- E & E Project No.: 003114.AG11

Unsolicited Right-of-Way Grant Application
for the
Atlantic Wind Connection Project

Original: March 31, 2011

Restated: August 10, 2011

ecology and environment, inc.
Global Environmental Specialists

Executive Summary

ES1 This Application

The *Right-of-Way Grant Application for the Atlantic Wind Connection Project* (ROW Application) is being submitted by Atlantic Grid Holdings LLC (the Applicant) as an "unsolicited grant application" in accordance with 30 Code of Federal Regulations (CFR) Part 285. The ROW Application is based on desktop analysis and initial stakeholder consultations conducted from October 2010 thru March 2011. The regulations of the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE; formerly Minerals Management Service) at 30 CFR 285.306 and 307 provide that upon receipt of an unsolicited request for a ROW grant, BOEMRE will issue a Request for Interest and publish it in the *Federal Register*, describing the parameters of the Project, which will give affected and interested parties an opportunity to comment on the proposed ROW requested in this Application. The regulations provide further that BOEMRE will evaluate comments received in response to the Request for Interest and make a determination of the level of competitive interest. If BOEMRE determines that there is no competitive interest for the area applied for, then BOEMRE may establish the terms and conditions for the award of a grant in consultation with the Applicant, and the Applicant must then submit a General Activities Plan (GAP) describing in detail the proposed facilities, existing conditions, potential impacts, and proposed mitigation. The GAP must be authorized by BOEMRE before the Applicant begins construction on the ROW.

This document is a restated version of the application described above which was submitted to BOEMRE on March 31, 2011. Subsequent to that initial filing, the Applicant provided two supplements to the Application. Those two supplements have been incorporated into this complete and restated filing to avoid confusion for the reader. Text, figures, and tables have all been updated to provide the reader with this one, concise document. The two supplements that were submitted are described below.

- The first supplement to the Application was submitted to BOEMRE on April 21, 2011. This supplement further refined the grant area requested by the Applicant in response to a request from BOEMRE requesting such a refinement.
- The second supplement was submitted to BOEMRE on July 14, 2011. After reviewing the initial ROW Application, BOEMRE's Sand and Gravel Program staff recommended that the proposed route be updated to avoid existing and future Sand and Gravel resource areas. This second supplement provided BOEMRE with a route that circumvents those areas used for or planned to be used for sand and gravel harvest.

ES2 Application Organization and Structure

The ROW Application is organized as follows:

- Section 1 – Contact Information for Applicant, Operator, and Consultant
- Section 2 – Unsolicited Right-of-Way Grant Application
- Section 3 – Project Objectives and Description of Phases
- Section 4 – Project Description and Facilities

- Section 5 – Area of Interest for Proposed Right-of-Way Grant
- Section 6 – General Information about Existing Environmental Conditions
- Appendix A – Geographical Information System (GIS) Datasets and Sources
- Attachment (provided under separate cover) – Applicant's Statement of Qualification to Hold a Renewable Energy Grant on the U.S. Outer Continental Shelf *(PRIVATE AND CONFIDENTIAL / NON-PUBLIC)*

ES3 About the Project

The Atlantic Wind Connection (AWC) Project is the first offshore backbone electrical transmission system proposed in the United States. The AWC Project would enable up to 7,000 megawatts (MW) of offshore wind turbine capacity to be integrated into the regional high-voltage grid controlled by PJM Interconnection, L.L.C., or the appropriate Regional Transmission Organization in a cost-effective manner, increasing reliability and reducing congestion in the heavily congested corridor between Virginia and the metropolitan New Jersey/New York City area. This cutting-edge, high-voltage direct-current, subsea backbone transmission system would be constructed off the coasts of New York, New Jersey, Delaware, Maryland, and Virginia.

The Project would be operated as a single integrated system even though it is anticipated to be constructed and financed in five phases: A through E. Facilities constructed in each phase would be owned by one of five public utility companies (the AWC Companies[1]). When fully built, the Project would comprise about 790 miles[2] (1,271kilometers) of offshore transmission cable constructed over approximately a 10-year timeframe:

- **Phase A.** The offshore portion from southern-New Jersey to Delaware with a capacity of up to 2,000 MW;
- **Phase B.** The offshore portion from southern-New Jersey to the northern New Jersey/New York metropolitan area with a capacity of up to 1,000 MW;
- **Phase C.** The offshore portion from Maryland to the northern New Jersey/New York metropolitan area with a capacity of up to 2,000 MW;
- **Phase D.** The offshore portion from Maryland to Virginia with a capacity of up to 1,000 MW ; and
- **Phase E.** The offshore portion from Delaware to Virginia with a capacity of up to 1,000 MW.

The phases of the AWC system design are intended to complement the progression of the mid-Atlantic offshore wind industry and to maximize grid reliability and benefits from the economical dispatch of generation.

The Project is designed to connect multiple offshore wind farms, to be built in the mid-Atlantic Wind Energy Areas (WEAs) recently identified by the United Department of Interior, to the strongest

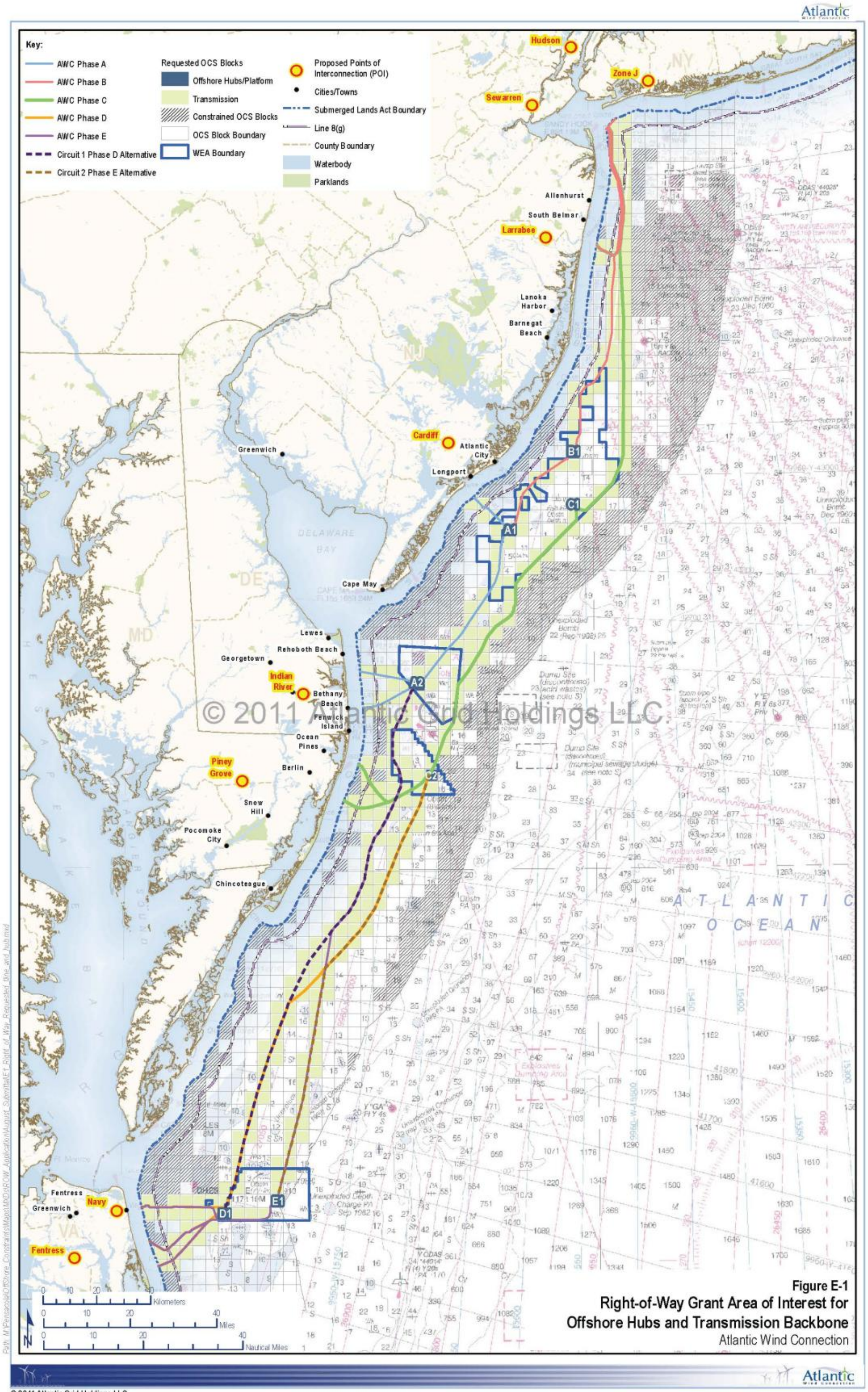
[1] The AWC Companies include: Atlantic Grid Operations A LLC, Atlantic Grid Operations B LLC, Atlantic Grid Operations C LLC, Atlantic Grid Operations D LLC, and Atlantic Grid Operations E LLC, and are indirect subsidiaries of Google Inc., Good Energies II L.P., and Marubeni Corporation.

[2] All mileage measurements reported in this application are presented in statute miles and transmission cable mileage is reflective of two circuits (Circuit 1 and Circuit 2).

parts of the terrestrial transmission grid. The completed Project phases would be owned and operated as a federally regulated public utility with the responsibility for providing open-access transmission service. This ROW Application does not solicit a lease for any areas on the Outer Continental Shelf (OCS) for the purpose of wind farm construction. Any wind farms that connect to AWC facilities would be built by entities unaffiliated with the Applicant using OCS leases secured from BOEMRE in separate applications.

ES3.1 AWC Project Circuits

The fully-built AWC Project would include two circuits (Circuit 1 and Circuit 2), each installed within a separate offshore corridor (see Figure E-1). Separating the corridors for each circuit is required to lessen the risk of a single event, such as an anchor drag, damaging both circuits.


Atlantic
Key:
AWC Phase A
AWC Phase B
AWC Phase C
AWC Phase D
AWC Phase E
Circuit 1 Phase D Alternative
Circuit 2 Phase E Alternative
Requested OCS Blocks
Offshore Hubs/Platform
Transmission
Constrained OCS Blocks
OCS Block Boundary
WEA Boundary
Proposed Points of Interconnection (POI)
Cities/Towns
Submerged Lands Act Boundary
Line 8(g)
County Boundary
Waterbody
Parklands
Hudson
Zone J
Sewarren
Allenhurst
South Belmar
Larrabee
Lanoka Harbor
Barnegat Beach
Cardiff
Atlantic City
Longport
Greenwich
Cape May
Lewes
Rehoboth Beach
Georgetown
Indian River
Bethany Beach
Fenwick Island
Ocean Pines
Berlin
Piney Grove
Snow Hill
Pocomoke City
Chincoteague
Fentress
Greenwich
Navy
Fentress
B1
C1
A1
A2
C2
D1
E1
ATLANTIC
OCEAN
© 2011 Atlantic Grid Holdings LLC
Kilometers
Miles
Nautical Miles
Figure E-1
Right-of-Way Grant Area of Interest for Offshore Hubs and Transmission Backbone
Atlantic Wind Connection

ES3.2 Offshore Facilities

The proposed AWC Project, extending from the northern New Jersey/New York metropolitan area to southern Virginia, would be capable of accepting up to 7,000 MW of capacity from offshore platforms. Each platform would accept a high-voltage alternating current (HVAC) feed from one or more wind farms and would convert the electricity to high-voltage direct current (HVDC) using state-of-the-art voltage sourced converters (VSCs). Each AWC offshore converter platform would be connected to one of the two separate circuits. Each circuit would be connected to the onshore transmission grid (at up to seven locations combined) where AWC terrestrial converter stations would convert the HVDC power to HVAC and connect into the grid. Each circuit of the Project would consist of a positive and negative pole, each requiring a separate 320 kilovolt (kV) rated cable.[3] A fiber optic cable system would be included with each circuit and would provide communications and control capability. The Project's two circuits would therefore require a total of four power cables and two communications cables.

Voltage Sourced Converters

The AWC Project is a multi-terminal HVDC system using VSCs. VSCs do not require a strong "driving" network which allows for operational flexibility; they can build the appropriate three-phase alternating current (AC) voltage required by the terrestrial AC transmission grid and, therefore, are an ideal technology where the feed is weak or variable, such as with wind farms.

Offshore Platforms

Each offshore wind project connected to AWC would have an AC electric service platform to which the inter-turbine low-voltage collector cables would be connected. The electric service platform would have transformers that would step up the voltage to higher AC voltage levels (e.g., 138 kV). AC feeder cables would connect the electric service platforms to AWC's offshore converter platforms. At this time, the configuration of individual offshore wind farms is unknown. The Project's unstaffed offshore converter platforms would have the capacity to accept approximately 1,000 MW of wind turbine output at each site. The Applicant currently expects that the AWC system would have seven offshore converter platforms, although this number could be optimized for future Project phases.

In addition to the HVDC converter equipment, each AWC offshore converter platform would be equipped with isolation devices, protection and control systems, emergency power, and communications facilities. Although the offshore converter platforms would generally be unstaffed, the platforms would have emergency shelter facilities for maintenance staff.

Offshore HVDC Transmission Line

Each AWC circuit would consist of two HVDC cable systems and one fiber optic cable system. Each section of circuit would be rated for 1,000 MW provided by two cables operating at voltages of +/-320 kV (640 kV between conductors). Each 320 kV direct current (DC) cable would have a diameter of about 5.5 inches. The fiber optic cable would have a diameter of about 1 inch. The cables proposed to be used in the AWC Project would be designed for operation in the ocean environment. The HVDC submarine cables would be composed of a single conductor core, insulation, shielding, steel wire armor, and an outer multi-layer sheath.

As noted above, the fully-built AWC Project would include two circuits (Circuit 1 and Circuit 2), each installed within a separate offshore corridor. Separating the corridors for each circuit is required to lessen the risk that a single event such as an anchor drag would damage both circuits. The submarine

[3] The project specifications described herein are indicative only. As design engineering progresses certain specifications may change.

cables for each circuit would be buried in the seabed and may be covered with protective materials in certain places to avoid or minimize the possibility of damage. Cables may be buried in a single trench in a bundle consisting of the two power cables and the fiber optic cable. Alternately, to increase cable power transfer capacity through better heat dissipation and to improve reliability, it may be preferred to use two trenches to separate the two cables of each circuit. Cable burial depth would be dependent on the type of seafloor (hard bottom or soft bottom), the potential presence of sandwaves and sediment megaripples that could migrate through the cable area and expose cables if not buried deep enough, and the marine use that takes place in that given cable area.

ES3.3 Onshore Facilities and Transmission Line to the State's Submerged Boundary

Permanent facilities that are not part of this ROW Application include portions of cable ROW located on state submerged lands, the onshore portions of the DC cable system, the onshore converter stations, and the connections to the AC grid.

ES4 Right-of-Way Grant Request for Blocks in the Outer Continental Shelf

AWC is an integrated, regional transmission system consisting of several phases that together comprise two independent circuits (Circuit 1 and Circuit 2) and associated facilities. The Applicant recognizes that BOEMRE regulations limit the ROW grant to a corridor of approximately 200 feet (61 meters) wide centered on the cable (30 CFR 285.301). A total of 300 OCS blocks are identified as the area of interest in this ROW Application. Of those blocks, 7 are identified as potential hub sites and all 300 are areas of interest for transmission siting, however it is possible that as stakeholder consultation and field study proceed, the Applicant may seek to shift hub locations to nearby adjacent OCS blocks identified here as areas of interest for transmission facilities. The total area of interest is approximately 2,604 mi^2 (6,744 km^2) of the OCS. However, a transmission corridor approximately 200 feet (61 meters) wide would encompass an area of approximately 24 mi^2 (62 km^2) or only 1% of the OCS block area identified in this ROW Application.

The Applicant has designed an Application that provides the siting flexibility that is needed, following offshore survey activities, to locate the transmission facilities prudently and to satisfy obligations under applicable federal and state requirements, including the National Environmental Policy Act, analogous state laws, and the Coastal Zone Management Act. We also recognize that, under 30 CFR 285.302(b), the United States reserves the right to grant other rights in the area of a previously issued ROW grant as long as that subsequent authorization does not unreasonably interfere with the activities approved in the prior award. Accordingly, the ROW grant requested in the ROW Application is not intended to restrict activities, such as wind farm development, on the lease blocks identified herein where such activities would not unreasonably interfere with AWC facilities that would be physically located on the OCS.[4]

[4] The Applicant recognizes that it also will have an obligation to avoid adverse impacts to preexisting wind farm facilities or other marine infrastructure present on the OCS of interest.

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<u>Appendices</u>

<u>Attachment *(provided under separate cover)*</u>

List of Tables

List of Figures

Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
AC	alternating current
ACS	American Cetacean Society
Applicant	Atlantic Grid Holdings LLC
AWC	Atlantic Wind Connection
BOEMRE	Bureau of Ocean Energy Management, Regulation, and Enforcement
CFR	Code of Federal Regulations
dBA	A-weighted decibel(s)
DC	direct current
DoD	(United States) Department of Defense
DOE	(United States) Department of Energy
DoN	(United States) Department of the Navy
DPS	distinct population segment
EEZ	Exclusive Economic Zone
EFH	essential fish habitat
ENC	Electronic Navigational Chart
ESA	Endangered Species Act (of 1973)
ESI	Environmental Sensitivity Index
FAA	Federal Aviation Administration
FERC	Federal Energy Regulatory Commission
FMP	fishery management plan
FR	*Federal Register*
GAP	General Activities Plan
GIS	Geographical Information System
HMS	highly migratory species
HVAC	high-voltage alternating-current
HVDC	high-voltage direct-current
km	kilometer(s)
km^2	square kilometer(s)

Acronyms and Abbreviations, continued

kV	kilovolt(s)
MAB	Mid-Atlantic Bight
mi	Statute Miles
mi^2	Statute square mile(s)
MMS	Minerals Management Service
MPA	Marine Protected Area
MW	megawatt(s)
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NYISO	New York Independent System Operator
NJDEP	New Jersey Department of Environmental Protection
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries Service	National Oceanic and Atmospheric Administration National Marine Fisheries Service
NYISO	New York Independent System Operator
OCS	Outer Continental Shelf
OPAREA	operating area
PJM	PJM Interconnection, L.L.C.
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
POI	point of interconnection
Project	the Atlantic Wind Connection project
psu	practical salinity unit(s)
RFI	Request for Interest
ROW	right-of-way
ROW Application	*Right-of-Way Grant Application for the Atlantic Wind Connection Project*; the document herein
RTO	Regional Transmission Organization
SAI and Loftus	Southwick Associates, Inc. and Andrew J. Loftus, Loftus Consulting
SST	sea surface temperature
TSS	traffic separation scheme
USDOC	United States Department of Commerce
USDOI	United States Department of the Interior

Acronyms and Abbreviations, continued

USFWS	United States Fish and Wildlife Service
VSC	voltage sourced converter
WEA	Wind Energy Area

1 Contact Information for Applicant, Operator, and Consultant

1.1 Applicant for Right-of-Way Grant

Atlantic Grid Holdings LLC (Applicant[5]):

4445 Willard Avenue
Suite 1050
Chevy Chase, Maryland 20815

Contact Person:

Kris Ohleth, Director of Permitting
Atlantic Grid Development, LLC
Telephone Number: (240) 396-2567
Facsimile Number: (240) 396-2599
Mobile Number: (201) 850-3690
E-mail Address: KOhleth@atlanticwindconnection.com

1.2 Designated Operator

Atlantic Grid Operations A LLC, an affiliate of the Applicant, will operate and maintain the Atlantic Wind Connection (AWC) Project (the Project) facilities. PJM Interconnection, L.L.C., (PJM) or the appropriate Regional Transmission Organization (RTO) will control the dispatch of energy on the AWC transmission system.

1.3 Regulatory Lead for Applicant

The regulatory lead for the Applicant is:

Ecology and Environment, Inc.
368 Pleasant View Drive
Lancaster, New York 14086

Contact Persons:

Sara Mochrie – Project Manager
Telephone Number: (716) 684-8060
Facsimile Number: (716) 684-0844
E-mail Address: smochrie@ene.com

and

Antonino Riccobono – Deputy Project Manager
Telephone Number: (305) 822-9959
Facsimile Number: (305) 822-5958
E-mail Address: ariccobono@ene.com

5 The Applicant is an indirect subsidiary of Google Inc., Good Energies II L.P., and Marubeni Corporation.

2 Unsolicited Right-of-Way Application

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The Project is an offshore backbone transmission system, to be built in the mid-Atlantic Wind Energy Areas (WEAs) recently identified by BOEMRE, designed to connect multiple offshore wind farms to the strongest parts of the terrestrial transmission grid. The Project would be owned and operated as a federally regulated public utility with the responsibility for providing open-access transmission service. This ROW Application does not solicit a lease for any areas on the Outer Continental Shelf (OCS) for the purpose of wind farm construction. Any wind farms that connect to AWC facilities would be built by entities unaffiliated with the Applicant using OCS leases secured from BOEMRE in separate applications.

The Applicant recognizes that, under 30 CFR 285.302(b), the United States reserves the right to grant other rights in the area of a previously issued ROW grant as long as that subsequent authorization does not unreasonably interfere with the activities approved in the prior award. Accordingly, the ROW grant requested in the ROW Application is not intended to restrict activities, such as wind farm development, on the lease blocks identified herein where such activities would not unreasonably interfere with AWC facilities that would be physically located on the OCS.

2.1 Filing with Federal Energy Regulatory Commission

On December 20, 2010, the Applicant filed with the Federal Energy Regulatory Commission (FERC) a Petition of Declaratory Order for incentive rate treatment and a request for approval of a return on equity for their investments in the Project pursuant to Sections 205 and 219 of the Federal Power Act, 16 United States Code § 824d, 824s(a), and Rule 207 of FERC's Rules of Practice and Procedure, 18 CFR § 385.207. On May 19, 2011, FERC issued an Order granting the Project various rate incentives conditioned upon ACE being included in the PJM Regional Transmission Expansion Plan (RTEP). No requests for a rehearing of that Order were filed and, as a result, the Order is final and non-appealable. As a result of Order 1000 issued July 18, 2011, PJM is in the process of reissuing its RTEP criteria to include considerations of projects, like AWC, that are designed to address state and federal public policy requirements like renewable portfolio standards. AWC is actively participating in PJM's stakeholder process that will lead to a compliance filing as early as the end of 2011.

2.2 The AWC Project and Its Adherence to National Ocean Policy

On July 19, 2010, the Obama Administration released the "Final Recommendations of the Interagency Ocean Policy Task Force," establishing a National Policy for the *Stewardship of the Ocean, Coasts, and Great Lakes*, and created the National Ocean Council. The National Policy identifies coastal and marine spatial planning as a priority, noting the importance of an integrated approach to planning and managing ocean uses and activities. The "Final Recommendations of the Interagency Ocean Policy Task Force" also note the need to better coordinate at the federal, state, tribal, and local levels. In October 2010, the Applicant initiated a robust engagement process with all previously identified regulatory stakeholders to receive input at the federal, state, and local levels. The Applicant intends to proceed in the spirit of this National Policy throughout the Project development process.

It is the Policy of the United States to:

- Protect, maintain, and restore the health and biological diversity of ocean, coastal, and Great Lakes ecosystems and resources;
- Improve the resiliency of ocean, coastal, and Great Lakes ecosystems, communities, and economies;
- Bolster the conservation and sustainable uses of land in ways that will improve the health of ocean, coastal, and Great Lakes ecosystems;
- Use the best available science and knowledge to inform decisions affecting the ocean, our coasts, and the Great Lakes, and enhance humanity's capacity to understand, respond, and adapt to a changing global environment;
- Support sustainable, safe, secure, and productive access to, and uses of the ocean, our coasts, and the Great Lakes;
- Respect and preserve our Nation's maritime heritage, including our social, cultural, recreational, and historical values;
- Exercise rights and jurisdiction and perform duties in accordance with applicable international law, including respect for and preservation of navigational rights and freedoms, which are essential for the global economy and international peace and security;
- Increase scientific understanding of ocean, coastal, and Great Lakes ecosystems as part of the global interconnected systems of air, land, ice, and water, including their relationships to humans and their activities;
- Improve our understanding and awareness of changing environmental conditions, trends, and their causes, and of human activities taking place in ocean, coastal, and Great Lakes waters; and
- Foster a public understanding of the value of the ocean, our coasts, and the Great Lakes to build a foundation for improved stewardship.

***Source:* "Final Recommendations of the Interagency Ocean Policy Task Force" (July 19, 2010)**

2.3 Summary of Outreach Efforts Conducted to Date

The Applicant has initiated Project outreach efforts to encourage stakeholders to participate and be involved throughout Project development. Early outreach efforts have primarily targeted federal and state agencies, local government entities, and offshore wind energy developers interested in siting wind farm projects on the OCS extending from the New York/New Jersey metropolitan area to southern Virginia (refer to Section 3 for project details). Early outreach has consisted of providing stakeholders with information about the Project, including its purpose and need, soliciting feedback from them and providing them with information to address their concerns. *Table* 2-1 provides a summary of the outreach efforts conducted to date (October 2010 through March 2011).

Table 2-1
Summary of Regulatory Stakeholders Outreach Efforts thru March 2011

Agency/Organization	Point(s) of Contact	Meeting Date(s)
Bureau of Ocean Energy Management, Regulation, and Enforcement	Michael Bromwich and staff	October 2010, February 2011, March 2011
Delmarva Peninsula Planning Association	Marianne Abdul	October 2010
Mid-Atlantic Fishery Management Council	Thomas Hoff	October 2010
United States Department of Defense	Dorothy Robyn, Jackie Pfannenstiel	October 2010, January 2011, February 2011
United States Department of Energy	Cathy Zoi, Chris Hart and other staff	October, November 2010, March 2011
Maryland Governor's Office	Governor O'Malley, Abigail Hopper	November 2010
United States Army Corps of Engineers	James Haggerty	November 2010
Virginia Governor's Office	Governor McDonnell, Maureen Matsen	November, December 2010
Chesapeake Climate Action Network	Mike Tidwell	December 2010
Dominion Power	Guy Chapman	December 2010
Federal Energy Regulatory Commission	Commissioners and staff	December 2010
Maryland State Senate	Senator Rob Garagiola	December 2010
Sierra Club, Virginia Chapter	Glen Besa	December 2010
U.S. Offshore Wind Development Coalition	Jim Lanard	December 2010, January – March 2011
United States Coast Guard District 1	Ron Beck	December 2010, March 2011
Virginia Alternative & Renewable Energy Association	Ken Hutcheson	December 2010
Virginia Department of Mines, Minerals, and Energy	Steve Walz	December 2010
Virginia Economic Development Partnership	Jerry Giles	December 2010
Delaware Public Service Commission	Bruce Burcat	January 2011
Natural Resources Defense Council	Frances Beinecke	January 2011
National Wildlife Federation	Curtis Fisher	January 2011, February 2011
United States Environmental Protection Agency	Lisa Jackson, Lingard Knutson	January 2011
Apex Wind	Tim Ryan	February 2011
Blue-Green Alliance	David Foster	February 2011
Center for American Progress	Mike Conathan	February 2011
Delaware Department of Natural Resources and Environmental Control	Lee Ann Walling	February 2011
Maryland Energy Administration	Andrew Gohn	February 2011
New Jersey Business and Industry Association	Sara Bluhm	February 2011
NOAA Fisheries Services, , Northeast Regional	Julie Crocker, Karen Greene	February 2011

Table 2-1
Summary of Regulatory Stakeholders Outreach Efforts thru March 2011

Agency/Organization	Point(s) of Contact	Meeting Date(s)
Office		
U.S. Legislators	Senators Coons and Webb; Representatives Pallone and Holt	February 2011
United States Coast Guard District 5, Waterways Management Section	John Walters	February 2011
United Steelworkers	Leo Gerard	February 2011
National Oceanic and Atmospheric Administration	Sally Yozell, Lois Schiffer	March 2011
New Jersey Department of Environmental Protection	Ruth Foster	March 2011
New York State Department of Environmental Conservation	Chris Hogan	March 2011
New York State Department of State, Coastal Resources Unit	Jeff Zappieri	March 2011
The Nature Conservancy	Jay Odell	March 2011
United States Fish and Wildlife Service	Keith Hastie, Wendy Walsh and other staff	March 2011

3 Project Objectives and Description of Phases

The AWC Project is the first offshore backbone electrical transmission system proposed in the United States. It will enable up to 7,000 megawatts (MW) of offshore wind turbine capacity to be integrated into the regional high-voltage grid controlled by PJM or the appropriate RTO in a cost-effective manner, increasing reliability and reducing congestion in the heavily congested corridor between Virginia and the New Jersey/New York metropolitan area. The offshore backbone transmission system would be located largely off the coasts of New York, New Jersey, Delaware, Maryland, and Virginia and connected to the existing terrestrial transmission system at strong transmission nodes and near load centers.

The Project would be operated as a single integrated system even though it is anticipated to be constructed and financed in five phases: A through E (see Figure 3-1). Facilities constructed in each phase would be owned by one of five public utility companies (the AWC Companies[6]) as described in the Applicant's Statement of Qualifications to Hold a Renewable Energy Grant on the U.S. Outer Continental Shelf (*PRIVATE AND CONFIDENTIAL/NON-PUBLIC; provided under separate cover*).

When fully built, the Project would comprise about 790 miles[7] (1,271 kilometers [km]) of offshore transmission cable constructed over approximately a 10-year timeframe (see Figure 3-1):

- **Phase A.** The offshore portion from southern-New Jersey to Delaware with a capacity of up to 2,000 MW;
- **Phase B.** The offshore portion from southern-New Jersey to the northern New Jersey/New York metropolitan area with a capacity of up to 1,000 MW;
- **Phase C.** The offshore portion from Maryland to the northern New Jersey/New York metropolitan area with a capacity of up to 2,000 MW;
- **Phase D.** The offshore portion from Maryland to Virginia with a capacity of up to 1,000 MW; and
- **Phase E.** The offshore portion from Delaware to Virginia with a capacity of up to 1,000 MW.

The phases of the AWC system design are intended to complement the progression of the mid-Atlantic offshore wind industry and to maximize grid reliability and benefits from the economical dispatch of generation. Project Phase A, for example, would serve the WEAs identified off the southern New Jersey and Delaware coastlines where multiple wind developers have already expressed an interest in building wind projects. Phase B would build on Phase A with an additional offshore transmission hub in the New Jersey WEA and a transmission extension to the north. The terrestrial terminal for Phase B would be one of several possible points of interconnection (POIs) depending on factors including the results of stakeholder consultation, transmission planning rules at PJM and the New York Independent System Operator (NYISO), state offshore wind policy, cost, wind energy customer requirements, and benefits such as reductions in locational marginal prices and enhanced grid reliability. These factors also

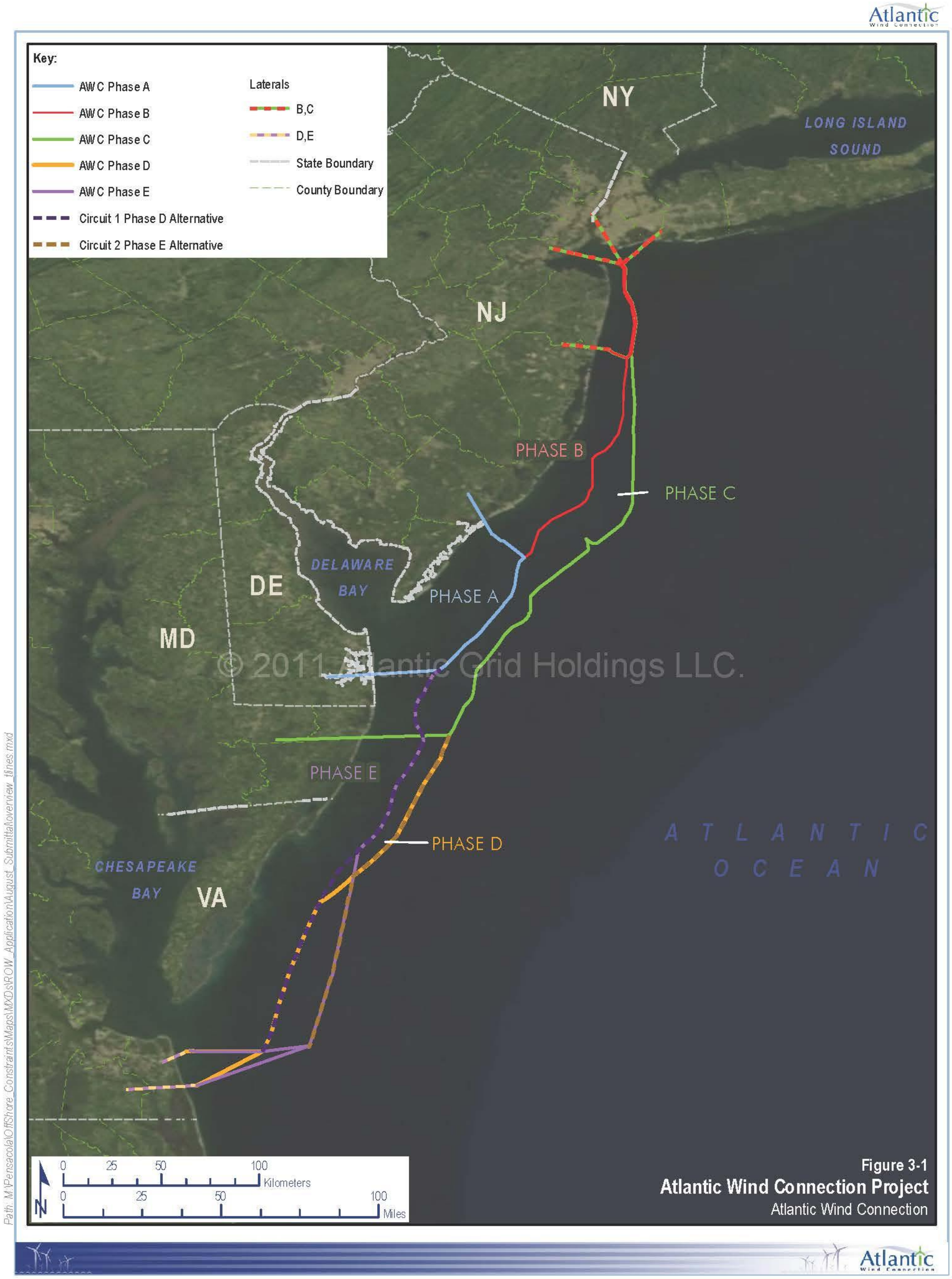
[6] The AWC Companies include: Atlantic Grid Operations A LLC, Atlantic Grid Operations B LLC, Atlantic Grid Operations C LLC, Atlantic Grid Operations D LLC, and Atlantic Grid Operations E LLC, and are indirect subsidiaries of Google Inc., Good Energies II L.P., and Marubeni Corporation.

