



**DEEPWATERWIND**

**Block Island Wind Farm  
Block Island Transmission System**

# **Environmental Report / Construction and Operations Plan**

September 2012



PREPARED BY



**TETRA TECH**

# Block Island Wind Farm and Block Island Transmission System Environmental Report / Construction and Operations Plan

*Submitted by*



CLEAN ENERGY IS JUST OVER THE HORIZON

*Prepared by*



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## EXECUTIVE SUMMARY

Deepwater Wind Block Island, LLC, a wholly owned indirect subsidiary of Deepwater Wind Holdings, LLC, proposes to develop the Block Island Wind Farm (BIWF), a 30-megawatt (MW) offshore wind farm located on average approximately 3 miles (mi) (4.8 kilometers [km])<sup>1</sup> southeast of Block Island, Rhode Island. The BIWF will consist of five, 6-MW wind turbine generators (WTGs), a submarine cable interconnecting the WTGs (Inter-Array Cable), and a 34.5-kilovolt (kV) transmission cable from the northernmost WTG to an interconnection point on Block Island (Export Cable). In connection with the BIWF, Deepwater Wind Block Island Transmission, LLC, also a wholly owned indirect subsidiary of Deepwater Wind Holdings, LLC, proposes to develop the Block Island Transmission System (BITS), a 34.5-kV alternating current (AC) bi-directional submarine transmission cable that will run up to approximately 21.8 miles (35.1 km) from Block Island to the Rhode Island mainland. The BITS will be capable of delivering power both to and from the Rhode Island mainland.

Deepwater Wind Block Island, LLC will construct, own, and operate the BIWF. Deepwater Wind Block Island Transmission, LLC will develop and construct the BITS and will likely transfer ownership of the BITS to The Narragansett Electric Company d/b/a National Grid (TNEC)<sup>2</sup>. For purposes of this Environmental Report (ER), the two Deepwater Wind Holdings, LLC corporate entities associated with the development of the BIWF and BITS are collectively referred to as “Deepwater Wind.” Likewise, the BIWF and BITS are collectively referred to as “the Project.”

The BIWF is located entirely within Rhode Island state territorial waters. The BIWF WTGs, Inter-Array Cable, and a portion of the Export Cable are located within the Rhode Island Renewable Energy Zone established by the Rhode Island Coastal Resources Management Council (CRMC). The offshore BITS cable is located within Rhode Island state territorial waters and in federal waters on the outer continental shelf (OCS).

The Project will also include construction of one new substation (Block Island Substation) in the Town of New Shoreham on Block Island at the site of an existing power generation facility on property owned by the Block Island Power Company (BIPCO). The Block Island Substation will provide a point of interconnection for the power from the BIWF and will also be the point of interconnection for BITS on Block Island. The onshore portions of the BIWF and BITS cables on Block Island will be collocated along the same route to the Block Island Substation. The Block Island Substation will consist of two adjoining switchyards, one dedicated to the BIWF (BIWF Generation Switchyard) and the other dedicated to the BITS (BITS Island Switchyard). The Project will also include upgrades to the existing substation on the BIPCO property. The BITS will connect to the existing TNEC system on the Rhode Island mainland via a new switchyard (Narragansett Switchyard) located in Narragansett, Rhode Island. The proposed Narragansett Switchyard will be located on municipally owned land located near the Narragansett Department of Public Works (DPW) maintenance facility in the Town of Narragansett, Rhode Island.

Construction staging and laydown for the Project will occur within designated onshore construction areas and rights-of-way and at the Quonset Point port facility in North Kingstown, Rhode Island. No upgrades or alterations will be required at the Quonset Point port facility to support the Project. Deepwater Wind

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<sup>1</sup> Distances throughout the ER are provided as statute miles (mi) or nautical miles (nm) as appropriate, with kilometers in parentheses. For reference, 1 mi equals approximately 0.87 nm.

<sup>2</sup> National Grid is an international energy delivery company with its US headquarters in Waltham, Massachusetts. Through its subsidiaries, New England Power Company, Massachusetts Electric Company, Nantucket Electric Company, The Narragansett Electric Company, Boston Gas Company and Colonial Gas Company, National Grid provides electricity and natural gas to millions of customers in New England.

will lease existing office space and a storage yard close to a dock in the Point Judith area of Narragansett, Rhode Island for the Project's Operation and Maintenance (O&M) facility.

The BIWF is expected to generate approximately 125,500 megawatt-hours (MWh) each year once it is fully operational, supplying enough energy to power approximately 17,200 Rhode Island households (DOE EIA 2010). The BIWF will be capable of supplying the majority of Block Island's electricity needs and will provide an alternative energy source to the diesel-fired generators that are currently used to power the Island. The BITS will export excess power from the BIWF to the Rhode Island mainland and will be capable of supplying power from the existing TNEC distribution system to Block Island. Block Island is not currently connected to the mainland electric grid. On June 30, 2010, Deepwater Wind and TNEC executed a power purchase agreement (PPA) for the sale of power from the BIWF to TNEC. The Rhode Island Public Utilities Commission (PUC) issued a written order on August 16, 2010 approving the PPA, which was upheld by the Rhode Island Supreme Court.

Deepwater Wind has prepared this ER to support the environmental assessment under the National Environmental Policy Act (NEPA), as amended (42 USC 4321 *et seq.*), as well as the environmental analysis required as part of other federal, state, and local approvals and consultations for the Project.

The Project components evaluated in this ER consist of construction, operation, and decommissioning of the following facilities:

- A WTG Array that consists of five 6-MW WTGs spaced approximately 0.5 mi (0.8 km) apart.
- A 34.5-kV, 2-mi (3.2 km) submarine cable system connecting the WTGs (Inter-Array Cable).
- A 34.5-kV, 6.2-mi (10-km) Export Cable that connects the WTG Array to the BIWF Generation Switchyard located within a new substation on Block Island (Block Island Substation).
- A 34.5-kV, 21.8-mi (35.1-km) BITS Cable to provide power to the Rhode Island mainland by interconnecting with TNEC's 34.5-kV distribution system in Narragansett, and two switchyards at either end of the BITS: one on the BIPCO property on Block Island (BITS Island Switchyard within the new Block Island Substation) and one in Narragansett (the Narragansett Switchyard).
- An O&M facility proposed to be located in the Point Judith area of Narragansett.

The Project will be located an average of approximately 3 mi (4.8 km) southeast of Block Island, and over 16 mi (25.7 km) south of the Rhode Island mainland. The state of Rhode Island, through the Rhode Island Ocean Special Area Management Plan (RI Ocean SAMP) process led by the CRMC, has invested considerable resources in conducting scientific studies necessary to determine which areas of coastal waters near Block Island are suitable for offshore wind development (Rhode Island Renewable Energy Zone).

The location of the WTG Array within the Rhode Island Renewable Energy Zone reflects substantial efforts undertaken with the involvement of agencies and stakeholders to choose a site that minimizes the potential impact on natural resources (benthic ecology, birds, marine mammals, sea turtles, fisheries resources, and habitat) and existing human uses (commercial and recreational fishing, cultural and historic sites, recreation and tourism, marine transportation, navigation and infrastructure).

Deepwater Wind has taken further action to design a Project that avoids, minimizes, or mitigates effects to environmental resources. The proposed Project represents four years of site-selection and consideration of alternative sites and operating parameters. The original project plan in 2009 included the installation of eight 3.6 MW WTGs. Deepwater Wind has refined its plan and is now proposing five 6-MW direct drive WTGs, which are the next generation of turbine technology. This reduction in the number of WTGs

improves the financial performance of the Project and minimizes the visual impacts, bottom disturbance, and other potential environmental effects. Additionally, Deepwater Wind's jacket foundation technology allows for placement of WTGs in the deeper regions of Rhode Island State waters, which allows the Project to be located as far as possible offshore while still providing the State of Rhode Island with the benefits of a project located in state territorial waters.

Deepwater Wind has completed thorough site-specific analyses and engaged in pre-application agency consultations and stakeholder outreach. The Project is not anticipated to result in significant adverse impacts on the environment due to the relatively small scale of the Project; the impact avoidance, minimization, and mitigation measures already adopted and proposed by Deepwater Wind in the siting and design of the Project; and the socioeconomic and air quality benefits of the Project. Table ES-1 summarizes the environmental resources evaluated in this ER, the potential impacts from the Project on each resource, and the avoidance, minimization, and mitigation measures undertaken and proposed by Deepwater Wind.

**Table ES-1 Potential Impacts and Avoidance, Minimization, and Mitigation Measures**

Resource	Potential Impacts	Avoidance, Minimization, and Mitigation Measures
Physical Oceanography and Meteorology	No effect to surrounding physical processes including circulation, flow patterns, stratification or possible long term rise in sea level.	No mitigation measures necessary. Deepwater Wind has designed the Project to account for site-specific oceanographic and meteorological conditions within the Project Area.
Geologic Resources	No geologic or shallow hazards identified.  Minor, short-term, and localized disturbance to the marine sediments and terrestrial soils during construction activities.  Potential impacts on existing telecommunication cables.	Project facilities sited to avoid shallow hazards.  Jet plowing, horizontal directional drilling (HDD) techniques and use of dynamically positioned (DP) vessels to install the Project cables will minimize sediment disturbance and alteration.  Deepwater Wind had designed cable crossings to avoid impacts on the operating telecommunication cables. If necessary, crossing agreements will be negotiated with cable owner-operators prior to construction.  Onshore facilities primarily located along existing rights-of-way and in currently developed areas.  Construction areas will be returned to pre-conditions.
Water Quality and Water Resources	No effect to groundwater or surface water resources are anticipated from onshore facilities.  Temporary sediment disturbance during construction activities will result in minor, short-term, and localized increases in total suspended solids (TSS) near WTG foundations and along submarine cable corridors.  Low risk of hazardous spill during construction and operation.  Low risk of frac-out during HDD activities.	Onshore facilities primarily located along existing rights-of-way and in currently developed areas.  Jet plowing, HDD techniques, and use of DP vessels to install the Project cables will minimize sediment disturbance and alteration.  Deepwater Wind will require all construction and operation vessels to comply with regulatory requirements related to the prevention and control of spills and discharges. Deepwater Wind will prepare a Project specific Spill Control and Response Plan prior to construction and operation to further minimize risk.  Deepwater Wind will develop an HDD Contingency Plan for the Inadvertent Releases of Drilling Fluid prior to construction to further minimize the risk associated with a frac-out.
Air Quality	Minor short-term air emissions from vessels used during construction, operation, and decommissioning.  Project could effectively displace the diesel-fired generators that are currently used to power the Block Island and their associated air emissions	No measures necessary.  Project will result in overall air quality benefits.

**Table ES-1 Potential Impacts and Avoidance, Minimization, and Mitigation Measures**

Resource	Potential Impacts	Avoidance, Minimization, and Mitigation Measures
Benthic Resources	<p>Minor, short-term, localized disturbance to benthic habitat from WTG installation and cable laying activities.</p> <p>Minimal permanent alteration of habitat associated with the five WTGs and the targeted use of additional cable protection (max of 2.25 acres [0.99 hectares]).</p> <p>WTG foundations may provide a minor beneficial impact by providing artificial hard substrate that may attract some sessile benthic encrusting species.</p> <p>No impacts from electromagnetic fields (EMF) due to cable design and burial depth.</p>	<p>The Project has been sited within the Renewable Energy Zone to minimize potential impacts on natural resources.</p> <p>Cable routes and WTGs have been sited to avoid impacts on potentially sensitive benthic communities including eelgrass beds and hard bottom habitats.</p> <p>Jet plowing, HDD techniques, and use of DP vessels to install the Project cables will minimize sediment disturbance and alteration.</p> <p>Deepwater Wind has committed to conducting a one-year pre-construction and a one-year post-construction ventless trap survey to provide a site-specific assessment of the local lobster community in Project Area. Data will support the further evaluation of both the construction and operational effects of the Project on the local lobster community.</p> <p>Deepwater Wind is currently funding a liaison to facilitate communication with the fishing industry.</p>
Finfish Resources	<p>Minor, short-term, localized disturbance to benthic habitat used by finfish from WTG installation and cable laying activities.</p> <p>Minimal permanent alteration of habitat associated with the five WTGs and the targeted use of additional cable protection (max of 2.25 acres [0.99 hectares]).</p> <p>Temporary sediment disturbance during construction activities will result in minor, short-term, and localized increases in total TSS near WTG foundations and along submarine cable corridors.</p> <p>WTG foundations may provide a minor beneficial impact by providing additional habitat for some structure-oriented species.</p> <p>Minor short-term impacts from underwater noise generated during pile driving.</p> <p>No impacts from EMF due to cable design and burial depth</p>	<p>The Project has been sited within the Renewable Energy Zone to minimize potential impacts on natural resources.</p> <p>Cable routes and WTGs have been sited to avoid direct impacts on important habitats such as eelgrass and hard bottom substrates known to be used by some finfish species throughout various lifestages.</p> <p>Jet plowing, HDD techniques and use of DP vessels to install the Project cables will minimize sediment disturbance and alteration.</p> <p>Deepwater Wind will implement techniques such as soft-starts to minimize impacts on finfish resources during pile driving activities.</p> <p>Deepwater Wind has committed to conducting a 5-year trawl survey (2 years pre-construction and 3 years during operation) in the Project Area to further assess the local finfish community. Data will support the further evaluation of both the construction and operational effects of the Project on the local finfish community.</p> <p>Deepwater Wind is currently funding a liaison to facilitate communication with the fishing industry.</p>
Essential Fish Habitat	<p>Minor, short-term, localized disturbance to habitats used by marine species from WTG installation and cable laying activities.</p> <p>Minimal permanent alteration of habitat associated with the five WTGs and the targeted use of additional cable protection (max of 2.25 acres [0.99 hectares]).</p> <p>Temporary sediment disturbance during construction activities will result in minor, short-term, and localized increases in total TSS near WTG foundations and along submarine cable corridors.</p> <p>Minor short-term impacts from underwater noise generated during pile driving.</p> <p>No impacts from EMF due to cable design and burial depth</p>	<p>The Project has been sited within the Renewable Energy Zone to minimize potential impacts on natural resources.</p> <p>Cable routes and WTGs have been sited to avoid direct impacts on important habitats such as eelgrass and hard bottom substrates known to be used by some marine species throughout various lifestages.</p> <p>Jet plowing, HDD techniques and use of DP vessels to install the Project cables will minimize sediment disturbance and alteration.</p> <p>Deepwater Wind will implement techniques such as soft-starts to minimize impacts on finfish resources during pile driving activities.</p>

**Table ES-1 Potential Impacts and Avoidance, Minimization, and Mitigation Measures**

Resource	Potential Impacts	Avoidance, Minimization, and Mitigation Measures
Marine Mammals and Sea Turtles	<p>No Level A Harassment from construction or operation of the Project.</p> <p>Minor short-term impacts from Level B Harassment due to temporary increases in underwater noise levels during construction activities (e.g., pile driving).</p> <p>Low risk of impacts from hazardous spill or marine debris during construction and operation.</p> <p>No impact anticipated during operation from loss of habitat or forage.</p>	<p>The Project has been sited within the Renewable Energy Zone to minimize potential impacts on natural resources.</p> <p>Vessels will follow National Oceanic and Atmospheric Administration (NOAA) guidelines for marine mammal strike avoidance.</p> <p>Deepwater Wind will employ visual monitoring and mitigation measures as directed by NOAA Fisheries permits for pile driving during construction. Impact avoidance and minimization measures may include shut-down procedures, marine mammal monitoring protocols, and use of soft-starts during pile driving.</p> <p>Deepwater Wind will require all construction and operation vessels to comply with regulatory requirements related to the prevention and control of spills and discharges.</p> <p>Deepwater Wind will prepare a Project specific Spill Control and Response Plan prior to construction and operation to further minimize risk.</p>
Terrestrial Wildlife	<p>Minor and short-term disturbance or displacement during construction.</p> <p>Minimal permanent alteration of habitat during operation due maintenance of cable rights-of-way (maximum of 3.1 acres [1.25 hectares]).</p>	<p>Use of HDD during construction to minimize potential impacts on shoreline habitats.</p> <p>Onshore facilities primarily located along existing rights-of-way and in currently developed areas.</p> <p>The vast majority of the cable right-of-way will be returned to pre-construction conditions with no need for permanent vegetation maintenance.</p>
Avian and Bat Species	<p>Short-term and minor impacts during construction and operation to food resources for foraging avian species; water depths generally too deep to affect sea duck foraging.</p> <p>Short-term and minor potential impact on shoreline habitats.</p> <p>Minimal potential for avian and bat mortality due to collision with WTGs during operation.</p>	<p>The Project has been sited within the Renewable Energy Zone to minimize potential impacts on natural resources.</p> <p>Area with the least potential for impacts on avian and bat species was siting criteria during selection of final location for WTG Array.</p> <p>WTGs represent a small percentage of air space available for migration.</p> <p>Deepwater Wind has reduced the number of WTGs from eight to five.</p> <p>Use of HDD during construction to minimize potential impacts on shoreline habitats.</p> <p>Onshore facilities primarily located along existing rights-of-way and in currently developed areas.</p> <p>Deepwater Wind has committed to pre- and post-construction beached bird surveys on southern Block Island.</p> <p>Deepwater Wind has committed to vessel based acoustic monitoring of bat activity during construction.</p> <p>Deepwater Wind has committed to ship-based bird monitoring focused on displacement of migrating and foraging birds.</p> <p>Deepwater Wind has committed to nocturnal bird flight and collision monitoring focused on nocturnal migrant activity and collision rates at select WTGs.</p>
Endangered and Threatened Species	<p>No terrestrial or avian threatened or endangered species identified during field surveys.</p> <p>Minor, short-term impacts similar to those described for terrestrial species, avian and, bat species, benthic and finfish species, marine mammals and sea turtles.</p>	<p>Avoidance, minimization, and mitigation measures are similar to those described for terrestrial species, avian, bat species, benthic and finfish species, marine mammals and sea turtles.</p>

**Table ES-1 Potential Impacts and Avoidance, Minimization, and Mitigation Measures**

Resource	Potential Impacts	Avoidance, Minimization, and Mitigation Measures
Acoustic Environment	<p>Minor, short-term and localized impacts on surface-level noise during construction and operation.</p> <p>Underwater noise impacts on marine species as described for fish, marine mammals, and sea turtles.</p>	<p>Pile driving activities will occur during daylight hours starting approximately 30 minutes after dawn and 30 minute prior to dusk unless a situation arises where ceasing the pile driving activity would compromise safety (both human health and environmental) and/or the integrity of the Project.</p> <p>HDD activities will be limited to daylight hours unless a situation arises where ceasing the HDD activity would compromise safety (both human health and environmental) and/or the integrity of the Project.</p> <p>In-noise from onshore HDD activities will be mitigated, as necessary, using a four-sided noise wall.</p> <p>Avoidance, minimization, and mitigation for underwater noise as described for marine mammals, sea turtles and finfish.</p>
Marine Cultural Resources	<p>No documented National Register of Historic Places (NRHP)-listed or NRHP-eligible sites within the Project Area.</p> <p>No archaeologically sensitive or potentially eligible sites were identified by the site-specific surveys within the footprint of Project facilities.</p>	<p>The Project has been sited within the Renewable Energy Zone to minimize potential impacts on important resources.</p> <p>Deepwater Wind engaged the Narragansett Indian Tribe and the Wampanoag Tribe of Gay Head (Aquinnah) in marine survey protocol design, execution of the surveys, and interpretation of the results.</p> <p>Deepwater Wind will implement an Unanticipated Discovery Plan that will include stop work and notification procedures to be followed in the event that a submerged cultural resource is encountered during installation.</p>
Terrestrial Archeological Resources	<p>The BIWF will not result in any direct effects to NRHP-listed archaeological sites.</p> <p>One previously unknown site identified as potentially eligible for listing in the NRHP on Block Island, the Harbor Pond Site.</p>	<p>Deepwater Wind engaged the Narragansett Indian Tribe and the Wampanoag Tribe of Gay Head (Aquinnah) in terrestrial survey protocol design, execution of the surveys, and interpretation of the results.</p> <p>Deepwater Wind will implement an Unanticipated Discoveries Plan for construction that specifies stop work and notification procedures in the event a site of potential cultural significance is encountered during construction.</p> <p>Deepwater Wind will conduct a Phase II archaeological survey to further evaluate the identified site and make recommendations to federal and state agencies about the significance and eligibility of archaeological and traditional cultural properties.</p>
Aboveground Historic Resources	<p>No direct impacts on NRHP-listed or potentially eligible aboveground historic properties.</p> <p>Minor long-term indirect impacts on seven NRHP-listed historic properties on Block Island from the alteration of historic views from Project facilities.</p>	<p>The Project has been sited within the Renewable Energy Zone to minimize potential impacts on important resources.</p> <p>The WTGs are located as far as possible offshore, while still remaining in state territorial waters and Renewable Energy Zone.</p> <p>Deepwater Wind has reduced the number of turbines from eight to five and will install WTGs with a uniform design, speed, height, and rotor diameter.</p> <p>The white or light-grey color (less than 5 percent grey tone) of the turbines generally blends well with the sky and water context and eliminates the need for daytime Federal Aviation Administration (FAA) warning lights or red paint marking of the blade tips.</p> <p>U.S. Coast Guard (USCG) warning lights at the base of the towers will have a maximum visible range of 4.6 mi (7.4 km).</p> <p>Deepwater Wind will evaluate the technical and financial feasibility of radar-controlled/aircraft-activated FAA lights to reduce nighttime visual impacts.</p>



**Table ES-1 Potential Impacts and Avoidance, Minimization, and Mitigation Measures**

Resource	Potential Impacts	Avoidance, Minimization, and Mitigation Measures
Visual Resources	<p>Impacts from the Project on the Rhode Island mainland are unlikely.</p> <p>Minor long-term impacts on select views on Block Island from WTGs.</p>	<p>The Project has been sited within the Renewable Energy Zone to minimize potential impacts on important resources.</p> <p>The WTGs are located as far as possible offshore, while still remaining in state territorial waters and the Renewable Energy Zone.</p> <p>Deepwater Wind has reduced the number of turbines from eight to five and will install WTGs with a uniform design, speed, height, and rotor diameter.</p> <p>The white or light grey color (less than 5 percent grey tone) of the turbines generally blends well with the sky and water context and eliminates the need for daytime Federal Aviation Administration (FAA) warning lights or red paint marking of the blade tips.</p> <p>USCG warning lights at the base of the towers will have a maximum visible range of 4.6 mi (7.4 km).</p> <p>Deepwater Wind will evaluate the technical and financial feasibility of radar-controlled/aircraft-activated FAA lights to reduce nighttime visual impacts.</p> <p>Although the Visual Impact Assessment concluded that no additional visual mitigation is required, Deepwater Wind has indicated a willingness to consider additional financially reasonable and technically feasible mitigation measures.</p>
Marine Uses	<p>Short-term and minor impacts during construction associated with temporary displacement of fishing, recreational and tourism activities.</p> <p>Minor long-term impacts on marine navigation during operation in the vicinity of the WTG Array.</p>	<p>The Project has been sited within the Rhode Island Renewable Energy Zone to minimize potential impacts on important resources.</p> <p>The operational phase Project footprint occupies a relatively small (di minimus) portion of the available fishing and boating area in Rhode Island Sound and Block Island Sound.</p> <p>Deepwater Wind does not propose any operational phase vessel exclusions around the WTGs or other areas of the Project.</p> <p>Cables will be buried at a target depth of 6 ft (1.8 m) below the seafloor to avoid interactions with fishing gear and/or anchors.</p> <p>Deepwater Wind will implement a comprehensive communication plan during construction to inform commercial and recreational fishermen, mariners, and recreational boaters of construction activities and vessel movements. Communication will be facilitated through a Project website, public notices to mariners and vessel float plans, and a fisheries liaison.</p> <p>Deepwater Wind will submit information to the USCG to issue Local Notices to Mariners (LNMs) during offshore installation activities.</p> <p>Deepwater Wind has established designated construction vessel traffic routes, construction standby areas, and work areas.</p> <p>WTGs will be marked and lit with both USCG and FAA approved navigational aids. The WTG located in the center of the Array will also include a sound signal.</p> <p>Deepwater Wind is currently funding a liaison to facilitate communication with the fishing industry.</p>

**Table ES-1 Potential Impacts and Avoidance, Minimization, and Mitigation Measures**

Resource	Potential Impacts	Avoidance, Minimization, and Mitigation Measures
Land Use	<p>Minor and short-term impacts from clearing and grading during Project construction.</p> <p>Minor visual impact at onshore recreational areas on Block Island.</p>	<p>Onshore facilities primarily located along existing rights-of-way and in currently developed areas.</p> <p>HDD will help to avoid disturbance to shoreland areas and tidal wetlands.</p> <p>Construction associated with cable landings and onshore facilities will not be completed in the summer months to avoid peak the tourist season.</p> <p>Additional avoidance, minimization, and mitigation measures are similar to those described for visual resources.</p>
Transportation	<p>Minor and short-term disruptions to marine transportation from offshore construction activities.</p> <p>Minor and short-term disruptions to onshore transportation from road closures and increased land-based traffic during installation of onshore facilities.</p> <p>Minor long-term impacts marine navigation and aviation during operation in the vicinity of the WTG Array.</p>	<p>The Project has been sited within the Rhode Island Renewable Energy Zone in an area that avoids heaviest vessel traffic and designated shipping lanes.</p> <p>Deepwater Wind will prepare a Traffic and Transportation Plan to minimize vehicle traffic impacts during construction.</p> <p>Deepwater Wind has established designated construction vessel traffic routes, construction standby areas, and work area to minimize potential impacts on mariners.</p> <p>Deepwater Wind will implement a comprehensive communication plan during construction to inform commercial and recreational fishermen, mariners, and recreational boaters of construction activities and vessel movements. Communication will be facilitated through a Project website, public notices to mariners and vessel float plans, and a fisheries liaison.</p> <p>Deepwater Wind will submit information to the USCG to issue LNMs during offshore installation activities.</p> <p>Construction associated with cable landings will be onshore facilities will not be conducted during the summer months to avoid peak the tourist season.</p> <p>WTGs will be marked and lit with both USCG and FAA approves navigational aids. The WTG located in the center of the Array will also include a sound signal.</p>
Socioeconomics and Environmental Justice	<p>Benefits to local and regional economies from job creation during construction and operation.</p> <p>No environmental justice communities affected by the Project.</p>	<p>No avoidance, minimization, or mitigation measures necessary due to the net socioeconomic benefit from the Project.</p>
Human Health and Safety	<p>Potential health and safety hazards related to marine and land-based construction.</p> <p>Potential health and safety hazards related to marine and terrestrial operation.</p> <p>No impacts from EMF.</p> <p>Low risk of impacts from hazardous spill or during construction and operation.</p>	<p>The Project has been sited within the Renewable Energy Zone to minimize potential impacts on natural resources and human uses.</p> <p>Deepwater Wind has designed the BIWF and BITS facilities to account for site-specific environmental conditions in the Project Area.</p> <p>Deepwater Wind is committed to carrying out its business activities with a primary focus on health, safety, and well-being of its employees, contractors, third parties, and the general public.</p> <p>Deepwater Wind will develop an overall a health and safety plan prior to construction of the Project and will ensure that all contractors and third parties perform their work in accordance with the overall plan and their own specific health and safety plans. Deepwater Wind will develop a similar plan for the operations phase of the Project.</p>

**Table ES-1 Potential Impacts and Avoidance, Minimization, and Mitigation Measures**

Resource	Potential Impacts	Avoidance, Minimization, and Mitigation Measures
Human Health and Safety (continued)		<p>Workers will receive training in health, safety, and emergency response prior to commencing work on the Project.</p> <p>Deepwater Wind will develop a communications plan during construction to inform the general public and commercial and recreational fishermen, mariners, and recreational boaters in particular of construction activities and vessel movements. Communication will be facilitated through maintaining a Project website and submitting LNMs and vessel float plans, as appropriate, to the USCG.</p> <p>Deepwater Wind will require all construction and operation vessels to comply with regulatory requirements related to the prevention and control of spills and discharges. Deepwater Wind will prepare a Project specific Spill Control and Response Plan prior to construction and operation to further minimize risk.</p>

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## ACRONYMS AND ABBREVIATIONS

AC	alternating current
AcTUP	Acoustic Toolbox User Interface Post processor
AIS	Automatic Identification System
APC	Area of Particular Concern
APE	Area of Potential Effect
ASMFC	Atlantic States Marine Fisheries Commission
BACI	before, after, control impact
BBS	Breeding Bird Survey
BCC	birds of conservation concern
BIPCO	Block Island Power Company
BITS	Block Island Transmission System
BIWF	Block Island Wind Farm
BOEM	Bureau of Ocean Energy Management
BP	before present
CAD	Confined Aquatic Disposal
CadnaA	Computer Aided Noise Abatement
CBRS	Coastal Barrier Resources Systems
CEQ	Council on Environmental Quality
CH <sub>4</sub>	methane
cm	centimeters
CO <sub>2</sub>	carbon dioxide
COLREGS	International Regulations for Preventing Collisions at Sea 1972
CRMC	Rhode Island Coastal Resources Management Council
CRMP	Rhode Island Coastal Resources Management Program
CVA	Certified Verification Agency
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dB	decibels
dBA	A-weighted decibel
dBL	linear decibel
Deepwater Wind	Deepwater Wind Block Island, LLC and Deepwater Wind Block Island Transmission, LLC
DGPS	digital Global Positioning System
DOI	U.S. Department of Interior
DP	dynamic positioning

DPW	Department of Public Works
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFD	energy flux density
EFH	essential fish habitat
EIS	Environmental Impact Statement
EMF	electromagnetic fields
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
ERL	extraneous residue limit
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAB	Fisheries Advisory Board
FONSI	Finding of No Significant Impact
ft	feet
GHG	greenhouse gases
GUI	Graphical User Interface
HAB	Habitat Advisory Board
HAP	hazardous air pollutant
HDD	horizontal directional drilling
HDPE	high density polyethylene
Hz	hertz
ICES	International Commission on Electromagnetic Safety
ICNIRP	International Commission on Non-ionizing Radiation Protection
ICPC	International Cable Protection Committee
IHA	Incidental Take Authorization
IPCC	Intergovernmental Panel on Climate Change
ISO	International Standards Organization
JDA	Joint Development Agreement
kHz	kilohertz
km	kilometer
kV	kilovolts
kV/m	kilovolts per meter
kW	kilowatts
L <sub>eq</sub>	equivalent sound level

L <sub>n</sub>	statistical sound level
LNM	Local Notices to Mariners
m	meters
m/s	meters per second
MAFMC	Mid-Atlantic Fishery Management Council
MARMAP	Marine Resources Monitoring, Assessment, and Prediction
MBTA	Migratory Bird Treaty Act
mG	milligauss
mg/L	milligrams per liter
MHW	mean high water
mi	statute mile
MLW	mean low water
mm	millimeters
MMPA	Marine Mammal Protection Act
MOA	Memorandum of Agreement
MP	milepost
mph	miles per hour
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSL	mean sea level
MW	megawatt
MWh	megawatt-hours
N <sub>2</sub> O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NASCA	North American Submarine Cable Association
TNEC	The Narragansett Electric Company d/b/a National Grid
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NGO	non-governmental organization
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
nm	nautical mile
NO	nitric oxide
NO <sub>2</sub>	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration

NOAA Fisheries	National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NO <sub>x</sub>	nitrogen oxide
NPS	National Park Service
NRHP	National Register of Historic Places
NSR	noise sensitive receptors
NVIC	Navigation Vessel Inspection Circular
NWR	national wildlife refuge
O&M	operations and maintenance
OCS	Outer Continental Shelf
OER	Rhode Island Office of Energy Resources
OPAREA	US Navy Atlantic Fleet Narragansett Bay Operating Area
OREI	Offshore Renewable Energy Installation
OSHA	Occupational Safety and Health Administration
OTDR	optical time domain reflectometer
μPa	micropascal
PATON	private aids to navigation
PPA	power purchase agreement
ppm	parts per million
ppt	parts per thousand
Project	Block Island Wind Farm and Block Island Transmission System
PSO	protected species observer
psu	practical salinity units
PTS	permanent threshold shift
PUC	Rhode Island Public Utilities Commission
QDC	Quonset Development Corporation
RAM	Range Dependent Acoustic Model
RES	renewable energy standard
RFP	Request for Proposal
RI Ocean SAMP	Rhode Island Ocean Special Area Management Plan
RIDEM	Rhode Island Department of Environmental Management
RIDEP	Rhode Island Department of Environmental Protection
RIDOT	Rhode Island Department of Transportation
RIEDC	Rhode Island Economic Development Corporation
RIHPHC	Rhode Island Historical Preservation and Heritage Commission
RIPDES	Rhode Island Pollutant Discharge Elimination System



RISAA	Rhode Island Saltwater Anglers Association
RIWINDS	Rhode Island Winds Program
RMS	root mean square
ROV	remotely operated vehicle
ROW	right-of-way
rpm	rotations per minute
RSZ	rotor-swept zone
SAMP	Special Area Management Plan
SAV	submerged aquatic vegetation
SCADA	supervisory control and data acquisition
SEL	sound exposure level
SFA	Sustainable Fisheries Act
SHPO	State Historical Preservation Office
SMA	Seasonal Management Area
SPCC Plan	Spill Prevention, Control and Countermeasure Plan
SPI	sediment profile imaging
SPL	sound pressure level
THPO	Tribal Historic Preservation Office
TSS	Traffic Separation Schemes
TSS	total suspended solids
TTS	temporary threshold shift
URI	University of Rhode Island
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
UXO	unexploded ordnance
VIA	Visual Impact Assessment
VOC	volatile organic compounds
VRAP	Visual Resources Assessment Procedure
VTR	vessel trip report
WMA	wildlife management area
WTG	wind turbine generator
ZOI	zone of influence

## 1.0 INTRODUCTION

### 1.1 Background

Deepwater Wind Block Island, LLC, a wholly owned indirect subsidiary of Deepwater Wind Holdings, LLC, proposes to develop the Block Island Wind Farm (BIWF), a 30 megawatt (MW) offshore wind farm located on average approximately 3 miles (mi) (4.8 kilometers [km])<sup>1</sup> southeast of Block Island, Rhode Island. The BIWF will consist of five, 6 MW wind turbine generators (WTGs), a submarine cable interconnecting the WTGs (Inter-Array Cable), and a 34.5-kilovolt (kV) transmission cable from the northernmost WTG to an interconnection point on Block Island (Export Cable). In connection with the BIWF, Deepwater Wind Block Island Transmission, LLC, also a wholly owned indirect subsidiary of Deepwater Wind Holdings, LLC, proposes to develop the Block Island Transmission System (BITS), a 34.5-kV alternating current (AC) bi-directional submarine transmission cable that will run 21.8 miles (35.1 km) from Block Island to the Rhode Island mainland (see Figure 1.1-1).

Deepwater Wind Block Island, LLC will construct, own, and operate the BIWF. Deepwater Wind Block Island Transmission, LLC will develop and construct the BITS and will likely transfer ownership of the BITS to The Narragansett Electric Company d/b/a National Grid (TNEC).<sup>2</sup> For purposes of this Environmental Report (ER), the two Deepwater Wind Holdings, LLC corporate entities associated with the development of the BIWF and BITS are collectively referred to as “Deepwater Wind.” Likewise, the BIWF and BITS are collectively referred to as “the Project.”

The Project will also include construction of one new substation at the site of an existing power generation facility on Block Island Power Company (BIPCO) property (Block Island Substation). The Block Island Substation will provide a point of interconnection for the power from the BIWF and will also be the point of interconnection for BITS on Block Island. The Block Island Substation will consist of two adjoining switchyards, one dedicated to the BIWF (BIWF Generation Switchyard) and the other dedicated to the BITS (BITS Island Switchyard). The Project will also include upgrades to the existing substation on the BIPCO property. The BITS will connect to the existing TNEC distribution system on the Rhode Island mainland via a new switchyard (Narragansett Switchyard) located in Narragansett, Rhode Island. The proposed Narragansett Switchyard will be located on municipally owned land located near the Narragansett Department of Public Works (DPW) maintenance facility in the Town of Narragansett, Rhode Island.

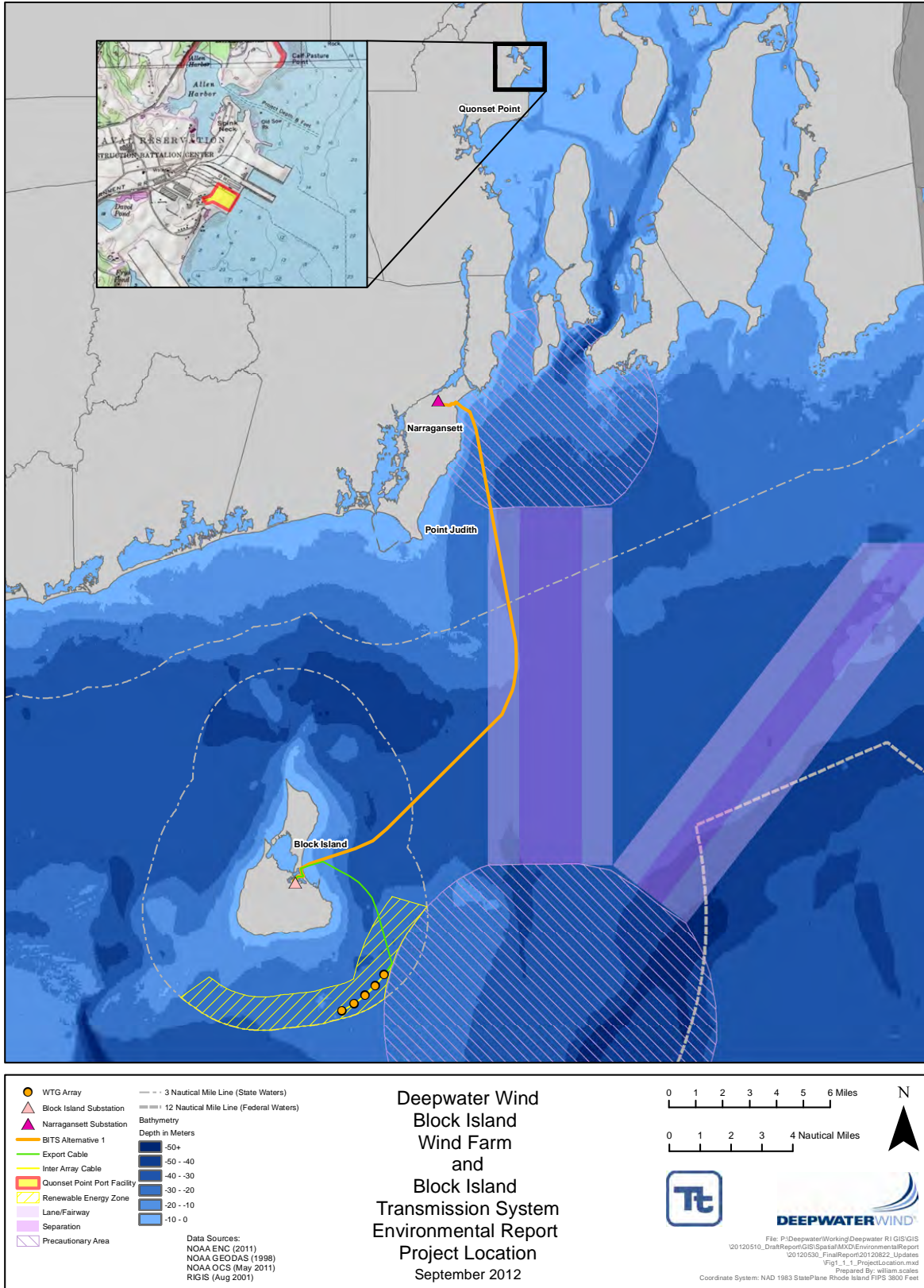
The BIWF is located entirely within Rhode Island state territorial waters. The BIWF WTGs, Inter-Array Cable, and a portion of the Export Cable are located within the Rhode Island Renewable Energy Zone established by the Rhode Island Coastal Resources Management Council (CRMC). The offshore BITS cable is located in Rhode Island state territorial waters and in federal waters on the outer continental shelf (OCS). Onshore cables, the substation, switchyards and other ancillary facilities associated with the BIWF and the BITS will be located in the Towns of New Shoreham (Block Island) and Narragansett in Washington County, Rhode Island. The onshore segments of the Export Cable and the BITS on Block Island will be collocated along the same route to the BIPCO property. Construction staging and laydown for offshore construction will occur at the Quonset Point port facility in North Kingstown, also in Washington County, Rhode Island.

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<sup>1</sup> Distances throughout the ER are provided as statute miles (mi) or nautical miles (nm) as appropriate, with kilometers in parentheses. For reference, 1 mi equals approximately 0.87 nm.

<sup>2</sup> National Grid is an international energy delivery company with its US headquarters in Waltham, Massachusetts. Through its subsidiaries, New England Power Company, Massachusetts Electric Company, Nantucket Electric Company, The Narragansett Electric Company, Boston Gas Company and Colonial Gas Company, National Grid provides electricity and natural gas to millions of customers in New England.

Figure 1.1-1 BIWF and BITS Project Location



The BIWF is expected to generate approximately 125,500 megawatt-hours (MWh) each year once it is fully operational, supplying enough energy to power approximately 17,200 Rhode Island households (DOE EIA 2010). The BIWF will be capable of supplying the majority of Block Island's electricity needs and will provide an alternative energy source to the diesel-fired generators that are currently used to power Block Island. The BITS will export excess power from the BIWF to the Rhode Island mainland and will be capable of supplying power from the existing TNEC distribution system to Block Island. On June 30, 2010, Deepwater Wind and TNEC executed a power purchase agreement (PPA) for the sale of power from the BIWF to TNEC. The Rhode Island Public Utilities Commission (PUC) issued a written order on August 16, 2010 approving the PPA, which was upheld by the Rhode Island Supreme Court.

Construction and operation of the BIWF and BITS will require federal, state, and local permits and environmental reviews. Deepwater Wind has prepared this ER to support the environmental assessment under the National Environmental Policy Act (NEPA), as amended (42 USC 4321 *et seq.*), as well as the environmental analysis required as part of other federal, state, and local approvals and consultations for the Project, which are discussed in Section 1.3. Deepwater Wind has developed the Project with consideration to the policies and standards specific to offshore wind energy projects established by the 2011 Rhode Island Ocean Special Area Management Plan (RI Ocean SAMP). The discussion of each environmental resource in this ER references the appropriate RI Ocean SAMP standard(s) regarding areas of particular concern, stakeholder outreach, and other requirements.

## 1.2 Purpose and Need

The purpose of the BIWF and BITS Project is to respond to the State of Rhode Island's expressed need for renewable energy as established by the Rhode Island Winds Program (RIWINDS), codified by Rhode Island State Legislations (RIGL §§ 39-26-1 *et seq* and 39-26.1-7); and as defined by the Joint Development Agreement (JDA) agreed upon by the State and Deepwater Wind. In combination, these actions called for:

- A renewable energy project that utilizes wind energy;
- A nameplate capacity of no more than 30 MWs and no more than 8 turbines;
- A location in state waters;
- Cost-effectiveness;
- Enhancement of the electric reliability and environmental quality of the Town of New Shoreham, Rhode Island; and
- Interconnection between Block Island and the Rhode Island mainland.

The following sections further define how the BIWF and BITS Project will satisfy these established needs.

### 1.2.1 The Need for a Renewable Energy Project

The need for the development of a renewable energy project was created by two pieces of Rhode Island State Legislation: RIGL §§ 39-26-1 *et seq* and 39-26.1-7.

Rhode Island established a renewable energy standard (RES) in 2004 that requires investor-owned utilities, including TNEC, to supply 16 percent of their retail electricity sales from renewable energy sources by 2019 (RIGL § 39-26-1 *et seq.*). The PUC adopted regulations for implementing the RES in 2007, which included a compliance requirement that began at 3 percent by the end of 2007. In 2009,

Rhode Island also adopted a separate long-term contracting standard that requires electric distribution companies to solicit proposals and enter into long-term contracts for capacity, energy and attributes from new renewable energy facilities for up to 90 MW by 2014. The Project will sell its output to a regulated utility, TNEC, which will help to meet these requirements.

Under RIGL § 39-26.1-7, TNEC was required to solicit proposals for the development of a renewable energy resource project that would not only provide a new source of renewable power but also enhance the electric reliability and environmental quality of the Town of New Shoreham, Rhode Island. Deepwater Wind responded to this request (RFP # 7067847: Rhode Island Energy Independence 1 Project) by proposing to develop both a 30 MW offshore wind farm that would interconnect directly to the Town of New Shoreham, Rhode Island on Block Island (the BIWF Project) and interconnect Block Island to the Rhode Island mainland electrical grid via a bi-directional submarine transmission cable (the BITS Project). Deepwater Wind was noticed as the successful bidder on September 25, 2008; which initiated the development of the BIWF and BITS Project.

