbines visible, Horizontal Field of View (HFOV) covered by the Project, and the percent of water views affected by the Project. This data is used to inform the evaluation of Seascape/Landscape Compatibility.

  In addition to these measurable factors, visual contrast between turbine components and their surroundings is an important element in determining visibility. The FAA requires that turbines be painted either white or a specific shade of light gray, since these colors have been shown to be most effective in providing the level of contrast needed for safety. "The recommended markings and lighting of these structures (wind turbines) is intended to provide day and night conspicuity and to assist pilots in identifying and avoiding these obstacles" (FAA 2015). Color contrast will change – and will increase or decrease visibility – depending upon many of the factors described in Table 5.5. Noticeable wind turbine contrast will be generally greatest under bright sun / clear blue-sky conditions. At the other extreme, the combination of distance, faded lighting, and atmospheric haze or other weather phenomenon can make the level of contrast almost inconsequential, rendering the turbines difficult to see.

- **Seascape/Landscape Compatibility**. The second part of the matrix provides an evaluation of how dominant the Project will appear in the seascape/landscape, based upon Project visibility and the degree of contrast (in form, line, color, and texture) anticipated with the surrounding seascape/landscape. This determination was completed using the visualizations for each of the viewpoints. At one end of the spectrum where the Project is dominant, the turbines would have a high degree of contrast and low compatibility with the existing seascape/landscape. At the other end of the spectrum where the Project is faint, the turbines would have a low degree of contrast and high compatibility with the existing seascape/landscape. The descriptive language in **Table 5.6** is taken directly from the Cape Cod Commission's *Technical Bulletin #12 – 001 Visual Impact Assessment (VIA) Methodology for Offshore Development*, published May 10, 2012.

Table 5.3 - Landscape's Capacity to Absorb Change Matrix.

LANDSCAPE'S CAPACITY TO ABSORB CHANGE					
	HIGH	MODERATE - HIGH	MODERATE	LOW - MODERATE	LOW
Shoreline or Landform	Very simple/ straight shoreline or landform.	Simple shoreline or landform.	Moderately complex shoreline or landform.	Complex shoreline or landform.	Highly complex shoreline or landform.
Visible Topography	Flat. No variation in elevation, such as a beach, marsh, fields, or open water.	Slight variation in elevation, such as low-lying dunes or small hills. (5-10 feet).	Some elevation variation, such as medium sized dunes, moderate hills (10-20 feet).	Moderate elevation variation, such as very prominent dunes or bluffs (20-40 feet).	Significant elevation changes, such as steep hills, visible mountains (40+ feet).
Ocean or Marshland View	Little or no view of ocean, bay, or marshland.	Limited view of ocean, bay, or marshland (vista < 90°).	Moderate view of ocean, bay, or marshland (vista 90°-180°).	Extensive view of ocean, bay, or marshland (vista approx. 180°).	Expansive view of ocean, bay, or marshland (vista >180°).
Landscape Distinctiveness	Insignificant: indistinct landscape character. May detract from character of landscape.	Common: commonly found landscape character. A landscape of local importance.	Noteworthy: some-what common landscape character. A landscape of regional importance.	Distinctive: unusual, somewhat distinctive landscape character. A landscape of state-wide importance.	Rare: very unusual, unique, or distinctive landscape character. A landscape of national importance.
Natural Patterns	Few or no natural areas. Highly developed. Man-made structures dominate the landscape.	Small natural or vegetated areas of local significance. May include highly manicured landscapes or small parks. Man-made structures are co-dominant in the landscape.	Moderately sized natural area of regional significance. May include beach and dunes. Man-made structures are widespread but not dominant in the landscape.	Large natural area that is not remote or isolated. State-wide conservation significance. Man-made structures are limited and scattered.	Remote or isolated natural area. Conservation area of national significance. Minimal evidence of man-made development.
Development Patterns	Heavily developed or industrial/commercial development pattern. Large-scale infrastructure or structures may be common or dominant.	Commercial or suburban development patterns. Moderate-scale infrastructure may be common and co-dominant.	Residential and commercial areas of local importance. Moderate scale buildings and infrastructure visible but not dominant. Development may be visible in midground.	Residential villages and downtowns, properties of state or regional importance. May include identified or eligible historic properties. Large-scale infrastructure, if present, is limited and scattered. Development may be visible in background.	High quality-built environment. May include historic properties or districts on the NRHP. Large scale infrastructure is inconspicuous or absent. Development may not be visible.

Table 5.4 – User Sensitivity Matrix.

USER SENSITIVITY					
	LOW	LOW - MODERATE	MODERATE	MODERATE - HIGH	HIGH
Scenic Resource Value	No formal recognition or designation as a scenic resource. No public amenity or recreational resource.	Public sites that may be identified in guidebooks but have no formal designation as a scenic resource.	Site with local or regional recognition / ownership, e.g., local park, central downtown, community resource venue, local historic site, local conservation land.	Site with state recognition / ownership, e.g., State Park, State Recreation Area, Wildlife Management Area, or site identified or eligible for the NHRP or SRHP.	Site with national recognition / ownership: e.g., National Park, National Wildlife Refuge. Sites on the NHRP that derive significance from landscape setting.
Primary Use	No recreational activity. Heavy commercial or industrial use. Transportation may be primary use.	Minimal recreational activity. Commercial or industrial use is common.	Recreational activity is present with some commercial or residential use. Recreation is not related to water or shoreline. May include amusement rides, shopping areas.	Recreational activity is predominant the use. Recreation is not directly tied to water or shoreline. May include boardwalks, nature trails, scenic byway.	Water dependent or oriented recreation is the predominant use. May include beaches, jetties, structures and seating oriented toward shoreline.
Value of Public Ocean View	No ocean view due to site location or intervening structures or vegetation.	Users are in the vicinity of the ocean, but the view is unrelated to the activity. May include people on their commute or going about their daily business.	Users are in the vicinity of the beachfront, but the ocean view may be an enhancement but not essential to the activity. May include shoppers, amusement park goers, golfers.	Uses are enhanced by the beachfront, but the ocean view is secondary to the activity. May include running, cycling, fishing.	Uses are dependent on ocean or strongly enhanced by water view. May include beachcombing, bird watching, boating, surfing, swimming, sightseeing.
Use Level	Low usage by residents and visitors.	Low-moderate usage by residents and visitors.	Moderate usage by residents and visitors.	Moderate-high usage by residents and visitors.	High usage by residents and visitors.
Visitor Expectations	Crowded with people, noisy, busy with continuous distractions, many lights.	Other people are constantly present, noticeable noise, frequent distractions, lights.	Other people are noticeably present, some noise, distractions are present.	Some presence of other people, somewhat quiet, some distraction, minimal lights.	Minimal presence of other people or infrastructure, very quiet, little distraction, night sky visible.
Duration of View	At viewpoint for a few seconds. May include brief glimpse of the viewpoint from car or boat.	At viewpoint for up to 30± minutes. May include a stop at an overlook or the top of a light house.	At viewpoint for 30 minutes to 2 hours. May include fishing, restaurant dining, boardwalk activities, walking, or biking.	At viewpoint for 2-4 hours. May include golf, recreational fishing, boating, bird watching.	At viewpoint for >4 hours. May include beach going, commercial fishing
Viewer Elevation	Water level.	Elevated ground plane such as a dune, boardwalk, jetty, or bluff.	2-3 story structure.	3-5 story structure or elevated bridges.	>5 story structures, including a high-rise building or light house.

Table 5.5 - Physical Factors Affecting Visibility Matrix.

PHYSICAL FACTORS AFFECTING VISIBILTY					
	LOW	LOW - MODERATE	MODERATE	MODERATE - HIGH	HIGH
Distance to nearest visible turbine	25+ miles from observer.	Over 20 to 25 miles from observer.	Over 15 to 20 miles from observer.	Over 5 to15 miles from observer.	0 to 5 miles from observer.
Vertical Field of View (apparent arm's length height)	Turbines appear to be less than $^1/_8$ inch above the horizon.	Turbines appear to be approximately $^1/_8$ inch but less than ¼ inch above the horizon.	Turbines appear to be approximately ¼ inch but less than ½ inch above the horizon.	Turbines appear to be approximately ½ inch but less than ¾ of an inch above the horizon.	Turbines appear to be ¾ of an inch or greater above the horizon.
Visual obstructions between the viewpoint and the Project	Visual obstructions make the Project components difficult to identify	Visual obstructions significantly reduce the level of project visibility	Visual obstructions notably reduce the level of project visibility	Visual obstructions slightly reduce the level of project visibility	Unobstructed view of Project components.
Horizontal Field of View	Visible turbines occupy less than 2º of the horizon.	Visible turbines occupy 2º to <15º of the horizon.	Visible turbines occupy 15º to <30º of the horizon.	Visible turbines occupy 30º to <45º of the horizon.	Visible turbines occupy more than 45º of the horizon.

Note: Table 5.5 assumes that a project is observed during daylight hours with good visibility. Distance, horizontal and vertical field of view, and visual obstructions are all fixed, quantifiable factors that will not change the relative visibility of an ocean-based wind development from a particular viewpoint over time. Landscape contrast – which is a measure of how similar or dissimilar an object is relative to its surroundings – will vary throughout an observation cycle, depending primarily upon weather conditions (i.e., fog, haze, rain, snow), lighting conditions (e.g., early morning vs. noontime vs. evening), and the color of the sky or clouds on the horizon. See 5.10.5 – Magnitude of Landscape Effects.

Table 5.6 – Seascape/Landscape Compatibility Matrix

SEASCAPE/LANDSCAPE COMPATIBILITY					
	FAINT	APPARENT	CONSPICUOUS	PROMINENT	DOMINANT
Compatibility Evaluation	Project is 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. 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.	Project is 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 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 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 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 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 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 commands or controls the view, either due to its proximity, massing, width, height, number of structures, duration of view, scale, visibility, or contrast with surrounding seascape. Project causes a very large alteration to the seascape character, or features within the seascape, such that here is a fundamental change from the pre-existing condition.

5.10.6. Summary of Visual Effect

The Summary of Visual Effect for each representative viewpoint is the visual impact statement for each viewpoint. Each summary is based on the evaluations provided in the above matrices. The factors contributing to this evaluation include the capacity of the seascape/landscape to absorb visual change, the sensitivity of the affected users, the physical change to the seascape/landscape, and the compatibility of the Project with the existing seascape/landscape. The evaluation findings are summarized in a statement outlining the overall level of visual effect for each viewpoint.

Overall Impact Assessment

The purpose of the VIA is to identify areas of potential Project visibility and describe the potential change to the scenic quality of the seascape/landscape and the potential effect on the viewing public. To achieve this, the overall assessment of visual impacts includes the impact on the landscape and user groups as well as the geographical extent of visual change. The overall impact assessment is provided in the following sections:

- **Potential Project Visibility.** The overall geographic extent of potential visibility based on the computer-based viewshed analyses provided in **VIA Appendix A**, cross sectional analysis, and a meteorological analysis.
- **Summary of Onshore Infrastructure Visual Effects.** The overall visual impact of the onshore Project components, including a detailed visual assessment of the onshore landfall locations, export cable routes, proposed substation locations, and proposed transmission lines to the interconnection points.
- **Summary of Offshore Infrastructure Visual Effect.** The cumulative findings from the 28 individual site assessments. Each viewpoint is evaluated for compatibility with the existing landscape/seascape. This evaluation is based upon Project visibility and the degree of contrast (in form, line, color, and

texture) anticipated with the surrounding seascape/landscape. This summary includes a discussion on the variability of visual impacts based on viewing distances, visual obstructions, viewer elevation, atmospheric conditions, and time of day.

6. Existing Study Area Character

The existing character of the study area is defined by the physical, ecological, and cultural characteristics of the landscape, as well as various user groups within the study area. The existing conditions are described in terms of Physiographic Areas, Landscape Similarity Zones, Scenic Resources, and User Groups.

6.1. Physiographic Areas

The landscape in the study area includes four distinct Physiographic Areas defined by the Atlantic Ocean and the unique geography of the southern New Jersey shoreline. The characteristic landscape in the southern part of the state is defined by the **open ocean,** relatively narrow **barrier Islands**, 1 to 3 miles of **marshland and open bays**, and the **mainland**. A map of the Physiographic Areas is provided in **Figure 5.5**. The geography and characteristics of these areas are described below:

6.1.1. Atlantic Ocean

The Atlantic Ocean is the offshore water east of the barrier islands commonly used for commercial fishing, open ocean navigation, recreational fishing and boating, sightseeing, and shipping.

6.1.2. Shoreline

The barrier islands that parallel the mainland between the open ocean and the marshland and open bays. This relatively narrow, elongated area is comprised of a variety of landscape types, including wide sand beaches facing the ocean views, vegetated dunes, remnant maritime forest, extensive residential communities, and major urban areas.

6.1.3. Marsh and Bay

The salt marshes and embayment between the barrier island and the mainland. While most of this area is protected, it is actively used for recreational boating and related activities, with some pockets of residential and water-dependent development. An extensive network of bridges and causeways cross over the area, connecting the mainland to the barrier islands.

6.1.4. Inland

The mainland area west of the marsh that is protected by the barrier islands. This area includes a broad range of landscapes, including highway development, suburban and village development, forested conservation, river corridors, and agricultural areas.

6.2. Landscape Similarity Zones

Each Physiographic Area is subdivided into recognizable sub-areas identified as Landscape Similarity Zones (LSZs) that are defined by similarities in topographic features, vegetation, waterbodies, development patterns, and other features. LSZs provide a more specific framework to describe the study area and assess potential visual impacts to scenic resources. The following is a description of each of the ten LSZs accompanied by a representative photograph that is representative it its visual character.

6.2.1. Open Ocean

Physical Description. The saltwater ocean environment is dynamic and constantly changing, based on seasonality, phases of the moon (tidal conditions), weather patterns, and distance to the shoreline. The study area is located entirely within the boundaries of the continental shelf, which is approximately 80 to 90 miles from the New Jersey shoreline.