[7] All mileage measurements reported in this application are presented in statute miles and transmission cable mileage is reflective of two circuits (Circuit 1 and Circuit 2).

may affect the sequencing of the AWC system phases subsequent to Phase A. For example, increased interest in development of the Virginia WEA may accelerate one of the Project phases that would serve the Virginia WEA. Since these factors will change over time, it is prudent to retain flexibility in the order of Project phasing and terrestrial POIs until closer to the trigger date for each such phase subsequent to Phase A. Flexibility is further reflected on Figure 3-1 for Phase D and Phase E for which two potential circuit paths are provided to allow for future technical advances (e.g., fast-acting circuit breakers) that may allow for possible adjustments to the circuit configuration.

Although the Project would be built in phases, a single company, Atlantic Grid Operations A LLC, would perform integrated system operations and maintenance of all Project facilities under a joint operating agreement among the five AWC Companies. The AWC Companies would, however, grant the appropriate RTO (i.e., PJM or NYISO) full operational and system dispatch authority, allowing the RTO to dispatch resources across the system as needed to enhance the reliability and economic performance of the entire mid-Atlantic region grid. The AWC Companies would not develop or own offshore wind farms, but would provide open, non-discriminatory access to offshore wind energy generation under a FERC-authorized tariff.

The Project would provide population centers in the Mid-Atlantic region with efficient access to substantial amounts of offshore wind resources. The Project supports federal and state economic development, environmental and renewable energy policy objectives, including Renewable Portfolio Standards adopted by states in the region, and it would enhance the competitive regional electric market by increasing supply options and reducing congestion on existing facilities.


Key:
AWC Phase A
AWC Phase B
AWC Phase C
AWC Phase D
AWC Phase E
Circuit 1 Phase D Alternative
Circuit 2 Phase E Alternative
Laterals
B,C
D,E
State Boundary
County Boundary
NY
LONG ISLAND SOUND
NJ
PHASE B
PHASE C
DELAWARE BAY
DE
PHASE A
MD
© 2011 Atlantic Grid Holdings LLC.
PHASE E
PHASE D
ATLANTIC OCEAN
CHESAPEAKE BAY
VA
0 25 50 100 Kilometers
0 25 50 100 Miles
Figure 3-1
Atlantic Wind Connection Project
Atlantic Wind Connection

4 Project Description and Facilities

The proposed AWC Project is a subsea backbone transmission system that would extend from the northern New Jersey/New York metropolitan area to southern Virginia. The Project would be capable of accepting up to 7,000 MW of capacity from offshore platforms. Each platform would accept a high voltage alternating current (HVAC) feed from one or more wind farms and would convert the electricity to high voltage direct current (HVDC) using state-of-the-art voltage sourced converters (VSC). The AWC offshore converter platforms would be connected to either Circuit 1 or Circuit 2, which in turn would be connected to the onshore alternating current (AC) transmission grid at up to seven locations where AWC onshore converter stations would convert the HVDC power to HVAC.[8] Each circuit of the Project would consist of a positive and negative pole, each requiring a separate 320 kilovolt (kV) rated cable system. A fiber optic cable system would be included with each circuit and would provide communications and control capability. The Project's two circuits would therefore require a total of four power cable systems and two communications cable systems. Circuit 1 would run roughly parallel to the mid-Atlantic coast approximately 4 to 30 miles (6.4 to 48.3 km) offshore. Circuit 2 also would run parallel to the coast, but would generally be located farther offshore than Circuit 1. Each section of circuit of the AWC system would be able to transmit 1,000 MW of capacity. Accordingly, the AWC system would not only provide the ability to transmit offshore wind energy, but also would allow the interchange of up to 2,000 MW of capacity between the southern and northern ends of the system. This transfer capability provides a way to balance the variable output of offshore wind generation and to reinforce grid weaknesses.

The following sections further describe the various components of the onshore and offshore Project facilities.

4.1 Offshore Facilities

4.1.1 Voltage Sourced Converters

As noted above, the AWC Project is a multi-terminal HVDC system using VSCs. VSCs do not require a strong "driving" network, which allows for operational flexibility; they can build the appropriate three-phase AC voltage required by the terrestrial transmission grid and therefore are an ideal technology where the connection is weak, such as with wind farms. VSC technology provides additional technical features when compared to "traditional" HVDC, which utilizes line-commutated current-sourced converters that require a strong AC system to operate.

VSC systems include: 1) independent control of active and reactive power; 2) the capability to supply weak or even passive networks (black-start capability); 3) superior multi-terminal control options; 4) multi-level VSC technology with no requirement for harmonic filters; and 5) reduced physical footprint or space requirements, which is critical for offshore applications. The Project's VSCs would use multiple sensors allowing real-time, self-performing, and remote monitoring of each unstaffed offshore platform. Operational data would be communicated via fiber optic cable.

[8] An "overbuild" of wind farm capacity relative to transmission capacity is likely. For example, with an overbuild of 10%, the AWC offshore transmission system having the capacity to deliver 7,000 MW would support an installed wind turbine capacity of 7,700 MW. Ultimately, wind project developers will balance wind farm capital cost and projected wind speeds to determine the expected curtailment frequency and the efficient level of overbuild. For purposes of simplicity, the AWC system is described herein in terms of its designed deliverable capacity of 7,000 MW, not in terms of a larger capacity of offshore wind farms that may be built if wind developers opt to overbuild.

A traditional wind farm has an array of medium-voltage cables collecting power from individual wind turbine generators to an offshore AC transformer platform, subsea HVAC cables to land, and a terrestrial substation connecting the offshore project to the terrestrial transmission grid. This "radial" transmission infrastructure is used when the wind is blowing, but sits idle when the weather is calm. The variability of the wind farm output, as it changes with the weather, is fed via the radial interconnection into just one point on the coastal transmission grid.

In contrast, the AWC network, using controllable VSCs, would provide the ability to connect multiple offshore wind farms over a broad geographic area. The mixing of individual wind farm variability could reduce the aggregate or overall variability of wind energy delivered by the AWC system (Kempton et al. 2010). In addition, the controllable AWC VSCs would provide the grid operator with a variety of grid optimization options. For example, the grid operator could direct power from the AWC system to the terrestrial terminal that is experiencing the highest prices, using the AWC supply to reduce locational energy market prices. The grid operator also may use the AWC system to "firm up" the wind energy. This would be done by responding to decreases in wind energy output with withdrawals of conventional electricity at one or more of AWC's terrestrial converter stations and mixing that conventional electricity with the wind energy on the AWC system to deliver the mixed power to other terrestrial converter stations from the AWC system. In addition, the grid operator may use the VSC's ability to independently control active and reactive power to help manage grid voltages to maintain power quality. In extreme cases when the terrestrial AC grid has collapsed in a blackout, AWC's VSCs could be used to transfer power from available connected sources to assist in restarting the AC grid.

The controllability of the VSCs used in AWC's offshore converter platforms and terrestrial converter stations would help provide safe, efficient, and reliable operation for the regional high-voltage grid. The virtues of a controllable system increase in importance as offshore wind energy is developed and the challenges of connecting this variable resource grows. The controllable AWC network would be operated under the direction of PJM or the appropriate RTO which would order the dispatch of power over the AWC system. The human-machine interface of the HVDC control system would provide real-time information to PJM or the appropriate RTO and the AWC Project operations center.

4.1.2 Offshore Platforms/Hubs

The AWC Project's offshore HVDC platforms would be sited in WEAs identified by the United States Department of the Interior (USDOI) and state offshore wind task forces as preferred for wind farm development. Wind farms in the WEAs would have a convenient, high-capacity connection to the terrestrial grid.

Each offshore wind project would have an electric service platform to which the inter-turbine low-voltage collector cables would be connected. The electric service platform would have transformers that would step up the voltage to higher AC voltage levels (e.g., 138 kV). HVAC feeder cables would connect the electric service platforms to AWC's offshore converter platforms. At this time, the configuration of individual offshore wind farms is unknown. The Project's unstaffed offshore converter platforms would have the capacity to accept approximately 500 to 1,000 MW of wind turbine output at each site. The Applicant currently expects that the AWC system would have seven offshore converter platforms, although this number could be optimized for future Project phases.

Converter platforms would be roughly 80 meters (262.5 feet) long and 50 meters (164 feet) wide, and would stand at a height approximately 35 meters (114.9 feet) above the water. The platforms would weigh approximately 11,000 tons (for 500 MW). In addition to the HVDC converter equipment, each AWC offshore HVDC platform would be equipped with isolation devices, protection and control systems, emergency power, and communications facilities. Although the offshore converter platforms would generally be unstaffed, the platforms would have emergency shelter facilities for maintenance staff.

4.2 Offshore HVDC Transmission Line

Each AWC Circuit would consist of two HVDC cable systems and one fiber optic cable system. Each section of circuit would be rated for 1,000 MW, provided by two cables operating at voltages of +/- 320 kV (640 kV between conductors). A single 320 kV DC cable would have a diameter of about 5.5 inches. The fiber optic cable would have a diameter of about 1 inch. The cables proposed to be used in the AWC Project would be designed for operation in the ocean environment. The HVDC submarine cables would be composed of a single conductor core, insulation, shielding, steel wire armor, and an outer multi-layer sheath.

As previously noted, the fully-built AWC Project would include two circuits (Circuit 1 and Circuit 2), each installed within a separate offshore corridor. Separating the corridors for each circuit is required to lessen the risk of a single event, such as an anchor drag, damaging both circuits. The submarine cables for each circuit would be buried in the seabed and may be covered with protective materials in certain places to avoid or minimize the possibility of damage. Cables may be buried in a single trench in a bundle consisting of the two power cables and the fiber optic cable. Alternately, to increase cable power transfer capacity through better heat dissipation and to improve reliability, it may be preferred to use two trenches to separate the two cables of each Circuit. Cable burial depth would be dependent on the type of seafloor (hard bottom or soft bottom), the potential presence of sandwaves and sediment megaripples that could migrate through the cable area and expose cables if not buried deep enough, and the marine use that takes place in that given cable area. The cable burial depth would be determined after completing a marine geophysical survey and field investigations for the Project and would be optimized to ensure the cable system's performance and protection.

At each offshore converter platform location, the HVDC and fiber optic cables would be brought to the platform topsides through conduits from the seabed. Some of the AWC offshore converter platforms also would have a cable connection from the offshore platform to an onshore converter station that would connect to the HVAC grid. The connections to the HVAC grid, if using underground cables, would be accomplished by direct burial of the cables in trenches or passage through underground conduits, or possibly overhead where existing utility ROW is available. The conduit system would be installed with conventional methods including open-trench placement of the conduits or their installation under obstructions or sensitive areas using horizontal directional drilling technology.

4.3 Onshore Facilities

Permanent facilities that are not part of this ROW Application include portions of the cable ROW located on state submerged lands, the onshore portions of the DC cable system described in Section 4.2, the onshore converter stations, and the connections to the AC grid. The AWC Project's onshore converter stations would be rated at up to 1,000 MW. It is anticipated that there would be seven onshore converter stations. Preliminary estimates indicate the parcel size for a 1,000 MW converter is approximately 12 acres. The power from each of the onshore converter stations would be injected into the AC grid at suitable interconnection points. As noted above, the VSCs can provide ancillary services and increased operational control for PJM, or the RTO that would have control over how the AWC system is used to manage the grid. Figure 4-1 illustrates the AWC Project, including its proposed POIs. Siting analysis corresponding to the connection from each of the proposed onshore converter stations to the state's jurisdictional waters boundary of submerged lands out to 3 nautical miles (5.6 km) is not part of this application.

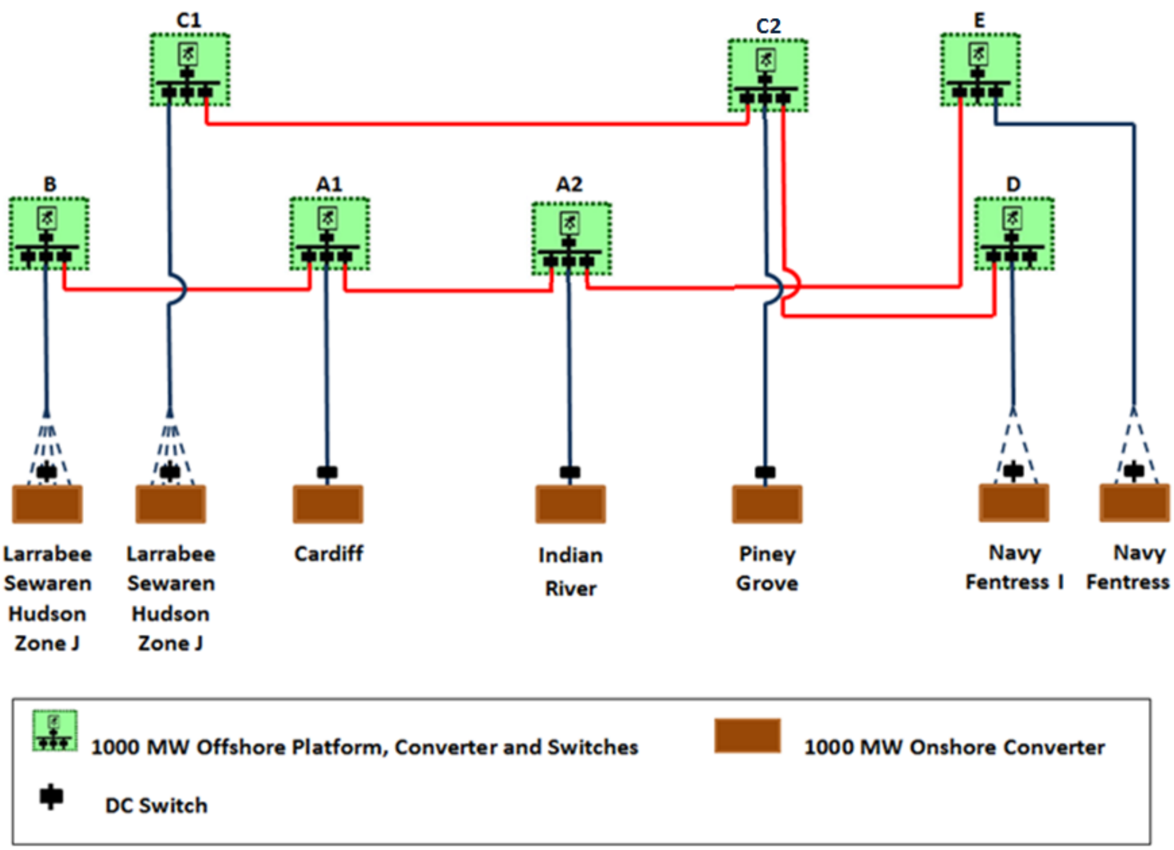


Figure 4-1: AWC Project Two-Circuit Design

Figure 4-2 illustrates the approximate area or zone of interest in state waters and on land that the Applicant would evaluate to establish a path between Project cable sited in federal waters and each of the terrestrial POIs. Extensive consultation with state, county, and local authorities, landowners, and other stakeholders, as well as field evaluation, is required before further refining the connecting path. Each connection from a cable section located on the federal OCS and a terrestrial POI would require a minimum of 3 nautical miles (5.6 km) of subsea cable path and approximately 10 miles (16.1 km) or more of terrestrial cable routing. The Applicant would evaluate alternatives to reach each POI to ensure that options for minimizing disturbance to sensitive near-shore, wetland, and terrestrial environments, and community impacts have been identified, evaluated, and addressed.

Landfall methodologies such as, horizontal directional drills (HDDs) or open cut trenching, will be evaluated on a case-by-case basis and presented in detail as part of the GAP. The Applicant will work with local stakeholders and regulatory agencies to identify the least environmentally damaging alternatives. Consideration also will be given to field data to be collected and studies to be conducted, so that routing nearshore and onshore account for all environmental and socioeconomic factors.

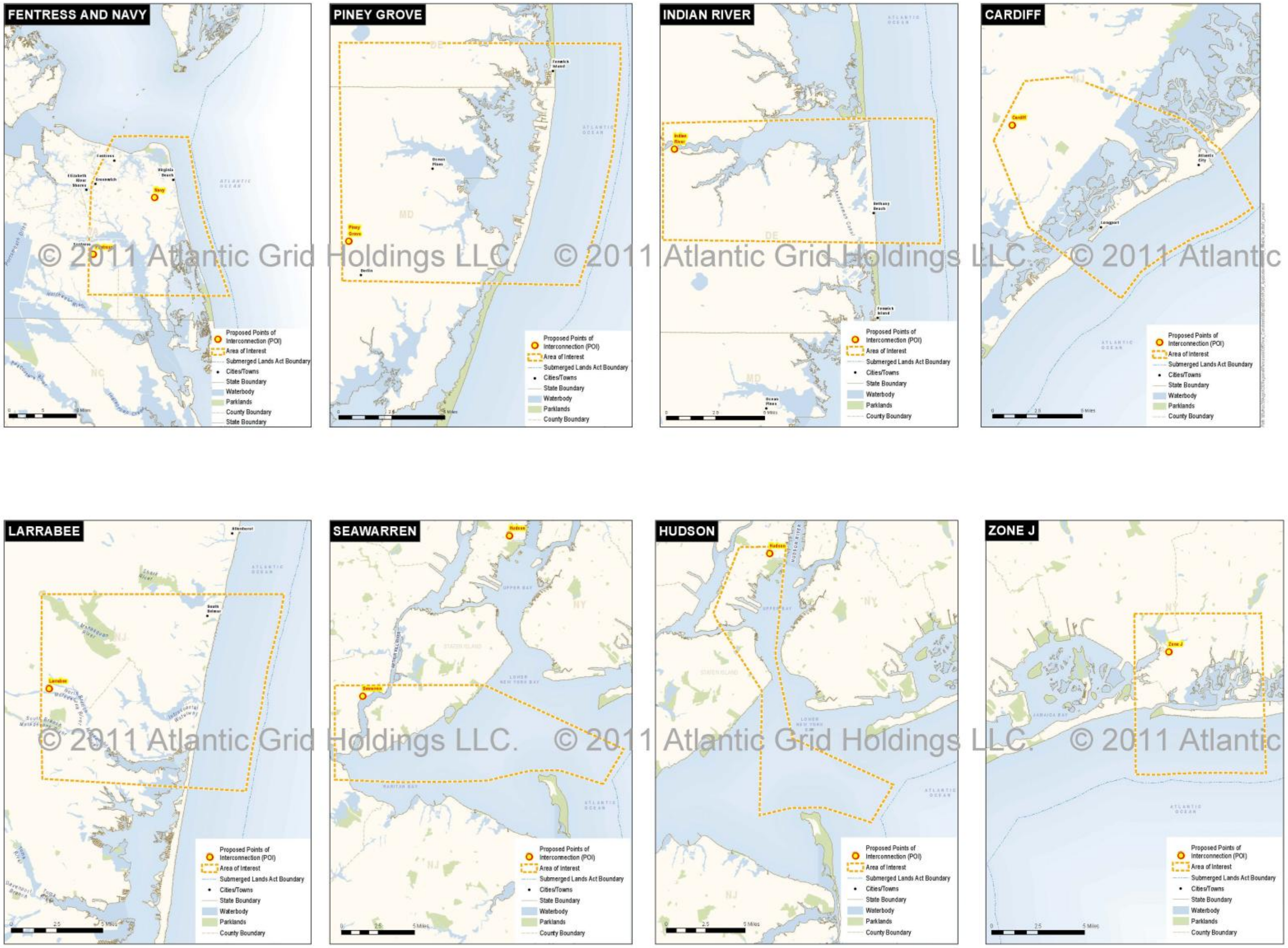


Figure 4-2
Area-of-Interest for Points of Interconnection
Atlantic Wind Connection

Data Sources:
ESRI 2010; NOAA 2011; BOEM 2010;
USGS 2008; USACE 2010

5 Area of Interest for Proposed Right-of-Way Grant

5.1 Corridor Selection Siting Process

5.1.1 Overview of the Ongoing Siting Process Conducted to Date

The siting process involved two principal steps, (1) the siting of offshore converter station hubs and (2) the siting of transmission corridors that would connect the offshore hubs and the terrestrial POIs. The Applicant followed a multi-tier analysis for both steps. To select the potential locations for the offshore converter hubs, the Applicant conducted an engineering and environmental analysis with the objective of identifying areas that were most conducive to wind energy development based on having the best combination of low cost of energy production and minimal environmental conflicts. Once the hub locations were identified, the Applicant conducted a second engineering and environmental analysis that focused on finding an efficient transmission path to avoid obstacles and environmental constraints on the seabed. The siting considerations applied to each step (i.e., offshore hubs and offshore transmission corridor) evaluated different constraints specific to each Project component and applied a tiered methodology explained further below. At the outset of the Project siting process, nearly 9,682 mi^2 (25,076 km^2) were examined on the OCS. Through the considerable siting efforts described in the attached application, the Applicant was able to eliminate 75% of the area from further consideration. As noted in Section 5.1.3.3, the location of a preferred corridor for Circuit 1, a preferred corridor for Circuit 2, and associated facilities will be subject to further evaluation after conducting site specific surveys and field investigations.

Notably, the discussion below focuses strictly on the offshore Project components that are relevant to this ROW Application to be sited within OCS blocks (outside the states' jurisdictional waters boundary). The siting analysis corresponding to the connection from each of the seven onshore converter stations to the boundary with state jurisdictional waters is not part of this application. Detailed information regarding facilities to be constructed within the boundaries of a state will be provided in the GAP and are not included in the Application.

5.1.2 Siting the Offshore Converter Hubs

The overriding consideration in the siting, permitting, construction, operation, and maintenance of the proposed AWC Project is ensuring protection of public health, safety, and the environment. Other considerations, including regulatory compliance, environmental factors, socioeconomic benefits, engineering design feasibility, construction feasibility, and cable operability, security, and costs, are critical in identifying and evaluating alternatives. Siting requires balancing a variety of potential considerations. Some factors are constraints that prevent the location of an offshore hub in a specific area of the OCS, while other factors influence site selection and require the application of best professional judgment.

Before applying the siting criteria for offshore hubs, the Applicant defined a siting envelope within which alternative locations for the offshore hubs could be identified:

- The Applicant built a Geographical Information System (GIS) database for the AWC Project to support the siting process. The database was populated with GIS data layers that are relevant and useful for the siting process; the layers were obtained from federal, state, and local entities, including research institutions and non-governmental organizations. Once the files were collected, meta-data were cataloged to ensure the data were in a useable format and that source information was acceptable and could be verified.

- The Applicant collected a wide variety of publicly available geophysical and environmental data and generated GIS shapefiles using all relevant GIS data layers. These shapefiles allowed the resource-specific and state-specific specialists from the E & E project team to work with GIS analysts to process the data so it could feed into the siting process and ultimately the routing analysis. The table provided in Appendix A summarizes all information used in building the GIS database.
- The Applicant defined east and west boundaries of the envelope, where the west boundary (closest to shore) was based on permitting/environmental constraints and the east boundary (furthest from shore) was based on constructability/available technology and project costs, as well as permitting/environmental constraints. The boundary on the west was set at 10 nautical miles (18.5 km) from shore to avoid potential increased levels of conflict due to bird activity, marine mammal activity, near-shore ship traffic, and viewshed interference. The boundary on the east was set at 30 nautical miles (55.6 km) from shore to reflect the likely extent of wind farm development given current offshore wind turbine and foundation technology and costs.

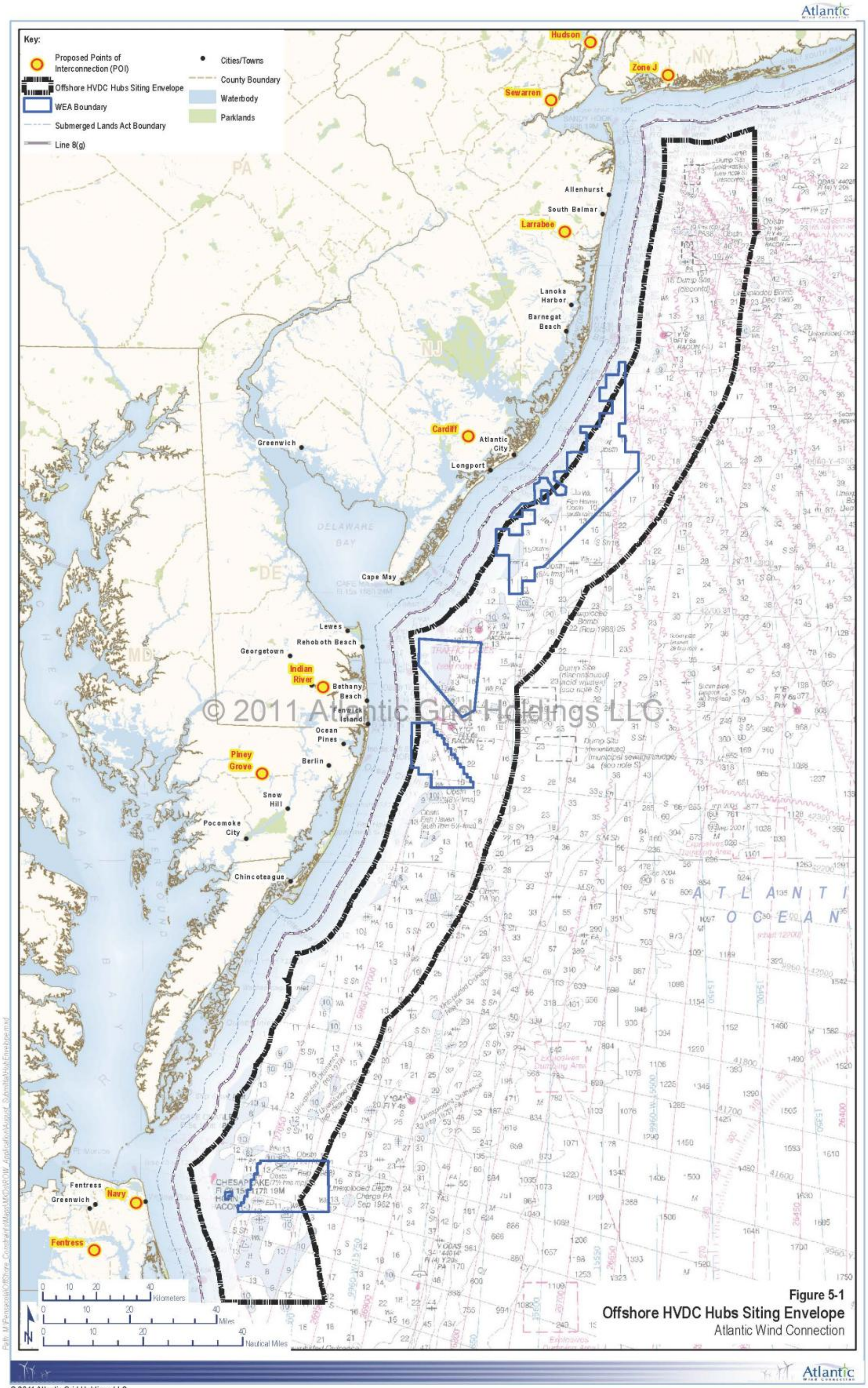
Figure 5-1 details the location of the envelope, which encompasses 784 full and some partial OCS blocks that were considered further in the analysis.

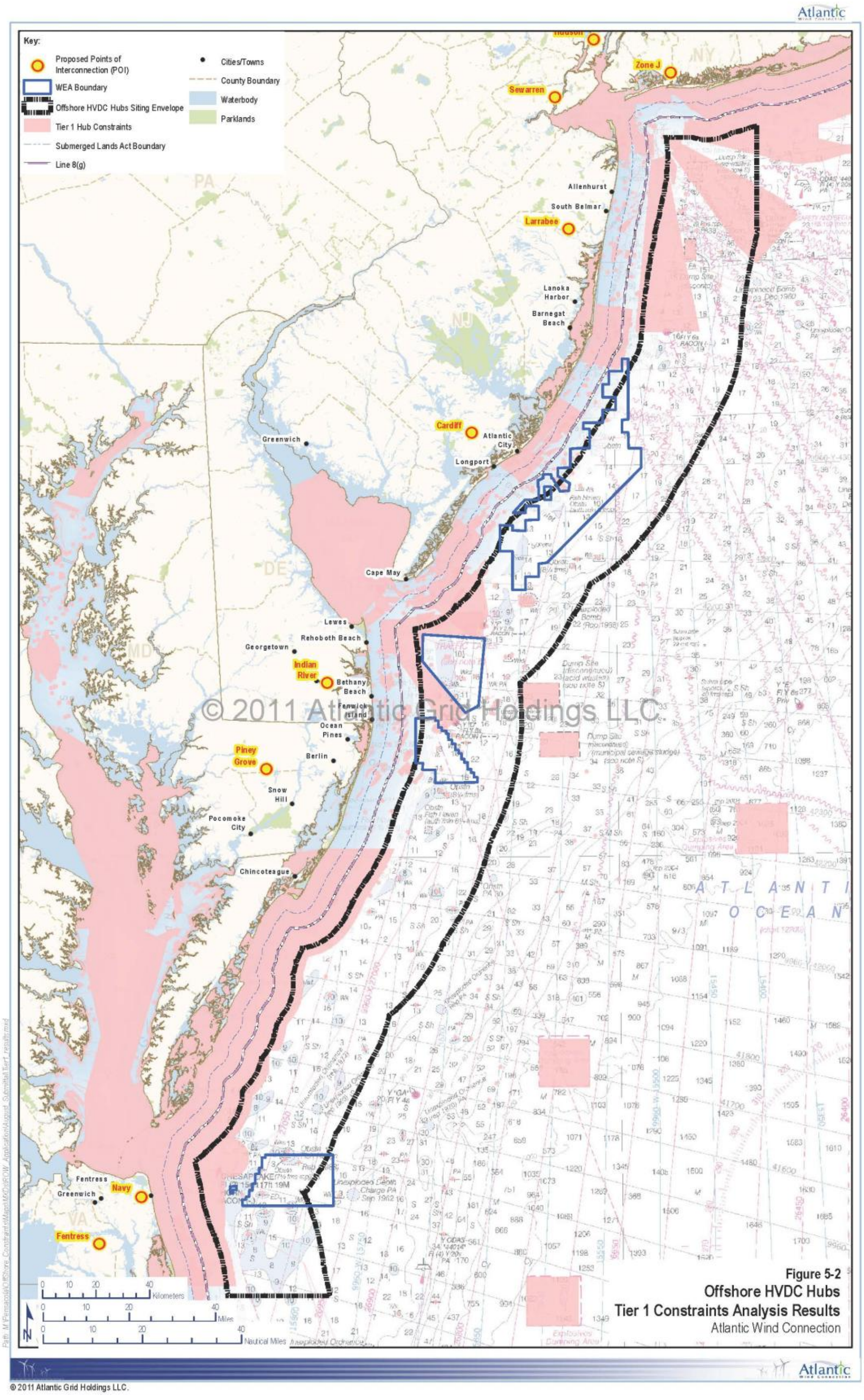
5.1.2.1 First-Tier Siting Criteria for Offshore Hubs

After defining the envelope, the Applicant applied Tier 1 offshore siting criteria to the area within the envelope which reflect constraints that would preclude development of a structure on the seabed and in the water column extending through the water surface:

- **Airspace designation**. Data on numerous airspace types were mapped and evaluated, including those within the Virginia Capes Operating Area (OPAREA), and other space designated by the Federal Aviation Administration (FAA), the National Aeronautics and Space Administration, and the Navy as prohibited, restricted, and warning areas.
- **Use conflict.** Data for numerous uses of the OCS were mapped and evaluated including navigation channels and traffic separation schemes (TSS), BOEMRE sand and gravel resource areas, dumping grounds, fish havens and shellfish harvest and management areas, dredge areas, and restricted areas. A large portion of this information is available from National Oceanic and Atmospheric Administration (NOAA) Electronic Navigational Charts (ENCs) of which these data layers were compiled and mapped as part of the GIS database.

Figure 5-2 details the area remaining within the envelope that is unconstrained by Tier 1 criteria identified above. A total of 721OCS blocks were determined to be unconstrained by Tier 1 offshore hub criteria and were considered further for Tier 2.


Atlantic
Key:
Proposed Points of Interconnection (POI)
Offshore HVDC Hubs Siting Envelope
WEA Boundary
Submerged Lands Act Boundary
Line 8(g)
Cities/Towns
County Boundary
Waterbody
Parklands
Hudson
Zone J
Sewarren
Larrabee
Cardiff
Indian River
Piney Grove
Navy
Fentress
Allenhurst
South Belmar
Lanoka Harbor
Barnegat Beach
Atlantic City
Longport
Greenwich
Cape May
Lewes
Rehoboth Beach
Georgetown
Bethany Beach
Fenwick Island
Ocean Pines
Berlin
Snow Hill
Pocomoke City
Chincoteague
Fentress
Greenwich
PA
NJ
NY
DE
MD
VA
DELAWARE BAY
ATLANTIC OCEAN
© 2011 Atlantic Grid Holdings LLC
Kilometers
Miles
Nautical Miles
Figure 5-1
Offshore HVDC Hubs Siting Envelope
Atlantic Wind Connection
Atlantic


Key:
Proposed Points of Interconnection (POI)
WEA Boundary
Offshore HVDC Hubs Siting Envelope
Tier 1 Hub Constraints
Submerged Lands Act Boundary
Line 8(g)
Cities/Towns
County Boundary
Waterbody
Parklands
Zone J
Sewarren
Allenhurst
South Belmar
Larrabee
Lanoka Harbor
Barnegat Beach
Cardiff
Atlantic City
Longport
Greenwich
Cape May
Lewes
Rehoboth Beach
Georgetown
Indian River
Bethany Beach
Fenwick Island
Ocean Pines
Berlin
Piney Grove
Snow Hill
Pocomoke City
Chincoteague
Fentress
Navy
ATLANTIC OCEAN
© 2011 Atlantic Grid Holdings LLC
Kilometers
Miles
Nautical Miles
Figure 5-2
Offshore HVDC Hubs
Tier 1 Constraints Analysis Results
Atlantic Wind Connection

5.1.2.2 Second –Tier Siting Criteria for Offshore Hubs

After defining the envelope and applying Tier 1 constraints that would exclude structural development, the Applicant applied the Tier 2 offshore siting criteria to the unconstrained areas remaining within the envelope depicted on Figure 5-2:

- **Preferred wind farm areas based on wind energy productivity.** The Applicant developed an offshore wind energy cost model to analyze possible offshore wind farm locations. In general, the model used two types of offshore wind turbines and an extensive wind database to estimate wind energy production within the Project envelope. The model also used bathymetry, distance from shore, seabed type, and other factors to estimate foundation and construction costs by turbine type. Based on the wind production and cost information produced by the model, results illustrate which areas would be attractive and unattractive for wind energy development.
- **Fishing areas.** Data for commercial and recreational fishing activity were mapped and evaluated. Sources for the data included New Jersey and Delaware sporting fishing areas and dredge bottom trawl fishing activity collected by the Nature Conservancy.
- **Visibility**. Aesthetic issues were considered related to visibility of offshore hubs and potential wind farm structures. This was evaluated using the concept that as an object moves farther away from the shoreline, the horizontal sight line increases. Simple concepts of visual physiology indicate that as an object moves further away in the horizontal sight line it appears smaller in the visual influence zone (Smardon, Palmer, and Felleman 1986).
- **Marine Protected Areas (MPAs)**. Areas with a MPA designation from NOAA encompass a variety of conservation and management measures that must be considered and employed.
- **Bird habitat**. Data for nine different subclasses of birds were mapped and evaluated from the NOAA Office of Response and Restoration Environmental Sensitivity Index (ESI) Maps. ESI maps identify coastal resources including biological habitat and shoreline environments that are used as a planning tool to highlight vulnerable areas.
- **Essential fish habitat**. The areas that include essential fish habitat (EFH) were mapped and evaluated. EFH includes all types of habitat where fish spawn, breed, feed, or grow. A subset of EFH data that was evaluated includes Habitat Areas of Particular Concern (HAPC) which are EFH areas that are especially important to the long-term viability of a managed species.
- **Wrecks and Obstructions**. NOAA ENCs were used to map the locations of bottom features that include wrecks and obstructions that can represent sensitive cultural resources and be problematic during construction due to the need to avoid and minimize impacts to these resources or dangers they may pose to navigation. In order to ensure avoidance of these features for siting, the mapped areas were buffered by 0.25 miles (1,320 feet or 0.4 km) and these data layers were compiled and mapped as part of the GIS database.