### 1.2.2 The Need for Wind Energy

As previously stated the need for wind energy in the State of Rhode Island was established through:

- RIWINDS;
- The JDA; and
- RIGL § 39-26.1-7.

In 2006, the State of Rhode Island initiated RIWINDS to study the State's wind resource as a potential source of domestic energy supply. The goal of the program was to find means to supply 15 percent of the State's energy needs with wind-generated energy by 2012. Based on the state annualized average electricity demand of 1,000 MW, this goal amounted to 150 MW of energy, or approximately 400 MW of installed nameplate wind energy capacity due to the intermittent nature of wind energy generation. In 2007, the Rhode Island Office of Energy Resources (OER) commissioned a Phase I Siting Study to assess the feasibility of meeting the goal of supplying the 15 percent of the State's energy needs by constructing wind energy facilities in state and federal waters off the coast of Rhode Island. The final report concluded that 95 percent of Rhode Island's wind energy resource is located offshore (78 percent of which is located in state waters) and the quantity of existing wind resources is sufficient to meet the goal of supplying 15 percent of the State's total energy needs (ATM 2007).

The implementation of the study recommendations began in 2008, when the OER, the Rhode Island Economic Development Corporation (RIEDC), and the Rhode Island Department of Administration issued a request for proposal (RFP) for the development of an offshore wind farm in Rhode Island. On September 25, 2008, the State selected Deepwater Wind as its preferred developer under the RFP, and on January 2, 2009 the State of Rhode Island and Deepwater Wind Rhode Island, LLC entered into a JDA to develop the Project. The JDA includes the requirement for the construction and operation of a demonstration-scale offshore wind energy facility located in state waters that interconnects with and supplies energy to BIPCO on Block Island and Rhode Island mainland. The proposed Project, which will sell power to TNEC under a 20-year PPA, meets these requirements of the JDA.

RIGL § 39-26.1-7 establishes the requirement to construction a facility with "up to eight (8) wind turbines with aggregate nameplate capacity of no more than thirty (30) megawatts." Additionally, subsection (a) of RIGL § 39-26.1-7(a) states: "[I]t is in the public interest for the State to facilitate the construction of a

small-scale offshore wind demonstration project off the coast of Block Island, including an undersea transmission cable that interconnects Block Island to the mainland...” As designed, the proposed Project meets each of these requirements.

### **1.2.3 The Need for a Project of No More than 30 MWs**

As stated previously, the need for developing a wind energy project with aggregate nameplate capacity of no more than 30 MWs was established by RIGL § 39-26.1-7. This legislation also limited the number of turbines that could be constructed to a maximum of eight WTGs. As designed the proposed Project meets the statutorily established generation requirement with the installation of only five WTGs.

### **1.2.4 The Need for a Project in State Waters**

The need to locate an offshore wind energy project in state waters is established by:

- The findings of the RIWINDS;
- The JDA;
- The State of Rhode Island’s RFP # 7067847; and
- The RI Ocean SAMP.

According to the findings of the RIWINDS, 78 percent of wind energy resources are located in state waters.

The portion of the JDA to which the proposed Project is applicable, requires the construction of a wind energy facility located in state waters.

RFP #7067847, which was issued on April 3, 2008, indicated that the preferred location for a wind energy facility off the coast of Rhode Island is an area known as “Area K”, located in state waters south of Block Island. Area K was determined as a preferred offshore wind energy development area in the RIWINDS siting study. The proposed Project has been sited within Area K and thus complies with the findings of the RIWINDS siting study.

The RI Ocean SAMP, which received final approval on July 22, 2011, established a Renewable Energy Zone. The Renewable Energy Zone is an area approximately 1.2 mi (2 km) wide and extends from a location east to southwest of Block Island. This area has been selected by the State of Rhode Island through the RI Ocean SAMP as the most suitable area for offshore renewable energy. The Project has been sited within the established Renewable Energy Zone, and thus complies with the findings of the RI Ocean SAMP.

### **1.2.5 The Need for Cost-Effectiveness**

The need for a cost-effective renewable energy project is established by RIGL § 39-26.1-7(a) as amended by 2010 R.I. Pub. Laws 31 and 32, which require that the sale of power from a Project is “commercially reasonable.” This is defined under this legislation as meaning that both the terms and pricing must be reasonably consistent with what an experienced power market analyst would expect to see for a project of a similar size, technology and location.

In its Report and Order for Docket No. 4185, the PUC noted that “the General Assembly has instructed this Commission to accept the high cost of offshore wind technology for a project with limited economies of scale, so long as the slated costs, and concomitant PPA pricing, terms and conditions, duly reflect those

costs.” The PUC found in their review of the Project, that the pricing met the requirement of being “commercially reasonable.”

The Need for Enhancement of the Electric Reliability and Environmental Quality of the Town of New Shoreham, Rhode Island As stated in Section 1.2.1, the need for enhancing the electric reliability and environmental quality of the Town of New Shoreham, Rhode Island is established by RIGL § 39-26.1-7, The BIWF and BITS Project as proposed will be capable of satisfying nearly all of Block Island’s energy needs and will represent approximately 1.2 percent of Rhode Island’s forecasted generation (Tufts 2010). An Advisory Opinion prepared by the Rhode Island Department of Environmental Management (RIDEM) during the PUC review of the PPA found that the Project would provide Block Island and the region with “measurable environmental benefits” (RIDEM 2010). Specifically, the Project will provide an alternative energy source to the five existing diesel-fired generators operated by BIPCO that are currently used to power the Island thereby enhancing the electrical reliability for the Town as well as helping to stabilize the cost of electricity. The Project could also effectively displace the need for these generators, which could help to improve environmental quality by reducing air emissions from these sources.

### **1.2.6 The Need for an Interconnection between Block Island and the Rhode Island Mainland**

The need for interconnecting Block Island to the Rhode Island mainland is established by both RIGL § 39-26.1-7 and the JDA. As stated previously in Section 1.2.1., the proposed Project meets these requirements by including a submarine cable system that will interconnect the Project to electrical distribution facilities on both Block Island and the Rhode Island mainland.

## **1.3 Regulatory Framework**

Several federal, state, and local agencies have regulatory authority over the Project based on the location of the different Project components. The WTGs, Export Cable, and segments of the BITS will be located within Rhode Island state territorial waters. A segment of the BITS cable route is located on the OCS in federal territorial waters (Figure 1.1-1). The substation, upland cables, and ancillary Project facilities, such as construction and laydown staging areas, will be located onshore in the towns of New Shoreham, Narragansett, and North Kingstown in Washington County, Rhode Island.

### **1.3.1 Permits, Approvals, and Consultations**

Construction and operation of the BIWF and BITS will each require an Individual Permit from the U.S. Army Corps of Engineers (USACE) under Section 10 of the Rivers and Harbors Act (33 USC 403) and Section 404 of the Clean Water Act (CWA) (33 USC 1344). Prior to issuance of an Individual Permit, USACE must review the environmental effects and benefits of the Project in accordance with NEPA and other agency-specific statutes, regulations, and guidelines.

A Right-of-Way Grant (ROW Grant) from the U.S. Department of Interior’s (DOI) Bureau of Ocean Energy Management (BOEM) will be necessary for the portion of the BITS that traverses federal waters<sup>3</sup>. BOEM’s issuance of the ROW Grant further requires review of the environmental effects and benefits of the Project in accordance with NEPA. Federal permitting agencies are also required to comply with Section 7 of the Endangered Species Act (ESA), the Magnuson-Stevens Fishery Conservation and

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<sup>3</sup> ROW Grant request was submitted to BOEM on October 7, 2011. A General Activities Plan was submitted to BOEM on April 20, 2012. BOEM published a request for competitive interest in the Federal Register on May 23, 2012. BOEM published a Determination of No Competitive Interest on August 7, 2012.

Management Act (MSFCMA), Section 106 of the National Historic Preservation Act (NHPA), and Section 307 of the Coastal Zone Management Act (CZMA).

At the state level, an Assent from the CRMC under the Rhode Island Coastal Resources Management Program (CRMP) is required for both the BIWF and the BITS. The CRMC Assent also constitutes federal consistency concurrence under the CZMA (16 USC 1452). A submerged lands lease from CRMC is required for the BIWF and that portion of the BITS that traverses state territorial waters. The RIDEM will review the effect of the Project on the state's water quality standards and protected species.

Table 1.3-1 provides a list of the required approvals and consultations, the anticipated timeline, and the status as of the writing of this report. Records of agency consultations are provided in Appendix A.

### **1.3.2 National Environmental Policy Act**

NEPA and implementing regulations (40 CFR 1500-1508) require that federal agencies consider the effects of their actions on the environment. Actions that are not listed as categorically excluded or considered an administrative action not subject to NEPA must be reviewed, and an Environmental Assessment (EA) and/or an Environmental Impact Statement (EIS) must be prepared to document the analysis. Issuance of the USACE Individual Permit and BOEM ROW Grant are considered federal actions subject to NEPA review. The USACE will act as the federal Lead Agency for the NEPA review of the Project. BOEM will act as a Cooperating Agency.

Deepwater Wind has prepared this ER to support the environmental assessment under NEPA, as well as the environmental analysis required as part of other federal, state, and local permits and approvals for the Project. The scope of this ER has been established through numerous pre-application meetings with agencies and review of permit application requirements. The USACE, as the Lead Agency, will prepare a joint EA with the Cooperating Agency (BOEM) based on the information presented in this ER, input from the Cooperating Agency, and public comments in response to the notice of application for a USACE Individual Permit. The EA will be prepared in accordance with Council on Environmental Quality (CEQ) NEPA implementing regulations and agency-specific NEPA implementing regulations and guidelines. If the review indicates that the Project will not have a significant effect on the environment considering the measures taken to avoid, minimize, and mitigate impacts, the Lead and Cooperating Agency will issue a joint Finding of No Significant Impact (FONSI), thereby concluding the NEPA review.

### **1.3.3 Rhode Island Coastal Resources Management Program Assent and Federal Consistency Certification**

Deepwater Wind has designed the proposed Project to comply with Rhode Island's approved CRMP. Deepwater Wind has specifically located the BIWF WTGs within the Rhode Island Renewable Energy Zone established in the RI Ocean SAMP. Deepwater Wind will submit an application to the CRMC for an Assent. Issuance of the Assent will constitute concurrence with the federal consistency certification. The Project is considered a Category B activity. An application for a Category B Assent is required to demonstrate the following under Section 300.1 of the CRMP:

- 1. Demonstrate the need for the proposed activity or alteration;*

Section 1.2 of this ER demonstrates the purpose and need for the proposed Project.



Table 1.3-1 Permits, Approvals, and Consultations

Permit, Approval, or Consultation	Regulatory Authority(ies)	Filing Date	Anticipated Approval	Status
<b>Federal</b>				
Individual Permit pursuant to Section 10 Rivers and Harbors Act (33 USC §403) & Section 404 Clean Water Act (CWA) (33 USC §1344)	USACE, New England District	9/14/2012	Q1 2013	Pre-application meetings with USACE. Application submitted with this ER.
ROW Grant for BITS on the OCS pursuant to the Outer Continental Shelf Lands Act (43 USC §§1331 <i>et seq.</i> ) and implementing regulations (30 CFR 250, 285, 290)	BOEM	Q4 2011	Q1 2013	ROW Grant request was submitted to BOEM on October 7, 2011. A General Activities Plan was submitted to BOEM on April 20, 2012. BOEM published request for competitive interest in Federal Register on May 23, 2012. BOEM published a Determination of No Competitive interest on August 7, 2012. This ER is submitted to BOEM in accordance with 30 CFR §585.646.
Consultation and Incidental Take Authorization (IHA) pursuant to the Marine Mammal Protection Act (MMPA) (16 USC §§1361 <i>et seq.</i> )	National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NOAA Fisheries)	Q4 2012	Q2 2013	Pre-application consultation has been ongoing since 2009. Studies to support consultation have been completed and are provided in this ER (Section 4.5, Appendix N).
Review pursuant to the National Environmental Policy Act (NEPA) (42 USC §§4321 <i>et seq.</i> )	USACE, BOEM	9/14/2012	Q1 2013	Scoping with primary federal permitting agencies has been ongoing since 2009. Required information to support NEPA review is provided in this ER.
Consultation pursuant to Section 7 of the Endangered Species Act (ESA) (16 USC §§1531 <i>et seq.</i> )	NOAA Fisheries, U.S. Fish and Wildlife Service (USFWS)	Ongoing	Q1 2013	Pre-application consultation has been ongoing since 2009. Surveys completed in accordance with agency-reviewed protocols. Information to support consultation between federal permitting agencies and federal wildlife resource agencies provided in this ER (Section 4.5.7, Appendix N, Appendix O).
Consultation pursuant to the Migratory Bird Treaty Act (MBTA) (16 USC §§703 <i>et seq.</i> )	USFWS	Ongoing	Q1 2013	Pre-application consultation has been ongoing since 2009. Surveys completed in accordance with agency-reviewed protocols. Information to support consultation with USFWS provided in this ER (Section 4.5.6, Appendix O).
Essential Fish Habitat (EFH) Consultation pursuant to the Magnuson-Stevens Act (16 USC §§1801 <i>et seq.</i> )	NOAA Fisheries	Ongoing	Q1 2013	Pre-application consultation has been ongoing since 2009. Information to support consultation between federal permitting agencies and federal wildlife resource agencies provided in this ER (Section 4.5.3).
Consultation pursuant to Section 106 of the National Historic Preservation Act (NHPA) (16 USC §§470 <i>et seq.</i> )	Rhode Island Historical Preservation and Heritage Commission (RIHPHC) State Historic Preservation Office (SHPO), Narragansett Tribe, Wampanoag Tribe	Ongoing	Q1 2013	Pre-application consultation ongoing since 2009. Cultural resource surveys completed in accordance with agency-reviewed protocols, under permit from the RIHPHC with participation by tribes. Information to support consultation provided in this ER (Section 4.7, Appendix P, Appendix Q, Appendix R).
Water Quality Certification under Section 401 of the CWA (33 USC §1341)	Rhode Island Department of Environmental Protection (RIDEM)	Q3 2012	Q1 2013	ER will be submitted to RIDEM to support review.
Determination of No Hazard (14 CFR 77)	Federal Aviation Administration (FAA)	4/2/2012	Q1 2013	Proposed lighting and marking provided in this ER (Section 4.11). A Notice of Proposed Construction for each WTG was filed on April 2, 2012.

**Table 1.3-1 Permits, Approvals, and Consultations (continued)**

Permit, Approval, or Consultation	Regulatory Authority(ies)	Filing Date	Anticipated Approval	Status
Approval for Private Aids to Navigation (PATON) (33 CFR 66)	U.S. Coast Guard (USCG)	Q4 2013	Q4 2013	Proposed lighting and marking developed in consultation with the USCG and provided in this ER (Section 4.11, Appendix U).
U.S. Environmental Protection Agency (USEPA) Air Conformity Determination pursuant to the Clean Air Act (42 USC §§7401 <i>et seq.</i> )	USEPA	Q3 2012	Q1 2013	Air emissions analysis completed. Information to support review provided in this ER (Section 4.4, Appendix K).
<b>State</b>				
State Assent under the Rhode Island Coastal Resources Management Program (RIGL 46-23-1 <i>et seq.</i> )	CRMC	Q3 2012	Q2 2013	Pre-application meetings with CRMC, Habitat Advisory Board (HAB), Fisheries Advisory Board (FAB) complete. ER submitted with application to CRMC.
Concurrence with Federal Consistency Certification pursuant to Section 307 of the Coastal Zone Management Act (CZMA) (16 USC §1456)	CRMC	Q3 2012	Q2 2013	The CRMC Assent will serve as the State's concurrence with the federal consistency certification.
Submerged Lands Lease	CRMC	Q2 2013	Q3 2013	Will be obtained after CRMC Assent.
Coastal and Freshwater Wetlands Permit (RIGL 46-23-6)	CRMC/RIDEM	Q4 2011	Q4 2012	Wetland Edge Verification Application for BIPCO property submitted December 12, 2011. Edge verification received on January 31, 2012 (Appendix A). The Narragansett Switchyard application is included as part of the BITS Assent application.
Consultation under the Rhode Island Endangered Species Act (RIGL 20-37-1 <i>et seq.</i> )	RIDEM	Ongoing	Q1 2013	Information provided in this ER to support consultation (Section 4.5.7).
Consultation under the Rhode Island Historic Preservation Act (RIGL 42-45-1 <i>et seq.</i> )	RIHPHC	Ongoing	Q1 2013	Pre-application consultation has been ongoing since 2009. Surveys completed in accordance with agency-reviewed protocols, under permit from RIHPHC with participation by the tribes. Information to support consultation provided in this ER (Section 4.7, Appendix P, Appendix Q, Appendix R).
Rhode Island Pollution Discharge Elimination System (RIPDES) General Permit for Storm Water Discharge Associated with Construction Activity pursuant to Section 402 of the CWA (33 USC §1342)	RIDEM	Q2 2013	Q3 2013	Draft storm water pollution prevention plan prepared and included in this ER. Deepwater Wind will file a Notice of Intent prior to construction.
Physical Alteration Permit and easement for cable and overhead electric lines in State Roadways	Rhode Island Department of Transportation (RIDOT)	Q3 2012	Q3 2013	Application will be filed in Q3 2012.
<b>Local</b>				
Special Use Permit for work on BIPCO property	Town of New Shoreham – Zoning Board	11/7/11	4/3/12	Approved on 4/3/12, 5-0 (Favorable) (Appendix A)
Development Plan Review for work on BIPCO property	Town of New Shoreham – Planning Board	11/7/11	4/11/12	Approved on 4/11/12, 5-0 (Favorable) (Appendix A)
Special Use Permit for work in wetland buffer and on land zoned for public use	Town of Narragansett	Q3 2012	Q1 2013	Application will be submitted in Q3 2012.

2. *Demonstrate that all applicable local zoning ordinances, building codes, flood hazard standards, and all safety codes, fire codes, and environmental requirements have or will be met; local approvals are required for activities as specifically prescribed for nontidal portions of a project in Sections 300.2, 300.3, 300.6, 300.8, 300.9, 300.11, 300.13, 300.15 and 300.17; for projects on state land, the state building official, for the purposes of this section, is the building official;*

Section 4.10 discusses applicable zoning approvals. Appendix A provides a copy of the special use permit approval from the Town of New Shoreham for the Project facilities on the BIPCO property.

3. *Describe the boundaries of the coastal waters and land area that are anticipated to be affected;*

Section 3.1 and Figures 3.1-1 through 3.1-4 describe the boundaries of the coastal waters and land area that will be affected by the Project.

4. *Demonstrate that the alteration or activity will not result in significant impacts on erosion and/or deposition processes along the shore and in tidal waters;*

Section 4.2 of this ER discusses soil erosion control measures that are proposed for the Project. Deepwater Wind will obtain a permit from RIDEM under the Rhode Island Pollutant Discharge Elimination System (RIPDES) that will include best management practice measures for erosion control during construction of the onshore portions of the Project. Implementation of these measures will assure impacts from erosion or deposition processes along the shore and in tidal waters are avoided and/or minimized to the extent possible. Offshore construction and Project operation will not affect erosion or deposition processes along the shore and in tidal waters.

5. *Demonstrate that the alteration or activity will not result in significant impacts on the abundance and diversity of plant and animal life;*

Section 4.5 of this ER demonstrates that the Project will not result in significant impacts on the abundance and diversity of plant and animal life.

6. *Demonstrate that the alteration will not unreasonably interfere with, impair, or significantly impact existing public access to, or use of, tidal waters and/or the shore;*

The WTGs are located within the Renewable Energy Zone established in the RI Ocean SAMP. Sections 4.9 through 4.12 of this ER further demonstrate that the Project will not unreasonably interfere with, impair, or significantly impact existing public access to, or use of, tidal waters and/or the shore.

7. *Demonstrate that the alteration will not result in significant impacts to water circulation, flushing, turbidity, and sedimentation;*

Sections 4.2 and 4.3 of this ER demonstrate that the Project will not result in significant impacts to water circulation, flushing, turbidity, and sedimentation.

8. *Demonstrate that there will be no significant deterioration in the quality of the water in the immediate vicinity as defined by DEM;*

Section 4.3 of this ER demonstrates that the Project will not result in significant deterioration of the quality of the water in the immediate vicinity of the Project. RIDEM will review the information presented in this ER and will issue a water quality certification as appropriate.

9. *Demonstrate that the alteration or activity will not result in significant impacts to areas of historic and archaeological significance;*

Section 4.7 of this ER demonstrates that the Project will not result in significant impacts to areas of historic and archaeological significance.

10. *Demonstrate that the alteration or activity will not result in significant conflicts with water-dependent uses and activities such as recreational boating, fishing, swimming, navigation, and commerce, and;*

The WTGs are located within the Renewable Energy Zone established in the RI Ocean SAMP. Sections 4.9 through 4.12 of this ER demonstrate that the Project will not result in significant conflicts with water-dependent uses and activities such as recreational boating, fishing, swimming, navigation, and commerce.

11. *Demonstrate that measures have been taken to minimize any adverse scenic impact.*

Section 4.8 and Appendix S of this ER provide the results of the Visual Impact Assessment conducted for the BIWF and BITS and details the measures Deepwater Wind has taken to minimize adverse scenic impacts.

#### **1.3.4 Agency and Public Outreach**

In 2009, Deepwater Wind began to meet with federal, state, and local officials to discuss the Project. At these meetings, Deepwater Wind provided background information on the Project including the scope, proposed environmental surveys and evaluations, and the anticipated timing of the permit applications.

During the past 3 years, Deepwater Wind has had extensive meetings with federal, state, and local representatives to describe the proposed Project and solicit early input. Deepwater Wind initiated an information exchange process prior to the formal filing of this ER and associated permit applications necessary for the approval BIWF and BITS Project. Deepwater Wind has also completed the necessary pre-application meeting required by the CRMC. Table 1.3-2 summarizes the agency coordination and pre-application meetings conducted on behalf of the Project. Records of official agency correspondences have been included as Appendix A. Deepwater Wind anticipates that these early sessions will lead to a more streamlined and effective permitting process for the proposed Project.

Similar information was also provided during this time period to stakeholders representing various interest groups, including the commercial and recreational fishing industry, members of the commercial shipping and recreational boating community, and non-governmental organizations (NGOs), such as the Conservation Law Foundation, the Audubon Society, The Nature Conservancy, the National Wildlife Federation, the National Resource Defense Council, Save the Bay, and The Ocean Conservancy.

Deepwater Wind has held a series of informational outreach meetings and open houses on Block Island beginning in 2009. Deepwater Wind first met with Town of New Shoreham (Block Island) elected and appointed officials immediately after execution of the JDA in January 2009. The first informational presentation to the Block Island Town Council and members of the public was held on January 21, 2009.

**Table 1.3-2 Summary of Agency Consultation**

Agency	Date	Consultation Summary
USACE, CRMC	2/19/2009	Project introduction meeting.
USACE, CRMC, EPA, NOAA/NMFS, USFWS, USCG, RIDEM	5/5/2009	Pre-application meeting.
MMS (now BOEM), ACOE, CRMC, DWW & RI commercial fishing interests	7/23/2009	Initial outreach to the fishing community.
USACE, BOEM (via phone), Narragansett THPO, NOAA, CRMC, RIDEM, RI SHPO	7/26/2011	Inter-agency pre-survey meeting for marine geophysical, geotechnical, archaeological, and benthic surveys.
BOEM	8/4/2011	Pre-survey meeting for marine geophysical, geotechnical, archaeological, and benthic surveys.
USACE, CRMC	11/4/2011	Pre-application meeting consultations are ongoing.
CRMC, Habitat Advisory Board. (HAB)	12/19/2011	Pre-application Project meeting to discuss habitats in accordance with the RI Ocean SAMP.
CRMC, Fisheries Advisory Board (FAB)	1/4/2012	Pre-application Project meeting to discuss fisheries in accordance with the RI Ocean SAMP.
CRMC, HAB and FAB	5/3/2012	Second pre-application Project meeting to discuss habitat and fisheries.
RIDEM	6/27/2012	Pre-application meeting.
RIDEM, Division of Fish & Wildlife	9/7/2012	Pre-application meeting to discuss fisheries effects and time of year construction windows.

Deepwater Wind invited the general public to a series of public outreach meetings during the period of January to March 2009. The public outreach meetings included discussions on the Project and monitoring equipment that would be deployed on Block Island including a meteorological tower and other wind, bird, and bat monitoring equipment. Each of these meetings and their summaries were published in The Block Island Times.

Deepwater Wind also invited the general public to a series of open houses during the late spring and summer 2010 and 2011 when Block Island's seasonal population peaks. The meetings were held at public venues and community centers including the Atlantic Inn, Spring House, Dead Eye Dick's, St. Andrew's Parish Center, and Hotel Manisses. Deepwater Wind also held meetings targeted towards specific interest groups including Real Estate Brokers on March 3, 2010 and the Chamber of Commerce and Tourism Council on September 27, 2010.

In December 2011, Deepwater Wind hosted an open house in Narragansett, Rhode Island that focused on the proposed mainland route for the BITS. The open house was advertised in the local and regional newspapers.

Deepwater Wind is committed to continued stakeholder communications and effective public outreach. The public outreach program includes the following:

- Employing a full-time resident of Block Island to be the local point of contact and hosting office hours every week on Block Island, the office was opened in 2009;
- Funding a liaison to support communication with the commercial and recreational fishing community;

- Identifying and meeting with local associations, citizen groups, and other NGOs to inform them about the Project and address any issues that may be raised, for example, Deepwater Wind provides regular Project updates to the Block Island Electric Utility Task Group and the Block Island Residents Association;
- Meeting with key federal, state, and local agencies and elected officials and other potentially interested stakeholders to identify issues;
- Holding public open houses to provide information about BIWF and BITS and;
- Maintaining a Project specific web site with information on the status of the Project (<http://dwwind.com>). Details available on the web site include:
  - A description of the Project, including photos and visual simulations of the BIWF;
  - News briefs;
  - Contact for additional information; and
  - Other appropriate Project-related information.

## 2.0 PROPOSED ACTION AND ALTERNATIVES

### 2.1 Proposed Action

Deepwater Wind anticipates that the Lead and Cooperating Agencies will define the Proposed Action, for the purpose of NEPA review, as the issuance of the USACE Individual Permit (for the construction, operation, and decommissioning of the BIWF and BITS) and the BOEM ROW Grant for the BITS (for construction, operation, and decommissioning of the BITS). Because construction, operation, and decommissioning of the BIWF and BITS are considered a consequence of the federal permit issuance, this ER evaluates the environmental impacts and benefits of the Project.

### 2.2 Methodology for Evaluating Alternatives

In developing the BIWF and BITS, Deepwater Wind considered alternatives to the development of the proposed Project (the Preferred Alternative), including:

- The No Action Alternative
- Alternative locations for the BIWF Project infrastructure, including:
  - alternative locations for the WTG Array
  - alternative locations for the BIWF Collection System
- Alternative locations for the BITS Project infrastructure, including:
  - alternative locations for the BITS Cable route
  - alternative locations for the BITS switchyards
- Alternative technologies for the BIWF, including:
  - alternative WTGs
  - alternative foundations

In evaluating the comparative merits of the various alternatives, Deepwater Wind considered not only environmental impacts of the alternatives, but also the ability of the alternatives to achieve the purpose and need of the Project. As described in Section 1.0, the proposed Project will help satisfy the need for renewable energy as established by the RIWINDS program, codified by Rhode Island State Legislations (RIGL §§ 39-26-1 *et seq* and 39-26.1-7); and as defined by the Joint Development Agreement (JDA) executed between the State and Deepwater Wind. In combination, these actions called for a renewable energy project that:

- utilizes wind energy;
- has a name plate capacity of no more than 30 MW and consists of no more than 8 WTGs;
- is located in state waters;
- is cost-effective;
- enhances the electric reliability and environmental quality of the Town of New Shoreham, Rhode Island; and
- interconnects Block Island and the Rhode Island mainland.

Sections 2.3 through 2.5 discuss the various alternatives considered and provide a comparison of the alternatives with respect to their environmental, technical, and financial consequences. Section 2.6 summarizes the preferred alternative.

## 2.3 No Action Alternative

Under the No Action Alternative, the federal permitting agencies would not issue the necessary permits for the Project, and therefore, the Project would not be constructed. If Deepwater Wind did not undertake the development of the BIWF and BITS, the impacts directly associated with the construction and operation of the Project would be avoided. However, as a consequence, the environmental benefits and objectives of the Project to deliver renewable, clean energy to Rhode Island, including Block Island residents, would not be realized. Specifically, the BITS would be the first cable interconnecting Block Island with the regional transmission system onshore, providing access to substantially lower cost and cleaner electricity for Block Island residents. Also, a smaller-scale offshore wind project within the Rhode Island Renewable Energy Zone is an important step in meeting both Rhode Island's renewable energy goals as well as regional and national goals of increasing economic growth, improving environmental quality, and enhancing national energy security. For these reasons the No Action Alternative is not considered to be a preferred alternative and is therefore excluded from further analysis in this ER.

## 2.4 Alternative Location(s) for the BIWF and BITS Infrastructure

### 2.4.1 WTG Array Alternatives

The policy of the State of Rhode Island, principally the RI Ocean SAMP, dictated the viable alternative locations for the WTG Array. Through the RI Ocean SAMP process, the State of Rhode Island evaluated existing environmental conditions and marine uses to designate an area for renewable energy development within state territorial waters that would minimize the potential impact to natural resources (benthic ecology, birds, marine, mammals, sea turtles, fisheries resources, and habitat), and existing human uses (commercial and recreational fishing, cultural and historic sites, recreation and tourism, marine transportation, navigation, and infrastructure). This designated area is referred to as the "Renewable Energy Zone." Given the requirement for the Project to be located within the Renewable Energy Zone established by the RI Ocean SAMP and within state waters of Rhode Island, all potential locations not within this established Zone were excluded from further siting consideration.

Within the Renewable Energy Zone, the analysis of potential locations for the WTG Array considered a variety of factors. Specifically, the following preliminary Project-specific siting criteria were applied to both minimize environmental impacts and ensure the economic and technical feasibility of the Project:

- Avoid hard substrates (e.g., cobble, boulders, bedrock) that could adversely affect Project costs and feasibility.
- Locate the WTGs in areas of the greatest wind energy potential with a minimum spacing of not less than 5 rotor-diameters (approximately 0.5 mi [805 m]) to maximize Project productivity and cost-effectiveness to enable the BIWF to maximize the "Wind Outperformance Adjustment Credit" provided for in the PPA, which benefits Rhode Island rate payers.
- Locate the WTGs as far as possible from shore while still remaining within the state waters and the Renewable Energy Zone to minimize potential visual impact to the maximum extent possible.
- Avoid the crossing of navigation features such as vessel traffic lanes, ferry routes, and boat racing routes to minimize potential impacts to marine uses.



- Avoid important marine habitats including hard bottom complexes (e.g., cobble, boulders) to minimize potential impacts to marine species.
- Avoid avian migration routes and foraging areas to minimize potential impact to avian species.
- Avoid cultural marine resource sites (pre-contact and post-contact).

These criteria were then evaluated against applicable federal and state guidance, agency consultation, and public outreach. Based upon the results of this analysis, two potential WTG Array locations were identified within the Renewable Energy Zone. As depicted in Figure 2.4-1, WTG Array Alternative 1 are located approximately 3 mi (4.8 km) southwest of Block Island; and WTG Array Alternative 2 is located approximately 3 mi (4.8 km) southeast of Block Island.

Both WTG Array Alternatives 1 and 2 are located within the Renewable Energy Zone and are comparable in terms of visual and wind resources selection criteria; however, WTG Array Alternative 1 was found to have several disadvantages. Specifically, WTG Array Alternative 1 is located near a potential sea duck foraging area and thus could have a greater impact on avian species. Alternative 1 will require that the Inter-Array Cable pass through the ridge of a terminal moraine that extends south from Block Island's southern shore. Installation of cables through this area of moraine will likely require cutting techniques that will have more significant environmental impacts than installation via jet plow. Alternative 1 requires the Export Cable to traverse an area of undisturbed cobbles, which poses both a potential geophysical obstruction to cable installation and impacts to benthic habitat.

In contrast, WTG Array Alternative 2 is primarily located in soft bottom substrate and avoids areas of hard bottom, which minimizes potential impacts to important marine habitats and obstructions to WTG and cable installation. In addition, Alternative 2 creates a shorter route for the Export Cable to Block Island and allows for the use of jet plowing for installation, which reduces both environmental impacts and costs.

For these reasons, Deepwater Wind determined that the WTG Array Alternative 2 was preferable to WTG Array Alternative 1 within the RI Ocean SAMP Renewable Energy Zone and Alternative 1 was thus excluded from further consideration.

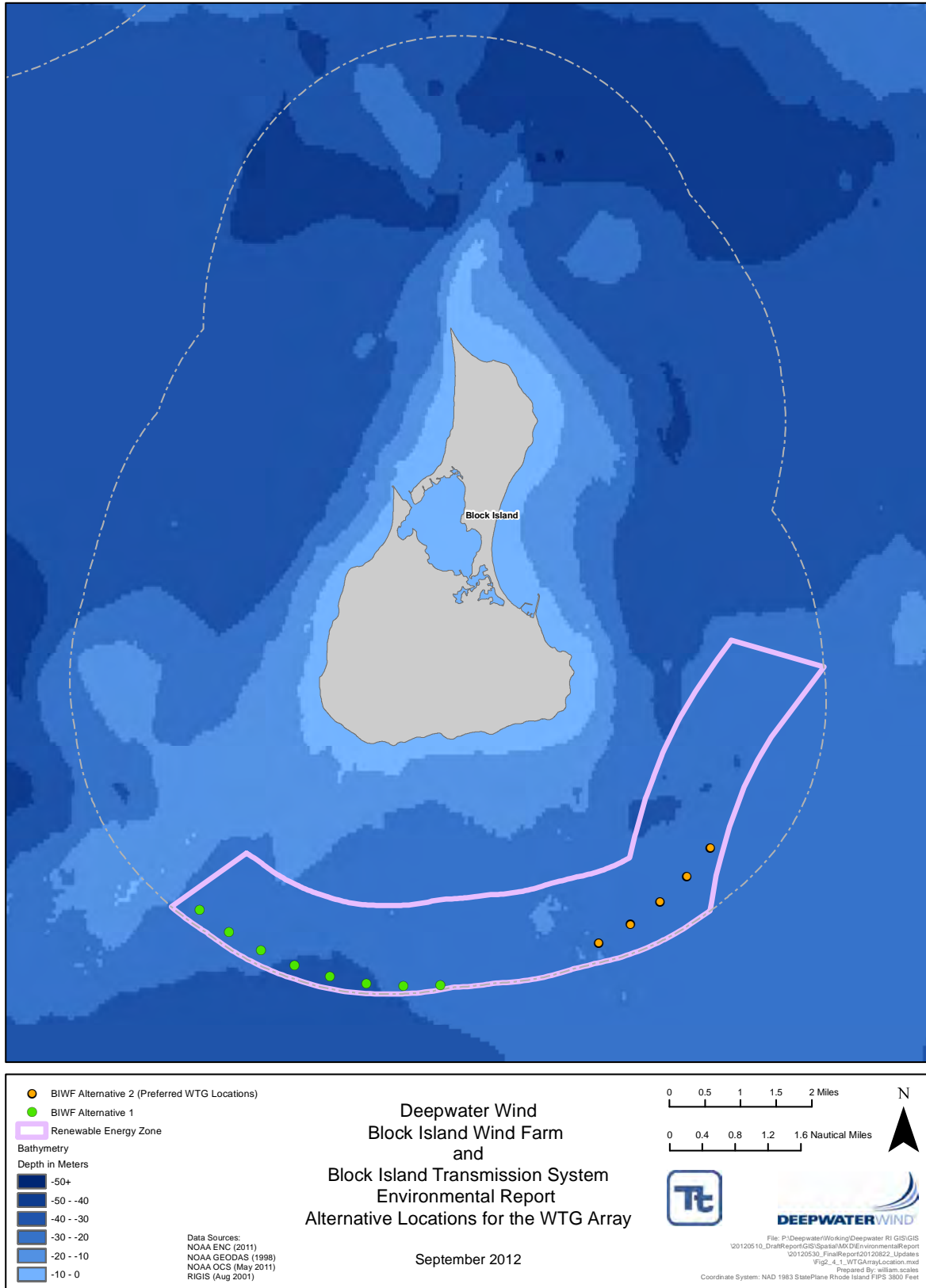
#### **2.4.2 BIWF Collection System Alternatives**

The BIWF Collection System comprises the following components:

- BIWF Generation Switchyard (part of the Block Island Substation);
- Submarine and terrestrial Export Cable; and
- Submarine Inter-Array Cable.

The following sections discuss the alternatives considered for each component of the BIWF Collection System and compare the alternatives for their environmental, technical, and financial consequences. The siting of the Inter-Array Cable has been dictated by the selection and studies performed in support of the WTG Array alternatives analysis and therefore is not discussed further in this section.

Figure 2.4-1 Alternative Locations for the WTG Array



### 2.4.2.1 Block Island Substation and Switchyard Alternatives

The BIPCO property complex located at the corner of Beach and Ocean Avenues is the only electrical distribution facility on Block Island and therefore the only location where the BIWF and BITS could interconnect.<sup>4</sup> However, Deepwater Wind evaluated the potential location for the Block Island Substation, which includes the BIWF Generation and BITS Island Switchyards, within the BIPCO property boundary. Deepwater Wind employed the following environmental and engineering/construction criteria to identify a site for the Block Island Substation:

- Minimize use of locations with contamination;
- Avoid or minimize impacts to wetlands and associated buffers;
- Avoid or minimize disturbance to previously undisturbed areas within the BIPCO property;
- Select a site that will minimize visual impacts to surrounding areas; and
- Select a site that will minimize impacts to other sensitive environmental receptors in surrounding area.

Based on these criteria, three potential substation locations for the new Block Island Substation were identified within the existing BIPCO property complex (Figure 2.4-2).

As depicted in Figure 2.4-2, Substation Alternative A is located on the eastern side of the BIPCO property, west of the DOT garage. Substation Alternative B is located on the southwestern side of the BIPCO property complex on land that is currently owned by the estate of Marjorie McGinnes, and currently contains one existing residential structure and one existing light industrial structure. Substation Alternative C is located at the northern corner of the BIPCO complex at the intersection of Beach and Ocean Avenues.




Based on the interconnection and substation location selection criteria and results of the site-specific environmental and engineering surveys, it was determined that all three alternatives on the BIPCO property complex are feasible for development. However, based on feedback from the BIPCO property owner, Alternative C was removed from further consideration. On April 3, 2012, the Town of New Shoreham Zoning Board of Review unanimously approved a Special Use Permit for the Block Island Substation. The Special Use Permit allows for construction of the Block Island Substation at either the Alternative A or B, but indicates a preference for Alternative A, which is also Deepwater Wind's preferred alternative. A copy of the decision is included in Appendix A. On April 11, 2012, the Town of New Shoreham Planning Board unanimously approved the Development Plan Review for the proposed work on the BIPCO property. A copy of the decision is included in Appendix A. Given the viability of both Substation Alternatives A and B, each of these locations is considered for development as part of the Preferred Alternative.

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<sup>4</sup> Physically other locations would be possible; however, any alternative would then also involve interconnecting with the BIPCO site, so other alternatives were excluded from further consideration as the impacts would always be greater than the evaluated alternative.

Figure 2.4-2 Block Island Substation Alternatives



<ul style="list-style-type: none"> <li><span style="color: orange;">---</span> Proposed Overhead Route (Block Island)</li> <li><span style="color: yellow;">---</span> Proposed Buried Route</li> <li><span style="border: 1px solid green; display: inline-block; width: 15px; height: 10px;"></span> Substation Alternative A (Preferred Alternative)</li> <li><span style="border: 1px solid blue; display: inline-block; width: 15px; height: 10px;"></span> Substation Alternative B</li> <li><span style="border: 1px solid pink; display: inline-block; width: 15px; height: 10px;"></span> Substation Alternative C</li> <li><span style="border: 1px solid purple; display: inline-block; width: 15px; height: 10px;"></span> Existing BIPCO Substation</li> </ul>	<p>Deepwater Wind Block Island Wind Farm and Block Island Transmission System Environmental Report Block Island Substation Alternatives</p>	<p>0 50 100 150 200 Feet</p> <p>0 20 40 60 Meters</p> <p style="text-align: right;">N</p> 
<p>Data Sources: ESRI World Imagery (May 2010)</p>	<p>September 2012</p>	  <p style="font-size: 8px;">             File: P:\Deepwater\Working\Deepwater RI GIS\GIS              10120510_DraftReport\GIS\Spatial\MXD\EnvironmentalReport              10120530_FinalReport\20120822_Updates              Fig2_4_2_BlockIslandSubstation\A.mxd              Prepared By: william.scales              Coordinate System: NAD 1983 UTM Zone 18N         </p>

### 2.4.2.2 Submarine Export Cable Route Alternatives

The Export Cable will interconnect the BIWF from its northernmost WTG with the electrical grid on Block Island. A multiphase approach was used in assessing potential submarine routes for the Export Cable and its associated landing location including a detailed desktop analysis of existing seafloor mapping information. This information included, but was not limited to, data provided by the RI Ocean SAMP, RIGIS, and the U.S. Geological Survey (USGS) to identify potential routes; screening-level marine route surveys to evaluate the feasibility of the specific routes that could be considered as alternatives; and a detailed site-specific route survey of the preferred alternative.

Environmental and engineering/construction routing criteria that were used in evaluating the alternative routes for the Export Cable included the following:

- Minimize the total length of Export Cable including:
  - reducing the total length of the marine cable route to minimize impacts to the surrounding marine environment, and
  - selecting a shore landing location that allows for minimal impact and minimal terrestrial distance to the Block Island Substation;
- Avoid impacting sensitive biological habitat (e.g., eelgrass) and cultural marine resource sites (pre- and post-contact);
- Avoid hard substrates (e.g., cobble, boulders, bedrock) that could adversely affect power costs and make use of the jet plow infeasible or increase the duration and impact of cable installation;
- Minimize impact to existing marine uses (e.g., vessel traffic lanes); and
- Select a site that will minimize impacts to other sensitive environmental receptors in surrounding area.

In identifying potential landfall locations for the Export Cable on Block Island, Deepwater Wind considered the following:

- Avoidance or minimization of disturbance to sensitive coastal areas, habitat, and resources (e.g., eelgrass, beach dunes);
- Avoidance of hard substrates (e.g., cobble, boulders, bedrock) that could adversely affect power costs and make use of the jet plow infeasible or increase the duration and impact of cable installation;
- Availability of a cable shore landing location with sufficient construction workspace; and
- Avoidance or minimization of impacts on the local community on Block Island.

Using these criteria Deepwater Wind identified three potential Export Cable Alternatives from the northernmost WTG to three potential landing locations on Block Island. As depicted on Figure 2.4-3, each of the three alternatives is located on the eastern side of Block Island, near Old Harbor. Given the preferred location of the WTG Array as described in Section 2.4.1 and the Block Island Substation as discussed in Section 2.4.2.1, any other landfall location would have resulted in a longer cable route, which would increase impacts and cost effectiveness.

Figure 2.4-3 Export Cable Route Alternatives



As shown on Figure 2.4-3, Export Cable Alternative 1 initiates at the northernmost WTG and terminates on privately owned land on the west side of Corn Neck Road, at its intersection with Beach Avenue. Export Cable Alternative 2 also makes landfall on private land on Corn Neck Road, while Export Cable Alternative 3 makes landfall on Crescent Beach on publicly owned land the east side of Corn Neck Road.

Each of the three alternatives considered was comparable in the following ways:

- The submarine portions of the cable are not significantly different in length and would therefore not result in a substantial difference in Project cost.
- Each alternative landfall location allows for a short terrestrial cable route installation to the preferred Block Island Substation.
- The geophysical conditions along the alternative routes and on the eastern side of Block Island are conducive to both jet-plow and HDD construction methodologies.

Despite these advantages, Export Cable Alternative 2 would result in the direct impact of a confirmed eelgrass bed. To avoid impacts to this important marine habitat, Deepwater Wind eliminated Export Cable Alternative 2 from further consideration.

Of the remaining alternatives considered, Export Cable Alternative 3 offers a number of advantages over Export Cable Alternative 1. Specifically, the proposed landing location for Export Cable Alternative 3 is on publicly owned land, which will avoid impacts to private property. Alternative 3 has softer substrate material that facilitates shore landing by jet plow and HDD allowing for minimal duration and impact of the shore landing. The proposed landfall location meets the spatial needs of HDD and jet plow construction activities without impacting sensitive environmental features on Block Island (e.g., beach dunes) and offers sufficient space for additional construction staging, minimizes the need for additional construction staging locations on Block Island, and improves the cost-effectiveness of the Project. Finally, the Alternative 3 shore landing allows for a marine cable route alignment that avoids impacts to offshore sensitive environmental features (e.g., eelgrass). For these reasons, Deepwater Wind has selected Export Cable Alternative 3 as the preferred alternative.