User activity. Activity on the ocean varies based on proximity to the shoreline. Offshore commercial and recreational fishing occur at greater distances from the shoreline. Commercial shipping traffic to and from Delaware Bay is also present in the study area.

Potential Project visibility. The Project will be seen from most viewpoints over the open ocean, where there are no structures, background vegetation, topography, or other elements to obstruct views or visually compete with the turbines. Many factors will influence Project visibility from the open ocean, including atmospheric conditions, wind, weather, viewing distance, wave action, curvature of the earth, refraction, time of day, and visual acuity of the observer.

Figure 6.1 - Example of Ocean (Corson's Inlet State Park).

6.2.2. Jetty/Seawall

Physical description. A man-made shoreline feature usually constructed from large quarried stone. Jetties extend out into the ocean, generally perpendicular to the shoreline, to create a breakwater or define a navigational channel. Seawalls runs parallel with the natural shoreline and are used extensively to stabilize eroding shorelines. Seawalls and jetties may be located in beachfronts or adjacent to urban development. They may form the edge of a causeway or stabilize the shoreline of conservation areas.

User activity. Many seawalls and jetties have been designed to facilitate public access and attract relatively large numbers of recreational users for fishing, bird watching, and ocean viewing. People are drawn to the jetties and seawalls by the proximity to the ocean, the distinctive views that are provided, and the unique experience of being in direct contact with waves and salt water. Some jetties serve as breakwaters off the beach and are not easily accessible by pedestrians.

Potential Project visibility. Seawalls and jetties on the eastern shoreline are immediately adjacent to the open ocean, generally affording slightly elevated unobstructed views of the Project.

Figure 6.2 - Example of Jetty/Seawall (Avalon, NJ).

6.2.3. Beachfront

Physical description. The sandy interface between the ocean and the coastal dune that is subject to tidal fluctuations, in this case typically ranging from 3 to 5 feet. Permanent development on or over the beachfront is generally limited to fishing piers that extend out over the beach, plus jetties and seawalls (described above). The width of the sand beach varies throughout the study area, with beaches 300 to 500 feet or more commonly found. Tidal fluctuations are generally not a factor in visibility, since the tidal range is relatively low and the observation points are fixed (with the exception of boats in the ocean).

User activity. The miles of sand beaches that line the barrier islands are a defining aesthetic feature of the study area. The wide beaches, defined by dunes, boardwalks, and beachfront communities, coupled with the breaking surf and open ocean views, are a main attraction of the Jersey Shore. Use levels along the shoreline vary greatly, from heavy concentrations at resorts and seasonal communities to undeveloped beaches that are virtually deserted and present a wild and somewhat unexpected side to the occasional visitor. Some beaches are off-limits to visitors, such as the one associated with the Cape May Coast Guard Training Center. Other beaches, such as the one at the north end of Brigantine, require special passes to gain access. Many of the beaches, while publicly accessible, require the purchase of beach tags to gain access during the summer months. Shoreline beach activities include swimming, fishing, beach sitting, beachcombing, walking and running, playing in the sand, and sports such as frisbee and volleyball. Surfing is a popular activity at certain beaches throughout the study area, peaking during summer months, especially after storm events. Sand beaches generally see the lowest use level at night, when most people prefer to walk on the boardwalks.

Potential Project visibility. Open views to the east are focused on the Atlantic Ocean. The majority of the beachfronts have unobstructed 180º views due to the relatively straight shoreline configuration. The occasional piers and jetties providing the only obstructions in the more heavily developed areas. Westerly views from the beaches vary widely, from relatively pristine vegetated sand dunes in conservation areas to highly concentrated development in the towns and cities. Similarly, light levels range from starry darkness in the natural areas to almost daylight conditions in the urban areas, where light pollution obstructs views of the night sky. Project visibility will be a function of distance to the turbines and the location of the viewer relative to the lease area. Nighttime visibility will be greatly influenced by the ambient light levels generated by shorefront development.

Figure 6.3 - Example of a Beachfront (Wildwood, NJ).

6.2.4. Coastal Dune

Physical description: The ridges of wind-deposited sand behind the beachfront, located above the normal high tide area. Dunes are living landscapes that change and shift over time, and vary greatly in height, depth, gradient, and vegetative cover. Most communities within the study area prohibit or strictly limit public access to the dunes to preserve the health of dune vegetation (which may include beach grass, scrub-shrub vegetation, and remnant maritime forests). Sand fences are found in many areas to restrict access, preserve sensitive dune vegetation, and capture wind-blown sand. Dune access includes elevated pathways, boardwalks, ramps and stairs, stabilized gravel, or plastic travel mats. In many areas the 15 to 25-foot dunes and associated vegetation creates a strong visual separation between the ocean and the boardwalks and nearby development areas. Following Hurricane Sandy in 2012, many of New Jersey's coastal communities rebuilt dunes and replanted with dune grass to protect vulnerable development along the barrier islands.

User activity. Activity on the dunes is generally limited to providing access to the shoreline beach. Some pathways have elevated structures with shaded seating areas, allowing the public to experience the waves and the waterfront without walking down to the beach. Dune paths are often designed with offsets to prevent storm surges from following access paths. Changes in pathway alignments result in social places where people stop to observe the water and beach activity.

Potential Project visibility. Visibility is dependent on dune height, vegetation, and observer position located within the dune system. In the back dune, the topography and vegetation in the front dune often block views to the ocean. The tops of the dune provide an elevated viewpoint over the shoreline beach to the ocean. Frontal dunes are higher than the beach, letting observers see farther out to sea. From these elevated locations, Project visibility will be similar to the beachfront. In some instances the height and/or vegetation on the dunes will prevent direct views of the Project from the adjacent boardwalk on the west side of the dune.

Figure 6.4 - Example of a Coastal Dune (Avalon, NJ).

6.2.5. Boardwalk

Physical description. An elevated walkway that runs parallel to the beach and the dune system. Boardwalks may be located immediately adjacent to the shoreline beach (in areas where there is no dune present) or on the backside of the dune system. Boardwalks are typically constructed out of wood, but may also have paved or concrete surfaces. Commercial and residential developments are typically found along the boardwalks and primarily located on the opposite side from the ocean. Boardwalks may be adjacent to high-rise casinos (i.e., Atlantic City), mid-rise motel development (i.e., Wildwood), quiet residential neighborhoods (i.e., Ventnor City), or community amenities (i.e., Avalon). Piers may extend from the boardwalk out over the ocean (piers are considered part of the Boardwalk LSZ). Boardwalks vary in width, elevation, character, lighting, and development patterns. Boardwalks are typically 3-12 feet above adjacent roadways and 20 to 25 feet above mean sea level.

User activity. Boardwalks exhibit a great variety of user activity, depending on adjacent development patterns, time of day, and season of year. In many of the larger communities, wide boardwalks have a carnival atmosphere during the warmer months, with amusement rides, motorized trams, tourist shops, and nighttime activity. In some areas, boardwalks may be a center of larger community functions or a place of amenity for beach goers. In the smaller communities, boardwalks are narrower and serve as waterfront walkways and running/cycling routes for residents. Neighborhoods in the smaller communities often have benches or shade structures where beach accessways (which are typically pedestrian extensions of the public road) join the boardwalks. These are often activity nodes for the neighborhoods, affording residents with an accessible place to socialize and enjoy the view of the ocean.

Potential Project visibility. In locations with moderate to large dune systems (rising 10 to 20± above the beach), the boardwalk is lower than the top of the dune and will have limited, filtered, or no Project visibility. In areas where the boardwalk is located immediately adjacent to the shoreline beach (i.e., with no intermediary dune) or where the tops of the dunes are at the same or lower elevation than the boardwalk, Project visibility is more likely, and will depend on the size and density of vegetation on the dunes. Ambient lighting on the boardwalk and the surrounding development will have a significant effect on nighttime Project visibility. In many of the tourist-oriented areas, intense light levels will make it very difficult to see the FAA aviation warning lights on the Project components.

Figure 6.5 - Example of a Boardwalk (Atlantic City, NJ).

6.2.6. Island Community

Physical description. The developed portion of a barrier island located west of the beachfront, coastal dune, and boardwalk. Development patterns vary in density and character and include single-family residential neighborhoods, commercial corridors, village centers, mid-rise motels, moderate to high-density residences, and high-rise casinos. Most communities are laid out on a rectilinear grid, with residential streets terminating at the boardwalk or coastal dune. While there is typically very little topographic change throughout the study area, there are many elevated structures (mostly private) that provide views of the seascape/landscape to the east. These include hotels, casinos, life-saving stations, upper floors of residential buildings, and lighthouses.

User activity. While there is a large year-round population, many of the communities support a significant influx of seasonal visitors, drawn by the beach and other activities at the Jersey Shore. The gaming and entertainment industry have had a profound effect on use patterns in Atlantic City, and to a lesser extent on nearby communities. Most communities within the study area support daily living for residents and visitors alike, with activities typically found in residential neighborhoods, commercial centers, parks, streets, and open spaces.

Potential Project visibility. While the Island Communities are proximate to the beach, ocean views are largely obstructed or obscured by buildings of various heights, dune systems, and street trees. Potential Project visibility from public viewpoints is dependent upon viewer location relative to the beach and the underlying topography. Locations closer to the immediate shoreline are more likely to have views of the Project than those farther inland. The orientation of the road and sidewalk network in relation to the Project is also a factor in potential visibility, i.e., roadways that are oriented toward the Project are more likely to have views – framed by nearby buildings – especially where the dunes are relatively low. Elevated viewpoints that provide views over the surrounding buildings are more likely to have visibility of the Project.

Figure 6.6 - Example of an Island Community (Ocean City, NJ).

6.2.7. Marshland

Physical description. Marshland is the tidal area between the mainland and barrier islands. The marshland landscape is large, stretching the length of the study area. The saltmarsh landscape is rich in ecological resources, with much of it held in conservation (e.g., National Wildlife Refuges, National Estuarine Research Reserves, State Wildlife Management Areas, State Natural Areas, Coastal Sanctuaries, State Parks, and municipal parks). The extensive marshlands provide a dramatic natural contrast to the intense level of development that borders them. Occasional elevated structures and viewing platforms provide panoramic views over the marsh.

User activity. Access to marshland is limited to boat launches in open water areas, in addition to the causeways and bridges that carry traffic from the barrier islands to the mainland. In a few locations, residential and water-related and water-dependent commercial development has occurred on placed fill within and immediately adjacent to the marsh. Recreational activities within the marsh include bird watching, fishing, hunting, boating, and touring conservation areas.

Potential Project visibility. Most views of the Project from the marshlands will be seen in context with the barrier islands, where development patterns will minimize views of the turbines. Views to the open ocean and the Project components will be possible in several locations where there is a break between the islands.

Figure 6.7 - Example of a Marshland (Edwin B. Forsyth NWA, Galloway, NJ).

6.2.8. Bay/Shoreline

Physical description. The bay/shoreline includes the various tidal bays and sounds and their shoreline that make up the open water between the mainland and barrier islands. The open water is typically accessible from boat launches and the shoreline is accessible from the mainland.

User activity. Recreational user activity includes boating, bird watching, and fishing.

Potential Project visibility. Most views of the Project from the bays and their shoreline will be seen in context with the barrier islands, where development patterns will minimize views of the turbines. Views to the open ocean will be possible from locations where there is a break between the islands.

Figure 6.8 - Example of a Bay/Shoreline (Tuckerton, NJ).

6.2.9. Bridges

Physical description. Bridges are the connective corridors between the mainland and the barrier islands, serving as gateways to each community, and providing views over the barrier islands to the open ocean. Bridges also extend between barrier islands, allowing residents and visitors to access multiple islands without returning to the mainland.

User activity. Motorists are the primary user group on the bridges, which often do not accommodate pedestrian traffic. There are tollbooth operators on some bridges. The majority of the bridges lack sidewalks, although some of the newer structures include bike lanes. The visitor center on the Stainton Memorial Bridge going into Ocean City provides a 360º panorama of the surrounding marshland and barrier islands from an upper level viewing deck. Other amenities associated with this bridge include areas for fishing and wildlife observation.

Potential Project visibility. Project visibility will vary based on location of the viewer and height of the span. The elevated position of many of the bridges allows motorists to see the larger landscape, which may include filtered views of the Project over the development on the barrier islands. While the bridges do provide extensive views of the landscape, seascape, and the Project, the viewing time is relatively short (generally less than a minute) and viewer attention is focused on points of interest in the midground and background.

Figure 6.9 - Example of a Bridge (Route 147 towards Wildwood, NJ).

6.2.10. Inland

Physical description. The inland LSZ, the largest in the study area, is characterized by a variety of land uses and physical features including highways, suburban and village development, forested conservation areas, river corridors, and agricultural areas. Topography is generally flat, which limits the ability to see objects beyond the midground. Notable exceptions are the occasional roadway overpasses, which provide brief elevated viewing opportunities. The Garden State Parkway serves as a north-south spine through the inland portion of the study area. Most of the Parkway is lined by mixed forestland, which limits most views to the foreground distance zone. Occasional open views to the barrier islands occur where the Parkway abuts marshlands to the east. Two major river systems are included in this LSZ: Great Egg Harbor River and Mullica River. Great Egg Harbor River and its many tributaries is a National Park Service-designated Wild and Scenic River. At the closest point, this area is located two miles from the open ocean.

User activity. The inland communities are year-round and have less seasonal population fluctuation than the barrier islands. The communities support daily living for residents, with activities typically found in residential neighborhoods, commercial centers, parks, streets, and open spaces.

Potential Project visibility. Project visibility, where it occurs, will be limited to distant background views over the marsh and barrier islands. Noticeable views will primarily occur east of the Garden State Parkway. The further an observer is from the marsh and bay, the less potential there is for Project visibility. Where they are visible, turbines will most often be seen in the context of barrier island development (multi-story buildings, utilities, amusement parks, etc.).

Figure 6.10 - Example of Mainland landscape (Linwood, NJ).