- **Wind Energy Area (WEAs) and Request for Interest (RFI) Areas.** BOEMRE working in collaboration with state offshore wind task forces and numerous federal agencies has determined areas on the mid-Atlantic OCS that would be preferred for wind energy development. These are commonly referred to as RFI areas when a formal request for interest has been published by BOEMRE or WEAs when they are identified under BOEMRE's "Smart from the Start" initiative. Because these areas reflect the collective wisdom of many stakeholders in the offshore environment they merit particular attention in the Tier 2 analysis.

The Tier 2 evaluation had two components, an energy cost analysis and an environmental analysis. Multiple Tier 2 constraints in an area would reflect a potentially more difficult siting hurdle making such areas less attractive for wind energy development and, accordingly, a less attractive place to site an offshore hub.

Figure 5-3 details the areas (OCS blocks) remaining within the envelope that are unconstrained by the numerous Tier 2 criteria identified above. The Applicant combined the Tier 2 criteria using GIS to identify areas with both low energy costs and low combined environmental and other ocean use conflicts. These "optimal" areas then became the focus of efforts to locate the AWC offshore hubs. The Applicant's proposed hub locations are designed to serve the optimal areas by providing adequate coverage, i.e., minimizing the distance that wind farms located within the optimal areas would need to stretch HVAC cable to reach an offshore hub.

5.1.3 Siting the Offshore Transmission Corridors

Once offshore hub locations had been identified, the Applicant performed separate Tier 1 and Tier 2 analyses to site the transmission corridors that would interconnect the offshore hubs and the terrestrial POIs. Given that the Project's transmission cable would be buried in the seabed and would not raise the same issues (e.g., bird activity, viewshed concerns) that had affected offshore hub siting, the siting approach was different from that described above for the offshore hubs. Before applying the siting criteria for transmission, the Applicant defined a siting envelope within which transmission corridors could be identified:

- The Applicant built a GIS database for the AWC Project to support the siting process. The database was populated with GIS data layers that are relevant and useful for the siting process; the layers were obtained from federal, state, and local entities, as well as research institutions and non-governmental organizations. Once the files were collected, meta-data were cataloged to ensure the data were in a useable format and that source information was acceptable and could be verified.
- The Applicant collected a wide variety of publicly available geophysical and environmental data and generated GIS shapefiles using all relevant GIS data layers. These shapefiles allowed the resource-specific and state-specific specialists from the E & E project team to work with GIS analysts to process the data so it could feed into the siting process and ultimately the routing analysis. The table provided in Appendix A summarizes all information used in building the GIS database.
- The Applicant defined east and west boundaries of the envelope, where the west boundary (closest to shore) was based on permitting/environmental constraints and the east boundary (furthest from shore) was based on constructability/available technology and project costs, as well as identified constraints. The boundary on the

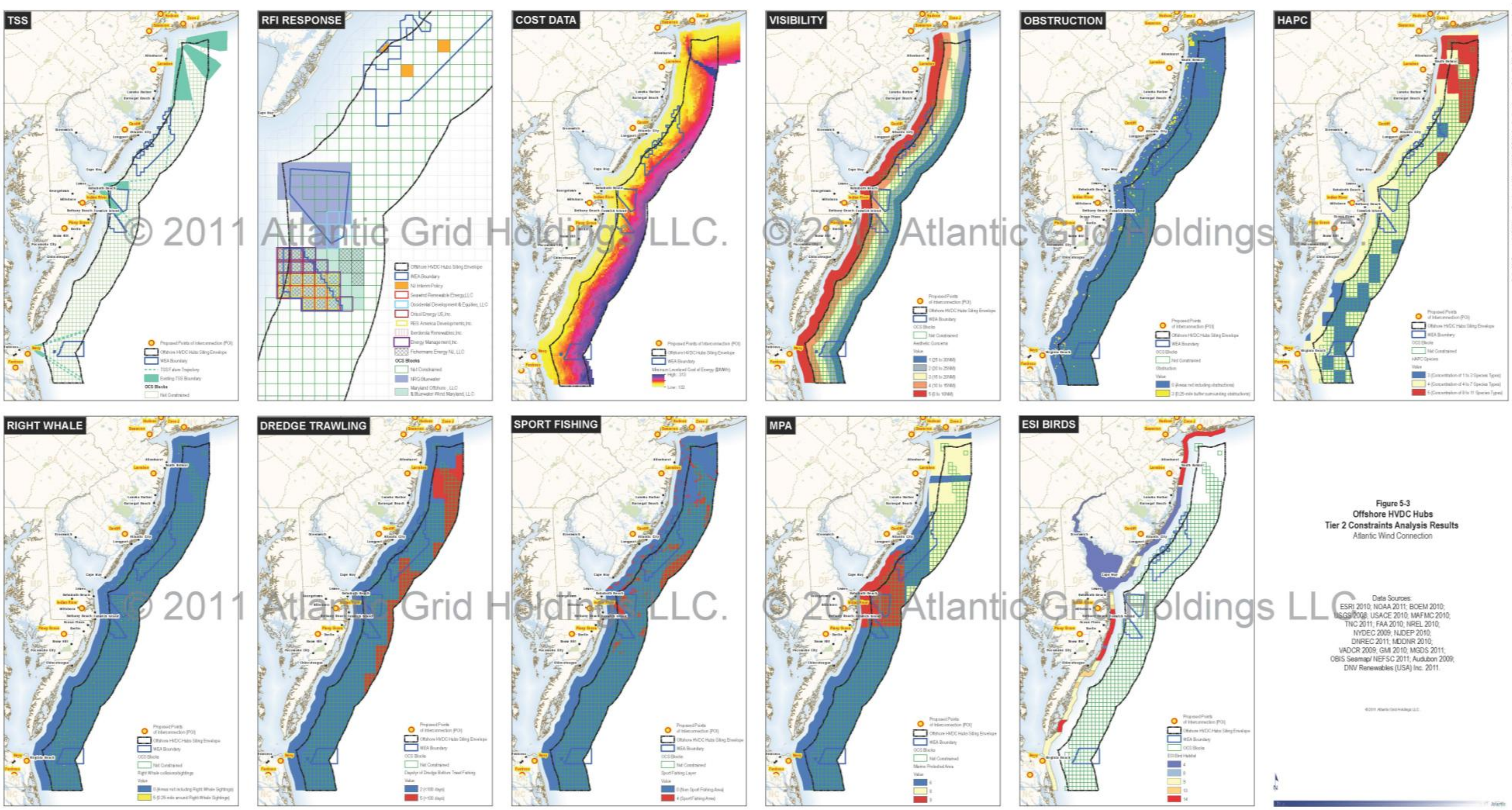


Figure 5-3
Offshore HVDC Hubs
Tier 2 Constraints Analysis Results
Atlantic Wind Connection

Data Sources:
ESRI 2010; NOAA 2011; BOEM 2010;
USGS 2008; USACE 2010; MAFMC 2010;
TNC 2011; FAA 2010; NREL 2010;
NYDEC 2009; NJDEP 2010;
DNREC 2011; MDDNR 2010;
VADCR 2009; GMI 2010; MGDS 2011;
OBIS Seamap/ NEFSC 2011; Audubon 2009;
DNV Renewables (USA) Inc. 2011.

west was set at 3 nautical miles (3.5 miles or 5.6 km) from shore to maintain the transmission routing within waters deeper than 15 meters (49.2 feet) and to minimize routing through state submerged lands and possibly sensitive near-shore habitats. The boundary on the east was set at 30 nautical miles (55.6 km) from shore to reflect a reasonable boundary for successful cable installation based on the proposed hub locations, capabilities of existing installation vessels, and currently available technology, as well as identified constraints.

Figure 5-4 details the location of the envelope which includes 1,220 full and some partial OCS blocks that were considered further in the analysis.

5.1.3.1 First-Tier Siting Criteria for Offshore Transmission Corridors

After defining the envelope, the Applicant applied Tier 1 offshore siting criteria to the area within the envelope which reflect constraints that would preclude development of cables on the seabed:

- Seafloor conditions. Suitable seafloor conditions are critical to identifying the preferred corridors for Circuits 1 and 2 since adequate burial depth using available installation technologies is necessary to obtain regulatory approvals and to maintain safe operation of the cable system. Applicant excluded hard bottom areas from the proposed cable alignment.
- Bathymetry. Seafloor depth was critical in evaluating connectivity of areas with a similar depth profile to site several continuous miles of cable. The bounds identified were no shallower than 15 meters (49.2 feet) and no deeper than 35 meters (114.8 feet). This is important for cable construction since depths that are too shallow are problematic for large cable installation vessels to safely maneuver and operate while not causing potential bottom impacts in sensitive areas, specifically for dynamically positioned vessels. In addition, depths greater than approximately 35 meters (114.8 feet) can be problematic for verification of cable installation and adequate cover due to limits of diving operations and technology. Water depth impacts capital and construction costs and time spent in water, which increases the opportunity for impacts to occur.
- **Use conflict.** Data for numerous uses of the OCS were mapped and evaluated including navigation channels and TSS, BOEMRE sand and gravel resource areas, dumping grounds, fish havens and shellfish harvest and management areas, dredge areas, and restricted areas. A large portion of this information is available from NOAA ENCs of which these data layers were compiled and mapped as part of the GIS database.
- **Wrecks and Obstructions.** NOAA ENCs were used to map the locations of bottom features that include wrecks and obstructions that can represent sensitive cultural resources and be problematic during construction due to the need to avoid and minimize impacts to these resources or dangers they may pose to navigation. In order to ensure avoidance of these features for siting, the mapped areas were buffered by 0.25 miles (1,320 feet or 0.4 km) and these data layers were compiled and mapped as part of the GIS database.

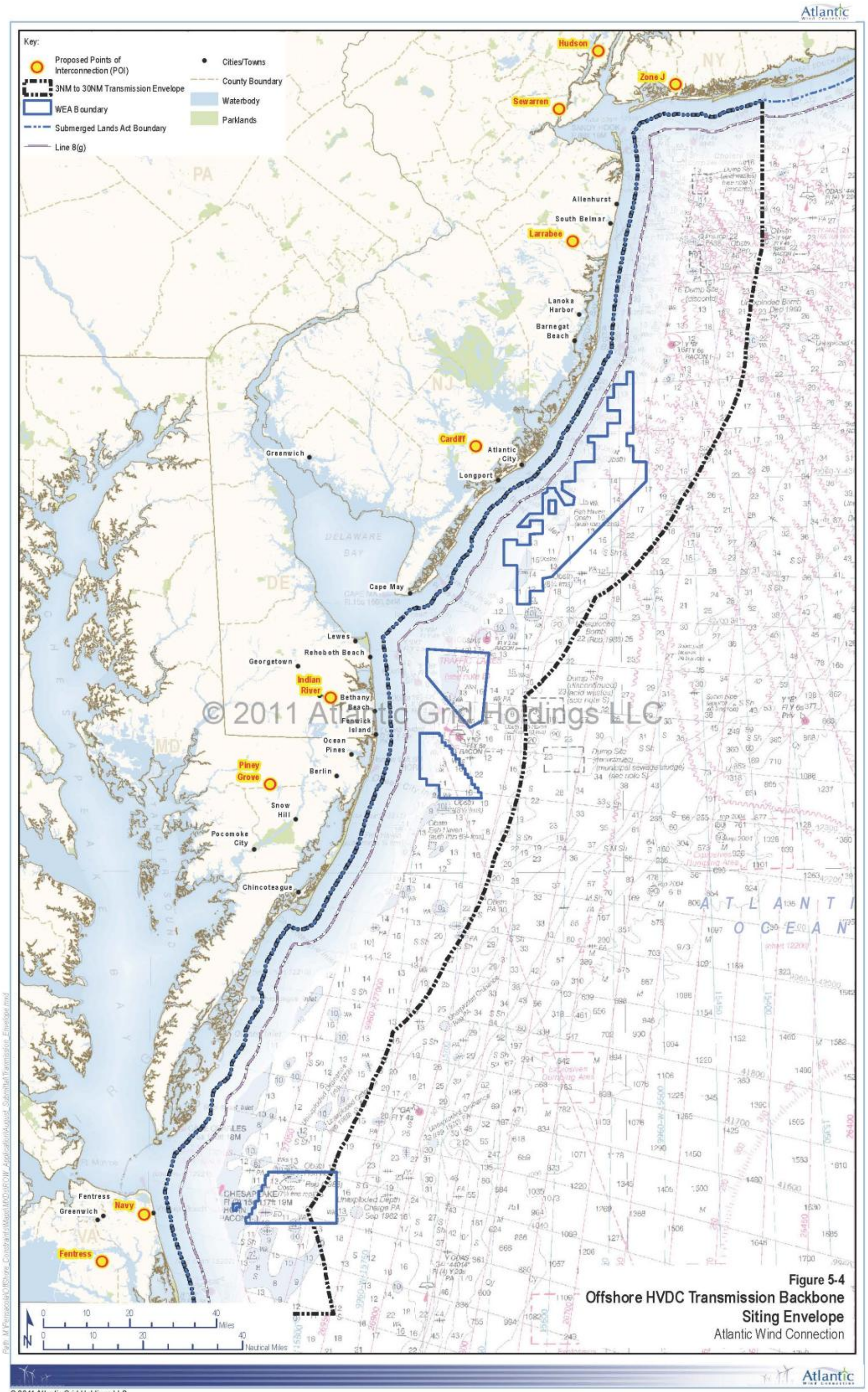
Figure 5-5 provides detail of the areas remaining within the envelope that is unconstrained by Tier 1 criteria identified above. A total of 787 OCS blocks were determined to be unconstrained by Tier 1 offshore transmission criteria and were considered further for Tier 2.

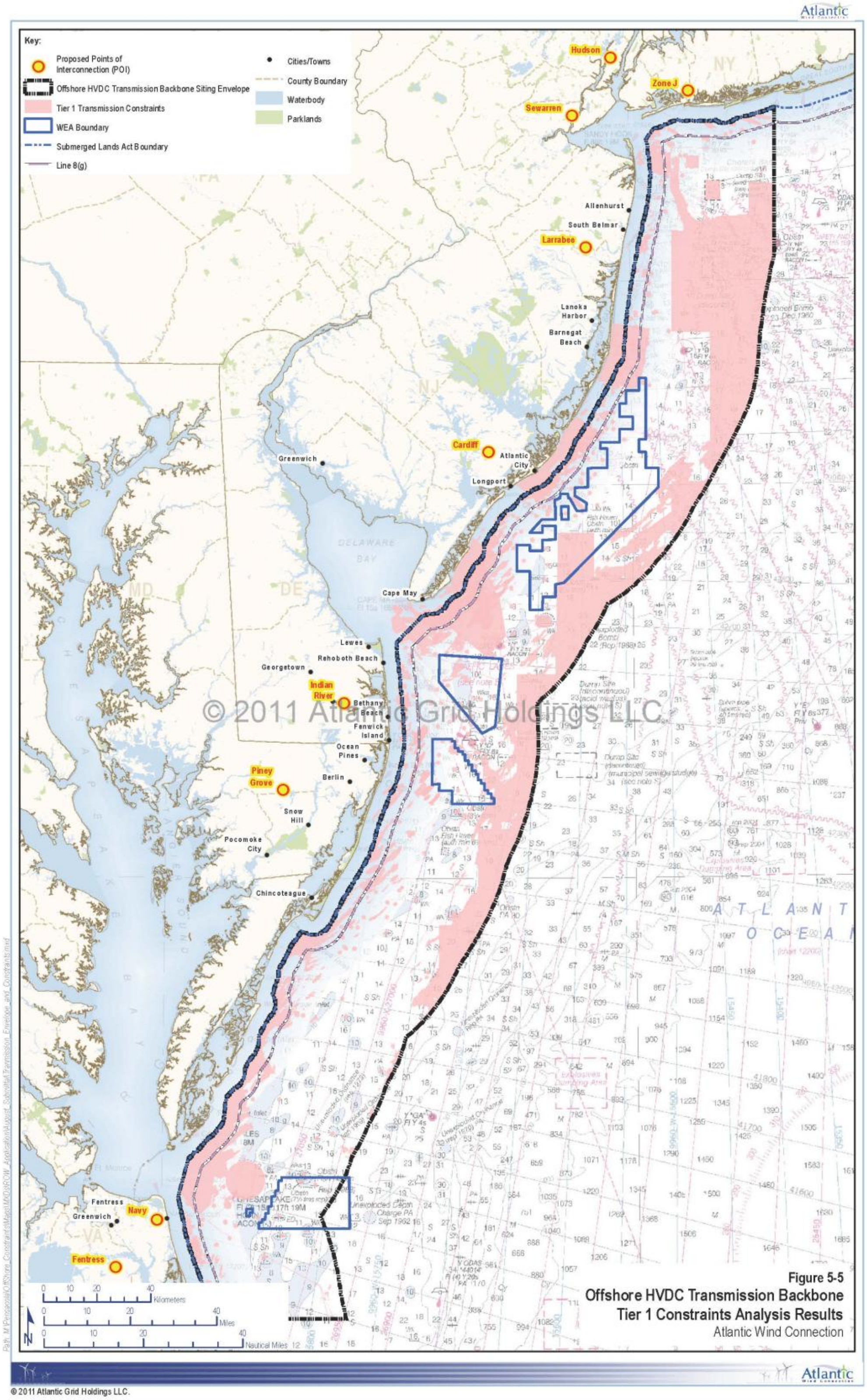
5.1.3.2 Second-Tier Siting Criteria for Offshore Transmission Corridors

The Tier 2 constraints analysis conducted for a transmission corridor must be different than those considered for the offshore hubs since the installation of a cable below the seabed results in different permitting, construction, and operating challenges than an offshore hub. This is due in large part to the fact that disturbance is limited to the construction event and operation of the cable in general has minimal long-term effects on marine resources present. Overall, the transmission siting attempted to minimize length while also minimizing the distance that features, such as TSS, were traversed, as well as minimize interference with potential development in RFI areas. The Tier 2 evaluation considered the following constraints:

- **Seafloor Gradient**. To the extent practicable, offshore transmission corridors and associated facilities would be sited within a suitable seafloor gradient to avoid or minimize impacts to the proposed facilities. Movements in seabed sediments can damage cables and sloped portions of the seabed are more likely to experience submarine landslides. The Applicant proposes to site the Project facilities entirely within the continental shelf (the Atlantic coast of the U.S. consists of three physiographic provinces: the continental shelf, continental slope, and continental rise), which is characterized by a gently sloping seaward gradient, low relief, and generally shallow water depths in comparison to other provinces in deeper waters.
- **Distance.** Cable distance affects the time spent in water and on the seabed which increases the opportunity for impacts to occur. A longer distance also increases Project cost. In general, where constraints allowed, the cable was routed along the shortest distance possible to minimize time spent in the water for construction, potential construction related impacts, and Project cost.
- **Traffic Separation Scheme (TSS).** To the extent practicable, Applicant sought to minimize cable lengths that were below TSS to reduce the potential for anchor strikes or drag events that could impact the cable.
- **Use conflict with wind farm development.** To the extent practicable, Applicant sought to route cable along the boundaries of the RFI areas and WEAs. Impacts from construction equipment used to build wind farms is frequently a cause of cable failures and the Applicant sought to minimize the possible interactions with the AWC cable by locating it along the periphery of the areas that would be developed for wind farms.
- **Cable and other infrastructure crossings.** To the extent practicable, the Applicant sought to avoid areas with extensive pre-existing cable and pipeline infrastructure to reduce installation complexity associated with cable and pipeline crossings.

Figure 5-6 details the areas (OCS blocks) remaining within the envelope that are unconstrained by Tier 2 criteria identified above.


Key:
Proposed Points of Interconnection (POI)
3NM to 30NM Transmission Envelope
WEA Boundary
Submerged Lands Act Boundary
Line 8(g)
Cities/Towns
County Boundary
Waterbody
Parklands
Hudson
Zone J
Sewarren
Larrabee
Cardiff
Indian River
Piney Grove
Navy
Fentress
Allenhurst
South Belmar
Lanoka Harbor
Barnegat Beach
Atlantic City
Longport
Greenwich
Cape May
Lewes
Rehoboth Beach
Georgetown
Bethany Beach
Fenwick Island
Ocean Pines
Berlin
Snow Hill
Pocomoke City
Chincoteague
Fentress
Greenwich
PA
NJ
NY
DE
MD
VA
DELAWARE BAY
ATLANTIC OCEAN
© 2011 Atlantic Grid Holdings LLC
Miles
Nautical Miles
Figure 5-4
Offshore HVDC Transmission Backbone
Siting Envelope
Atlantic Wind Connection
Atlantic


Key:
Proposed Points of Interconnection (POI)
Offshore HVDC Transmission Backbone Siting Envelope
Tier 1 Transmission Constraints
WEA Boundary
Submerged Lands Act Boundary
Line 8(g)
Cities/Towns
County Boundary
Waterbody
Parklands
Hudson
Zone J
Sewarren
NY
Allenhurst
South Belmar
Larrabee
Lanoka Harbor
Barnegat Beach
NJ
Cardiff
Atlantic City
Longport
Greenwich
DELAWARE BAY
Cape May
MD
DE
Lewes
Rehoboth Beach
Georgetown
Indian River
Bethany Beach
Fenwick Island
Ocean Pines
Berlin
Piney Grove
Snow Hill
Pocomoke City
Chincoteague
ATLANTIC OCEAN
Fentress
Greenwich
Navy
VA
Fentress
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Kilometers
Miles
Nautical Miles
Figure 5-5
Offshore HVDC Transmission Backbone
Tier 1 Constraints Analysis Results
Atlantic Wind Connection
Atlantic
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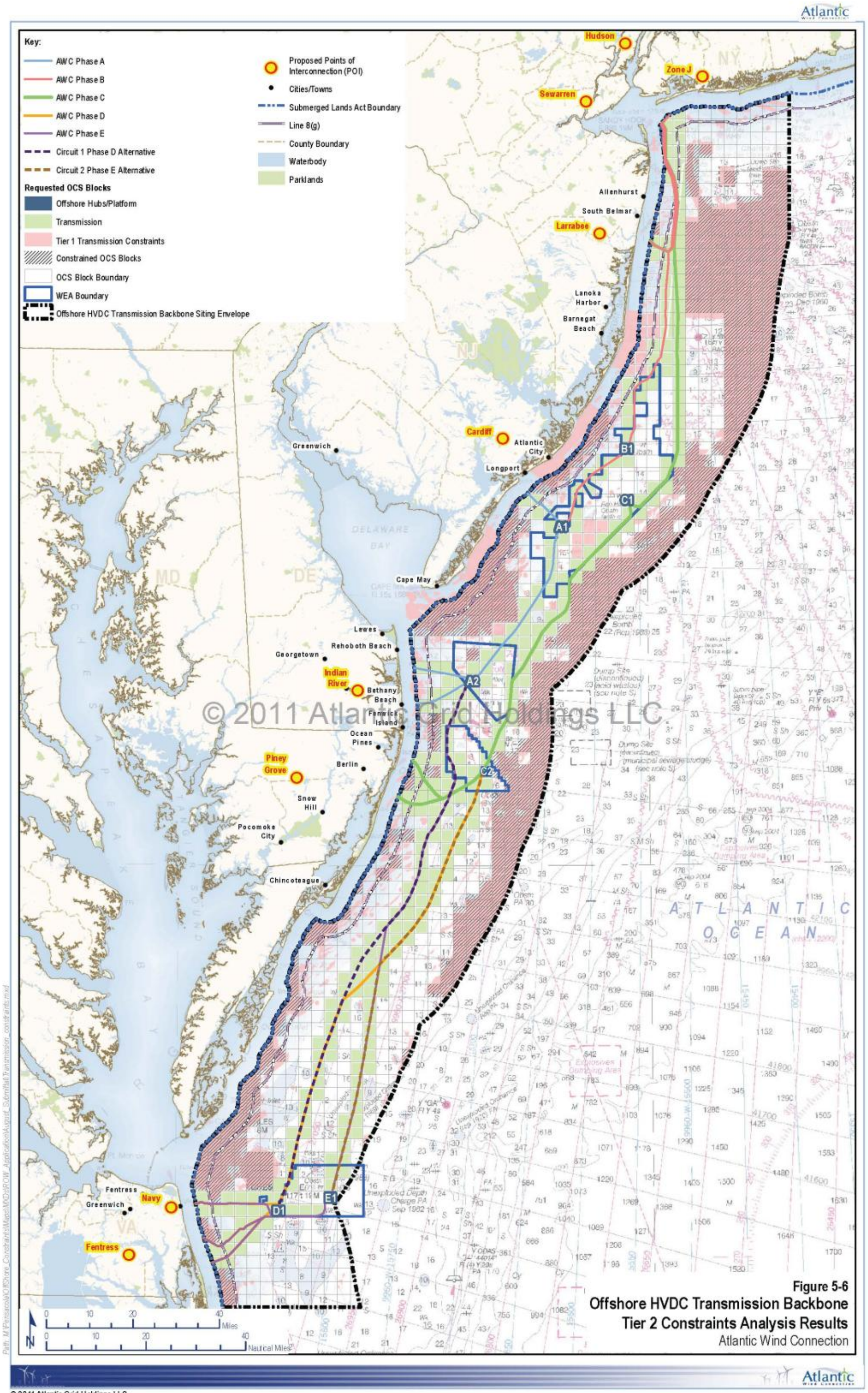
Atlantic
Key:
AWC Phase A
AWC Phase B
AWC Phase C
AWC Phase D
AWC Phase E
Circuit 1 Phase D Alternative
Circuit 2 Phase E Alternative
Requested OCS Blocks
Offshore Hubs/Platform
Transmission
Tier 1 Transmission Constraints
Constrained OCS Blocks
OCS Block Boundary
WEA Boundary
Offshore HVDC Transmission Backbone Siting Envelope
Proposed Points of Interconnection (POI)
Cities/Towns
Submerged Lands Act Boundary
Line 8(g)
County Boundary
Waterbody
Parklands
Hudson
Zone J
Sewarren
NY
Allenhurst
South Belmar
Larrabee
Lanoka Harbor
Barnegat Beach
NJ
Cardiff
Atlantic City
Longport
Greenwich
DELAWARE BAY
Cape May
MD
DE
Lewes
Rehoboth Beach
Georgetown
Indian River
Bethany Beach
Fenwick Island
Ocean Pines
Berlin
Piney Grove
Snow Hill
Pocomoke City
Chincoteague
Fentress
Greenwich
Navy
Fentress
VA
A1
A2
B1
C1
C2
D1
E1
ATLANTIC
OCEAN
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Miles
Nautical Miles
Figure 5-6
Offshore HVDC Transmission Backbone
Tier 2 Constraints Analysis Results
Atlantic Wind Connection
Atlantic

5.1.3.3 Third-Tier Siting Criteria for Offshore Components

The third tier (Tier 3) of the siting analysis will be based on site-specific environmental data to be acquired primarily through surveys, such as geophysical, bathymetry, sensitive biological communities, and archeological resources evaluations that would be used to fine-tune the transmission corridor and the preferred locations for the offshore hubs. Applicant expects to begin the Tier 3 evaluations and analyses once BOEMRE issues the determination of no competitive interest for the applied ROW grant defined in Section 5.2 of this application. The Tier 3 siting criteria include:

- **Protected Species.** Known populations and habitats of federally and state-listed species and state species of special concern would be avoided to the extent practicable.
- **Cultural Resources.** To the extent practicable, known archeological and historical sites would be avoided.
- **Geologic/Geotechnical Hazards.** Areas that may represent a geologic hazard would be avoided, to the extent practicable.

Specific to offshore hub (platform) and wind farm locations:

- Public safety. Public safety concerns may include navigation hazards and other issues.

In parallel with the Project siting process, the Applicant has been consulting with, and will continue to consult with, numerous stakeholders (including federal, state, and local government agencies, wind developers, and other interested parties); refer to Section 2.3 for a summary of ongoing outreach efforts.

5.2 Grant Blocks Requested on the Outer Continental Shelf

Based on the data gathered and Tier 1 and Tier 2 analysis conducted for the Project to date, the Applicant seeks a ROW grant located within OCS blocks extending from offshore New York to offshore southern Virginia for the AWC subsea HVDC backbone transmission system project (Phases A through E). The proposed areas of interest are located beyond the federal-state jurisdictional waters boundary on the OCS (i.e., the 3-mile limit).

A summary of the OCS blocks within which the Applicant is requesting a ROW grant is provided in Sections 5.2.1 and 5.2.2.

5.2.1 Offshore HVDC Hubs (Phases A through E)

The Applicant requests a grant within the OCS blocks set forth in Table 5-1 for seven offshore HVDC hubs to be located in the OCS (see Figure 5-7). The Applicant expects that the exact dimensions and location of the granted area on the OCS would be specified upon the authorization of Applicant's GAP for each phase of the Project. Although the offshore hubs would occupy only a small portion of the identified OCS blocks, field surveys will be required to identify more definitively the most suitable site within these proposed OCS blocks for the HVDC hubs.

Table 5-1
OCS Blocks Identified as
Areas of Interest for HVDC Hubs

Block Number	State	Protraction Number
6425	Delaware	NJ18-05
6776	Maryland	NJ18-05
6687	New Jersey	NJ18-02
6887	New Jersey	NJ18-02
6982	New Jersey	NJ18-02
6114	Virginia	NJ18-11
6160	Virginia	NJ18-11

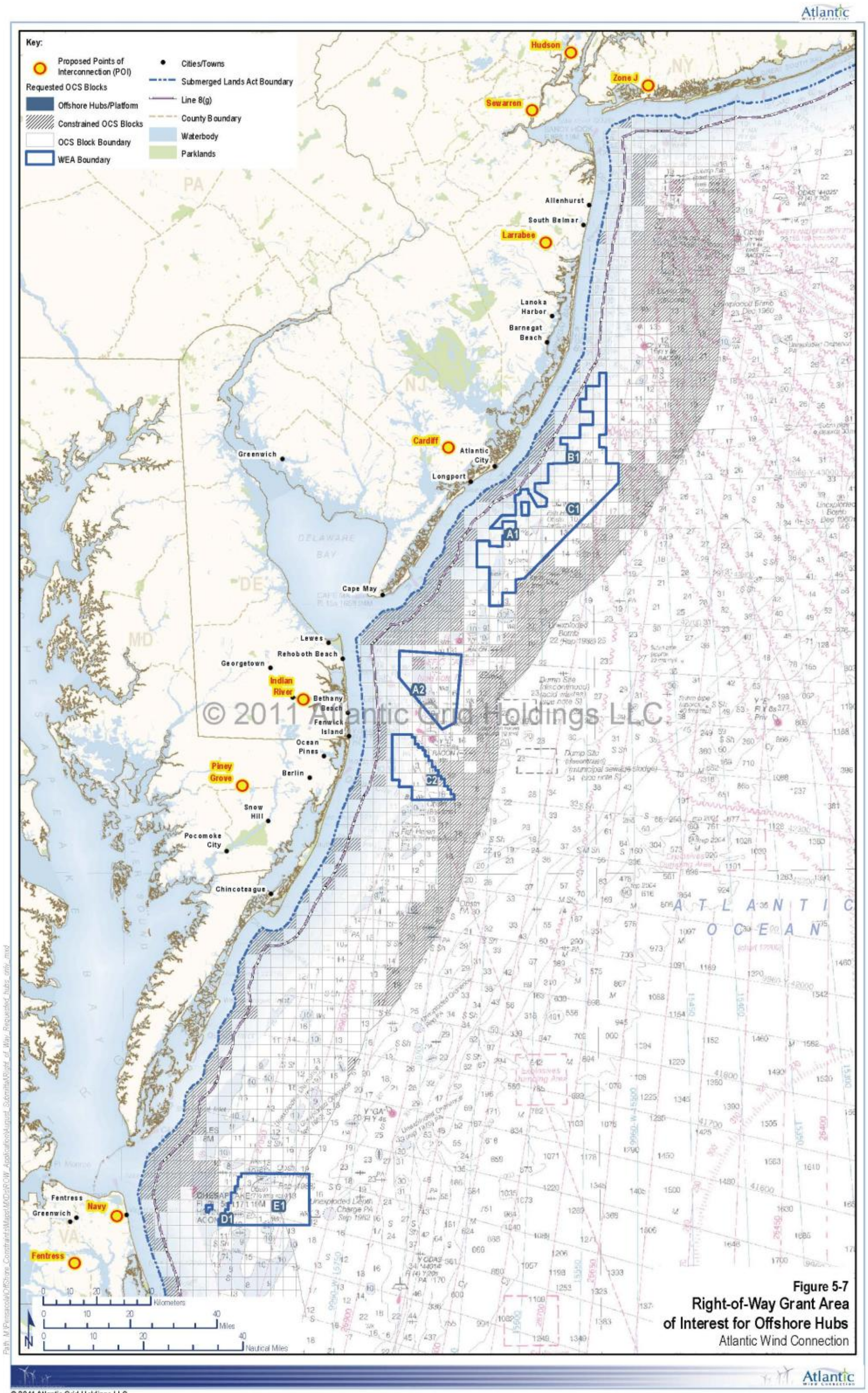

Figure 5-7
Right-of-Way Grant Area of Interest for Offshore Hubs
Atlantic Wind Connection

5.2.2 HVDC Transmission Backbone Corridor and Laterals (Phases A through E)

The Applicant requests a ROW grant on the OCS blocks set forth in Table 5-2 and depicted on Figure 5-8 for the HVDC transmission backbone system consisting of Circuits 1 and 2. Note that all OCS blocks identified above as areas of interest for hubs also are necessarily listed as areas of interest for transmission corridors because the hubs would be connected with transmission cable. See Appendix B for the specific latitude and longitude coordinates of the preferred route within the lease blocks listed below.