Based on the detailed site-specific surveys performed on Export Cable Alternative 3 in fall of 2011 and winter of 2012, the entire 200-ft (61 m) centerline corridor for the proposed route has been determined to be feasible for development.

### **2.4.2.3 Terrestrial Export Cable Route Alternatives**

Terrestrial cable route alignments for the Export Cable were evaluated from the preferred landfall location described in Section 2.4.2.2 to the BIPCO property preferred site location for the Block Island Substation discussed in Section 2.4.2.1.

The following is a list of the environmental and engineering/construction routing criteria that were used in evaluating the alternative routes for the terrestrial portion of the Export Cable route:

- Minimize the distance between the preferred landfall location and the preferred substation location.
- Maximize the use of existing rights-of way to avoid and/or minimize potential impacts to existing utilities, infrastructure, and the local community.
- Avoid or minimize potential impacts to environmental, archaeological, and cultural resources.

Based on these criteria, two Export Cable alignments to connect the preferred landfall location with the BIPCO property were identified (see Figure 2.4-3).

As depicted in Figure 2.4-3, Terrestrial Alignment 1 runs south from the preferred landfall location within an existing right-of-way on Corn Neck Road, turns west along the existing right-of-way on Beach Avenue, and then turns southeast onto an existing access road to the BIPCO property. Terrestrial Alignment 2 follows existing rights-of-way from the preferred landfall location south along Corn Neck Road, west on Beach Avenue, and turns south onto Ocean Avenue within an existing right-of-way, before turning southwest onto an existing access road to the BIPCO property.

An evaluation of the two alternative alignments found them both comparable in linear distance and use of existing right-of-way. However, Terrestrial Alignment 1 offers a distinct advantage over Terrestrial Alignment 2 by avoiding historic underground contamination that extends north from the BIPCO property under Ocean Avenue.

For these reasons, Terrestrial Alignment 1 was selected as the preferred alternative and Terrestrial Alignment 2 was excluded from further consideration.

### **2.4.3 BITS**

The BITS comprises the following components:

- BITS Island Switchyard (part of the Block Island Substation);
- Rhode Island mainland switchyard; and
- Submarine and terrestrial BITS Cable.

The following sections discuss the alternatives considered for each component of the BITS and compare the alternatives for their environmental, technical, and financial consequences. Because the BITS facilities on Block Island will be co-located with the BIWF facilities along the terrestrial cable route and at the Block Island Substation, the alternatives analysis for the BITS on Block Island is as described in Sections 2.4.2.1 and 2.4.2.2 and therefore is not discussed further in this section.

#### **2.4.3.1 BITS Mainland Interconnection Alternatives**

In 2007, BIPCO completed an Electric Resource Planning Study that included an economic analysis of new supply and demand-side management options for BIPCO (HDR 2007). One of the new supply options considered by this analysis was a submarine cable connecting Block Island to the mainland. The study, which did not contain engineering details, identified two potential routes and points of interconnection owned by TNEC at:

- Langworthy Substation near Westerly, Rhode Island (Langworthy Alternative)
- Wood River Substation near Wood River Junction, Rhode Island (Wood River Alternative)

Based on the BIPCO Study, the Langworthy Alternative results in a 14.5 mi (23.3 km) submarine cable route from Block Island to a landing location on the Rhode Island mainland near the Weekapaug Breachway and a 2 mi (3.2 km) terrestrial cable to make the final connection to the existing Langworthy Substation.

The Wood River Alternative results in a 13.3 mi (21.4 km) submarine cable route from Block Island to a landing location on the Rhode Island mainland near Quonochontany Pond and a 9.5 mi (15.3 km) terrestrial cable route to make the final connection to the existing Wood River Substation.



In 2009, Deepwater Wind conducted a preliminary engineering and environmental analysis to identify one or more viable points of interconnection with the existing TNEC distribution system on the mainland, including a detailed review of the 2007 BIPCO study (HDR 2007). The same selection criteria that were used to evaluate the Export Cable route and points of interconnection and substation locations on Block Island (see Sections 2.4.2.1 and 2.4.2.2) were used to evaluate these routes and substation locations. Based on this criteria, Deepwater Wind's preliminary analysis determined that interconnection at the Langworthy Substation would not be cost effective, due to the significant number of upgrades required to support the additional power produced by the BIWF. Accordingly, the Langworthy Alternative was excluded from further consideration.

Preliminary analysis found that the Wood River Substation could cost effectively support the delivery of power from the BIWF. Deepwater Wind then engaged Tetra Tech to prepare a Critical Issues Analysis evaluating the viability of an alignment connecting Block Island to the mainland at one of these two locations (Tetra Tech 2011). This study identified engineering and environmental issues that would adversely affect the cost effectiveness of the Project. Accordingly, the Wood River interconnection was excluded from further consideration.

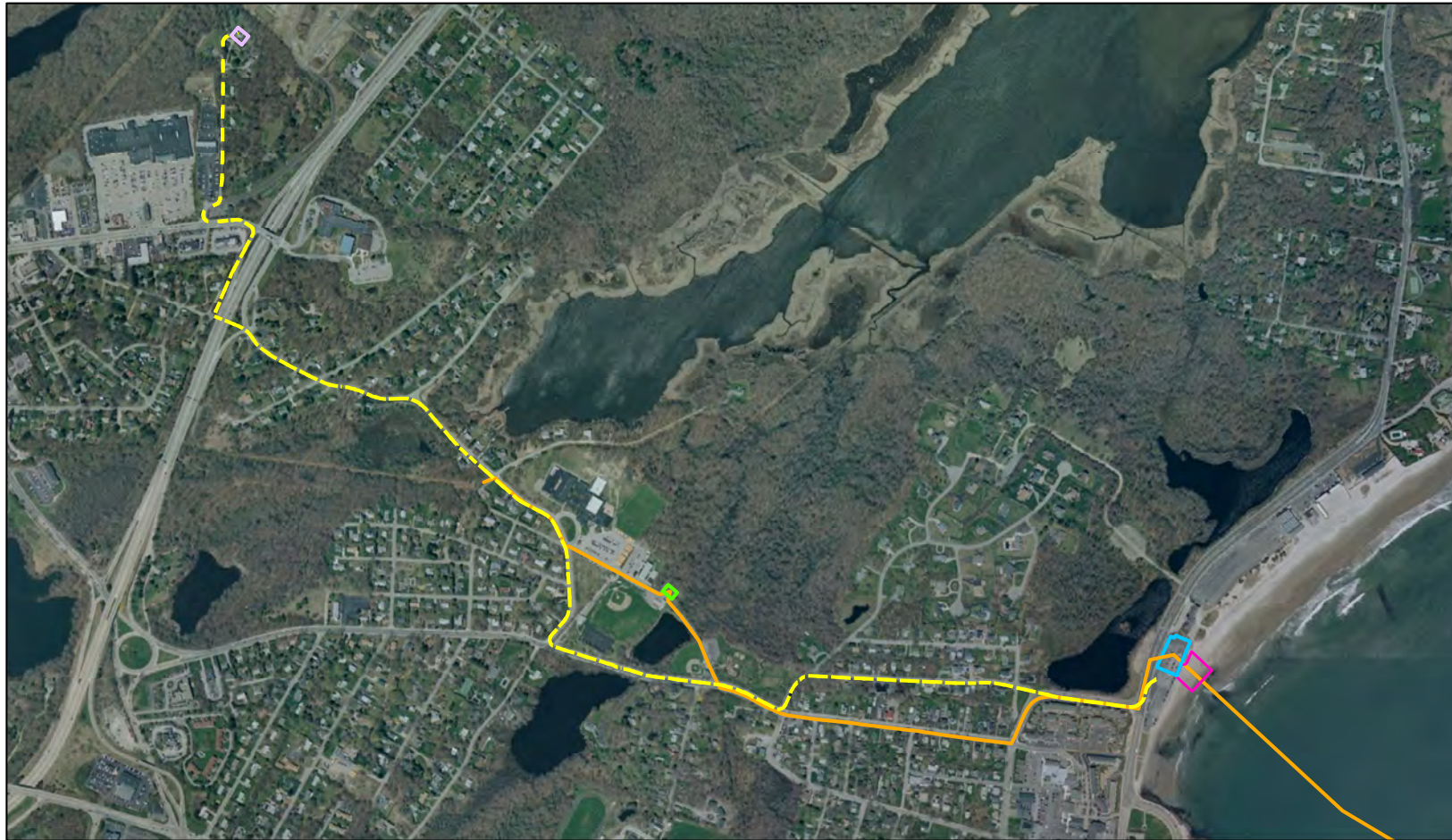
Further coordination and analysis of suitable interconnection alternatives on the Rhode Island mainland were conducted in coordination with TNEC from 2009 through 2012. Results of this coordination and analysis identified three potential points of interconnection that could successfully accept power from the BIWF (Figure 2.4-4). These locations include the following:

- Interconnection with TNEC's Feeder 3307 at the end of Albro Lane in South Kingston, Rhode Island (Albro Lane Alternative).
- Interconnection with TNEC's Feeder 3302 near the near the Narragansett Department of Public Works (DPW) maintenance facility in Narragansett, Rhode Island (Narragansett Alternative).
- Interconnection with TNEC's existing Bonnet Substation in Narragansett, Rhode Island (Bonnet Alternative).

As depicted in Figure 2.4-4, interconnection with Feeder 3307 (Albro Lane Alternative) will require a constructing a new switchyard—the Albro Lane Switchyard—on private property in South Kingston, Rhode Island, proximate to TNEC's existing 3307 right-of-way and other existing commercial uses. Interconnecting with Feeder 3307 is not expected to require any material system upgrades. The Albro Lane Alternative will require a combination of overhead and buried cable along existing and private rights-of-way for a distance of 2.1 mi (3.4 km) including crossing of a major road, Route 1. Given the cost and engineering challenges with the long route and the Route 1 crossing, the Albro Lane Alternative was excluded from further consideration.

Interconnecting with Feeder 3302 under the Narragansett Alternative will require construction of a new switchyard—the Narragansett Switchyard—on public property in Narragansett, Rhode Island, proximate to TNEC's existing 3302 right-of-way and the Narragansett DPW garage. Interconnecting with Feeder 3302 is expected to require replacing approximately 1 mi (1.6 km) of the existing Feeder 3302 between the new Narragansett Switchyard and the existing Wakefield Substation with new overhead wire in the same location as the existing wire. Additionally, interconnection with Feeder 3302 is expected to require certain protection upgrades at the Wakefield Substation.

Figure 2.4-4 BITS Alternative 1 Rhode Island Mainland Interconnection Alternatives

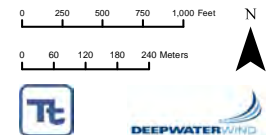


- BITS Alternative 1: Mainland Alignment 1 (Preferred Alternative)
- BITS Alternative 1: Mainland Alignment 2
- Narragansett Switchyard
- Albro Lane Switchyard
- HDD Work Area
- HDD Beach Work Area

Data Sources:  
ESRI World Imagery (May 2010)

Deepwater Wind  
Block Island Wind Farm  
and  
Block Island Transmission System  
Environmental Report  
BITS Alternative 1:  
Mainland Interconnection Alternatives

September 2012



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Prepared By: william.schiller  
Coordinate System: NAD 1983 UTM Zone 18N

The Bonnet Alternative includes the expansion of the existing TNEC Bonnet Substation near the URI Bay Campus in Narragansett, Rhode Island. Interconnecting at the Bonnet Substation is expected to require replacing approximately 9 mi (14.5 km) of the existing Feeder 3302 between the existing Bonnet Substation and the existing Wakefield Substation in South Kingston, Rhode Island, with new overhead wire in the same location as the existing wire. Additionally, interconnection at the Bonnet Substation is expected to require certain protection upgrades at the Wakefield and Bonnet Substations.

Based on site-specific studies, both the Narragansett and Bonnet Alternatives were found to be feasible for development because of their location close to the proposed TNEC point-of-interconnection, proximity to shore, and compatible surrounding land uses. However, the Narragansett Alternative was found to be more attractive than the Bonnet Alternative for the following reasons:

- the Bonnet Alternative is a longer and more expensive submarine cable route;
- the Bonnet Alternative is technically a more complicated landfall, and therefore more costly; and
- upgrade of Feeder 3302 will be expensive and has potential adverse environmental impacts to both wetlands and residences.

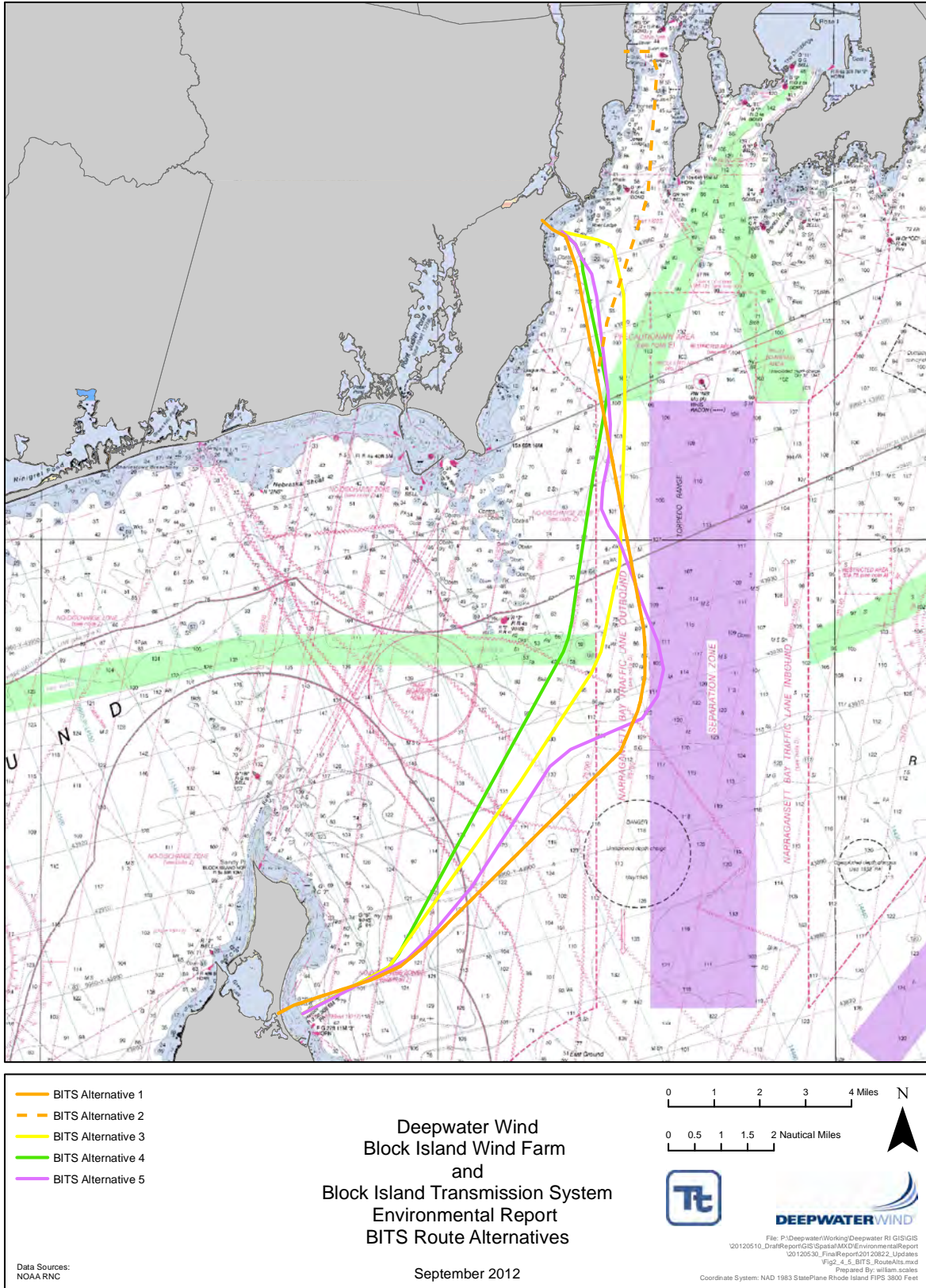
For these reasons, the Narragansett Alternative was determined to be the Preferred Alternative and the Bonnet Alternative was excluded from further considerations.

#### **2.4.3.2 BITS Submarine Cable Route Alternatives**

The environmental and engineering/construction routing criteria that were used in evaluating the alternative routes for the BITS submarine cable are the same as those described for the Export Cable in Section 2.4.2.2. Based upon these selection criteria, Deepwater Wind identified five preliminary submarine cable alignments from the preferred cable landfall location on Block Island to the Rhode Island mainland. These alternatives are depicted on Figure 2.4-5 and include the following:

- BITS Alternative 1 runs northeasterly from the preferred Block Island landing location before turning north and terminating at the preferred landfall location in Narragansett, Rhode Island near the Narragansett Town Beach. The total length of BITS Alternative 1 is approximately 21.8 mi (35.1 km).
- BITS Alternative 2 follows the same route as the BITS Alternative 1 route from Block Island to the area west of Point Judith, Rhode Island, where the BITS Alternative 2 proceeds farther north toward the URI Bay Campus. The total length of BITS Alternative 2 is approximately 25.9 mi (41.7 km).
- BITS Alternative 3 runs northeasterly from Old Harbor before turning north and then northwest and terminating at the preferred landfall location in Narragansett, RI. The total length is 20.59 mi (33.1 km).
- BITS Alternative 4 runs northeasterly from Old Harbor, to the west of Alternative 2 before turning north and then northwest and terminating at the preferred landfall location in Narragansett, RI. The total length is 18.9 mi (30.4 km).

**Figure 2.4-5 BITS Route Alternatives**



- BITS Alternative 5 follows the path of Alignment 1 when it leaves Old Harbor. Alternative 3 leaves the path of Alternative 1 when it turns to the northeast to circumvent an area of rocky substrate, Point Judith shoal that extends southward from Point Judith. The path then turns north and then northwest before terminating the preferred landfall location in Narragansett, Rhode Island. The total length is 20.9 mi (33.6 km).

Based on the detailed sediment profile imaging (SPI) survey conducted along the cable routes in the fall of 2009 (Appendix D), BITS Alternatives 3 and 4 were found to pass through an area with hard substrates and were thus excluded from further consideration.

BITS Alternatives 1, 2, and 5 were found to be comparable in both technical feasibility and environmental impacts; however, BITS Alternative 5 crosses into the Traffic Separation Zone and was therefore excluded from further consideration.

Deepwater Wind conducted detailed site-specific geophysical and geotechnical, marine benthic and marine archeological investigations along BITS Alternatives 1 and 2 in the fall 2011/winter 2012 (Appendices E, F, and P). Based on the route selection criteria and the results of the site-specific environmental and engineering surveys, although feasible, BITS Alternative 2 was found to be technically more complicated and costly. BITS Alternative 2 would also require additional upgrades to connect with TNEC's existing Bonnet substation. For these reasons, BITS Alternative 2 has been excluded from further consideration and BITS Alternative 1 was determined to be the Preferred Alternative.

#### **2.4.3.3 BITS Alternative 1 Landfall Alternatives**

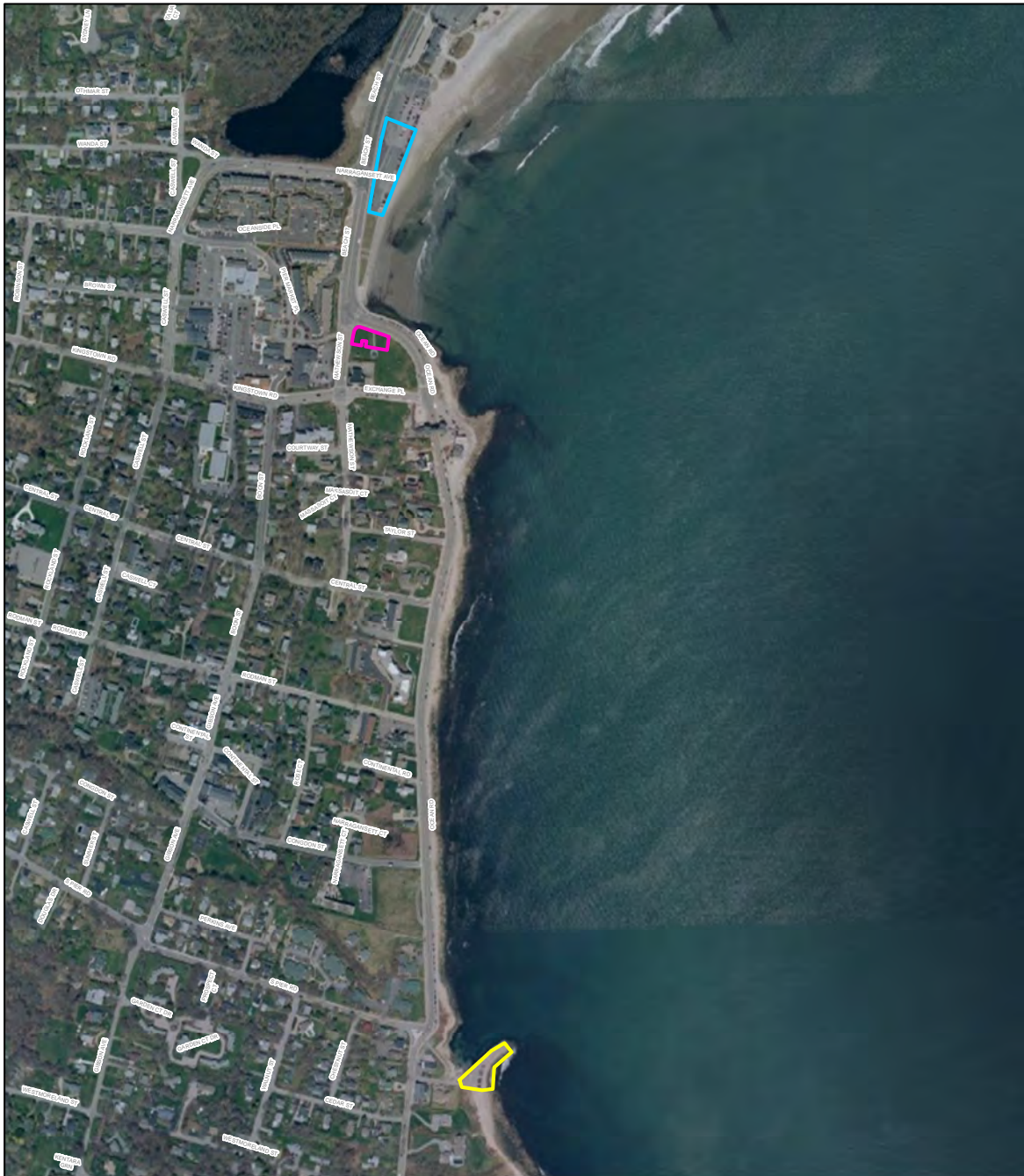
Deepwater Wind evaluated several potential landing locations on the Rhode Island mainland for BITS Alternative 1 in the vicinity of Narragansett Town Beach. The prospective landfall locations were evaluated using the same screening criteria discussed in Section 2.4.2.2. Based upon these criteria, three potential landfall locations were identified (Figure 2.4-6).

As depicted on Figure 2.4-6, Mainland Landfall Alternative 1 would bring the BITS cable ashore on state-owned land at State Pier #5. Mainland Landfall Alternative 2 would bring the cable to shore on town-owned land at Gazebo Park, and Mainland Landfall Alternative 3 would result in the BITS cable coming to shore in the parking lot of Narragansett Town Beach.

Further evaluation of Mainland Landfall Alternative 1 revealed disadvantages. Namely, this alternative would land BITS Alternative 1 at a rock pier. There are, to Deepwater Wind's knowledge, currently no available as-built drawings to determine the depth of the pier foundations. In addition, this alternative landing location is in an area comprising large gravel, boulders, and exposed bedrock that will prevent the successful use of HDD to bring the cable ashore. Finally, the site does not afford enough space to support the necessary HDD construction equipment. Due to these conditions, construction of a landfall at the State Pier will be technically challenging, if even feasible, and costly. Accordingly, Mainland Landfall Alternative 1 was excluded from further consideration.

Evaluation of Mainland Alternative 2 revealed that the area contains large gravel, boulders, and exposed bedrock. Although physical space for an HDD construction workspace is potentially available, the lack of as-built drawings for the seawall construction at this landfall location and the requirement to drill through bedrock under the seawall will add both significant time to the construction schedule and cost. Additionally, Mainland Landfall Alternative 2 is located proximate to a number of new housing units, which might be disturbed. Accordingly, Mainland Landfall Alternative 2 was excluded from further consideration.

Figure 2.4-6 BITS Alternative 1 Landfall Locations

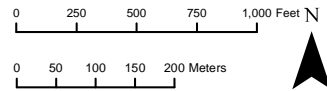


- BITS Alternative 1: Landfall Alternative 1
- BITS Alternative 1: Landfall Alternative 2
- BITS Alternative 1: Landfall Alternative 3

Deepwater Wind  
 Block Island Wind Farm  
 and  
 Block Island Transmission System  
 Environmental Report  
 BITS Alternative 1 Landfall Locations

Data Sources:  
 ESRI World Imagery (May 2010)

September 2012



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 \Fig. 2.4.6\_BITS\BIT\_S\IT\_LandfallLocations.mxd  
 Prepared By: william.scales  
 Coordinate System: NAD 1983 StatePlane Rhode Island FIPS 3800 Feet

In contrast to Mainland Alternatives 1 and 2, Mainland Alternative 3 offers a number of advantages. Specifically, Mainland Alternative 3 located is on publicly owned land, which will avoid impacts to private property and eliminate the need to obtain easements from private parties for construction activities. The BITS cable route to this landfall location is through predominantly soft sandy substrate making the use of both the HDD and jet plow methodologies technically feasible and cost-effective. In addition, the proposed landfall location meets the spatial needs of HDD construction activities and offers sufficient space for additional construction staging. For these reasons, Deepwater Wind has selected Mainland Landfall Alternative 3 as the preferred alternative.

#### **2.4.3.4 BITS Alternative 1 Terrestrial Cable Route Alternatives**

Based upon the results of the interconnection, submarine cable route, and landing alternatives analysis described in Sections 2.4.3.1 through 2.4.3.3, Deepwater Wind evaluated potential terrestrial cable route alignments from the BITS Alternative 1 preferred landing location to the preferred Narragansett Switchyard Alternative in Narragansett, Rhode Island. Using the same siting criteria as applied to the terrestrial portion of the Project cable routes on Block Island (Section 2.4.2.3), Deepwater Wind identified three potential terrestrial alignments to the preferred Narragansett Switchyard (see Figure 2.4-4). The selection of these alternatives was also further informed by wetland, cultural, and civil surveys (desktop and field) conducted in the fall of 2011, and the winter, spring and summer of 2012.

As depicted in Figure 2.4-4, Mainland Alignment 1 initiates from the preferred landfall location at the Narragansett Town Beach at an existing TNEC' riser pole located in the Town Beach parking lot. From this riser pole, Mainland Alignment 1 follows TNEC's existing overhead distribution system right-of-way along Narragansett Avenue (Route 1A) to the DPW access road and interconnection at the proposed Narragansett Switchyard. This alignment will require up to eight new poles and upgrades to up to 30 existing poles.

Mainland Alignment 2 also consists of an overhead route from the riser pole in the Narragansett Town Beach parking lot. This alternative follows the existing TNEC overhead distribution system along Narragansett Avenue (Route 1A) to its intersection with Wanda Street. The overhead alignment follows Wanda Street, a residential street, to its interconnection with Strathmore Road, also a residential street. From Strathmore Road, the route interconnects Narragansett Avenue (Route 1A) again to the DPW access road and then interconnects at the proposed Narragansett Switchyard. This alignment will require approximately six new poles and upgrades to up to approximately 28 existing poles.

Mainland Alignment 3 follows the same proposed route as Alternative 1; however, this route will be located underground along existing road rights-of-way of Boston Neck Road and Narragansett Avenue. This route also requires a new right-of-way along the DPW access road leading to the proposed Narragansett Switchyard.

Alignments 1 and 2, which are predominantly overhead construction rather than buried cable, were found to offer a number of advantages relative to Alignment 3. Specifically, Alignments 1 and 2 minimize the extent of construction disturbance along the roadways, thereby reducing potential traffic, infrastructure, and local community impacts. In addition, ground disturbance will be limited to the installation of new and replacement poles along an existing utility right-of-way thereby minimizing potential environmental impacts. In contrast, Alignment 3 will require constructing a new concrete encased duct bank in State and Town roads. Alignments 1 and 2 also represent substantial cost savings to the Project over Alignment 3

because of the route distance and construction/installation techniques. For these reasons, Alignment 3 has been excluded from further consideration.

Alignment 2 includes a portion of route along Wanda Street, which is a residential road, whereas Alignment 1 offers the advantage of staying off that street. For this reason, Alignment 1 was selected as the preferred alternative and Alignments 2 and 3 were excluded from further consideration.

## **2.5 Alternative Technologies**

### **2.5.1 Wind Turbine Generators**

Deepwater Wind considered multiple currently available offshore turbine technologies in designing the preferred WTG Array as describe in Section 2.4.1. Specifically, Deepwater Wind considered the environmental, technical, and financial consequences of the following WTGs and associated combinations to fulfill the purpose and need of the Projects:

- Eight 2.5 MW WTGs = 20 MW BIWF capacity;
- Eight 3.6 MW WTGs = 28.8 MW BIWF capacity;
- Six 5.0 MW WTGs = 30 MW BIWF capacity; and
- Five 6.0 MW WTGs = 30 MW BIWF capacity.

Due to economies of scale, a 30-MW project was determined to be materially more cost effective than smaller project sizes. Therefore, based on the need for cost effectiveness, project sizes smaller than 30 MW were excluded from consideration.<sup>5</sup>

The configuration consisting of five 6-MW WTGs has the ability to achieve the 30-MW target Project size with the fewest number of WTGs. The use of fewer turbines improves the cost effectiveness of the Project by expediting installation and minimizing environmental impacts, particularly visual impacts and bottom disturbances. As well, use of the larger turbine has the potential for increasing the Wind Outperformance Adjustment Credit, thereby increasing benefits to Rhode Island ratepayers.

For these reasons, a project configuration consisting of five 6.0-MW WTGs was selected as the preferred alternative and other project configurations and turbines were excluded from further consideration.

### **2.5.2 Foundations**

Deepwater Wind considered various currently available foundation technologies in designing the preferred WTG Array as described in Section 2.4.1. Specifically, Deepwater Wind considered the environmental, technical, and financial consequences of the following foundation technologies to fulfill the purpose and need of the Project:

- Monopiles;
- Steel-piled jackets;
- Gravity-based structures; and
- Floating foundations.

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<sup>5</sup> In addition, the statutory basis for this Project limited the size of the project to 30 MW. Accordingly, arrays larger than 30 MW were excluded from consideration.



Deepwater Wind evaluated each foundation type based on suitability for the bottom type and water depths for the preferred WTG Array, cost effectiveness, demonstrated success in similar commercial applications, and the supply chain available to support their cost-effective fabrication and installation.

Monopile WTG foundations have been cost effectively installed in water depths of up to 60 ft (18.3 m). A brief suitability assessment of monopile foundations found that the weight of the monopiles would be significantly heavier than jackets at this water depth and thus more costly. Because the Renewable Energy Zone established by the RI Ocean SAMP comprises water depths that are deeper (approximately 80 ft 24.4 km) than the monopiles' cost-effective range, monopiles were excluded from further consideration.

Steel-piled jacket foundations allow WTGs to be installed in deeper waters compared to monopile foundations using currently available technology. The waters in the Renewable Energy Zone are of a suitable depth to successfully install WTGs using jacket foundations. Jacket foundations have been used in the offshore oil and gas industry for many years, and their application to WTGs has been proven in commercial European offshore wind projects. Additionally, there is a robust U.S.-based supply chain for the construction and installation of steel-piled jackets.

Gravity-based structures were found to be commercially proven and technically feasible given the conditions within the Renewable Energy Zone, but were not cost-effective when compared with steel-piled jackets. Additionally, supply chain issues were identified in setting up for only five foundations. As such, gravity-based structures were excluded from further consideration.

Because floating platforms are still in the development stage, are generally aimed at cost-effective installations at much deeper water depths, and have not been deployed in commercial offshore wind applications, they are not currently considered technically feasible for the Project and were excluded from further consideration.

Due to their cost effectiveness, proven application in numerous offshore wind installations, their ability to meet the Project site conditions and the existence of an established supply chain in the United States, the jacket foundation has been selected as preferred foundation alternative.

## **2.6 Preferred Alternative**

Deepwater Wind's analysis indicates that the proposed location of the BIWF, BITS, and associated facilities as depicted in Figure 1.1-1 (Section 1.1) and turbine technology represent the preferred alternative under the Proposed Action. Section 3.0 provides a detailed description of the Preferred Alternative, including specifics regarding the location, installation, operation, and maintenance and removal of the facilities. Section 4.0 describes the potential environmental impacts resulting from the construction, operation, and decommissioning of the Project and proposed mitigation measures.

## 3.0 PROJECT DESCRIPTION

### 3.1 Project Location

This section describes the proposed location of each of the BIWF and BITS components. The proposed locations have been selected based on environmental and engineering site characterization studies completed to date. The location of Project facilities will be further refined based on final detailed engineering design.

The offshore components of the BIWF and BITS will be located in federal and state territorial waters. Onshore cables, switchyards, substation, and other ancillary facilities will be located in the towns of New Shoreham (Block Island) and Narragansett in Washington County, Rhode Island. Construction staging and laydown for offshore construction will occur at the Quonset Point port facility in North Kingstown, Washington County, Rhode Island. Deepwater Wind expects to locate an O&M facility, which will include a shore operations center and a control room on an existing waterfront parcel in the Point Judith area. The facility will be a combination of office, maintenance shop, and a small dockside facility.

For the purposes of this ER, the Project Area refers to the footprint of the BIWF and BITS facilities within these locations. Figure 1.1-1 in Section 1.1 provides an overview of the Project Area.

#### 3.1.1 Block Island Wind Farm

The BIWF will be located an average of approximately 3 mi (4.8 km) southeast of Block Island, and approximately 16 mi (25.7 km) south of the Rhode Island mainland. The WTGs, Inter-Array Cable, and a portion of the Export Cable will be located within the Rhode Island Renewable Energy Zone established by the CRMC through the RI Ocean SAMP. The WTGs will be arranged in a radial configuration spaced approximately 0.5 mi (0.8 km) apart. The Inter-Array Cable will connect the five WTGs for a total length of 2 mi (3.2 km) from the northernmost WTG to the southernmost WTG (Figure 1.1-1 in Section 1.1).

The submarine Export Cable will originate at the northernmost WTG and travel 6.2 mi (10 km) to a manhole on Block Island. Water depths along the Export Cable submarine route range up to approximately 121 ft (36.9 m) in the deepest areas of the route. The manhole will serve as the transition point where the submarine portion of the Export Cable will be anchored and spliced with the buried terrestrial portion of the cable. The manhole will be located within the boundary defined by the temporary horizontal directional drilling (HDD) work area in the parking lot of Crescent Beach off of Corn Neck Road as shown on Figure 3.1-1. The preliminary Project design plans in Appendix B indicate the proposed location of the manhole for the Export Cable pending final engineering.

From the manhole at the Town Beach parking lot, the Export Cable will follow an upland route along existing public road rights-of-way for 0.8 mi (1.3 km) to the BIPCO property (Figure 3.1-1). The cable will be buried underground except where the cable crosses the bridge between Trims Pond and Harbor Pond for a distance of approximately 45 feet (ft) (14 meters [m]). The buried terrestrial portion of the Export Cable will be collocated in the same concrete-encased duct bank as the buried terrestrial portion of the BITS cable. At the BIPCO property, the Export Cable will transition to overhead poles and will be collocated with the BITS cable for a distance of up to 0.2 mi (0.3 km). The Export Cable will terminate at the BIWF Generation Switchyard, which is part of the Block Island Substation. In total, the Export Cable will be approximately 7.2 mi (11.6 km) from the northernmost WTG to the interconnection on the BIPCO property.

Figure 3.1-1 Block Island BIWF and BITS Cable Routes



<ul style="list-style-type: none"> <li><span style="color: orange;">—</span> BITS Alternative 1</li> <li><span style="color: orange;">—</span> Proposed Overhead Onshore Route (Block Island)</li> <li><span style="color: yellow;">—</span> Proposed Buried Route</li> <li><span style="color: green;">—</span> Export Cable</li> <li><span style="border: 1px solid green; display: inline-block; width: 10px; height: 10px;"></span> Block Island Substation (Alternatives A &amp; B)</li> <li><span style="border: 1px solid pink; display: inline-block; width: 10px; height: 10px;"></span> Existing BIPCO Substation</li> <li><span style="border-bottom: 1px dashed black; width: 10px; display: inline-block;"></span> Temporary Access Road</li> <li><span style="border: 1px solid blue; display: inline-block; width: 10px; height: 10px;"></span> HDD Beach Work Area</li> <li><span style="border: 1px solid blue; display: inline-block; width: 10px; height: 10px;"></span> HDD Work Area</li> <li><span style="border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Cofferdam Area</li> <li><span style="border-bottom: 1px dashed black; width: 10px; display: inline-block;"></span> Survey Corridor (300m)</li> </ul> <p>Data Sources:                  ESRI World Imagery (May 2010)</p>	<p>Deepwater Wind                  Block Island                  Wind Farm                  and                  Block Island                  Transmission System                  Environmental Report                  Block Island Cable Route                  September 2012</p>	<p>0 250 500 750 1,000 Feet</p> <p>0 50 100 150 200 Meters</p>    <p><small>File: P:\Deepwater\Working\Deepwater RI GIS\GIS\20120510_DrillReport\GIS\Spatial\MXD\EnvironmentalReport\20120530_FinalReport\20120622_Update\Fig3_1_1_BlockIslandCableRoute.mxd                  Prepared By: william.scales                  Coordinate System: NAD 1983 UTM Zone 19N</small></p>
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A new substation, the Block Island Substation, is proposed to be located on the BIPCO property. The Block Island Substation will be the point of interconnection between the BIWF and the BITS. The Block Island Substation will consist of two adjoining switchyards, one dedicated to the BIWF (BIWF Generation Switchyard) and the other dedicated to the BITS (BITS Island Switchyard) and is discussed in more detail in Section 3.1.2.

### **3.1.2 Block Island Transmission System**

The BITS will originate on Block Island at the BITS Island Switchyard located within the Block Island Substation on the BIPCO property. As part of the BITS, the existing BIPCO Substation will be expanded and upgraded to interconnect the BITS with BIPCO's facilities.

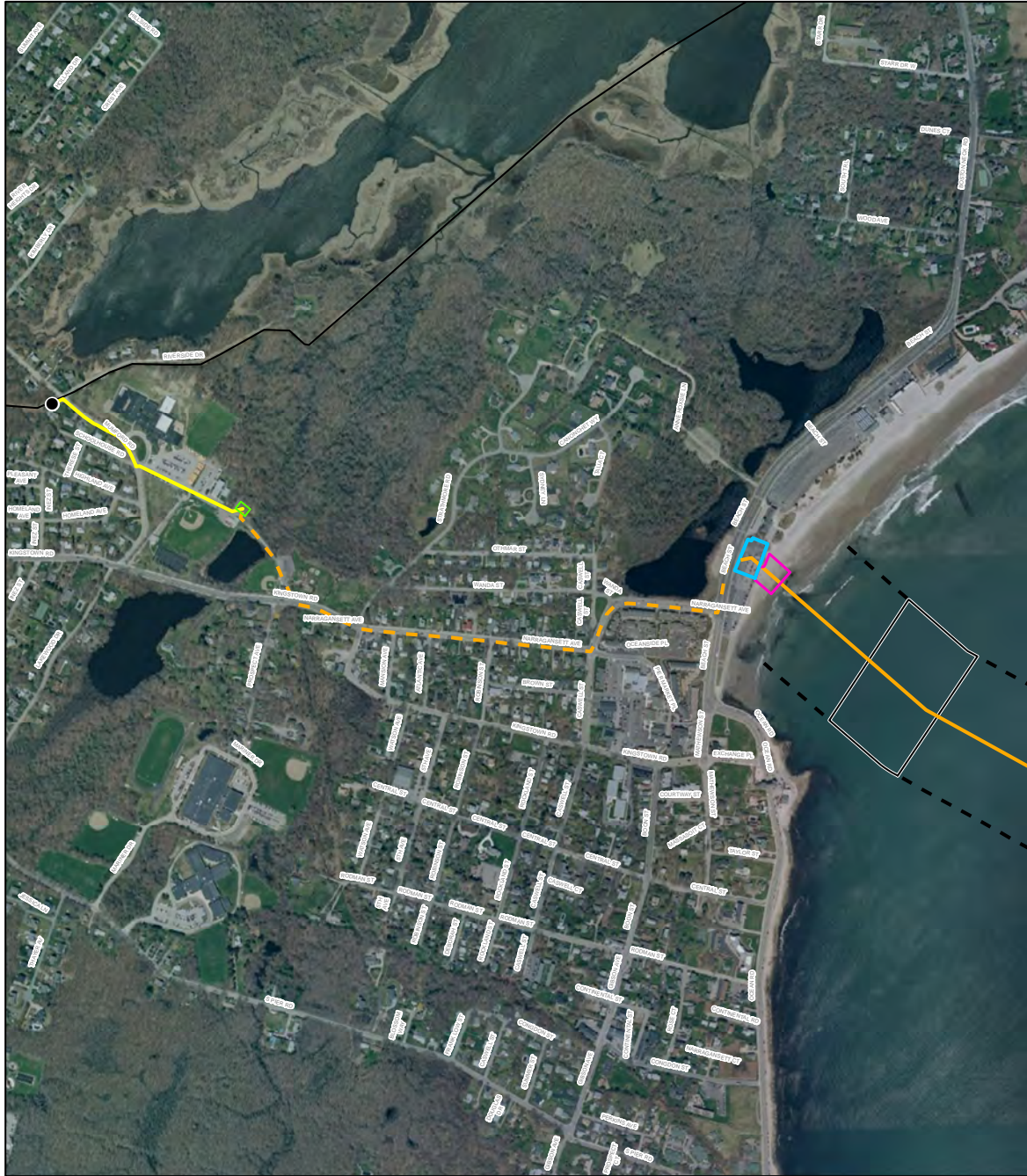
The facilities associated with the Block Island Substation and the BIPCO Substation expansion will require development of up to 0.5 acre (0.2 hectare) on the BIPCO property. Up to an additional 0.6 acre (0.2 hectare) will be utilized during construction to support staging, stormwater management measures, and other temporary construction activities. Deepwater Wind is currently considering two potential locations for the Block Island Substation within the BIPCO property, referred to as Substation Alternative A and Substation Alternative B (Figure 3.1-1). On April 3, 2012 the Town of New Shoreham Zoning Board of Review approved the construction of the Block Island Substation at either one of these locations; however, their approval cited a preference for Alternative A which is also Deepwater Wind's preferred alternative. A copy of the decision is included in Appendix A. Appendix B shows the preliminary site plans for the Block Island Substation and BIPCO Substation expansion.

The terrestrial portion of the BITS cable on Block Island will follow the same cable route as the terrestrial portion of the BIWF Export Cable to a second, separate BITS manhole in the parking lot of Crescent Beach. Similar to the BIWF Export Cable, the manhole will serve as a transition point where the buried terrestrial portion of the BITS cable will be spliced with the submarine cable. The BITS manhole will be located adjacent to the BIWF manhole within the boundary defined by the temporary HDD work area in the parking lot of Crescent Beach (Figure 3.1-1). The preliminary Project design plans in Appendix B indicate the proposed location of the BITS manhole on Block Island pending final engineering.

From the Block Island manhole, the BITS will traverse federal and state submerged lands in Rhode Island Sound from Block Island to Narragansett (Figure 1.1-1 in Section 1.1). The portion of BITS through federal waters consists of approximately 9 mi (14.5 km) on OCS Official Protraction Diagram Blocks 6711, 6761, 6810, and 6811. Deepwater Wind will obtain a ROW Grant from BOEM for a BITS route corridor on the OCS.

The BITS cable route from Block Island to its interconnection point with TNEC's existing distribution system on the Rhode Island Mainland is referred to as BITS Alternative 1. BITS Alternative 1 would make landfall in southern Narragansett, Rhode Island at a manhole located in the Narragansett Town Beach parking lot off of Beach Street (Figure 3.1-2). The manhole will be located within the temporary HDD work area within the parking lot as shown on Figure 3.1-2. The manhole will serve as the transition point for BITS Alternative 1. The preliminary Project design plans provided in Appendix B indicate the proposed location of the BITS Alternative 1 manhole in Narragansett, Rhode Island.