6.3. Scenic Resources

Scenic Resources are locations (vantage points, linear features, or scenic areas) that are accessible to and visited by the general public in part for the use, observation, enjoyment, and appreciation of their natural or cultural scenic qualities. Most of these locations are focused on water resources, i.e., marshlands, rivers, bays, the ocean), which are typically regarded as indicators of scenic quality. These are places where viewers may have a heightened sensitivity to visual change in the landscape or seascape. Scenic Resources include designated conservation areas (e.g., National, State, or regional Parks and Forests; Wildlife Management Areas; National Natural Landmarks; etc.); historic resources (especially those what derive their significance by their proximity to or relationship with their setting); and other resources recognized for their scenic qualities (e.g., Scenic Byways, Wild and Scenic Rivers, lakes, ponds, rivers, and ocean).

Resources were identified through existing State databases and the additional research discussed in **Section 5.3**. A total of 1,187 Scenic Resources were identified within the study area. Viewshed mapping determined that 145 resources were located within the APVI. **Table 6.1** summarizes the scenic resources present in the study area. A complete inventory of scenic resources and corresponding maps are presented in **VIA Appendix B**.

Table 6.1 - Scenic Resources Summary.

Type of Resource	Resources in Study Area	Resources in the APVI
CONSERVATION AREAS		
National Natural Landmarks	2	2
National Wildlife Refuges	2	2
State Parks / State Forests	9	3
State Wildlife Management Areas (WMA)	31	9
State Recreation and Conservation Areas	48	3
Local Park, Conservation, and Recreation Areas	461	79
Historic of Cultural Conservation Areas	26	3
Private Conservation Lands	66	6
HISTORIC RESOURCES		
National Historic Landmarks	3	2
Listed National Register Resources	184	10
Eligible National Register Historic Resources	169	21
Locally Designated Historic Resources	33	1
OTHER RESOURCES		
State Scenic Byways	2	2
National Wild and Scenic Rivers	2	1
Waterbodies	62	0
Cemeteries	87	1
TOTAL	**1,187**	**145**

6.3.1. Conservation Areas

Conservation Areas are publicly accessible places designated by Federal, State, or Local governments and Non-Governmental Organizations in part for their ecological, recreation, and scenic values. The 642 sites identified in the study area were included in the *State of New Jersey Open Space & Preservation Resources Database* and the *National Conservation Easement Database*. Conservation Areas are classified in eight categories based on government designation, ownership, use, or management.

National Natural Landmarks (NNL)

National Natural Landmarks (NNL) are sites designated for the outstanding quality of their biological or geological resources. NNLs are recognized for their value to science, rarity, diversity, and natural condition. The National Park Service administers the NNL program and sites are assigned NNL designation by the U.S. Secretary of the Interior. Lands designated as NNLs are owned by a variety of private and public entities. The National Parks Service works with landowners to promote the conservation and natural heritage of the area.

Two NNLs are located in the study area: the Manahawkin Bottomland Hardwood Forest and the Stone Harbor Bird Sanctuary. The Manahawkin Forest, located in Stafford Township, is a 64-acre state-owned hardwood forest that overlaps with the Manahawkin Wildlife Management Area and the Edwin B. Forsythe NWR. The Stone Harbor Sanctuary, located in Stone Harbor, is a 21-acre municipally owned site managed for bird nesting and habitat. This site has had a great influence in increasing heron populations in southern New Jersey.

National Wildlife Refuges (NWR)

National Wildlife Refuges (NWR) are federal lands and waters designated for the conservation of wildlife, fish, and plant species. These are public lands protected and managed by the U.S. Fish and Wildlife Service. Public access for a variety of outdoor recreational opportunities are allowed and regulated in NWRs. Activities include hunting, fishing, wildlife viewing, interpretation, environmental education, and photography. The two NWRs located in the study area are the Edwin B. Forsythe National Wildlife Refuge and the Cape May National Wildlife Refuge.

State Parks / State Forests

State Parks and State Forests are state-owned conservation areas managed by the New Jersey Department of Parks and Forest, a division of the New Jersey Department of Environmental Protection (NJDEP). These resources are publicly accessible during hours of operation and offer a variety of recreational opportunities for the public. There are four State Parks in the study area: Corson’s Inlet, Barnegat Light House, Cape May Point, and the southern tip of Island Beach State Park at the northern edge of the study area. There are three State Forests in the study area: Wharton, Bass River, and Belleplain.

State Wildlife Management Areas (WMA)

State Wildlife Management Areas (WMAs) are managed by the New Jersey Division of Fish and Wildlife under the NJDEP. While WMAs were established as public lands for hunting and fishing, many have expanded their role in offering other types of recreational opportunities. WMAs play an important role in protecting and enhancing significant fish and wildlife habitat.

The majority of the WMAs in the study area are located in the Marsh and Bay physiographic area, where they protect salt marsh habitats critical for shorebirds, birds, fish, and other species. Examples of WMAs in the study area are the Cape May Coastal Wetland WMA and the Great Bay Boulevard WMA.

State Recreation and Conservation Areas

State Recreation and Conservation Areas are various state lands managed by the New Jersey Department of Parks and Forest (a division of the NJDEP). These areas include state preserves, public beaches, dunes, boat launches, and unnamed undeveloped areas. There are three water access points designated as State Recreation Areas in the study area: Absecon Creek Boat Ramp, Senator Frank S. Farley State Marina, and Spicers Creek Boat Access.

Local Park, Conservation, and Recreation Areas

Local Park, Conservation, and Recreation Areas are places owned and managed by a municipality or county. These are generally publicly accessible and include a wide range of uses, including parks, athletic fields, boat launches, wood lots, and small preserves. Examples include the Oscar E McClinton Waterfront Park in Atlantic City, Brigantine Golf Course and Baypark Marina in Avalon, and Indian Trail Swamp Preserve in Middle Township.

Historic and Cultural Conservation Areas

Historic and Cultural Conservation Areas are lands managed by either the State of New Jersey or a local government entity. These resources include state and local historic sites, educational/interpretive areas, arboretums, museums, and community centers. In the case of a historic site, the conservation area may include the land or property around a historic resource. For example, the Absecon Lighthouse is listed on the National Register of Historic Places. The green space at its base is a Historic and Cultural Conservation Area identified as the Absecon Lighthouse Historic Site.

Private Conservation Lands

Private Conservation Lands are identified in the state database of conservation lands. The properties are owned or easements are held by a variety of Non-Governmental Organizations such as The Nature Conservancy, the New Jersey Conservation Foundation, the New Jersey Audubon Society, and Natural Lands Trust. While the database indicates that many of these lands are publicly accessible, use restrictions and public access status for each site have not been identified in this VIA.

6.3.2. Historic Resources

Historic resources are sites that have been identified for their historic value. Sites may be listed on or eligible for the National Register of Historic Places (NRHP), based on their historic significance in American history, architecture, archeology, engineering, or culture. Historic resources identified in the study area include those in the *Historic Property Features of New Jersey and Historic Districts of New Jersey* databases. Historic resources are classified in the following four categories based on their official designation.

National Historic Landmarks

National Historic Landmarks (NHL) are buildings, sites, structures, objects and districts that have been determined by the U.S. Secretary of the Interior to be nationally significant in American history and culture. Upon designation as an NHL, sites are also listed on the NRHP (if not already listed). There are three National Historic Landmarks in the study area: the Atlantic City Convention Center, the Cape May Historic District, and Lucy the Elephant in Margate City.

National Register of Historic Places (NHRP)

Listed resources may be individual sites or historic districts on the NRHP, which is administered by the National Parks Service. Listed historic sites may derive their historic significance from their place in American history, architecture, archeology, engineering, or culture. NRHP sites in the study area include lighthouses, life-saving stations, village historic districts, municipal buildings, hotels, churches, private clubs, and private homes.

Eligible Historic Resources

This category includes historic properties and districts that have been determined eligible for listing on the NRHP by the New Jersey State Review Board for Historic Places and the New Jersey Office of Historic Preservation and may be approved for listing on the Register in the future. Eligible historic sites included village historic districts, municipal buildings, hotels, churches, private clubs, private homes, and several highway historic districts and bridges.

Locally Designated Historic Resources

Locally Designated Historic Resources are properties and districts that have been designated by individual communities as important historic resources within the municipality. While these sites have not been determined eligible or listed on the NRHP, they are important to the local community as designated local historic landmarks.

In the study area, there are five locally designated historic districts in Tuckerton, all of which overlap with the eligible Tuckerton Historic District.

6.3.3. Other Scenic Resources

There are a variety of other Scenic Resources in the study area, including Scenic Byways, National Wild and Scenic Rivers, other waterbodies, and cemeteries.

State Scenic Byways

Scenic Byways are transportation corridors identified for their scenic, natural, recreational, cultural, or archeological significance and designated by the New Jersey Department of Transportation, which manages the State Scenic Byways program. Each Byway in the state program is guided by a management plan to balance development, conservation, tourism, and economic vitality along the route. The two state scenic byways in the study area are the Pine Barren Scenic Byway (located on a portion of the Garden State Parkway north of Somers Point) and the Bayshore Heritage Scenic Byway (located in the southern portion of the study area on Route 47 to Cape May). Both byways are located in the Mainland physiographic area, away from the immediate shoreline. There are no National Scenic Byways located within the study area.

National Wild and Scenic Rivers

The National Wild and Scenic River program was established to preserve the natural, cultural, and recreation values of free-flowing rivers. Rivers in the program are designated by Congress or by the Secretary of the Interior. National Wild and Scenic Rivers often include multiple tributaries and are designated as either “scenic”, “wild”, or “recreational”. While the federal government generally does not own land along the river corridors, the program acts as a safeguard against water pollution and regulates the treatment of the corridor shorelines.

The study area contains two rivers designated in the Program. The Great Egg Harbor National Wild and Scenic River, centrally located in the study area, is designated as scenic. The Maurice National Wild and Scenic River is on the western edge of the study area. There are approximately 42 miles of this river within the study area, 28.5 miles of which are designated scenic.

Waterbodies

Waterbodies identified in the National Hydrology Database include lakes, ponds, and ocean waters. The largest waterbody in the study area is the Atlantic Ocean, followed by the Intracoastal Waterway between the barrier islands and the mainland. Freshwater lakes and ponds are generally located inland, away from the bays and saltmarshes that characterize the shoreline.

Cemeteries

Cemeteries include those identified in the *Land Use/Land Cover of New Jersey 2012* spatial database. In addition to their primary function as burial grounds, cemeteries often provide communities with open space used for walking, wildlife observation, and other passive recreational pursuits.

6.4. User Groups

User groups describe the various types of viewers who live, work, visit, or recreate in the study area. The identification of user groups defines the variations in potential sensitivity to visual change. The way in which users interact with the landscape impacts their perception and awareness of their surroundings. Four categories of user groups who may be affected by the Project are recognized: **Year-round Residents, Visitors** (seasonal residents / tourists), **Through Travelers, and Mariners.** A description of each user group is provided below, along with a discussion about the general population statistics for each of the three counties included in the study area.

6.4.1. Year-Round Residents

Year-round residents live and work in the study area throughout the majority of the year. They are the ones who most frequently use and interact with the study area – from their homes, roadways, places of employment, and those amenities necessary to their daily lives.

The location and patterns of use by year-round residents vary greatly throughout the study area. The barrier island communities typically have fewer year-round residents than inland communities, which have smaller populations of summer visitors. However, there are some shoreline communities, such as Ocean City and Atlantic City, with substantial year-round populations.

Seascape/landscape viewing, appreciation, and expectation is highly individualized, depending on their place of residence, type of work, commuting pattern, and recreational activities. With the exception of homes facing the ocean, residential properties are typically organized in recognizable neighborhoods with views focused on the immediate surroundings. This user group is likely to experience the seascape/landscape a) from stationary viewpoints over prolonged periods of time from their homes or work; b) while moving through the landscape during commuting or day-to-day travels within the community; and c) during time spent pursuing outdoor recreational activities within the study area.

Year-round residents have the greatest level of familiarity with the landscape as a whole. While residents with properties on the immediate shoreline will have a greater level of sensitivity to visual change, it is likely that all year-round residents are familiar with views of the coastline and will be sensitive to visual change in the seascape/landscape.

6.4.2. Visitors (Seasonal Residents / Tourists)

Visitors to the study area are non-year-round residents and includes tourists, seasonal residents, and vacationers. The barrier island communities typically experience a great influx of people during the summer months, attracted to the Jersey Shore by its unique environment, the beaches, recreational and cultural opportunities, and change in pace. Some may visit the shore for a few days, while others who own or rent homes may stay for the full summer season. Visitors include one-time tourists as well as those who come back to the same place over multiple generations. While there is variation over length of stay and frequency of visitation, the majority of visitors come to the study area between Memorial Day to Labor Day.

This seasonal user group is most likely to participate in outdoor recreational activities such as beachcombing, boating, fishing, walking/hiking, golfing, cycling, surfing, and wildlife viewing. According to the 2016 Cape May County Tourism Report, 93.5% of visitors to Cape May County (at the southern end of the study area) visited the beach.[5] A list of the survey results by activity are listed in **Table 6.2**.

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[5] 2016 Cape May County Tourism Report: Measuring Tourism Growth by Diane Wieland, Director of the Cape May County Department of Tourism. May 5, 2016

Table 6.2 - Cape May County Tourism Survey.

2016 Cape May County Tourism Report – Survey of Visitor	
Activity	**Percentage of Survey Respondents**
Beach	93.5%
Shopping	83.2%
Restaurants/Dining	91.8%
Cultural/Historic	45.9%
Boardwalk	66.4%
Eco/Nature Based	24.8%
Birding	11.3%
Fishing/Boating	28.6%
Golfing	12.4%
Water Sports	27.5%
Wineries	38.9%
Camping	6.4%
Zoo	42.1%
Art exhibits/theater	15.1%
Relaxation	65.9%

As the Tourism Report indicates, visitors are likely to frequent the beaches and boardwalks, conservation areas, and historic sites, i.e., all places where there may be views of the Project. This group is also likely to take advantage of the commercial attractions along the shoreline: carnivals, performances, waterparks, boardwalk activities, and casinos. Views of the landscape may be static or moving, depending on the activity.