Table 5-2
OCS Blocks Identified as Areas of Interest for HVDC Transmission Backbone

Block Number	State	Protraction Number
6228	Delaware	NJ18-05
6229	Delaware	NJ18-05
6230	Delaware	NJ18-05
6231	Delaware	NJ18-05
6277	Delaware	NJ18-05
6278	Delaware	NJ18-05
6279	Delaware	NJ18-05
6280	Delaware	NJ18-05
6326	Delaware	NJ18-05
6327	Delaware	NJ18-05
6329	Delaware	NJ18-05
6330	Delaware	NJ18-05
6371	Delaware	NJ18-05
6372	Delaware	NJ18-05
6373	Delaware	NJ18-05
6375	Delaware	NJ18-05
6376	Delaware	NJ18-05
6378	Delaware	NJ18-05
6379	Delaware	NJ18-05
6423	Delaware	NJ18-05
6424	Delaware	NJ18-05
6426	Delaware	NJ18-05
6428	Delaware	NJ18-05
6429	Delaware	NJ18-05
6472	Delaware	NJ18-05
6473	Delaware	NJ18-05
6474	Delaware	NJ18-05
6475	Delaware	NJ18-05
6478	Delaware	NJ18-05
6521	Delaware	NJ18-05
6522	Delaware	NJ18-05

Table 5-2
OCS Blocks Identified as Areas of Interest
for HVDC Transmission Backbone

Block Number	State	Protraction Number
6524	Delaware	NJ18-05
6528	Delaware	NJ18-05
6573	Delaware	NJ18-05
6574	Delaware	NJ18-05
6577	Delaware	NJ18-05
6578	Delaware	NJ18-05
6623	Maryland	NJ18-05
6627	Maryland	NJ18-05
6673	Maryland	NJ18-05
6676	Maryland	NJ18-05
6677	Maryland	NJ18-05
6720	Maryland	NJ18-05
6721	Maryland	NJ18-05
6722	Maryland	NJ18-05
6723	Maryland	NJ18-05
6724	Maryland	NJ18-05
6726	Maryland	NJ18-05
6771	Maryland	NJ18-05
6773	Maryland	NJ18-05
6774	Maryland	NJ18-05
6775	Maryland	NJ18-05
6821	Maryland	NJ18-05
6822	Maryland	NJ18-05
6823	Maryland	NJ18-05
6824	Maryland	NJ18-05
6825	Maryland	NJ18-05
6826	Maryland	NJ18-05
6869	Maryland	NJ18-05
6870	Maryland	NJ18-05
6871	Maryland	NJ18-05
6872	Maryland	NJ18-05
6873	Maryland	NJ18-05
6874	Maryland	NJ18-05
6875	Maryland	NJ18-05
6920	Maryland	NJ18-05
6921	Maryland	NJ18-05
6922	Maryland	NJ18-05
6923	Maryland	NJ18-05
6925	Maryland	NJ18-05
6972	Maryland	NJ18-05
6974	Maryland	NJ18-05
6975	Maryland	NJ18-05

Table 5-2
OCS Blocks Identified as Areas of Interest
for HVDC Transmission Backbone

Block Number	State	Protraction Number
7021	Maryland	NJ18-05
7022	Maryland	NJ18-05
7023	Maryland	NJ18-05
7024	Maryland	NJ18-05
7071	Maryland	NJ18-05
7073	Maryland	NJ18-05
7074	Maryland	NJ18-05
7121	Maryland	NJ18-05
7123	Maryland	NJ18-05
6001	New Jersey	NJ18-03
6031	New Jersey	NJ18-02
6032	New Jersey	NJ18-02
6033	New Jersey	NJ18-05
6040	New Jersey	NJ18-02
6051	New Jersey	NJ18-03
6080	New Jersey	NJ18-05
6081	New Jersey	NJ18-05
6082	New Jersey	NJ18-05
6090	New Jersey	NJ18-02
6101	New Jersey	NJ18-03
6129	New Jersey	NJ18-05
6130	New Jersey	NJ18-05
6132	New Jersey	NJ18-05
6140	New Jersey	NJ18-02
6151	New Jersey	NJ18-03
6179	New Jersey	NJ18-05
6181	New Jersey	NJ18-05
6182	New Jersey	NJ18-05
6190	New Jersey	NJ18-02
6201	New Jersey	NJ18-03
6240	New Jersey	NJ18-02
6251	New Jersey	NJ18-03
6289	New Jersey	NJ18-02
6290	New Jersey	NJ18-02
6301	New Jersey	NJ18-03
6339	New Jersey	NJ18-02
6340	New Jersey	NJ18-02
6351	New Jersey	NJ18-03
6389	New Jersey	NJ18-02
6390	New Jersey	NJ18-02
6401	New Jersey	NJ18-03
6437	New Jersey	NJ18-02

Table 5-2
OCS Blocks Identified as Areas of Interest
for HVDC Transmission Backbone

Block Number	State	Protraction Number
6438	New Jersey	NJ18-02
6439	New Jersey	NJ18-02
6451	New Jersey	NJ18-03
6487	New Jersey	NJ18-02
6488	New Jersey	NJ18-02
6501	New Jersey	NJ18-03
6537	New Jersey	NJ18-02
6551	New Jersey	NJ18-03
6587	New Jersey	NJ18-02
6601	New Jersey	NK18-11
6601	New Jersey	NJ18-03
6637	New Jersey	NJ18-02
6640	New Jersey	NK18-11
6651	New Jersey	NK18-11
6651	New Jersey	NJ18-03
6690	New Jersey	NK18-11
6701	New Jersey	NK18-11
6701	New Jersey	NJ18-03
6735	New Jersey	NJ18-02
6736	New Jersey	NJ18-02
6737	New Jersey	NJ18-02
6740	New Jersey	NK18-11
6740	New Jersey	NJ18-02
6751	New Jersey	NK18-11
6784	New Jersey	NJ18-02
6785	New Jersey	NJ18-02
6790	New Jersey	NK18-11
6790	New Jersey	NJ18-02
6801	New Jersey	NK18-11
6829	New Jersey	NJ18-02
6833	New Jersey	NJ18-02
6834	New Jersey	NJ18-02
6839	New Jersey	NJ18-02
6840	New Jersey	NJ18-02
6851	New Jersey	NK18-11
6879	New Jersey	NJ18-02
6880	New Jersey	NJ18-02
6883	New Jersey	NJ18-02
6888	New Jersey	NJ18-02
6889	New Jersey	NJ18-02
6901	New Jersey	NK18-11
6930	New Jersey	NJ18-02

Table 5-2
OCS Blocks Identified as Areas of Interest
for HVDC Transmission Backbone

Block Number	State	Protraction Number
6931	New Jersey	NJ18-02
6933	New Jersey	NJ18-02
6937	New Jersey	NJ18-02
6938	New Jersey	NJ18-02
6951	New Jersey	NK18-12
6981	New Jersey	NJ18-02
6983	New Jersey	NJ18-02
6986	New Jersey	NJ18-02
6987	New Jersey	NJ18-02
7001	New Jersey	NK18-12
7031	New Jersey	NJ18-02
7032	New Jersey	NJ18-02
7035	New Jersey	NJ18-02
7036	New Jersey	NJ18-02
7039	New Jersey	NK18-11
7040	New Jersey	NK18-11
7051	New Jersey	NK18-12
7081	New Jersey	NJ18-02
7084	New Jersey	NJ18-02
7085	New Jersey	NJ18-02
7089	New Jersey	NK18-11
7090	New Jersey	NK18-11
7101	New Jersey	NK18-12
7131	New Jersey	NJ18-02
7133	New Jersey	NJ18-02
7134	New Jersey	NJ18-02
7140	New Jersey	NJ18-02
6501	New York	NK18-11
6540	New York	NK18-11
6551	New York	NK18-11
6590	New York	NK18-11
6011	Virginia	NJ18-08
6014	Virginia	NJ18-08
6015	Virginia	NJ18-08
6021	Virginia	NJ18-08
6022	Virginia	NJ18-05
6023	Virginia	NJ18-08
6060	Virginia	NJ18-11
6061	Virginia	NJ18-11
6064	Virginia	NJ18-11
6070	Virginia	NJ18-08
6071	Virginia	NJ18-08

Table 5-2
OCS Blocks Identified as Areas of Interest
for HVDC Transmission Backbone

Block Number	State	Protraction Number
6072	Virginia	NJ18-08
6104	Virginia	NJ18-11
6106	Virginia	NJ18-11
6107	Virginia	NJ18-11
6108	Virginia	NJ18-11
6109	Virginia	NJ18-11
6110	Virginia	NJ18-11
6120	Virginia	NJ18-08
6121	Virginia	NJ18-08
6122	Virginia	NJ18-08
6154	Virginia	NJ18-11
6155	Virginia	NJ18-11
6156	Virginia	NJ18-11
6157	Virginia	NJ18-11
6158	Virginia	NJ18-11
6159	Virginia	NJ18-11
6161	Virginia	NJ18-11
6162	Virginia	NJ18-11
6163	Virginia	NJ18-11
6169	Virginia	NJ18-08
6170	Virginia	NJ18-08
6171	Virginia	NJ18-08
6207	Virginia	NJ18-11
6208	Virginia	NJ18-11
6209	Virginia	NJ18-11
6218	Virginia	NJ18-08
6219	Virginia	NJ18-08
6220	Virginia	NJ18-08
6221	Virginia	NJ18-08
6256	Virginia	NJ18-11
6257	Virginia	NJ18-11
6258	Virginia	NJ18-11
6267	Virginia	NJ18-08
6268	Virginia	NJ18-08
6269	Virginia	NJ18-08
6270	Virginia	NJ18-08
6304	Virginia	NJ18-11
6305	Virginia	NJ18-11
6306	Virginia	NJ18-11
6307	Virginia	NJ18-11
6316	Virginia	NJ18-08
6317	Virginia	NJ18-08

Table 5-2
OCS Blocks Identified as Areas of Interest
for HVDC Transmission Backbone

Block Number	State	Protraction Number
6318	Virginia	NJ18-08
6319	Virginia	NJ18-08
6355	Virginia	NJ18-11
6356	Virginia	NJ18-11
6366	Virginia	NJ18-08
6367	Virginia	NJ18-08
6368	Virginia	NJ18-08
6415	Virginia	NJ18-08
6416	Virginia	NJ18-08
6417	Virginia	NJ18-08
6418	Virginia	NJ18-08
6465	Virginia	NJ18-08
6466	Virginia	NJ18-08
6467	Virginia	NJ18-08
6468	Virginia	NJ18-08
6514	Virginia	NJ18-08
6515	Virginia	NJ18-08
6517	Virginia	NJ18-08
6564	Virginia	NJ18-08
6565	Virginia	NJ18-08
6567	Virginia	NJ18-08
6614	Virginia	NJ18-08
6617	Virginia	NJ18-08
6663	Virginia	NJ18-08
6664	Virginia	NJ18-08
6667	Virginia	NJ18-08
6713	Virginia	NJ18-08
6714	Virginia	NJ18-08
6716	Virginia	NJ18-08
6717	Virginia	NJ18-08
6763	Virginia	NJ18-08
6766	Virginia	NJ18-08
6767	Virginia	NJ18-08
6813	Virginia	NJ18-08
6816	Virginia	NJ18-08
6862	Virginia	NJ18-08
6863	Virginia	NJ18-08
6866	Virginia	NJ18-08
6912	Virginia	NJ18-08
6916	Virginia	NJ18-08
6962	Virginia	NJ18-08
6965	Virginia	NJ18-08

Table 5-2
OCS Blocks Identified as Areas of Interest for HVDC Transmission Backbone

Block Number	State	Protraction Number
6966	Virginia	NJ18-08
7011	Virginia	NJ18-08
7012	Virginia	NJ18-08
7015	Virginia	NJ18-08
7016	Virginia	NJ18-08
7061	Virginia	NJ18-08
7065	Virginia	NJ18-08
7111	Virginia	NJ18-08
7114	Virginia	NJ18-08
7115	Virginia	NJ18-08
6425	Delaware	NJ18-05
6776	Maryland	NJ18-05
6687	New Jersey	NJ18-02
6887	New Jersey	NJ18-02
6982	New Jersey	NJ18-02
6114	Virginia	NJ18-11
6160	Virginia	NJ18-11

Note: Blocks identified in Table 5-1 as areas of interest for hubs are also listed in Table 5-2 with a blue highlight as areas of interest for transmission corridors due to connectivity between hubs with transmission cable.

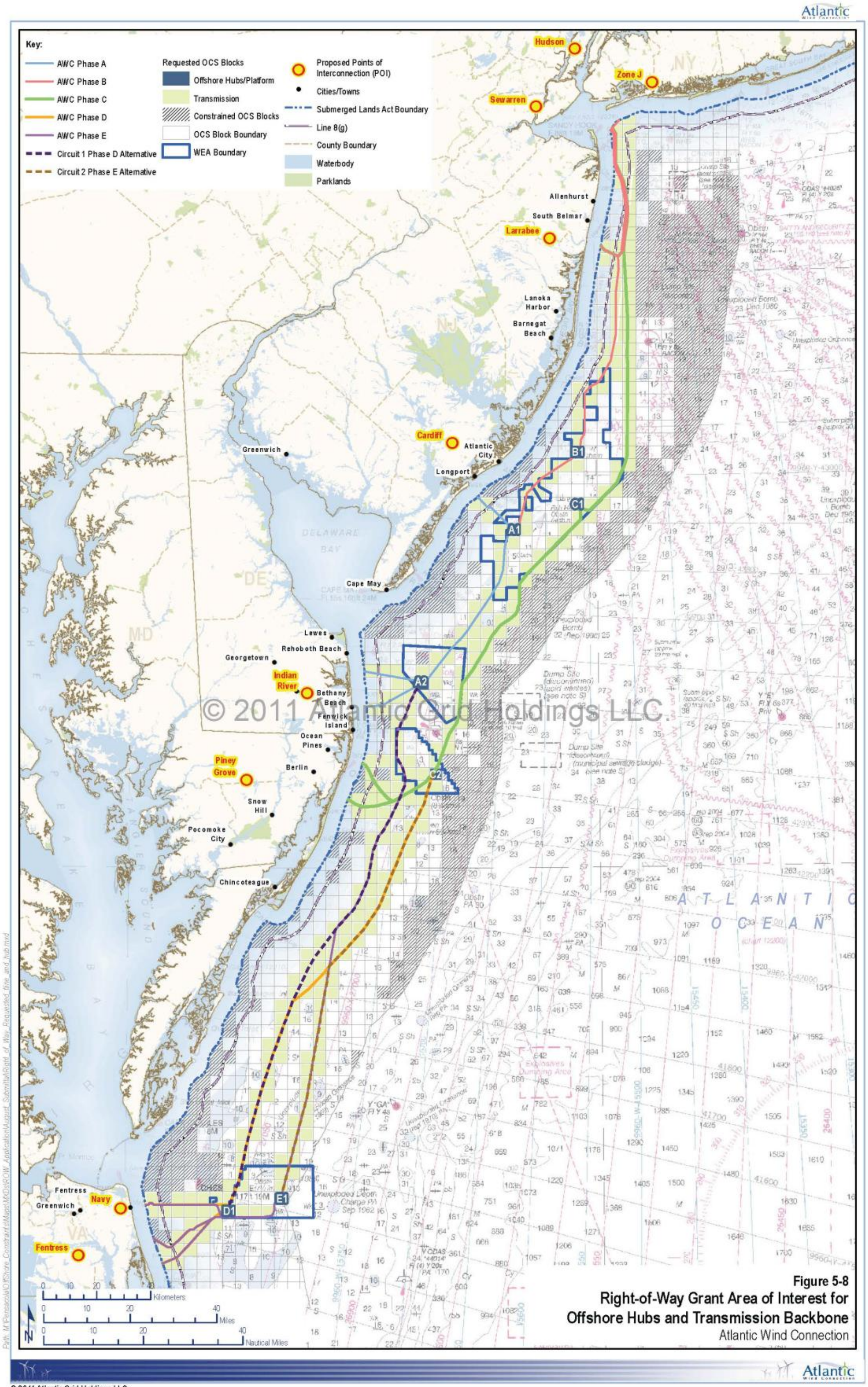

Figure 5-8
Right-of-Way Grant Area of Interest for Offshore Hubs and Transmission Backbone
Atlantic Wind Connection

5.2.3 ROW Grant Block Summary (Phases A through E)

As noted in Section 2, the proposed area of interest for the requested ROW grant encompasses numerous connected lease blocks. An area of such breadth is required to ensure that the Applicant can exercise flexibility and adequately consider environmental and other use constraints and input from stakeholders which could influence the final alignment of the preferred corridor and the location of the offshore facilities (cables and platforms). When installed, the AWC Project facilities located on the OCS would actually require a relatively small footprint within the lease blocks currently proposed for evaluation. Accordingly, the Applicant does not anticipate that the Project would prevent the United States from granting rights to others on the OCS in the proposed areas of interest identified here by the Applicant.

A total of 300 OCS blocks are requested as part of this ROW Application. Of those blocks, 7 have been identified for hub siting and all 300 have been identified for transmission siting. This totals approximately 2,604 square miles (mi^2; 6,744 square kilometers [km^2]) of the OCS. It is anticipated that BOEMRE will issue a ROW grant for a 200-feet (61-meter)-wide corridor for each AWC circuit. The actual area that would be subject to the ROW grant would represent an area of approximately 24 mi^2 (62 km^2) or only 1% of the total OCS blocks identified in this ROW Application. An example to scale of a potential 200-foot-wide corridor within an OCS block is provided in Figure 5-9 and a complete map of all OCS numbered blocks identified as the area of interest in this ROW Application for all Project components discussed in Sections 5.2.1 and 5.2.2 is provided on Figure 5-10.

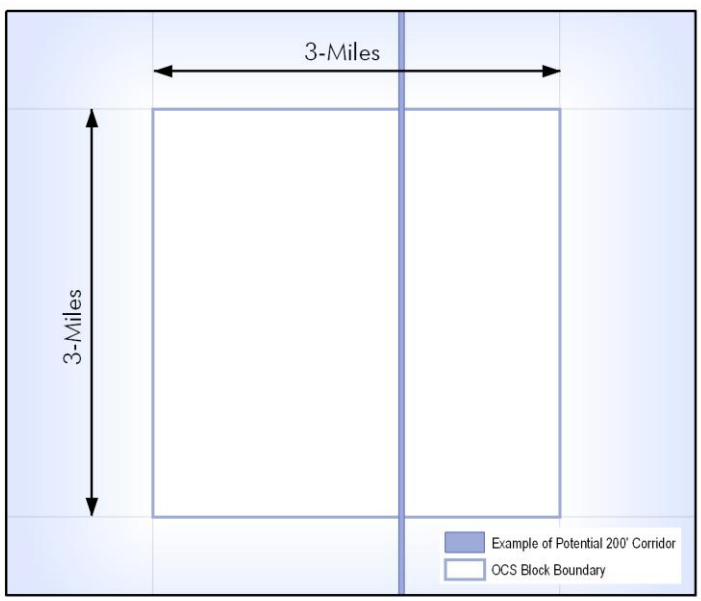

Figure 5-9: Footprint of Potential 200-foot-wide Corridor within the Outer Continental Shelf Block

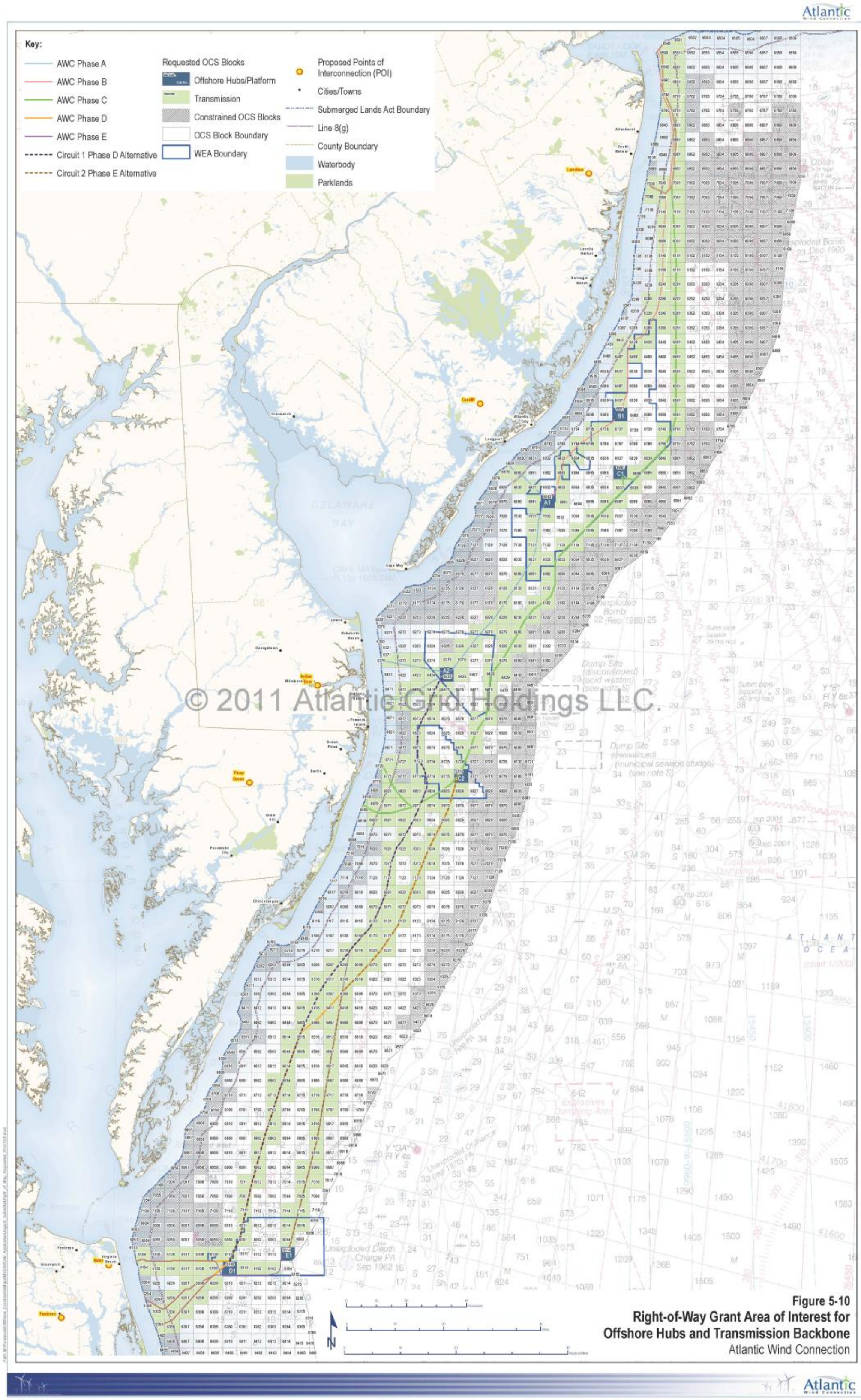

Figure 5-10
Right-of-Way Grant Area of Interest for Offshore Hubs and Transmission Backbone
Atlantic Wind Connection

6 General Information about Existing Environmental Conditions

6.1 Water and Sediment Quality

6.1.1 Physiography

The continental margin (i.e., the boundary between continents and ocean basins) off the Atlantic coast of the U.S. consists of three physiographic provinces typical of a passive margin: the continental shelf, continental slope, and continental rise (Department of the Navy [DoN] 2008). Passive margins are characterized by subsidence, erosion, and thick sediment accumulations leading to the development of the classic continental margin sequence, with transitions between the provinces dictated mainly by changes in gradient in the sea floor (DoN 2005). The proposed Project lies entirely within the continental shelf province.

The continental shelf along the U.S. East Coast extends from Maine to the Florida Keys, ranging in width from less than 5 km (3.1 miles) to nearly 400 km (248.5 miles). The Mid-Atlantic Bight (MAB; the area of the shelf off the mid-Atlantic coastline) consists of a gently sloping seaward gradient, low relief, and generally shallow water depths in comparison to other provinces. Topographic features in the MAB consist of level to flat sloping depressions and mid-to-high flats (Greene et al. 2010). Beyond the shelf, the continental slope is incised with more than 70 submarine canyons (i.e., V-shaped submarine valleys with steep walls that are continuous from their beginnings to their base on the continental slope), the largest of which is the Hudson Canyon (DoN 2005), which also carves into the continental shelf forming the Hudson shelf valley, and defines the approximate northern boundary of the Project area. Other prominent canyons in the MAB include the Baltimore Canyon to the southeast of Delaware Bay and the Norfolk Canyon to the east of the Chesapeake Bay (Greene et al. 2010).

The shelf off the New York/New Jersey coast between the Hudson and Delaware shelf valleys covers approximately 25,000 km^2 (9,653 mi^2), ranges from 120 to 150 km (75 to 93 miles) wide, and ranges in depth from 130 meters (427 feet) in the north to 100 meters (328 feet) in the south, sloping to the east and becoming steeper further offshore (New Jersey Department of Environmental Protection [NJDEP] 2010). To the south of the New Jersey shelf, the Mid-Atlantic Basin extends from just south of the Delaware shelf valley to North Carolina, includes glacially formed moraines at its northern extent, and numerous named and unnamed canyons incising the shelf throughout the basin. Similar to the New Jersey shelf, the Mid-Atlantic Basin has a gentle gradient, widths of approximately 100 km (62 miles), and maximum water depths of 130 meters (426 feet) (DoN 2008). The shelf in this area is overlain by a mantle of sand, ranging in thickness from 20 meters (65 feet) to 40 meters (130 feet) (Minerals Management Service [MMS] 2007). The shelf area also contains many linear, symmetrical, east-northeast oriented trending shoals and shore face sand ridges that are up to 10 meters (33 feet) thick, generally over 1,000 meters (3,281 feet) long, and from 1 to 3 km (0.6 to 1.9 miles) wide (NJDEP 2010). The morphology of these near and offshore sand waves and ridges off of capes and at the mouths of bays, such as Chesapeake Bay and Delaware Bay, are heavily influenced by long shore and cross-shelf currents as well as tidal fluctuations (DoN 2008).

Four ancient shorelines, running the entire length of the Project area approximately parallel to the present day coastline, indicate the progression of sea level rise since the Pleistocene Era and giving the shelf its present terraced structure (DoN 2008). These ancient shorelines range in length from approximately 570 to 800 km (354.2 to 497.1 miles) and vary in depth from 36 to over 160 meters (118 to over 525 feet). In addition, several elongated, ancient stream channels cross the continental shelf approximately perpendicular to the shoreline, including the Hudson Channel, the Delaware Channel, and an unnamed channel extending from the mouth of Chesapeake Bay is covered by recently deposited sediments (DoN 2008).

6.1.2 Physical Oceanography

The two primary forces that drive circulation, or currents, in these water masses are the wind and differences in water density. Surface currents are primarily driven by the drag of the wind over the surface of the water which causes the water to move and form currents. Wind-driven circulation, as it is called, affects primarily the upper 100 meters (328 feet) of the water column. Variations in temperature and salinity result in differences in water density; these differences drive thermohaline or vertical circulation. Thermohaline circulation causes movement in water masses at all levels of the water column (i.e., deep and surface), but is generally dominated by wind-driven circulation at the surface (DoN 2008). Actual circulation is driven by episodic wind events more than by large-scale current systems. For example, the longshore current in New Jersey is separated into two currents that flow in opposite directions from a single bifurcation point, with one flowing northward along the coastline and the other flowing southward along the coastline (NJDEP 2010). This bifurcation point can vary in location from near Barnegat Inlet during the summer to as far north as Bradley Beach in the winter.

Shelf Break Front and Current

The circulation of ocean currents in the vicinity of New Jersey is affected by processes occurring at distances far from the New Jersey coast. The coastal current system that flows along the coast of New Jersey is the Western North Atlantic Shelf Break Front and Current, which originates as the Labrador Current (NJDEP 2010). The Shelf Break Front and Current system represents a semi-permanent barrier that limits the exchange of waters between the shelf and the open ocean. While temperature and salinity of the Shelf Break Front increase moving to the south, fluctuations in temperature and salinity compensate each other and the density of the front generally remains constant (NJDEP 2010). The system is governed by freshwater input, air-sea interactions, wind stress, and ice coverage, all of which vary geographically, seasonally, and interannually. The displacement of the Shelf Break Front seaward is largely regulated by seasonal freshwater input and movement of this freshwater seaward. Offshore of New Jersey from December through May, the front occurs from the surface perpendicular to the bottom. The intersection of the front with the seafloor is located more shoreward during December and January. During the summer and early fall months, the front may not reach the surface of the water and its leading edge is located as much as 40 km (24.9 miles) seaward of the 100-meter (328-foot) isobath (NJDEP 2010).

Delaware Coastal Current

The Delaware Coastal Current is a longshore, buoyancy-driven current that begins at the mouth of the Delaware Bay and flows southward along the Delmarva Peninsula coastline into the Chesapeake Bay plume (DoN 2008). The Delaware Coastal Current is a persistent offshore current, unlike the longshore currents off the coast of the Carolinas, and it appears to maintain a mean velocity of approximately 10 centimeters (3.9 inches) per second (DoN 2008). Wind direction and speed influence the current, but only strong upwelling-favorable winds coupled with moderate to low riverine discharge result in a reversal of the current flow and a dispersion of the plume over the mid and outer continental shelf. Downwelling-favorable winds augment the southward flow of the current and cause it to narrow into a well-defined jet that can extend through the entire water column (DoN 2008).

Chesapeake Bay Outflow

The Chesapeake Bay plume flows seaward from the mouth of the bay, turning south to form a coastal jet that can extend to Cape Hatteras (DoN 2008). Outflow from the mouth of the Chesapeake Bay takes the form of a plume characterized by colder, less saline waters than the adjacent shelf waters. The less dense plume waters flow above the denser shelf waters resulting in steep oceanographic fronts in temperature and salinity that are indicative of the magnitude and spatial extent of the plume (DoN 2008). Transient upwelling, downwelling, and enhanced primary productivity often occur along the frontal boundaries induced by the intrusion of plume waters. Under the influence of the Coriolis Effect and local winds, a current associated with the plume is directed southward and contributes to a longshore current flowing adjacent to the Virginia and North Carolina coast (DoN 2008).

Gulf Stream Current

Further to the south, a distinctive and variable water mass is formed by the deflection of the Chesapeake Bay Outflow and the mixing of cooler subpolar and Arctic waters with the water from the Gulf Stream found on the continental slope (NJDEP 2010). The Gulf Stream includes a complex system of surface currents that flow from the Caribbean Sea to the northeastern Atlantic Ocean. It flows northward along the coastline of the southeastern United States and is the dominant surface current in the western North Atlantic (DoN 2008).Variations in the location of the Gulf Stream increase as the current moves north, forming small gyres (called warm-core and cold-core rings) that separate from the Gulf Stream east of the Project area (MMS 2005).

6.1.3 Water Quality and Hydrography

Water quality is a measure of the ability of a waterbody to maintain the ecosystems it supports or influences. In the case of coastal and marine environments, water quality is influenced by many factors including rivers that drain into the area, quantity and composition of wet and dry atmospheric deposition, and the influx of constituents from sediments (MMS 2009). The primary factors influencing coastal and marine environments include temperature, salinity, dissolved oxygen, nutrients, potential of hydrogen (pH), oxidation reduction potential (Eh), pathogens, and turbidity or suspended load (MMS 2009).

Water quality is controlled primarily by the anthropogenic inputs of land runoff, land point source discharges, and atmospheric deposition, much of which is influenced by nearby populations and agricultural land practices (MMS 2007). However, freshwater inputs into the MAB are mitigated by coastal bays and an extensive system of estuaries and salt marshes that filter riverine outflow and reduce total discharge into shelf waters (DoN 2008). Most major rivers along the Atlantic coast empty into one of three major coastal outflows (New York Bay, Delaware Bay, or Chesapeake Bay), where lower salinity waters are mixed with brackish bay waters before being discharged into the ocean. This results in a buoyant plume of less dense water entering shelf area currents (DoN 2008).

Water Temperature

Oceanic circulation patterns play an increasingly larger role in dispersing and diluting anthropogenic contaminants and affecting water quality further away from shore (MMS 2007). Both water temperature and salinity drive the vertical and horizontal stratification and geostrophic circulation of large water masses globally and regionally, with this circulation affecting the movement of nutrients and planktonic organisms within and among water masses (NJDEP 2010).

A gradient of increasing sea surface temperature (SST) from north to south is present during most of the year, though the trend is less obvious in the summer when the range in surface water temperature is the smallest (DoN 2008). SSTs across the MAB exhibit a range of seasonal values due to the north-south gradient, with average SSTs near New Jersey ranging from 4.8 to 23.5 degrees Celsius (°C or approximately 41 to 74 degrees Fahrenheit [°F]), while SSTs in waters just south of the mouth of the Chesapeake Bay ranging from 21°C to 31°C (approximately 70°F to 88°F), mainly due to the influence of the Gulf Stream.

Vertical stratification of the water column also typifies the waters of the MAB. Surface stratification begins in mid-spring as waters warm and a distinct layering of the column developing (warmer, fresher, less dense water accumulating at the surface and denser, colder, and more saline water gathering closer to the seafloor), with waters over the shelf becoming fully stratified in the summer. Stratification breaks down during the fall due to wind-mixing or surface cooling and by winter, only bottom waters remain stratified (DoN 2005). Horizontal temperature gradients dominate during winter, with colder water close to the coast and warmer water near the shelfbreak. Here, the vertical temperature profile is nearly homogenous with slightly colder water found near the bottom offshore (NJDEP 2010). Stratification is strong closest to the coast due to the presence of freshwater from plumes associated with major bays and river systems and coastal runoff, whereas the stratification in the offshore region is much weaker as a result of more intense mixing

<u>Salinity</u>

Average salinity increases offshore as it is more heavily influenced by the more saline water of the open ocean. The waters closer to the coast are more heavily influenced by coastal runoff and freshwater rivers draining into the ocean (NJDEP 2010). Other factors that influence the salinity include: wind stress and whether winds are downwelling-favorable or upwelling-favorable; transient storm systems; and the position of the Gulf Stream (DoN 2008).

Surface salinities in the MAB typically range from between 30 and 35 practical salinity units (psu), throughout most of the year, though ship transect measurements from the Delaware Coastal Current recorded a range from 24 to 32 psu (DoN 2008). Bottom salinities typically only vary by 3 psu from surface measurements (DoN 2005).

<u>Dissolved Oxygen, Turbidity, and Overall Water Quality</u>

Dissolved oxygen is generally highest in the winter and lowest in the summer in the MAB. Surface waters consistently have sufficient dissolved oxygen; bottom waters also have expected dissolved oxygen levels, ranging from about 3 to 10 milligrams per liter (MMS 2008). However, many bottom areas exhibit low dissolved oxygen during the summer months, especially in the more southern waters of New Jersey (MMS 2008). The cause is likely a combination of stratification and anthropogenic nutrients.

Mid-Atlantic waters beyond 3 miles typically have very low concentrations of suspended particles (generally less than 1 milligram per liter), with some higher levels in bottom waters due to the resuspension of sands/sediments caused by bottom currents (MMS 2009). Suspended particles also increase naturally during storm events and vary locally between surface and bottom waters, different seasons, and in different areas due to differing sources and grain sizes (MMS 2007). The distance from shore also reduces the significance of the potential influence of coastal processes (MMS 2009).