**Figure 3.1-2 BITS Alternative 1 Mainland Cable Route**



<ul style="list-style-type: none"> <li><span style="color: orange;">—</span> BITS Alternative 1</li> <li><span style="color: orange; border-bottom: 1px dashed orange;">—</span> Proposed Overhead Onshore Route (Narragansett Ave.)</li> <li><span style="color: yellow;">—</span> Proposed Buried Route</li> <li><span style="color: black; border-bottom: 1px solid black;">—</span> Existing Transmission Line</li> <li><span style="color: black;">●</span> Interconnection Point with National Grid 3302 Feeder Line</li> <li><span style="border: 1px solid blue; display: inline-block; width: 15px; height: 10px;"></span> HDD Work Area</li> <li><span style="border: 1px solid pink; display: inline-block; width: 15px; height: 10px;"></span> HDD Beach Work Area</li> <li><span style="border: 1px solid green; display: inline-block; width: 15px; height: 10px;"></span> Narragansett Switchyard</li> <li><span style="border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> Cofferdam Area</li> <li><span style="border-bottom: 1px dashed black; display: inline-block; width: 15px;"></span> Survey Corridor (300m)</li> </ul> <p>Data Sources:          ESRI World Imagery (May 2010)</p>	<p><b>Deepwater Wind              Block Island              Wind Farm              and              Block Island              Transmission System              Environmental Report              BITS Mainland Route (Alt 1)              September 2012</b></p>	<p>0 350 700 1,050 1,400 Feet N</p> <p>0 75 150 225 300 Meters</p> <p> <b>DEEPWATERWIND</b></p> <p><small>File: P:\Deepwater\Working\Deepwater RI GIS\GIS\20120510_DraftReport\GIS\Spatial\MADE\Environmental\ER-report\20120530_FinalReport\20120822_Updates\Fig3_1_2_BITSMainland_Alt1.mxd          Prepared By: William Scates          Coordinate System: NAD 1983 StatePlane Rhode Island FIPS 3800 Feet</small></p>
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From the manhole, BITS Alternative 1 will transition to an overhead line via an existing TNEC riser pole located within the parking lot of Narragansett Town Beach. It is anticipated that the overhead portion of BITS Alternative 1 on the Rhode Island mainland will follow TNEC's existing overhead distribution system for approximately 0.8 mi (1.3 km) to its interconnection point at the proposed Narragansett Switchyard, located adjacent to the Narragansett DPW facility off of Mumford Road (Figure 3.1-2). From the Narragansett Switchyard, BITS Alternative 1 will be buried in an underground concrete-encased duct bank for approximately 0.3 mi (0.5 km) to its connection point with the existing TNEC system off of Mumford Road (Figure 3.1-2).

In total, BITS Alternative 1 will be approximately 23.9 mi (38.5 km) from the Block Island Substation to its interconnection with the TNEC system in Narragansett, Rhode Island. Of this total approximately 21.8 mi (35.1 km) is submarine from its manhole on Block Island to its manhole on Narragansett Town Beach. Water depths along the BITS Alternative 1 submarine cable route range up to approximately 129 ft (39 m) in the deepest areas of the route.

### 3.1.3 Construction and O&M Facilities

Deepwater Wind has executed an agreement for the rights to acreage at the Quonset Business Park port facility, which will serve as a logistics hub for the development of the Project. The Quonset Point Business Park port facility is located in North Kingstown, Rhode Island approximately 32.2 mi (51.9 km) from the WTG Array (Figure 3.1-3).

Deepwater Wind expects to locate an O&M facility, which will include a shore operations center and a control room on an existing waterfront parcel in the Point Judith area. The facility will be a combination of office, maintenance shop, and a small dockside facility.

## 3.2 Project Facilities

The Project consists of two distinct components—the BIWF and the BITS. Project components comprise the following facilities:

- BIWF
  - Five WTGs on jacket foundations
  - Collection System
    - submarine Inter-Array Cable
    - submarine and terrestrial Export Cable
    - BIWF Generation Switchyard (part of the Block Island Substation)
- BITS
  - BITS Island Switchyard (part of the Block Island Substation)
  - Submarine and terrestrial BITS Cable
  - Narragansett Switchyard

In addition, the Project will be supported by a construction and an O&M facility in Rhode Island.

Sections 3.2.1 through 3.2.3 provide a detailed description of the facilities that comprise the BIWF, BITS, and the construction and an O&M facility.

Figure 3.1-3 Location of the Quonset Point Port Facility



 Quonset Point Port Facility

Deepwater Wind  
Block Island  
Wind Farm  
and  
Block Island  
Transmission System  
Environmental Report  
Quonset Point Port Facility Staging Area  
September 2012

0 500 1,000 1,500 2,000 Feet

0 150 300 450 600 Meters



Data Sources:  
ESRI World Imagery (May 2010)

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10120530\_FinalReport\20120922\_Updates  
Fig3\_1-3\_QuonsetPointPortFacility.mxd  
Prepared By: william.scales  
Coordinate System: NAD 1983 StatePlane Rhode Island FIPS 3800 Feet

### 3.2.1 BIWF

#### 3.2.1.1 Wind Turbine Generators

The BIWF will consist of five, 6 MW WTGs. Deepwater Wind will select the WTG model that is best suited for the sub-bottom and wind resource conditions southeast of Block Island that will be commercially available at the time construction is scheduled to commence. Deepwater Wind plans to install the Siemens 6.0 MW direct drive WTG or comparable model. For the purposes of environmental analysis in this ER, Deepwater Wind has provided a representative WTG design that encompasses a conservative range of design specifications for the 6 MW class of turbines (Figure 3.2-1). The proposed WTG will have a hub height above mean low water (MLW) between 269 ft (82 m) and 328 ft (100 m) and a rotor diameter between 505 ft (154 m) and 541 ft (165 m), for a total height between 581 ft (177 m) and 659 ft (201 m) above MLW. The blade clearance will range between 75 ft (23 m) and 118 ft (36 m) above MLW. An illustration of the representative minimum and maximum 6 MW WTG is shown in Figure 3.2-1. Each of the WTGs will comprise a tower, nacelle, rotor, and blades. Control, lighting, and safety systems will be installed on each WTG. There will be small amounts of lubrication grease and oil within the WTG to support the operation of the WTG's bearing, pitch and hydraulic systems as well as the WTG transformer.

##### **Tower**

The tower will be a tapered, hollow, steel tubular structure that will be manufactured in three segments. The tower will have a diameter of approximately 22 ft (6.8 m) at the base and 15 ft (4.5 m) at the top.

##### **Nacelle**

The nacelle will be approximately 62 ft (18.9 m) long, 20.5 ft (6.2 m) tall, and 20 ft (6.1 m) wide. The weather screen and housing canopy around the machinery in the nacelle is made of fiberglass-reinforced laminated panels with multiple fire-protecting properties. A hollow, fixed man shaft provides internal access from the canopy to the hub.

A transformer to step up the generator voltage will be located in a ventilated room in the nacelle. For cooling purposes, the transformer will be filled with mineral or comparable insulating oil that will be monitored for temperature, fluid level, and pressure.

##### **Rotor**

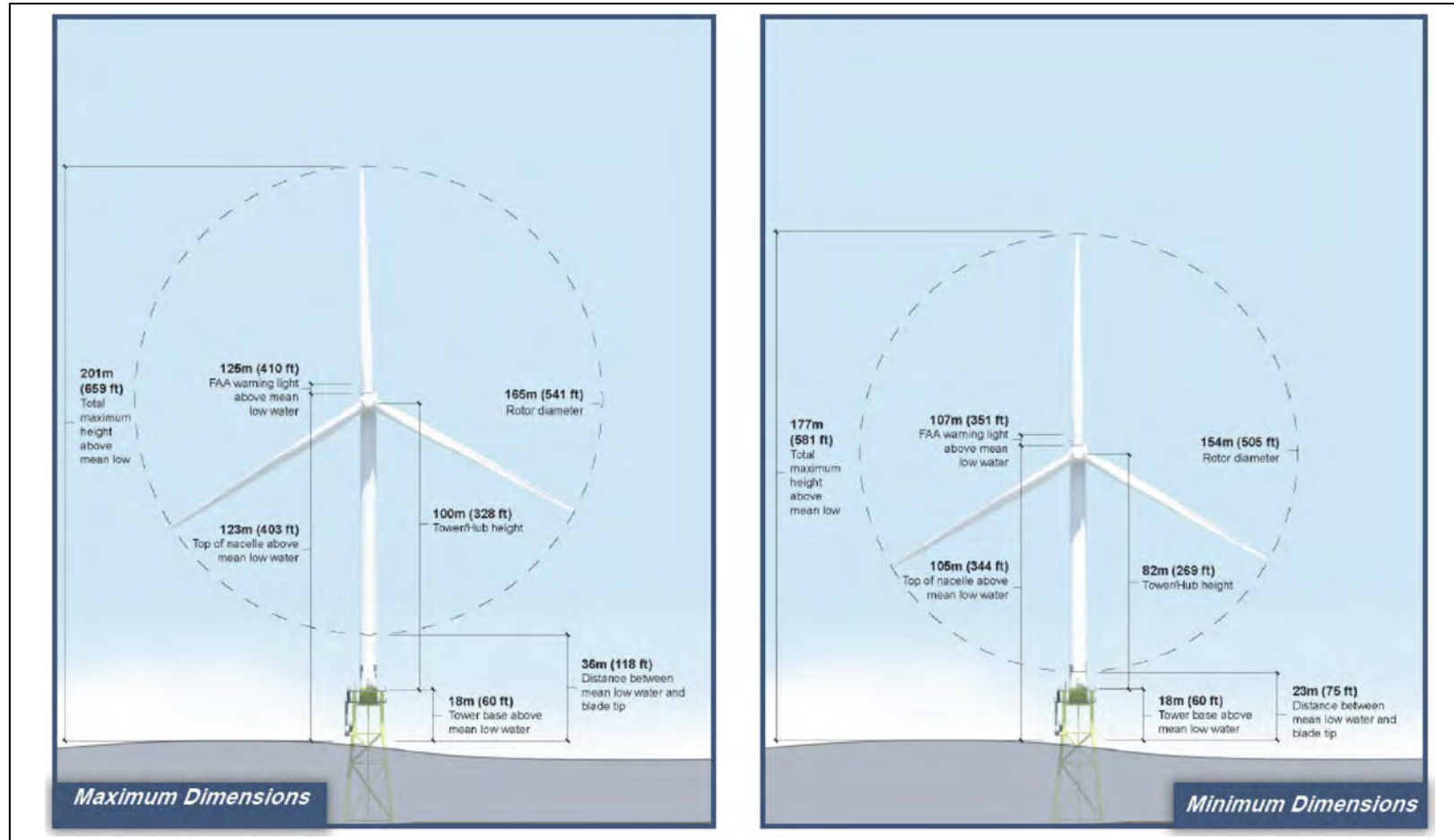
The WTG rotor is a three-bladed cantilevered construction, mounted upwind of the tower. The power output is controlled by pitch regulation. The WTG will operate between a cut-in wind speed of 4.5 miles per hour (mph) (2 meters per second [m/s]) and a cut-out wind speed of 67 mph (30 m/s). The WTG will have a rotor speed from 5 to 11 rotations per minute (rpm).

##### **Blades**

The blades will be made of fiberglass-reinforced epoxy resin manufactured in a single operation. The blades will be mounted on pitch bearings and can be feathered 80 degrees for shutdown purposes. Each blade will have its own independent fail-safe pitching mechanism capable of feathering the blade under any operating condition, and allowing fine tuning to maximize power output. The blade will have a length of approximately 253 ft (77 m) to 271 ft (83 m) and a maximum chord (i.e., cross section diameter) of approximately 16 ft (5 m).



Figure 3.2-1 Representative Minimum and Maximum 6 MW WTG



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Block Island Wind Farm  
and  
Block Island Transmission System  
Environmental Report  
Conceptual Turbine



September 2012

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00120510\_Spauld\env\00120510\_000001  
Fig\_2\_1\_MaxMinTurbine.mxd  
Prepared By: William Spauld  
Coordinate System: NAD 1983 UTM Zone 19N

## WTG Control Systems

The WTG controller will be a self-diagnosing, microprocessor-based industrial controller that has a keyboard and display for easy readout of status and adjustment of settings. The controller is complete with switchgear and protection devices. The WTGs will be equipped with a Supervisory Control and Data Acquisition (SCADA) system providing remote control and monitoring of the WTGs from an operations center onshore. The system provides real time information on electrical and mechanical data, operation and fault status, meteorological data, and grid station data. In addition to the SCADA system, the WTGs will be equipped with a condition monitoring system that monitors the vibration level of the main WTG components.

## Access, Safety, and Lighting

The WTGs will be lit and marked in accordance with FAA and USCG requirements for aviation and navigation obstruction lighting. The proposed lighting and marking for the WTGs is presented in Section 4.11 of this ER. The lights will be equipped with back-up battery power to maintain operation should a power outage occur on a WTG.

The interior components of the nacelle will be protected by the canopy housing the machinery. The WTGs will also be protected against lightning strikes by various means. Lightning rods will be installed on the nacelle's external bracket to protect the WTG lighting systems for aviation and navigation. Secondary effects of lightning (e.g., power surges) will be suppressed by surge arrestors.

The WTG design will include fire prevention and fire protection measures and each WTG will be equipped with control sensors, including fire and smoke alarms. Firefighting equipment will be available in each WTG in accordance with the applicable regulations.

The WTGs will not operate in extreme wind conditions. If the wind speed exceeds 67 mph (30 m/s) the blades will automatically pitch out of the wind. The WTGs will be designed in accordance with engineering standards for offshore wind turbines (IEC 61400-1/3), which require load case simulations with extreme gust conditions in combination with grid loss.

Access to the WTGs will be through a door located on the tower platform at the base of each WTG tower. For safety purposes, the door will always be locked and only assessable by authorized personnel.

### 3.2.1.2 Foundation

Each WTG will be attached to the seafloor using a four-leg jacket foundation secured with four through-the-leg foundation piles. The jackets consist of hollow steel tubular members joined together in a lattice structure, which sit on the seabed supporting the WTG (Appendix C, Figure 2). The diameter of each pile is expected to be between 42 inches [in] and 54 in (107 centimeters [cm] and 137 cm), with a maximum wall thickness of 1.5 in (3.8 cm). The foundation piles will be inserted into the legs and driven to a depth of up to 250 ft (76.2 m) below the mudline. The piles will then be cut off at the top of the jacket and welded to the jacket structure.

Alternatively a foundation with skirt piles may be used. If used, the alternate skirt piles will have the same pile dimensions as described for the through-the-leg piles. However, instead of welded connections to the jacket structure, grouted connections will be used.

The part of the foundation structure on the seafloor consists of the circular legs, linear braces, and triangular steel mats. The mats consist of structured steel, steel plate, and/or wood beams and plates, which are attached to the jacket to provide stability during installation until the piles are driven into place.

Bags of sand and/or cement will also be placed on the seafloor at the base of the jacket to secure the Inter-Array Cable between the J-tube exit point and subsea burial point (Appendix C, Figure 3). The foundation components and cable armoring material will create a total footprint of approximately 0.07 acre (0.03 hectare) on the seafloor per WTG. Table 3.2-1 provides a summary of the construction and operation footprints for the five WTG foundations.

The foundations measure approximately 50 ft by 50 ft (15.2 m by 15.2 m) at sea level. A transition deck, boat landing, ladders and stairs, and guide tubes for the submarine cable will be installed on the jacket foundation, along with other appurtenances (Appendix C, Figure 4).

**Table 3.2-1 WTG Array Foundation Construction and Operation Footprint**

	Construction	Operation
WTG Foundations <sup>a/</sup>	0.35 ac / 0.15 ha	0.35 ac / 0.15 ha
Jack-Up Barges <sup>b/</sup>	0.55 ac / 0.22 ha	--
Jack-Up Transportation Barge <sup>c/</sup>	0.21 ac / 0.08 ha	--
Derrick Barge <sup>d/</sup>	0.09 ac / 0.04 ha	--
<b>Total per WTG Array</b>	<b>1.2 ac / 0.49 ha</b>	<b>0.35 ac / 0.15 ha</b>
<sup>a/</sup> Area per WTG is comprised of 4 circular legs (0.003 ac / 0.001 ha), 4 linear braces (0.015 ac / 0.006 ha), 4 triangular mud mats (0.041 ac / 0.017 ha), and sand/cement bags at the base (0.011 ac / 0.004 ha). <sup>b/</sup> Area of impact conservatively assumes a maximum of two jack-ups per WTG (0.009 ac / 0.004 ha per spud can). <sup>c/</sup> Area of impact conservatively assumes a maximum of two jack-ups per WTG (0.005 ac / 0.002 ha per spud can). <sup>d/</sup> Area of impact conservatively assumes three anchorages consisting of an 8-point anchor spread per WTG (0.006 ac / 0.003 ha per anchor).		

### 3.2.1.3 Collection System

The BIWF collection system comprises the following components:

- submarine Inter-Array Cable
- submarine and terrestrial Export Cable
- BIWF Generation Switchyard (part of the Block Island Substation)

#### Inter-Array Cable

The WTGs will be interconnected via a 34.5-kV submarine cable system connecting the WTGs in a radial inter-turbine configuration (Inter-Array Cable). The WTGs will be connected in series.

The Inter-Array Cable will comprise a single, three-core submarine cable that will carry 3-phase AC power. The cable will consist of three bundled aluminum or copper conductor cores surrounded by layers of insulating material within conducting and non-conductive metallic sheathing. The metallic sheathing is typically comprised of a lead alloy covered by protective compound (typically polyethylene) designed to prevent direct contact between the metallic sheath and the surrounding water environment, thus effectively preventing the lead from corrosion as well as the dissolution of lead contaminants into the environment throughout operation and future abandonment. The specific insulating, sheathing, filler, and protective coating material will depend on the manufacturer. One or more fiber optic cables will be included in the interstitial space between the three conductors and will be used to transmit data from each WTG or the BIWF Generation Switchyard as part of the SCADA system. The bundled cable will be approximately 6 in to 10 in (15.2 cm in to 25.4 cm) in diameter, depending on the manufacturer. See Appendix C, Figure 5, for a typical drawing of the proposed submarine cable system.

The Inter-Array Cable will be installed with a jet plow that will create a narrow temporary trench up to 5 ft (1.5 m) wide. The cable is fed into this trench as the jet plow moves along the ocean floor (see Section 3.3.4.4 for a detailed description of offshore cable installation). The jet plow will rest on skids or wheels with a width of approximately 15 ft (4.6 m). The cable will be buried to a target depth of 6 ft (1.8 m) beneath the seafloor. The actual burial depth will depend on the substrate encountered along the route and could vary from 4 ft to 8 ft (1.2 m to 2.4 m). If less than 4 ft (1.2 m) burial is achieved, Deepwater Wind may elect to install additional protection such as concrete matting or rock piles. Appendix C, Figures 6 and 7 contains a typical drawing of both the cable trench and the additional protection. Anchored vessels will be used to install additional cable protection. The anchor spread will have a radius of approximately 500 ft (152 m) at each location. Deepwater Wind expects that no more than 1 percent of the cable associated with the Project will require additional protection.

At each of the foundation locations, the Inter-Array Cable will be pulled into J-tubes mounted on the foundations (Appendix C, Figures 2 and 3). A portion of the cable will not be buried, but instead will be covered with supplemental armoring, including rock, sandbags, and/or concrete mats. Appendix B shows the preliminary Inter-Array Cable plan and profile drawings.

Table 3.2-2 provides a summary of the total construction and operation footprints for Inter-Array Cable.

**Table 3.2-2 Inter-Array Cable Construction and Operation Footprint**

	Construction	Operation
Submarine Cable <sup>a/</sup>	3.64 ac / 1.48 ha	--
Additional Cable Protection <sup>b/</sup>	0.1 ac / 0.04 ha	0.1 ac / 0.04 ha
<b>Total</b>	<b>3.74 ac / 1.52 ha</b>	<b>0.1 ac / 0.04 ha</b>
<sup>a/</sup> Includes 15 ft ( 4.6 m ) which accounts for jet plow skids/wheel area and 5 ft (1.5 m) cable trench.		
<sup>b/</sup> Conservatively assumes additional protection required for up to 1 percent of this cable installed using an anchored vessel.		

## Export Cable

A 34.5-kV AC cable will connect the WTG Array to the BIWF Generation Switchyard via WTG 5 (Export Cable). The submarine portion of the Export Cable will be the same type of cable as described for the Inter-Array Cable, and will be installed using the same jet plow technique, buried to the same target depth and will require the same additional protective armoring installed by an anchored vessel in those areas where less than 4 ft (1.2 m) of burial is achieved (see Appendix C, Figures 5 through 7). Appendix B shows the preliminary Export Cable plan and profile drawings. As detailed further in Section 3.3.3, Deepwater Wind is considering two potential alternatives for landing the Export Cable on shore - a short-distance HDD or a long-distance HDD. Table 3.2-3 provides a summary of the total footprint for the submarine portion of the Export Cable associated with construction via either a short-distance or long-distance HDD and operation of the Project.

The submarine portion of the Export Cable will make landfall on Block Island at a manhole located in the Crescent Beach parking lot. From this manhole, the Export Cable will be collocated in the same trench as the BITS and will follow the same route along existing public road rights-of-way to the newly proposed Block Island Substation on the BIPCO property (Figure 3.1-1). The underground portion of the Export Cable will be installed in a concrete-encased duct bank consisting of three single-core insulated aluminum or copper conductors in a protective jacket. The cable will be between approximately 2.5 in to 3.5 in (6.4 cm to 8.9 cm) in diameter, depending on the manufacturer. In order to cross the bridge between Trims Pond and Harbor Pond, the cable will be installed in a conduit under the bridge in bays below the

sidewalk and road surface. Appendix C, Figures 8 through 12 contain typical drawings of the terrestrial cable, manhole, and the duct banks for either aluminum or copper cable, respectively.

**Table 3.2-3 Export Cable Construction and Operation Footprint**

Export Cable	Construction	Operation
<b>Offshore</b>		
Submarine Cable <sup>a/</sup>	11.27 ac / 4.59 ha	--
Additional Cable Protection <sup>b/</sup>	0.29 ac / 0.12 ha	0.29 ac / 0.12 ha
Offshore Temporary Cofferdam <sup>c/</sup>	0.05 ac / 0.02 ha	--
<b>Total Short-Distance HDD</b>	<b>11.56 ac / 4.71 ha</b>	<b>0.29 ac / 0.12 ha</b>
<b>Total Long-Distance HDD</b>	<b>11.61 ac / 4.73 ha</b>	<b>0.29 ac / 0.12 ha</b>
<b>Onshore</b>		
Short-Distance HDD Beach Work Area <sup>d/</sup>	1.84 ac / 0.74 ha	--
Short and Long-Distance HDD Work Area	0.45 ac / 0.18 ha	--
Jet-Plow Trench <sup>e/</sup>	0.01 ac / 0.01 ha	--
Underground Cable <sup>f/ g/</sup>	3.88 ac / 1.57 ha	0 ac / 0 ha-
Overhead Cable <sup>h/</sup>	0.73 ac / 0.29 ha	0.44 ac / 0.18 ha
<b>Total Short-Distance HDD</b>	<b>7.47 ac / 3.00 ha</b>	<b>0.44 ac / 0.18 ha</b>
<b>Total Long-Distance HDD</b>	<b>5.61 ac / 2.28 ha</b>	<b>0.44 ac / 0.18 ha</b>
<sup>a/</sup> Includes 15 ft ( 4.6 m ) which accounts for jet plow skids/wheel area and 5 ft (1.5 m) cable trench. <sup>b/</sup> Conservatively assumed additional protection required for up to 1 percent of this cable installed using an anchored vessel. The construction phase temporary vessel anchorage impacts are negligible at 0.004 ac / 0.002 ha per anchorage. <sup>c/</sup> Only applicable to the long-distance HDD Alternative and includes installation using a spud barge. <sup>d/</sup> Includes temporary short-distance HDD work area and access road on Crescent Beach. <sup>e/</sup> Only applicable to the short-distance HDD Alternative and includes maximum 10 by 60 ft (3.1m by 18.3m) trench area to launch jet plow from the beach. <sup>f/</sup> Includes the 45 ft (14 m) length along bridge. <sup>g/</sup> Includes the 40 ft (12.2 m) construction right-of-way within the existing public road right-of-way. Vegetation will not need to be managed during operation. <sup>h/</sup> Includes the 30 ft (9.1 m) construction right-of-way and up to 18 ft (5.5 m) permanent right-of-way.		

Installation of the Export Cable will require a 40-ft (12.2-m) wide temporary construction right-of-way that coincides with the public road right-of-way. Deepwater Wind will keep one lane of traffic open during construction of the Export Cable on Block Island. Deepwater Wind will obtain a permanent easement from the Town of New Shoreham for the terrestrial portion of the Export Cable. No routine maintenance or vegetation clearing will be required during operation. Table 3.2-3 summarizes the construction and operation footprint associated with the terrestrial underground portion of the Export Cable route.

The Export Cable will transition to an overhead cable for a short length (approximately 0.2 mi [0.3 km]) on the BIPCO property. The overhead portion of the Export Cable will consist of three non-insulated steel-reinforced aluminum conductors, approximately 1 in and 1.5 in (2.5 cm and 3.8 cm) in diameter, supported by insulators on a set of newly installed wooden poles up to 40 ft (12.1 m) in height. If Deepwater Wind selects Substation Alternative A as the location for the Block Island Substation, 17 new poles will be required. If Deepwater Wind selects Substation Alternative B as the location for the Block Island Substation then 20 new poles will be required (see Figure 3.1-1). This new set of poles will be located along the northern side of an existing causeway on BIPCO property extending from Beach Avenue to the Block Island Substation area. These poles will replace the three currently existing poles located on the south side of this same causeway. The new poles have been designed to support the two

Project circuits, one for the BIWF Export Cable and one for the BITS Cable. The fiber optic cable associated with the Project also will transition to overhead along this portion of the terrestrial route, and be carried on these same new overhead poles. Appendix B shows the preliminary Export Cable plan and profile drawings for this overhead portion of the terrestrial route.

### BIWF Generation Switchyard

The new BIWF Generation Switchyard will consist of a switchgear building, an isolation transformer, and a separate O&M building, all of which will be located inside the 0.5 acre (0.2 acre) Block Island Substation area. This area will be fenced in and covered with crushed stone surface material.

The switchgear building will be installed on a new concrete pad and will contain the 34.5-kV metal clad switchgear, electric bus, the breakers and associated electrical equipment, including a 125-V direct current (DC) control system, batteries, charger, and DC distribution panel. New underground cable in conduit will connect this switchgear to the isolation transformer and the switchgear in the adjacent BITS Island Switchyard (see Section 3.2.2.1). The switchgear building will also house the required SCADA system and other communication equipment for monitoring of the BIWF.

The new 34.5-kV to 5-kV isolation transformer will contain approximately 4,000 gallons (15,141.6 liters) of mineral insulating transformer oil and will be mounted on a concrete foundation with a concrete oil containment pit. This containment pit has been designed consistent with TNEC standards to hold 120 percent of the oil contained in the isolation transformer.

The BIWF O&M building will be installed atop a new concrete foundation and will contain the SCADA and other communication equipment for Deepwater Wind and the WTG manufacturer to control and monitor the WTGs.

Appendix B shows the preliminary site plans for the Block Island Substation Alternatives A and B, which will contain both the BIWF Generation and BITS Island Switchyards. Table 3.2-4 summarizes the construction and operation footprints for the Block Island Substation.

**Table 3.2-4 Block Island Substation Construction and Operation Footprint**

	Construction <sup>a/</sup>	Operation <sup>b/</sup>
Block Island Substation	4.48 ac / 1.81 ha <sup>c/</sup>	0.4 ac / 0.2 ha
BIPCO Expansion	0.05 ac / 0.02 ha	0.01 ac / 0.01 ha
<b>Total</b>	<b>4.53 ac / 1.83 ha</b>	<b>0.41 ac / 0.21 ha</b>
<sup>a/</sup> Construction footprint consist of areas required for poles, staging, stormwater management, and other construction activities. <sup>b/</sup> Operation impacts consist of areas required for permanent facilities. <sup>c/</sup> Conservatively includes the entire BIPCO property.		

### 3.2.2 BITS

The BITS will consist of the BITS Island Switchyard (part of the Block Island Substation), an expansion of the existing BIPCO Substation, a terrestrial and submarine transmission cable, and the Narragansett Switchyard.

### 3.2.2.1 BITS Island Switchyard

The BITS Island Switchyard will include switchgear building, two shunt reactors, and one 34.5-kV to 5-kV distribution transformer that will be installed within the 0.5 acre (0.2 hectare) Block Island Substation. The shunt reactors and distribution transformer will be separated by a concrete fire wall.

The new 34.5-kV and 5-kV metal clad switchgear will be located inside a switchgear building installed atop a new concrete pad, which will contain the electric bus, the breakers and associated protection equipment, 125-V DC control system, batteries, charger, and DC distribution panel. The switchgear building will also house the required SCADA system and other communication equipment related to the BITS for TNEC.

The two shunt reactors will each contain approximately 1,000 gallons (3,785.4 liters) of mineral insulating transformer oil. Each of the shunt reactors will be mounted on a concrete foundation with a concrete oil containment pit. Each of the containment pits will be designed to TNEC standards to hold a minimum of 120 percent of the oil contained in the shunt reactors.

The distribution transformer will contain approximately 2,500 gallons (9,463.5 liters) of mineral insulating transformer oil. The distribution transformer will also be mounted on a concrete foundation with a concrete oil containment pit designed to hold a minimum of 120 percent of the oil contained in the distribution transformer.

The construction and operation footprints of the BITS Island Switchyard are part of the footprint of the Block Island Substation, which is detailed in Table 3.2-4.

### 3.2.2.2 Expansion of the Existing BIPCO Substation

The existing BIPCO Substation will be expanded to allow for the transmission of electricity from the BITS into the existing Block Island grid. The expansion will consist of an open-air 3-phase, 5-kV-class electrical bus and open air disconnect switches supported by steel structures. The BIPCO Substation expansion will require development of up to 0.05 acre (0.02 hectare) on the BIPCO property.

### 3.2.2.3 BITS Cable

The submarine portion of the BITS Alternative 1 Cable will be the same type of cable as described for both the Inter-Array Cable and Export Cable in Section 3.2.1.3, and will be installed using the same jet plow technique, buried to the same target depth and will also require the same additional protective armoring installed by an anchored vessel in those areas where less than 4 ft (1.2 m) of burial is achieved (see Appendix C, Figures 5 through 7). Table 3.2-5 provides a summary of the construction and operation footprints for the BITS Alternative 1. Appendix B shows the BITS Alternative 1 cable preliminary design drawings.

BITS Alternative 1 crosses four existing telecommunications cables in federal waters (see Figure 4.2-2 in Section 4.2.1.3). Two of these cables are in service and two have been decommissioned. In addition, the BITS may cross a fifth abandoned cable that is identified on a NOAA Chart 13218; however, Deepwater Wind has been unable to verify the existence of this cable despite the screening level environmental and engineering surveys conducted in 2009 and the detailed geophysical, geotechnical, benthic habitat, and archeological surveys completed in 2011. Where the BITS crosses each of the in-service cables, the BITS cable will be installed directly on the seafloor and will be protected from external aggression using a combination of sand bags and concrete mattresses (Appendix C, Figure 13). An anchored vessel will be

used to support each cable crossing in the same manner as described for the installation of the additional cable protection. Where Deepwater Wind crosses inactive cables, it is anticipated that the cables will be cut and cleared from the cable corridor during the pre-lay grapnel run. As recommended by the International Cable Protection Committee (ICPC), Deepwater Wind will coordinate with the cable owners prior to crossing the operating cables and clearing the route of the inactive cables. Appendix B shows the preliminary plan and profile drawings for the proposed cable crossings.

The BITS submarine cable will make landfall on Block Island at a manhole located adjacent to the Export Cable manhole in the Crescent Beach parking lot and will be collocated with the Export Cable along the entirety of the route to its interconnection point at the Block Island Substation. As described for the Export Cable in Section 3.2.1.3, Deepwater Wind is considering landing the BITS Cable on shore via either a short-distance or long-distance HDD.

The terrestrial portion of the BITS on Block Island will be the same type of cable as described for the Export Cable in Section 3.2.1.3, and will be installed using the same techniques, in the same duct bank and on the same poles. Appendix C, Figures 8 through 12 contain a typical drawing of the terrestrial cable, manhole, the duct banks for either aluminum or copper cable, and bridge crossing, respectively. The construction and operational footprints of the BITS on Block Island will be the same as described for the Export Cable (see Section 3.2.1.3, Table 3.2-3).

On the Rhode Island mainland, submarine portion of BITS Alternative 1 will make landfall at manhole at the Narragansett Town Beach via either a short-distance or long-distance HDD and will transition to a new overhead cable co-located with other utilities for approximately 0.8 mi (1.3 km) to its interconnection at the proposed Narragansett Switchyard. The overhead portion of BITS Alternative 1 will be supported by approximately 40 poles primarily located along TNEC's existing overhead distribution system. Installation of BITS Alternative 1 along this route will require the enhancement of up to 30 existing poles, and the installation of up to eight new poles to support both the BITS and existing utilities (Figure 3.1-4). The enhanced poles will be up to 10 ft (3 m) higher than the existing poles along the route. Installation of this portion of BITS Alternative 1 will require a up to a 30-ft (9.1 m) wide temporary construction right-of-way. During operations vegetation will be maintained within an 18-ft (5.5-m) right-of-way (see Table 3.2-5).

BITS Alternative 1 will transition to an underground cable for a short length (approximately 0.3 mi [0.5 km]) between the Narragansett Switchyard and two new poles that will be installed to support its interconnection with the TNEC system (Figure 3.1-2). The underground portion of BITS Alternative 1 will be installed in a concrete-encased double circuit duct bank (Appendix C, Figures 10 and 11). Installation of this underground segment will require a 40-ft (12.1-m) wide temporary construction right-of-way that coincides with a public parking lot and the public road right-of-way. Deepwater Wind will keep one lane of traffic open during construction of the buried portion of the BITS Alternative 1. Deepwater Wind will obtain a permanent easement from the Town of Narragansett for the buried portion of the BITS Alternative 1.



**Table 3.2-5 BITS Alternative 1 Cable Construction and Operation Footprint**

BITS Alternative 1	Construction	Operation
<b>Offshore</b>		
Submarine Cable <sup>a/</sup>	39.64 ac / 16.14 ha	--
Cable Crossings <sup>b/</sup>	0.33 ac / 0.13 ha	0.33 ac / 0.13 ha
Additional Cable Protection <sup>c/</sup>	1 ac / 0.4 ha	1 ac / 0.4 ha
Offshore Temporary Cofferdam <sup>d/</sup>	0.05 ac / 0.02 ha	--
<b>Total Short-Distance HDD</b>	40.97 ac / 16.67 ha	1.33 ac / 0.53 ha
<b>Total Long-Distance HDD</b>	41.02 ac / 16.69 ha	1.33 ac / 0.53 ha
<b>Onshore</b>		
Short-Distance HDD Beach Work Area	0.78 ac / 0.31 ha	--
Short and Long-Distance HDD Work Area	0.45 ac / 0.18 ha	--
Jet-Plow Trench <sup>e/</sup>	0.02 ac / 0.01 ha	--
Underground Cable <sup>f/</sup>	1.45 ac / 0.59 ha	--
Overhead Cable <sup>g/</sup>	3.05 ac / 1.24 ha	1.83 ac / 0.74 ha
Temporary Laydown Area	0.25 ac / 0.1 ha	--
Narragansett Switchyard	0.9 ac / 0.36 ha	0.4 ac / 0.16 ha
<b>Total Short-Distance HDD</b>	6.9 ac / 2.79 ha	2.23 ac / 0.9 ha
<b>Total Long-Distance HDD</b>	6.1 ac / 2.47 ha	2.23 ac / 0.9 ha
<sup>a/</sup> Includes 15 ft ( 4.6 m ) which accounts for jet plow skids/wheel area and 5 ft (1.5 m) cable trench. <sup>b/</sup> Inclusive of the two active cable crossings support by an anchored vessel. The construction phase temporary vessel anchorage impacts are negligible at 0.004 ac / 0.002 ha per anchorage. <sup>c/</sup> Conservatively assumes additional protection required for up to 1 percent of this cable installed using an anchored vessel. The construction phase temporary vessel anchorage impacts are negligible at 0.004 ac / 0.002 ha per anchorage. <sup>d/</sup> Only applicable to the long-distance HDD Alternative and includes installation using a spud barge. <sup>e/</sup> Only applicable to the short-distance HDD Alternative and includes maximum 10 ft by 70 ft (3.1m by 21.3m) trench area to launch jet plow from the beach <sup>f/</sup> Includes the 40 ft (12.2 m) construction right-of-way. Vegetation will not need to be managed during operation. <sup>g/</sup> Includes the 30 ft (9.1 m) construction right-of-way and 18 ft (5.5 m) permanent right-of-way.		

### 3.2.2.4 Narragansett Switchyard

The Narragansett Switchyard will be constructed at a location adjacent to a Town of Narragansett DPW building. The Narragansett Switchyard will consist of an approximately 0.6 acre (0.2 hectare) area that will contain a 34.5 kV metal clad switchgear and two shunt reactors that will be installed in a walled area covered with crushed stone surface material. The shunt reactors will be separated by a concrete fire wall.

The new metal clad switchgear will be located inside a switchgear building installed atop a new concrete pad, which will contain the electric bus, the breakers and associated electrical equipment, 125-V DC control system, batteries, charger, and DC distribution panel. The switchgear building will also house the required SCADA system and other communication equipment related to the BITS for TNEC.

The two shunt reactors will each contain approximately 1,000 gallons (3785.4 liters) of mineral insulating transformer oil. Each of the shunt reactors will be mounted on a concrete foundation with a concrete oil containment pit. Each of the containment pits will be designed to TNEC standards to hold a minimum of 120 percent of the oil contained in the shunt reactors.

The Narragansett Switchyard will be connected to the TNEC electric distribution system at Feeder 3302 via a buried cable within a concrete-encased duct bank (see Section 3.2.2.3).

Appendix B shows the preliminary design plans for the Narragansett Switchyard. Table 3.2-5 summarizes the construction and operation footprint associated with the Switchyard.

### **3.2.3 Construction and O&M Facilities**

#### **3.2.3.1 Quonset Point Port Facility**

Deepwater Wind has executed a land lease option, under which it has secured the rights to parcels at the Quonset Point port facility from the Quonset Development Corporation (QDC), the State-owned agency that manages the port facility. The QDC manages the 3,207-acre (1297.8-hectare) Quonset Business Park in North Kingstown, which includes 164 companies involved in manufacturing, warehouse and distribution, marine construction, importation, and commercial offices. The area for the Project construction staging and storage is located in the northeastern section of the park at the Davisville Waterfront District. The Port of Davisville provides 4,500 linear ft (1,372 m) of berthing space consisting of two piers, a bulkhead, on-dock rail, and a 14-acre (5.7-hectare) laydown area.

Deepwater Wind will use existing piers for offloading, staging, pre-assembly, and load-out for the WTGs and some other smaller components of the BIWF and the BITS. Deepwater Wind does not anticipate that improvements or land-disturbing activities will be necessary to utilize the site for construction and staging of the Project.

#### **3.2.3.2 Operation and Maintenance Facility**

Deepwater Wind expects to locate an O&M facility that will include a shore operations center and a control room on an existing waterfront parcel in the Point Judith, Rhode Island area. The facility will be a combination of office, maintenance shop, and a small dockside facility.

These facilities will house the Project's administrative support offices, the warehouse facility and maintenance shop for all offshore generating units, and a marine terminal for the Project's offshore support and logistics vessels.

The O&M facility and switchgear buildings located within the newly proposed Block Island Substation and the Narragansett Switchyard on the Rhode Island mainland will contain remotely operated SCADA control systems for use during operation of the Project.

### **3.3 Construction**

The construction of the Project involves the following sequence of activities:

- Contracting, mobilization, and verification
- Onshore Construction
  - Substation construction
  - Underground cable installation
  - Overhead cable Installation
- Construction of cable landfalls on Block Island and the mainland
- Offshore Construction
  - Foundation fabrication and transportation
  - Mobilization
  - Foundation installation
  - Offshore cable installation
  - Installation of the WTGs

- Commissioning and Post-Construction Activities

The following sections provide additional details regarding each of the activities associated with the construction of the BIWF and BITS.

### **3.3.1 Contracting, Mobilization, and Verification**

Upon receipt of all requisite permits and approvals, Deepwater Wind will finalize contracts with vendors, fabrication contractors, and installation contractors. Deepwater Wind will mobilize the necessary service vessels and finalize arrangements at the Quonset Point port facilities to support Project activities. For the BIWF, Deepwater Wind will engage an independent Certified Verification Agent (CVA) to review the Project design, fabrication, and installation plans in accordance with CRMC requirements. Prior to construction, Deepwater Wind will prepare an environmental compliance plan describing all of the environmental and permitting commitments to be carried out during construction. In addition, per CRMC requirements (RI Ocean SAMP Standard 1160.8[2]), Deepwater Wind will also employ a third-party environmental inspector to monitor construction activities.

### **3.3.2 Onshore Construction**

#### **3.3.2.1 Substation and Switchyard Construction**

The site for the new Block Island Substation and the Narragansett Switchyard will be excavated using heavy equipment, and the foundations for the substation will be constructed. Spoils from the excavation will be temporarily stored within the limits of work and used in the construction of the substation foundation. If disposal of spoils is needed, spoils will be tested and disposed appropriately. The concrete pad foundations for the substation components will be poured on-site or may be pre-assembled and transported from off-site.

Once the foundations have been poured, the civil work will be completed by installing the final crushed stone surface material to the substation or switchyard area. Major equipment will be transported by truck to the Narragansett Switchyard and either barged to Block Island or transported by ferry. Once on Block Island, major equipment will be transported to the BIPCO property by truck. Major equipment will be installed using a mobile crane.

The expansion of the existing BIPCO Substation facilities on Block Island will occur concurrently with the construction of the new Block Island Substation. The expansion will consist of an open-air 3-phase, 5-kV-class electrical bus and open air disconnect switches supported by steel structures.

Construction of the Narragansett Switchyard, the Block Island Substation and expansion of the existing BIPCO Substation is expected to occur over the course of up to four months. Construction activities will occur 12 hours per day during typical work hours.

#### **3.3.2.2 Terrestrial Cable Installation**

Deepwater Wind anticipates that the underground segments of the onshore portions of the Export Cable and BITS Transmission Cable routes will be installed using open-cut trenching. Open-cut trenching is completed in four phases:

- Manhole installation;
- Trench excavation;
- Duct bank installation; and
- Cable installation and testing.

The cables will be installed in sections such that these phases will be ongoing simultaneously along different sections of the route.

Measures will be implemented prior to and during construction to avoid, minimize, and mitigate impacts related to traffic, noise, stormwater runoff, erosion, sedimentation, fugitive dust, and solid waste disposal. These measures are described for each relevant resource in Section 4.0. Construction activities will occur 12 hours per day during typical hours.

### **Manhole Installation**

Access manholes will be installed along the underground cable routes on Block Island and the Rhode Island mainland. Manholes facilitate cable installation and splicing, and allow access to perform any potential future maintenance and/or repairs. Manholes will be installed at the identified submarine cable landfall locations on Block Island and at Narragansett Town Beach and located at regular intervals along the terrestrial cable route. Manholes are typically spaced 1,000 ft to 1,500 ft (305 m to 457 m) apart; however, the final spacing will be determined based on the length of the cable that can be pulled through the conduits. The manhole size will also be determined by the space required for cable pulling and splicing, as well as supporting the cable in the manhole.

### **Trench Excavation**

A saw will be used to cut along lines that mark the width of the trench to be excavated for the duct bank along existing road rights-of-way. On Block Island, the trench may be up to 4 ft (1.2 m) wide to accommodate the duct bank for both the Export Cable and the BITS. On the Rhode Island mainland, for the BITS Alternative 1 cable route, the trench may be up to 3 ft (0.9 m) wide to accommodate the BITS cable. The BITS Alternative 1 trenches will be located within both the Narragansett Town Beach parking lot from the manhole to the existing riser pole and along the approximate 0.3 mi (0.5 km) segment of the route between the Narragansett Switchyard and its connection point with the existing TNEC system along Mumford Road.

Following saw cutting, the existing pavement will be excavated by pneumatic hammers to a depth of up to 7 ft (2.1 m). In some areas, the excavation will be done by hand to avoid disturbing existing utility lines and service connections, which may necessitate a deeper trench at specific utility crossings. The trench will be sheeted and shored during construction as required by soil conditions and Occupational Safety and Health Administration (OSHA) safety rules to permit traffic travel adjacent to the trench and to allow for the trench to be covered with a steel plate to permit traffic over the trench during non-working hours.

Excavated soil may be temporarily stockpiled adjacent to the trench within the approved workspace or Project staging areas. This excavated soil may either be used as backfill for the trench or disposed of appropriately. The pavement will be loaded into a dump truck and will be handled separately from the soil to allow recycling of the pavement at an asphalt batching plant. Rocks encountered during excavation will be removed by mechanical means.