Landscape familiarity varies significantly within the user group. A person who spends every summer in a community may have a great sense of familiarity with the seascape/landscape than a one-time tourist. Visitors participating in certain recreational activities (such as swimming, beach strolling, and sightseeing) have a relatively high sensitivity to the aesthetic quality of the landscape. As a visitor, a person is not as focused on the daily routine. They may be more aware of the scenery or the seascape because of the limited time they have to spend in the coastal environment.

6.4.3. Through Travelers

Through travelers are people passing through the study area on their way to destinations outside the study area. Those passing through are more likely to be on a major highway or through road such as the Garden

State Parkway. The immediate shoreline does not receive through-traffic because the road network has limited connectivity to the barrier islands. Local commuters and visitors, who are described above, have different expectations of scenic quality than through travelers.

Through travelers experience the landscape from a moving vehicle, where views are generally limited to the immediate roadway, with occasional openings in vegetation that expose views of the larger landscape. Passengers are more likely to notice the scenery than the driver because they do not have to focus on the task of driving. This user group is typically more focused on the roadways, and not the study area landscape as a whole, and therefore may be less likely to notice or be sensitive to visual change that occurs outside their normal frame of reference (i.e., foreground or midground distance zone).

6.4.4. Offshore Mariners

Offshore mariners include those boating, fishing, sightseeing, or transiting in the Atlantic Ocean. This user group may be offshore for commercial or recreational purposes as part of their daily work, weekend recreation, or passing through on cargo vessels or other large transit ships.

The commercial core of this user group is typically focused on the task at hand, more engaged with their primary activity of fishing or navigation and less concerned with the aesthetic quality of the seascape/ landscape. On the other hand, people on sightseeing boats and cruises are focused on the scenic qualities of the beaches, the ocean, and the visible shoreline development at its edge. While charter fishing boat passengers are focused on the waters in the immediate foreground, being on the open ocean with 360º views certainly enhances the experience.

Sensitivity to visual change in this user group varies. Commercial mariners may be accustomed to the presence of industrial infrastructure around the water and have less sensitivity to visual change. Offshore recreational fishermen may be more likely to consider and appreciate the seascape views. This is the only group with the potential to have foreground views of the Project by electing to navigate out to and through the turbine array. The Block Island Wind Farm in Rhode Island has generated considerable interest from tourists, which has led to charter boat tours to the five-turbine array three miles from the island.

6.4.5. General Population Statistics

The New Jersey shore is home to both year-round communities and receives an influx of visitors, tourists, and residents during the summer months. The following is a review of the seasonal population fluctuations in the three counties included in the study area.

Cape May County. The 2018 year-round population of Cape May County was 95,805, with an estimated summer population of 766,622.[6] In addition to the seasonal and year-round residents, there were an estimated 12.5 million visitors to the county in 2016. Ocean City has the largest number of summer residents. Communities such as Avalon, Stone Harbor, Sea Isle City, and North Wildwood have a summer population that is more than triple the size of the year-round population. Communities with larger year-round populations include Lower, Upper, and Woodbine.

Atlantic County. According to the US Census, the 2017 population of Atlantic County was 269,918. The estimated annual visitor population to Atlantic City alone, is 27 million people.[7] In Atlantic County, 29% of the

[6] Source: "The Official Cape May County 2018 Directory" https://capemaycountynj.gov/DocumentCenter/View/4800/2018-County-Directory Accessed December 6, 2018.

[7] Source: http://www.atlanticcitynj.com/media/fact-sheets/details.aspx?factSheetID=27. Accessed April 17, 2019.

2015 population was seasonal. Longport has the highest percentage of summer residents and Atlantic City has the lowest percentage when compared to the year-round population.

Ocean County. According to the US Census, the 2017 population of Ocean County was 597,943. In Ocean County, 34% of the 2015 population was seasonal. The community with the largest summer population is Long Beach. The seaside communities, including all communities from Long Beach to Barnegat Light, have summer populations more than twice as large as the year-round populations. Mainland communities, such as Tuckerton, have summer populations that make up only a fraction of the year-round population.[8]

7. Potential Visibility of Offshore Infrastructure

Potential project visibility is presented in the form of a) viewshed analyses that show the geographic extent of potential visibility, b) visualizations of representative viewpoints, and c) cross sectional analyses.

7.1. Computer-Based Viewshed Analysis

A computer-based viewshed analysis examines potential onshore visibility of the turbines using topographic and surface models of the study area landscape. The analysis is a predictive screening tool used to identify points and areas where turbines may be visible. It identifies the potential geographic extent of visibility according to a computer analysis. In this type of analysis, turbines are counted as 'visible' if the computer determines that the line of sight from a single point on the component is unobstructed from an observation point five feet above the ground (i.e., equivalent to the eye level of an average person). Computer-based viewshed analysis does not determine the degree of potential visibility based on distance, weather, or other atmospheric conditions. Nor does it determine how many turbines or how much of a turbine would be visible from any particular viewpoint. Because the degree of potential visibility cannot be represented in the viewshed analysis, the analysis maps (provided in **VIA Appendix A**) should not be used in isolation or without the aid of visualizations (provided in **VIA Appendix D**).

Three analyses were conducted for the offshore turbine layout: 1) potential visibility of turbine blade tips based on a topographic model analysis; 2) potential visibility of the turbine blade tips based on topographic and surface models; and 3) potential visibility of turbine hubs (and the FAA warning lights) based on topographic and surface models. **Figure 7.1** demonstrates the three computer-based viewshed analyses for Atlantic City.

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[8] These N.J. shore towns are about to see their populations explode By Stephen Stirling for NJ Advance Media for NJ.com. Originally published May 3, 2018 https://www.nj.com/data/2018/05/these_nj_shore_towns_are_about_to_see_their_populations_explode.html. Accessed on April 18, 2019.

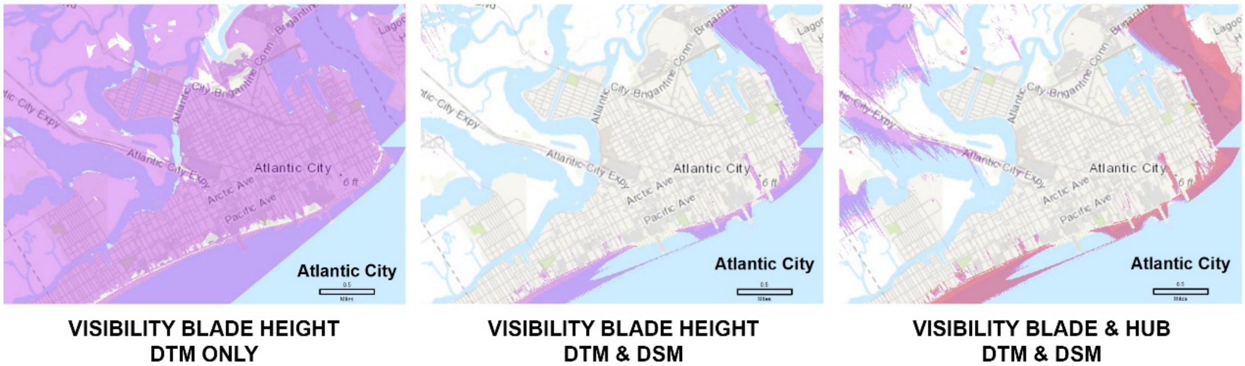


Figure 7.1 - Snapshot of Computer Based Visibility Analyses in Atlantic City.

Available LiDAR data, which primarily covers the landmass within the study area and not the open ocean, was used for the computer-based visibility analysis. The extent of the data is visible on all viewshed maps provided in **VIA Appendix A**. Where the data ends just beyond the ocean shoreline, the map does not show visibility. While the ocean does not appear to have potential visibility in the analysis, it is understood that the Project would be theoretically visible from all points on the open ocean within the 40-mile study area because there are no fixed features on open water that would block visibility.

7.1.1. Topographic Model Viewshed Analysis

The potential visibility of turbine blade tips based on a topographic model analysis presents the worst-case scenario. This analysis is provided in **Viewshed Map 1** in **VIA Appendix A**. This analysis illustrates potential areas of visibility based on bare-earth conditions, without accounting for any intervening vegetation or structures in the landscape. Nor does it account for the limits of human visual acuity; i.e., the human eye will be unable to recognize a turbine blade beyond certain distances. For more information on the impacts of viewing distance, see **Section 4**. While this analysis presents an unrealistic representation of potential visibility, it does identify those areas where topography alone may block views of the Project. This analysis should not be relied on to represent the geographic extent of potential visibility.

7.1.2. Surface Model Viewshed Analyses

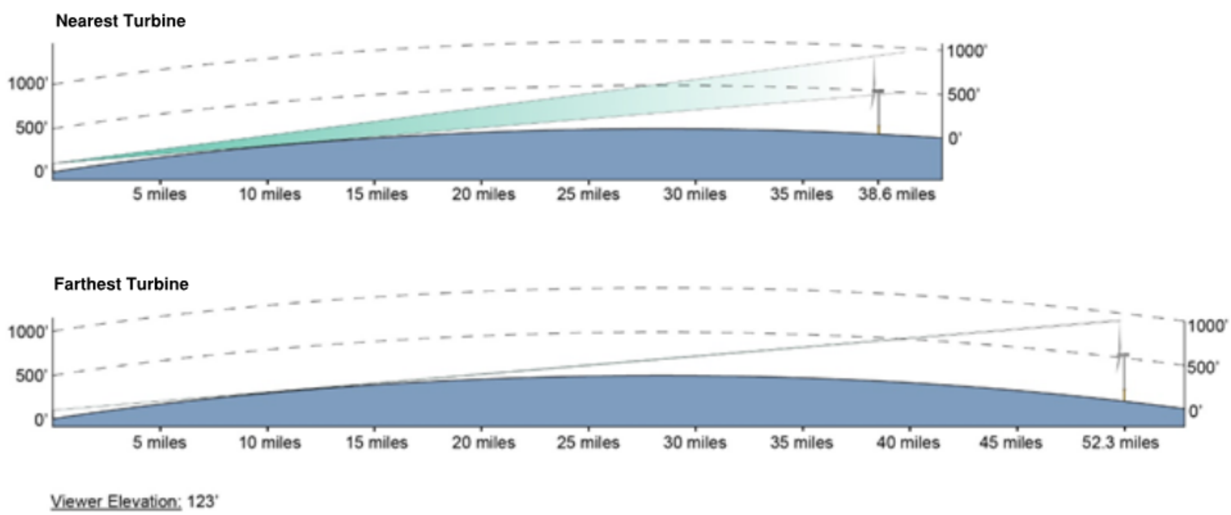
The two analyses were conducted using both the topographic and surface models to determine potential visibility of both turbine hubs (and FAA warning lights) and turbine blade tips. Both analyses are provided in **Viewshed Map 2 and Viewshed Map 3** in **VIA Appendix A**. These analyses are a better representation of the geographic extent of potential visibility because they account for existing vegetation and buildings, as well as topography, that reduce visibility.

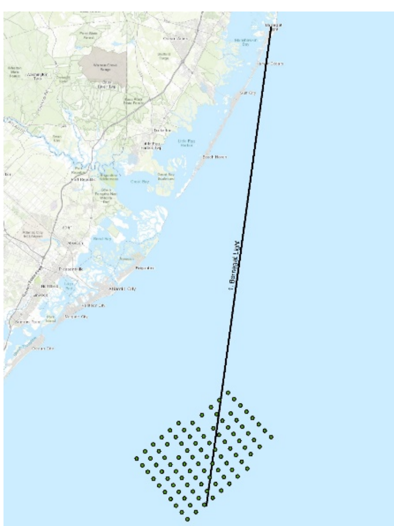
Theoretical hub visibility is generally limited to the Atlantic Ocean, Shoreline, and the Marsh and Bay Physiographic Areas. Within the Inland Physiographic Area, there is some potential visibility in the river landscapes around Great Egg Harbor River and the Mullica River due to the lack of variation in topography and vegetation on open water.

7.2. Cross Sectional Analyses

Cross sectional analyses were completed for three representative viewpoints and presented below in **Figure 7.2**, **Figure 7.3**, and **Figure 7.4**. The cross sections demonstrate the extent of turbine visibility for both the nearest and furthest turbines. They show the effect of earth curvature, viewer elevation, and intervening buildings and vegetation. The cross sections do not demonstrate the effect of visual acuity or atmospheric conditions, which can greatly affect visibility.

Figure 7.2 is a cross section from Barnegat Lighthouse in Barnegat Light, NJ between the nearest and furthest turbines. From this viewpoint, 123’ above sea level, the nearest turbine from the bottom of the hub to the top of the blade would be theoretically visible. The very tip of the blade located furthest from the viewpoint would be theoretically visible from this viewpoint. However, over a distance of approximately 52 miles, the blade tip would not be visible to the human eye.