Overall, water quality in the marine areas of the mid-Atlantic are generally good, as the region generally exhibits low water column stratification, nutrient concentrations, chlorophyll levels, and good water quality measurements (MMS 2007). While some major local variations exist due primarily to the influence of tidal plumes leaving estuaries, there are far fewer major threats to marine water quality than for coastal water quality, as the vast majority of pollutants and threats to marine waters originate on land and have a greater influence on coastal water (MMS 2007).

6.1.4 Sediment Quality

The continental shelf in the MAB is typically overlain by a thin, approximately 1 to 20 meters (3 to 65 feet) thick surficial layer of poorly sorted shell and medium-to-coarse grained sand over clay sediments (MMS 2007). The bottom sediments underlying the MAB are composed of mainly clastic, soft sediments (i.e., derived from clastic rocks like sandstone and shale) deposited by glaciers, erosion, reworking, and re-deposition (NJDEP 2010). Most sediments in the MAB come from one of four primary sources: rivers, glaciers, terrigenous and submarine outcrops of older rocks, and biogenic productivity (DoN 2008).

Bottom sediments found on the continental margin of the MAB are well sorted by grain size, with sands and localized areas of gravelly sand distributed throughout the shelf and finer grained silts and clays transported shoreward by tidal currents into the estuaries or seaward by turbidity currents onto the continental slope and rise (DoN 2008). Most shelf sands in the MAB consist of quartz and feldspar (DoN 2008) and, in general, surficial sediments grade from medium-grained sands inshore to finer sediments at the shelf break (MMS 2007). Based on average grain sizes, sediments in the MAB generally range from approximately 0.04 to 0.54 millimeters, with areas of larger sediments present near the Hudson shelf valley, the mouth of the Delaware Bay, and the mouth of the Chesapeake Bay (Greene et al. 2010). Sediments in the New Jersey shelf area generally consist of detrital sands with mixtures of silt or gravel (NJDEP 2010).

The sand and wave ridges in the Project area consist of unconsolidated fine-to-medium grained sand (NJDEP 2010). Towards the northern extent of the Project, the shoals and ridges are mostly composed of a top layer of medium-grained quartzose sand, which is on top of a layer of quartz and glauconite and a bottom layer of sands, silts, and clays. In southern New Jersey, the quartzose shoals are mostly Holocene and are higher, longer, and appear more frequently than those to the north (NJDEP 2010).

Deposition of sediments onto the shelf by rivers is, however, minimal and is limited primarily to near-shore regions and estuaries (DoN 2008). Relict sediments deposited on the continental shelf by receding glaciers consist mainly of terrigenous sediments eroded by ancient rivers and carbonate detritus. In addition, the high-energy current and tidal systems of the region transport sediments off the shelves into deeper waters. Thus, the continental shelf region is considered to be sediment starved (DoN 2008).

Sediment samples along the continental slope and rise found hydrocarbons of mainly biogenic and pyrogenic sources (i.e., the burning of fossil fuels). Trace metals are also present in the water and sediment column in generally minute amounts that rarely approach toxicity limits as defined by the United States Environmental Protection Agency (MMS 2007).

Seafloor sediments contain varying amounts of organic matter depending on grain size and oceanographic conditions. Physical mixing of surficial sediments by invertebrates, together with microbial activity, recycle nutrients into the overlying water column where they become accessible to algae and plants. There are also many important biogeochemical processes within the sediments which form a mosaic of structure and function for biological communities (MMS 2007).

6.2 Marine Habitat

Atlantic marine habitats associated with the proposed Project vicinity range from coastal marshes to the deep-sea abyssal plain. The Project falls within the MAB (Cape Cod, Massachusetts, to Cape Hatteras, North Carolina), which is characterized as being a relatively flat, homogenous habitat composed of soft sediment [mostly sands] that gradually transitions to silt-clay in deeper areas (Stumf and Biggs 1988; Poppe, Schlee, and Knebel 1994, as cited in Steimle and Zetlin 2000). Generally, coastal and shelf waters throughout the MAB support extensive and productive fisheries and many types of mammal, fish and invertebrate populations, including threatened and endangered species, non-listed species, and species that are important to commercial and recreational fisheries. The relatively high biological productivity of the Atlantic results from a number of interacting features and processes, including cross-isobath fluxes of nutrient-rich deep waters, which occur year round, and winter convective mixing (Townsend et al. 2004). The Gulf Stream is the most dominant feature in the northwestern Atlantic Ocean and influences the dynamics of the adjacent continental shelf waters. Its location offshore ranges from as close as 30 km (18.6 miles) to the shoreline off Cape Hatteras, to much more widely varying distances offshore as it flows northeastward (Townsend et al. 2004). The continental shelves within the MAB are wide and vary with location, being widest in the northeastern sector, starting at about 250 km (155.3 miles) in the eastern Nova Scotian Shelf and narrowing to about 30 km (18.6 miles) at Cape Hatteras (Townsend et al. 2004). The continental shelf off New York/New Jersey is approximately 120 km (74.6 miles) wide, exhibits low relief physiography, and is very gently sloping (Nordfjord et al. 2009). Other important topographic features along the Atlantic coast include various fishing banks and ledges, coral reefs, seamounts, and submarine canyons. The combination of oceanic currents and topography causes nutrient-rich waters to be transported into the shallow areas where photosynthesis can take place, thereby resulting in an area that is especially productive for marine organisms.

Fronts or boundaries between water masses with distinctly differing physical properties (e.g., temperature or salinity) are prominent features of the MAB and affect the distribution of biological communities. Within the Project area, two significant estuaries—Chesapeake Bay and Delaware Bay—have major influences on MAB surface water chemistry, and to a lesser extent, deep water circulation over the continental shelf (DoN 2008). The offshore oceanic environment is generally divided into two primary marine zones – the pelagic zone and the benthic zone.

The pelagic zone comprises the entire water column from the sea surface to the greatest ocean depths and supports the plankton and nekton. Additional subdivisions of the pelagic zone can be made based on depth. Also, the pelagic zone can be subdivided into a photic zone and an aphotic zone based on the depth to which light penetrates the water column. The photic zone extends from the surface to the depth at which light is attenuated to 1% of its surface intensity. On average, this depth is approximately 200 meters (656.2 feet) in the open ocean, but can be much shallower where turbidity is high such as in coastal regions. The aphotic zone begins at the depth of the photic zone and extends to the seafloor (Lalli and Parsons 2000).

The benthic zone encompasses the seafloor environment and includes the shoreline, intertidal zones, coral reefs, and the deep-sea basins. Additional subdivisions of the benthic zone are made based on depth and include the bathyal zone (200 to approximately 3,000 meters [approximately 656 to 9,842 feet) and the abyssal zone (approximately 3,000 to 6,000 meters [approximately 9,842 to 19,685 feet) (DoN 2008). Organisms inhabiting the benthic zone include attached sea grasses, sessile sponges and barnacles, corals, and any animals that crawl on or burrow into the seafloor (Lalli and Parsons 2000).

Both state and federal agencies are involved in management of natural resources found within the MAB. NOAA Fisheries Service manages commercial and recreational fisheries within the federal waters of the Exclusive Economic Zone (EEZ) which ranges between 3 and 200 miles (4.8 and 321.9 km) offshore. Fisheries found within EEZ waters offshore of New York, New Jersey, Delaware, Maryland, and Virginia are managed by the Northeast Region of NOAA Fisheries Service. Fishery management plans (FMPs) for fishery resources within federal waters of the EEZ are developed by the Mid-Atlantic Fishery Management Council. The Atlantic States Marine Fisheries Commission's Interstate Fisheries Management Program is responsible for developing FMPs for marine, estuarine, and anadromous fisheries in state waters.

Marine Protected Areas (MPAs) include national marine sanctuaries, national parks, national wildlife refuges, national estuarine research reserves, and estuaries within the national estuary program of the Atlantic region. Over 120 MPAs have been noted to occur within the Atlantic region (MMS 2007). It is expected that about eight of these occur within the Project vicinity. In addition, a number of coastal and aquatic reserves that are managed by state agencies or non-governmental organizations are located along the Atlantic coast.

Plankton

Planktons are organisms that float or drift and cannot maintain their direction against the movement of currents (Parsons, Takahashi, and Hargraves 1984). Plankton includes phytoplankton (plant-like organisms), zooplankton (animals), bacterioplankton (bacteria), and meroplankton (individual life stages of some organisms, like the eggs or larvae of certain fish species).

Most major river systems in the Project area discharge either into Chesapeake Bay or Delaware Bay where freshwater from the rivers is mixed with brackish estuarine water before reaching offshore waters. Phytoplankton communities change in response to changing environmental conditions on several different scales, with phytoplankton community composition varying both temporally and spatially in the North Atlantic (DoN 2008). In general, the total number of species and individual cells decreases seaward from the coast. Large-scale surveys of phytoplankton species composition conducted in the late 1970s and in early 1980 have identified over 900 phytoplankton species in waters from the Gulf of Maine to the Florida Straits (Wiebe et al. 1987).

Zooplankton biomass is influenced by seasonal fluctuations in hydrography and phytoplankton abundance. In general, zooplankton biomass is as much as four times higher in waters over the continental slope than in further offshore waters (DoN 2008). An increase in zooplankton biomass occurs in spring within the upper 200 meters (656.2 feet) following the annual spring phytoplankton bloom (Wiebe et al. 1987). Increases in zooplankton biomass may occur when shelf water intrudes over slope water, creating a stratified water column. High nutrients and a shallow mixed layer will give rise to enhanced primary production, which in turn leads to an increase in zooplankton biomass or secondary production.

Meroplankton describes those zooplankton species that spend only a portion of their life history as plankton. Certain life stages of bivalves, fish, and arthropods are planktonic; however, in each of these cases the adult life stage is not (Lalli and Parsons 2000). For instance, the larval life stage of the blue crab (*Callinectes sapidus*) is spent in the surface waters of the MAB before returning to Chesapeake Bay and developing into the adult (Lalli and Parsons 2000). Ichthyoplankton (a subset of the meroplankton) consist of the larvae and eggs of fish species. Large frontal eddies associated with Gulf Stream meandering can transport ichthyoplankton normally associated with Gulf Stream waters into mid-shelf waters (Powell, Lindquist, and Hare 2000; Quattrini et al. 2005). Ichthyoplankton species known to be present in plume waters of Chesapeake Bay and to undergo some level of disbursement over the continental shelf include: *Anchoa* spp. (anchovies), *Micropogonias undulates* (Atlantic croaker), *Etropus microstomus* (smallmouth flounder), and *Centropristis striata* (black sea bass) (Reiss and McConaugha 1999).

Benthos

Thousands of invertebrates per square meter live along with bacteria and protozoa in or on the sediments of the ocean bottom. Amphipod and polychaete tubes can cover and cement the sediment surface over hundreds of square kilometers at certain locations during certain times. These emergent tubes can provide habitat for other important macroinvertebrates, as well as fish. Physical mixing of surficial sediments by these invertebrates, together with microbial activity, recycle nutrients into the overlying water column where they become accessible to algae and plants. There are also many important biogeochemical processes within the sediments, which form a mosaic of structure and function. The fauna associated with the sediments account for a major portion of the biomass in the ocean and constitute an integral part of the marine food web that supports exploitable fish species.

A major biogeographic boundary for marine organisms on the continental shelf occurs at Cape Hatteras where the Gulf Stream turns eastward, separating the temperate and tropical provinces (Cerame-Vivas and Gray 1966). The shelf is composed of a thin (1- to 20-meter [3- to 65-foot]) surficial layer of poorly sorted shell and medium-to-coarse grained sand that overlays clay sediments. In general, the surficial sediments grade from medium-grained sands inshore to finer sediments at the shelf break (Wigley and Theroux 1981). A sand-shell mixture is characteristic of the OCS, while sediments along the slope generally are fine-grained (silty sand to clay). Faunal composition and abundance has been shown to strongly correlate with sediment gradient (Wigley and Theroux 1981). Coarse-grained sediments generally support the largest quantities of animals, including many sessile forms. Fine-grained sediments usually contain low faunal densities, and attached organisms are uncommon.

Wigley and Theroux (1981) found that, in general, the density of benthic organisms within the MAB decreased markedly from north to south and from shallow to deep water. Numerically dominant taxonomic groups in shallow habitats include Bivalvia, Crustacea, Annelida, Echinoidea, Sipunculidae, Echiura, and Holothuroidea. In terms of biomass, the leading groups include Crustacea, Bivalvia, Annelida, Echinoidea, Ophiuridea, Holothuroidea, and the bathyal assemblages. In areas approximately 8 to 17 miles (12.9 to 27.4 km) off the coasts of Delaware and New Jersey, sand substrate predominates, along with patches of fine silt and coarse gravel (Williams et al. 2006). At a southern tract near the border of Delaware and Maryland (Fenwick shoals) Cutter et al. (2000) found that the infaunal community was dominated by annelids, molluscs, and crustaceans. Assessments of shoals off the coast of New Jersey by Byrnes et al. (2004) characterized the occurrence of sand ridges grading into clayey-silty sediment. Sand ridges were generally occupied by very small ascidians (sea squirts) attached to sand grains and by burrowing amphipods. Neighboring swales supported structure-building infauna such as polychaetes and tube-dwelling amphipods. The communities seemed to change readily with the shifting of sand features that result from seasonal storm events. Virginia's shelf sediments are comprised mostly of shell and sand-shell (very little hardbottom) with various shoals scattered throughout that support macrobenthic organisms such as annelids, arthropods, and bivalves (Wigley and Theroux 1981).

Hardbottom benthic habitat supports sessile fauna, flora, and demersal fish species (Jones et al. 1985; Cahoon et al. 1990). From Delaware Bay to Virginia hardbottom is sparse on the continental shelf but artificial reefs and shipwrecks occur throughout the area (Steimle and Zetlin 2000). Except for work by Wigley and Theroux (1981), generally, no comprehensive surveys have been conducted of seafloor substrates in the southern region of the MAB. There are no tropical coral reefs within the Project vicinity, but temperate corals are found on the shelf that not only use photosynthesis as a mode of nutrition, but also consume zooplankton (Wigley and Theroux 1981; Steimle and Zetlin 2000).

6.3 Commercial and Recreational Fisheries

The zoogeography of marine fishes is closely tied to oceanographic processes and their position to continents (Moyle and Cech 1988). Like distributions of marine invertebrates, marine fishes are subject to currents, ocean temperatures, and topographic features, but are also largely dependent upon the composition (firmness, texture, and stability) of the substrate they reside upon (Sumich 1988). Their larval stage allows extensive distributions by drifting along stretches of open water and miles of coastline (Sumich 1988).

The oceanography of the Project area is complex due to mixing currents and cooler water temperatures, and as a result, a wide variety of fish species are found. Fishes species found within the Project's vicinity constitute those found within both the Mid-Atlantic and northern South Atlantic bights and can be classified primarily as temperate species – but also include subtropical-tropical and highly migratory species. Both the numbers and types of species present change from northern to southern latitudes and reflect differences in habitat conditions such as topography, temperature gradients, locations of major oceanic currents, and the availability of appropriate food sources.

Diadromous fishes, or those that spend portions of their life cycles in freshwater and portions in saltwater are subdivided into anadromous and catadromous fish. Anadromous fishes spend most of their adult lives at sea, but migrate from the ocean to spawn in freshwater rivers or in the brackish upper reaches of estuaries. Catadromous fishes spend most of their adult lives in freshwater, but migrate to the marine environment to spawn; the resulting young catadromous fish then move to the riverine environment to mature. In the Atlantic Ocean, anadromous fish include various species of sturgeons (family Acipenseridae), herrings and shad (family Clupeidae), temperate basses (family Moronidae), smelts (family Osmeridae), lampreys (family Petromyzontidae), and trout and salmon (family Salmonidae) (MMS 2007). The American eel (*Anguilla rostrata*) is the only catadromous species that occurs along the Atlantic coast (ASMFC 2006).

Fish that spend most of their lives swimming in the water column, rather than occurring on or near the bottom, are known as pelagic species. Important coastal pelagic species in the Atlantic region include important schooling forage fish such as menhaden (*Brevoortia tyrannus*) and predatory species such as red drum (*Sciaenops ocellatus*) (MMS 2007). Many coastal pelagic species rely on coastal wetlands, seagrass habitats, and estuaries to provide habitat for specific life stages and many of these species migrate north and south along the Atlantic coast during some periods of the year. Some pelagic species are distributed from the shore to the continental shelf edge. A number of these species are schooling fish that are sought by both recreational and commercial fisheries including Atlantic herring (*Clupea harengus*) and larger predatory fishes such as bluefish (*Pomatomus saltatrix*), king mackerel (*Scomberomorus cavalla*), Spanish mackerel (*Scomberomorus maculatus*), cobia (*Rachycentron canadum*), and dolphin (*Coryphaena hippurus*). Generally, these fish use the highly productive coastal waters within the Atlantic region during the summer months and migrate to deeper and/or more distant waters during the rest of the year. A number of FMPs are in place for regulating and managing pelagic fisheries in the Atlantic region, including plans for Atlantic salmon, Atlantic herring, bluefish, dolphin, and wahoo (*Acanthocybium solandri*). Typically gears, such as trawls, longlines, and purse seines are employed by commercial fisheries to target pelagic fish species.

Demersal fish (groundfish) spend at least the adult portion of their life cycle associated with the ocean bottom. Many of these species are highly valued and are sought by both commercial and recreational anglers. Demersal fish often occur in mixed species aggregations that differ depending upon the specific area and time of year. Examples of common demersal fish within these aggregations include flounders (family Pleronectidae), hakes and cods (family Gadidae), and sea basses and groupers (family Serranidae). Many demersal fish species have pelagic eggs or larvae that are sometimes carried long distances by oceanic surface currents. In the southern mid-Atlantic region, groundfish assemblages that occur in association with hard-bottom substrates (rock outcroppings, wrecks and other bottom anomalies) are generally be categorized as belonging to the snapper-grouper complex. They typically include various species of snappers (family Lutjanidae) or groupers, in addition to other species. In northern portions of the region Atlantic cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), and pollock (*Pollachius virens*) are commonly associated with such habitats. Demersal fish are usually taken by commercial fisheries in trawls, although a many are also caught with other gear such as gill nets, traps, and longlines. Fisheries for demersal fishes in the Atlantic region are managed by multispecies groundfish FMPs, as well as a number of single-species management plans.

Highly migratory species (HMS) include those often considered as “big game” or “blue water” species. Fish within this assemblage typically migrate from southern portions of the South Atlantic to as far north as the Gulf of Maine. Examples of these wide-ranging pelagic species include Atlantic swordfish (*Xiphias gladius*), sailfish (*Istiophorus platypterus*), blue marlin (*Makaira nigricans*), white marlin (*Tetrapturus albidus*), Atlantic bluefin tuna (*Thunnus thynnus*), albacore (*Thunnus alalunga*), blackfin tuna (*Thunnus atlanticus*), and yellowfin tuna (*Thunnus albacares*). Other than some tuna species (family Scombridae), which exhibit schooling behavior, many of the HMS may occur either singly or in pairs. A wide variety of highly migratory pelagic shark species also occur in waters of the Atlantic region. Many of these are also sought by commercial and recreational anglers. Example species include blue shark (*Prionace glauca*), thresher shark (*Alopias vulpinus*), oceanic whitetip shark (*Carcharhinus longimanus*), porbeagle (*Lamna nasus*), shortfin mako (*Isurus oxyrinchus*), and longfin mako (*Isurus paucus*). Many of these species are managed under am FMP, but the lack of data on reproductive capacity and rates results in much uncertainty for establishing appropriate harvest rates. Fisheries for Atlantic Ocean HMS are managed under two FMPs: one for Atlantic tunas, swordfishes, and sharks and a second for Atlantic billfishes.

Commercial fisheries landed from New York, New Jersey, Delaware, Maryland, and Virginia in 2009 were valued at approximately $435 million (NOAA Fisheries Service 2011a). Landings for New Jersey and Virginia made up approximately 34% each of the total. Generally, based on landings but not necessarily catch locations, summer flounder (*Paralichthys dentatus*) is the most commercially valuable fishery in the Project’s vicinity (NOAA Fisheries Service 2011). Landings for invertebrates such as shrimp, sea scallop (*Placopecten megallancius*), Atlantic surf clam (*Spisula solidissima*), and ocean quahog (*Arctica islandica*) averaged over $70 million a year from 1994 through 2004, with the sea scallop accounting for almost 50% of that value (NOAA Fisheries Service 2011a). The most important fisheries by volume and value in Delaware included striped bass (*Morone saxatilis*), blue crab (*Callinectes sapidus*), horseshoe crab (*Limulus polyphemus*), and knobbed whelk (*Busycon carica*) (United States Department of Commerce [USDOC] 2008; USDOC 2009). The Atlantic menhaden (*Brevoortia tyrannus*) are considered one of the largest commercial fisheries along the U.S. Atlantic coast in terms of landing size (ranked second in the nation) (Southwick Associates, Inc. and Andrew J. Loftus, Loftus Consulting [SAI and Loftus] 2006). This species is harvested to produce oils, meal, and other products, and is also a bait fishery (SAI and Loftus 2006).

Marine recreational fishing is both a popular and profitable activity along the eastern coast of the United States. Extensive bays and estuaries support nursery grounds for juvenile fishes, while artificial reefs, shipwrecks and natural hard-bottom substrate on the continental shelf provide habitat for varied communities of reef fish and invertebrates (Steimle and Zetlin 2000; Street et al. 2005). A variety of game fish are sought recreationally in the Project vicinity and include: bottom fish (flounders, black sea bass, snappers, groupers, and porgies), targeted near structures such as artificial reefs, rock outcrops, and canyons; and coastal pelagics and big gamefish (bigeye tuna [*Thunnus obesus*], bluefin tuna, yellowfin tuna, bluefish, cobia, cod, dolphinfish [*Coryphaenidae hippurus*], king mackerel, Spanish mackerel, sharks, blue marlin, white marlin, sailfish, sea trout [*Cynoscion nebulosis*], and wahoo) (Ross 1998). Species taken in the greatest number include bluefish, spot croaker (*Leiostomus xanthurus*), summer flounder, spiny dogfish (Squalus acanthias), Atlantic croaker (Micropogonias undulatus*)*, black sea bass *(Centropristis striata)*, striped bass *(Morone saxatilis),* and tautog (*Tautoga onitis*) (NOAA Fisheries Service 2011a). Since 1990, ocean recreational fishing effort from the four-state region was highest for New Jersey and lowest for Delaware. New Jersey averaged over 3 million fishing trips per year during the 21-year period; Virginia averaged 652,000; Maryland averaged 284,000; and Delaware averaged 180,000 (NOAA Fisheries Service 2011a).

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act requires fishery management councils to describe and identify EFH in their respective regions, to specify actions to conserve and enhance that EFH, and to minimize the adverse effects of fishing on EFH. Marine fish and invertebrates depend on healthy habitats to survive and reproduce. Throughout their lives, these organisms use many types of habitats including seagrass, salt marsh, coral reefs, rocky intertidal areas, and hard/live bottom areas, among others. As mandated by the Magnuson-Stevens Fishery Conservation and Management Act, consultation is required on the possible and potential impacts from a proposed action on EFH.

Within the Project's vicinity, EFH has been designated for approximately 91 fish and invertebrate species. These species are generally referred to as managed species and include temperate, subtropical-tropical, and highly migratory species. Table 6-1 provides information on EFH species managed by the Mid-Atlantic Fishery Management Council.

Table 6-1
Essential Fish Habitat Associated with the Life Stages of Species Managed by the Mid-Atlantic Fishery Management Council

Fish Species	Life Stage	Specific Habitats
Summer Flounder (*Paralichthys dentatus*)	Eggs	Pelagic waters, most commonly 30 to 360 feet (9.1 to 109.7 meters), seagrass beds
	Larva	Pelagic waters, nearshore (12 to 50 miles [19.3 to 80.5 km] offshore), 30 to 230 feet (9.1 to 70.1 meters), seagrass beds
	Juveniles	Demersal waters
	Adults	Demersal waters
Scup (*Stenotomus crysops*)	Eggs	None designated offshore
	Larva	None designated offshore
	Juveniles	Demersal waters
	Adults	Demersal waters
Black Sea Bass (*Centropristis striata*)	Eggs	None designated offshore
	Larva	Pelagic waters, sponge beds
	Juveniles	Demersal waters, rough bottom, shellfish and eelgrass beds, sandy-shelly areas
	Adults	Demersal waters, structured habitats, sand and shell substrate

Table 6-1
Essential Fish Habitat Associated with the Life Stages of Species Managed by the Mid-Atlantic Fishery Management Council

Fish Species	Life Stage	Specific Habitats
Bluefish (*Pomatomus saltatrix*)	Eggs	Pelagic waters
	Larva	Pelagic waters
	Juveniles	Pelagic waters
	Adults	Pelagic waters
Surf Clams (*Spisula solidissima*)	Juveniles	Substrate to depth of 3 feet (0.9 meters) below water sediment interface, beach to 200 feet (61 meters)
	Adults	Substrate to depth of 3 feet (0.9 meters) below water sediment interface, beach to 200 feet (61 meters)
Ocean Quahogs (*Arctica islandica*)	Juveniles	Substrate to depth of 3 feet (0.9 meters) below water sediment interface, 30 to 800 feet (to meters)
	Adults	Substrate to depth of 3 feet (0.9 meters) below water sediment interface, 30 to 800 feet (to meters)
Atlantic Mackerel (*Scomber scombrus*)	Eggs	Pelagic waters, shore to 50 feet (15.2 meters)
	Larva	Pelagic waters, 33 to 425 feet (10 to 129.5 meters)
	Juveniles	Pelagic waters, shore to 1,050 feet (320 meters)
	Adults	Pelagic waters, shore to 1,250 feet (381 feet)
Loligo Squid (*Loliginidae*)	Pre-recruit	Pelagic waters, shore to 700 feet (213.3 meters)
	Recruit	Pelagic waters, shore to 1,000 feet (304.8 meters)
Illex Squid (Illex spp.)	Pre-recruit	Pelagic waters, shore to 600 feet (182.9 meters)
	Recruit	Pelagic waters, shore to 600 feet (182.9 meters)
Butterfish (*Peprilus triacanthus)*	Eggs	Pelagic waters, shore to 6,000 feet (1,828.8 meters)
	Larva	Pelagic waters, 33 to 6,000 feet (10 to 1,828.8 meters)
	Juveniles	Pelagic waters, 33 to 1,200 feet (10 to 365.8 meters)
	Adults	Pelagic waters, 33 to 1,200 feet (10 to 365.8 meters)
Spiny Dogfish (*Squalus acanthias*)	Juveniles	Depths of 33 to 1,280 feet (10 to 390.1 meters)
	Adults	Depths of 33 to 1,480 feet (10 to 451.1 meters)
Monkfish (*Lophius americanus*)	Eggs	Pelagic waters, shore to 3,000 feet (914.4 meters)
	Larva	Pelagic waters, 75 to 3,000 feet (22.9 to 914.4 meters)
	Juveniles	Pelagic waters, 75 to 600 feet (22.9 to 182.9 meters)
	Adults	Pelagic waters, 75 to 600 feet (22.9 to 182.9 meters)
Tilefish (*Caulolatilus princeps*)	Eggs	Pelagic waters, shore to 1,200 feet (365.8 meters)
	Larva	Pelagic waters, shore to 1,200 feet (365.8 meters)
	Juveniles	Demersal waters, 250 to 1,200 feet (76.2 to 365.8 meters)
	Adults	Demersal waters, 250 to 1,200 feet (76.2 to 365.8 meters)

Source: Abstracted from NOAA Fisheries Service 2011b.

6.4 Wildlife and Protected Species

6.4.1 Marine Mammals

More than 120 species of marine mammals occur worldwide (Rice 1998). Marine mammals, as a group, are comprised of various species from three orders; cetacea (baleen whales), odontocetes (toothed whales, including the sperm whale, dolphins, and porpoises); and sirenia (manatees). Forty (40) marine mammal species have confirmed or potential occurrence in the Project vicinity. These species include 35 cetaceans, four pinnipeds, and one sirenian. Of these 40 species, only 23 are expected to occur regularly in the region. Some cetacean species are resident in the area year-round (e.g., bottlenose dolphins [*Tursiops truncates*] and beaked whales [*family Ziphiidae*]), while others (e.g., North Atlantic right whales [*Eubalaena glacialis*] and humpback whales [*Megaptera novaeangliae*]) occur seasonally as they migrate through the area. Only extra-limital occurrences of the West Indian manatee (*Trichechus manatus*) are anticipated in the Project area. Gray seals (*Halichoerus grypus*), harp seals (*Phoca groenlandica*), and hooded seals (*Cystophora cristata*) are also extra-limital, and harbor seals (*Phoca vitulina*) would be considered rare.

Marine mammals inhabit most marine environments from deep ocean canyons to shallow estuarine waters. Marine mammal distribution is affected by demographic, evolutionary, ecological, habitat-related, and anthropogenic factors (Bjørge 2002; Bowen et al. 2002; Forcada 2002; Stevick, McConnell, and Hammond 2002). Movement of individuals is generally associated with feeding or breeding activity and, in the case of pinnipeds, molting (Stevick, McConnell, and Hammond 2002). Some baleen whale species, such as humpback whales, make extensive annual migrations to low-latitude mating and calving grounds in the winter and to high-latitude feeding grounds in the summer (Corkeron and Connor 1999). Cetacean movements have been linked to indirect indicators of prey, such as temperature variations, sea-surface chlorophyll *a* concentrations, and features such as bottom depth (Fiedler 2002).

The abundance and quality of prey, as well as its seasonal distribution, is also important to long-range pinniped movements (Forcada 2002). Phocids appear to migrate more than otariids as a result of a more variable environment (i.e., ice cover) in their higher-latitude distributions (Bowen and Siniff 1999). As with cetacean migrations, variations in timing exist and may be influenced by age classes (Forcada 2002).

Seven species of marine mammals that occur in Atlantic waters of the United States are listed as endangered under the Endangered Species Act of 1973 (ESA). These include five species of baleen whales (North Atlantic right whale [, blue whale [*Baleontoptera musculus*], fin whale [*Balaenoptera physalus*], sei whale [*Balaenoptera borealis*], and humpback whale), one toothed whale (the sperm whale), and the West Indian manatee. All cetaceans are protected under the Marine Mammal Protection Act, and some species (or stocks) may be designated as depleted under the Act. The species of endangered mysticetes reported from the western Atlantic along the U.S. coast are the North Atlantic right whale, blue whale, fin whale, sei whale, and humpback whale.

The western stock of the North Atlantic right whale is the most endangered whale occurring along the Atlantic coast. This species ranges from wintering and calving grounds in coastal waters of the southeastern United States to summer feeding, nursery, and mating grounds in New England waters and northward to the Bay of Fundy and the Scotian Shelf.

The blue whale is the largest of all marine mammals. Blue whales may be found in all oceans of the world, but sightings in the Atlantic OCS waters have been sporadic. This species migrates to tropical-to-temperate waters during winter months to mate and give birth to calves. No critical habitat has been designated for the blue whale.

The fin whale is an oceanic species that occurs worldwide, although it seems to prefer temperate and polar waters to tropical seas (American Cetacean Society [ACS] 2010a). It is the second largest baleen whale and the most abundant of the ESA-listed large whale species in Mid- and North Atlantic OCS waters (Waring et al. 2007). There is evidence that fin whales calve in the mid-Atlantic region.

The sei whale is an oceanic species that occurs from tropic to polar regions; in Atlantic waters of the United States, it is more often observed at more northern latitudes (ACS 2010b; NatureServe 2010; Waring et al. 2007). Sei whales show a seasonal movement pattern, between southern wintering grounds and northern feeding grounds (NatureServe 2010).

The humpback whale occurs in all oceans, feeding in higher latitudes during spring, summer, and autumn, and migrating to a winter range over shallow tropical banks where they breed and calve (ACS 2010c). Humpback whales may be observed migrating north and south offshore of the Atlantic states during mid-to-late spring and mid-to-late fall, respectively. Humpbacks are rarely observed inshore north of North Carolina, but from Cape Hatteras south to Florida, inshore sightings occur more frequently. The overall North Atlantic population is estimated at 8,000 individuals (The Whale Center of New England 2009).

The sperm whale is the largest toothed whale species. Adult females can reach 12 meters (39.4 feet) in length, while adult males measure as much as 18 meters (59.1 feet) in length (Jefferson et al. 1993). The head is large (comprising about one-third of the body length) and somewhat square. Sperm whale distribution can be variable but is generally associated with waters over the continental shelf edge, continental slope, and offshore waters (CETAP 1982; Hain et al. 1985; Smith et al. 1996; Davis et al. 2002).

The West Indian manatee is considered extra-limital to the Project area and is not expected included in the model for threatened and endangered marine mammals due to the lack of survey data.

6.4.2 Marine and Coastal Birds

The Atlantic coast of North America provides a wide variety of habitats that are used by a diverse bird fauna, while the offshore waters support a variety of marine birds (National Geographic Society 1999). Marine birds or seabirds are generally considered to include species that spend the majority of their life at sea, coming ashore mainly to breed or to avoid severe environmental conditions. Included in this group are pelagic birds (e.g., petrels and shearwaters); diving birds (e.g., cormorants and pelicans); and gulls, terns, and skimmers. Pelagic species tend to concentrate in nutrient-rich upwelling areas to feed. Coastal birds forage and nest in coastal habitats such as beaches, wetlands, marshes, and ridges. These include shorebirds such as sandpipers and plovers, wading birds such as herons and egrets, and numerous passerines (National Geographic Society 1999).

Threatened and Endangered Bird Species

Several species of federally endangered or threatened species of birds occur in Atlantic OCS waters during at least part of the year. These species include the endangered Eskimo curlew (*Numenius borealis*), Everglade snail kite (*Rostrhamus sociabilis plumbeus*), wood stork (*Mycteria americana*), Bachman's warbler (*Vermivora bachmanii*), and the northeastern U.S. population of the roseate tern (*Sterna dougallii*). Species listed as threatened include the Florida scrub jay (*Aphelocoma coerulescens*), piping plover (*Charadrius melodus*), and the roseate tern from other northeastern U.S. coastal areas. There is currently only one bird species, the red knot (*Calidris canutus*), identified from the Atlantic coast states as a candidate for listing as threatened or endangered under the Endangered Species Act (United States Fish and Wildlife Service [USFWS] 2011).

The piping plover is a shorebird that inhabits coastal sandy beaches and mudflats. This species is currently in decline and listed as endangered in the Great Lakes watershed (breeding range of the Great Lakes population of this species) and as threatened in the remainder of its range. Critical wintering habitat has been established in each of the Gulf Coast states for all three populations (Atlantic, Great Lakes, and Great Plains) of the piping plover (66 FR 36038–36143).

The roseate tern is a seabird that commonly ventures into oceanic waters; however, its western Atlantic population is known to occur in the far southeastern Gulf to breed in scattered colonies along the Florida Keys (Saliva 1993; USFWS 1999). It is currently listed as endangered for populations along the U.S. Atlantic coast from Maine to North Carolina, Canada, and Bermuda; it is listed as threatened in Florida, Puerto Rico, the Virgin Islands, and the remaining western hemisphere and adjacent oceans.