The depth of the water table and tidal influence along the terrestrial route of the Project will be defined pre-construction to determine if groundwater will have to be managed. If a small quantity of water enters the trench, this water will be pumped out of the work area through filter bags or a hay bale corral either into catch basins or, where catch basins are not available, off the road. If a significant quantity of water enters the trench, a more permanent area will be designated for water removal. Hoses may be used to pump the groundwater from the trench to the designated area. Water will be directed through filter bags or

hay bales to a catch basin or to an area that has the capacity to accept the infiltration of the water generated (e.g., a sandy beach parking lot).

### **Duct Bank Installation**

Once a portion of a trench is excavated, the conduit will be assembled and lowered into the trench. The area around the conduit will be filled with a high strength thermal concrete. After the concrete is installed, the trench will be backfilled and the site restored to pre-construction conditions. Appendix C, Figures 10 and 11 show the typical terrestrial cable trench configuration.

### **Underground Cable Installation and Testing**

The underground cable will be installed following the installation of the duct bank and manholes. The conduit will be tested and cleaned prior to installation of the cable by pulling a swab mandrel through each of the ducts to ensure they are clear of debris. When the mandrel has been pulled successfully, the conduit is ready for installation. The cable will be installed by pulling from one manhole to another. The cable will be spliced in the connecting manholes after installation using a splicing van and generator. The splicing van will contain the equipment and material to make a complete splice. If necessary, an air conditioning unit will be used to control the moisture content in the manhole. A generator provides the electrical power for a splicing van and air conditioning unit. The cable will be tested after installation and energized upon successful completion of testing.

### **Overhead Cable Installation**

On Block Island, Deepwater Wind will install up to 0.2 mi (0.3 km) of overhead cable to interconnect the BIWF Export Cable and the BITS to the new Block Island Substation located at the BIPCO property. Construction of this segment of overhead line will require the removal of three existing poles and the installation of either 17 or 20 new overhead poles depending on the alternative substation location selected (see Figure 3.1-1). The poles will be up to 40 ft (12.1 m) in height and will be augured into the ground to a depth of about 10 ft (3 m).

On the Rhode Island mainland, BITS Alternative 1 will require the enhancement of up to 30 existing poles and the installation of eight new poles. The enhanced poles will be up to 10 ft (3 m) higher than the existing poles along the route. These poles will also be augured to a depth of about 10 ft (3 m).

### **3.3.3 Landfall Construction**

Prior to the installation of the offshore portions of the Export Cable and BITS, landfalls will be constructed on both Block Island and in Narragansett. Deepwater Wind is planning to bring the cables ashore using a HDD will be used to install either a steel or high density polyethylene (HDPE) conduit for the cable under the beach. The conduit will be up to 16 in (40.6 cm) in diameter, requiring an HDD drill-hole diameter of up to 24 in (61 cm).

There are two alternatives for this HDD construction:

- 1. Short-distance HDD** from the onshore manholes located within the HDD work areas to approximately the mean high water (MHW) line (Landing Alternative 1).
- 2. Long-distance HDD** from the onshore manholes located within the HDD work areas to temporary offshore cofferdams (Landing Alternative 2).

Based on environmental and engineering analysis completed to date, the short-distance HDD is the preferred alternative. Deepwater Wind is reviewing both options in this ER.

For either alternative, the HDD for the Export Cable and BITS Cable on Block Island will begin at their respective manhole locations in the parking lot of Crescent Beach off of Corn Neck Road. On the Rhode Island mainland, the BITS HDD will begin at the proposed manhole location in the Narragansett Town Beach parking lot (BITS Alternative 1). The manholes will be installed upon completion of the conduit installation.

The manholes will be located within the proposed temporary HDD work areas shown on Figures 3.1-1 and 3.1-2. These HDD work areas have been sized to accommodate an HDD drill rig, mud pumps, generators, a slurry plant, desilter, backhoe, boom truck, crane, pickup truck, and other equipment and facilities necessary to support the construction of the Project.

For the short-distance HDD only additional workspaces will be required on each beach to support both the HDD and the jet-plow (Figures 3.1-1 and 3.1-2).

Each HDD is expected to take 3 to 12 weeks. Deepwater Wind will complete the HDD activities between fall and spring to avoid disturbance during the summer recreational season.

HDD activities will occur 12 hours per day during typical hours unless a situation arises where ceasing the HDD activity would compromise safety (both human health and environmental) and/or the integrity of the Project.

The following sections provide additional details regarding the proposed cable landing alternatives. Deepwater Wind will select the preferred landing alternative based on final engineering design.

### **3.3.3.1 Landing Alternative 1: Short-distance HDD**

On Block Island, Deepwater Wind's preferred shore landing method is a short-distance HDD from the proposed Export Cable and BITS manhole locations in the parking lot of Crescent Beach to temporary excavated trenches beginning at approximately MHW on Crescent Beach. The Export Cable and BITS trenches will each consist of an excavated area approximately 6 ft to 10 ft (1.8 m to 3 m) wide, 12 ft (3.7 m) deep, and 60 ft (10.8 m) long. Spoils from each trench excavation will be stored on the beach within the designated work area and returned to the trench after the cables are installed.

The final location for the excavated trenches will be determined prior to construction. Deepwater Wind has identified a 200 ft (61 m) permit corridor for each the Export Cable and BITS shore landing, the excavated trench will be located within the alignment of the 200 ft (61 m) corridors. Appendix B shows the preliminary short-distance HDD plan and profile drawings for the Export Cable and BITS on Block Island.

On the Rhode Island mainland, for BITS Alternative 1, Deepwater Wind's preferred shore landing is also a short-distance HDD from the proposed manhole location in the Narragansett Town Beach parking lot to a temporary excavated trench at approximately MHW on the Narragansett Town Beach. This excavated trench will be approximately 6 ft to 10 ft (1.8 m to 3 m) wide, 12 ft (3.7 m) deep, and 70 ft (21.3 m) long. Spoils from the trench excavation will be stored on the beach and returned to the trench after the cables are installed.

The final location for the excavated trench will be determined prior to construction, upon completion of final engineering design. Deepwater Wind has identified a 200 ft (61 m) permit corridor for the BITS Alternative 1 shore landing at the Narragansett Town Beach, the excavated trench will be located within the alignment of the 200 ft (61 m) corridors. Appendix B shows the preliminary short-distance HDD plan and profile drawings for the BITS Alternative 1 on the Rhode Island mainland.

To support the HDD on Block Island and the Narragansett Town Beach, Deepwater Wind will install steel sheet piling to stabilize the excavated trenches. The HDD will enter through the shore side of the excavated trench and the cable conduit will be installed between the trench and the manhole. The cables will then be pulled from the excavated trench into the manhole through the newly installed conduit.

A jet plow will be used to install the cables below the seabed at each landing location. To accomplish the necessary burial, the jet plow will be positioned over the trench at the MLW mark and be pulled from shore by the cable installation vessel. Once the vessel reaches a water depth of 20 ft (6.1 m) on the opposite shore, the plow lead lines will be detached from the vessel and transferred to a winch located with the temporary HDD work area. The winch will then be used to pull the jet plow the remaining distance up onto the beach and into the excavated trench. Deepwater Wind anticipates the cable-laying vessel will pull the plow from the Rhode Island mainland towards Block Island.

### 3.3.3.2 Landing Alternative 2: Long-Distance HDD

The Long-Distance HDD is an alternative landing methodology for the Export Cable and BITS on Block Island and the BITS Alternative 1 on the Rhode Island mainland.

On Block Island, Deepwater Wind is considering a long-distance HDD from each manhole in the parking lot of Crescent Beach to two temporary offshore cofferdams (one for the Export Cable and one for BITS) (Figure 3.1-1). The two temporary cofferdams would be located within the 984-ft (300-m) wide survey corridor evaluated during geophysical and geotechnical studies in water depths of up to 25 ft (7.6 m). Each of the HDDs will extend from the HDD work area on Block Island to the temporary cofferdams located up to 1,900 ft (579.1 m). The final location for the cofferdams will be determined prior to construction, upon completion of final engineering design. It is anticipated, however, that the BITS cofferdam and the Export Cable cofferdam would be located approximately 100 ft (30.5 m) apart.

On the Rhode Island mainland, the long-distance HDD for BITS Alternative 1 will extend from the HDD work area in the Narragansett Town Beach parking lot (Figure 3.1-2) to a temporary cofferdam located up to 1,600 ft (487.4 m) offshore in water depths up to approximately 30 ft (9.1 m). The BITS Alternative 1 cofferdam location will be within the 984-ft (300-m) survey corridor evaluated during geophysical and geotechnical studies. The final location for the cofferdams will be determined prior to construction and after completion of final engineering design.

Each temporary cofferdam will be constructed using steel sheet piles to create an enclosed area approximately 20 ft by 50 ft (15.2 m by 6.1 m). Appendix C, Figure 14 shows a typical cofferdam. The construction of the cofferdams will be supported by a spud barge. A spud barge uses up to four spuds, one attached to each corner. These spuds are lowered to the sea floor to secure the barge in place. The sizes of the pads vary, but typically range between 4 ft and 6 ft (1.2 m and 1.8 m) in diameter.

Once the sheet piles are in place, the bottom of the cofferdams will be excavated to a depth of up to 9 ft (2.7 m). The volume of excavated material will be up to 333.3 cubic yards (yd<sup>3</sup>) (254.8 cubic meters [m<sup>3</sup>]). Deepwater Wind has completed a sediment chemistry evaluation of representative samples taken at each proposed cofferdam location to support an evaluation of the sediment quality and to determine its suitability for various placement/disposal options (Appendix G). Based upon the results, Deepwater Wind has proposed that the 333.3 yd<sup>3</sup> (254.8 m<sup>3</sup>) of sediment removed from these locations be placed directly adjacent to each respective cofferdam (see Section 4.2.1.2).

Once the cable is installed the cofferdam will be removed by vibratory hammer (the reverse of installation). The excavated sediments placed in the immediate vicinity of the cofferdams will allow for

the area to return to pre-construction condition through natural movement (transport) and sorting by waves and currents using materials of similar geologic composition, grain size and biological characteristics. The potential need for the backfilling of the cofferdams with additional material prior to removal will be determined during final engineering design. Should additional material be required, Deepwater Wind will ensure the fill selected will be clean and consistent with the characteristics of the site (e.g., grain size distribution).

### 3.3.4 Offshore Construction

This section describes construction of the offshore components of the BITS and BIWF based on representative methods, vessels, and equipment. Final detailed construction plans will be developed and vendors and vessels will be procured during the contracting phase following receipt of Project permits.

The proposed construction methods, vessels, and equipment as outlined in the following sections are based on industry knowledge and site conditions. Deepwater Wind has proposed techniques that minimize impacts to natural resources and existing human uses to the extent possible. These measures include but are not limited to the implementation of a comprehensive communication plan during construction to inform commercial and recreational fishermen, mariners, and recreational boaters of construction activities and vessel movements and the establishment of designated construction vessel traffic routes, construction standby areas, and work area. Communication will be facilitated through maintaining a Project website and submitting local notices to mariners and vessel float plans, as appropriate, to the USCG. The CRMC will also require, as part of Deepwater Wind's State Assent, that Deepwater Wind fund a Fisheries Liaison Officer to support communications throughout the duration of offshore construction. To ensure that the Project is planned in a manner that minimizes impacts to commercial and recreational fishing, Deepwater Wind has already started to fund a liaison to facilitate communication between the fishing industry and Deepwater Wind.

Figure 3.3-1 illustrates the proposed Project vessel routes, the two vessel standby areas (A and B), and the designated BIWF work area for offshore construction. Table 3.3-1 provides the coordinates of the identified offshore construction and support areas.

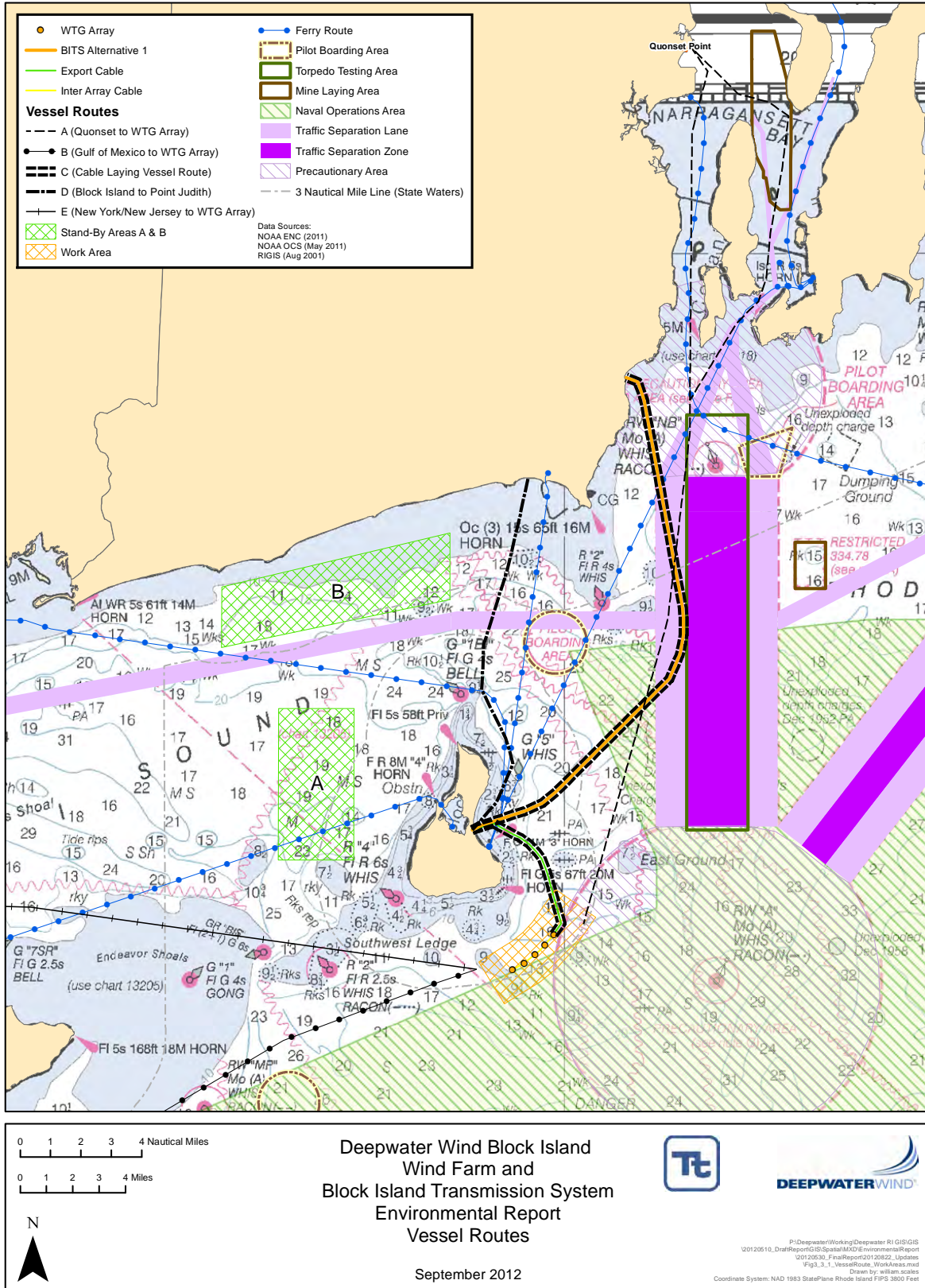
**Table 3.3-1 Project Offshore Construction and Support Areas**

Offshore Construction and Support Areas	Boundaries Coordinates	
	Latitude	Longitude
BIWF Work Area	41° 5' 16.10" N	71° 32' 36.31" W
	41° 6' 38.75" N	71° 33' 44.06" W
	41° 9' 3.04" N	71° 30' 22.93" W
	41° 8' 6.89" N	71° 28' 37.90" W
Standby Area A	41° 10' 0.12" N	71° 39' 11.88" W
	41° 10' 0.12" N	71° 42' 29.99" W
	41° 15' 0.01" N	71° 42' 29.99" W
	41° 15' 0.01" N	71° 39' 11.88" W
Standby Area B	41° 18' 36.00" N	71° 34' 59.88" W

Deepwater Wind does not propose to restrict marine use (e.g., fishing, boating) within the proposed standby areas during offshore construction activities. However, to ensure the safety of the public, work crews and equipment, Deepwater Wind will restrict access within the propose BIWF work area during the 11 week foundation, WTG and cable installation period. The area and period of restricted access will vary based on the specific construction activity and will communicated to the public through notices to mariners, the project website, and the Fisheries Liaison.



Figure 3.3-1 Construction Vessel Routes and Offshore Work Areas



Offshore construction will be completed according to the following sequence and detailed further in the following sections:

- Transportation of the foundations to the WTG installation site;
- Mobilization of equipment;
- Installation of the foundations;
- Installation of the cable systems; and
- Installation of the WTGs.

A detailed schedule for these activities is provided in Section 3.7.

### 3.3.4.1 Foundation Transportation

Deepwater Wind will commission the fabrication of the foundations, including piles, jackets, and transition decks. The jackets and transition decks will be fabricated in the U.S. Gulf of Mexico region, most likely in Texas or Louisiana, and shipped to Rhode Island.

Once foundation components have been fabricated, the fabrication contractor will load out and tie down the structures for transportation on barges. The jacket, deck, piles, and all other platform components and appurtenances will then be towed by ocean-going tugs to the installation sites where the installation vessel will be mobilized, or to one of the designated offshore support areas (Figure 3.3-1).

### 3.3.4.2 Mobilization

The WTGs and smaller secondary equipment will be transported to the staging facility on Quonset Point prior to construction. During construction, transportation barges and material barges will transport the Project components and equipment to the offshore construction sites. Figure 3.3-1 and Table 3.3-2 describe the proposed vessel routes for offshore construction. Vessels that will not be transporting material from Quonset Point will travel directly to the work sites from locations that will be determined prior to construction. Table 3.3-3 lists the types of vessels that may be utilized during construction depending on contract agreements and vessel availability. Sections 3.3.4.1 and 3.3.4.3 provide more detail on the construction methods, vessels, and equipment that will be utilized to install the offshore components of the BIWF and BITS.

**Table 3.3-2 Vessel Routes**

Route	Activities	Vessels*
A – Quonset to WTG Array	Transportation of WTGs and WTG foundation piles from construction laydown and storage area. Travel to shelter area in Narragansett Bay.	Transportation barges, towing tugs.
B – Gulf of Mexico to WTG Array	Transportation of foundations from Gulf of Mexico and mobilization of derrick barge and possibly jack-up barge.	Transportation barge, derrick barge, jack-up barge, anchor handling tug, towing tug.
C – Cable Laying Vessel Route	Jet plowing, laying of Inter-Array Cable, Export Cable and BITS.	Cable-laying barge, material barge, tugs, work vessels, support vessels, and crew boats.
D – Block Island to Point Judith	Crew boat vessel daily route to Project Area	Crew boat
E – New York/New Jersey to WTG Array	Mobilization and demobilization.	Transportation barge, derrick barge, cable-laying barge, material barge, work vessel, towing tugs.

\*Note: The routes for the derrick barge, anchor tug, or jack-up barge to the work site are unknown. These vessels may originate from the Gulf of Mexico, Atlantic Coast, or Europe depending on contract agreements and vessel availability.

**Table 3.3-3 Vessel Types**

Vessel Type	Approximate Dimensions (ft) Length x width x depth (draft)	Remarks
Transportation Barge	400 x 120 x 25 (12)	Flat-topped material transportation barge with sufficient deck space to store and secure the wind farm foundation components.
Towing Tug 1	180 x 45 x 40 (20)	80 ton bollard pull ocean going tug to tow the transportation barges with the foundation components.
Towing Tug 2	160 x 40 x 35 (18)	60 ton bollard pull ocean going tug to tow the transportation barge with the foundation piles.
Material Barge 1	120 x 50 x 20 (10)	Flat-topped material transportation barge with supporting equipment for the jet plow.
Material Barge 2	275 x 80 x 20 (8)	Flat topped material transportation barge to support cable lay operations.
Derrick Barge	500 x 140 x 40 (25)	Derrick barge with approximately 1000 ton crane and 8 anchors to keep position.
Anchor Handling Tug	180 x 45 x 40 (20)	Ocean-going tug necessary for moving the derrick barge and positioning the barge anchors during installation of the foundations.
Jack-up Transportation Barge	300 x 90 x 22 (12)	Flat-topped material barge with jack-up legs for the transportation of the WTG components.
Jack-up Barge	500 x 140 x 50 (25)	Floating barge with jack-up legs and approximately 600 ton crane for installation of the WTGs.
Cable-laying Barge	400 x 120 x 40 (18)	Floating barge with a dynamic positioning system, a turntable, a cable ramp, and a 200-ton crawler crane.
Work Vessel	300 x 80 x 25 (10)	Floating barge with a 4-anchor mooring system and a crawler crane for construction of the cofferdams.
Work Vessel Support Tug	160 x 40 x 35 (18)	60-ton bollard pull ocean-going tug to support and anchor out the work vessel.
Crew Transport Vessel	70 x 30 x 15 (5)	Provides crew transfer to/from the work sites.
Helicopter	54 x 15 x 17	Emergency air transport from work sites.
Support Vessel	50 x 15 x 20 (6)	Single-hull vessel to host the environmental and marine mammal observers.

As stated previously, Deepwater Wind will implement a communication plan during construction to inform commercial and recreational fishermen, mariners, and recreational boaters of construction activities and vessel movements. Communication will be facilitated through maintaining a Project website and submitting local notices to mariners and vessel float plans, as appropriate, to the USCG.

### 3.3.4.3 Foundation Installation

Offshore installation of the jacket foundations will be carried out from 500-ft (152.4-m) derrick barges moored to the seabed by an 8-point mooring system consisting of 10-ton anchors with a maximum penetration depth of 10 ft (3 m). Appendix C, Figure 15 shows a typical construction vessel spread for installation of the jacket foundation using a derrick barge. Alternatively the installation may be executed from the same jack-up vessel that will be used for the WTG installation.

The derrick barge will be anchored at the location of the first foundation, most likely the most northern WTG. Prior to commencing installation activities, the seabed will be checked for debris and levelness within a 100-ft (30.5-m) radius of the jacket installation location, and debris will be removed as necessary. Each jacket will be lifted from the material barge, placed onto the seafloor, leveled, and made ready for piling (Appendix C, Figure 16). The piles will then be inserted above sea level into each corner of the jacket in two segments. First, the lead sections of the piles will be inserted into the jacket legs and then driven into the seafloor. The second length of the piles will be placed on the lead pile section and welded into place. The foundation piles will then be driven into the seafloor to their final penetration

design depth or until refusal, whichever occurs first. Deepwater Wind anticipates a final pile depth of up to 250 ft (76.2 m). All pile driving will occur above sea level (Appendix C, Figure 17).

For the purpose of analysis in this ER, Deepwater Wind has assumed that the pile driving would start with a 200 kilojoule (kJ) rated hydraulic hammer, followed by a 600 KJ rated hammer to reach final design penetration. A 1,000-kilowatt (kW) unit will power the hammers.

Once the pile driving is complete, the top of the piles will be welded to the jacket legs using shear plates and cut to allow for horizontal placement of the transition deck. Finally, the boat landing and transition decks will be welded into place (Appendix C, Figure 18). Duration of pile driving is anticipated to be 4 days per jacket. Pile driving activities will occur during daylight hours starting approximately 30 minutes after dawn and ending 30 minutes prior to dusk unless a situation arises where ceasing the pile driving activity would compromise safety (both human health and environmental) and/or the integrity of the Project. Each jacket will require 7 days to complete installation. Jackets will be installed one at a time at each WTG location for a total of 5 weeks assuming no delays due to weather or other circumstances.

#### **3.3.4.4 Offshore Cable Installation**

Prior to installation, Deepwater Wind will complete route clearance and pre-lay grapnel activities to identify and remove any obstructions in the cable route. Any identified obstructions identified will be disposed of on the seafloor within the surveyed corridor.

Submerged cable installation for the Inter-Array Cable, Export Cable, and BITS will utilize a jet plow to minimize seafloor disturbance. The jet plow will be operated from a dynamic positioning (DP) cable-laying barge. DP vessels maintain their position with the use of thrusters instead of anchors. The cable-lay barge will also house a linear cable tensioner, also called a linear cable engine or caterpillar that will control the speed at which the cable is spooled over the back of the barge.

The jet plow may be a rubber-tired or skid-mounted plow with a width of approximately 15 ft (4.6 m) that will be pulled along the seafloor behind the cable-laying barge with assistance of a material barge. High-pressure water from vessel-mounted pumps will be injected into the sediments through nozzles situated along the plow, causing the sediments to temporarily fluidize and create a liquefied trench. Deepwater Wind anticipates a temporary trench width of up to 5 ft (1.5 m). As the plow is pulled along the route behind the barge, the cable will be laid into the temporary, liquefied trench through the back of the plow. The trench will be backfilled by the water current and the natural settlement of the suspended material. Umbilical cords will connect the submerged jet plow to the vessel and to control equipment to allow the operators to monitor and control the installation process and make adjustments to the speed and alignment as the installation proceeds across the water.

Depth of burial is controlled by adjusting the angle of the plow relative to the bottom. The Export Cable and BITS cables will be buried to a target depth of 6 ft (1.8 m) beneath the seafloor. The actual burial depth will depend on substrate encountered along the route and could vary from 4 ft to 8 ft (1.2 m to 2.4 m). If less than 4 ft (1.2 m) burial is achieved, Deepwater Wind may elect to install additional protection, such as concrete matting or rock piles. Appendix C, Figure 7 contains a typical drawing of the additional protection. Deepwater Wind expects that no more than 1 percent of the cable associated with the Project will require additional protection.

At each of the WTGs, cables will be pulled into the jacket through J-tubes installed on the sides of the jackets (Appendix C, Figure 3). At the submarine cable transition point at the J-tubes, additional cable

armoring as well as sand bags or rocks will be used to protect the cable. Approximately 0.01 acre (0.004 hectare) of protective material is expected to be placed on the seafloor for each WTG.

Where the BITS crosses two existing submarine cables in federal waters, the cable will be installed directly on the seafloor and will be protected from external aggression using a combination of sand bags and concrete mattresses (Appendix C, Figure 13). Anchored vessels will be used to install both the BITS and the associated cable armoring at these locations. The anchor spread will have a radius of approximately 500 ft (152 m) around the crossing. Where Deepwater Wind crosses inactive cables, it is anticipated that the cables will be cut and cleared from the cable corridor during the pre-lay grapnel run.

Depending on bottom conditions, weather, and other factors, cable installation is expected to take 2 to 4 weeks for the Export Cable and 4 to 6 weeks for the BITS Transmission Cable. This schedule assumes offshore cable laying can proceed 24 hours per day, 7 days per week.

The WTGs will be installed upon completion of the jacket foundations and the pull-in of the Inter-Array Cable. The WTGs will be transported to the offshore installation site from the storage facility at Quonset Point by jack-up material transportation barges. These transportation barges will set up at the installation site adjacent to the jack-up lift barges. The jack-up barge legs will be lowered to the seafloor to provide a level work surface and begin the WTG installation. The WTGs will be installed in sections with the lower tower section lifted onto the transition deck followed by the upper tower section. The nacelle and each blade will then be lifted and connected to the tower (Appendix C, Figure 19). Pending final engineering, the tower sections and the full rotor might be pre-assembled at Quonset Point. Installation of each turbine will require 2 days to complete assuming a 24-hour work window and no delays due to weather or other circumstances. The accommodation unit on the jack-up lift barge will provide board and lodging for crew, construction managers and inspectors. Occasional crew changes will be provided by the crew boat and/or helicopters.

The derrick barge described in Section 3.3.4.3 for the foundation installation may also be used to install the WTGs.

### **3.4 Commissioning and Post-Construction Activities**

Once all WTGs for the Project have been installed, Deepwater Wind will commence commissioning of the facility. This will entail testing the WTGs' and transmission system's capabilities to meet standards for safety and grid interconnection reliability. This testing will require technicians traveling to the turbines frequently during the initial operating period following construction. Technicians will be transported to and from the WTGs via a dedicated crew workboat.

After the BITS submarine cable has been installed, but before connections to the terrestrial cables are completed, Deepwater Wind will perform a conductor continuity test and a voltage test. Once connections to the terrestrial cables are complete, Deepwater Wind will perform additional commissioning tests, including a second continuity test and an AC voltage test. In addition, an optical time domain reflectometer (OTDR) will be used to verify the continuity of the fiber optic cable and that its terminations are in good working order. These testing and commissioning activities may be performed while the cable is energized.

Deepwater Wind will also conduct a post-construction inspection using a multi-beam survey and shallow sub-bottom profiler (chirp) to ensure cable burial depth was achieved to verify reconstitution of the trench. Based upon this post-construction inspection, Deepwater Wind will determine the need and

frequency of “spot-checks” during the O&M phase to ensure the minimum safe burial depth is maintained.

### **3.5 Operations and Maintenance**

#### **3.5.1 BIWF**

Deepwater Wind Block Island, LLC will be responsible for operation of the BIWF.

Prior to the commencement of operations, a facility-specific environmental compliance manual will be prepared for the BIWF. The manual will outline specific operating obligations and aid the staff regarding day-to-day regulatory and permit requirements.

##### **3.5.1.1 Wind Turbine Generators and Foundations**

The WTG will be maintained in accordance with a dedicated maintenance plan. It is anticipated that each WTG will require approximately 3 to 5 days of planned maintenance per year. This timing of this maintenance will be coordinated with TNEC in advance of execution.

For the foundation, an annual inspection program will be developed to ensure all nodes of the foundations are inspected within a 5-year time frame. Underwater inspection will include visuals and eddy currents tests with divers and/or remotely operated vehicles (ROVs). Any damage or cracks will be analyzed immediately and repaired accordingly.

##### **3.5.1.2 Inter-Array and Export Cables**

The Inter-Array cable and submarine and underground portions of Export Cable have no maintenance needs unless a fault or failure occurs. Cable failures are only anticipated as a result of damage from outside influences, such as boat anchors. The armoring of the Inter-Array Cable at the J-tubes, the target burial depth of 6 ft (1.8 m) for the remainder of the offshore cable and burial depth onshore of up to 7 ft (2.1 m) will ensure that damage would be an unlikely occurrence.

The cable burial depth along the route will be inspected using a sub-bottom profiler at least once every 5 years. The cable burial depth might be inspected more frequently based on the post-lay data.

Operations-phase reporting for the submarine transmission cable will be implemented, as necessary, in accordance with the requirements specified in operating permits.

Both the overhead and underground sections of the terrestrial Export Cable will be maintained consistent with TNEC standards and will consist of periodic inspections and tree trimming in the vicinity of the overhead line right-of-way to prevent damage/interference from overgrown vegetation. The overhead poles, cross arms, insulators, and conductors will also be visually inspected on a regular basis and any damage will be noted and fixed as necessary per industry standards. If the overhead lines are damaged by a severe event (e.g., a storm) they will be repaired in accordance with TNEC procedures. If necessary, the WTGs will be shut-down during the repair.

The standard industry life expectancy of the Inter-Array and Export Cables is 50 years. The equipment will be scheduled for decommissioning in advance of this timeframe or replacement/upgrade in accordance with this standard.

### **3.5.1.3 BIWF Generation Switchyard (part of Block Island Substation)**

Deepwater Wind will monitor the BIWF Generation Switchyard remotely utilizing a SCADA system located in the O&M building and will visually inspect the switchyard annually. In addition, the switchgear and its relaying equipment will be cleaned and calibrated or tested consistent with TNEC standards at periodic intervals.

Because the BIWF Generation Switchyard will utilize metal clad switchgear, Deepwater Wind anticipates O&M needs will be relatively low. However, during a severe storm or weather event it may be necessary to inspect and remove stormwater from the concrete transformer oil containment units. During such an event, BIWF maintenance personnel will visually inspect the liquid in the containment. If there is no sign of oil (i.e., oil sheen on water), the stormwater will be removed and discharged into the onsite drainage system by a portable sump pump. If there are signs of oil, the containment will be scheduled to be pumped and cleaned per industry standards in accordance with EPA requirements. The source of a leak will be investigated and leaking equipment will be fixed or replaced.

The standard industry life expectancy of the BIWF Generation Switchyard equipment is between 30 and 40 years. The equipment will be scheduled for replacement/upgrade per this standard.

### **3.5.2 BITS**

Deepwater Wind Block Island Transmission, LLC will initially be responsible for operation of the BITS. It is anticipated that TNEC will purchase the BITS and will become responsible for all operations and maintenance of the BITS.

#### **3.5.2.1 BITS Transmission Cable**

The operation and maintenance of the BITS transmission cable will be as described for the BIWF Export Cable in Section 3.5.1.2.

#### **3.5.2.2 BITS Island Switchyard and Block Island Substation**

The operation and maintenance of the BITS Island Switchyard and Block Island Substation will be as described for BIWF Generation Switchyard in Section 3.5.1.2.

## **3.6 Decommissioning**

### **3.6.1 BIWF**

Decommissioning will follow the same relative sequence as construction, but will occur in reverse. The WTG components will be removed by a jack-up lift vessel or a derrick barge and lifted onto a material barge. The material barge will transport the components to a recycling yard where the components will be disassembled and prepared for re-use and/or recycling for scrap steel and other materials. The foundations will be cut by an internal abrasive water jet cutting tool at approximately 10 ft (3 m) below the seabed. The balance of the foundations will be removed using 500-ton derrick barges and lifted onto material barges. The submarine cables will be abandoned in place. The substations associated with the BIWF will be disconnected, dismantled, and recycled in accordance with applicable permits and regulations.

### **3.6.2 BITS**

Deepwater Wind proposes to allow the BITS submarine cable to remain in place at decommissioning. Abandoning decommissioned submarine cables in place is standard industry practice.

### 3.7 Project Schedule

Offshore installation of the five WTGs, Inter-Array Cable, Export Cable, and the BITS is anticipated to occur in the spring and summer of 2014, with the facility commissioned and operational by the end of 2014. Installation of the onshore components is scheduled to occur in the winter of 2013/2014 and spring of 2014. The Project schedule assumes permits will be obtained by March 2013 in order to allow for one year of final engineering and design, contract negotiations, procurement, and manufacturing prior to installation of WTGs. Table 3.7-1 summarizes the anticipated Project schedule.

**Table 3.7-1 Project Schedule**

Activity	Anticipated Schedule
Contracting, mobilization, and verification	Spring 2013 – Spring 2014
Onshore HDD installation	December 2013 – May 2014
Cable landfall construction	January 2014 – May 2014
Onshore cable installation	October 2013 – May 2014
Substation construction	October 2013 – May 2014
Offshore cable installation	April 2014 – August 2014
Landfall demobilization and remediation	May 2014 – July 2014
Foundation fabrication and transportation	October 2013 – April 2014
WTG jacket installation and pile driving	April 2014 – June 2014
WTG installation	June 2014 – September 2014
Commissioning	July 2014 – November 2014



#### 4.0 AFFECTED ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATION MEASURES

This chapter describes the environmental analysis for the BIWF and BITS Project. The topics discussed in this section were identified through an Interdisciplinary Team process, public outreach, and agency consultations. These topics are organized and addressed according to resource areas as follows:

- Physical Oceanography and Meteorology
- Geologic Resources
- Water Quality and Water Resources
- Air Quality
- Benthic Resources
- Finfish Resources
- Essential Fish Habitat
- Marine Mammals and Sea Turtles
- Terrestrial Wildlife
- Avian and Bat Species
- Endangered and Threatened Species
- Acoustic Environment
- Marine Cultural Resources
- Terrestrial Archaeological Resources
- Aboveground Historic Resources
- Visual Resources
- Marine Uses
- Land Use
- Transportation
- Socioeconomics and Environmental Justice
- Public Health and Safety

For the purposes of this section, the Project Area refers to the footprint of the BIWF and BITS facilities within federal and state territorial waters of Rhode Island and Block Island Sound, and within the towns of New Shoreham and Narragansett in Washington County, Rhode Island. The Quonset Point port laydown area and the BIWF and BITS O&M facility will be located at existing industrial or commercial sites. Project activities at these sites are consistent with the existing uses in those areas; therefore, they are not further discussed in this section. Figure 1.1-1 in Section 1.0 provides an overview of the Project Area.

The environmental setting for each resource is described based on available literature, including but not limited to the RI Ocean SAMP, Project site-specific environmental surveys, agency consultations, and public outreach.

For each resource area, the potential environmental effects are discussed immediately following the presentation of the environmental setting. The environmental effects sections address the potential direct, indirect, and combined impacts (if any) associated with construction and operation of the BIWF and BITS. Effects are characterized as direct or indirect, are further identified from a temporal perspective, and finally are defined in terms of degree.

- **Direct or Indirect Effects:** Direct effects are those occurring at the same place and time as the initial cause or action. Indirect effects are those that occur later in time or are spatially removed from the activity.
- **Short-term or Long-term Impacts:** Short- or long-term impacts do not refer to any defined time period. In general, short-term impacts are those that occur only for a limited period or only during the time required for construction or installation activities. Long-term impacts are those that are likely to occur on a recurring or permanent basis.
- **Minor, Moderate, or Major Impacts:** Minor, moderate, or major impacts are relative terms used to characterize the magnitude of an impact. Minor impacts are generally those that may be perceptible but, in context, are not amenable to measurement because of their relatively limited and/or localized and minor impacts. Moderate impacts are those that are more perceptible and more measurable and, if adverse, might benefit from mitigation. Major impacts are those impacts that, if adverse, due to their severity, have the potential to meet the thresholds for significance set forth in CEQ regulations (Title 40 CFR Section 1508.27).

#### 4.1 Physical Oceanography and Meteorology

This section discusses the physical characteristics of the ocean including but not limited to circulation, currents, winds, waves, temperature, salinity, and density and the meteorological conditions associated with the Project Area. This section also identifies how the Project facilities and construction and operational activities may affect or be affected by the oceanographic and meteorological conditions in the Project area. Water resources and quality are discussed in Section 4.3.

##### 4.1.1 Affected Environment

###### 4.1.1.1 Physical Oceanography

The marine portions of the Project Area are located within the waters of Block Island and Rhode Island Sound and lie within the Rhode Island Renewable Energy Zone. Extensive research has been performed to characterize the physical oceanography within these waters including but not limited to the research performed in support of the Rhode Island Ocean SAMP (2011) and site-specific surveys conducted by Deepwater Wind.

Circulation in Rhode Island Sound is influenced by the interaction with Narragansett Bay, Buzzards Bay, Vineyard Sound, Nantucket Shoals, and the Atlantic Ocean. Circulation in Block Island Sound, located west of Rhode Island Sound between Block Island and the Rhode Island mainland, is largely influenced by interaction with Long Island Sound and the volume of freshwater received from the Connecticut and Thames Rivers. Winds have not been shown to play a major role in driving the long-term circulation patterns observed in Rhode Island Sound and Block Island Sound, although winds may be a significant short-term or seasonal factor. Summer southwesterly winds contribute to upwelling along the coast, help to drive the flow of Long Island Sound waters offshore, and increase the exchange of water between Block Island Sound and Rhode Island Sound. Winter winds, which are stronger than summer winds, are predominantly from the northwest and increase water column mixing (Gay et al. 2004; RI Ocean SAMP 2011).

Data indicate that waves in the Project Area come predominantly from the south, southwest, and southeast (RI Ocean SAMP 2011). The 10-year probable wave height extremes are estimated to be 21.3 ft to 23 ft (6.5 m to 7.0 m), the 50-year extremes are estimated to be 26.9 ft to 27.4 ft (8.2 m to 8.35 m), and the 100-year extremes are estimated to be 28.9 ft to 29.5 ft (8.8 m to 9.0 m).

Tides in the Project Area are predominantly semi-diurnal (e.g., nearly twice daily) with a mean tidal range of approximately 3.3 ft (1 m) (Shonting and Cook 1970). Tidal currents in Rhode Island Sound also tend to have a northwest to southwest flow, with variability due to the influence of wind stress and turbulent flow around the complex bottom topography of shoals and islands.

The difference in temperature between the surface and bottom waters associated with the Project Area ranges between approximately 32°F to 35.6°F (0°C to 2°C) in the winter months and 50°F (10°C) in the summer months (Codiga and Ullman 2010). Winter conditions tend to have a destabilizing effect that breaks down temperature stratification in the water column; conversely, summer conditions tend to promote temperature stratification.

A sharply delineated boundary, or sharp gradient (also called a front), is observed south of Block Island where lower salinity estuarine waters meet saltier continental shelf waters (Edwards et al. 2004; Ullman and Cornillon 2001). The front, readily noted by a temperature discontinuity, especially during summer months, may represent the outer boundary of estuarine influence from Long Island Sound (Ullman and Codiga 2004; Ullman and Cornillon 2001). This front fluctuates based on seasonal air temperatures and land-based rainfall (Ullman and Codiga 2004; Ullman and Cornillon 2001).

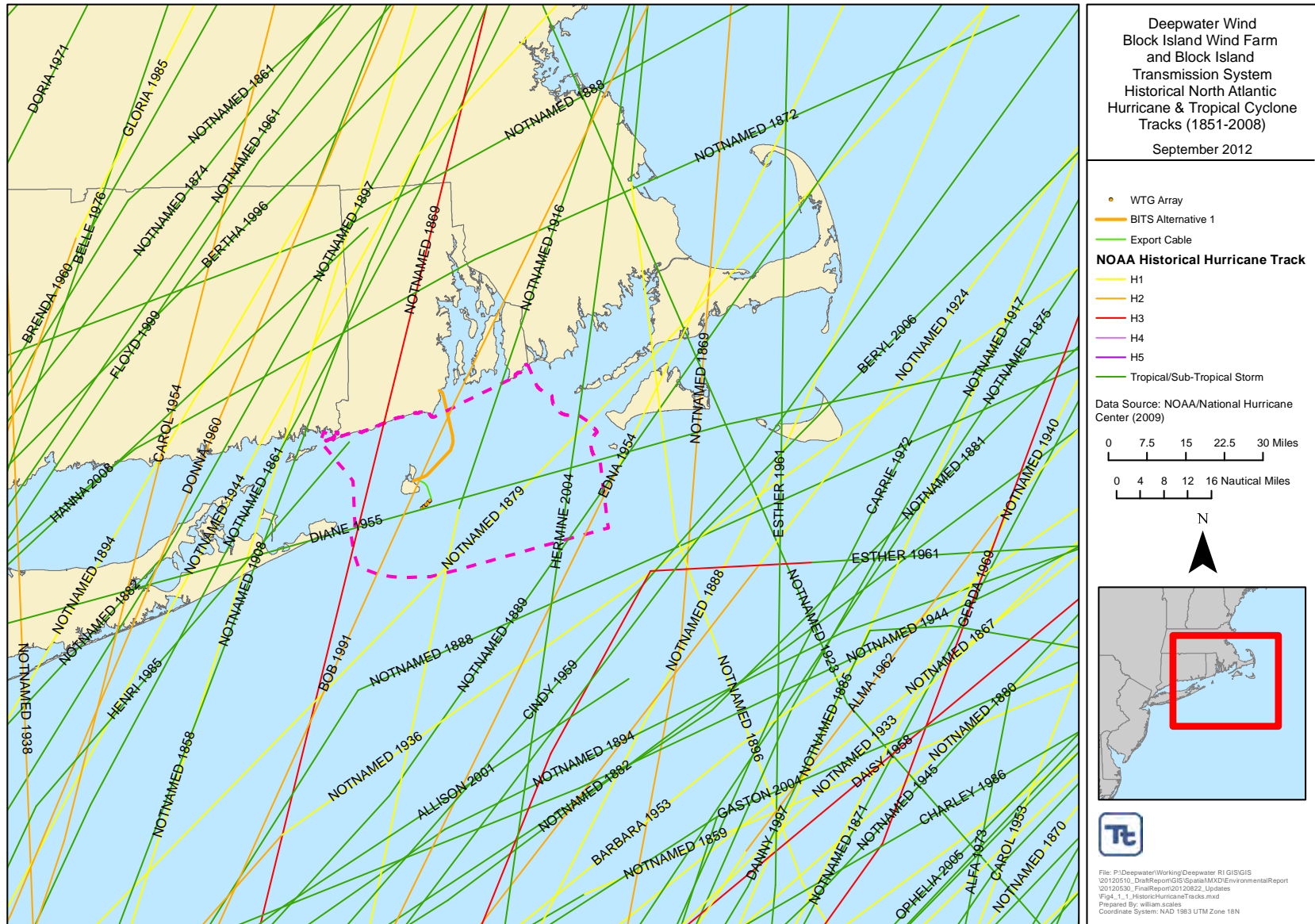
Based on monthly mean sea level data collected at the Newport Tide Gauge between the dates of 1930 to 2006, sea level rise within the Project Area, is equivalent to approximately 0.1 in (2.6 mm) per year (RI Ocean SAMP 2011). Over a 100-year period, this rate of rise would be equivalent to a change in sea level of about 10.2 in (25.9 cm). This change may however be an underestimate, as data currently shows the rate of sea level rise over the last 20 years has increased by approximately 25 percent (CRMC 2008). In addition to the rise in sea level, data also shows that Rhode Island is subsiding at a rate of 6 in (15 cm) every hundred years (CRMC 2008). Based on this information and global sea level rise modeling, it is estimated that sea level may rise between 2 ft and 5 ft (0.6 m and 1.5 m) in Rhode Island by 2100 (CRMC 2008).