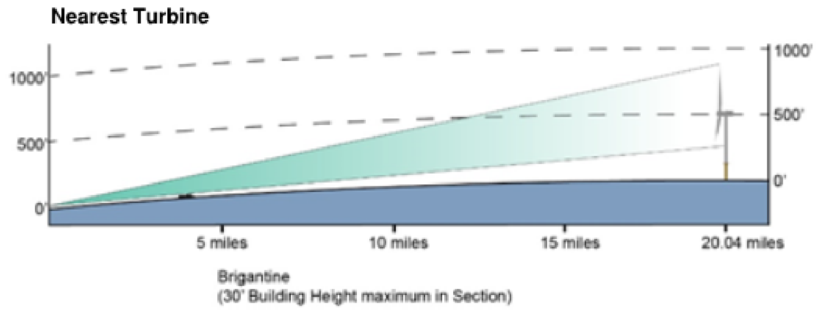


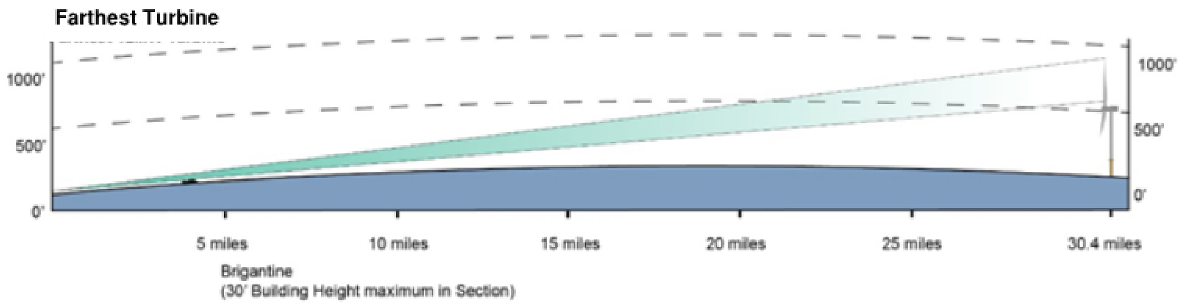


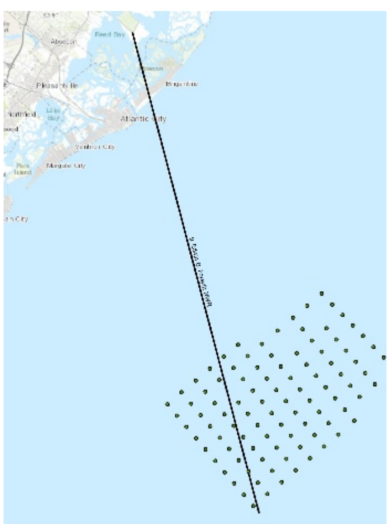
Plan of Cross Section Line from V01 to Furthest Turbine

Figure 7.2 - Cross Section from V01 Barnegat Lighthouse.

Figure 7.3 is a cross section from the Edwin B. Forsyth National Wildlife Refuge in Galloway Township, NJ through to the closest and furthest turbines. The community of Brigantine is located approximately four miles from the viewpoint. The buildings and vegetation on Brigantine partially block the turbines from view. At this viewpoint a portion of the nearest turbine from below the hub to the top of the blade could be visible. The view of the turbine furthest from the viewpoint would only include the very top portion of the blade. See V07 Edwin B. Forsyth National Wildlife Refuge in VIA Appendix D to see how buildings and vegetation in Brigantine affect turbine visibility. The visualization also demonstrates the effect of visual acuity and atmospheric conditions.



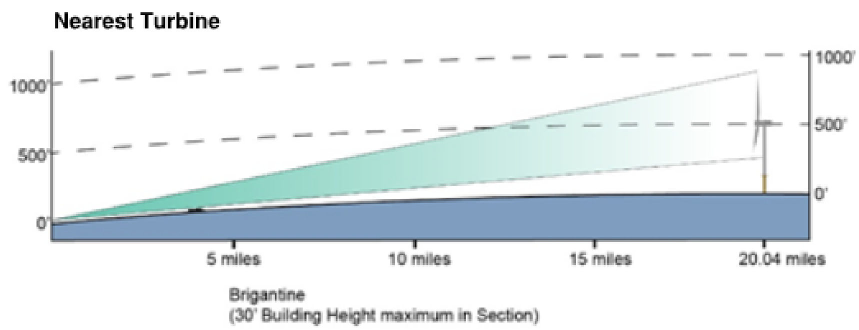


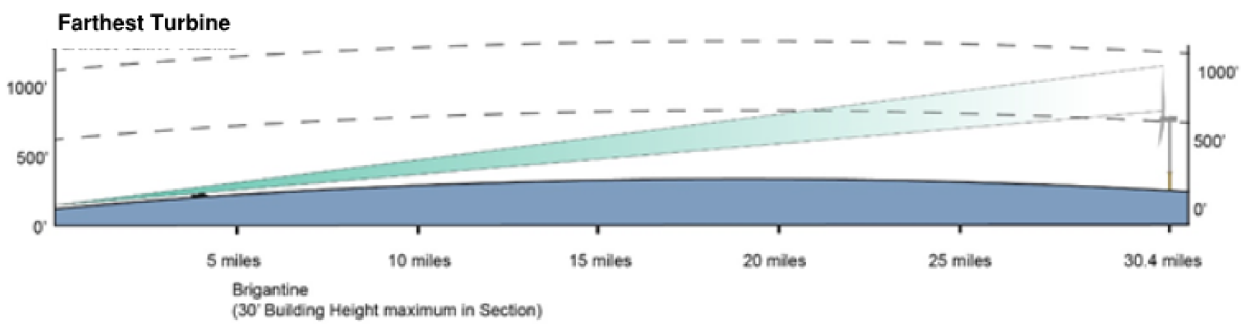


Plan of Cross Section Line from V07 to Furthest Turbine

Figure 7.3 - Cross Section from V07 Edwin B. Forsyth National Wildlife Refuge.

Figure 7.4 is a cross section from the Absecon Boat Launch in Absecon, NJ through to the nearest and furthest turbines. The Atlantic City skyline is approximately 5.5 miles from the viewpoint. The buildings and vegetation in the direct line of site of the closest turbine are approximately 50 feet in height (the high-rise buildings block views of other turbines). From this viewpoint the view of the nearest turbine would extend from the bottom of the hub to the top of the blade. The view of the turbine located furthest from the viewpoint would only include the very top portion of the blade. The cross-section also includes a wind turbine from the Atlantic County Utilities Authority (ACUA) Wind Farm, located approximately 3.5 miles from the viewpoint. The ACUA Wind Farm includes five turbines with hubs 262 feet in height and blade tips 380 feet in height. Even though they are considerably smaller than the proposed turbines, the ACUA turbines would appear more than twice as tall due to their proximity to the observation point. See V08 Absecon Boat Ramp in **VIA Appendix D** to see the impact of visual acuity and atmospheric conditions. The visualization also demonstrates how various building heights in Atlantic City and the ACUA Wind Farm impact turbine visibility.





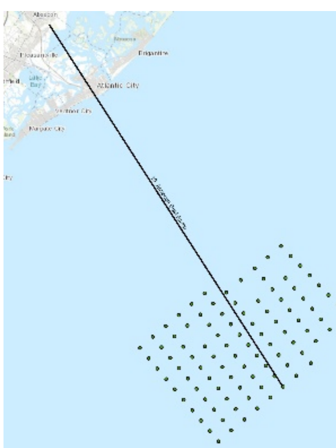

Plan of Cross Section Line from V08 to Furthest Turbine

Figure 7.4 - Cross Section from V08 Absecon Boat Ramp.

7.3. Meteorological Analysis

7.3.1. Northern Atlantic Setting

The climate of the offshore Atlantic Ocean and adjacent land areas is influenced by a number of variables, including the temperatures of the surface waters, water currents, and the winds blowing across the ocean and related waters. Because of the ocean's great capacity for retaining heat, maritime climates are moderate and are generally free of extreme seasonal variations. The oceans are the major source of the atmospheric moisture that is obtained through evaporation. Ocean currents contribute to climatic control by transporting warm and cold waters between regions. Adjacent land areas are affected by the winds that are cooled or warmed when blowing over these currents, while such winds also transport moisture to adjacent land areas. (BOEM, 2007a)

On the northern coastal areas of the Atlantic Ocean (New Jersey to Maine) the most frequent wind directions measured by National Data Buoy Center buoys are from the southwest or south-southwest, but wind directions are relatively uniformly distributed. The average wind speeds are between 12.4–16.2 mph (5.6 and 7.3 m/s). Wind speeds are typically lowest in July at 9.0–12.1 mph (4.0−5.4 m/s) and highest in January at 15.7–20.0 mph (7.0−9.0 m/s) (BOEM, 2007a).

Precipitation in this area of the coast is frequent and abundant but uniformly distributed around the year. Rainfall in the warmer months is usually associated with convective cloud systems that produce showers and thunderstorms. Winter rains and snowfall are associated with the passage of frontal systems through the area. Fog occurs occasionally in cooler months as a result of warm, moist air blowing over cool land or water surfaces. Poorest visibility conditions occur from November through April. During periods of air stagnation, industrial pollution and agricultural burning also can impact visibility. (BOEM, 2007a).

7.3.2. New Jersey Climate Zones

Coastal weather conditions will have a significant impact on Project visibility. A dry clear day with full sun will typically have greater visibility than a day with cloudy skies, precipitation, fog, or haze. While weather conditions may not eliminate visibility altogether, viewing distances beyond 10 miles may be significantly reduced.

The New Jersey State Climatologist divides the state into five distinct climate zones. The study area is within the Coastal Zone, a strip paralleling the coastline approximately 40 miles in width, where continental and oceanic influences battle for dominance on daily to weekly bases. In autumn and early winter, when the ocean is warmer than the land surface, the Coastal Zone experiences warmer temperatures than interior regions of the state. In the spring months, ocean breezes keep temperatures along the coast cooler. Being adjacent to the Atlantic Ocean, with its high heat capacity (compared to land), seasonal temperature fluctuations tend to be more gradual and less prone to extremes (ONJSC).

Sea breezes play a major role in the coastal climate. When the land is warmed by the sun, heated air rises, allowing cooler air at the ocean surface to spread inland. Sea breezes often penetrate 5-10 miles inland, but under more favorable conditions can affect locations 25-40 miles inland. They are most common in spring and summer (ONJSC).

7.3.3. Atlantic City Weather Data

The most appropriate meteorological reporting for use in determining visual range, cloud cover, and wind are stations located at airports. The following information on weather data (NOAA) is based upon records from the

Atlantic City Airport, which is located approximately 9 miles inland from the coastline. Atlantic City (KACY) is the only weather station reporting the necessary meteorological variables that had a continuous period of record. While the ideal location to measure these atmospheric properties would be directly on the coast, KACY provides a reasonable proxy for such a non-existent station, since it is located within the same climate zone as the study area.

Precipitation. Rain or the occasional snow will typically reduce visibility, depending upon the intensity of the event, the size of the rain drops or snowflakes. On average, approximately 10 days/month will have some type of precipitation, with some variability between the seasons as noted in **Table 7.1** below (NOAA).

Table 7.1 - Number of Rainfall Days Per Month (2009-2018).

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Monthly Average/Yr.
2009	10	8	11	12	14	17	8	13	11	10	12	10	11.3
2010	6	13	13	9	6	6	9	5	9	11	8	7	8.5
2011	14	10	8	13	8	9	7	12	12	10	8	11	10.2
2012	11	9	7	7	10	10	7	11	13	10	3	15	9.4
2013	8	15	10	11	9	15	12	10	7	10	8	12	10.6
2014	13	15	11	10	10	6	12	7	10	11	9	16	10.8
2015	11	8	14	10	4	19	10	7	5	7	10	13	9.8
2016	10	13	12	12	13	8	13	7	8	7	8	9	10.0
2017	14	4	10	11	14	10	11	12	6	9	6	11	9.8
2018	10	15	12	12	12	10	12	10	13	11	12	11	11.7
Monthly Average	**10.7**	**11.0**	**10.8**	**10.7**	**10.0**	**11.0**	**10.1**	**9.4**	**9.4**	**9.6**	**8.4**	**11.5**	**10.2**

Sky Cover. Clear days (defined as 0 to 30% cloud cover) can result in brightly lit seascapes, which generate the highest degree of contrast between the turbines and the surrounding sky and ocean. Cloudy days (80 to 100% cloud cover) produce fewer shadows, reducing the overall contrast, which makes distant object more difficult to detect. Cloudy days often create white skies, which will reduce the color contrast of the turbines on the horizon.

KACY reports that 94 days per year have clear sky conditions (26% of the time). Partly cloudy days (40 to 70% cloud cover) occur 111 days per year (30% of the time). Days with cloudy skies occur 160 days per year (44% of the time). There is little variability in sky cover between the seasons, similar to the precipitation records. See **Table 7.2** below (NOAA).

Table 7.2 - Annual and Monthly Sky Cover (mean number of days).

ANNUAL		
Clear (CL)	Partly Cloudy (PC)	Cloudy (CD)
94	111	160

JAN			FEB			MAR			APR			MAY			JUN		
CL	PC	CD	CL	PC	CD	CL	PC	CD	CL	PC	CD	CL	PC	CD	CL	PC	CD
8	8	15	8	7	14	8	8	15	7	9	14	6	11	14	7	12	12
JUL			**AUG**			**SEP**			**OCT**			**NOV**			**DEC**		
CL	PC	CD	CL	PC	CD	CL	PC	CD	CL	PC	CD	CL	PC	CD	CL	PC	CD
7	12	13	8	11	12	10	8	12	11	9	12	8	9	13	8	8	15

Note: Table shows the mean number of days per category, daylight hours only.

Haze and Fog. Of all potential weather conditions, haze and fog may have the greatest impact on potential visibility. Fog is a common condition in ocean landscapes due to the interaction between air and water temperature; the likelihood of fog events is enhanced in locations that are under the meteorological influence of the marine environment (Tardiff, 2007). Specific data on the frequency and timing of fog and haze on the ocean and immediate coastline are not available.

On average haze or fog was recorded approximately 4 days per month (see **Table 7.3)**. When it does occur, it typically does not stay for the duration of the day. On average there are approximately 13 hours per month with recorded fog or haze (see **Table 7.4**). Over the past ten years the months with the highest recorded haze and fog are March, May, and July.

A study on the physical characteristics of fog in the New York City region found that Atlantic City averaged 27 fog events per year, based on records from the Atlantic City Airport from 1977 to 1996. This was considerably higher than the 17 events/year found in locations studied between NYC and Delaware. (Tardiff, 2007).

Table 7.3 - Number of Days Per Month with Recorded Haze or Fog (2009-2018).