The red knot occurs in coastal habitats in the North Atlantic are considered critical to the survival of hemispheric populations of some shorebirds, such as red knots (Clark and Niles 2000). According to the USFWS (2011), the red knot is truly a master of long-distance aviation. Red knots fly more than 9,300 miles from south to north every spring and repeat the trip in reverse every autumn.

Threatened or Endangered Fish Species

Three fish species that are currently federally listed as endangered occur along the Atlantic coast: shortnose sturgeon (*Acipenser brevirostrum*), smalltooth sawfish(*Pristis pectinata*), and Atlantic salmon (*Salmo salar*). Another species, the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), is currently being considered for listing as threatened or endangered (72 FR 15865−15866).

The shortnose sturgeon is federally listed as an endangered species, is an anadromous fish that spawns in the coastal rivers along the east coast of North America from the St. John River in Canada to the St. Johns River in Florida. In the northern portion of the range, it is found in the Chesapeake Bay system; Delaware River; the Hudson River; the Connecticut River; the lower Merrimack River; and Kennebec River to the St. John River in New Brunswick, Canada. The shortnose sturgeon prefers the nearshore marine, estuarine, and riverine habitats associated with large river systems, and migrates periodically into faster-moving freshwater areas to spawn. Shortnose sturgeon individuals do not appear to make long-distance offshore migrations.

The smalltooth sawfish is one of two species of sawfish that inhabit U.S. waters. Little is known about the life history of these animals, but they may live up to 25 to 30 years and commonly reach 18 feet (5.5 meters) or more in length. Smalltooth sawfish are usually found over muddy and sandy bottoms in sheltered bays, on nearshore shallow banks, and in estuaries or river mouths.

Smalltooth sawfish have been reported in the Pacific and Atlantic Oceans, and Gulf of Mexico; however, the U.S. population is found only in the Atlantic Ocean and Gulf of Mexico and it is this distinct population segment (DPS) that is federally listed as endangered (68 FR 15674). The decline in smalltooth sawfish abundance has been largely attributed to their capture as bycatch in various fisheries (especially in gill nets), loss and limited availability of appropriate habitat (especially for juveniles), and to the species' low population growth rate.

The Atlantic salmon in the Gulf of Maine DPS spawns within eight coastal watersheds of Maine is federally listed as endangered (65 FR 69459), while other Atlantic salmon populations in Maine waters are considered species of concern. The listing of this population segment was based on a species status review that concluded that Atlantic salmon in the Gulf of Maine DPS exhibit a critically low abundance of spawning fish, poor marine survival, and are confronted with the increased presence of numerous threats. In the U.S., adult Atlantic salmon ascend the rivers of New England to spawn during the spring to fall seasons. Juvenile salmon feed and grow in the rivers from one to three years before migrating to the ocean. Atlantic salmon of U.S. origin are highly migratory, undertaking long marine migrations between the mouths of U.S. rivers and the northwest Atlantic Ocean where they are widely distributed over much of the region south of Greenland.

Sea Turtles

Sea turtles are long-lived, slow growing reptiles found throughout the world's tropical, sub-tropical, and temperate seas (Lutz and Musick 1997). There are seven living species of sea turtles from two distinct families, the Cheloniidae (hard-shelled sea turtles; six species) and the Dermochelyidae (leatherback sea turtle, one species). These two families can be distinguished from one another on the basis of their carapace structure (upper shell) and other morphological features.

Of these seven species, five are known to inhabit the Atlantic Ocean and could potentially occur within the Project's vicinity. Species include the loggerhead (*Caretta caretta*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), Kemp's ridley (*Lepidochelys kempii*), and leatherback (*Dermochelys coriacea*) sea turtles. They are all HMS, occurring in nearshore water throughout the North Atlantic, Gulf of Mexico, and Caribbean Sea. These species use coastal and oceanic waters for foraging, while some species nest on sandy coastal beaches. The loggerhead is the most widely seen sea turtle species on the Atlantic coast, followed by the leatherback and then the Kemp's ridley. Green turtles prefer the warmer waters of the South Atlantic and are uncommon further north. The hawksbill is considered to be an accidental visitor to Mid- and South Atlantic coastal habitat area waters (NOAA Fisheries Service 2011c). Their relative occurrence in the western North Atlantic is presented in Table 6-2. All sea turtles have a protected status (with respect to the ESA and the Convention on International Trade in Endangered Species).

Table 6-2
Sea Turtles Potentially Occurring in the Project Area

Species	Regulatory Status	Typical Adult Habitat
Family Cheloniidae		
Loggerhead turtle (*Caretta caretta*)	Threatened	Estuarine coastal, and shelf waters
Green turtle(*Chelonia mydas*),	Threatened	Shallow coastal waters, seagrass beds
Hawksbill turtle (*Eretmochelys imbricata*)	Endangered	Coral reefs, hard bottom areas in coastal waters
Kemp's ridley turtle (*Lepidochelys kempii*)	Endangered	Shallow coastal waters, seagrass beds
Family Dermochelyidae		
Leatherback turtle (*Dermochelys coriacea*)	Endangered	Slope, shelf, and coastal waters, considered the most 'pelagic' of sea turtles

6.5 Cultural Resources

The onshore region adjacent to the Project area consists of approximately 375 miles (603.5 km) of coastline directly on the Atlantic Ocean. Offshore cultural resources include numerous shipwrecks dating from as early as the 16th Century (MMS 2007), as well as prehistoric cultural sites associated with inhabitants of the Atlantic coastline prior to Spanish exploration. Early Spanish exploration occurred at that time in the South Atlantic, and shipwrecks dating to this period are present in the area. Further north, early exploration and commercial shipping into the Mid-Atlantic area occurred since the 17th Century. Many commercial shipwrecks dating between 1630 and 1800 are clustered in the Chesapeake Bay vicinity (MMS 2007). The potential for finding shipwrecks increases in areas such as historic shipping routes, approaches to sea ports, reefs, straits, and shoals (MMS 2007).

6.5.1 Submerged Prehistoric Sites

Potential offshore cultural resources include submerged prehistoric archaeological sites. Available data for the Atlantic shelf region indicate that the position of paleoshorelines varies greatly from north to south, primarily related to the distance from the late Wisconsin glacial ice mass (MMS 2007). Sea levels in the Project area were between 23 and 36 meters (75 and 118 feet) below the present sea level approximately 10,000 years ago. While little data are available for sea levels prior to 10,000 years ago, what is available indicates sea levels of 70 meters (230 feet) below present levels north of Cape Hatteras (MMS 2007). Based on these available data, the approximate area where sea levels were when the earliest human populations were known to exist in the region (around 12,000 years ago) north of Cape Hatteras are located between 50 and 56 meters (164 and 184 feet) below present sea level (MMS 2007). Submerged areas between the present shoreline and the approximate paleoshoreline would, therefore, have been available to aboriginal human populations during the last ice age (MMS 2009).

Underwater prehistoric site preservation is subject to many factors. Low-energy environments (i.e., those with little current or sedimentary movement) have the best preservation potential and would include previous river channels and associated floodplains, terraces, levees and point bars, estuaries, barrier islands, and back barrier lagoons buried by estuarine and marine sediments (MMS 2007). These same types of features are present in submerged areas of the MAB and have the same potential for being associated with prehistoric sites offshore. The preservation of organic materials is possible when buried under such conditions. Relict river courses have been shown to have higher concentrations of sites in the United States, and it is suspected that the intersection of major shelf river valleys and the paleoshoreline along the Atlantic coast would be the areas of highest potential for well-preserved, significant early prehistoric archaeological sites (MMS 2007). High-energy environments (i.e., those that are fully or partially exposed in near-shore areas) are likely to erode over time, displacing or destroying the artifacts and their primary context (MMS 2007).

6.5.2 Shipwrecks

Offshore cultural resources also would include the numerous shipwrecks dating from as early as the 16th century. An electronic database associated with the NOAA electronic navigational charts, NOAA Automated Wreck and Obstruction Information System, and NOAA raster navigational charts is available to search for information on any wrecks and obstructions in the Project area. The potential for finding shipwrecks increases in areas such as historic shipping routes, approaches to sea ports, reefs, straits, and shoals (MMS 2009).

Literature searches can be completed for reported ship losses and known shipwrecks, but they offer only a partial understanding of the resources that may be present. Based on research conducted by the MMS, 86 shipwrecks with known locations were reported in the vicinity of potential wind data collection lease areas, dating from between 1689 and 1930 (MMS 2009). Overall, a large number of shipwrecks are found in the state waters adjacent to or within the Project area, including over 1,500 in New York and over 2,000 in New Jersey (DoN 2005). The majority of these wrecks can be attributed to the heavy coastal ship traffic and the associated higher frequency of wrecks attributed to onboard fires, collisions, nautical equipment breakdowns, or being torpedoed by German submarines (DoN 2005). Along the Delaware and Maryland coastline, there are at least 32 shipwrecks resulting from severe weather or warfare (DoN 2008). Off the coast of Virginia, there are over 40 shipwrecks ranging from ocean liners to ships of war. Clusters of shipwrecks are located around the mouth of the Chesapeake Bay and along the continental slope. At least 25 shipwrecks are off the northern coast of North Carolina (DoN 2008).

Numerous other shipwrecks have been reported in the area, but reports are not always detailed enough to definitively assign a location. Some percentage of all reported wrecks are inaccurate due to imprecise recording of wreck locations, the dispersal during drift of badly broken up ships, and potential additional ship losses not being documented, such as losses of smaller fishing boats (MMS 2009). Existing records typically do not provide information on a particular wreck's potential for preservation, which can be determined by magnetometer survey or by visiting a site. Water depth, type of bottom, nature of adjacent coast, strength and direction of storm currents and waves, and size and type of the vessel are all factors that can contribute to the condition of the shipwreck and the spatial distribution of materials and artifacts associated with the shipwreck (MMS 2009).

6.6 Socioeconomics

6.6.1 Regional Population, Employment, and Income Statistics

Using Census 2000 data, it is estimated that, as of 2009, approximately 8.49 million persons were living in the 14 counties along the segment of the Atlantic coast that may be directly influenced by the Project, including portions of New York, New Jersey, Delaware, Maryland, Virginia, and North Carolina (Table 6-3). This represents an approximately 5% increase over the population in the area from the 2000 Census. Within the area, the majority of the coastal population is concentrated in the coastal counties of New York (estimated 5.4 million in 2009) and New Jersey (estimated 2.4 million), with smaller coastal populations in Delaware (estimated 0.2 million), Maryland (estimated 0.05 million), Virginia (estimated 0.5 million), and North Carolina (estimated 0.02 million).

Employment in the counties adjacent to the Atlantic coast stood at 2.96 million in 2000 and, on the basis of population growth rates, was expected to reach 3.5 million by 2009 (Table 6-3). Personal income in the area was expected to rise from $239 billion in 2000 to $339 billion in 2009. As with total population, employment in the area is concentrated in the coastal counties in New York (estimated 1.7 million in 2009) and New Jersey (estimated 1.4 million), with much smaller levels in the remaining areas.

The coastal area in the vicinity of the Project consists of a number of contrasting types of economic areas. While numerous large metropolitan areas are located inland along coastal bays and estuaries in the area (i.e., Baltimore, Philadelphia, and Washington), only New York City and its metropolitan area are directly along the Atlantic coast. These metropolitan areas have highly complex economic structures, representing a wide range of industries, labor markets, and occupations (MMS 2007). A number of smaller urban and suburban areas that serve fewer, though more specialized, are also located throughout the coastal area. Outside the urban areas, there are a large number of local and regional markets serving resource extraction, agriculture, power generation, and transportation industries. These areas have simpler economic structures and contain smaller, less-diversified labor markets (MMS 2007).

Table 6-3
Population, Employment, and Personal Income by Coastal County in the Vicinity of the Project

State	County	Population (a) 2000	Population (a) 2004 (c)	Population (a) 2009 (c)	Employment (b) 2000	Employment (b) 2004	Employment (b) 2008	Personal Income ($ millions) (b) 2000	Personal Income ($ millions) (b) 2004	Personal Income ($ millions) (b) 2008
New York	Kings	2,465,326	2,497,859	2,567,098	608,866	669,216	760,001	60,520	69,936	87,701
	Queens	2,229,379	2,250,718	2,306,712	650,117	677,916	763,916	62,219	70,136	87,506
	Richmond	443,728	471,313	491,730	119,275	128,068	143,594	15,177	17,363	21,711
	Subtotal	5,138,433	5,219,890	5,365,540	1,378,258	1,475,200	1,667,511	137,916	157,435	196,918
New Jersey	Atlantic	252,552	266,015	271,712	172,547	179,393	186,480	8,082	9,223	10,780
	Cape May	102,326	99,920	96,091	53,561	61,781	65,033	3,327	3,871	4,438
	Middlesex	750,162	774,209	790,738	479,147	482,763	512,308	27,688	31,005	38,052
	Monmouth	615,301	639,987	644,105	314,754	340,429	365,027	26,636	29,788	36,429
	Ocean	510,916	551,798	573,678	182,233	207,601	227,362	15,750	18,506	22,514
	Subtotal	2,231,257	2,331,929	2,376,324	1,202,242	1,271,967	1,356,210	81,483	92,393	112,213
Delaware	Sussex	156,638	171,370	192,747	82,427	91,131	101,368	3,897	5,079	6,426
Maryland	Worcester	46,543	48,902	49,122	31,150	33,190	34,387	1,337	1,680	2,014
Virginia	Accomack	38,305	38,669	38,462	17,421	18,037	18,541	729	897	1,073
	Northampton	13,093	13,199	13,492	7,127	7,093	7,243	291	380	451
	Virginia Beach	425,257	439,048	433,575	232,622	243,990	254,780	13,078	16,313	19,460
	Subtotal	476,655	490,916	485,529	257,170	269,120	280,564	14,098	17,590	20,984
North Carolina	Currituck	18,180	21,802	24,216	6,284	8,422	9,613	487	658	844
Total		**8,067,706**	**8,284,809**	**8,493,478**	**2,957,531**	**3,149,030**	**3,449,653**	**239,218**	**274,835**	**339,399**

Notes:
(a) USDOC, Census Bureau 2011a.
(b) USDOC, Bureau of Economic Analysis 2010.
(c) Estimated based on Census 2000 data.

Employment Opportunities

Currently, employment from offshore wind development is not a major contributing factor to the overall economic landscape of the Atlantic coastal region. However, the development of an offshore wind industry would create jobs and economic growth in the region in various sectors. In fact, the Department of Energy (DOE) released a report in February 2011 detailing the economic benefits of offshore wind development:

> Deployment of wind energy along U.S. coasts would also trigger direct and indirect economic benefits. According to NREL analysis and extrapolation of European studies, offshore wind would create approximately 20.7 direct jobs per annual megawatt installed in U.S. waters (W. Musial 2010). Installing 54 GW of offshore wind capacity in U.S. waters would create more than 43,000 permanent operations and maintenance (O&M) jobs and would require more than 1.1 million job-years to manufacture and install the turbines (W. Musial 2010). Many of these jobs would be located in economically depressed ports and shipyards, which could be revitalized as fabrication and staging areas for the manufacture, installation, and maintenance of offshore wind turbines. (DOE 2011)

To accelerate the development of offshore wind energy, create new jobs and reduce or dependency on fossil fuel; on February 7, 2011, Secretary of the Interior Ken Salazar and Secretary of Energy Steven Chu announced major steps in support of offshore wind energy in the United States, including new funding opportunities for up to $50.5 million for projects that support offshore wind energy deployment in several high priority WEAs of the mid-Atlantic that will spur rapid, responsible development of this abundant renewable resource. The release of three solicitations, representing up to $50.5 million over five years, to develop breakthrough offshore wind energy technology and to reduce specific market barriers to its deployment includes:

- **Technology Development** (*up to $25 million over 5 years*): The DOE will support the development of innovative wind turbine design tools and hardware to provide the foundation for a cost competitive and world-class offshore wind industry in the United States.
- **Removing Market Barriers** (up to $18 million over 3 years): The DOE will support baseline studies and targeted environmental research to characterize key industry sectors and factors limiting the deployment of offshore wind.
- **Next-Generation Drivetrain** (up to $7.5 million over 3 years): The DOE will fund the development and refinement of next-generation designs for wind turbine drivetrains, a core technology required for cost-effective offshore wind power.

The largest costs of offshore wind energy are from labor-intensive and high paying job sectors, such as research and development, wind turbine and platform construction, marine transport vessel construction and operation, and overall maintenance. Growth in these sectors would build off of existing strengths of the Atlantic coastal economy and infrastructure, including shipbuilding, fishing, port operations, and other industries (NWF 2010).

6.6.2 Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (59 FR 7629), issued by President Clinton on February 11, 1994, requires federal agencies to incorporate environmental justice as part of their missions. Specifically, it directs them to address, as appropriate, any disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority and low-income populations (individuals living below the poverty line (MMS 2007). A minority is considered to be any person identifying themselves as one of six racial groups, excluding those of Hispanic origin. A minority population exists where the percentage of minority persons is more than 20% greater than the national percentage of minority persons, or in areas where the number of minority persons exceeds 50% of the total population of that area (MMS 2007). Low income persons are considered to be those who fall below the poverty line. Low income populations exist where the percentage of low income persons is more than 20% greater than the national percentage of low income persons, or in areas where the number of low income persons exceeds 50% of the total population of that area (MMS 2007).

According to United States Census data from 2000 (extrapolated to 2009), of the total 8.5 million people living in the Atlantic coastal area, over 51% are considered to be minorities, with approximately 13.3% considered to be low income persons. While the estimate of minorities in the overall area constitutes 50% of the total population and would represent a minority population in the area, the vast majority of minority persons in the coastal Atlantic counties (nearly 75%) reside in either Kings County or Queens County in the New York City metropolitan area.

Table 6-4
Project Area Percent Population
Below Poverty Level and Minorities

State	County	Minority [(a)]	Below Poverty Level [(b)]
New York	Kings	63.0	21.1
	Queens	69.3	12.3
	Richmond	34.1	10.3
New Jersey	Atlantic	39.1	11.1
	Cape May	11.7	8.9
	Middlesex	48.1	7.1
	Monmouth	22.8	5.9
	Ocean	13.2	8.6

Delaware	Sussex	23.5	12.0
Maryland	Worcester	19.5	10.5
Virginia	Accomack	39.3	20.6
	Northampton	45.7	19.5
	Virginia Beach	34.1	7.0
North Carolina	Currituck	11.8	9.7
Overall		**51.0**	**13.3**

Source: USDOC, Census Bureau 2011b.
Notes:
(a) Based on 2009 population estimates of Census 2000 data.
(b) Based on 2008 population estimates of Census 2000 data.

6.7 Geological Resources

6.7.1 Geologic History

The North to Mid-Atlantic region is situated on a broad shelf with a width generally greater than 120 km (75 miles). The 100-meter (330-feet) water-depth contour generally coincides with the extent of the shelf in this area. The shelf is overlain by a mantle of sand, ranging in thickness from 20 meters (65 feet) on the Mid-Atlantic portion of the shelf to 40 meters (130 feet) on the North Atlantic portion. Linear sand ridges are also characteristic of the continental shelf in this region (MMS 2007). Deltas and linear sand ridges shield underlying Holocene muds from wave and current erosion, producing a substrate of varying thickness and unconformable boundaries.

A hinge line (i.e., the boundary between a stable region and one undergoing relative vertical movement) parallels the New Jersey coast approximately 20 km (12 miles) offshore, curving to parallel Long Island, New York (NJDEP 2010). Subsidence east of the line measures about 0.0150 millimeter (mm; 0.0006 in.) per year, declining towards the west to near zero (NJDEP 2010). The northern zone is undergoing uplift while the southern zone features a depression due to somewhat greater accommodation space for deposition created by glacial rebound to the north and forebulge subsidence (NJDEP 2010). The movement of salt intrusions near the deepest portion of the Baltimore Canyon Trough (north of the hinge line) could possibly account for local uplift (NJDEP 2010).

The Mid-Atlantic continental margin is underlain by a deep sedimentary basin called the Baltimore Canyon Trough (MMS 2007). The elongate, northeast-trending basin is characterized by extensional tectonic features related to the rifting between North America and Africa during the Triassic. The basin thickens seaward, with a maximum thickness of up to 18 km (11 miles), and has no physiographic expression (MMS 2007). The development of the passive margin shelf along the Atlantic coast was the result of rifting between the North American and African plates initiated in the Triassic period. A basin was then developed over time due to the progressive overlapping of marine and deltaic deposits, generating an extensive continental terrace, most of which presently lies beneath the Atlantic Ocean (NJDEP 2010).

During the Triassic period, marine transgression deposited evaporites as far south as Cape Hatteras. Clastic sands, silts, and shales were also deposited as surrounding rift mountains were eroded. As rifting began, the basin opened, and a long, narrow seaway was formed (MMS 2007). This seaway basin remained shallow and evaporites were deposited in local shallow basins (forming the early Carolina Trough) and by the Middle Jurassic, the ocean basin was wider and about 3 to 3.5 km (1.9 to 2.2 miles) deep. Carbonate reefs and banks formed on the North American continent margin (MMS 2007). The ocean basin continued to widen into the Late Jurassic, a period of increased sediment accumulation and subsidence (MMS 2007). During the Early Cretaceous the deposition of terrigenous and shallow water clastic debris from the continental shelf into the adjacent deep basins (e.g., the Baltimore Canyon Trough) produced gently sloping sediment prisms Calcareous pelagic sediments were also deposited at this time (MMS 2007). The Late Cretaceous was a period of continued spreading, and extensive deposition and deepening of the sedimentary basins along the continental margin. The ocean basin continued to enlarge during the Early Tertiary, with pelagic shales and turbidites rich in calcareous and biosiliceous debris deposited over large areas (MMS 2007). Thick sequences of sediments were then eroded, cutting down to Lower Cretaceous levels in the southeastern part of the continent, with mass movement of sediments along the margin common during this time (MMS 2007).

Sediments that crop out on the ocean floor near New Jersey range in age from Miocene to Holocene (NJDEP 2010). Starting in the Pleistocene Epoch, the Atlantic continental margin experienced three sea level fluctuations caused by the advance and retreat of ice sheets and northern continental glaciers (NJDEP 2010). During low sea level cycles associated with these glacial epochs, glaciers in the north scoured the continental shelf and deposited debris on the continental margin (MMS 2007), creating barrier islands, tidal delta sands, and linear sand ridges formed in the high energy environments, while lagoonal muds and marsh formed in the low-energy environments (NJDEP 2010). Marine sediments deposited during the sea-level highstands are typically separated by fluvial gravels and coarse sands deposited or reworked during sea-level lowstands. Some of the sand ridges are composed of Miocene to Holocene deposits, with Holocene, Eocene, Cretaceous, and Triassic subsurface layers overlie inlets and channels, as well as being found near sand ridges (NJDEP 2010). During the most recent sea-level rise, older Holocene-age sand and muds have been eroded and overlain by younger Holocene-age barrier island and shoreface sands (MMS 2007).

6.7.2 Mineral Resources

Even though there have been no oil and gas leases off the Atlantic coast since November 17, 2000, it is estimated that there are undiscovered oil and gas resources in this area, particularly the Baltimore Canyon Trough in the Project area. An estimated 3.8 billion barrels of oil and 1.1 trillion cubic meters (37 trillion cubic feet) of natural gas are potentially located off the Atlantic coast (MMS 2007). These are mainly located in progradational clastic sediments within delta and fan complexes. The source rocks for oil and gas tend to be shales and platform carbonates, with anticlines, normal faults, and sediment pinchouts against diapirs acting as trapping structures. There are also reserves of hard mineral resources within the region, including sand and gravel (estimated 2 trillion cubic feet) throughout the Atlantic shelf, and titanium, rare earths, zirconium, and precious metals in unconsolidated shoreline sediments and Pleistocene fluvial channels, clay deposits, calcium carbonate sands, diatomites, evaporates, and peats (MMS 2007).

6.7.3 Geologic Hazards

Geologic hazards off the U.S. Atlantic coast are generally associated with the scouring action of ocean currents and seafloor instability. Potential geohazards include:

- *Scouring action of ocean currents*. This is the result of tidal circulation and storm waves which effect the transport of sediments on the surface of the continental shelf;
- *Slope failures*. Unconsolidated surficial sediments are water saturated and susceptible to liquefaction and mass movement, which can be triggered by earthquakes, wave and tidal currents, storm surges, or human activity. Though rare on the shelf, widespread mass movements have been reported on the continental slope in the North Atlantic;
- *Tsunamis*. Submarine earthquakes anywhere in the Atlantic Ocean or local landslides have the potential to create tsunamis;
- *Fluid and gas expulsion*. Gaseous sediments may be present as a result of decomposing organic matter or gas rising along fault planes from a deeper reservoir into surficial sediments;
- *Variable bottom types*. Bottom types in this section of the Atlantic coast vary in composition and can affect the anchoring of structures; and
- *Irregular topography.* Various features such as reef mounds, submarine channels and canyons, scour depressions, and escarpments are highly variable in load-bearing capacity and may present potential hazards to foundation structures. Additionally, sediments across irregular topography may vary in thickness while steep slopes increase the risk of sediment failure (MMS 2007).

6.8 Coastal Zone Use, Recreation and Aesthetics

6.8.1 Coastal Zone Use

Area Land Use and Existing Infrastructure

The coastline of the Atlantic region contains numerous large cities and ports and land uses are highly diverse and have been well established over many years. Centers for manufacturing, transportation, communication, military operations, and urban development are found on the coast. The coastline also supports both low-density agricultural production and areas known for their aesthetic appeal and wildness, areas frequently for their natural appeal and recreational opportunities (MMS 2007).

The northern portion of the region has robust transportation systems in place, including maritime ports of all sizes and an extensive highway and rail system. The southern portion of the region is less densely developed and has less transportation infrastructure. For example, the Atlantic coast near New York/New Jersey state border has many nearshore uses, including shipping lanes, telecommunication cables, municipal waste disposal areas, oil and gas production facilities, military operations areas, and marine protected areas (MMS 2007). This is in opposition to areas along the

Delmarva Peninsula with less developed industrial uses, with many more protected areas both on and offshore.

Atlantic coastal states have authority over submerged lands out to 3 nautical miles (3.5 miles or approximately 5.6 km) and manage ocean energy resources and structures within these coastal zones. The Federal government; however, regulates navigation, commerce, and foreign affairs in this area. State-managed uses in this area includes alternative energy developments, though there has been no offshore development in this area to date; the BOEMRE has been in discussions regarding the leasing of this area for both oil and gas exploration and permitting for wind energy development (MMS 2007).

All of the states in the Atlantic region are participants in the Coastal Zone Management Program and have taken various approaches to managing their coastal lands. Coastal areas of Atlantic states are very diverse. Some of the most prominent geographical features of the area are Long Island, the Chesapeake Bay, and the beaches of the Eastern Shore of Virginia and Maryland, and the Outer Banks of North Carolina (MMS 2007). The Atlantic coastal side of the Eastern Shore of Virginia is considered a global treasure and has been designated by the United Nations as a “Man and the Biosphere Reserve” (MMS 2007). Beyond these uses, agriculture is an important activity in many of the Atlantic coast states.

Two oceanographic weather buoys are moored and maintained by NOAA’s National Data Buoy Center in the Atlantic shelf area off Virginia, as well as a light tower platform to the east of the mouth of the Chesapeake Bay (DoN 2008). These sites were established by the National Data Buoy Center for the National Weather Service and are capable of monitoring wind direction, wind speed and gust, air temperature, and barometric pressure; however, some sites also measure relative humidity, precipitation, sea surface temperature, and visibility (DoN 2008). In addition to these parameters, the moored oceanographic buoys can measure wave energy spectra, allowing for the calculation of wave height, dominant and average wave period, and the direction of wave propagation (DoN 2008).

<u>Military Use Areas</u>

Military Use Areas are required by individual units within the U.S. Department of Defense (DoD), including the U.S. Air Force, U.S. Department of the Navy, U.S. Marine Corps, and Special Operations Forces, to conduct various testing and training missions in numerous areas off U.S. coastlines. Military activities normally consist of various air-to-air, air-to-surface, and surface-to-surface naval fleet training, submarine and antisubmarine training, and air force exercises (MMS 2007).

The U.S. Army Corps of Engineers has established surface danger zones (i.e., water areas used for a variety of hazardous operations) and restricted areas (i.e., water area for the purpose of prohibiting or limiting public access) in many areas adjacent to U.S. coastlines to account for military uses (MMS 2007). Danger zones may be closed to the public on a fulltime or intermittent basis, while restricted areas generally provide security for government property and protection to the public from the risks of damage or injury arising from government uses of an area (MMS 2007). The DoD and the National Aeronautics and Space Administration use danger zones and restricted areas within coastal waters and offshore for rocket launching, weapons testing, and a variety of training and readiness operations.

Military OPAREAs are areas where the Navy conducts surface and subsurface training and operations activities, including sinking exercises of surface targets and mine warfare exercises, and shakedown cruises for newly built ships and for ships completing overhaul or extensive repairs in shipyards located along the coasts (MMS 2007). Of note, Navy Fleet and Marine Corps amphibious training occurs nearly every day all along the east coast. Activity levels vary from unit-level training to full-scale carrier or strike group operations and certification. Two OPAREAs are located within the proposed Project Area, including the Atlantic City OPAREA near New Jersey and the Virginia Capes OPAREA off the coasts of Maryland, Virginia, and North Carolina. Aircraft operated by all DoD units train within special use airspace overlying the coast and offshore (MMS 2007).

The DoD recently completed an assessment of the offshore wind lease blocks in the Virginia Capes OPAREA. Using a process to identify areas in three different use areas, the study concluded that a majority of the OPAREA should be classified as a Wind Energy Exclusion Area (Walsh 2010). This included an area to the east of the mouth of the Chesapeake Bay used for mine warfare countermeasures training, as well as an area off the southern Virginia coast used for aerial/surface live targeting operations. A third area, at the entrance of the Bay, is classified as having site specific conditions and stipulations due to surface/helicopter transiting of the area.

In additional, the FAA has designated warning areas in offshore waters. Extending from 3 nautical miles (3.5 miles; 5.6 km) outward from the coast over international waters and in international airspace, these areas are designated as airspace for military activities. While the purpose of warning areas is to warn nonparticipating pilots of the potential danger, because they occur over international waters, there are no restrictions on nonmilitary aircraft (MMS 2007). Warning areas and military operating areas are generally used for air-to-air training operations (MMS 2007).

There are numerous military and civilian radar systems that provide radar coverage along the U.S. coastline. In 2006, the DoD found a potential conflict between the installation of wind energy developments and the operation of various radar systems in offshore waters (MMS 2007). The FAA has also found potential hazards due to the potential effect of wind energy developments on radar system performance (MMS 2007). As future offshore wind projects are proposed for the Atlantic shelf area, the FAA/DoD will comment and provide feedback on the proposed projects. However, until further study is completed, FAA/DoD will not provide blanket input or exclusions for a large area.

Transportation

Navigable waterways of the U.S. are those waters that are presently used to transport interstate or foreign commerce. A determination of navigation, once made, applies laterally over the entire surface of the water body and is not extinguished by later actions or events that impede or destroy navigable capacity (DoN 2005). Navigable waterways aid all vessels (commercial, recreational, and military) in avoiding conflicts and collisions while entering and leaving major ports (DoN 2008).

The western North Atlantic supports a large volume of both domestic and international maritime traffic, having some of the busiest shipping lanes in the world. Maritime traffic includes ships traveling within mid-Atlantic ports in the U.S., as well as traffic to eastern Canada and the eastern Atlantic Ocean. Commercial shipping comprises the vast majority of this traffic (DoN 2008). The waters off New Jersey contain several primary shipping lanes leading from New York City and Newark to ports in Delaware Bay and the mid-Atlantic U.S. (DoN 2008). Ships transiting near Virginia and Delaware may use any one of the shipping lanes that intersect the area. One shipping lane runs roughly parallel to the coast and serves as a connecting route between domestic ports along the coast. Offshore waterways and shipping lanes are not designated and vessels follow routes determined by their destination, depth requirements, and weather conditions. These offshore shipping lanes extend to the southeast towards the Caribbean or to the northeast towards Europe and the Mediterranean (DoN 2008).

Some of the largest ports in the U.S. are located along the Atlantic coast and are connected by navigable waterways and shipping lanes to each other and to other areas outside the Atlantic coastal region. Ports provide an interface to land-based transportation systems such as highways and railroads where vessels may dock. Ports provide equipment and personnel to load and unload cargo and passenger vessels, as well as areas for vessel maintenance and cargo storage (MMS 2007). Vessels using ports may include military, commercial business craft, commercial recreational craft, research vessels, and personal craft. While many of these vessels generally remain within state waters, such as most ferries and personal craft, they influence the availability of port facilities and impact vessel traffic in offshore areas near ports (MMS 2007).

All major U.S. ports are governed by TSS established by the U.S. Coast Guard (USCG) and the U.S. Department of Transportation (USDoT). These channels direct incoming and outgoing traffic into different lanes for safe negotiation into U.S. ports. These schemes also provide Precautionary Areas where the direction of traffic is recommended (DoN 2005). To facilitate transit into and out of the Chesapeake Bay and Delaware Bay, a TSS scheme has been defined at the mouth of each bay. The TSS at the mouth of Chesapeake Bay consists of two approaches (southern and eastern) and a 2-mile radius precautionary area located shoreward of the approaches (DoN 2008). The eastern approach has an inbound and an outbound lane, with a no-transit area between each lane designed to keep traffic separated. The southern approach also consists of an inbound and outbound lane; however, between the two lanes is a deep-water route to be used by ships with drafts that exceed 13.5 meters (45 feet) in freshwater, and for Navy aircraft carriers. The Delaware Bay TSS consists of two approaches (southeastern and northeastern), a two-way traffic route, and a precautionary area (DoN 2008). Each approach consists of an inbound and outbound lane. The two-way traffic route is located along the northern side of the TSS and is recommend for use by tug and tow traffic entering or leaving the bay. The precautionary area, which is larger than the one at the mouth of Chesapeake Bay, is located on the shoreward side of the TSS (DoN 2008).

In the northern portion of the Project area, the port complex of New York City/Newark is ranked third in the U.S. as determined by the Port Import/Export Reporting Service (DoN 2005). This complex has more scheduled services to a wider variety of trade lanes than any other port in North America and is the leading container volume gateway on the east coast. Overall, the ports of New York and Philadelphia handled the most vessel calls of oceangoing vessels of 10 deadweight tons or larger in 2005, with 4,902 and 2,998 vessels, respectively (MMS 2007). While detailed statistics are not available for smaller commercial vessels, this traffic is expected to have a similar trend. In addition, larger vessels are more likely than smaller craft to travel into federal waters. Another measure of vessel traffic and port size and capabilities is the annual volume of goods shipped and received (MMS 2007).