#### **4.1.1.2 Meteorology**

Weather conditions in the vicinity of the Project Area are typical of the northern Mid-Atlantic Bight, which has hot summers, cold winters, and frequent precipitation. Weather conditions are more variable in the fall and winter when storms produce strong winds and high seas. In summer, the predominant winds blow from the southwest and are usually light, except for tropical storms and hurricanes, which occasionally occur in this area in August, September, or October. In winter, the predominant winds blow from the northwest (Loder et al. 1998; Spaulding et al. 2010). Wind speeds increase with distance from the mainland and are expected to be approximately 21.5 mph to 21.7 mph to (9.6 m/s to 9.7 m/s) at the WTG Array (AWS TruePower 2009).

NOAA's historical hurricane records indicate that hurricanes and tropical storms are infrequent at these latitudes and are more likely to occur to the southeast of Rhode Island Sound. Figure 4.1-1 shows the historical storm tracks recorded in the current NOAA database from 1851 to 2008 (NOAA 2009). No Category 4 or 5 hurricanes have made landfall in Rhode Island during this time period.

Figure 4.1-1 Historical North Atlantic Hurricane and Tropical Cyclone Tracks, 1851 to 2008 (NOAA 2009)



Southern New England coastal waters also experience frequent intensive wintertime storms referred to as Nor'easters that generate strong alongshore currents and cross-shelf pressure gradients that can be felt from Cape Cod to Cape Hatteras (Beardsley et al. 1976). These storms are largely responsible for the episodic events that drive strong waves and currents, and ultimately sediment transport, along the coastlines resulting in beach erosion and sediment re-suspension offshore.

A meteorological analysis of fog and icing conditions was conducted for the RI Ocean SAMP (Merrill 2010). The study used hourly observations of air temperature and dew point values to estimate fog from two offshore meteorological towers including the Martha's Vineyard Coastal Observatory (MVCO; located approximately 5 mi [8 km] from Cuttyhunk, Massachusetts) and the Buzzard's Bay Tower (BUZM3; located approximately 2 mi [3 km] south of Martha's Vineyard). Using hourly observation data from these sites, Merrill (2010) determined conditions to be "foggy" when the air and dew point temperatures were equal. Results of this analysis suggest that on average during the months of March through May and October through December, there is an average of 3 to 4 foggy days per month. A higher occurrence of fog is present during the months of June, July and August when 6 to 10 days of fog per month are likely. The results presented by Merrill (2010) are consistent with observations of fog at onshore sites, including the Block Island airport. This data is also corroborated by the U.S. Coast Pilot (NOAA 2011).

Icing potential was also evaluated in the Project Area by Merrill (2010). This analysis evaluated icing potential based on wave action, temperature of seawater, ambient temperatures, and wind speeds acting on a moving vessel. Based on the results of this analysis light icing was estimated to occur approximately 5 days per month during the months of December, January, and February. Moderate icing conditions were estimated to occur less than one day per month and only during the month of January. While this analysis was related to icing on vessels in motion and not stationary structures; the study states that these estimates can be considered as very conservative upper limits for the icing potential at stationary vessels and structures (Merrill 2010). For stationary structures, the reduced occurrence and intensity of wave breaking, because the hull or structure is stationary, lessens the volume of water raised above the sea surface, thus reducing the icing potential.

## **4.1.2 Potential Impacts and Proposed Mitigation**

### **4.1.2.1 BIWF**

#### **Physical Oceanography**

Deepwater Wind has designed the WTGs and jacket foundations to account for site-specific conditions within the Project Area. Given the relatively small diameter of the foundation piles, the total area of seafloor disturbance associated with the jacket foundations (approximately 0.07 ac [0.03 ha]), and the proposed spacing between the five foundations (0.5 mi [0.8 km]), the introduction of these structures into the water column will not have a significant effect on surrounding physical processes, including circulation, flow patterns, or stratification. Additionally, due to the water depth of 75 ft to 93 ft (22.8 m to 23.3 m) and the sediment composition within the WTG area of sand with some cobble/boulders (which provide natural scour protection), the risk of scour around the WTG foundations is low. Despite this low risk of scour, Deepwater Wind will monitor the foundations throughout operations. Underwater inspection will include visual checks and eddy current tests by divers and/or using ROVs. Should inspections reveal scour, Deepwater Wind will evaluate the need for and type of appropriate scour protection. As necessary the scour protection strategy will be discussed with jurisdictional agencies, and the appropriate permits obtained prior to installation of the necessary protection.

At the target installation depth proposed for the Inter-Array and Export Cables (approximately 6 ft [1.8 m] beneath the seafloor, varying from 4 ft to 8 ft [1.2 m to 2.4 m]), there is no potential for the cables to alter wind-driven or tidal currents, wave height, frequency, or orientation in the Project Area. In addition, the proposed cable burial depth will effectively mitigate the risk of cable movement or exposure in waters offshore.

As stated in Section 3.3.3, Deepwater Wind is considering landing the Export Cable on Block Island via either a short-distance HDD with the jet plow launch directly from the beach or a long-distance HDD to a temporary cofferdam located up to 1,900 ft (579.1 m) offshore. For the short-distance HDD the Export Cable will be buried a minimum of 10 ft (3 m) under the beach. For the long-distance HDD the Export Cable will be buried a minimum of 30 ft (9.1 m). Deepwater Wind has evaluated the potential risk for erosion that could result in the exposure of the Export Cable at its landing location under the two proposed landing alternatives. Erosion can result from a number of factors, including but not limited to wave climate, sediment transport along the beach, and sea level rise. The alignment of Crescent Beach towards the open ocean creates an environment of significant wave energy. In addition, as detailed in Section 4.1.1.1 Rhode Island is currently experiencing both minor sea-level rise and land mass subsidence that could contribute to the erosion of Crescent Beach. However, a review of available aerial photography from 1952 to present indicates that the beach has been relatively stable over time with no obvious recession or accretion. Based on this data and the proposed depth at which the Export Cable will be buried under either the short-distance or long-distance HDD landing alternative, the risk of the Cable becoming exposed due to erosion is anticipated to be low.

Deepwater Wind has completed detailed offshore and nearshore geophysical investigations to further support this assessment and to support the final engineering design of the proposed HDD landing alternatives. The results of these surveys and analyses are provided in Appendix E.

Evaluation of the effects of radiated heat from existing buried cables has found that changes in sediment temperature from subsurface cables are undetectable against natural fluctuations (RI Ocean SAMP 2011). Data showed a rise in sediment temperature directly above the cables of only 0.3°F (0.2°C) and an increase in temperature of the surrounding seawater of only 0.0000108°F (0.000006°C) (RI Ocean SAMP 2010). Based on these results, alterations to sediment temperature from the proposed Inter-Array and Export Cables would be minimal and highly localized to an area directly above the cable. As such, impacts to the surrounding water temperature will be negligible.

As evidenced above, Deepwater Wind has designed the Project to account for site-specific oceanographic conditions. Accordingly it is expected that operation of the BIWF will have no impact on and will not be adversely affected by the local physical oceanography.

Decommissioning of the BIWF WGTs and foundations at the end of the Project's projected 25-year life will follow the same relative sequence as construction, but in reverse. The Inter-Array Cable and Export Cable will be abandoned in place. As with construction and operation, decommissioning of the BIWF will have no impact on local physical oceanography.

## **Meteorology**

Deepwater Wind has designed the BIWF to account for the meteorological conditions within the Project Area. Per International Electrotechnical Commission (IEC) standards, the Siemens 6.0 MW WTG, has been designed for a maximum operational limit of up to 67 mph (30 m/s), at which point the WTG is shut down by feathering of the blades. Above these wind speeds, the WTG operations will be curtailed and the

blades will be pitched such that there is minimum load on the WTG. In addition, the WTG yaw systems will turn the rotor into the direction of the wind, further minimizing the potential stress on the structure. Based on these operating standards and under a worst-case storm conditions (50-year storm event) it is highly unlikely that the WTGs or foundations could be damaged or experience a failure.

Based on the review of meteorological conditions in the Project Area, both fog and icing conditions are known to occur at various times throughout the year. Fog conditions could potentially result in an increased risk to mariners and aviators operating in the vicinity of the WTGs. To mitigate this risk, both the WTGs and foundations will be lit with FAA and USCG-approved lighting. In addition, WTG 3 will be equipped with a fog signal (see Section 4.11.2 for additional details).

The WTGs have also been designed to minimize the effects of icing conditions in the Project Area. Specifically, the pitch and shape of the blades and blade coating material are designed to impede the build-up of ice and snow both during operations and when WTGs are immobile. In addition, the SCADA monitoring system and turbine control management system are designed to detect the build-up of ice and/or snow on the WTG and shut down operations as necessary.

The target burial depth for the Inter-Array and Export Cables of approximately 6 ft (1.8 m) beneath the seafloor (varying from 4 ft to 8 ft [1.2 m to 2.4 m]) will effectively mitigate the risk of cable movement or exposure during storm events. On Block Island, the majority of the Export Cable will be buried and therefore shielded from meteorological events. The overhead portion of the Export Cable within the BIPCO property will be exposed to elements and has been designed in accordance with TNEC standards for such environments.

Decommissioning of the BIWF will follow the same relative sequence as construction, but in reverse. The Inter-Array Cable and Export Cable will be abandoned in place. Accordingly, it is expected that BIWF will have no impact on and will not be adversely affected by the local meteorological conditions during construction, operation, or decommissioning.

#### **4.1.2.2 BITS**

##### **Physical Oceanography**

As described in Section 3.2.2.3, the submarine portion of the BITS Alternative 1 Cable will be the same type of cable as described for both the Inter-Array Cable and Export Cable and will be installed using the same jet plow technique, and buried to the same target depth. Accordingly, the construction, operation and decommissioning of the BITS will have no impact on the local physical oceanography.

Impacts on the BITS Cable from ocean processes (i.e., waves, tides and currents) along the proposed cable route and at the BITS landing location on Block Island will also be the same as described for the BIWF cable (see Section 4.1.2.1). As described for the Export Cable, the risk of cable movement or exposure in offshore waters and at the BITS landing location on Crescent Beach have been successfully mitigated by the proposed cable burial depth. At the proposed BITS Alternative 1 landing location on Narragansett Town Beach, Deepwater Wind has also taken into consideration the potential risk of cable exposure from beach erosion. Similar to Crescent Beach, Narragansett Town Beach is a dynamic beach that is strongly influenced by waves, tides, currents, storm surge, and sea level rise. According to a recent study conducted by the Woods Hole Group (2011) over the last 134-years (1869 to 2003) these processes have contributed to the erosion of Narragansett Town Beach at a rate of approximately 0.9 ft (0.3 m) per year. To avoid the risk of cable exposure at this landing location, Deepwater Wind has conservatively proposed a minimum cable burial depth of 10 ft (3 m) under the beach for the short-distance HDD

alternative and a minimum of 30 ft (9.1 m) under the beach for the long-distance HDD alternative. Deepwater Wind has also planned the installation period for the cable over the months (January to May) when natural seasonal beach scour is at its greatest. Construction during this period will therefore help to ensure the appropriate burial depth and minimize the potential for future cable exposure as natural sediment transport mechanisms will result in thicker sequences of sand throughout much of the rest of the year. For these reasons, the risk of the BITS Alternative 1 cable at the Narragansett Town Beach becoming exposed due to erosion is anticipated to be low.

Deepwater Wind has completed detailed nearshore geophysical investigations at Narragansett Town Beach to support the final engineering design of either the short or long-distance HDD landing alternative. The results of these surveys and analyses are provided in Appendix E.

### **Meteorology**

The effects of meteorological conditions in the Project Area on the submarine, overhead and underground portions of the BITS on Block Island and the Rhode Island mainland will be as described for the BIWF in Section 4.1.2.1. Deepwater Wind has designed the BITS to account for the meteorological conditions within the Project Area. Therefore the construction, operation and decommissioning of the BITS will have no impact on and will not be adversely affected by the local meteorological conditions in the Project Area.

#### **4.1.2.3 Combined Effects**

The BIWF and BITS have been designed to meet the oceanographic and meteorological conditions present within the Project Area. Therefore, there are no cumulative effects associated with the combined construction and operation of the BIWF and BITS on the surrounding physical oceanographic and meteorological conditions.

## **4.2 Geologic Resources**

This section describes the geologic resources within and surrounding the Project Area, including the regional and local geology, geologic and shallow hazards, and marine and terrestrial sediments and soils. This section also identifies how the geologic conditions within the Project Area may affect or be affected by construction and/or operation of the Project.

The geologic setting for the Project, as described in the following sections, is based on available literature including but not limited to the RI Ocean SAMP and the results of site-specific studies performed by Deepwater Wind in the BIWF and BITS Project Area.

The site-specific studies were conducted in two phases. The first phase was conducted between July and October of 2009 and consisted of a comprehensive Sediment Profile Imaging Survey to characterize the bottom sediment type at the proposed BIWF and BITS locations; and a detailed geophysical and geotechnical investigation for up to eight potential WTG locations, including borings up to 230 ft (70.1 m) in the area of the BIWF. This first phase of site-specific work helped define the preferred WTG, Inter-Array Cable, Export Cable, and BITS cable locations. The second phase of studies was comprised of a multi-disciplinary marine investigation specifically designed to further characterize and evaluate seafloor conditions and underlying shallow stratigraphy in the Project Area to support detailed Project siting and engineering design; address shallow hazard concerns; and to provide information on marine and terrestrial archaeological resources and important marine and terrestrial habitats that could potentially



be affected by construction and operational activities. This second phase of site-specific studies was conducted from September 2011 to January 2012 and in June 2012 and included the following:

- **Hydrographic Survey:** to determine water depths and reveal the existing seafloor topography using multi-beam depth sounding techniques;
- **Side-Scan Sonar Survey:** to identify morphologic variations and natural and human-caused obstructions present on the seafloor using surficial acoustic imaging techniques;
- **Magnetometer Survey:** to identify ferrous objects on or buried below the seafloor;
- **Sub-bottom Survey:** to map shallow and deep subsurface stratigraphy and geologic features using seismic reflection methods (Chip, Boomer) and included vibratory coring to directly sample the upper 10 ft (3.28 m) of seabed materials to document composition and ground truth shallow seismic profile interpretations;
- **Benthic ROV Video Survey:** to visually inspect and document benthic habitats on the seafloor; and
- **Existing utility mapping (cable toner):** to map the precise location of existing submarine cables that cross the proposed route.

Detailed descriptions and results of each of the site characterization studies can be found in Appendix E and F of this ER. A summary of the site characterization results, as they relate to the characterization of the existing environment and the impact on and effects to the proposed BIWF and BITS, are summarized in the following sections.

Deepwater Wind will complete additional shore geologic investigations to support the final engineering design of the Export Cable and BITS on Block Island, the BITS Alternative 1 route and at the Narragansett Switchyard on the Rhode Island mainland. Results of these additional surveys and investigations will be provided by Deepwater Wind, as necessary.

## 4.2.1 Affected Environment

### 4.2.1.1 Regional Geology

The proposed BIWF and BITS are located within the Avalonian Platform of eastern Massachusetts and Rhode Island. This zone is characterized by large-scale tectonic block faulting and volcanism that occurred during the Proterozoic Era, a geological time unit equivalent to the Late Precambrian Era, approximately 600 million years before present (BP) (Zen 1983), that created the complex suite of underlying bedrock schist's and volcanic and sedimentary rocks that characterize this area. Additional deformation within the region occurred during late Paleozoic and Mesozoic time as faults were reactivated. The region was further marked by deposition of near-shore coastal plain type deposits during the Cretaceous Period and early Tertiary Period. During the late Tertiary Period, in response to a worldwide low stand of sea level, the area was subaerially exposed and eroded. This period of erosion may have cut unconformities atop the bedrock and coastal plain deposits within Narragansett Bay and Rhode Island Sound.

### 4.2.1.2 Local Geology

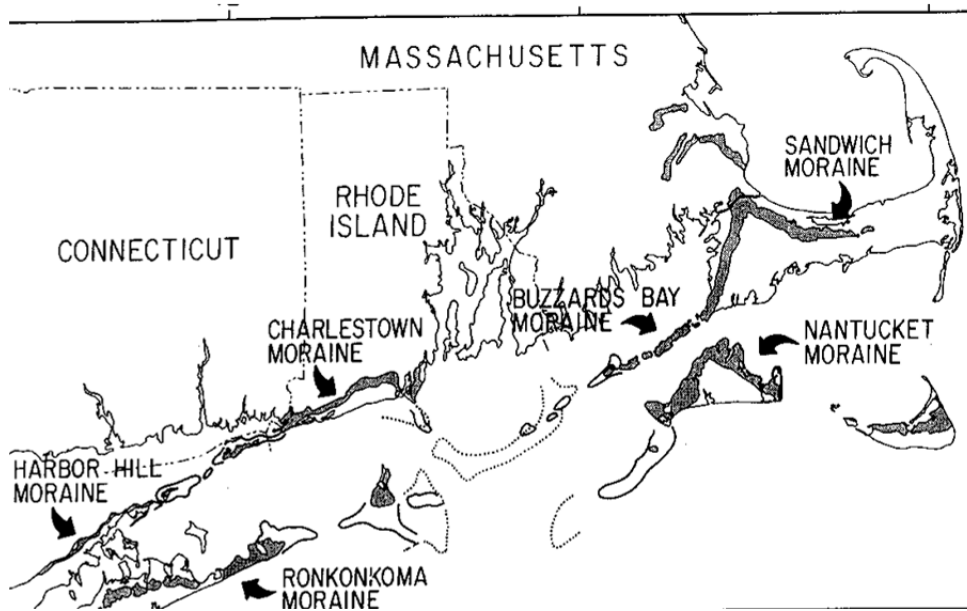
#### Marine

The surficial sediments of the Rhode Island Sound are largely of glacial origin and have been extensively reworked by shallow marine and subaerial processes during advances and retreats of the shoreline across

this area. The shoreline advances and retreats are attributed to glacial advances and retreats along with glacially related crustal depression and rebound (Oldale 1988).

In the present, the surficial sediments and features are reworked and shaped by modern tidal and storm-generated currents that erode and transport finer sediments from the shallow areas into deeper areas.

The most prominent local geological features present within the proposed Project Area and throughout the Rhode Island Sound are a series of glacial moraines enveloping Block Island and south of Point Judith, Rhode Island. As shown in Figure 4.2-1, Block Island is actually an above sea level portion of the Ronkonkoma/Buzzards Bay terminal (end) moraine system (Skehan 2008).



**Figure 4.2-1 Terminal Moraines Identifying Wisconsin Glacial Extent (Skehan, 2008)**

The moraines, in general, are composed of coarse sands and gravel, along with fine sand and silt, boulders and large glacial erratics. These moraines were deposited during the late Pleistocene glacial activity. The moraines represent the maximum extent of the Wisconsin Laurentide ice sheet that reached this area about 24,000 years BP (Stone and Borns 1986; Boothroyd and Sirkin 2002). To the north of these moraines, various freshwater glacial lakes formed within Block Island Sound and Long Island Sound, which allowed for the formation of lacustrine deposits (Skehan 2008).

The carving of underlying coastal plain strata by an ice sheet over 1 mi (1.6 km) thick, accumulations of material deposited by the glaciers, modification by meltwater streams during retreat, transformation by fluvial systems during subaerial exposure, and the reworking of deposits by shoreline transgression all played an important role in shaping the submarine landscape on the inner continental shelf off Rhode Island. The undulating morainal topography provides vertical relief on the seafloor, increasing the surface area available for modern biologic colonization in the area.

The location of these moraines and other subaqueous features was mapped as part of the RI Ocean SAMP and were further investigated by Deepwater Wind during site-specific sediment surveys and geophysical and geotechnical investigations in the Project Area (see Appendix E).

The result of Deepwater Wind's site-specific sediment surveys of the BIWF indicate that the site can be generally described as being comprised of unconsolidated sediments within the upper 10 ft to 15 ft (3 m to 4.6 m) of the stratigraphic column with coarse sediments (sand and gravel with scattered cobbles and boulders) dominant throughout. The thickness of this material was determined by the USGS to be approximately 524 ft (160 m). Depths of up to 230 ft (70.1 m) were confirmed by Deepwater Wind in 2009 during deep geotechnical borings at each of the jacket foundation locations.

One section of the Export Cable route from MP 2.0 to MP 2.8 (see Appendix E-1) does contain finer sediments (silt, clay, fine sand) that infill a relict depression in that area. Sand waves are abundant in all coarser surficial sediment areas and exhibit typical heights of 0.5 ft to 2 ft (0.2 m to 0.6 m). Sediments become even coarser farther west beyond the offshore end of the WTG array, where boulders are abundant. The constituent material is consistent with the position of the BIWF in relation to the southernmost glacial advance.

The site-specific evaluation of the BITS indicated that overall the area was comprised of unconsolidated sediments within the upper 10 ft to 15 ft (3 m to 4.6 m) of the stratigraphic column with finer sediments (silt, clay, fine sand) dominant in deeper areas. Coarser sediments (medium-coarse sand, gravel, cobble, and boulders) were found to be more common on shoals and in nearshore areas. Studies also revealed localized areas of coarse material at a number of locations along the BITS routes and the possibility of isolated boulders.

More specifically, the route proposed for BITS Alternative 1 consists of mobile sand closest to the Block Island coastline, with pockets of undisturbed cobble present. Moving into the deeper waters along BITS Alternative 1 between Block Island and Point Judith, Rhode Island, the bottom sediments turn to mostly silty sand and soft silt. The shallow region just south of Point Judith is composed of a mix of mobile sand, gravel, undisturbed cobble, and some silty sand. At the mouth of Narragansett Bay, the sediment type is consistently composed of soft silt.

As part of the geophysical and geotechnical investigation, soil samples were taken for grain size and potential soil contaminant criteria (AECOM 2012b). The Sediment Survey and Analysis Report on this effort is included as Appendix G. The results confirm predominantly sands in the area of the BIWF and silty/sand in the BITS (ASA 2012). In addition, this data was compared to the CRMC criteria for beach nourishment and Confined Aquatic Disposal (CAD) cell capping to assess the purity of area sediments. All chemical parameters were below the CRMC-dredged material suitability limits for subaqueous CAD capping purposes and also were below the biological extraneous residue limit (ERL) concentrations. Therefore, Project Area sediments are of sufficient quality to be used for marine capping applications in Rhode Island waters. This data also suggests that the sediments excavated from the proposed temporary BIWF and BITS cofferdams offshore of Block Island and Narragansett Town Beach are suitable for marine disposal. Based upon these results, if the long-distance HDD option is selected, Deepwater Wind proposes to excavate the approximate 333.3 yrd<sup>3</sup> (254.8 m<sup>3</sup>) of sediment from each of the BIWF and BITS cofferdams and deposit it by mechanical means immediately outside of and adjacent to each cofferdam. To minimize the potential for sediment dispersion, Deepwater Wind will utilize an anchored silt curtain around each cofferdam. Once the cable is installed the cofferdam will be removed. The excavated sediments placed in the immediate vicinity of the cofferdams will allow for the area to return to pre-construction condition through natural movement (transport) and sorting by waves and currents using materials of similar geologic composition, grain size and biological characteristics. The rate of discharge of material, the exact location of the silt curtain and the potential need for the backfilling of the cofferdams with additional material prior to removal will be determined during final engineering design.

## Terrestrial

The Block Island soils consist of various types of disturbed (including fill) and undisturbed sands and fine sands with lesser degrees of silt (AECOM 2012a). These soils are glacially derived and represent terminal morainal and post-glacial outwash (sorted) material. A site-specific evaluation of both the soil characteristics and depth to water along the terrestrial portion of the Export Cable route and at the two proposed locations for the Block Island Substation (Alternatives A and B) on the BIPCO property will be performed during the final engineering design.

Soils in Narragansett, Rhode Island, along the terrestrial portions of the BITS Alternative 1 and the associated Narragansett Switchyard are primarily poorly to moderately drained soils formed in dense till derived principally from dark phyllite, slate, shale, and schist. These soils were shown to have considerable areas of historic soil disturbance and can be characterized as primarily comprised of clay to cobble (AECOM 2012a).

### 4.2.1.3 Geologic and Shallow Hazards

#### Geologic Hazards

According to the 2008 USGS National Seismic Hazard Maps (USGS 2008), there is a low seismic hazard potential in the Project Area. The peak horizontal ground accelerations with a 10 percent and a 2 percent probability of exceedance in 50 years are 1 to 2 percent and 4 to 6 percent of acceleration due to gravity, respectively (USGS 2008). In addition, there are no known active faults within the Project Area.

Based on regional geologic mapping, there is no karst topography in the area and therefore no ground subsidence from these conditions is anticipated. The most recent regional volcanic activity was approximately 65 million years ago in Cape Nedrick, Maine.

Slope failures and collapse are also unlikely in the Project Area due to the topography and composition of the sediments, the bathymetry, and the current tectonic environment.

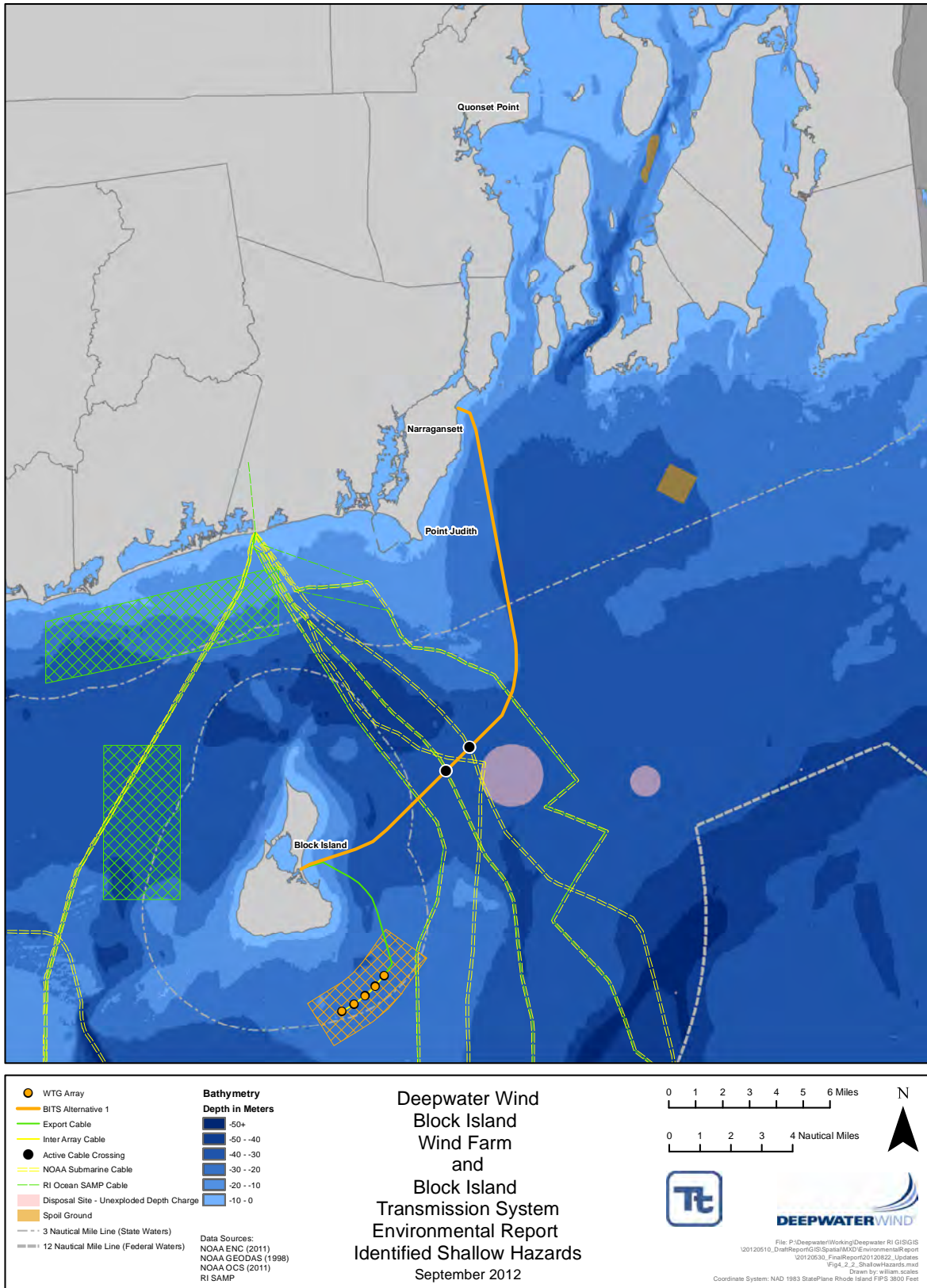
#### Shallow Hazards

Shallow hazards in the vicinity of the Project Area consist of one identified unexploded ordnance area located approximately 1 mi (1.6 km) southeast from the BITS cable route that is characterized as an unexploded depth charge (1995) (NOAA Chart 13218).

Additionally, BITS Alternative 1 traverses four existing telecommunications cables in federal waters (Figure 4.2-2). Two of these cables are in service and two have been decommissioned. A fifth abandoned cable identified on NOAA Chart 13218 has been removed and is no longer present within the route proposed for BITS Alternative. Deepwater Wind has actively located the two in service cables and passively located the two decommissioned cables in the detailed geophysical, geotechnical, benthic habitat, and archeological surveys completed in 2011.

The recent geophysical investigations offshore and in the nearshore cable landfall locations have also revealed minimal metallic man-made debris within the BIWF and BITS Project Area and associated offshore work areas. The highest concentrations of debris that were detected were found near the shoreline.

Figure 4.2-2 Identified Shallow Hazards



## 4.2.2 Potential Impacts and Proposed Mitigation

### 4.2.2.1 BIWF

#### Local Geology

Disturbance to the marine sediments during BIWF construction of the WTGs and the Inter-Array and Export Cables would be short-term, localized and minor. Tables 3.2-1 through 3.2-3 in Section 3.2.1.3 provides a summary of the total area of sediment disturbance associated with the construction of the BIWF.

As demonstrated in Tables 3.2-1 in Section 3.2.1, construction of the WTGs and foundations from the positioning of the jack-up barges and vessel anchors used during the installation will disturb a total of approximately 1.2 acres (0.5 hectares) of seafloor sediments when deployed. However, the area of disturbance associated with the jack-up barge, jack-up transportation barge, and derrick barge anchor scour (a total of approximately 0.85 acre (0.34 hectare) will be temporary and localized with sediments anticipated to return to preconstruction conditions (ASA 2012).

Based on water depth and sediment composition within the WTG area of sand with some cobble/boulders (which provide natural scour protection), the risk of scour around the WTG foundations is low.

The Inter-Array and Export Cables will be installed using a jet plow pulled from a DP vessel. The choice of a DP vessel, relative to an anchored vessel, reduces the amount of anchoring required for cable installation and the associated anchoring impacts.

Jet-plowing activities associated with the laying of these cables would result in a maximum area of disturbance of approximately 14.9 acres (6.1 hectares) along the Inter-Array and Export Cable routes (assuming a temporary trench width of 5 ft (1.5 m) and jet plow skids/wheel area of 15 ft (4.6 m). See Tables 3.2-2 and 3.2-3 in Section 3.2.1.3. Jet-plowing technology has however been demonstrated to have minimal effects to the surrounding environment. Site-specific modeling of jet-plow operations along the Inter-Array and Export Cable routes showed impacts offshore will be minor with little to no effect on the surrounding Project Area from sediment deposition. Results indicated that the total amount of sediments suspended during jet-plowing in the offshore environment would be short-lived with the majority of sediments falling primarily back into the cable trench. Because the fraction of silt and clay along these cable routes are low, deposition was also predicted to be minor. The model predicted a narrow corridor where thicknesses exceeded 10 mm (0.4 in) directly adjacent to the trench. Accumulations outside of the jet plow corridor were confined to an area of about 130 ft (40 m) and 250 ft (75 m) from the Inter-Array and Export Cable centerlines, respectively, where accumulations did not exceed 1 mm (0.04 in). The full Sediment Transport Analysis Report for offshore cable laying activities may be found in Appendix H.

As stated in Section 3.3.3, Deepwater Wind is currently considering two alternative methods for landing the Export Cable on Block Island. These methods include performing either: 1) a long-distance HDD from the parking lot of Crescent Beach off of Corn Neck Road to a temporary cofferdam located up to 1,900 ft (579.1 m) from shore; or 2) a short-distance HDD from the Crescent Beach parking lot to a location south of the dune complex near the high-water line where jet-plow operations will be initiated on the beach.

Installing the Export Cable using the long-distance HDD method would result in the installation and excavation of a temporary 50 ft by 20 ft. (15m by 6 m) offshore cofferdam. Construction of the cofferdam offshore will be supported by barge with spud piles and/or anchors and will result in a total of

approximately 0.05 acre (0.02 hectare) of temporary disturbance to the ocean floor (see Table 3.2-3, Section 3.2.1.3). Construction of the cofferdam will also require the excavation of approximately 333.3 yd<sup>3</sup> (254.8 m<sup>3</sup>) of sediment. As detailed in Section 4.2.1.2, Deepwater Wind has proposed a location and method for application of these sediments adjacent to the cofferdam.

Impacts associated with the construction and excavation of the cofferdam will be minor and short-term. Site-specific modeling of cofferdam construction activities under the worst-case (cofferdam backfilling if required) showed little to no impact on the surrounding environment as the sheet-piling installed to form the cofferdam would help to prevent sediment from traveling outside the immediate vicinity of the construction area. Specifically, the model predicted that accumulations greater than 0.4 in (10 mm) were limited to within 15 m (50 ft) of the cofferdam. Sediment accumulations did not exceed 0.04 in (1 mm) beyond 34 m (110 ft) of cofferdam (see Appendix H). Potential impacts to the surrounding environment from an inadvertent release of drilling fluid during HDD activities are discussed in Section 4.3.2.1.

Deepwater Wind has conducted geophysical surveys and analysis in the nearshore/tidal zone to assess the feasibility of the short-distance HDD landing alternative. Based on the site-specific data collected to date and a detailed review of existing information on the local geology, installation by this methodology has been determined to be feasible. The landing of the Export Cable on Block Island via a short-distance HDD would require the construction of a temporary 60 ft by 20 ft by 10 ft (18 m by 12 ft by 3.7 m) trench to support the launching of the jet plow from the beach. The construction of this trench will require the excavation of approximately 266.7 yd<sup>3</sup> (203.9 m<sup>3</sup>) of sediment and result in the temporary disturbance of about 0.1 acres (0.1 hectares). Excavated sediments will be stored according to grain size within the proposed temporary work area on the beach and will be returned to the trench upon completion of cable installation. To address the potential for long-term erosion, Deepwater Wind will match existing soil stratigraphy and density. A sediment transport analysis of jet-plow operations in the nearshore/tidal zone indicated that impacts to the surrounding environment from installation of the Export Cable off the beach will be short-term and minor, producing sediment concentrations that are of the same order of magnitude and between the average and storm conditions known to occur at Crescent Beach. The detailed nearshore sediment transport analysis has been included as Appendix H to this ER.

It should be noted that the proposed construction period for this segment of the cable is planned to take place predominantly in the winter months, when natural seasonal beach scour is at its greatest. Construction during this period will therefore help to ensure the appropriate burial depth and minimize the potential for future cable exposure as natural sediment transport mechanisms will result in thicker sequences of sand throughout much of the rest of the year at the cable landfall site. Periodic inspection of the intertidal area to ensure the cable does not become exposed will, however, be a part of the operational plan for the Project.

From the manhole on Block Island, the Export Cable will follow an upland route for approximately 0.8 mi (1.3 km) to the newly proposed Block Island Substation on the BIPCO property (Figure 3.1-1 in Section 3.1). Except where the Export Cable crosses a bridge between Trims Pond and Harbor Pond (a distance of approximately 15 ft [4.6 m]), the terrestrial portion of the Export Cable will be installed in a concrete-encased underground duct bank that will require a trench approximately 4 ft (1.2-m) wide and 7 ft (2.1 m) deep. The buried terrestrial portion of the Export Cable will be collocated in the same trench and duct bank as the buried terrestrial portion of the BITS cable and will follow the same route along existing road rights-of-way to the BIPCO property. At the BIPCO property, the Export Cable (and BITS) will transition to an overhead line for a distance of up to 0.2 mi (0.3 km) on a series of 17 to 20 new poles

to its interconnection point at the BIWF Generation Switchyard that will be located within the boundaries of the newly proposed Block Island Substation.

Construction of the Export Cable trench onshore will result in a total area of temporary disturbance of 3.9 acres (1.6 hectares) of previously disturbed soils along existing road rights-of-way (see Table 3.2-3, Section 3.2.1.3). Construction at the BIPCO property from expansion of the existing BIPCO substation, and installation of the new Block Island Substation will result in the temporary disturbance of approximately 4.5 acres (1.8 hectares) of previously disturbed soils (see Table 3.2-4, Section 3.2.1.3). If final engineering design indicates that both the Export Cable trench and substation foundation depths are greater than the depth to the water table, a dewatering plan will be developed to meet regulatory erosion and discharge requirements and submitted to agencies for review and approval prior to construction.

The BIWF and associated onshore and offshore facilities have been designed to meet the local geologic conditions of the Project Area and therefore no impacts are anticipated during operation of the BIWF Project. Furthermore, upon completion of construction, it is anticipated that sediments disturbed within the offshore BIWF construction work area and along the Inter-Array and marine portions of the Export Cable routes will return to preconstruction conditions. If a long-distance HDD is performed to land the Export Cable on Crescent Beach, upon completion of construction, the temporary offshore cofferdam will be removed and the excavated sediments placed in the immediate vicinity of the cofferdam will allow for the area to return to pre-construction condition through natural movement (transport) and sorting by waves and currents. If a short-distance HDD is performed, material excavated from the trench located on the beach will be returned to the trench and the site restored to preconstruction conditions. The trenches along the upland portion of the Export Cable route will also be backfilled and the road rights-of-way returned to preconstruction conditions. On the BIPCO property, the areas that will be disturbed in support of the construction of the Block Island Substation and associated BIWF Generation Switchyard will be graded and landscaped to minimize aesthetic impacts on the site.

Decommissioning of the BIWF at the end of the Project's projected 25-year life, as with construction, will be temporarily disruptive to the surrounding area. The WTGs and foundations will be removed (piles will be cut below the mud line) and the Inter-Array and Export Cables below the mud line will be abandoned in place. Onshore, the underground portion of the Export Cables will likewise be abandoned in place and the overhead portion of the cable removed. The Block Island Substation will be disconnected, dismantled and recycled in accordance with applicable permits and regulations. Aside from the temporary disruption of sediments and soils during the decommissioning process, which would not be materially different from construction, there will be no long-term effects to local geologic resources in the Project Area from these activities.

### **Geologic Hazards**

Of the natural seafloor hazards examined, bedforms (sand waves) and water scour are present in the survey areas. Inspection of the site-specific project survey data for natural subsurface hazards, identified small scale slumps, shallow gas, and buried channels, but no items of major significance were identified within the area of the proposed WTGs, Inter-Array Cable, and Export Cable. In addition, the likelihood of a significant geologic event, such as an earthquake as described in Section 4.2.1.3, in this area is low.

Man-made hazards include debris on the seafloor. Existing submarine cables have been avoided in the BIWF Project Area. Prior to installation, Deepwater Wind will complete route clearance and pre-lay grapnel activities to identify any obstructions within the BIWF work area and along the Export Cable



route. Obstructions identified during the route clearance and pre-lay grapnel run will be removed or moved, as is appropriate.

Results of the site-specific surveys show areas of coarse geologic material (particularly boulders) in places along the Inter-Array and Export Cable routes that may increase the difficulty of cable burial at certain points along these proposed routes. Mitigation for these conditions will be site-specific avoidance of boulders. In addition, in areas where the burial depth is less than 4 ft (1.2 m), Deepwater Wind may elect to install additional protection over the cable, such as concrete matting or rock piles. Deepwater Wind expects that no more than 1 percent the total BIWF cable routes will require additional protection or burial measures. These activities could result in a total of approximately 0.4 acre (0.2 hectare) of additional temporary sediment disturbance along the Inter-Array Cable and Export Cable routes.

The BIWF and associated onshore and offshore facilities have been designed to meet the local geologic conditions of the Project Area and therefore, no impacts are anticipated during operation of the BIWF Project.

As stated previously, the decommissioning of the BIWF at the end of the Project's projected 25-year life will result in the complete removal of the WTGs and the foundations and the Inter-Array and Export Cables offshore below the mud line will be abandoned in place. Onshore, the underground portion of the Export Cables will likewise be abandoned in place and the overhead portion of the cable removed. The Block Island Substation will be disconnected, dismantled, and recycled in accordance with applicable permits and regulations. Aside from the temporary disruption of sediments and soils during the decommissioning process, which would not be materially different from construction, there will be no long-term effects to local geologic resources in the Project Area from these activities.

#### **4.2.2.2 BITS**

##### **Local Geology**

The BITS will be installed offshore using the same jet-plowing technique as described for the BIWF Inter-Array and Export Cables. Assuming a temporary trench width of 5 ft (1.5 m) and 15 ft (4.6 m) jet plow skids/wheel area, jet-plowing activities associated with the laying of BITS Alternative 1 would result in a maximum area of disturbance of approximately 39.6 acres (16.1 hectares). Analysis of potential sediment resuspension and transport associated with jet-plowing activities along BITS Alternative 1 indicate that impacts will be minor and short-term, with little to no effect on the surrounding Project Area from sediment deposition. Similar to the modeling results of the Inter-Array and Export cable described in Section 4.2.2.1 the total amount of sediments suspended during cable installation would settle rapidly with accumulations exceeding 0.04 in (1 mm) limited to an area within about 330 ft (100 m) of the jet-plow trench along the entirety of each route (Appendix H).

The methodology for landing and installing the BITS on Block Island and its interconnection to the Block Island Substation at the BIPCO property, including potential impacts and proposed mitigation measures, will be as described for the BIWF Export Cable in Section 4.1.2.1.

On the Rhode Island mainland, Deepwater Wind is also considering either the short-distance or long-distance HDD landing alternative to bring BITS Alternative 1 ashore at Narragansett Town Beach. Installing BITS Alternative 1 using either the long-distance or short-distance HDD methods would occur during a similar time period, and result in similar limited impacts as described for the Export Cable (see Section 4.1.2.1 and Section 3.2.2.3, Table 3.2-5). As detailed in Section 4.2.1.2, Deepwater Wind has proposed a location and method for application of these sediments adjacent to the cofferdam.

As stated previously, Deepwater Wind has conducted geophysical surveys and analyses in the nearshore/tidal zone of Narragansett Town Beach to assess BITS Alternative 1 landing using the short-distance HDD method (see Appendix H). Based on the review of both site-specific and existing information on local geology, installation by this methodology on Narragansett Town Beach is also feasible. At this location, the results of the sediment transport analysis also confirmed that jet-plow operations in the nearshore/tidal zone will be short-term, minor and on the same order of magnitude and between the average and storm conditions known to occur at this beach. The detailed nearshore sediment transport analysis has been included as Appendix H to this ER.

From its landfall location on Narragansett Town Beach, BITS Alternative 1 would travel overhead on a series of 34 poles along TNEC's existing distribution system to the proposed Narragansett Switchyard (refer to Section 3.1.2, Figure 3.1-2). Installation of the eight new poles and the replacement of 30 existing poles will result in a minor temporary disturbance of 2 acre (0.8 hectare) during construction of previously disturbed soils along existing road rights-of-way (see Table 3.2-5, Section 3.2.1). Construction at the Narragansett Switchyard will also result in the temporary disturbance of 0.7 acre (0.3 hectare) of previously disturbed soils. From the Narragansett Switchyard, BITS Alternative 1 will travel approximately 0.3 mi (0.5 km) in an underground duct bank to its interconnection with the TNEC distribution system. Construction of the trench will result in a total area of temporary disturbance of 1.5 acres (0.6 hectares) of previously disturbed soils (see Table 3.2-5, Section 3.2.1).

The BITS onshore and offshore facilities have been designed to meet the local geologic conditions of the Project Area, and therefore no impacts are anticipated during operation of the BITS Project. Furthermore, upon completion of construction, it is anticipated that sediments disturbed along the marine portions of the BITS Alternative 1 route will return to preconstruction conditions. If a long-distance HDD is performed to land the BITS cable on Block Island or the Rhode Island mainland, upon completion of construction, the excavated sediments placed in the immediate vicinity of the cofferdam will allow for the area to return to pre-construction condition through natural movement (transport) and sorting by waves and currents. If a short-distance HDD is performed on Block Island and at the BITS Alternative 1 landing location on Narragansett Town Beach, the materials excavated from the trench would be returned to the trench and the site restored to preconstruction conditions. Operation of the upland portion of either BITS Alternative 1 cable route will result in minor long-term impacts associated the maintenance of a permanently cleared right of way along of approximately 1.8 acres (0.7 hectares) for BITS Alternative 1. On the BIPCO property, the areas disturbed for the construction of the Block Island Substation and associated Block Island Switchyard will be graded and landscaped to minimize aesthetic impacts on the site. The locations associated with the proposed Narragansett Switchyard will also undergo similar landscaping and grading to minimize aesthetics impacts on the surrounding areas.