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVG
2009	5	0	6	5	8	8	6	9	1	2	4	4	4.83
2010	3	7	4	2	4	5	6	6	2	0	5	5	4.08
2011	6	5	1	1	8	11	12	1	7	4	6	3	5.42
2012	3	3	12	1	8	4	6	1	1	4	5	7	4.58
2013	5	9	6	3	3	3	3	5	0	4	3	5	4.08
2014	8	3	6	3	7	2	1	1	1	1	3	4	3.33
2015	4	4	6	2	8	4	4	0	8	0	3	12	4.58
2016	2	4	5	2	5	3	2	4	0	4	4	2	3.08
2017	5	4	5	5	5	1	3	5	3	3	3	2	3.67
2018	5	4	3	3	10	3	3	4	5	5	3	4	4.33
Average	4.6	4.3	5.4	2.7	6.6	4.4	4.6	3.6	2.8	2.7	3.9	4.8	4.2

Table 7.4 - Number of Hours Per Month with Recorded Haze or Fog (2009-2018).

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Sum
2009	12	0	17	12	26	18	15	16	1	7	5	17	146
2010	7	24	13	8	9	14	24	14	5	0	23	18	159
2011	16	12	1	3	32	56	77	6	25	5	19	12	264
2012	4	7	62	1	21	18	15	3	1	11	16	31	190
2013	23	12	15	6	7	7	13	14	0	18	11	11	137
2014	32	8	12	8	29	7	3	3	1	3	19	7	132
2015	7	7	15	4	30	7	5	0	24	0	9	26	134
2016	5	8	11	2	8	4	2	6	0	7	22	2	77
2017	14	7	10	18	15	1	5	9	11	12	8	6	116
2018	28	13	9	10	36	13	7	5	21	10	8	9	169
Average	14.8	9.8	16.5	7.2	21.3	14.5	16.6	7.6	8.9	7.3	14.0	13.9	**12.7**

Table 7.5 below illustrates a very strong correlation between the presence of fog and haze and the number of hours per year with visibility (less than 10 mi).

Table 7.5 - <10 mi of Visibility with Reported Haze or Fog.

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Average
Hours/year with visibility of <10 mi in Fog or Haze	145	155	261	188	127	132	134	77	116	168	**150**

Fog and haze in the vicinity of the Atlantic airport will typically develop late in the afternoon, continue overnight, and dissipate by early morning. Figure 7.5 below shows the number of hours with recorded haze or fog from 2009 to 2018 by time of day (NOAA).

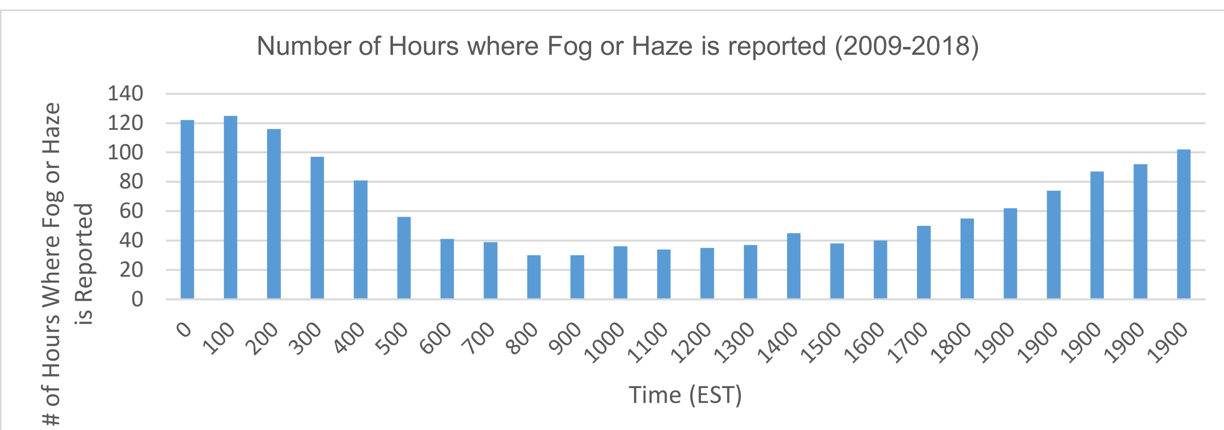


Figure 7.5 - Time of Day where Fog and Haze are Reported (2009-2018).

7.3.4. Probabilistic Meteorological Visibility

HDR Atmospheric Science Group investigated the probability that atmospheric conditions would limit the visibility of the offshore Project over the course of a typical year. The investigation looked at 10 years of hourly and sub-hourly data from 2009–2019 from three meteorological observing platforms in southern New Jersey: Miller Air Park Tom's River (KMJX), Atlantic City International Airport (KACY), and Wildwood, Cape May (KWWD). All of these stations have weather data from a significant (>30 years) period of record (POR) from which to derive visibility information. These observation platforms are all located inland from the coastline and may not be representative of offshore conditions in the Project area.

During the 10-year period of record of hourly and sub-hourly observations at the three airports, there were no reports of visibility in excess of 10 miles. It is possible that the visibility in a given direction (i.e. east of the airports) was potentially more than 10 miles, but at an approximate airport tower height of 50 feet, the visible horizon on the seaward side (to the east) would be ~9.33 miles. This then becomes a limiting factor to the reporting of visibility.

Table 7.6 represents the monthly and annual percentage of time (both day and night) that atmospheric conditions occurred that limited offshore visibility to less than 10 miles during the POR. These percentages represent that average monthly and yearly probability of experiencing atmospheric conditions that would preclude viewing any portion of the offshore wind towers.

Table 7.6 - Monthly and Annual Probabilities of Amount of Time That Atmospheric Conditions Would Preclude Viewing Offshore Turbines.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Tom's River	16.6%	16.0%	16.9%	16.5%	14.9%	15.4%	12.2%	11.2%	15.0%	13.9%	14.1%	16.5%	14.9%
Atlantic City	22.6%	26.7%	27.7%	22.6%	21.8%	20.4%	18.4%	17.4%	22.8%	21.8%	18.1%	21.2%	21.8%
Wildwood	16.1%	15.6%	16.9%	16.5%	14.9%	15.4%	12.2%	11.2%	15.0%	13.9%	14.1%	16.5%	14.9%
Averaged Annual Total													17.2%

7.3.5. Meteorological Summary

Weather and atmospheric conditions are constantly changing over the course of each day and season, which will have a significant impact on Project visibility. A dry clear day with full sun will typically have greater visibility than a day with cloudy skies, precipitation, fog, or haze.

Rain or the occasional snow will reduce visibility, depending upon the intensity of the event. It is typical to have some type of precipitation approximately 33% of the time, with some variability between the seasons (NOAA).

Cloud cover can affect the contrast between the sky and the color of a turbine. Sunny blue-sky days will typically have more contrast with the white turbines than cloudy days with a grey-white sky. Sky cover is constantly changing and relatively evenly split between clear days, partly cloudy days, and cloudy days. On average, records from the Atlantic City area show clear skies 26% of the time; partly cloudy 30% of the time; and cloudy skies 44% of the time.

Haze and fog may have the greatest impact on potential visibility. Fog is a common condition in ocean landscapes due to the interaction between air and water temperature. According to the best available data, haze or fog was recorded approximately 4 days per month. On average there are approximately 13 hours per month with recorded fog or haze. Since the nearest fog data is recorded 9 miles inland at the Atlantic City Airport, the occurrence of haze and fog over the open ocean may be more prevalent.

The 30 visualizations in **VIA Appendix D** provide a representative sample of a variety of weather and lighting conditions. Please refer to these images to see the variation in Project visibility under various atmospheric conditions.

8. Summary of Onshore Infrastructure Visual Effects

8.1. Visual Assessment of Onshore Export Cable Routes and Landfall Locations

All landfall infrastructure and export cable routes between the offshore substations and the onshore substations would be underground. Most routes would be located within existing roadways, in previous disturbed areas, or submerged underwater. Vegetation clearing would be minimal within the existing ROWs. Significant trees would be identified as part of the final alignment and measures taken to avoid and protect them during construction. No permanent visual impact due to the proposed underground installation would be anticipated. The following is a detailed assessment of the proposed route options.

8.1.1. Oyster Creek Landfall Locations and Export Cable Routes

Bay Parkway and Lighthouse Drive Routes. The Bay Parkway and Lighthouse Drive routes are all-road routes in Ocean Township. Both are in residential neighborhoods without paved shoulders or sidewalks. On the south side of Bay Parkway there is undeveloped marshland adjacent to the roadway. Both routes connect to Route 9, a commercial corridor with strip mall and pad site development. All roadways have overhead distribution lines.

There are no areas identified for vegetation clearing. All underground routes would be located within the right-of-way. Because the line would be located underground, there would be no permanent visual impact to any scenic resources.

Exelon Property Route. The Exelon Property route is located in a disturbed but undeveloped area between Oyster Creek and Orlando Drive in the Town of Lacy. The route would follow previously disturbed areas and existing berms, paths and trails. It would also follow abandoned roadways associated with the existing confined disposal facility and Exelon property, and would connect to Route 9. At the closest point, the underground line would be located approximately 450 feet south of Orlando Drive.

There would be some vegetation clearing in the undeveloped portion of the underground route south of Orlando Drive. This clearing would not be visible from the adjacent neighborhoods due to tree cover and dense vegetation near the roadway. Vegetation clearing may also be needed where the cable intersects with Route 9. This area is partially cleared and closed to public access from the roadway. The visual effects of the clearing would not be noticeable to the casual observer.

8.1.2. BL England Landfall Locations and Export Cable Routes

The 5th and 13th Street Routes. These two roadway options in Ocean City would start at landfall locations and be located within existing rights-of-way of local streets, and then follow West Avenue to connect with the 35th Street Route (described below). The 5th Street Route is the longer option, connecting 5th Street to West Avenue, then tying into 13th Street. This cable route runs through the Ocean City Residential Historic District, listed on the NRHP.

There are no areas identified for vegetation clearing in any location on the all-road routes. All underground cable routes would be located within the right-of-way or submerged below water. There would be no permanent visual impact to any scenic resources within the study area.

35th Street Route. After making landfall at 35th street in Ocean City and travelling on local roads west, trenchless technology methods would be utilized to cross under the Roosevelt Boulevard Bridge. From there the route would continue on existing road rights-of-way turning north on Rte. 9 to the substation site at the BL England Generating Station.

The only area identified for vegetation clearing for this option is at the substation property itself. All underground cable routes would be located within the right-of-way or submerged below water. There would be no permanent visual impact to any scenic resources within the study area.

All ocean-side landfalls are planned to utilize trenchless technology methods under the beaches and boardwalk of Ocean City resulting in no permanent visual impact.

8.2. Visual Assessment of Onshore Substations

The proposed substations would have electrical equipment and other infrastructure that would reach a maximum height of up to 49 feet, with relatively thin lightning masts reaching heights of up to 98 feet. Firewalls would reach a height of up to 82 feet. The buildings and other components of the substations (including the firewalls) have not been designed at this point. When the Project components are designed, consideration will be given to visually adapt them into their physical context by repeating the forms, lines, colors, and textures found in the setting into their design per coordination with regulatory agencies and municipalities.

The visual effect of the substations will largely be a function of a) the proximity of scenic resources, b) the location of the site relative to public viewpoints, c) the context of the site and the surrounding land uses, d) visual effect of contrasts (in color, form, line, texture, and scale) between the substation components and the surrounding landscape, and e) the ability to screen the substation from public viewpoints. The response to each of the onshore locations under consideration is unique to the particular site. The following is a detailed assessment of each substation option.

8.2.1. Oyster Creek Substation

Scenic Resources. While the 800-acre site is primarily an industrial complex, there are several scenic resources within the one-mile APE. Oyster Creek is located approximately 350 feet from the substation parcel. A multi-use trail system parallels Route 9 within 0.5 mile of the site. The Garden State Parkway is 0.6 mile from the site.

Public Viewpoints. There is no public access to the Oyster Creek Nuclear Generating Facility. The new substation site itself is located on a private road. The only public view of the new substation would be from the Barnegat Branch multi-purpose trail on the west side of Route 9, where recreational users will have brief views of the site from the pedestrian bridge over Oyster Creek. This viewpoint is located 0.5 mile from the substation. Any views, however, would be filtered through the chain link security enclosure on the footbridge and seen in the context of the existing power generating facility. The Garden State Parkway is mostly screened by forest cover with very limited views. There is no public access to the section of Oyster Creek that is within the Nuclear Generating Facility. The creek is located approximately 350 feet from the substation parcel. Lacey Business Park and commercial development on Route 9 in Ocean Township (each located approximately 0.6 mi from the substation parcel) are the nearest publicly accessible land use. Views from these places are blocked by commercial development and existing trees in the immediate foreground and the components of the existing generating station.

Site Context. The Oyster Creek Site is surrounded by the industrial forms of the Oyster Creek Nuclear Generating Station, which is characterized by large scale buildings, lattice transmission towers, additional monopoles, an existing substation, and other tall, metal structures. The nuclear reactor was shut down in 2018 after five decades of operation and is currently being decommissioned. The public does not have access to the facility beyond the entrances from Route 9.

Viewpoint Evaluation. Site security measures and lack of public access limits views of the proposed facility to a pedestrian and bicycle bridge on the Barnegat Branch Trail over Oyster Creek. The new substation would be further from viewers than the current industrial facilities. As seen in **Visualization V29** in **VIA Appendix D**, the view from the public trail is obscured by a chain link security fence surrounding the bridge. Views to the northwest toward the facility would be limited to the relatively short time it takes for a walker / cyclist to cross the bridge. Any views would be seen in context with the existing power-generating infrastructure. The substation would be seen in the midground viewing distance where details start to become obscured by the effects of distance and atmospheric perspective. The most noticeable component of the substation would be the firewalls. Several of the lightning masts may also be visible from the trail south of Oyster Creek, where they would be seen in conjunction with foreground parking lots lights, a stack from the generating facility, and other tall vertical elements associated with the Generating Station. The visual effect on those who now use the trail or walk or ride over the bridge should be minimal; most people should not notice any significant change to the industrial landscape that surrounds the site.