The major commercial shipping ports of Baltimore, Philadelphia, and various ports of Virginia all access the Atlantic by transiting the Project area. In 2003, the port of Baltimore was the eighth busiest U.S. seaport and the eighteenth busiest port overall for international trade, while in 2004, the port of Philadelphia, in combination with other Delaware River ports, ranked as the sixth most frequented port in the U.S. (DoN 2008). Several piers in Philadelphia specialize in handling the shipment, storage, and distribution of goods, such as fruits and vegetables, cocoa products, and forest products, and the Tioga Marine Terminal serves as the homeport for two Navy supply vessels that can be docked at the port to handle military supplies (DoN 2008). The port of Virginia is made up of four cargo terminals including the Norfolk International Terminals, the marine ports of Portsmouth and Newport News, and the Virginia Inland Port at Front Royal (DoN 2008). The top three exports in terms of tons of cargo shipped are coal, wood, and wood pulp, and the top three imports are oil, geologic-based products, and machinery (DoN 2008).

On February 17, 2011, the Applicant met with USCG District 5 to present the Project as part of the outreach efforts. USCG D5 indicated that some of the TSS are in the process of being expanded as shown on Figure 5-3 (refer to TSS panel, top left hand corner).

Commercial fishing ports could also provide a base of support operations for OCS alternative energy facilities. While data regarding total vessel activity at fishing ports are not readily available, total fish landings can act as a surrogate for total vessel activity of a port. Overall, about half the fish landed off the Atlantic coast were caught in federal waters. Almost 30% of the total landings occurred in Virginia, but most of that state's landings (84%) were caught within Virginia State waters (MMS 2007). Larger ports also service and are departure points for cruise ships, with approximately 17 major cruise lines operating cruises with a U.S. port of call (MMS 2007). These cruise ships are larger oceangoing vessels, often with international ports of call (MMS 2007).

6.8.2 Recreation

The Mid-Atlantic coastal region is a popular tourist and recreational destination that offers a diverse range of activities, featuring sandy beaches, barrier islands, inland water bodies, estuarine bays and sounds, river deltas, maritime forests, and marshland (MMS 2007). Popular recreational activities include swimming, boating, fishing, sunbathing, waterfowl hunting, wildlife viewing and other nature studies, visits to historic and cultural sites, visits to amusement parks and other commercial destinations, nightlife and entertainment, shopping, gaming, outdoor sports, and specialized activities including surfing, hang-gliding, kayaking, and scuba diving. Coastal habitats are extensively and intensively used for recreational activity by residents of the local areas and tourists (MMS 2009). Public lands, intermingled with developed areas throughout the region include National Parks and Seashores and National Wildlife Refuges containing marine habitats occupying more than 414,400 hectares (1,600 mi^2) of the mid-Atlantic coastal region. Other public lands include state and locally protected lands and military and research establishments (MMS 2007). Commercial and private recreational facilities and establishments also serve as primary interest areas and support services for people who seek enjoyment from the recreational resources in these states (MMS 2009).

Beaches are a major recreational resource that attracts tourists and residents to the coastal counties for fishing, swimming, shelling, beachcombing, camping, picnicking, bird watching, and other activities. The scenic and aesthetic values of beaches play an important role in attracting visitors. Recreation and tourism provide employment and wages in the coastal counties (MMS 2009).

Sussex County is the coastal county of Delaware and has substantial recreation, particularly in connection with marine fishing and beach-related activities, with ocean shorefronts offering a diversity of natural and developed landscapes and seascapes (MMS 2009). Ocean-related recreation and tourism in Sussex County contributed over 6,000 jobs and $96 million in wages in 2004, with more than 5 million people visiting the Delaware Atlantic coastal area each year (MMS 2009). Delaware has 26 miles of Atlantic Ocean coastline in Sussex County, 20 beaches, and 12 miles of the coastline in state parks (MMS 2009). The coastal counties of New Jersey have substantial recreation, particularly in connection with marine fishing and beach-related activities. The shorefronts along these counties in New Jersey offer a diversity of natural and developed landscapes and seascapes (MMS 2009). New Jersey ranks fourth in marine recreation and it attracts about 6.2 million people, with the number one activity being visiting beaches (MMS 2009). New Jersey has 127 miles of public coastal beaches and 686 beaches in six coastal counties (MMS 2009).

<u>Artificial Habitats</u>

Artificial habitats (artificial reefs, shipwrecks, and other human-made structures) represent physical alterations to the seafloor and can benefit benthic communities and onshore economies. Artificial substrates are typically introduced to seafloor areas predominantly composed of soft sediments to provide habitats for the settlement and colonization of epibenthic organisms. The succession of colonizing, benthic organisms on artificial substrates, ultimately attract large predatory game fish and even sea turtles. Such artificial reefs are prime fishing spots for recreational and commercial fishermen (DoN 2008). Fishermen commonly target sharks, mackerels, cobia, and bluefish at productive artificial habitat sites, as well as black sea bass, scup, monkfish, summer flounder, and members of the snapper and grouper families. The process of reef colonization and community building can extend the potential range of some commercially and recreationally important fishes and invertebrates (DoN 2005). In addition, despite being located in temperate latitudes, the artificial reefs and shipwrecks off the mid-Atlantic coast also host tropical and subtropical species. A wide variety of anthropogenic structures and materials have been constructed and placed in the Project area. Structures include shoreline bulkheads, bridge abutments, piers, docks, groins, lighthouses, pipelines, communication cables, and shipwrecks (DoN 2005).

Artificial reefs are defined by the design and arrangement of materials used in construction and function according to their purpose. A large number of materials of varying sizes can and have been used in the creation of artificial reefs (DoN 2005). Materials can include natural objects such as wood, shells, and rock, and man-made objects such as vehicles, aircraft, boats, home appliances, discarded construction materials, scrap vehicle tires, oil/gas platforms, ash byproducts, and prefabricated concrete structures. The purposes of deploying artificial reefs are to enhance commercial fishery production and recreational activities (e.g., fishing, scuba diving, and tourism), to restore water and habitat quality, to provide habitat protection and aquaculture production sites, and to control fish (DoN 2005). Reef complexes are areas composed of more than one type of reef material and consist of an aggregation of individual reef sites within close proximity of one another (DoN 2005).

New York, New Jersey, and Delaware have had active artificial reef programs since 1962, 1984, and 1995, respectively (DoN 2005). The U.S. Maritime Administration Artificial Fish Reef Program authorized the transfer of scrap Liberty ships to any state filing an application. While many southern coastal states have taken advantage of this program, a total of two ships were deployed near the Project area, both off the coast of New Jersey (DoN 2005).

Construction of artificial reefs using other vessels (mainly barges and landing craft) has occurred primarily off the Atlantic coast states and western Florida. Since 1984, however, a total of 126 ships were sunk in offshore waters to form the network of fourteen ocean reef sites off New Jersey (DoN 2005). Currently, a total of sixteen individual artificial reefs occur in the waters off New Jersey (DoN 2005). The New York State Department of Environmental Conservation has developed seven artificial reef sites near the eastern shore of Long Island. The fourteen artificial reef sites in New Jersey have been constructed of over 1,000 reefs, including 126 vessels, and are maintained near the coast between 2 and 25 nautical miles offshore from Sandy Hook to Cape May, at depths ranging from 9 meters to greater than 30 meters of water (DoN 2005). Delaware's Artificial Reef Program has permitted eleven artificial reef sites with eight in Delaware Bay and three in the Atlantic Ocean adjacent to the Indian River Inlet (DoN 2005).

Scuba Diving Sites

A number of popular scuba diving and snorkeling sites are located near the proposed Project area. Few of these sites are natural and unlike dive sites in the Caribbean Sea, dive sites in Atlantic coastal region are typically associated with artificial habitats (DoN 2005). Recreational divers can generally access dive sites by boat or by entering the water directly from the beach, with many opportunities in waters shallower than 130 feet. The most popular sites include shipwrecks (especially off of the Delaware and North Carolina coasts) and artificial reef. In addition to shipwrecks, oyster reefs and mussel beds also attract divers to the waters in the Mid-Atlantic, though most of these sites are located closer to shore or near the large bay systems (i.e. the Chesapeake Bay) (DoN 2008).

New Jersey has many diving opportunities from wreck dives to artificial reefs (DoN 2005). The dive season off of Delaware, Maryland, and Virginia starts in May and runs through October, during which time visibility can be up to 15 meters and temperatures generally range between 20°C to 28°C in summer, with cooler temperatures in fall and spring (DoN 2008). A large amount of diving occurs on the inner and mid-shelf off of North Carolina, where one of the largest concentrations of shipwrecks on the east coast is found. Diving occurs throughout the year, but the most popular recreational season is still from May to October at depths of about 25 and 38 meters (82.2 and 124.7 feet) (DoN 2008).

6.8.3 Aesthetics

The proposed Project area is located within the mid-Atlantic Coastal Plain area, extending from the Atlantic Ocean south of Long Island in New York to the Virginia-North Carolina border. This area provides a rich diversity of visual resources. Water is a dominant feature of the landscape, with wetlands, marshes, and barrier islands and bay complexes also distinctive features, as well as upland forests on remaining lands. Much of the ocean frontage along the mid-Atlantic coast consists of sandy beach-dune and/or barrier beach areas. Coastal wetlands and a number of major estuaries, including the Raritan, Delaware, and Chesapeake Bays and Currituck Sound, support a great diversity of fish and wildlife, including waterfowl, shorebirds, wading birds, and raptors, as well as a variety of reptiles and mammalian species (MMS 2007). In the vicinity of urban areas, there are localized sections of dense shoreline development.

Visual impacts incurred by onshore receptors due to both construction and operation of a transmission cable system and offshore wind farm are some of the more contentious issues associated with constructing offshore wind generation facilities. A large percentage of the U.S. population lives near the Atlantic coast and, consequently, beaches are heavily used for recreation, particularly near large urban areas (MMS 2007). The number of potential viewers and their activities make viewsheds from beaches particularly sensitive to offshore visual impacts. In addition, many residences are located at or very close to the shore and residents would likely have frequent and extended views of offshore energy developments. Seaside residents would potentially be very sensitive to changes visible from the shore, and hence viewsheds from seaside residences are of particular concern for potential visual impacts (MMS 2007).

Past research has not conclusively determined the effect of offshore wind development on onshore resources. Recently, researchers conducted a series of surveys in 2006 (Firestone, Kempton, and Krueger 2009) and 2007 (Blaydes, Firestone, and Kempton 2010) to determine public perception of a potential wind farm built in the Atlantic Ocean off the coast of Delaware. Visual simulations were used to inquire as to the perceived effect a development might have on residents of the state and on non-resident usage of coastal areas (i.e., effects on tourism). These surveys concluded that, in general, there was high support for offshore wind development. While residents were willing to pay to move wind turbines further offshore, concerns over visual impacts were low (unless turbines were located within 1 mile of the shore) when fossil fuel energy production was factored in and compared to wind development. The researchers also recommended that developers not claim that there would be no negative impact on tourism, since the surveys found that at least some residents and tourists would modify their behavior in relation to wind development.

6.9 Meteorology, Air Quality, and Noise

6.9.1 Meteorology

The AWC Project would be constructed offshore from New Jersey to Virginia. In addition, an interconnection from the AWC to a borough in New York City may be constructed. Meteorological conditions in this region are summarized in the Alternative Energy Programmatic EIS (USDOI 2007). The climate is determined by the influence of the surface water temperature and ocean currents in the offshore area. Air moving across these waters is modified through heat and moisture transfer from water to the air. The climate is moderate and free of extreme variation, although in winter, cold snaps and snow storms can occur onshore, especially in the northern portion of the Project area.

New Jersey is considered to be the southern-most state in the North Atlantic Planning Area. New York City boroughs are also in the southern part of the North Atlantic Planning Area. Delaware, Maryland, and Virginia are in the Mid-Atlantic Planning Area. Generally, meteorological conditions in New York City/New Jersey south to Virginia are similar; however, there is some variation in temperature and precipitation in this region. Wind direction and speed are similar (MMS 2007); prevailing winds are from the south through southwest with an average speed range between 5.9 and 7.2 meters per second (13.2 to 16.0 miles per hour). Annual average temperature in New York City/New Jersey is 59.5°F (15.3°C) (corresponding to the southern-most location in the North Atlantic planning area) to 69.3°F (20.7°C) in Virginia. Precipitation in the region is fairly uniform throughout the year; however, during winter snow is typically more frequent in New York City/New Jersey than in Virginia. Rain in summer is typically associated with convective activity such as thunderstorms. Annual average precipitation is approximately 42 inches (106.7 centimeters) in the northern part of the Project area to about 50 inches (127 centimeters) in the southern part of the Project area. The region can also be affected by hurricanes during the summer and fall, with New York City/New Jersey less likely to be affected by hurricanes compared to Virginia. Hurricanes typically lose their strength rapidly as they move north, thus they can be somewhat weaker in the northern part of the Project area.

Atmospheric stability is a factor in determining how well the atmosphere is mixed, and hence how well pollutants are transported away from emission sources. In a stable atmosphere, pollutant transport can be inhibited, whereas in unstable conditions pollutants tend to mix well in the atmosphere. Over water areas, the atmosphere tends to be neutral to slightly unstable due to the heat and moisture coming from the underlying water surface. Over land areas, stability is highly variable; during daytime conditions are typically unstable and during night are stable. Fog can also occur during stable conditions in offshore and near onshore areas in cooler months when warmer moisture laden air blows over cooler near shore areas.

6.9.2 Air Quality

The Clean Air Act established National Ambient Air Quality Standards (NAAQS) for six pollutants. These pollutants are ozone, nitrogen dioxide, carbon monoxide, sulfur dioxide, particulate matter, and lead. The concentration of these pollutants are measured continuously and routinely at monitoring stations in order to determine whether air quality in a region meets (e.g., is better than) or does not meet (e.g., is worse than) the NAAQS. Monitoring stations exist in the onshore areas of boroughs of New York City, New Jersey, Delaware, Maryland, and Virginia.

Based on data from the monitoring stations processed in accordance with the requirements of the NAAQS and compared to the NAAQS, areas showing non-compliance are classified as *nonattainment* for the pollutant whose ambient concentration is worse than the corresponding NAAQS. Areas where the pollutant concentrations are better than the NAAQS are classified as *attainment*. For offshore areas beyond state boundaries, the NAAQS designation of the corresponding onshore area is applicable (MMS 2007). Coastal counties in New Jersey and the New York City metropolitan area are nonattainment for ozone. Coastal counties in northern New Jersey and the New York City metropolitan area are also classified as nonattainment for particulate matter less than 2.5 microns in diameter ($PM_{2.5}$). Some or all coastal counties (depending on the state) in Delaware, Maryland, and Virginia are classified as moderate or marginal nonattainment areas for ozone.

Class I areas are federally owned property that are afforded higher protection to preserve or improve existing conditions for air quality and air quality related values. A Class I area that could potentially require an assessment of air quality impacts due to construction is the Brigantine Wildlife Area located on the coast of New Jersey. Operational emissions would likely be too low to have the potential to impact Brigantine. Another Class I area (Swanquarter Wildlife Area) in northern North Carolina could potentially be impacted by emissions produced during construction of the southernmost portion of the Project in Virginia. An assessment of the distance between the Project location and boundary of this Class I area would be prepared to determine if emission impacts need evaluation.

Regulatory controls on air pollutant emissions from the Project's construction and operational phases are dependent on the location of those emissions. State regulatory requirements are applicable to emissions in state waters (within 3 miles [4.8 km] of the coastline and within 25 miles [40.2 km] of the state's seaward boundary). Beyond 25 miles (40.2 km) of the state's seaward boundary, federal requirements for major sources under the Prevention of Significant Deterioration rule apply.

In addition, activities producing emissions associated with construction and operation in nonattainment or maintenance air quality areas may be subject to the General Conformity rule. This rule requires a federal action to account for emissions occurring in these areas and, if above de minimis thresholds, determine if the emissions comply with the applicable State Implementation Plan. For the AWC Project, construction-related equipment and vessel emissions and operational emissions from support vessels would likely be evaluated under the General Conformity Rule.

6.9.3 Noise

Ambient Noise Conditions

General ambient noise levels onshore in Project activity areas would vary depending on population density, proximity to highways, airports, and local industry.

The ambient acoustic environment in the vicinity of the shore crossings for the AWC transmission lines would be variable, according to weather conditions and the sea state, with sound levels ranging from 45 to 55 A-weighted decibels (dBA). The ambient noise environment of the crossings would be dominated by noise from the ocean and wind, with intermittent contributions from birds.

Offshore ambient noise levels vary depending on weather conditions and ship traffic. Average baseline acoustic noise levels would be expected to be 50 to 55 dBA.

Construction

Noise would be generated during construction activities that may exceed noise regulations or ordinances set by local authorities. However, most local noise codes or ordinances exempt construction noise from any established noise limits providing the construction takes place during daytime hours on weekdays. In addition, construction noise would be present for short time periods as the construction moves along the route.

Offshore construction would not be expected to generate noise impacts at onshore receptors due to the distance (approximately 10 nautical miles [18.52 km] or more) from the shore to the offshore cable location. As the construction of the connection lines approach the shore, there would be the potential for some nearby noise receptors to be impacted. Again, this construction noise would be present for short time periods as the construction moves along the route.

Operation

Noise would be generated by the operation of the onshore converter stations. Noise impacts may occur depending on the distance from the station to the nearest noise receptors. With proper siting, equipment selection, and noise control measures (if necessary) most noise impacts from the converter stations could be avoided.

Acoustic noise would be generated by the operation of offshore VSCs, HVAC transformer platforms, and offshore HVDC transmission system converter platform. Due to the distance (10 or more miles) from these offshore facilities to onshore receptors, they would not be expected to generate noise impacts.

7 Project Schedule and Waivers/Departures

Manufacturing and construction of Phase A of the AWC Project between Indian River, Delaware, and southern New Jersey is planned to begin in Quarter 1 of 2013, with completion and commencement of commercial service in 2016. Phase B of the Project would be operational in Quarter 2 of 2017 and would interconnect additional wind farms along the coastline. Subject to the receipt of permits and availability of materials, components, and equipment, the entire system could be in operation by 2021. The Applicant's Statement of Qualification to Hold a Renewable Energy Grant on the U.S. Outer Continental Shelf *(PRIVATE AND CONFIDENTIAL / NON-PUBLIC)*, provided under separate cover, provides additional development and construction detail and the currently estimated cost for each phase of the Project.

The U.S. offshore wind industry is in its early stages of development and much is needed to mobilize an effective and efficient supply chain. There is, for example, no U.S. manufacturer of submarine cable, and the equipment and expertise needed to manufacture offshore platforms and foundations resides in the states bordering the Gulf of Mexico. Attracting that supply chain to the mid-Atlantic region will require a predictable, steady, long-term stream of offshore projects. The phased approach for the AWC Project supports the steady and predictable expansion of offshore wind energy in the region by ensuring that wind energy projects have ready access to high-capacity transmission infrastructure.

While transmission infrastructure needs to precede offshore wind project construction (or there would be stranded generation), having transmission capacity in place that substantially exceeds the likely demand at any point in time would be inefficient. To prevent this result, the Applicant will coordinate closely with BOEMRE, the wind developer community, and the transmission planning staff at PJM or the appropriate RTO to plan an efficient "roll-out" of the AWC Project. A roll-out that places Phase A in commercial service in 2016 and subsequent phases following through 2021 is one possible scenario. Clearly, the actual schedule will depend on factors not entirely within Applicant's control, such as the overall pace of wind energy industry development.

For these and other reasons, after receiving a determination of no competitive interest from BOEMRE, the Applicant intends to seek a waiver/departure of BOEMRE regulations (30 CFR 285.231) granting the Applicant greater than 60 days to prepare and submit the GAP for the Project. The additional time provided by the waiver/departure would be used by the Applicant to scope the offshore and terrestrial field studies to ensure that the data to be collected will satisfy engineering and regulatory requirements, to mobilize appropriate vessels and crews to execute the studies, to analyze the data, and to draft the GAP.

In addition, the Applicant would seek a waiver/departure that would allow for supplemental submissions to the GAP for Phases B through E of the Project. As noted above, field studies and other tasks precedent to the subsequent GAP filings would be triggered in consultation with BOEMRE, wind developers proposing projects that require additional transmission capacity, and PJM or the appropriate RTO. The duration of the waiver/departure requested for submitting supplements to the GAP for Phases B through E would be several years (and could be incorporated as a condition of any grant issued by BOEMRE). The Applicant recognizes that it is the Applicant's burden to demonstrate to BOEMRE that it is continuing to diligently pursue the development of the Project to be entitled to a continued waiver/departure. Hence, the Applicant's waiver/departure request is likely to specify a fixed period of years for an initial waiver/departure (i.e., a sunset provision) which could be extended upon a satisfactory showing by the Applicant that it has diligently advanced the development of subsequent phases of the Project and it is therefore in the public interest to extend the waiver/departure.

Lastly, the Applicant acknowledges that there may be other issues under the BOEMRE regulations that will need to be addressed prior to the issuance of a grant. Such issues should be amenable to resolution as the ROW Application matures towards the issuance of a grant. However, if BOEMRE determines that any additional waivers/departures from regulations are required to proceed to the issuance of a notice soliciting competitive interest, the Applicant requests a waiver/departure of such regulations for the limited purpose of allowing the issuance of the notice to proceed.

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Appendix A

Geographical Information System (GIS) Datasets and Sources

Category	Dataset	Source & Description	Date	Online Linkage	Citation
Engineering	Off-shore Wind Resources	NREL; US Wind Resource Map	10/1/1986	http://rredc.nrel.gov/wind/pubs/atlas/	Elliott D.L., et al. Wind Energy Resource Atlas of the United States. Solar Technical Information Program [now the National Renewable Energy Laboratory]1986. Golden, Colorado.
	Shipwrecks, Buoys, Other Obstructions	NOAA; Electronic Navigation Charts (ENC)	1/11/2011	http://www.nauticalcharts.noaa.gov/csdl/encdirect_met.html	NOAA ENC Direct to GIS. www.nauticalcharts.noaa.gov/csdl/ctp/encdirect_new.htm. n.d. Web. 11 January 2011.
	Dump Sites/Historic Dump Site*	NOAA; Electronic Navigation Charts (ENC) | USACE; HARS (Historic Area Remediation Site) Program	1/11/2011 | 12/20/2010	http://www.nan.usace.army.mil/business/prjlinks/dmmp/benefic/hars.htm	NOAA ENC direct to GIS-see above | US Army Corps of Engineers. "HARS Historic Area Remediation Sites". www.nan.usace.army.mil/business/prjlinks/dmmp/benefic/hars.htm. 17 May. 2010. Web. 20 December. 2010.
	Navigation Channels/Designated Shipping Fairways/Ferry Routes	NOAA; Electronic Navigation Charts (ENC)	1/11/2011	http://www.nauticalcharts.noaa.gov/csdl/encdirect_met.html	NOAA ENC Direct to GIS. www.nauticalcharts.noaa.gov/csdl/ctp/encdirect_new.htm. n.d. Web. 11 January 2011.
	USGS Land Cover/ Land Use	USGS NLCD	2001	http://www.mrlc.gov/index.php	Homer, C. C. Huang, L. Yang, B. Wylie and M. Coan. 2004. Development of a 2001 National Landcover Database for the United States. Photogrammetric Engineering and Remote Sensing, Vol. 70, No. 7, July 2004, pp. 829-840.
	Navigable Waterways	USACE	7/25/2006	http://www.ndc.iwr.usace.army.mil//data/data1.htm	USACE Navigation Data Center. "US Waterway Data". www.ndc.iwr.usace.army.mil//data/data1.htm. 25 May. 2006. Web. 5 May. 2009.
	Topography/ contours	ESRI - USGS topo	2010	CD ROM	ESRI Data & Maps [CD-ROM]. (2010). Redlands, CA: Environmental Systems Research Institute.
	Onshore Pipelines	US Department of Transportation - NPMS	1/28/2004	http://www.npms.phmsa.dot.gov/application.asp?tact=Data&page=subapp.asp?app=data&act=data_req	US Depratment of Transportation. "National Pipeline Mapping System". www.npms.phmsa.dot.gov. 2007. Web. 5 May 2009.

Category	Dataset	Source & Description	Date	Online Linkage	Citation
Engineering (cont.)	State/ County/urban boundaries	ESRI	2010	CD ROM	ESRI Data & Maps [CD-ROM]. (2010). Redlands, CA: Environmental Systems Research Institute.
	Cities/ Parks/ Landmarks/schools/churches	ESRI	2010	CD ROM	ESRI Data & Maps [CD-ROM]. (2010). Redlands, CA: Environmental Systems Research Institute.
	BOERME LEASE Blocks - Atlantic	BOEMRE	11/22/2010	http://www.boemre.gov/offshore/mapping/index.htm	Bureau of Ocean Energy Management, Regulation and Enforcement. "Maps and GIS Data". www.boemre.gov/offshore/mapping/index.htm. . 22 November. 2010. Web. 23 January. 2011.
	Airports and Flight Paths	FAA; Digital Aeronautical Data for airport locations or tall obstacle information; Special Use Airspace; civilian flight path data not readily available	2/8/2010	http://www.faa.gov/air_traffic/flight_info/aeronav/productcatalog/DigitalProducts/	Federal Aviation Administration Catalog of Products. "Digital Products".www.faa.gov/ 8 September. 2010. Web. 10 October. 2010.
	State offshore administrative boundaries associated with planned oil and gas leasing	BOEMRE	11/22/2010	http://www.boemre.gov/offshore/mapping/index.htm	Bureau of Ocean Energy Management, Regulation and Enforcement. "Maps and GIS Data". www.boemre.gov/offshore/mapping/index.htm. . 22 November. 2010. Web. 23 January. 2011.
	Off-shore Communication cables/pipelines	NOAA; Electronic Navigation Charts (ENC)	1/11/2011	http://www.nauticalcharts.noaa.gov/csdl/encdirect_met.html	NOAA ENC Direct to GIS. www.nauticalcharts.noaa.gov/csdl/ctp/encdirect_new.htm. n.d. Web. 11 January 2011.
	parcel datsets for landfall areas	Real Property Services of various counties	see below	see below	see below
		Kings Co NY	2/5/2007	http://www.nyc.gov/html/dcp/html/bytes/applbyte.shtml	BYTES of the Big Apple Project, Attn: B.G. Bartlett, Dept. of City Planning , 22 Reade Street, 5E
		Brooklyn Co NY	2/5/2007	http://www.nyc.gov/html/dcp/html/bytes/applbyte.shtml	BYTES of the Big Apple Project, Attn: B.G. Bartlett, Dept. of City Planning , 22 Reade Street, 5E
		Nassau Co NY	9/16/2009	http://www.nyc.gov/html/dcp/html/bytes/applbyte.shtml	BYTES of the Big Apple Project, Attn: B.G. Bartlett, Dept. of City Planning , 22 Reade Street, 5E
		Atlantic Co. NJ	3/5/2008	http://www.aclink.org/GIS/mainpages/shapefiles.asp	Atlantic County GIS. www.aclink.org/GIS/mainpages/shapefiles.asp . N.p Web. 5 March 2009

Category	Dataset	Source & Description	Date	Online Linkage	Citation
Engineering (cont.)		Hudson Co. NJ	11/15/2010	https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp	New Jersey State Geographic Information Network. njgin.state.nj.us/NJ_NJGINExplorer/index.jsp. 15 november. 2010 Web. 29 January. 2011.
		Middlesex Co NJ	11/15/2010	https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp	New Jersey State Geographic Information Network. njgin.state.nj.us/NJ_NJGINExplorer/index.jsp. 15 november. 2010 Web. 29 January. 2011.
		Monmouth Co NJ	11/15/2010	https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp	New Jersey State Geographic Information Network. njgin.state.nj.us/NJ_NJGINExplorer/index.jsp. 15 november. 2010 Web. 29 January. 2011.
		Ocean Co NJ	11/15/2010	https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp	New Jersey State Geographic Information Network. njgin.state.nj.us/NJ_NJGINExplorer/index.jsp. 15 november. 2010 Web. 29 January. 2011.
		Union Co NJ	11/15/2010	https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp	New Jersey State Geographic Information Network. njgin.state.nj.us/NJ_NJGINExplorer/index.jsp. 15 november. 2010 Web. 29 January. 2011.
		Sussex Co DE	4/5/2006	http://datamil.delaware.gov/geonetwork/srv/en/main.home	Delaware DataMIL. "County Parcels".datamil.delaware.gov/geonetwork/srv/en/main.home. 5 April. 2006. Web. 23 November 2010
		Chesapeake Co, VA	1/4/2006	http://www.cityofchesapeake.net/services/depart/infotech/gis/gis-purchase.shtml	City of Chesapeake. "Geo-spacial Data Available from the City of Chesapeake's Geographic Information Systems Division". www.cityofchesapeake.net/services/depart/infotech/gis/gis-purchase.shtml. 4 January. 2006 Web. 11 March. 2010
		Virginia Beach Co, VA	2009	http://www.vbgov.com/e-gov/emapping/	City of Virginia Beach. "City of Virginia Beach eMapping". www.vbgov.com/e-gov/emapping. 2009. Web 25 November 2009.
	Zoning Data for landfall areas	Real Property Services of various counties	see below	see below	see below

Category	Dataset	Source & Description	Date	Online Linkage	Citation
Engineering (cont.)		New York Department of City Planning	1/1/2011	http://www.nyc.gov/html/dcp/html/bytes/dwnzdata.shtml	New York City Department of City Planning. "NYC Zoning features". www.nyc.gov/html/dcp/html/bytes/dwnzdata.shtml. January 2011. Web 11 November 2011.
		Sussex Co DE	4/5/2006	http://datamil.delaware.gov/geonetwork/srv/en/main.home	Delaware DataMIL. "County Parcels".datamil.delaware.gov/geonetwork/srv/en/main.home. 5 April. 2006. Web. 23 November 2010
	onshore Electrial Transmission infrastructure	Platts	1/14/2011	http://www.platts.com/	Platts Energy Products & Services, Customer Support:+1-800-PLATTS-8 / +1-800-752-8878 (Toll-free in U.S and Canada)
	Railroads	ESRI	2010	CD ROM	ESRI Data & Maps [CD-ROM]. (2010). Redlands, CA: Environmental Systems Research Institute.
Environmental	SSURGO soils	United States Department of Agriculture (USDA)	2006	http://soildatamart.nrcs.usda.gov/	Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database for [NY,NJ,DE,MD,VA]. Available online at http://soildatamart.nrcs.usda.gov N.D. Web. 11 December 2006
	Aerial Imagery	ESRI; Microsoft Virtual Earth	2010	CD-ROM	ESRI Data & Maps [CD-ROM]. (2010). Redlands, CA: Environmental Systems Research Institute.
	administrative boundaries	ESRI	2010	CD-ROM	ESRI Data & Maps [CD-ROM]. (2010). Redlands, CA: Environmental Systems Research Institute.
	Federal /State/County Parks; Wildlife Preserves	ESRI	2010	CD-ROM	ESRI Data & Maps [CD-ROM]. (2010). Redlands, CA: Environmental Systems Research Institute.
	Federal and State-owned lands	ESRI	2010	CD-ROM	ESRI Data & Maps [CD-ROM]. (2010). Redlands, CA: Environmental Systems Research Institute.

Category	Dataset	Source & Description	Date	Online Linkage	Citation
Environmental (cont.)	Streets	ESRI; Streetmap North America	2010	CD-ROM	ESRI Data & Maps [CD-ROM]. (2010). Redlands, CA: Environmental Systems Research Institute.
	USGS Topo Quads	ESRI; United States Geological Survey (USGS)	2010	CD-ROM	ESRI Data & Maps [CD-ROM]. (2010). Redlands, CA: Environmental Systems Research Institute.
	Land Cover	United States Geological Survey-National Land Cover Dataset (USGS NLCD)	Jul-2004	http://landcover.usgs.gov/natlandcover.php	Homer, C. C. Huang, L. Yang, B. Wylie and M. Coan. 2004. Development of a 2001 National Landcover Database for the United States. Photogrammetric Engineering and Remote Sensing, Vol. 70, No. 7, July 2004, pp. 829-840.
	NWI Wetlands	United States Fish and Wildlife Service (USFWS)	10/1/2010	http://www.fws.gov/wetlands/data/Mapper.html	U. S. Fish and Wildlife Service. Publication date (10/1/2010). National Wetlands Inventory website. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. http://www.fws.gov/wetlands/.
	Migratory Bird Flyways or other Avian data (onshore)	United States Geological Survey- Breeding Bird Survey Routes	Feb-1999	http://www.nationalatlas.gov/mld/bbsrtsl.html	USGS Patuxent Wildlife Research Center. "Breeding Bird Route Locations for Lower 48 States". National Atlas of the United States.02/1999. Web. 15 September 2010.
	NOAA Biological Resources shown on ESI maps	National Ocean & Atmospheric Administration- National Ocean Service (NOAA NOS)	7/26/2008	http://response.restoration.noaa.gov/type_subtopic_entry.php?RECORD_KEY%28entry_subtopic_type%29=entry_id,subtopic_id,type_id&entry_id(entry_subtopic_type)=307&subtopic_id(entry_subtopic_type)=8&type_id(entry_subtopic_type)=3	NOAA Emergency Response Division. "Biological Resources Shown on ESI Maps". Office of Response and Restoration, NOAA's Ocean Service. 26 June 2008. Web. 4 November 2010.
	Marine Sanctuaries	Bureau of Ocean Management, Regulation and Enforcement (BOEMRE); NOAA National Marine Sanctuary Data	2004	http://sanctuaries.noaa.gov/library/imast_gis.html	NOAA / National Marine Sanctuaries Program. "National Marine Sanctuary Program Digital Boundary Files" NOAA / National Marine Sanctuaries Program. 2004.Web. 13 December 2010.

Category	Dataset	Source & Description	Date	Online Linkage	Citation
Environmental (cont.)	Coastal Barrier Resource Areas	United States Fish and Wildlife Service (USFWS)	4/1/2010	http://www.fws.gov/GIS/data/national/index.htm	United States Fish and Wildlife Service. "Coastal Barrier Resource System". USFWS. 4/1/2010. Web. 17 December 2010.
	Artifical Reefs	NOAA; Electronic Navigation Charts (ENC)	1/11/2011	http://www.nauticalcharts.noaa.gov/csdl/encdirect_met.html	NOAA ENC Direct to GIS. www.nauticalcharts.noaa.gov/csdl/ctp/encdirect_new.htm. n.d. Web. 11 January 2011.
	NY Artificial Reefs	Digitized from reference doc from NY Department of Environmental Conservation		http://www.dec.ny.gov/outdoor/9212.html	NY Deptarment of Envrionmental Conservation- Bureau of Marine Resources-Division of Fish, Wildlife, and Marine Resources. "Coordinates for NYS Artificial Reefs". NY Department of Environmental Conservation. Web. 13 January 2011.
	NJ Artificial Reefs	New Jersey Department of Environmental Protection		http://www.state.nj.us/dep/fgw/pdf/reeflocs.pdf	NJ Department of Environmental Protection, Division of Fish & Wildlife. "Locations of New Jersey Artificial Reefs". NJ Department of Environmental Protection, Division of Fish & Wildlife. Web. 12 January 2011.
	DE Artificial Reefs	Digitized from reference doc from DE Deptarment of Natural Resources- Divison of Fish and Wildlife.	2008	http://www.fw.delaware.gov/Fisheries/Documents/2008%20Delaware%20Reef%20Guide.pdf	State of Delaware Department of Natural Resources & Environmental Control. Division of Fish & Wildlife. "Delaware Reef Guide 2008". State of Delaware Department of Natural Resources & Environmental Control. Division of Fish & Wildlife. 2008. Web. 11 January 2011.
	MD Artificial Reefs	Daybreak Fishing, Maryland -Virginia Saltwater Fishing	2007	http://www.daybreakfishing.com/Coordinates.html	MD-VA Saltwater Fishing. "Maryland-Virginia GPS Coordinates" *MD-VA Saltwater Fishing.* Daybreak Web Designs. 2007. Web. 12 January 2011.
	VA Artificial Reefs	Virginia Marine Resources Commission	2010	http://www.mrc.virginia.gov/reef_map/reef_map.shtm	Virginia Marine Resources Commission. "Virginia Artificial Reef Sites". Virginia Marine Resources Commission. Virginia.gov. 2010.Web. 13 January 2011.