It is anticipated that the BITS will be kept in operation in perpetuity. However, should the cable and associated onshore facilities reach the end of their useful operational life, the cable will be abandoned in place and the overhead portions removed. The switchyards will be disconnected, dismantled and recycled in accordance with applicable permits and regulations. Aside from the temporary disruption of sediments and soils during decommissioning, there will be no long-term effects to local geologic resources in the Project Area from these activities.

### **Geologic Hazards**

The BITS and onshore and offshore facilities have been designed to meet the local geologic conditions of the Project Area and therefore, no impacts are anticipated during operation of the Project.

As stated previously, bedforms (sand waves) and water scour are present in the Project Areas; however, no items of major significance were identified within the area of BITS Alternative 1. In addition, the likelihood of a significant geologic event, such as an earthquake, in this area is low.

Deepwater Wind has avoided man-made hazards to the extent possible; however, as indicated in Section 4.2.1.3, BITS Alternative 1 will cross two active submarine cables and two known inactive cables. As described in Section 3.2.2.1, where the BITS crosses each of the in-service cables, potential impacts will be avoided by installing the BITS cable directly on the seafloor. The cable will then be protected from external aggression using a combination of sand bags and concrete mattresses. The known inactive cables will be cleared from the BITS route in accordance with industry standard procedures. In addition, as recommended by the ICPC, Deepwater Wind will coordinate with the cable owners prior to crossing the operating cables and clearing the route of the inactive cables. It is estimated that the total area of temporary sediment disturbance associated with these cable crossings is 0.3 acres (0.1 hectares) and would have a negligible impact on the surrounding environment.

Results of the site-specific surveys show areas of coarse geologic material (particularly boulders) in places along the BITS Alternative 1 route that may increase the difficulty of cable burial at certain points along the proposed routes and require additional protection. As stated previously, Deepwater Wind expects that no more than 1 percent of the BITS cable route will require additional protection or burial measures. These activities could result in a total of approximately 1 acre (0.4 hectare) of additional temporary sediment disturbance along the BITS Project cable routes. Should these areas occur along the BITS route the mitigation measures and procedures will be the same as described for the BIWF Inter-Array and Export Cable in Section 4.2.2.1.

As stated previously, it anticipated that the BITS will be kept in operation in perpetuity. However, should the cable and associated onshore facilities reach the end of their useful operational life, aside from the temporary disruption of sediments and soils onshore during the decommissioning process, there will be no long-term effects to local geologic resources in the Project Area from these activities.

#### **4.2.2.3 Combined Effects**

The BIWF and BITS would have little to no impact on the geology associated with Project Area either through construction or operation. The BIWF and BITS have also been designed to meet the geologic conditions present within the Project Area, and the probability of a geologic event in the Project Area is low. Therefore, there are no cumulative effects associated with the combined construction and operation of the BIWF and BITS on or by the geologic resource conditions of the surrounding Project Area.

### **4.3 Water Resources and Water Quality**

This section discusses existing water quality in Rhode Island Sound based on data collected for the RI Ocean SAMP and other publicly available resources, along with data recently collected by Deepwater Wind. This section also identifies groundwater and surface water resources on Block Island and the Rhode Island mainland near the proposed onshore facilities. Wetlands are discussed in conjunction with land use in Section 4.10.

Water resources and water quality of Rhode Island marine and fresh waters are regulated by various federal and state authorities. Section 401 of the CWA (33 USC 1341) requires a water quality certification for activities that may result in discharge of dredged or fill material into navigable waters of the United States. Rhode Island State law (RIGL 46-12-1) further requires certification that the proposed activity complies with Rhode Island Water Quality Regulations, which establish water quality standards for the

state's surface waters. RIDEM is responsible for issuing the certification. The information provided in this section and related appendices are intended to support RIDEM's review of the Project prior to issuing a water quality certification. Additionally, pursuant to Section 402 of the CWA (33 USC 1342), a construction stormwater permit under the RIPDES is required for disturbance of more than 1 acre (0.4 hectare) of land to prevent the discharge of pollutants from these activities. Deepwater Wind will obtain coverage under the RIPDES construction stormwater permit prior to construction.

The State of Rhode Island has established protected coastal and marine waters throughout the state, designating the most sensitive uses for which the various waters of the State shall be enhanced, maintained, and protected. The anti-degradation provision of the regulations requires that the level of water quality necessary to protect existing uses must be maintained and protected. The Export Cable and BITS cable landfall on Block Island and the BITS Alternative 1 cable landfall on Narragansett Town Beach are located within areas designated as Conservation Areas (Type 1). The marine BIWF and BITS facilities are located in Multipurpose Waters (Type 4), with the WTGs in Multipurpose Waters designated for renewable energy development (Type 4E). Further detail related to siting of the Project components in these areas is provided in the coastal zoning discussion in Section 4.10.

### **4.3.1 Affected Environment**

#### **4.3.1.1 Marine Waters**

The areas proposed to support the construction and operation of the BIWF and BITS Project are located within the waters of Block Island and Rhode Island Sound and lie within the designated RI Ocean SAMP area. Ocean waters beyond 2.6 nm (4.8 km) offshore are typically characterized by very low concentrations of suspended particles. The Rhode Island Sound and the adjacent Atlantic Ocean exhibit this low concentration of suspended matter, similar to much of the Mid-Atlantic Bight, with an average concentration ranging from (1 milligram per liter [mg/L] to 2 mg/L) (Pratt and Heavers 1975). Bottom currents may resuspend silt and fine-grained sands causing higher suspended particle levels in benthic waters. Storm events, particularly frequent intensive wintertime storms (including Nor'easters), may also cause a temporary increase in suspended sediment loads.

Dissolved nutrients are primarily introduced by outflow from Narragansett Bay, Long Island Sound, and Buzzards Bay. Discharge of groundwater to coastal waters is another important source of dissolved nutrients that may affect waters in the Project Area, especially at the coastal interconnection points on Block Island and Narragansett, Rhode Island. Previous research on nutrient concentrations in Block Island Sound concluded that overall nutrient concentrations were highest in the autumn and near zero/undetectable during late spring and early summer (Staker and Bruno 1977).

According to the RI Ocean SAMP, metals concentrations (silver, arsenic, cadmium, chromium, copper, nickel, lead, selenium, zinc) in the water column associated with the RI Ocean SAMP study area, and inclusive of the Project Area, are at concentrations well below ambient RIDEM water quality criteria for toxic pollutants.

Suspended matter in the near-shore environment is typically higher than that found in deeper waters. Actual sampling of seawater as part of the sediment survey conducted by Deepwater Wind in the area of the proposed temporary cofferdams for the long-distance HDD landfall alternative indicated total suspended solids (TSS) at the reference locations to be in the 20 mg/L to 30 mg/L range (Appendix H). Corresponding metals analyses were generally within the range of expected concentrations for these

coastal seawater samples. Additional detail is provided in the Sediment Survey and Analysis Report in Appendix G.

#### **4.3.1.2 Groundwater**

Block Island was designated as a sole source aquifer in 1983 by the EPA. This designation means that all of Block Island is considered a continuous aquifer bounded by the Atlantic Ocean that serves as a source of drinking water for local residents with no existing alternative drinking water source or combination of sources that could potentially provide 50 percent or more of the drinking water, nor are there any reasonably available alternative in the future (EPA 1984). Accordingly, Deepwater Wind has taken care to design the Project so that it will have no adverse impact on Block Island's sole-source aquifer, as further detailed in Section 4.3.2.1.

Several publicly and privately operated wells provide water to the Town of New Shoreham. Wellhead protection areas have been established throughout Block Island to protect groundwater quality. The BIPCO property and the terrestrial portion of the BIWF Export Cable and BITS route up to the bridge between Trims Pond and Harbor Pond are located within the 1,200-acre (486 hectares) Harbor Area Wellhead Protection Area. This protection area encompasses 29 wells located in or near the downtown commercial district in east-central Block Island that are maintained by 25 water suppliers (Rhode Island Department of Health 2003).

The BIPCO Property is supplied by potable water from an on-site well. In the past, over 69 underground storage tanks (USTs) have been located on the BIPCO property; the site has been investigated for contamination from the release of fuel products and has been undergone remediation. Recently completed soil and groundwater investigations indicate that the contaminant levels at the site do not exceed applicable RIDEM criteria (GZA 2012).

Public drinking water for Narragansett is supplied by municipal sources that do not rely on local groundwater withdrawal.

#### **4.3.1.3 Surface Water**

The BITS Export Cable crosses the bridge between Harbor Pond and Trims Pond. These salt ponds influenced by tidal fluctuations are considered a dynamic coastal estuarine environment and are identified as Coastal Barrier Resources Systems (CBRS) Areas.

Surface waterbodies in the area of the BIPCO property flow to the north through a series of freshwater wetlands and shallow ponds situated around the south, west, and northwest borders of the property (Figure 4.3-1). These surface waters appear to be contiguous with Trims Pond to the north via culverts under Beach Avenue. Several of the shallow ponds are former cooling water ponds or discharge locations for previous BIPCO activities (AECOM 2012a).

Surface waters along the BITS Alternative 1 consist of Lake Canonchet and Little Neck Pond west of the Town Beach parking lot. The BITS cable will be located on existing poles along the road south of Lake Canonchet. Near the Narragansett Switchyard, the BITS Alternative 1 cable will be located on existing poles along the road north of Sprague Pond. The southern tip of Pettaquamscott Cove is located approximately 500 ft (152.4 m) north of the interconnection point with the existing TNEC 3302 Feeder Line (Figure 4.3-2).

Figure 4.3-1 Block Island Cable Route

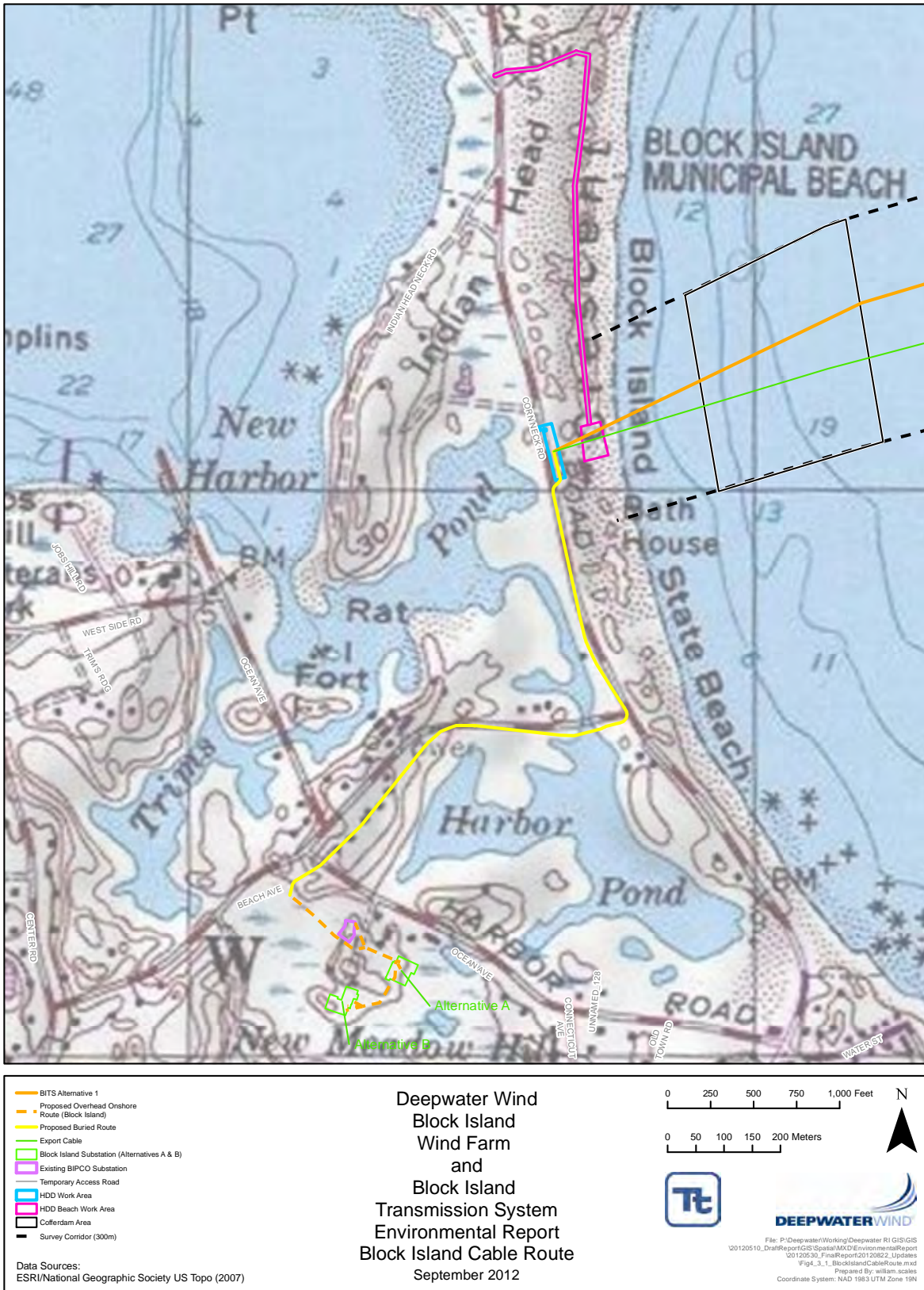
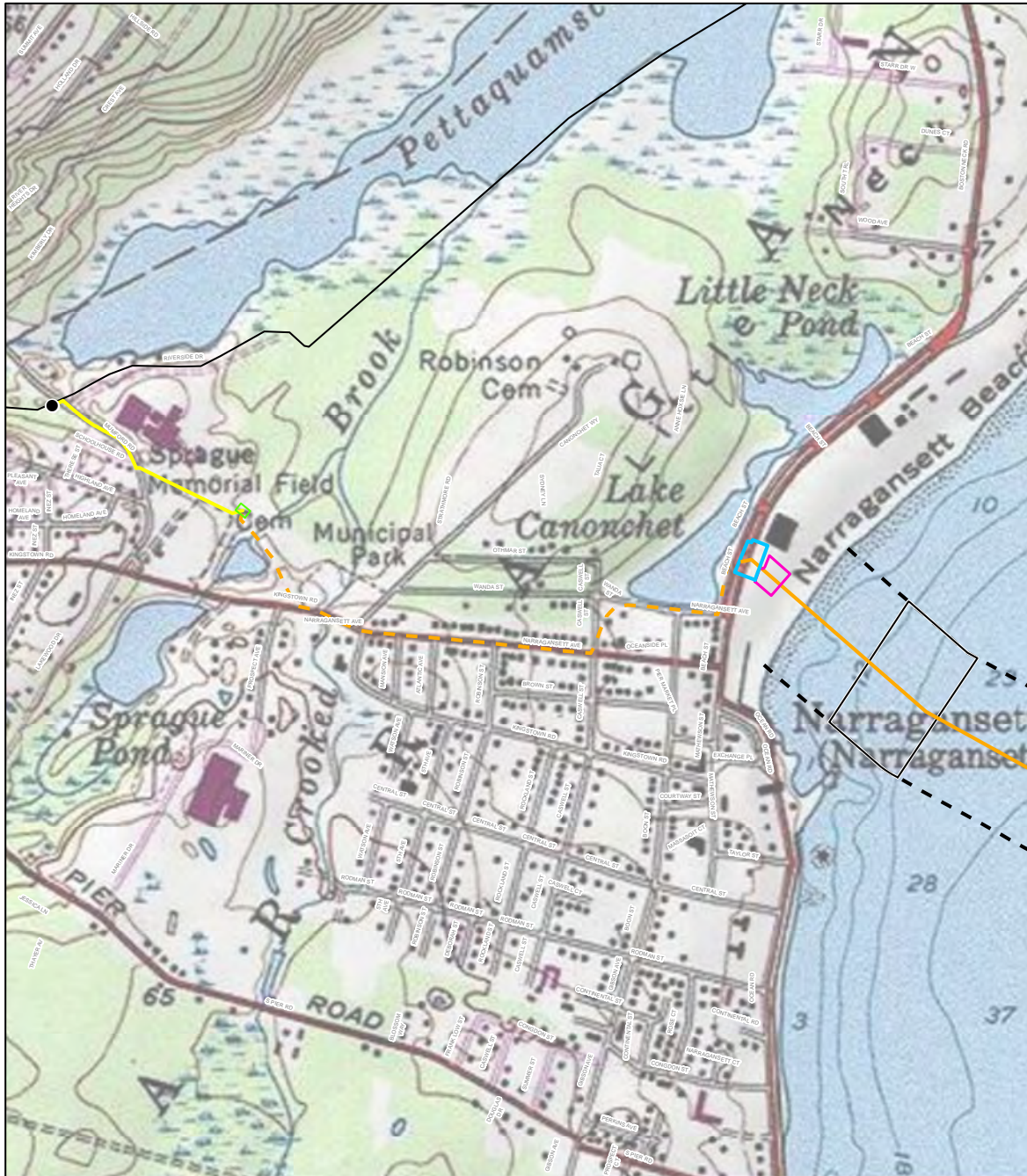


Figure 4.3-2 BITS Alternative 1 Mainland Route



- BITS Alternative 1
- Proposed Overhead Onshore Route (Narragansett Ave.)
- Proposed Buried Route
- Existing Transmission Line
- Interconnection Point with National Grid 3302 Feeder Line
- HDD Work Area
- HDD Beach Work Area
- Narragansett Switchyard
- Cofferdam Area
- Survey Corridor (300m)

Data Sources:  
 ESRI/National Geographic Society US Topo (2007)

Deepwater Wind  
 Block Island  
 Wind Farm  
 and  
 Block Island  
 Transmission System  
 Environmental Report  
 BITS Mainland Route (Alt 1)  
 September 2012

0 350 700 1,050 1,400 Feet N

0 75 150 225 300 Meters



File: P:\Deepwater\Working\Deepwater RI GIS\GIS\20120510\_DraftReport\GIS\Scale\MXD\EnvironmentalReport\20120530\_FinalReport\20120822\_Updates\Fig4\_3\_2\_BITSMainland\_Alt1.mxd  
 Prepared By: william scales  
 Coordinate System: NAD 1983 StatePlane Rhode Island FIPS 3800 Feet

## 4.3.2 Potential Impacts and Proposed Mitigation

### 4.3.2.1 BIWF

#### Marine Waters

Impacts to marine water quality resulting from the construction of the BIWF would be minor and temporary, consisting of sediment disturbance from pile-driving, cable-laying, and the positioning of jack-up barges and vessel anchors. Sediments disturbed in the cable-laying process are not expected to contain contaminants based on site-specific sampling results at the proposed cofferdam location off of Block Island for the long HDD landing alternative (Appendix G).

Installation of the Export Cable and Inter-Array Cable using a jet plow and refilling of the temporary cofferdam, if applicable, will result in temporary and localized suspension of sediments in the water column. The magnitude of the effects depends on the source sediment characterization (i.e., grain size), the volume of affected sediment, the rate of resuspension during the activity, and the currents transporting the sediment. A sediment transport study was completed for the Project to estimate the suspended solids concentrations that may result from marine construction activities in both the offshore and nearshore/tidal zone (Appendix H). For the jet plow activities, the study modeled three different jet plow advance rates to evaluate the effect to sediment resuspension. Potential impacts were determined to be minor, short-term, and localized and will not have a significant impact on marine water quality.

Sediments along the Inter-Array Cable consist predominantly of coarse sands and gravels. Modeling results of sediments suspended during jet plow activities indicated that in regions with large grain sizes sediments would quickly drop back to the seafloor keeping concentrations low. Concentrations above ambient background levels would only occur within a few meters of the jet plow. Along the entirety of the route, TSS concentrations would not exceed 100 mg/L, and were predicted to decrease to 10 mg/L or less within an hour, and remain confined to an area within 160 ft (50 m) of the Inter-Array Cable route.

Elevated TSS concentrations along the offshore segment of the BIWF Export Cable route were also calculated to be low, with the majority of the sediments settling out rapidly. The sediment grain size distribution along the Export Cable route was more variable than the Inter-Array, including areas with a large proportion of clay and silt. While the majority of the route was sandy and sediments settled quickly, modeling indicated that in the clay/silt areas maximum concentrations reached 500 mg/L and extended up to 650 ft (200 m) away from the jet plow track. In these same areas, TSS concentrations of 10 mg/L reached up to 3,300 ft (1,000 m) from the jet plow. Plumes with higher concentrations (>200 mg/L) areas persisted for less than 10 cumulative minutes, although lower concentration plumes (10 mg/L) were experienced for up to 2 hours.

Cable landfall construction activities may also result in temporary, localized, and minor impacts to the shallow waters near the cable landfall location. The sediment transport study modeled the potential TSS concentrations resulting from the installation of a temporary 50 ft by 20 ft (15.2 m by 6.1 m) offshore cofferdam, which would only be necessary for long-distance HDD landfall alternative. Refilling of the cofferdam was modeled as representative of the largest potential increase in TSS from cofferdam activities. The sediments at the Block Island cofferdam site are sandy and therefore the material will tend to settle relatively rapidly to the bottom. The sediment transport study predicted that concentrations rarely exceeded 100 mg/L from these operations and that such plumes were expected to dissipate within about 10 minutes. For the short-distance HDD landing alternative no offshore cofferdam is required. Instead the jet plow would be launched from a trench excavated up to the mean high water line on the beach.



Analysis of the nearshore sediment transport for jet plow operations off the beach indicated that the resulting TSS provided a very small contribution to the natural sediment concentrations in the nearshore environment of Crescent Beach and were on the same order of magnitude and between the average and storm conditions known to occur at this beach. The detailed nearshore sediment transport analysis has been included as Appendix H to this ER.

For the short-distance HDD landing alternative, spoils from the trench excavation will be stored on the beach within the designated temporary work area and returned to the trench after the cables are installed. Deepwater Wind will implement stormwater pollution prevention best management practices and erosion control measures during construction to avoid and/or minimize any potential impacts. A draft Generic Stormwater Pollution Prevention Plan (SWPPP) is included as Appendix I. The SWPPP and erosion control plans will be prepared during final design and prior to construction be submitted to RIDEM for review and approval under RIPDES.

Both the short- and long-distance HDD landfall alternatives would require the use of HDD drilling fluid, which typically consists of a water and bentonite mixture. The mixture is made up of mainly inert and non-toxic clays and rock particles consisting predominantly of clay with quartz, feldspars, and accessory material such as calcite and gypsum. While the mixture is not anticipated to significantly affect water quality if released, Deepwater Wind will implement best management practices during construction to minimize potential release of the fluid. These measures may include returning the drilling fluid to surface pits and collecting it for reuse after cleaning.

The HDD also creates a potential for frac-out during drilling activities. A frac-out occurs when the drilling fluids migrate unpredictably to the surface through fractures, fissures, or other conduits in the underlying rock or unconsolidated sediments. A frac-out could potentially increase turbidity and possibly affect aquatic habitats. As the suspended material settles out of the water column, sedimentation would partially or entirely cover the waterbody substrate and any sessile benthic organisms. Because Deepwater Wind has avoided sensitive habitats in selection of the cable landfall location, a potential frac-out will result in only minor and localized impacts to water quality in the shallow marine environment along the Export Cable route. In addition, Deepwater Wind will develop an HDD Contingency Plan for the Inadvertent Releases of Drilling Fluid prior to construction to further minimize the potential risks associated with a frac-out.

As standard practice, vessels operate in compliance with oil spill prevention and response plans that meet USCG requirements. While the WTGs will not contain significant amounts of lubricating oil or other materials that may affect water quality if released into the marine environment, Deepwater Wind will prepare a Spill Prevention and Response Plan to address the limited low quantity of such materials.

As discussed above, impacts from construction activities will be temporary, localized, and minor; operation of the BIWF is not anticipated to result in any impacts to water quality.

### **Groundwater**

From the manhole on Block Island, the Export Cable will follow an upland route for 0.8 mi (1.3 km) to the BIPCO property (refer to Figure 3.1-1 in Section 3.1-2). The terrestrial portion of the Export Cable will be installed in a concrete-encased underground duct bank with the BITS terrestrial cable from the manhole to the BIPCO property. The trench for the installation of the duct bank will be excavated up to a depth of 7 ft (2.1 m). In some areas, the excavation will be completed by hand to avoid disturbing existing utility lines and service connections, and may necessitate a deeper trench at specific utility crossings.

The depth of the water table and tidal influence along the terrestrial route will be defined during final engineering to determine if groundwater will have to be managed during construction. If dewatering is determined to be necessary in the final engineering design, a dewatering plan will be developed in accordance to regulatory erosion control and discharge requirements and submitted to agencies for review and approval prior to construction. Potential dewatering measures that may be implemented during cable installation are described in Section 3.3.2.2. Dewatering activities would be temporary and the volumes of water withdrawn would be minimal compared to the volume of Block Island's sole source aquifer. It is highly unlikely that hazardous materials will be introduced to the aquifer during construction activities; however Deepwater Wind will have a spill response procedure in place during construction. The BIWF will have no impact on drinking water quality or quantity.

During operation, the Export Cable will be collocated with the BITS cable in a duct bank that will be encased in high strength thermal concrete. The trench will be backfilled with excavated material, thermal sand, and/or a thermal concrete mix. No adverse impacts on groundwater are anticipated during operation of the BIWF.

### **Surface Water**

The BIWF Export Cable will be located along existing rights-of-way and will avoid direct impacts on surface waters. To cross the bridge between Trims Pond and Harbor Pond, the cable will be installed in a conduit under the bridge in bays below the sidewalk and road surface. The BIWF Generation Switchyard will be constructed at a previously disturbed site. The greatest potential for impacts to surface water quality from these activities would result from the indirect effects of erosion and run-off during construction. As stated previously, Deepwater Wind will implement an agency approved SWPPP, best management practices and erosion control measures during construction to avoid and/or minimize any potential impacts. Given the implementation of these measures construction activities are not expected to have an impact on surface water quality.

During operation, the Export Cable will be buried in a concrete-encased underground duct bank for the majority of the route, and therefore will not affect surface water quality. The BIWF Generation Switchyard transformer will contain approximately 4,000 gallons (15,142 liters) of mineral insulating transformer oil and will be mounted on a concrete foundation with a concrete oil containment pit. The pit will be able to hold 120 percent of the oil contained in the isolation transformer. Give the implementation of the spill containment measures, operation of the BIWF Generation Switchyard is not expected to impact surface water quality.

#### **4.3.2.2 BITS**

### **Marine Waters**

Impacts to marine water quality resulting from the construction of the BITS would be minor and consist of temporary sediment disturbance during cable-laying activities. Sediments disturbed in the cable-laying process are not expected to contain any significant contaminants based on site-specific sampling results at the proposed cofferdam locations off of Block Island and Narragansett Town Beach for the BITS Alternative 1 (Appendix G).

As described for the BIWF submarine cables, installation of the offshore segment of the BITS using a jet plow will result in the temporary resuspension of sediments. However, based upon the results of the Sediment Transport Analysis (Appendix H), impacts to water quality from jet-plowing activities will be minor, short-term, and localized along the proposed BITS routes. Overall, modeling results showed that

the majority of the suspended sediments dropped quickly back to the seafloor within a few meters of the jet plow keeping concentrations low. Specifically for the offshore portions of BITS Alternative 1, stretching from Block Island to the area offshore of its landing location at Narragansett Town Beach, where the mix of sediments consisted of more clay and silt, concentrations of 10 mg/L were predicted to extend a distance of approximately 6,500 ft (2,000 m) from the jet plow. Concentrations greater than 200 mg/L were not predicted to extend farther than a few hundred meters from the jet plow corridor and were also short-lived. Concentrations 500 mg/L were only occurred for very short duration, of 10 minutes or less. Analysis of the nearshore sediment transport for jet plow operations off of Narragansett Town Beach under the short-distance HDD landing alternative indicated that impacts on the surrounding environment would also be short-term and minor resulting in effects similar in magnitude and between the average and storm conditions known to occur at this beach. The detailed nearshore sediment transport analysis has been included as Appendix H to this ER.

The sediment transport study also modeled the potential TSS concentrations resulting from the refill activities of the temporary 50 ft by 20 ft (15.2 m by 6.1 m) offshore cofferdams to support the long-distance HDD for the BITS off of Block Island and Narragansett Town Beach. Potential impacts from BITS cofferdam activities off of Block Island area as described for the BIWF Export Cable in Section 4.3.2.1. The sediments at the BITS Alternative 1 cofferdam location off of Narragansett Town Beach was characterized by a mix of sand, silt, and clay. Modeling at this location showed that water column concentrations exceeded 500 mg/L, very briefly, but because the dispersion of the concentration covered a larger area than that predicted at the Block Island cofferdam, impacts were minimal and temporary.

Potential impacts for the short-distance HDD landing alternative related to HDD drilling fluid are as described for the BIWF in Section 4.3.2.1. Deepwater Wind will implement best management practices during construction to minimize potential release of drilling fluid.

Construction and operation will necessitate the use of work boats and ships. As standard practice, vessels operate in compliance with oil spill prevention and response plans that meet USCG requirements. The BITS submarine cable will be buried below the seafloor and, as a result, will not result in impacts to water quality during operation. Occasional maintenance or repair activities may result in localized, minor, and temporary impacts.

### **Groundwater**

As stated in Section 4.3.1, public drinking water for Narragansett is supplied by municipal sources that do not rely on local groundwater withdrawal. Therefore, private wells are not anticipated in the areas surrounding the BITS Alternative 1 terrestrial cable. However, Deepwater Wind will consider the groundwater table during final engineering design and a dewatering plan will be implemented if necessary (see Section 4.3.2). The installation of an overhead line for the BITS Alternative 1 would further reduce the potential impact on groundwater resources from construction activities. Therefore, no impacts on groundwater resources from construction of the BITS are anticipated.

Potential impacts during operation are as described for the BIWF in Section 4.3.2 and are not anticipated for the BITS.

### **Surface Water**

Potential impacts for the BITS onshore facilities are as discussed in Section 4.3.2.1 for the BIWF. The stormwater pollution prevention plan, best management practices and erosion control measures will apply

during construction of the BITS facilities on Block Island and Narragansett. The BITS onshore facilities will also include containment for 120 percent of the transformer mineral oil present at both the BITS Island and Narragansett Switchyards. As a result, construction and operation of the BITS will not result in impacts on surface water quality.

#### 4.3.2.3 Combined Effects

Deepwater Wind has minimized impacts on water resources and water quality by selecting construction techniques and equipment, such as a jet plow and HDD, to minimize disturbance of sediments and resulting TSS concentrations along the marine cable routes; maintaining spill response plans in support of both offshore construction and operational activities; implementing stormwater pollution prevention best management practices and erosion control measures during construction of the onshore portions of the Project; the installation of spill containment measures at the substation and switchyard locations; and by designing the Project to avoid impacts on Block Island’s sole-source aquifer and known publicly and privately operated wells.

For these reasons when considered together, the potential combined impacts associated with the construction, operation, and decommissioning of the BIWF and BITS will not have a significant effect on water resources or water quality.

#### 4.4 Air Quality

This section will discuss the attainment status for the State of Rhode Island for the National Ambient Air Quality Standards (NAAQS) criteria pollutants as well as any anticipated emissions from construction and operation of the Project. Air pollutants can be divided into three categories: “criteria” pollutants, for which ambient air quality standards exist; “toxic” or “hazardous” air pollutants (HAPs); and greenhouse gases (GHGs). Criteria pollutants are those for which EPA is required to establish National Ambient Air Quality Standards (NAAQS) that protect the public health and welfare and include particulate matter (PM), ozone (O<sub>3</sub>), nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), carbon monoxide (CO) and lead (Pb). Areas that do not attain the NAAQS are designated as “nonattainment” areas. The NAAQS have become more stringent over time; the most current standards are shown in Table 4.4-1.

**Table 4.4-1 Criteria Pollutants and National Ambient Air Quality Standards**

Pollutant	Averaging Time	Standard
Particulate Matter Smaller than 2.5 Microns (PM <sub>2.5</sub> )	24 hours 1 year	98 <sup>th</sup> percentile concentration ≤ 35 µg/m <sup>3</sup> 15.0 µg/m <sup>3</sup>
Particulate Matter Smaller than 10 Microns (PM <sub>10</sub> )	24 hours	150 µg/m <sup>3</sup> , expected number of exceedances per year ≤ 1
Ozone (O <sub>3</sub> )	8 hours	4 <sup>th</sup> highest daily maximum value ≤ 0.075 ppm
Nitrogen Dioxide (NO <sub>2</sub> )	1 hour 1 year	98 <sup>th</sup> percentile daily maximum ≤ 0.100 ppm 0.053 ppm
Sulfur Dioxide (SO <sub>2</sub> )	1 hour 3 hours 24 hours 1 year	99 <sup>th</sup> percentile daily maximum ≤ 0.075 ppm 0.5 ppm, not to be exceeded more than once per year 0.14 ppm, not to be exceeded more than once per year 0.030 ppm
Carbon Monoxide (CO)	1 hour 8 hours	35 ppm, not to be exceeded more than once per year 9 ppm, not to be exceeded more than once per year
Lead (Pb) and its compounds	3 months	0.15 µg/m <sup>3</sup>

Source: U.S. Code of Federal Regulations, Title 40, Part 50.  
µg/m<sup>3</sup> = micrograms per (standard) cubic meter; ppm = parts per million (by volume). For all standards with averaging times < 1 year, attainment of the NAAQS is based on three years’ worth of data.

Of the criteria pollutants, ozone is unique in that it is formed in the atmosphere by reactions between volatile organic compounds (VOC) and oxides of nitrogen (nitrogen oxides [NO<sub>x</sub>], which includes nitric oxide [NO] and nitrogen dioxide [NO<sub>2</sub>]); therefore, when referring to emissions (rather than ambient concentrations) of criteria pollutants, VOC is usually substituted for ozone and NO<sub>x</sub> is substituted for NO<sub>2</sub>, even though technically VOC and NO<sub>x</sub> are not criteria air pollutants but precursors to a criteria air pollutant.

A small portion of the VOC and particulate matter are classified as HAPs. There are no ambient air quality standards for HAPs, but HAPs emissions are regulated through a combination of national requirements to control emissions at the manufacturing end (e.g., standards that apply to engine manufacturers) as well as permit requirements.

GHGs are those that trap heat within the atmosphere. Water vapor traps the most heat; however, in terms of increased heat trapping due to man-made emissions, the most important anthropogenic GHGs (considering the combined impact of global warming potential and the relative amounts of the gases) are carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O). The Intergovernmental Panel on Climate Change (IPCC) has stated that:

“Most of the observed increase in global average temperatures since the mid-20<sup>th</sup> century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations. This is an advance since the TAR’s [2001 Third Assessment Report’s] conclusion that ‘most of the observed warming over the last 50 years is *likely* to have been due to the increase in greenhouse gas concentrations.’ Discernible human influences now extend to other aspects of climate, including ocean warming, continental-average temperatures, temperature extremes and wind patterns.”<sup>6</sup> (IPCC 2007)

#### 4.4.1 Affected Environment

The latest air quality concentration trends published by the RIDEM show that concentrations of criteria pollutants and selected HAPs (i.e., those that have been tracked for multiple years) have shown decreasing trends over the last several years or decades (with the exception of formaldehyde and acetaldehyde, which showed no obvious trend) (RIDEM 2009). With regard to the NAAQS, the only “nonattainment” classification in the entire state of Rhode Island is for ozone, and EPA determined that the state met the 1997 ozone standard of 0.08 part per million (ppm) by the June 2010 statutory deadline (EPA 2010). EPA has classified the entire state as “attainment/unclassifiable” with respect to the new ozone standard of 0.075 ppm (EPA 2012a) and proposed to rescind the older ozone standard effective in 2013 (EPA 2012b).

Increased air temperatures and other related climate trends are identified in the RI Ocean SAMP (McCann et al. 2010) as having potential impacts on marine transportation, recreation, marine ecology, and other factors. For these reasons, the CRMC supports the policy of increasing offshore renewable energy production in Rhode Island as a means of mitigating the potential effects of global climate change (McCann et al. 2010).

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<sup>6</sup> In this reference, the following terms were used to indicate the assessed likelihood, using expert judgment, of an outcome or a result: *Virtually certain* > 99 percent probability of occurrence, *Extremely likely* > 95 percent, *Very likely* > 90 percent, *Likely* > 66 percent, *More likely than not* > 50 percent, *Unlikely* < 33 percent, *Very unlikely* < 10 percent, *Extremely unlikely* < 5 percent.

It has previously been shown that 98 percent of the GHG emissions emitted within Rhode Island are from fossil fuel combustion and that GHG emissions associated with electricity imported into the state are 50 percent of the emissions generated within the state (Brown University 2000).

## 4.4.2 Potential Impacts and Proposed Mitigation

### 4.4.2.1 BIWF

The BIWF is not subject to stationary source permitting because no stationary sources of air emissions are being constructed, and it is not subject to OCS air permitting requirements (40 CFR 55) because no authorization under the OCS Lands Act is required. However, air emissions are associated with the marine vessels needed to both construct and perform O&M activities at the BIWF, and therefore these emissions are quantified below.

Emissions from BIWF construction activities are divided into four categories:

- (1) Onshore activities at the Quonset Point facility (including preparation of the facilities/operations center to support fabrication and installation activities, fabrication of the foundation piles for the wind turbines, and eventually assembly of sets of wind turbine jackets from the jackets and transition decks shipped in from the Gulf of Mexico, and load-out/tie-down of the foundation components onto the installation barges);
- (2) BIWF terrestrial cable activities (i.e., HDD of the Export Cable landfall on Block Island, the installation of the Export Cable on Block Island between the HDD entry point to the BIPCO property, and expansion of the existing BIPCO Substation);
- (3) Construction of the BIWF portions of the Block Island Substation (including the BIWF Generation Switchyard); and
- (4) BIWF offshore construction activities (including transportation of materials, pre-installation checks of the seabed, installation, and commissioning activities).

Emissions from the construction activities during the estimated 2-year construction time frame are shown in Tables 4.4-2 (2013 construction activities) and 4.4-3 (2014 construction activities). Detailed emissions calculations are included in Appendix K to this ER. Emissions from the BIWF construction in 2014 include 397 tons of NO<sub>x</sub>, including 352 tons of NO<sub>x</sub> within state waters. Emissions associated with the eventual decommissioning of the BIWF will involve comparable types of equipment and will be less than or equivalent to those shown in Tables 4.4-2 and 4.4-3.

**Table 4.4-2 Emissions from BIWF Construction in 2013 (tons)**

Pollutant	VOC	NO <sub>x</sub>	CO	PM <sub>10</sub>	SO <sub>2</sub>	GHG
Quonset <sup>a/</sup>	0.80	7.16	4.26	0.43	0.011	1,145
BIWF terrestrial cable	0.29	2.49	1.47	0.19	0.004	404
Substation BI <sup>b/</sup>	0.35	2.88	1.65	0.27	0.004	425
BIWF	0	0	0	0	0	0
<b>TOTAL <sup>c/</sup></b>	<b>1.43</b>	<b>12.53</b>	<b>7.38</b>	<b>0.89</b>	<b>0.018</b>	<b>1,975</b>

<sup>a/</sup> Includes construction activities associated with both BIWF and BITS.  
<sup>b/</sup> This is 50 percent of the total substation Block Island construction emissions (i.e., portion attributed to BIWF).  
<sup>c/</sup> Data may not add to totals due to rounding.

**Table 4.4-3 Emissions from BIWF Construction in 2014 (tons)**

Pollutant	VOC	NO <sub>x</sub>	CO	PM <sub>10</sub>	SO <sub>2</sub>	GHG
Quonset <sup>a/</sup>	5.0	49.4	24.8	3.1	0.06	6,665
BIWF terrestrial cable	0.1	1.2	0.7	0.1	0.00	202
Substation BI <sup>b/</sup>	0.2	1.7	1.0	0.2	0.002	254
BIWF	11.8	344.6	42.6	22.0	0.22	21,866
<b>TOTAL <sup>c/</sup></b>	17.1	397.0	69.1	25.3	0.28	28,987

<sup>a/</sup> Includes construction activities associated with both BIWF and BITS.  
<sup>b/</sup> This is 50 percent of the total substation Block Island construction emissions (i.e., portion attributed to BIWF).  
<sup>c/</sup> Data may not add to totals due to rounding.

EPA General Conformity requirements can apply to projects emitting over 100 tons of NO<sub>x</sub> per year (the so-called “Federal de minimis” level) in ozone nonattainment or maintenance areas; however, because Rhode Island has attained the new ozone standard (and the old standard is scheduled to be revoked prior to the commencement of construction), the BIWF is not expected to be subject to these requirements. If the Block Island area is designated as nonattainment, or it is expected to be classified as a “maintenance” area with respect to the old ozone standard, Deepwater Wind commits to obtaining emissions offsets necessary to demonstrate compliance with the General Conformity rule.

Operational emissions of criteria pollutants and GHGs associated with the BIWF are scheduled to start occurring in November 2014; annual emissions for 2015 and beyond are shown in Table 4.4-4 (emissions of HAPs are a small fraction of VOC emissions, and are insignificant) and result solely from the use of marine vessels to service the WTGs at various intervals throughout the lifetime of the Project. The values in Table 4.4-4 are based on the following BIWF operating assumptions:

- 53 days/year of crew boat usage
- 16 days/year of work vessel usage (with support tug)
- 9 days/year of jack-up barge usage (with support tug)

**Table 4.4-4 Total Annual Operational Emissions**

	Annual Operational Emissions					
	VOC tons	NO <sub>x</sub> tons	CO tons	PM <sub>10</sub> tons	SO <sub>2</sub> tons	GHG tons
<b>TOTAL</b>	0.8	21.4	2.8	1.4	0.01	1,572

While there will be some emissions associated with the construction and operation of the BIWF, as stated in the RI Ocean SAMP (McCann et al. 2010), offshore wind facilities will produce far fewer emissions of criteria pollutants, HAPs, and GHGs than fossil fuel-burning generating stations. The BIWF will represent approximately 1.2 percent of Rhode Island’s forecasted generation (Tufts 2010), resulting in the displacement of marginal generation from natural gas-fired power plants (but is unlikely to displace baseload generation from coal-fired power plants). On Block Island, the Project could effectively displace the diesel-fired generators that are currently used to power the Island and their associated air emissions.<sup>7</sup>

<sup>7</sup> The five diesel generators located at the BIPCO facility may be maintained and operated at the discretion of BIPCO as a source of alternate back-up power once the BIWF is operational.

As stated in an Advisory Opinion prepared by the RIDEM on the Project, the BIWF would provide Block Island and the region with “measurable environmental benefits” including, but not limited to, a regional reduction in air pollution from criteria pollutants, HAP, and GHGs (RIDEM 2010). For example, RIDEM identified that CO<sub>2</sub> emissions from BIPCO have been 10,328 tons/yr (1,910 lb/MWh),<sup>8</sup> and the latest marginal emissions rates from ISO New England (for calendar year 2010) are 943 lb/MWh.<sup>9</sup> This means that the 124,500 MWh/yr projected to be provided by this Project would displace at least 58,000 tons of CO<sub>2</sub> emissions from BIPCO and the mainland. In addition, operational emissions of every criteria air pollutant from BIWF operation are lower than those from BIPCO, even though the BIWF will generate approximately 10 times more electrical power.

#### 4.4.2.2 BITS

There are no operational emissions associated with the BITS; however, there are emissions associated with construction of the BITS. Emissions from BITS construction activities are divided into four categories:

- (1) Onshore activities at Quonset Point (as described in Section 4.4.2.1);
- (2) Construction of the BITS portions of the Block Island Substation (including the BITS Island Switchyard);
- (3) BITS terrestrial cable activities (i.e., HDD for the cable landfall on Block Island and Narragansett, installation of the BITS cable on Block Island along the same trench as the BIWF Export Cable, installation of the cable between the HDD site and the mainland terminus, and construction of the Narragansett Switchyard); and
- (4) BITS offshore construction activities (including installation and burial of the cabling between Block Island and Narragansett).

Total emissions from Quonset Point activities have already been accounted for in Tables 4.4-2 and 4.4-3. Emissions from other BITS construction activities are shown in Tables 4.4-5 and 4.4-6. Emissions associated with the eventual decommissioning of the BITS would involve comparable types of equipment and would be less than or equivalent to those shown in Tables 4.4-4 and 4.4-5. As discussed in Section 4.4.2.1, General Conformity requirements are not expected to apply to the BITS. As was the case with the BIWF, OCS air permitting requirements pursuant to 40 CFR 55 do not apply.