Visual Effect. The components used in the substation would be similar in color, scale, function, and appearance to those found at the existing generating facility. Visual contrast with existing conditions would be low. The two main buildings at the Oyster Creek substation could each be up to 166 or 149 feet in length x 50 feet in width and 35 or 40 feet in height. The maximum dimensions of the secondary building(s) could be up to 66 feet in length x 57 feet in width and 33 feet in height. The indicative height of the tallest electrical component would be 49 feet, which is less than the height of the surrounding forest cover and many of the buildings at the generating facility. The proposed substation would be constructed of materials with similar shapes, forms, colors, and textures as the existing facility, resulting in little contrast between the existing facility and the new one. The proposed substation will be seen as an extension of the industrial landscape of the adjacent generating station. Lightning masts may reach 98-feet in height, which are similar in height to existing light standards and electrical components seen from the bridge. The gray color of the galvanized metal and relatively low mass of the substation components would make them difficult to visually detect from the anticipated viewing distance. The most visible elements would be the firewalls, which would appear as flat two-dimensional screens, up to 82 feet in height. **Section 8.3.1** provides an evaluation of the potential visual effect of the proposed transmission structures associated with the substation. The buildings and other components of the substation (including the firewalls) have not been designed at this point. When they are designed, consideration will be given to visually adapt them into their physical context by repeating the forms, lines, colors, and textures found in the setting into the design of the Project components.

Local permitting for the substation will include pre-application outreach to Lacey Township planning and zoning representatives. In preparation for that process, the design team will investigate measures to reduce visual contrasts if it is determined that there will be significant contrasts from the proposed Project elements, e.g., fencing, lightning masts, and other features within the substation. Measures to reduce color contrast may include post-galvanizing treatments that would reduce the reflectivity or dull the bright surfaces of the monopoles and other galvanized elements, or the use of dark vinyl cladding on fencing to minimize reflectivity and color contrast.

Screening. While there are limited opportunities for screening the substation, it may not be necessary, given the lack of public viewpoints, the distance from the pedestrian bridge, the site's location in the midground, its industrial context, and the surrounding forest cover.

Conclusion. From a visual perspective, Oyster Creek appears to be well suited for this type of use, in that a) it would be located in an existing large-scale generating facility with an existing substation, b) the site is well screened from public roads, and c) there is no public access. Measures that may typically be used to minimize visual contrast may not be warranted in this situation, given the viewing distance, the industrial context, viewer expectation, the limited level of visual exposure by pedestrians or bicyclists, and the natural weathering process that will reduce visual contrast.

8.2.2. BL England Substation

Scenic Resources. The substation site occupies a transitional landscape between the leafy green residential neighborhoods near North Shore Road and the gray and blue industrial landscape of the BL England Generating Station. While the 358-acre site is primarily an industrial complex, there are several scenic resources within the one-mile APE. The state database for conservation land indicates that the entire BL England Generation Station, surrounding undeveloped area, and the substation site are included in a local conservation area known as Upper Township 1. Other conservation parcels within the 1-mile study area include Tuckahoe Wildlife Management Area; Cape May Coastal Wetlands Wildlife Management Area; and Golden Oak Recreation Area. At its closest point, the site is approximately 500 feet west of Great Egg Harbor River, a designated Wild and Scenic River. The Thomas Beesley Sr. House, listed on the NRHP, is located approximately 0.5 mile south from the substation site. Beesley's Point Beach is approximately 0.2 mile to the northeast. The Garden State Parkway bridge over the Great Egg Harbor River is located approximately 0.3 mile from the site.

Public Viewpoints. The former golf course, which is the site of the proposed substation, was part of the BL England property but closed several years ago, along with a picnic area and other employee recreation facilities. A fishing pier at the end of Clay Avenue (a private roadway associated with the generating site) is still open and affords anglers an opportunity to fish in Great Egg Harbor River just below the now-closed BL England generating plant. The substation may be partially visible to southbound motorists on the Garden State Parkway (an elevated viewpoint that may allow viewers to see over the tree line). Portions of the substation may also be visible to people on the fishing pier at a distance of approximately 500 feet and to boaters on the Great Egg Harbor River at distances of over one mile. Where the substation may be visible, it will be seen in the context of the existing industrial development.

Site Context. The site is immediately south of the now-closed BL England Generation Station, which is a local landmark due to its height and dominant presence on the river. East of the site at the end of North Shore Road is a town park and beach (Beesley's Point Beach), a jet ski rental, a boat launch, and the Historic Tuckahoe Inn on North Shore Road. South of the site is an extensive salt marsh marked by meandering streams and linear drainage channels. Single-family residential is the primary use south of the BL England site on either side of North Shore Road.

Viewpoint Evaluation. As seen in **Visualization V30** in **VIA Appendix D**, the view from the vicinity of the fishing pier now includes the boardwalk to the end of the pier, the BL England Generating Station and stack, access roads and parking lots, a stormwater pond, local distribution lines, and the mixed tree cover that surrounds the former golf course. The proposed substation will remove a relatively small amount of the visible trees, creating an opening that will expose the side and end of one of the proposed buildings. Lightning masts and firewalls, along with transmission structures and conductors (see **Section 8.3.3**), will visible above the treeline in the foreground. Several types of viewers are anticipated: local residents who walk/jog/bike/walk dogs on Clay Avenue, people who use the fishing pier, boaters in Great Egg Harbor River immediately offshore from the site, and motorists and pedestrians on the recently constructed Garden State Parkway bridge over the river. As seen in the visualization, the substation would be largely screened by existing deciduous and coniferous trees along Clay Avenue. Views from the vicinity of the fishing pier would be of relatively short duration, since most people at this location would be walking toward the end of the pier and looking out to the water, or returning from the pier going to their car, all occurring in the shadow of the existing generating station. To someone on the river, the majority of the proposed substation will be screened by existing woodland vegetation, remnants of the former golf course that formerly occupied this site. River views would be dominated by the presence of the BL England Generating Station, the 7 large lattice transmission structures crossing the water, and the Garden State Parkway bridge. Several of the lightning masts may be visible above the trees. Views from the bridge would be partially obscured by the guardrail and protective fencing.

Visual Effect. The design, color, form, and materials of the components used in the substation would be similar to those found throughout the existing industrial landscape that surrounds the site. Contrast with existing conditions would be low. The main building in the proposed substation could be up to 81 feet in length x 67 feet in width and 33 feet in height. The maximum dimensions of the secondary building(s) could be up to 154 feet in length x 45 feet in width and 33 feet in height. The indicative height of the tallest electrical component would be 49 feet, which is less than the height of the generating facility and the surrounding forest cover. Lightning masts may reach 98 feet in height. The most visible elements would be the firewalls, which would appear as flat two-dimensional screens, up to 82 feet in height. The proposed substation and related infrastructure will be dwarfed by the existing generating building and its adjacent stack. The majority of the substation components would be screened by the existing trees on the west side of Clay Avenue, with the exception of the lightning masts, the firewalls, the transmission structures, and a portion of one of the buildings. The buildings and other components of the substations (including the firewalls) have not been designed at this point. When they are designed, consideration will be given to visually adapt them into their physical context by repeating the forms, lines, colors, and textures found in the setting into the design of the Project components.

The Upper Township Zoning Code requires, as part of the Conditional Use permit, that the project "must conform to the general character of the area..." Outreach to Upper Township officials and local residents early in the permitting process is planned to present the proposed onshore substation development and to discuss how the Project's proposed site development plan, substation equipment and buildings, security fencing, etc. complies with these standards. As part of this outreach effort, the design team will select colors and textures for the buildings, firewalls, plantings, and other visible elements that will complement the existing colors found in the immediate area. Final selection of colors, textures, forms, or other variables of proposed elements visible to the public will be selected in consultation with local residents to minimize visual contrast.

The design team will work with local architects to create structures that are both highly functional and reflective of the building styles that characterize this part of New Jersey. The final design of the buildings, and the selection of material colors and architectural detailing, will be informed by input from the community in order to produce a design that will blend in with the existing visual environment. Measures to reduce color contrast may include post-galvanizing treatments that would reduce the reflectivity or dull the bright surfaces of certain elements or the use of dark vinyl cladding on fencing to minimize reflectivity and color contrast.

Screening. Limiting exposure to residential neighbors and recreational users on Clay Avenue would be key to reducing visibility and contrasts in form, line, color, and texture and assuring that the facility visually adapts to its surroundings. Several mitigation options may be explored to achieve an optimal landscape fit, e.g., changing the grade of the substation or surrounding landscape; incorporating an earth berm and additional screen plantings along Clay Avenue; preserving as much vegetation as possible between Clay Avenue and the substation; aligning the service entrance and overhead utilities to avoid direct views into the facility; selecting colors and siding materials for the buildings that complement the forms, colors, and textures of both the industrial and residential context; and constructing screening walls or fences to reduce visual penetration.

While there are opportunities for screening the substation from Great Egg Harbor River, it may not be necessary, given the industrial context of the site and the wooded landscape between the substation and the river. At its closest point, the proposed substation would be approximately 500 feet from the river. Much of that distance is comprised of woodland that would provide a significant amount of screening. Approximately 600 feet of wooded buffer separates the substation site from the commercial/recreational/historic resources along North Shore Road to the southeast.

Conclusion. From a visual perspective, the BL England site appears to be well suited for this type of use, in that it would be located in an existing large-scale generating facility with an existing substation. The site is well screened from public roads and nearby residential neighborhoods. If any components of the substation were visible, they would be seen in the context of the existing BL England Generation Station, a far larger and more visually dominant feature in the landscape. Existing vegetation presents an opportunity to screen the substation and minimize its presence in the public landscape. Orsted will also work with the local community to develop a substation with minimal impact to local residents.

8.3. Visual Assessment of Interconnection Transmission Lines

Power from the substations would be transferred to an interconnect point, either through an overhead transmission line or an underground duct bank. The visual effect of overhead transmission structures will largely be a function of a) the proximity of scenic resources to the transmission line, b) the location of the transmission corridor relative to publicly accessible viewpoints, c) the context of the transmission route and the surrounding land uses, d) visual effect of contrasts (in color, form, line, texture, and scale) between the transmission components and the surrounding landscape, and e) the ability to screen the transmission line from public viewpoints. The response to each of the interconnection transmission lines under consideration is unique to the particular site.

The following is a detailed assessment of the potential visual effect of the transmission lines for each onshore substation option. The scenic resources, public viewpoints, and site context for each site will be the same as described for each substation in **Section 8.2**. The computer-based viewshed analyses completed for the aboveground transmission lines are represented on **Map 4** and **Map 5** in **VIA Appendix A**.

8.3.1. Oyster Creek Interconnect

The computer-based viewshed analysis, presented in **Map 4** in **VIA Appendix A**, indicates potential visibility will be concentrated in the area surrounding the Oyster Creek Nuclear Generating Facility. Views of the transmission structures and/or the lightning masts may also be possible over the treeline from portions of the Forked River and scattered locations on the east side of Route 9.

The viewshed analysis indicates that the transmission structures, conductors, and the lightning masts may be visible from the Barnegat Branch multi-purpose trail paralleling Route 9. However, views from the pathway would be at a distance of over 0.5 mile (i.e., in the midground viewing distance) and seen through a chain link enclosure, which would greatly limit the clarity of the view. Views from the pathway already contains a significant amount of industrial infrastructure in both the foreground and midground viewing distances, so the addition of the transmission structures and lightning masts would not seem out of character with the existing uses. The transmission structures would not be visible from any other publicly accessible scenic resources.

In preparation for local permitting and public outreach, the design team will investigate measures to reduce color contrasts and reflectivity for the more prominent galvanized elements, particularly the galvanized monopoles, if it is determined that there will be significant color contrasts associated with the proposed transmission monopoles, lightning masts, or other metallic surfaces. Measures may include post-galvanizing treatments that would reduce the reflectivity or dull the bright surfaces of the monopoles and other galvanized elements.

9. Summary of Offshore Infrastructure Visual Effects

9.1. Summary of Individual Site Assessment Findings

9.1.1. Representative Viewpoint Variability

The visualizations of the representative viewpoints show potential Project visibility at various viewing distances, times of day, times of year, viewing elevations, weather conditions, and local contexts. As noted earlier, the representation of the Project components in the visualizations gives a more accurate and realistic impression of Project visibility than the geographic extent of visibility presented in the computer-based viewshed analysis. Across the 28 visualizations presented in **VIA Appendix D**, the ranges in locations and conditions include:

- **Viewing distances to the nearest turbine:** from 15.21 miles (V14 Playground Pier in Atlantic City) to 38.64 miles (V01 Barnegat Lighthouse in Barnegat Light).
- **Time of day:** from 8:03 am (V04 Garden State Parkway) to 10:45 pm (V20 Atlantic City Beachfront).
- **Time of year:** summer, autumn, and winter seasons. Photographs were collected in July, August, September, and December of 2018.
- **Viewing elevations:** from the beach front just above sea level to one of the tallest lighthouses in New Jersey (V01 Barnegat Lighthouse in Barnegat Light).
- **Weather conditions:** sunny/clear days, hazy days, overcast days, and cloudy days.
- **Local contexts:** representation from all identified Landscape Similarity Zones (LSZs), public beaches and boardwalks, historic resources, conservation areas, public buildings, and roadways.

The visualizations demonstrate that areas with theoretical visibility (according to the computer-based viewshed analysis) do not necessarily mean the Project would be visible to the average viewer. Distance to the Project, surrounding context, and atmospheric conditions can significantly reduce visibility (See **Section 4** for more information). Two examples of viewpoints that have theoretical visibility, but do not present views of the Project that are discernible to the average viewer, are V08 Absecon Boat Launch and V28 Cape May Lighthouse. In both cases, an enlarged portion of the visualization was included to show where the Project would be theoretically visible due to the minute size of Project components in the visualizations.

9.1.2. Overall Landscape/Seascape Compatibility Findings

Each viewpoint is evaluated for compatibility with the existing landscape/seascape. This evaluation is based upon Project visibility and the degree of contrast (in form, line, color, and texture) anticipated with the surrounding seascape/landscape. This determination was completed using the visualizations for each of the 28 viewpoints. The evaluation scale ranges from *faint, apparent, conspicuous, prominent, to dominant*. **Table 5.6** provides descriptive language for each level of evaluation. A summary of the landscape/seascape compatibility evaluation for each viewpoint is provided in **Table 9.1**. None of the viewpoints received an evaluation greater than *conspicuous*, meaning no viewpoint received a compatibility rating of *prominent* or *dominant*.