Category	Dataset	Source & Description	Date	Online Linkage	Citation
Environmental (cont.)	VA Impaired Waters/Rivers/Reservoirs/Estuarine	The Virginia Department of Environmental Quality	Oct-2008	http://gisweb.deq.virginia.gov/	Virginia Department of Environmental Quality. "VEGIS Dataset Downloads" *Virginia Environmental Geographic Information Systems Available DEQ Datasets*. VA DEQ. October 2008. Web. 21 December 2010.
	EFH (Essential Fish Habitat)/ HAPC (Habitat Areas of Particular Concern)	National Oceanic & Atmospheric Administration (NOAA)	2010	http://sharpfin.nmfs.noaa.gov/website/EFH_Mapper/map.aspx	NOAA Fisheries. "Essential Habitat Mapper" NOAA. 2010. Web. 21 December 2010.
	Highly Migratory Species (HMS)	National Oceanic & Atmospheric Administration (NOAA)	2009	http://www.nmfs.noaa.gov/sfa/hms/EFH/shapefiles.htm	NOAA Fisheries Office of Sustainable Fisheries. "Atlatntic Highly Migratory Species". NOAA Fisheries Office of Sustainable Fisheries 2009.Web. 4 January 2011.
	Right Whale (and other ESA species) critical habitat	National Oceanic & Atmospheric Administration (NOAA)	Sep-2008	http://www.nmfs.noaa.gov/pr/species/criticalhabitat.htm	NOAA Fisheries Office of Protected Resources. "Critical Habitat". NOAA Fisheries Office of Protected Resources. 9/2008Web. 3 January 2011.
	Whale Sightings	OBIS SEAMAP (Ocean Biogeographic Information System- Spatial Ecological Analysis of Megavertabrate Populations)/NOAA Northeast Fisheries Science Center (NEFSC)	5/28/2010	http://seamap.env.duke.edu/datasets/detail/513	NOAA Northeast Fisheries Science Center. "NEFSC Right Whale Survey". *OBIS SEAMAP*. NOAA Northeast Fisheries Science Center. 28 May 2010. Web. 21 December 2011.
	Whale Collisions	National Oceanic & Atmospheric Administration (NOAA) - Office of Protected Resources -"Large Whale Ship Strike Database"	Jan-2004	http://www.nmfs.noaa.gov/pr/pdfs/shipstrike/lwssdata.pdf	Jensen, Aleria S. and Gregory K. Silber. "Large Whale Ship Strike Database". NOAA NMFS. January 2004. Web. 21 December 2010.
	Off-Limits to Wind Development Areas - NJ Bird/Bat Impacts	NJ Dept. of Environmental Protecton: File "windturbinesiting", offlimits to wind development because of interference and impacts with Birds and Bats	Sep-2009	http://www.state.nj.us/dep/gis/lists.html	NJ Department of Environmental Protection, Division of Fish & Wildlife, Endangered and Nongame Species Program. "NJDEP Large Scale Wind Turbine Siting Map". NJDEP. 09/2009. Web. 28 December 2010.

Category	Dataset	Source & Description	Date	Online Linkage	Citation
Environmental (cont.)	Environmentally Sensitive Areas (ESA) NJ	NJ Dept of Environmental Protection- environmentally sensitive areas identified under the Permit Extension Act.	11/14/2008	http://www.state.nj.us/dep/gis/stateshp.html#PARCELS	NJ Department of Environmental Protection, Planning and Sustainable Communities. "Environmentally Sensitive Areas as Defined by the Permit Extension Act of 2008". NJDEP. 2008. Web. 22 November 2010.
	Beach Nourishment Projects	Digitized from ACOE Renourishment spreadsheet; and ACOE Philadelphia District project factsheets	2010	http://www.usace.army.mil/Pages/default.aspx	US Army Corps of Engineers, Philadelphia District & New York District. "Project Factsheets" USACE. 2010. Web. 6 December 2010.
	Submerged aquatic vegetation-NJ	Rutgers University- submerged aquatic vegetation along the coast of Ocean County, NJ	Spring 2004	http://www.crssa.rutgers.edu/projects/runj/bbdata/	Grant F. Walton Center for Remote Sensing and Spatial Analysis, Rutgers University. "Sumerged Aquatic Vegetation and Bottom Type-Barnegat Bay". CRSSA, Rutgers University. Spring 2004. Web. 22 December 2010.
	Submerged aquatic vegetation-MD & VA	Virginia Institute of Marine Science- Submerged aquatic vegetation dataset for the Chesapeake Bay area	2008	http://ccrm.vims.edu/gis_data_maps/interactive_maps/blueinfrastructure/bi_intro.html	Virginia Institute of Marine Science. "Chesapeake Bay Submerged Aquatic Vegetation". Virginia Institute of Marine Science. 2008. Web. 6 January 2011.
	New Jesey Ecological Baseline Studies	Ecological Baseline Data: Marine Mammals, Avain, Bat , Sea Turtle, Federally Listed Species in Study Area off New Jersey Coast.	Jul-2010	CD-ROM	Geo-Marine, Inc. "New Jersey Department of Environmental Protection Baseline Studies". Volume I. Geo-Marine, Inc. July 2010. CD-ROM
	National Estuarine Research Reserve - Jacques Cousteau National Estuarine Research Reserve - Mullica River - Located along coastal NJ between HWY 180 and 30	National Estuarine Research Reserve-NOAA	3/24/2010	http://csc-s-web-p.csc.noaa.gov/MMC/#	Department of Commerce (DOC), National Oceanic and Atmospheric Adminis, 2010, MPA Inventory Database (3/2010): NOAA's Ocean Service, National Marine Protected Areas Center (MPAC), Monterey, CA. Web. 1 February 2011.

Category	Dataset	Source & Description	Date	Online Linkage	Citation
Environmental (cont.)	State Wetlands NY		1999	http://cugir.mannlib.cornell.edu/datatheme.jsp?id=111	New York State Department of Environmental Conservation. "New York State Regulatory Freshwater Wetlands". NYSDEC. 1999. Web. 28 December 2010.
		New Jersey Department of Envrionmental Protection	1986	http://www.state.nj.us/dep/gis/digidownload/metadata/lulc95/update.html	NJ Deptartment of Environmental Protection, Office of Information Resource Management, Bureau of Geographic Information and Analysis. "Freshwater Wetlands (FWW)". NJDEP. 1986. Web. 15 December 2010.
		DE Dept. of Natural Resources and Envrionmental Control	1994	http://www.nav.dnrec.delaware.gov/DEN3/DataDownload.aspx	State of Delaware Department of Natural Resources & Environmental Control. "State Wetland Mapping Project". State of Delaware Department of Natural Resources & Environmental Control. 1994. Web. 22 December 2010.
		Maryland - Department of Natural Resources	Jan-1993	http://dnrweb.dnr.state.md.us/gis/data/data.asp	Maryland Department of Natural Resources. "DNR Wetlands". Maryland Department of Natural Resources- Geographic Information Services Division. 1/1993. Web. 4 January 2011.
	Tidal Wetlands	New York Department of Environmental Conservation	Nov-2005	http://www.nysgis.state.ny.us/gisdata/inventories/index.cfm?AlphaIndex=T	New York State Department of Environmental Conservation. "Tidal Wetlands-NYC and Long Island-1974". NYSDEC. 11/1/2005. Web. December 2010.
		New Jersey - Department of Environmental Protection	1992	http://www.state.nj.us/dep/gis/stateshp.html#SHORSTRC	NJ Department of Environmental Protection, Office of Information Resources Management, Bureau of Geographic Information and Analysis. "South Jersey Marsh". NJDEP. 1992. Web. 7 January 2011.

Category	Dataset	Source & Description	Date	Online Linkage	Citation
Environmental (cont.)		DE Dept. of Natural Resources and Envrionmental Control- digitized from reference aerial photo wetland deliniation	Mar-1988	http://maps.dnrec.delaware.gov/TidalWetlandsMapIndex/	Salisbury State University Image Processing & Remote Sensing Center. "Delaware Tidal Wetland Delineations". Salisbury State University Image Processing & Remote Sensing Center, for DE DENREC. 3/1988. Web. December 2010.
		Virginia Department of Environmental Quality - Comprehensive Coastal Inventory	1988	http://ccrm.vims.edu/gis_data_maps/static_maps/gis/tmi.html	Comprehensive Coastal Inventory, VIMS, College of William and Mary. "Tidal Marsh Inventory". Virginia Institute of Marine Science. 1988. Web. 14 January 2011.
	Coastal Habitat	New York State - NYS Department of State, Division of Coastal Resources	5/4/2006	http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=318	NY State Division of Coastal Resources. "Significant Coastal Fish and Wildlife Boundaries".www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=318. May 4 2006. NYS GIS Clearinghouse. January 2011.
		New Jersey - Coastal Areas Facilities Review Act boundary - NJDEP/New Jersey Pinelands Commission	7/20/2007	http://www.state.nj.us/dep/gis/stateshp.html#PARCELS	The New Jersey Pinelands Commission. "NJDEP GIS Statewide Digital Data Downloads - CAFRA Boundary File".http://www.state.nj.us/dep/gis/stateshp.html#PARCELS. 20 July 2007. Web. 20 July 2007.
		Delaware - Coastal Zone mangement Area and Tidelands - Department of Natural Resources & Environmental Control	8/2/1993	http://www.nav.dnrec.delaware.gov/DEN3/DataDownload.aspx	Delaware Department of Natural Resources & Environmental Control, Environmental Navigator. "Coastal Zone Management Area". www.nav.dnrec.delaware.gov/DEN3/DataDownload.aspx. 2 August 1993. Web. 10 December 2010.
		Maryland - Oyster Sanctuaries/bars , MD Department of Natural Resources	1997-2010	http://dnrweb.dnr.state.md.us/gis/data/index.asp	Maryland Department of Natural Resources. "Oyster Sanctuaries Established Prior to September 2010". Maryland Department of Natural Resources- Geographic Information Services Division. 2010/1997. Web. 14 January 2011.

Category	Dataset	Source & Description	Date	Online Linkage	Citation
Environmental (cont.)		Virginia - Center for Coastal Resources Management - Blue Infrastructure and Tidal Marsh Inventory	2006	http://ccrm.vims.edu/gis_data_maps/data/index.html	Center for Coastal Resources Management. "Digital Tidal Marsh Inventory Series" 1992. Comprehensive Coastal Inventory Program, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Virginia, 23062. Web. 14 January 2011.
	Benthic Data	NOAA; Coastal Services Center	12/31/2003	http://www.csc.noaa.gov/benthic/	NOAA Coastal Services Center. "Benthic Habitat Mapping, Spatial Data".http://www.csc.noaa.gov/benthic. 2003. Web 30 December 2010.
	Shellfish	various State agencies (see below)			
		New Jersey - Department of Environmental Protection (NJDEP)	04/2009	http://www.state.nj.us/dep/gis/	The New Jersey Department of Environmental Conservation. "NJDEP GIS Statewide Digital Data Downloads - shellfish classification".http://www.state.nj.us/dep/gis. September 2009. Web. 8, September 2009.
		Delaware - Department of Water Resources	N.D.	http://www.wr.dnrec.delaware.gov/Services/OtherServices/Pages/GrowingWaters.aspx	Delaware Department of Water Resources. "Shellfish Growing Waters".www.wr.dnrec.delaware.gov/Services/OtherServices/Pages/GrowingWaters.aspx. N.D. Web. 13 january 2011.
		Maryland - Department of Natural Resources, Fisheries Service	1997	http://dnrweb.dnr.state.md.us/gis/data/data.asp	Maryland Department of Natural Resources. "Mayrland's Historic Osyter Bottom"". Maryland Department of Natural Resources- Geographic Information Services Division.1997. Web. 13 January 2011.

Category	Dataset	Source & Description	Date	Online Linkage	Citation
Environmental (cont.)		Virginia - Center for Coastal Resources Management - Blue Infrastructure and Osyter/Crab aquaculture	2006	http://ccrm.vims.edu/gis_data_maps/interactive_maps/blueinfrastructure/disclaimer_bi.html	Center for Coastal Resources Management. "Data:Blue Infrastructure". Comprehensive Coastal Inventory Program, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Virginia, 23062. 2004. Web. 14 January 2011.
	Recreational Fishing Grounds	various State agencies (see below)			
		New York - Department of Environmental Conservation	9/14/2009	http://www.nysgis.state.ny.us/gisdata/metadata/nysdec.accessibledestinations.xml	NY State Department of Environmental Conservation. "Accessible recreation sites".http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=1201 . 14 September 2009. NYS GIS Clearinghouse. January 2011.
		New Jersey Department of Environmental Protection (NJDEP), Division of Fish & Wildlife (DFW), Bureau of Marine Fisheries (BMF)	2003	http://www.state.nj.us/dep/gis/	The New Jersey Department of Environmental Conservation. "NJDEP GIS Statewide Digital Data Downloads - Sport Ocean Fishing Grounds".http://www.state.nj.us/dep/gis. 2003. Web. 16, February 2011.
		Maryland - Department of Natural Resources, Fisheries Service	N.D.	Data Release from Chesapeake and Coastal Program Maryland Department of Natural Resources	Catherine Mcall Chesapeake and Coastal Program Maryland Department of Natural Resources Ph: 410.260.8737
		Virginia - Center for Coastal Resources Management - Blue Infrastructure and public recreation areas	2006	http://ccrm.vims.edu/gis_data_maps/interactive_maps/blueinfrastructure/disclaimer_bi.html	Center for Coastal Resources Management. "Data:Blue Infrastructure". Comprehensive Coastal Inventory Program, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Virginia, 23062. 2004. Web. 14 January 2011.

Category	Dataset	Source & Description	Date	Online Linkage	Citation
Environmental (cont.)	Diadromous fish habitat data	Atlantic States Marine Fisheries Commission,by the Biodiversity and Spatial Information Center (BaSIC) at North Carolina State University	12/1/2005	Data release from Atlantic States Marine Fisheries Commission	Greene, K. E., J. L. Zimmerman, R. W. Laney, and J. C. Thomas-Blate. 2009.Atlantic coast diadromous fish habitat: A review of utilization, threats,recommendations for conservation, and research needs. Atlantic StatesMarine Fisheries Commission Habitat Management Series No. 9,Washington, D.C.
	Summer Flounder locations	OBIS SEAMAP (Ocean Biogeographic Information System) and GBIF (Global Biodiversity Informatuion Facility)	2007	http://data.gbif.org/species/13537575/commonName/Summer%20flounder	GBIF. "Paralichthys dentatus, Summer Flonunder". data.gbif.org/species/13537575/commonName/Summer%20flounder. 2007. Web. 21 December 2011.
	Storm Surge Areas/ Beach Renourishment	US Army Corps of Engineers New York District and Philadelphia District	2010	http://www.nan.usace.army.mil/project/index.php?NJ | http://www.nap.usace.army.mil/cenap-dp/projects/projects.htm	US Army Corps of Engineers. "New York District Projects and Studies" , "Philadelphia District Project Factsheets". www.nap.usace.army.mil/cenap-dp/projects/projects.htm. 2010. Web. December 2010.
	Land Use - State Game lands	various State agencies (see below)			
		New York - Department of Environmental Conservation	11/25/2008	\\dlf-serv\dlf1\kurt\st_land\dec08.shp	NY State Department of Environmental Conservation. "DEC Lands" 25 November 2008. Web. 4 April 2010
		New Jersey - Department of Environmental Protection	1995	http://www.state.nj.us/dep/gis/	The New Jersey Department of Environmental Conservation. "State Owned, Protected Open Space and Recreation Areas in New Jersey".http://www.state.nj.us/dep/gis. 2003. Web. 16, February 2011.

Category	Dataset	Source & Description	Date	Online Linkage	Citation
Environmental (cont.)		Maryland Department of Natural Resources, Wildlife and Heritage Division	1998-2010	http://dnrweb.dnr.state.md.us/gis/data/data.asp	Maryland Department of Natural Resources. "DNR Lands and Conservation Easments, Natural Heritage Area boundaries, Forest Legacy Easments, Agricultural alnd Preservation, County Owned Properties, ". Maryland Department of Natural Resources- Geographic Information Services Division. 1998-2010. Web. 13 January 2011.
		Virginia - Department of Conservation and Recreation	1/3/2011	http://www.dcr.virginia.gov/natural_heritage/cldownload.shtml	Virginia Department of Conservation and Recreation. "Conservation Lands Data Download".www.dcr.virginia.gov/natural_heritage/cldownload.shtml VA DCR. 3 January 2011. Web. 3 January 2011.
Geology	Seabed Geology (generalized data)	USGS	6/1/2005	http://woodshole.er.usgs.gov/openfile/of2005-1001/htmldocs/datacatalog.htm#geology	U.S. Geological Survey, Coastal and Marine Geology Program. "USGS East Coast Sediment Texture Database".woodshole.er.usgs.gov/openfile/of2005-1001/htmldocs/datacatalog.htm#geology. June 2005. Web 3 July 2007.
	Bathymetric Contours	National Geophysical Data Center (NGDC); GEODAS Database	5/4/2006	http://www.ngdc.noaa.gov/mgg/gdas/gd_designagrid.html	NOAA National Geophysical Data Center. "GEODAS Grid Translator".www.ngdc.noaa.gov/mgg/gdas/gd_designagrid.html. 4 May.2006. Web. 12 January 2011.
	Seismic Hazard zones for land areas	USGS	08/2002	http://www.nationalatlas.gov/mld/seihazp.html	National Atlas. "Seismic Hazard Map for the United States". www.nationalatlas.gov/mld/seihazp.html. August 2002. Web. 13 October. 2009
	Total Sediment thickness of Seafloor	NOAA	12/23/2003	http://www.ngdc.noaa.gov/mgg/sedthick/sedthick.html	NOAA National Geophysical Data Center. "Total Sediment Thickness of the World's Oceans & Marginal Seas". www.ngdc.noaa.gov/mgg/sedthick/sedthick.html. 23 December. 2003. Web. 3 January. 2011

Category	Dataset	Source & Description	Date	Online Linkage	Citation
	GMRT: seafloor topography derived from multibeam bathymetery	MGDS / Marine GeoScience Data System.Org	3/25/2009	http://www.marine-geo.org/tools/maps_grids.php	Marine GeoScience Data System. "Create Maps & Grids". www.marine-geo.org/tools/maps_grids.php. 25 March. 2009 Web. 11 January. 2011.
	Mid-Atlantic Sand and Gravel Borrow / Resource Areas	BOEMRE	06/23/2011	http://www.boemre.gov/sandandgravel/	Contact: Wright Jay Frank, Energy Program Specialist, 703-787-1325, Office of Offshore Alternative Energy Programs, Bureau of Ocean Energy Management, Regulation and Enforcement, 381 Elden Street, MS 4090 Herndon, VA 20170
Department of Defense	VACAPES regulated airspace	FAA; Digital Aeronautical Data	2/8/2010	http://www.faa.gov/air_traffic/flight_info/aeronav/productcatalog/DigitalProducts/	Federal Aviation Administration Catalog of Products. "Digital Products". www.faa.gov/. 8 September. 2010. Web. 10 October. 2010.
	the Langley/Victor and NAWCAD airspace corridors	CIER, University of Maryland	10/2010	Data Release from University at Maryland, CIER Institute	Blohm, Andrew, et al. Maryland Offshore Wind Development:Regulatory Environment, Potential Interconnection Points, Investment Model, and Select Conflict Areas. n.p. Center for Integrative Environmental Research (CIER), University of Maryland, October 2010.
	FAA Sectional Raster Aeronautical Charts	FAA	2/8/2010	http://www.faa.gov/air_traffic/flight_info/aeronav/productcatalog/DigitalProducts/	Federal Aviation Administration Catalog of Products. "Digital Products". www.faa.gov/. 8 September. 2010. Web. 10 October. 2010.
	NASA Wallops Flight Facility boundary	ESRI fedldp	2010	CD ROM	ESRI Data & Maps [CD-ROM]. (2010). Redlands, CA: Environmental Systems Research Institute.

Category	Dataset	Source & Description	Date	Online Linkage	Citation
	Wallops Flight Facility - regulated airspace;	FAA; Digital Aeronautical Data	2/8/2010	http://www.faa.gov/air_traffic/flight_info/aeronav/productcatalog/DigitalProducts/	Federal Aviation Administration Catalog of Products. "Digital Products". www.faa.gov/. 8 September. 2010. Web. 10 October. 2010.
	Wallops Flight Facility - launch hazard area; offshore temporary exclusion areas	NASA Wallops, Facilities Management Branch	1/24/2011	Data Release from NASA Wallops, Facilities Management Branch	Wayne Johnson, GISP WICC Team Member, Spatial Services Manager Facilities Management Branch, Transystems Corporation NASA/Wallops Flight Facility Building N-161 Wallops Island, Virginia 23337 wayne.t.johnson@gsfc.nasa.gov Phone: (757) 824 1856 Fax: (757) 824 1831
	NASA Mid-Atlantic Regional Spaceport (MARS) launch area (located at NASA Wallops Facility)	NASA Wallops, Facilities Management Branch	1/24/2011	Data Release from NASA Wallops, Facilities Management Branch	Wayne Johnson, GISP WICC Team Member, Spatial Services Manager Facilities Management Branch, Transystems Corporation NASA/Wallops Flight Facility Building N-161 Wallops Island, Virginia 23337 wayne.t.johnson@gsfc.nasa.gov Phone: (757) 824 1856 Fax: (757) 824 1831
	Naval Restricted Area - Norfolk	Digitized from reference doc	1/12/2011	NA	Blohm, Andrew, et al. Maryland Offshore Wind Development:Regulatory Environment, Potential Interconnection Points, Investment Model, and Select Conflict Areas. n.p. Center for Integrative Environmental Research (CIER), University of Maryland, October 2010.

Category	Dataset	Source & Description	Date	Online Linkage	Citation
	Naval Firing Ranges - VA Beach	Digitized from reference doc	1/12/2011	NA	Blohm, Andrew, et al. Maryland Offshore Wind Development:Regulatory Environment, Potential Interconnection Points, Investment Model, and Select Conflict Areas. n.p. Center for Integrative Environmental Research (CIER), University of Maryland, October 2010.

Key to Color Scheme:

complete: have data
in progress: have some datasets but not complete for entire AOI

Appendix B

Centerline Coordinates for Preferred Cable Route

Phase	Longitude	Latitude
B	-74.0825	39.3914
B	-74.0678	39.4196
B	-74.0644	39.4362
B	-74.0593	39.4439
B	-74.0525	39.4520
B	-74.0498	39.4596
B	-74.0498	39.4651
B	-74.0494	39.5162
B	-74.0489	39.5553
B	-74.0490	39.5844
B	-74.0482	39.5888
B	-74.0463	39.5917
B	-74.0389	39.5997
B	-74.0193	39.6140
B	-73.9928	39.6238
B	-73.9795	39.6348
B	-73.9669	39.6509
B	-73.9461	39.6832
B	-73.9323	39.6993
B	-73.9092	39.7882
B	-73.9078	39.8055
B	-73.9088	39.8365
B	-73.9059	39.9277
B	-73.8939	40.0091
B	-73.8942	40.0506
B	-73.8942	40.0506
B	-73.9530	40.0719
B	-73.9692	40.0857
B	-73.8942	40.0506
B	-73.8696	40.0713
B	-73.8656	40.0971
B	-73.8588	40.1444
B	-73.8545	40.1661
B	-73.8509	40.1977
B	-73.8499	40.2161
B	-73.8526	40.2257
B	-73.8521	40.2356
B	-73.8656	40.3002
B	-73.9002	40.3622
B	-73.8994	40.4623

Phase	Longitude	Latitude
B	-73.9132	40.4816
C	-73.8696	40.0713
C	-73.8621	39.9360
C	-73.8560	39.8364
C	-73.8615	39.7103
C	-73.8600	39.6884
C	-73.8656	39.3814
C	-73.8785	39.3471
C	-73.8961	39.3187
C	-73.9109	39.2889
C	-73.9524	39.2574
C	-74.0300	39.1965
C	-74.0313	39.1964
C	-74.0482	39.1995
C	-74.0625	39.2036
C	-74.0817	39.2202
C	-74.0743	39.2046
C	-74.0713	39.1929
C	-74.0700	39.1807
C	-74.0699	39.1716
C	-74.0709	39.1651
C	-74.0840	39.1551
C	-74.1561	39.0994
C	-74.1775	39.0832
C	-74.2354	39.0372
C	-74.2965	38.9906
C	-74.3353	38.9530
C	-74.3360	38.8837
C	-74.3417	38.8729
C	-74.3441	38.8662
C	-74.3532	38.8496
C	-74.3734	38.8366
C	-74.4178	38.8125
C	-74.4553	38.7774
C	-74.4836	38.7333
C	-74.5119	38.6973
C	-74.5360	38.6641
C	-74.5844	38.6167
C	-74.5908	38.5677
C	-74.5959	38.5300

Phase	Longitude	Latitude
C	-74.5984	38.5076
C	-74.6050	38.4878
C	-74.6394	38.4476
C	-74.6880	38.3450
C	-74.7098	38.3161
ALT D	-74.7098	38.3161
ALT D	-74.7176	38.2933
ALT D	-74.7376	38.2407
ALT D	-74.7476	38.2137
ALT D	-74.8256	38.0904
ALT D	-74.9394	37.8674
ALT D	-74.9535	37.8507
ALT D	-75.0050	37.7914
ALT D	-75.0711	37.7327
ALT D	-75.1480	37.6693
ALT D	-75.1664	37.5815
ALT D	-75.1802	37.5167
ALT D	-75.2062	37.3944
ALT D	-75.2324	37.2707
ALT D	-75.2432	37.2235
ALT D	-75.2591	37.1733
ALT D	-75.2824	37.0999
ALT D	-75.3039	37.0320
ALT D	-75.3204	36.9796
ALT D	-75.3438	36.9056
ALT D	-75.3503	36.8849
D	-75.6254	36.8643
D	-75.5658	36.8646
D	-75.5648	36.8646
E	-75.8410	36.6661
E	-75.8377	36.6671
E	-75.7802	36.6854
E	-75.7317	36.7287
E	-75.6420	36.8103
E	-75.5654	36.8634
ALT E	-75.5654	36.8634
ALT E	-75.5261	36.9409
ALT E	-75.4897	37.0812
ALT E	-75.4391	37.2335
ALT E	-75.3858	37.3681

Phase	Longitude	Latitude
ALT E	-75.3427	37.4624
ALT E	-75.3023	37.5507
ALT E	-75.2309	37.6716
ALT E	-75.2129	37.6966
ALT E	-75.1095	37.8041
ALT E	-75.0465	37.8590
ALT E	-75.0177	37.9005
ALT E	-74.9825	37.9674
ALT E	-74.9645	38.0547
ALT E	-74.9417	38.1036
ALT E	-74.9247	38.1193
ALT E	-74.8915	38.1652
ALT E	-74.8612	38.2152
ALT E	-74.8304	38.2747
ALT E	-74.8274	38.2862
ALT E	-74.8279	38.3000
ALT E	-74.8308	38.3133
ALT E	-74.8347	38.3247
ALT E	-74.8368	38.3323
ALT E	-74.8408	38.3400
ALT E	-74.8441	38.3444
D	-75.5654	36.8634
D	-75.5261	36.9409
D	-75.4897	37.0812
D	-75.4391	37.2335
D	-75.3858	37.3681
D	-75.3427	37.4624
D	-75.3023	37.5507
D	-75.2755	37.5659
D	-75.2370	37.5914
D	-75.1728	37.6452
D	-75.1480	37.6693
D	-75.0711	37.7327
D	-75.0050	37.7914
D	-74.9535	37.8507
D	-74.9394	37.8674
D	-74.8256	38.0904
D	-74.7476	38.2137
D	-74.7376	38.2407
D	-74.7176	38.2933

Phase	Longitude	Latitude
D	-74.7098	38.3161
C	-74.7098	38.3161
C	-74.7246	38.3021
C	-74.7358	38.2914
C	-74.7484	38.2830
C	-74.7644	38.2746
C	-74.8781	38.2235
C	-74.9228	38.2139
C	-74.9471	38.2081
C	-74.9691	38.2049
C	-75.0037	38.2039
C	-75.0219	38.2078
C	-75.0391	38.2139
C	-75.0703	38.2288
C	-74.8781	38.2235
C	-74.8891	38.2267
C	-74.8994	38.2318
C	-74.9126	38.2417
C	-74.9313	38.2588
C	-74.9534	38.2811
C	-74.9656	38.2970
C	-74.9823	38.3273
C	-74.9975	38.3445
C	-75.0087	38.3489
A	-74.9881	38.5417
A	-74.9527	38.5429
A	-74.9303	38.5466
A	-74.9115	38.5515
A	-74.8837	38.5633
A	-74.8477	38.5786
A	-74.7902	38.6043
A	-74.7457	38.6226
A	-74.7457	38.6226
A	-74.8234	38.6355
A	-75.0008	38.6603
C	-74.7253	38.3366
E	-75.9141	36.8633
E	-75.9137	36.8636
E	-75.9020	36.8637
E	-75.8963	36.8678

Phase	Longitude	Latitude
E	-75.8949	36.8678
E	-75.8946	36.8681
E	-75.8882	36.8682
E	-75.8875	36.8676
E	-75.8855	36.8676
E	-75.8828	36.8655
E	-75.8818	36.8655
E	-75.8791	36.8634
E	-75.8626	36.8635
E	-75.8604	36.8627
E	-75.8015	36.8631
E	-75.7847	36.8632
E	-75.7778	36.8643
E	-75.6448	36.8643
E	-75.6397	36.8643
E	-75.6360	36.8643
E	-75.6268	36.8643
E	-75.6154	36.8602
E	-75.5963	36.8230
E	-75.5961	36.8228
E	-75.5960	36.8226
E	-75.5614	36.8227
E	-75.4229	36.8233
E	-75.4094	36.8246
E	-75.3968	36.8272
E	-75.3872	36.8301
E	-75.3809	36.8350
E	-75.3765	36.8461
E	-75.3758	36.8673
E	-75.3723	36.8728
E	-75.3660	36.8776
E	-75.3503	36.8849
E	-75.3500	36.8858
E	-75.8780	36.7482
E	-75.8196	36.7205
E	-75.8090	36.7206
E	-75.8005	36.7236
E	-75.7829	36.7380
E	-75.7819	36.7380
E	-75.7809	36.7388

Phase	Longitude	Latitude
E	-75.7792	36.7388
E	-75.7392	36.7716
E	-75.7285	36.7803
E	-75.7124	36.7804
E	-75.7017	36.7891
E	-75.7000	36.7891
E	-75.6973	36.7913
E	-75.6219	36.8224
E	-75.5614	36.8227
E	-75.4229	36.8233
E	-75.4094	36.8246
E	-75.3968	36.8272
E	-75.3872	36.8301
E	-75.3809	36.8350
E	-75.3765	36.8461
E	-75.3758	36.8673
E	-75.3723	36.8728
E	-75.3660	36.8776
E	-75.3503	36.8849
E	-75.3500	36.8858
B	-74.3622	39.1347
B	-74.3332	39.1569
B	-74.3249	39.1803
B	-74.2990	39.2558
B	-74.2356	39.3069
B	-74.1137	39.3683
B	-74.1127	39.3683
B	-74.1081	39.3718
B	-74.0825	39.3914
A	-74.7536	38.6164
A	-74.7461	38.6223
A	-74.7461	38.6223
A	-74.7458	38.6224
A	-74.7458	38.6224
A	-74.7457	38.6226
A	-74.7457	38.6226
A	-74.7243	38.6393
A	-74.6310	38.7329
A	-74.5982	38.7614
A	-74.5828	38.7732

Phase	Longitude	Latitude
A	-74.5637	38.7916
A	-74.5329	38.8274
A	-74.4557	38.9165
A	-74.4557	38.9182
A	-74.4221	38.9585
A	-74.4059	38.9995
A	-74.3979	39.0776
A	-74.3841	39.1128
A	-74.3622	39.1347
A	-74.3889	39.1571
A	-74.3890	39.1572
A	-74.4562	39.2101
A	-74.4687	39.2102
A	-74.5074	39.2406
A	-74.5081	39.2406
A	-74.5091	39.2414
A	-74.5098	39.2414
A	-74.5136	39.2443
C	-73.9692	40.0857
C	-73.9530	40.0719
C	-73.8942	40.0506
C	-73.8696	40.0713
C	-73.8656	40.0971
C	-73.8588	40.1444
C	-73.8545	40.1661
C	-73.8509	40.1977
C	-73.8499	40.2161
C	-73.8526	40.2257
C	-73.8521	40.2356
C	-73.8656	40.3002
C	-73.9002	40.3622
C	-73.8994	40.4623
C	-73.9132	40.4816
A	-74.8441	38.3444
A	-74.8534	38.3568
A	-74.8626	38.3697
A	-74.8630	38.4368
A	-74.8600	38.4543
A	-74.8552	38.4641
A	-74.8444	38.4863

Phase	Longitude	Latitude
A	-74.8270	38.5069
A	-74.8132	38.5415
A	-74.8013	38.5624
A	-74.7821	38.5953
A	-74.7536	38.6164
A	-74.7457	38.6226
E	-75.3503	36.8849
E	-75.3438	36.9056
E	-75.3204	36.9796
E	-75.3039	37.0320
E	-75.2824	37.0999
E	-75.2591	37.1733
E	-75.2432	37.2235
E	-75.2324	37.2707
E	-75.2062	37.3944
E	-75.1802	37.5167
E	-75.1664	37.5815
E	-75.1480	37.6693
E	-75.1216	37.7916
E	-75.1095	37.8041
E	-75.0465	37.8590
E	-75.0177	37.9005
E	-74.9825	37.9674
E	-74.9645	38.0547
E	-74.9417	38.1036
E	-74.9247	38.1193
E	-74.8915	38.1652
E	-74.8612	38.2152
E	-74.8304	38.2747
E	-74.8274	38.2862
E	-74.8279	38.3000
E	-74.8308	38.3133
E	-74.8347	38.3247
E	-74.8368	38.3323
E	-74.8408	38.3400
E	-74.8441	38.3444

Attachment

Applicant's Statement of Qualification to Hold a Renewable Energy Grant on the U.S. Outer Continental Shelf

(PRIVATE AND CONFIDENTIAL / NON-PUBLIC)