Table 9.1 - Summary of Landscape/Seascape Compatibility Evaluations.

#	VIEWPOINT NAME	Compatibility Evaluation	Distance to Nearest Turbine	Visual Obstruction	Time of Day
V01	Barnegat Light House	Faint	38.64 mi	No	11:34 AM
V02	Harvey Cedars Beach Access	Faint	33.36 mi	No	10:59 AM
V03	Bayview Park	Faint	28.08 mi	No	10:14 AM
V04	Garden State Parkway	Faint	27.98 mi	Yes	8:03 AM
V05	Edwin B. Forsythe NWR - Holgate Unit	Apparent	22.58 mi	No	7:57 AM
V06	Great Bay Boulevard WMA	Faint	21.85 mi	Yes	9:40 AM
V07	Edwin B. Forsythe National Wildlife Refuge	Faint	20.04 mi	Yes	5:45 PM
V08	Absecon Creek Boat Ramp	Faint	21.01 mi	Yes	3:13 PM
V09	North Brigantine Natural Area Observation Deck	Conspicuous	16.77 mi	No	6:33 PM
V10	16th Street Park Beachfront (Evening)	Conspicuous	16.22 mi	No	6:09 PM
V11	Atlantic City Country Club	Faint	19.71 mi	Yes	12:10 PM
V12	Atlantic City Beachfront (Day)	Conspicuous	16.04 mi	No	2:39 PM
V13	Atlantic City Beachfront (Night)	Apparent	16.04 mi	No	10:45 PM
V14	Playground Pier	Conspicuous	15.21 mi	No	12:28 PM
V15	City Hall in Ventnor City	Faint	15.80 mi	Yes	3:55 PM
V16	Lucy The Elephant National Historic Landmark	Conspicuous	16.01 mi	No	12:50 PM
V17	Municipal Beach Park, Bay Front Hist. Dist.	Faint	18.33 mi	Yes	10:50 AM
V18	Ocean City Boardwalk	Conspicuous	15.54 mi	No	7:18 PM
V19	Corson's Inlet State Park	Conspicuous	16.22 mi	No	4:55 PM
V20	Sea Isle City Promenade	Faint	17.36 mi	Yes	1:50 PM
V21	Jetty at north end of Avalon beach	Apparent	17.84 mi	No	10:14 AM
V22	Stone Harbor Beach Access (Day)	Apparent	20.93 mi	No	4:22 PM
V23	Stone Harbor Beach Access (Night)	Faint	20.93 mi	No	8:49 PM
V24	North Wildwood Boulevard Bridge	Apparent	24.29 mi	Yes	1:54 PM
V25	Hereford Inlet Lighthouse	Apparent	23.61 mi	Yes	3:20 PM
V26	Wildwood Crest Fishing Pier	Faint	25.95 mi	No	3:49 PM
V27	Cape May National Wildlife Refuge	Faint	28.45 mi	No	11:16 AM
V28	Cape May Lighthouse	Faint	33.88 mi	Yes	2:03 PM

9.2. Factors Affecting Project Visibility and Landscape/Seascape Compatibility

Each representative viewpoint was evaluated by the review panel who considered the visualizations, context images, and written baseline reports provided for each viewpoint. The summary of overall landscape/seascape compatibility findings is based on an analysis of the results. The findings did not drive or influence the evaluation of individual viewpoints.

9.2.1. Viewing Distance

Viewing distance made a significant and consistent impact on the compatibility evaluation for all viewpoints. The further the viewer is from the Project, the less visible the Project components became. This is due to a combination of factors, including earth curvature and visual acuity. The following summarizes the impact of distance on visibility.

- Viewpoints over 25 miles away were evaluated as *faint*, regardless of viewer elevation, weather conditions, or lighting conditions. At that distance the relative size of the turbines (measured at arm's length) was less than 1/8 inch.
- Viewpoints less than 25 miles away evaluated as *faint* contained visual obstructions (such as land mass, buildings, or vegetation between the viewpoint and the project) or were based on night conditions where only the FAA warning lights would be visible on the horizon. Significant visual obstructions, such as the buildings that frame the view from V15 Ventnor City Hall or the presence of tall dunes at V20 Sea Isle City Promenade, made the project *faintly* visible even at distances 15 to 20 miles from the Project.
- Viewpoints between 17 and 25 miles from the Project were typically evaluated as *apparen*t, unless there were visual obstructions or other factors (e.g., night conditions) that made the turbines less visible.
- Viewpoints less than 17 miles from the Project without visual obstructions were typically evaluated as *conspicuous*, unless there were visual obstructions or other factors (e.g., night conditions) that made the turbines less visible.
- The only visualization over 16 miles from the Project with a *conspicuous* evaluation was from an elevated viewing platform (V09 North Brigantine Natural Area Wildlife Observation Deck).

9.2.2. Visual Obstructions and Viewer Elevation

Visual obstructions include elements between the viewpoint and the Project. These may include vegetation, buildings, bridge structures, or land mass. Visual obstructions significantly limit Project visibility for the following reasons:

- **Limits Vertical Field of View.** A visual obstruction may screen the base of the turbines, limiting visibility to the tops where only blades are visible. An example of this is in V07 Edwin B. Forsythe National Wildlife Refuge, where the development in Brigantine blocks the base of the turbines. A second example is V20 Sea Isle City Promenade, where dune vegetation in the foreground screens the base of the turbines and makes the blades difficult to visually detect above the dunegrass.
- **Limits Horizontal Field of View (HFOV).** A visual obstruction may limit the HFOV, limiting Project visibility from that particular viewpoint. In locations where less of the Project is visible it may make it more difficult to detect or draw less attention from the viewer. An example of this is in V15 Ventnor

City Hall, where only a handful of turbines are visible (less than 2° HFOV). The residential development, vegetation, and streetscape infrastructure in the foreground limits overall visibility and makes the turbines difficult to detect.

- **Visual Distraction.** Elements in the foreground or midground may visually distract viewer attention from the Project. For example, V11 Atlantic City Country Club has trees in the foreground, marshland in the midground, and urban development in the background, making the Project only *faintly* visible beyond the visual obstructions. Viewpoints located immediately adjacent to the shoreline with clear views of the open ocean are more likely to attract a viewer's attention toward the Project.

All visualizations with elements in the landscape screening views of the turbines received a compatibility evaluation of *faint*, with the exception of two locations. V24 North Wildwood Boulevard Bridge and V25 Hereford Lighthouse received compatibility evaluations of *apparent*. While there are features in the landscape partially blocking the turbines from view, both are elevated viewpoints with direct views of the open water. In both situations an observer would be able to see the full vertical extent of the turbines. The elevated nature of the viewpoints also allows the viewer to see further to the horizon, thus diminishing the effect of earth curvature.

9.2.3. Atmospheric Conditions

Considerable variations in weather and atmospheric conditions are possible that over the course of a single day: Project visibility will shift as fog moves in and out and sky cover changes with passing weather. There is no single typical viewing condition, as coastal weather patterns frequently fluctuate.

Each viewpoint was evaluated based on the atmospheric and lighting conditions presented in the photograph. Within the collection of 30 visualizations, weather conditions ranged from sunny/clear days, hazy days, overcast days, and cloudy days. The effect of weather conditions on Project visibility is most evident in the contrast between hazy/foggy/cloudy days and clear/sunny days.

- **Haze / Fog / Clouds.** Conditions of haze or fog blur the horizon, diminish visible contrast, and reduce overall visibility. An example of this is in V16 Lucy the Elephant National Historic Landmark. This particular day was overcast and hazy, making the turbines more difficult to detect on the horizon. Even in the haze, this viewpoint still received a *conspicuous* rating due to the viewing distance, elevated viewing location, and focus on the horizon. The contrast in the visualization from Lucy was adjusted to make the turbines brighter (and thus more representative of a less hazy day). A second example of the impact of haze is V08 Absecon Boat Ramp, located 21 miles from the project. The haze in this image reduces the visual clarity of the Atlantic City skyline (4 miles from viewpoint) and makes the Project nearly impossible to detect, even when using the 4x magnification image provided on the visualization.
- **Clear Day / Full Sun.** Clear sunny days allow viewers to see further to the well-defined horizon and create greater contrast between the white turbine color and the blue-sky backdrop. V26 Wildwood Fishing Pier, located 26 miles from the Project, is an example of clear day with maximum visibility over the water. This viewpoint is 5 miles further from the project than V08 Absecon Board Ramp, yet the turbines are easier to identify on the horizon.

9.2.4. Time of Day and Lighting Conditions

The lighting conditions represented in visualizations ranged from early morning, afternoon, evening, and after dark. The time of day, and therefore the angle of the sunlight hitting the turbines, has a notable impact on the level of Project visibility. Within the study area, views of the Project are generally facing east (with variability between the southeast and northeast). As the sun rises and sets, the different quality and direction of the sunlight impacts the color of the turbines.

- **Morning Light.** In the morning, the turbines would be backlit as the sun rises behind the array in the east. In this condition the turbines are seen in silhouette against the sky. V05 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit, photographed at 8am, is an example of backlit turbines on the horizon. In this image, the grey turbines contrast with the white sky, resulting in an *apparent* compatibility rating at a distance of 22 miles.
- **Evening Light.** In the late afternoon / evening, the Project would be front lit, highlighting the bright white color of the turbines. V18 Ocean City Boardwalk, photographed at 7pm, is an example of front lit turbines. In this image, the bright white turbines contrast with the blue sky at sunset, resulting in a *conspicuous* compatibility rating at a distance of 15 miles.

After dark, the turbines would no longer be visible. However, the FAA aviation warning lights would be visible as pairs of red points on the horizon when the occasional aircraft triggered the Aircraft Detection and Lighting System. V13 Atlantic City Beachfront (Night) and V23 Stone Harbor Beach Access (Night) are examples of what the Project would look like when the warning lights were activated.

10. Mitigation

Mitigation measures to reduce potential visual effects of both the offshore and onshore components have been incorporated into the Project planning and design process and follow the mitigation measures recommended by BOEM (BOEM 2007b).

10.1. Offshore Components

Location. The Project will be located in a designated lease area identified by BOEM as suitable for offshore wind development. All offshore Project components (turbines and substations) will be sited in the far background distance zone, i.e., at least 15 miles offshore, where visibility will be minimized by the effects of distance, weather conditions, and atmospheric perspective.

Design. All wind turbines will be identical in design, color, base configuration, blade length, hub height, and tower type to create a consistent appearance throughout the Project.

Color. Most of the Project components (base, hub, blades) will be painted no lighter than radar-activated light (RAL) 9010 Pure White and no darker than RAL 7035 Light Grey, to minimize color contrast as seen against a sky background. In conformance with Coast Guard regulations, the foundation structures will be painted yellow to a point 50 feet above mean high water. Non-reflective paint will be used on all Project components. With few exceptions, the majority of Project views are against the sky background. The turbines will not contain any commercial or advertising messages.

Lighting. The Project will be equipped with an Aircraft Detection and Lighting System (ADLS), contingent on BOEM approval and compliant with Federal Aviation Administration (FAA) guidelines, to reduce the effects of nighttime lighting on viewpoints within the study area along the shoreline. The system will only be activated when aircraft are within a designated radius around the Project, which will greatly reduce the effects to onshore observers, particularly those at oceanfront viewpoints who are accustomed to seeing a dark horizon.

Maintenance. The Project will be maintained on a regular basis to ensure that all turbines are operational. This will include cleaning the hubs, towers, and turbine blades to remove any leaked fluids, insect build-ups, dust accumulation, etc.

10.2. Onshore Components

Siting. Substation sites have been selected to minimize visibility to surrounding residential development, using existing substations and/or power generating sites that already have extensive electrical infrastructure. Sites within these facilities will be minimally visible from public viewpoints.

Screening. Where substation components may be visible and highly contrasting with their surroundings, the Project would provide supplemental plantings and other landscape elements to screen the substation from public view. While the existing vegetation between the site and the river at the BL England site will be adequate to screen the substation, additional evergreen trees and native shrub masses may be necessary to supplement the trees along Clay Avenue in order to maintain its park-like atmosphere.

Transmission Lines. All landfall and export cable route will be located underground from the shoreline to the substations. Cable routes have been selected to minimize disturbance to residential or commercial properties. Overhead transmission lines will be utilized only from the substation parcel to the interconnection point.

Security Lighting. Lighting installed on the substations for security and/or emergency operations will utilize full cut-off fixtures to avoid light pollution and trespass outside the property. The objective is to have the minimal amount of lighting needed for security, with additional lighting that could be turned on manually to provide a safe work environment, but only when needed to deal with emergencies. Lighting should not be an issue at the Oyster Creek substation, due to its industrial context and the distance from public viewpoints. Lighting at the BL England site will take into consideration nearby residences that may be affected by lights from the facility (the nearest home is over a quarter mile away and largely screened by vegetation). The FAA should not require aviation warning lights (as are now present on the existing power generating facility) since there are no elements in the proposed substation greater than 200 feet in height.

Overall Design. During the design process, consideration will be given to visually adapt the buildings and other substation components into their physical context. The forms, lines, colors, and textures of these components will be influenced by their immediate surroundings and selected to minimize visual contrast and potential visual impact. The proposed Oyster Creek substation will utilize forms, materials, colors, and textures that complement the existing facility, with minimal contrast between the existing and proposed infrastructure. Measures that may typically be used to minimize visual contrast may not be warranted in this situation, given the viewing distance, the industrial context, viewer expectation, the limited level of visual exposure by pedestrians or bicyclists, and the natural weathering process that will reduce visual contrast. At the BL England substation, where the general public will be able to experience the substation within the foreground viewing zone, the textures and the colors (in particular) of proposed elements visible to the public will be selected in consultation with local residents to minimize visual contrast. The design team will work with local architects to create structures that are both highly functional and reflective of the building styles that characterize this part of New Jersey.

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