**Table 4.4-5 Emissions from BITS Construction in 2013 (tons)**

Pollutant	VOC	NO <sub>x</sub>	CO	PM <sub>10</sub>	SO <sub>2</sub>	GHG
Substation BI <sup>a/</sup>	0.35	2.88	1.65	0.27	0.004	425
BITS terrestrial cable	0.14	1.24	0.74	0.10	0.002	202
BITS	0	0	0	0	0	0
<b>TOTAL<sup>b/</sup></b>	0.49	4.13	2.38	0.36	0.006	627

<sup>a/</sup> This is 50 percent of the total substation Block Island construction emissions (i.e., portion attributed to BITS)

<sup>b/</sup> Data may not add to totals due to rounding.

<sup>8</sup> RIDEM, 2010, Advisory Opinion, Public Utility Commission Docket No. 4185, July 20, 2010.

<sup>9</sup> ISO New England Inc., “2010 ISO New England Electric Generator Air Emissions Report,” March 2012.



**Table 4.4-6 Emissions from BITS Construction in 2014 (tons)**

Pollutant	VOC	NO <sub>x</sub>	CO	PM <sub>10</sub>	SO <sub>2</sub>	GHG
Substation BI <sup>a/</sup>	0.2	1.7	1.0	0.2	0.002	254
BITS terrestrial cable	0.6	5.0	2.9	0.4	0.01	808
BITS	5.8	161.8	17.8	9.8	0.10	10,010
<b>TOTAL<sup>b/</sup></b>	6.6	168.5	21.8	10.3	0.11	11,073
<sup>a/</sup> This is 50 percent of the total substation Block Island construction emissions (i.e., portion attributed to BITS)						
<sup>b/</sup> Data may not add to totals due to rounding.						

Like the BIWF, construction of the BITS will result in emissions of NO<sub>x</sub> and other air pollutants. However, the emissions from construction of the BITS are temporary, “one-time” emissions. Once the BITS and the BIWF are operational, they will displace emissions from fuel-fired electricity generators every year.

#### 4.4.2.3 Combined Effects

The combined effects of constructing and operating the BIWF and BITS in 2013 and 2014 is represented by the sum of information presented in Sections 4.4.2.1 and 4.4.2.2, respectively, as shown in Tables 4.4-7 and 4.4-8 below. (Air emissions associated with operations in 2015 and beyond are associated with BIWF only and were identified previously in Table 4.4-4.)

**Table 4.4-7 Emissions from BIWF and BITS Construction in 2013 (tons)**

Pollutant	VOC	NO <sub>x</sub>	CO	PM <sub>10</sub>	SO <sub>2</sub>	GHG
BIWF (includes all Quonset emissions)	1.43	12.53	7.38	0.89	0.018	1,975
BITS (excludes all Quonset emissions)	0.49	4.13	2.38	0.36	0.006	627
<b>TOTAL<sup>a/</sup></b>	1.93	16.66	9.76	1.25	0.024	2,602
<sup>a/</sup> Data may not add to totals due to rounding.						

**Table 4.4-8 Emissions from BIWF and BITS Construction and Operation in 2014 (tons)**

Pollutant	VOC	NO <sub>x</sub>	CO	PM <sub>10</sub>	SO <sub>2</sub>	GHG
BIWF (includes all Quonset emissions)	17.1	397.0	69.1	25.3	0.28	28,987
BITS (excludes all Quonset emissions)	6.6	168.5	21.8	10.3	0.11	11,073
Operational Emissions (Nov – Dec)	0.1	3.8	0.5	0.3	0.00	278
<b>TOTAL<sup>a/</sup></b>	23.8	569.3	91.4	35.9	0.40	40,338
<sup>a/</sup> Data may not add to totals due to rounding.						

As mentioned previously, most of the emissions associated with the BIWF and BITS are one-time construction emissions (operational emissions are very minor in comparison), whereas the operation of the BIWF and BITS will reduce onshore emissions every year (including 58,000 tons per year of CO<sub>2</sub>).

## 4.5 Biological Resources

### 4.5.1 Benthic and Shellfish Resources

This section describes the benthic resources within and surrounding the Project Area, including the benthic habitats and species. This section also identifies the Project activities that may affect both benthic species and their habitat within the Project Area. The benthic environment also includes a number of demersal finfish species, as well as important Essential Fish Habitats (EFH), which are discussed separately in Section 4.5.2 and Section 4.5.3, respectively.

The following benthic resources discussion is based on available literature including, but not limited to, the RI Ocean SAMP (LaFrance 2010) and the results of site-specific studies performed by Deepwater Wind in the BIWF and BITS Project Area. These site-specific surveys and evaluations implemented in support of the Project's benthic resources evaluation include:

- **Geophysical Surveys (between July and October of 2009, September 2011 to January 2012, and June 2012):** to characterize and evaluate seafloor conditions (see Section 4.2).
- **Sediment Profile Imagery (SPI; October 2009):** to characterize the physical and biological features of the near-surface sediments.
- **Eelgrass and Seafloor Conditions Survey (August 2010):** to examine and document the existing distribution of eelgrass beds or obstructions (e.g., rock) in nearshore areas.
- **Benthic Habitat Survey and Remotely Operated Vehicle (ROV) Videography (December 2011):** to provide detailed characterization of the hard substrate resources identified during the geophysical survey.
- **Benthic Intertidal Survey (June 2012):** to provide detailed characterization of benthic intertidal resources at the cable landfall locations.
- **Sediment Transport Analysis (May and August 2012):** to evaluate the sediment trajectory and fate from Project construction activities, including jet plowing in the offshore and nearshore/tidal zone and the filling of the temporary cofferdams, if required.
- **Electromagnetic Fields (EMF) Analysis (April 2012):** to evaluate the potential impacts from the operating Project cables (Inter-Array, Export Cable, and BITS) on the overlying substrate, water column, and species.

Survey reports for the above studies can be found in Appendices D, E, F, H, L, and M of this ER. A summary of the site characterization results, as they relate to the characterization of the existing environment and the impacts of the proposed BIWF and BITS on benthic resources, are summarized in this section.

In addition to the site-specific surveys already completed, Deepwater Wind is conducting the following additional, surveys to evaluate demersal finfish and crustacean resources:

- **Fish Trawl Survey:** a 2-year pre-construction and 3-year post-construction survey to provide a before, after, control impact (BACI) assessment on the local demersal finfish community, to confirm the seasonal patterns, and determine potential post-construction impacts (see Section 4.5.2 for additional information).

- **Ventless Trap Survey:** a 1-year pre-construction and at least a 1-year post-construction survey to assess the local lobster community and determine the seasonal and spatial patterns of lobster abundance within the general BIWF and BITS Project Area.

#### 4.5.1.1 Affected Environment

The review of available data indicates that the BIWF and BITS Project Area includes variable substrate such as cobble, gravel, sand, silty sand, and soft silt benthic habitat types. Finer-grain sediments accumulate within broad topographic depressions, forming soft silt and silty sand habitats that were observed in water depths deeper than 90 ft (27.4 m). These soft sediment habitats exhibit high infaunal densities. Nearshore, shallow environments generally consist of hard cobble and gravel habitats where attached algae is common. These habitat types exhibit low apparent infaunal densities; however, mobile epifauna such as lobster, crab, shrimp, echinoderms, and demersal fish are abundant.

#### Marine Vegetation

Marine vegetation that occurs in coastal Rhode Island waters includes the following groups: blue-green algae (*Cyanobacteria*), dinoflagellates (*Dinophyta*), green algae (*Chlorophyta*), diatoms and brown/golden brown algae (*Ochrophyta*), red algae (*Rhodophyta*), and seagrasses/cordgrasses (*Magnoliophyta*). The BIWF and BITS Benthic Resource Survey Report confirmed that variability in the substrate conditions provide a range of habitat conditions for benthic biota. Analysis of transects<sup>12</sup> conducted for the survey identified 11 taxa, including three types of algae, were found exclusively on or in direct association with cobble or boulders (see Appendix F). Coralline algae (*corallinales*) and erect red algae were observed on most transects and generally ranged from present to abundant. Green algae occurred only on three transects.

Seagrasses are the only marine vegetation group within the Project Area that could be affected by BIWF and BITS construction, operation, and decommissioning activities. Therefore, the other marine vegetation groups will not be discussed further in this section. Seagrasses grow predominantly in shallow, subtidal, or intertidal sediments sheltered from wave action in estuaries, lagoons, and bays and in some locations can extend over large areas to form seagrass beds (Phillips and Meñez 1988). The occurrence of seagrass is limited by light penetration through the water column, which is dependent upon water clarity and depth. The depth limits for seagrasses in coastal Rhode Island waters are 19.7 ft (6 m) (Narragansett Bay Estuary Program 2010).

Eelgrass (*Zostera marina*) and other seagrasses are often referred to as submerged aquatic vegetation (SAV) to distinguish them from algae and emergent saltwater plants found in salt marshes. Eelgrass is the primary seagrass species found in the waters surrounding the Project Area. Eelgrass beds are important wetland components of shallow coastal ecosystems throughout the region and provide important habitat, food, and shelter for diverse communities of fish, shellfish, and invertebrates (Heck et al. 2003). Eelgrass is federally protected under the CWA and is specifically defined as a “special aquatic site” under EPA’s Section 404 (b)(1) Guidelines, which require that any eelgrass destroyed by human activity be replaced or restored. Eelgrass and other SAV also help maintain water quality by trapping suspended sediments, which can cloud the water and bury benthic invertebrates, as well as moderate the effects of storms and boat wakes on shoreline erosion (Dawes et al. 1997).

<sup>12</sup> A total of eleven 10 to 15 minute video transects were performed at the Narragansett Site, and ten 15 to 30 minute video transects at the Block Island Site. Video transect line spacing ranged from 25 ft to 100 ft (7.6 m to 30.5 m) with one cross-tie line at each site. The viewing area of the video sled in is approximately 1 square meter (m<sup>2</sup>).

Globally seagrass coverage has decreased by 75 percent overall from 1879 to 2006 (Waycott et al. 2009). Seagrasses are susceptible to numerous threats, including being uprooted by dredging, scarred by boat propellers (Hemminga and Duarte 2000; Spalding et al. 2003), and being uprooted and broken by anchors (Francour et al. 1999). Seagrass that is scarred from boat propellers can take years to regrow (Dawes et al. 1997). Sedimentation associated with severe storms can impact some seagrass populations, particularly those located near inlets. Degraded water quality also has potential to damage seagrass by stimulating algal growth that can shade it.

Eelgrass beds are known to occur in isolated shallow coastal water habitats of Narragansett Bay, coastal salt ponds, and the protected harbors of southern Rhode Island and Block Island (Heck et al. 2003). SAV inventories conducted during the times of peak biomass provide the best indication of habitat or potential habitat (Fonseca et. al 1998). The growth and reproduction of eelgrass is affected by a number of environmental factors, such as light, water temperature, and nutrient availability. Under optimal conditions, growth rates of eelgrass have been measured in the range of 2 cm to 5 cm/day (Kemp et al. 1987). However, when water temperatures exceed approximately 71.6°F (22 °C) in Rhode Island waters, eelgrass vegetative growth can dramatically decrease as plant resources shift to reproduction (the development of seeds). As a result, the peak biomass period for eelgrass in Narragansett Bay typically occurs between July and August before plants have released their seeds. Plants that flower and develop seeds die shortly after seeds are released (CRMC 2007).

Eelgrass surveys were conducted in August 2010 at the landfall locations for the BITS and BIWF cables near Old Harbor on Block Island, and the BITS Alternative 1 cable off of Narragansett Town Beach. No eelgrass was identified at the BITS Alternative 1 cable landfall location in Narragansett. An existing eelgrass bed was confirmed along the southern margin of Old Harbor, Block Island. To avoid impacts, Deepwater Wind adjusted the proposed landing location for the BIWF Export Cable and BITS cable to a location approximately 2,000 ft (610 m) north of this confirmed bed (see Figure 4.5-1).

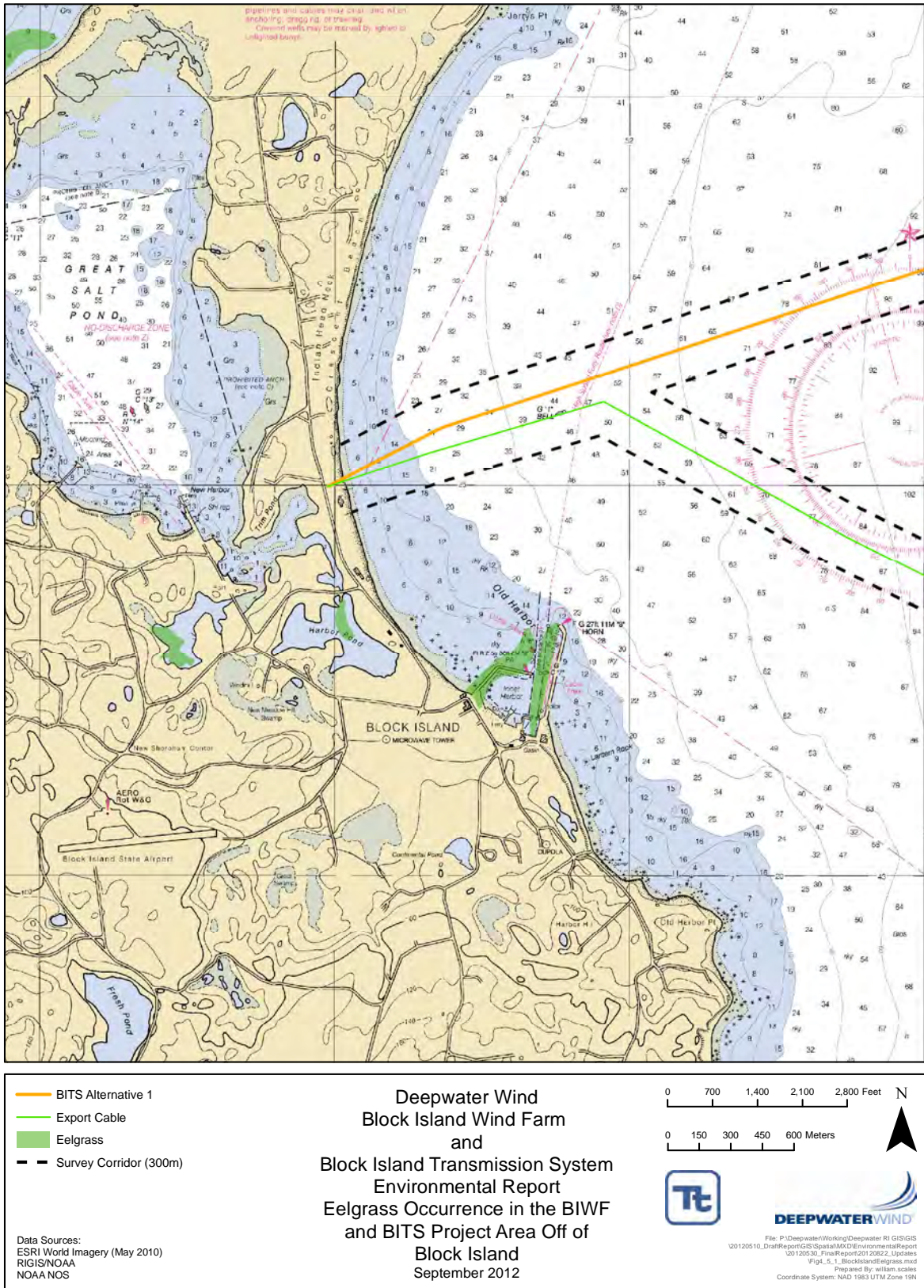
### Benthic Macroinvertebrates

The benthic macroinvertebrates associated with the waters off of Rhode Island consist of a wide variety of invertebrate species, most of which can be grouped at the phylum-level as shown in Table 4.5-1.

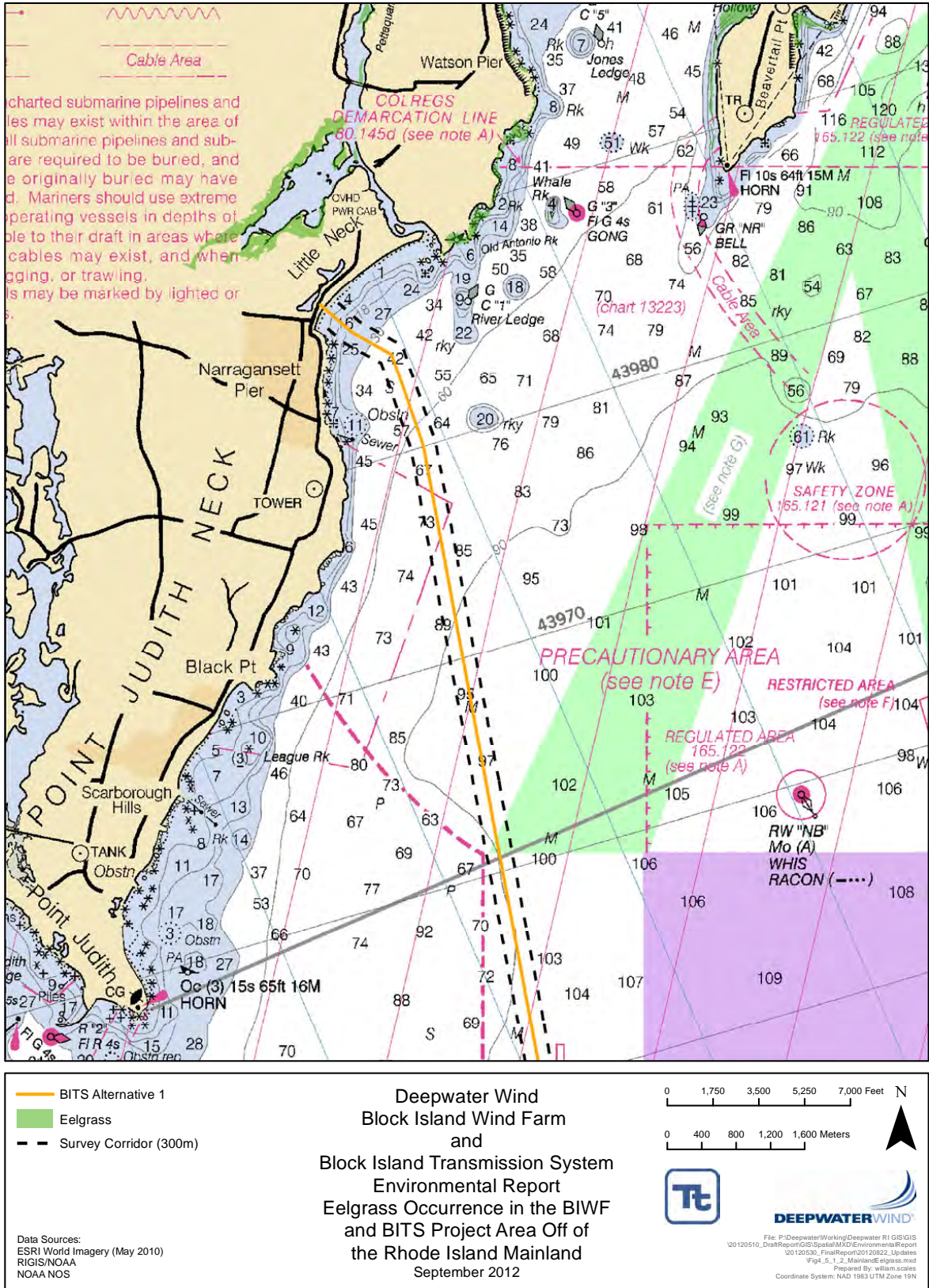
**Table 4.5-1 Benthic Invertebrate Groups**

Common Name (Taxonomic Group)	Description
Sponges ( <i>phylum Porifera</i> )	Bottom-dwelling animals; large species have calcium carbonate or silica structures embedded in cells to provide structural support.
Hydroids and corals ( <i>phylum Cnidaria</i> )	Bottom-dwelling animals either habit-forming or attached to other substrates.
Flatworms ( <i>phylum Platyhelminthes</i> )	Mostly bottom-dwelling; simplest form of marine worm with a flattened body.
Ribbon worms ( <i>phylum Nemertea</i> )	Bottom-dwelling marine worms with a long extension from the mouth (proboscis) that helps capture food.
Round worms ( <i>phylum Nematoda</i> )	Small bottom-dwelling marine worms; many live in close association with other animals (typically as parasites).
Segmented worms ( <i>phylum Annelida</i> )	Mostly bottom-dwelling, highly mobile marine worms; many tube-dwelling species.
Bryozoans ( <i>phylum Ectoprocta</i> )	Lace-like animals that exist as filter-feeding colonies attached to the seafloor.
Squid, bivalves, clams, quahog, sea snails, chitons, conchs ( <i>phylum Mollusca</i> )	Mollusks are a diverse group of soft-bodied invertebrates with a specialized layer of tissue called a mantle. Mollusks such as squid are active swimmers and predators, while others such as sea snails are predators or grazers and clams are filter feeders.
Shrimp, crab, lobster, barnacles, copepods ( <i>phylum Arthropoda</i> )	Bottom-dwelling or pelagic; some are immobile; with an external skeleton; all feeding modes from predator to filter feeder.
Sea stars, sea urchins, sea cucumbers ( <i>phylum Echinodermata</i> )	Bottom-dwelling predators and filter feeders with tube feet.

Figure 4.5-1 Eelgrass Occurrence in the BIWF and BITS Project Area off Block Island



**Figure 4.5-2 Eelgrass Occurrence in the BITS Project Area off the Rhode Island Mainland**



Benthic macroinvertebrates have been generally categorized through a number of published accounts from studies throughout coastal Rhode Island waters. The RI Ocean SAMP (2011) reports that macrobenthic fauna generally comprise several species groups that show varying affinities to certain bottom types and the potential for seasonality within those habitats. Assemblages associated with silty fine sands are dominated by several species of ampeliscid amphipods (e.g., *Ampelisca agassizi*) and the nut clam, *Nucula proxima*, while coarser sands were dominated by several other amphipod species (e.g., *Byblis serrata*, *Acanthohaustorius millsii*) and several polychaete species (e.g., *Aricidea catherinae*; Steimle 1982).

Benthic communities in coastal Rhode Island waters are dominated by several amphipods, bivalves (*Nucula*), mussels (*Mytilus edulis*), and ocean quahogs (*Arctica islandica*) and several polychaete species, including *Prionospio steenstrupia*, *Nephtys incisa*, and *Clymenella torquata* (Hale 2002). Small surface burrowing polychaetes of the genus *Lumbrineris* are also broadly distributed, followed by small surface burrowing amphipods of the genus *Unciola* and large deep burrowing polychaetes of the genus *Glycera* (LaFrance et al. 2010). LaFrance et al. (2010) also reported that tube-dwelling amphipods of the genus *Ampelisca*, followed by *Leptocheirus*, were most abundant.

The results from the site-specific surveys for benthic resources described in Section 4.5.1 provide a complete picture of the hard and soft-substrate habitat and the faunal communities associated with them for each portion of the Project. The results from these surveys are also consistent with information reported by the RI Ocean SAMP.

The SPI survey (Appendix D), and subsequent geophysical survey (Appendix E), determined that the bottom types across the Project Area range from depositional silty sand, to mobile sand areas (sand ripples), to high energy/non-depositional gravel and cobble. Specifically, the proposed locations for the BIWF WTGs and Inter-Array Cable are composed primarily of washed gravel, with some areas of mobile sand on the western part of the WTG Array. The route proposed for the Export Cable to Block Island comprises a mix of mobile sand, silty sand, and some washed gravel. The BITS route crosses varied sediment types, starting with mobile sand closest to the Block Island coastline, with pockets of undisturbed cobble. In the deeper waters between Block Island and Point Judith, bottom sediments turn to mostly silty sand and soft silt. The shallow region just south of Point Judith is composed of a mix of mobile sand, washed gravel, undisturbed cobble, and some silty sand. At the mouth of Narragansett Bay, the sediment type is consistently composed of soft silt. At the coastal connection point of BITS Alternative 1 at the Narragansett Town Beach, bottom sediments are composed of mobile sand and silty sand. This varied, or patchy, substrate distribution provides a variety of benthic habitat types (Knebel et al. 1982). The softer bottom substrates are likely well-oxygenated and would maintain a mix of organisms such as amphipods, bivalves, and polychaete worms. Harder substrate types such as cobble and gravel are largely composed of macrobenthic invertebrate species dominated mainly by lobsters (*Homarus americanus*), starfish, and crabs. Complete results from these surveys are included in Appendices D, E and F.

The BIWF and BITS Benthic Resource Survey Report (Appendix F) survey confirmed that variability in the substrate conditions along transects provides a range of habitat conditions for benthic biota. Eleven taxa, including eight invertebrates, were found exclusively on or in direct association with cobble or boulders. Sessile or encrusting invertebrates observed on most transects included sponges, cnidarians, polychaete worms (*polychaeta*), mollusks, and arthropods. The echinoderm blood star *Henricia sanguinolenta* was also found on cobble and boulders. Soft substrate organisms were observed less regularly and are undoubtedly under-represented in video observations because many reside within the

sediment rather than on the surface. Echinoderms included two species of sea stars (*Asterias* sp. and the blood star) and the sand dollar (*Echinorachnias parma*). Blood stars were usually, but not always, observed on hard substrate and were more common than *Asterias*. Bryozoans were observed on two transects. Other evidence of invertebrate activity included worm castings on the sand surface and tubes. The hard bottom survey also reported at least four species of bivalve mollusks (sea scallop [*Placopecten magellanicus*], *Astarte* sp., ocean quahog [*Arctica islandica*], and horse mussel [*Modiolus modiolus*]) present in the Project Area on one or more transects within hard bottom cobble and boulder habitats. *Astarte* was observed most frequently. Bivalves were typically found in areas of sand and were not associated with hard substrate, with the exception of horse mussels. Arthropods observed on hard bottom habitats included barnacles, sand shrimp, and hermit crabs. Barnacles were found on all transects on hard substrate. Hermit crabs and sand shrimp occurred on about half of the transects and were associated with sand. No lobsters were observed during the Benthic Resource Survey. However, this was not surprising because lobsters are generally more active at night and recording their activity is difficult during a daytime survey; the lack of observations does not suggest they are absent from the Project Area. Complete results from the Benthic Resource Survey Report are included in Appendix F.

For BIWF and BITS landfall locations on Crescent Beach and Narragansett Town Beach, respectively, results of the Benthic Intertidal Survey Report (Appendix F) indicate that species composition is typical of intertidal communities found along the Atlantic coast, dominated by amphipods, polychaetes, and mollusks. No adult shellfish were observed at Crescent Beach; however, some juvenile surf clams (*Spisula solidissima*) were present. Beach substrate at Crescent Beach was dominated by sand. Benthic infauna was confirmed to be more abundant and diverse below mean low water in both locations, but particularly at Narragansett Town Beach, where infauna was more abundant than that found on Crescent Beach in the low intertidal and shallow subtidal areas. Samples taken at Narragansett Town Beach were constant with the prototypical tidal gradient, with bivalve mollusks (*Mytilus edulis* and *Lcuna vincta*) found in higher elevations and aphipod and isopod species present at lower elevations. The intertidal zone is a hostile environment because of its exposure to air and consequent desiccation during low tides. Typically, benthic fauna are restricted to those species that have developed mechanisms for tolerating or avoiding dessication by burrowing rapidly or closing up (bivalve mollusks) and temporarily reducing metabolism. Substrate at Narragansett Town Beach was mostly sand at higher elevations transitioning to a coarse sand, pebble, and shell fragment mix at lower elevations with the mid-tide zone machine raked and low in species abundance. Differences in infauna abundance below mean low water between Crescent Beach and Narragansett Town Beach may be a factor of daily beach grooming at Narragansett Town Beach during the summer, which has been found to significantly reduce species richness, abundance, and biomass (Dugan et al. 2003).

### **Ecologically and Economically Important Benthic Macroinvertebrates**

There are 10 species of benthic macroinvertebrates of economic importance known to occur within and in the vicinity of the Project Area. These species include longfin squid (*Loligo pealeii*), shortfin squid (*Illex illecebrosus*), American lobster (*Homarus americanus*), northern quahog (*Mercinaria mercinaria*), Atlantic sea scallop (*Placopecten magellanicus*), Atlantic rock crab (*Cancer irroratus*), Jonah crab (*C. borealis*), red crab (*Chaceon quinques*), Atlantic surfcalm (*Spisula solidissima*) and the horseshoe crab (*Limulus polyphemus*). Of these species, the American lobster, longfin squid, northern quahog, and Atlantic sea scallop represent the first, second, third, and fifth most economically valuable species landed by the Rhode Island commercial fleet over the last 10 years, respectively. The fourth most economically valuable species is a finfish species, the monkfish, which is discussed further in Sections 4.5.2 and 4.5.3. Horseshoe crab is currently in demand by both the bait and the biomedical industries, Management



entities for each species, as well as the current status of each fish stock, are codified in the MSFCA, 16 U.S.C. 1801 et. seq. Species-specific regulations are managed by the New England Fishery Management Council (NEFMC), Atlantic States Marine Fisheries Commission (ASMFC), and Mid-Atlantic Fishery Management Council (MAFMC). Lobsters in both state and federal waters are managed under the Interstate Fisheries Management Program administered by the ASMFC. The horseshoe crab is also managed by the ASMFC, and the state of Rhode Island prohibits any harvesting for 48 hours preceding and following the new and full moons in May through June.

The American lobster, longfin squid, and Atlantic sea scallop have been identified by the CRMC in the RI Ocean SAMP as species that are ecologically important to the stability and resiliency of the local marine community (RI Ocean SAMP 2011). Additionally, the longfin squid, Atlantic sea scallop, and Atlantic surf clam have designated EFH within the BIWF and BITS Project Area. While EFH for Atlantic surf clam juveniles and adults has been designated along northern portions of the BITS route, the Benthic Intertidal Survey Report (Appendix F) indicates the presence of juvenile surf clams along the BIWF and BITS routes at the cable landfall locations on Block Island, suggesting the presence of spawning populations of this species in Rhode Island Sound. A complete evaluation of these species and associated EFH is provided in Section 4.5.3.

Horseshoe crab has important ecological value as their eggs represent an important food resource for migrating shorebirds. This species is known to spawn on sandy beaches in low energy areas in the spring. The closest spawning site to the Project Area is in The Narrows, approximately 0.95 mi (1.5 km) north of the BITS Alternative 1 landfall location on Narragansett Town Beach (Scott Olszewski, RIDEM, personal communication, 2012). Horseshoe crab offshore distribution in Rhode Island Sound is unknown, however throughout its range, this species is thought to prefer water depths less than 98 ft (30 m; ASMFC 2010). Within this depth range, migrating horseshoe crabs may transit the Project Area within the WTG Array and along portions of the BIWF Inter-Array Cable and Export Cable routes, and the BITS route.

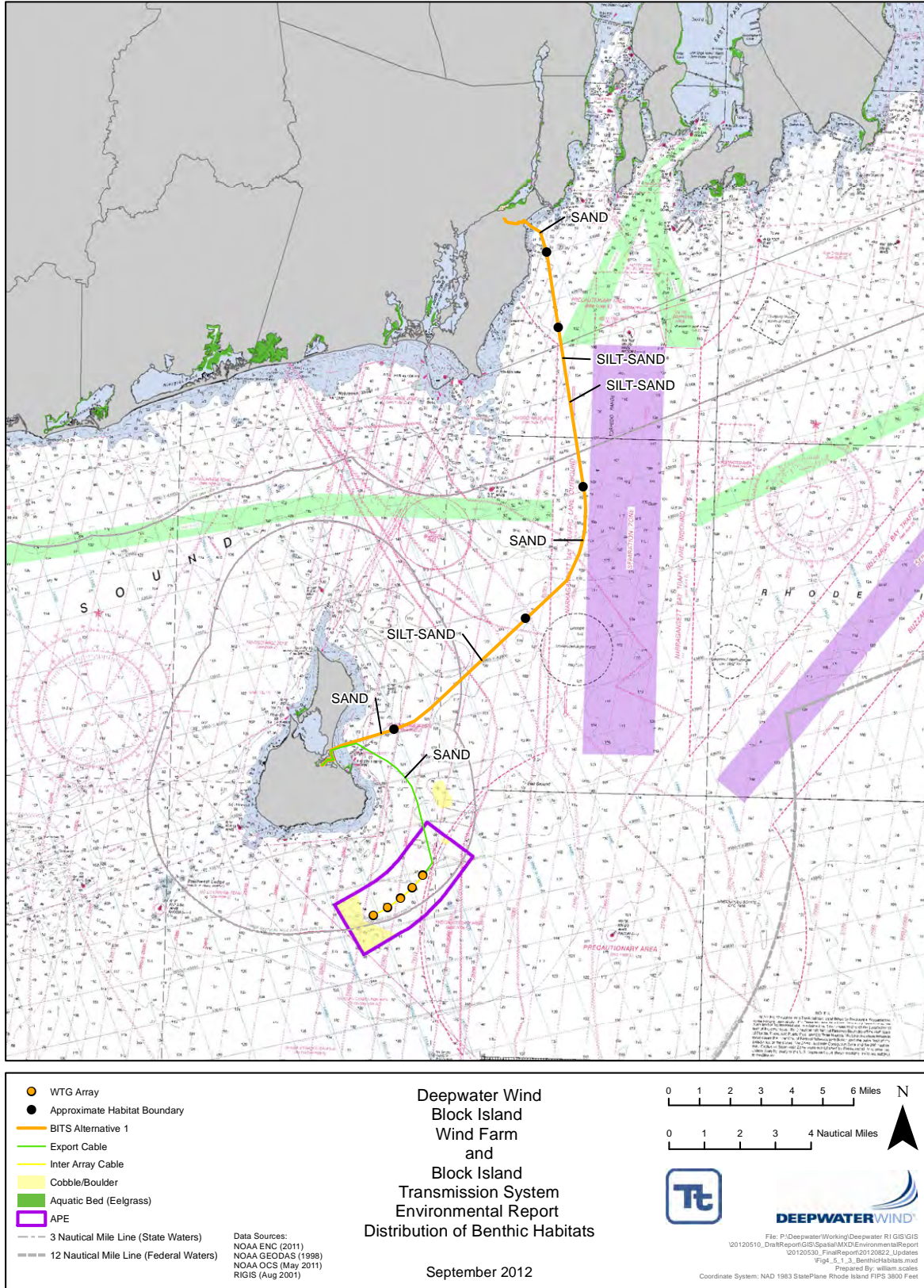
Survey results of the Project Area indicate that there are several shallow, hard bottom ridges in the vicinity of both the BIWF and portions of the BITS route, formed by glacial moraine deposits that may provide habitats for these commercially important and federally managed species. These habitats comprise cobble and boulder-sized rocks with extensive coverage by algae and marine life. The Project facility components themselves, inclusive of the WTGs, BIWF Inter-Array and Export Cable routes, and the BITS route, have been sited to avoid direct impacts on these glacial moraine areas (Figure 4.5-3).

#### **4.5.1.2 Potential Impacts and Proposed Mitigation**

Deepwater Wind has minimized impacts on benthic resources by siting the BIWF within the Renewable Energy Zone. This zone was established by the CRMC under the RI Ocean SAMP to specifically minimize potential impacts on natural resources (e.g., important marine habitats) and existing human uses.

In addition, Deepwater Wind has further minimized impacts to benthic resources by committing to use jet-plow methodology for cable installation and a DP vessel. The use of a jet plow is a proven and common mitigation strategy for minimizing disturbance and alteration of substrate, and thus helps to minimize potential impacts on benthic resources in the Project Area. The use of DP vessels further reduces potential impacts on benthic resources by eliminating the need for anchor placement along the majority of the cable installation routes. Substrate conditions and habitat type (e.g., hard bottom substrate, seagrasses, etc.) were also important considerations during siting of the BIWF and BITS facility components.

Figure 4.5-3 Location of Project Components and Distribution of Benthic Habitats



## BIWF

The BIWF is not expected to have a significant long-term impact on benthic resources identified within and in the vicinity of the Project Area during construction, operation, or decommissioning. Construction activities may, however, cause minor and short-term impacts on benthic resources resulting from the disturbance and/or alteration of habitat.

### *Marine Vegetation*

As stated in Section 4.5.1.1, eelgrass is the only marine vegetation of significance with the potential to be affected by construction, operation, and decommissioning activities that was found to occur in the vicinity of the Project Area. The only identified and verified eelgrass bed in the BIWF area is located more than 2,000 ft (610 m) south of the proposed landing location of the Export Cable on Block Island. Construction activities at the landing location will consist of jet plowing and, if the long-distance HDD is selected, installation and refill of a temporary offshore cofferdam. All construction activities will be localized to the 200 ft (61 m) permit corridor and the 0.05 acre (0.02 hectare) cofferdam area. Therefore, the Project will not result in direct impacts to eelgrass. Modeling conducted to determine the spatial and temporal extent of suspended sediment transport caused by jet-plowing and cofferdam construction activities also indicates that impacts on this bed from the deposition of suspended sediments are unlikely (see Appendix H). The modeling results in the offshore environment predicted a narrow corridor where thicknesses exceeded 10 mm (0.4 in) directly adjacent to the trench. Accumulations outside of the jet-plow corridor were confined to an area of about 250 ft (75 m) from the Export Cable centerline, and did not exceed 1 mm (0.04 in). At the Export Cable cofferdam location, modeling of cofferdam construction activities under the worst-case (cofferdam backfilling if required) showed that accumulations greater than 0.4 in (10 mm) were limited to within 15 m (50 ft) of the cofferdam and sediment accumulations did not exceed 0.04 in (1 mm) beyond 34 m (110 ft) of the site. The full Sediment Transport Analysis Report may be found in Appendix H.

Deepwater Wind has also conducted sediment transport modeling of the short-distance HDD landing option in the nearshore/tidal zone off of Block Island to determine the potential effects on the surrounding environment, including the identified eelgrass bed. The results of this study are provided in Appendix H. Model results indicate that excess water column concentrations and sediment accumulation were similar to those found for the Inter-Array Cable and Export Cable and were limited to areas close to the jet plow track<sup>11</sup>. Sediment thicknesses exceeded 10 mm (0.4 in) directly adjacent to the trench and accumulations did not exceed 1 mm (0.04 in) beyond 65 m (213 ft) from the trench. Given the minimal area of potential disturbance and the short duration of activities, as well as the distance of the disturbance from the identified eelgrass bed from the proposed short-distance HDD landfall location, no impact on the identified eelgrass bed is expected.

Operation of the BIWF will have no effect on the historic eelgrass bed located in the vicinity of the Export Cable landing location. Decommissioning of the BIWF at the end of its projected 25-year life will also not have any effect on the integrity of the bed because the Export Cable will be abandoned in-place.

### *Benthic Macroinvertebrates*

The greatest potential for impacts on benthic macroinvertebrates will result from construction of the BIWF. Construction of the BIWF will cause direct and indirect impacts on benthic resources. Direct impacts will occur in the footprints of the Inter-Array and Export Cables, the WTG foundations and the

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<sup>11</sup> The jet plow track is defined as the 15 ft (4.6 m) area between the jet plow wheels/skids and includes the 5 ft (1.5 m) cable trench.

temporary cofferdam, if required. Additional direct impacts will result from the use of jack-up barges and anchored vessels for installation of the WTGs, foundations, for the placement of protective armoring along portions of the cable routes, and if required the installation of the temporary offshore cofferdam. Indirect impacts will result from the suspension and redeposition of sediments from cable-laying activities and anchor cables sweep may also occur.

The installation of the WTGs will result in 0.07 acre (0.03 hectares) of direct impact to soft bottom habitats at each WTG location from the installation of the foundation legs and braces, mud mats, and protective cable armoring at the base of each foundation. The total area of direct impact for all five WTGs will be approximately 0.35 acre (0.15 hectare). In addition, installation of the WTG foundations will require the support of an anchored derrick barge. This derrick barge will require the use of eight 10-ton anchors. Under normal conditions, the derrick barge would place these eight anchors once per foundation; however, Deepwater Wind has conservatively assumed that anchoring could occur up to three times per foundation. Impacts from the anchor chains are also likely to occur during foundation installation as they rest on the seafloor or sweep across the bottom in response to bottom currents. Where cable sweep occurs in soft substrates, the top few inches of the sediment may be disturbed. Installation of the WTGs will be supported by two jack-up barges each held in place with four spuds. Deepwater Wind has assumed that each jack-up barge may be required to reposition once during WTG installation at each location, for a total of 10 jack-up events. The total area of direct impact resulting from the placement of jack-up barge spuds and vessel anchors will be approximately 0.85 acre (0.34 hectare).

Benthic fauna directly within the footprint of the WTG foundations, anchors, and jack-up barge spuds will be crushed. Pile-driving will also push any organisms in this footprint more deeply into the substrate, removing them from the benthic ecosystem even as a contribution to the detrital or nutrient cycles. Anchoring will largely occur in soft sediments within BIWF work area (see Figure 4.5-3). In the areas of anchor chain sweep, tube-dwelling amphipods and polychaetes, solitary anemones, and other larger infauna are probably the most susceptible to harm and will also likely be killed. While disturbed sediments may be released into the water column, the action of the cable sweep is not as forceful as that of the proposed jet-plowing activities associated with cable installation; therefore, it is unlikely that resuspended sediments would be transported very far from the source. If anchoring of the derrick barge is required in the southwestern portion of the work area where some hard bottom habitat was identified during the Project-specific Benthic Resource Survey (see Figure 4.5-3), then it is likely that either the anchors themselves or the anchor cables will affect this resource. The main damage from anchoring in hard substrate areas will likely be from the direct impact of the anchor on the substrate, an action that will crush attached epifauna and further imbed rocks and cobble into the sediment. Organisms likely to be affected include sponges, corals, anemones, and hydroids, as well as some motile fauna such as crustaceans and sea stars. Anchor cables may also sweep across hard substrate when the cable drags across the seafloor. Deepwater Wind is working to design an anchor configuration that will minimize impacts on these hard substrate areas for a situation that requires anchoring within this habitat type.

Overall impacts on benthic resources from construction of the WTGs will be limited in spatial extent, totaling approximately 1.2 acres (0.49 hectares) for all activities, and of short duration, totaling approximately 7 weeks (5 weeks for foundation installation and 2 weeks for WTG installation). Given this relatively small spatial area and temporal extent of impact, the loss of benthos from this area during construction will not likely affect the general population or productivity. Once construction is complete, areas disturbed by the anchors, spuds, and anchor chain sweep will be allowed to fill in through natural processes and will ultimately be recolonized with native benthic species, as evidenced from similar

activities during pipeline installations in Massachusetts Bay (TRC et al. 2005). Recolonization generally occurs as a result of both larval settlement and migration of individuals from nearby areas. Given the small area of impact and the widespread distribution of dominant species in Block Island and Rhode Island Sounds, it is reasonable to suggest that either mechanism could occur here.

The installation of the Inter-Array and Export Cable by jet plow will disturb a 5-foot (1.5 m) wide swath of the substrate to a depth of up to about 8 ft (2.4 m) along the length of each cable section. This disturbance will directly affect 3.64 acres (1.48 hectares) and up to 11.27 acres (4.59 hectares), respectively, of substrate during Inter-Array and Export Cable installation activities, respectively. Infaunal organisms removed from the trench by the jet plow will likely not survive, and surface-dwelling benthic species located in the path of the jet plow and skids or wheels spanning the trench will likely be crushed. The loss of these organisms will result in a localized, temporary, and short-term loss of benthic production during the 4- to 7-week BIWF cable installation period. It is common, however, for scavengers such as fish and epibenthic crustaceans to be attracted to areas of disturbance, thus returning some of this benthic production to the food web. Dead organisms not consumed will eventually be broken down chemically and returned to the ecosystem through the nutrient cycle.

Another impact from jet plowing would be the deposition of suspended sediments on surrounding habitat, which is also expected to be localized, short-term, and minor. As stated previously, sediment redeposition along the Inter-Array Cable and the offshore segment of the Export Cable route of 1 mm (0.04 in) is expected to be confined to an area within 130 ft (40 m) and 250 ft (76 m), respectively, of the trench centerlines. There is substantial evidence from both Project-specific substrate characterization surveys that the physical environment in the vicinity of the Project is dynamic. The presence of sand waves throughout much of the area is a strong indicator that bottom currents routinely move surface sediments routinely, an action that is likely enhanced during storm events. The dominant benthic fauna in the Project Area contains species that are adapted to these types of dynamic physical conditions (CRMC 2010) and are likely to be able to withstand the small amounts of sedimentation expected during construction in the Project Area. In addition, studies by Maurer et al. (1986) found that several species of marine benthic infauna (the clam *Mercenaria mercenaria*, the amphipod *Parahaustorius longimerus*, and the polychaetes *Scoloplos fragilis* and *Nereis succinea*) exhibited little to no mortality when buried under up to 3 in (8 cm) of various types of sediment (from predominantly silt-clay to pure sand). While these species do not dominate in the Project Area, data suggests that burial by 0.4 in (10 mm) of sediment for jet plow and/or cofferdam construction activities will have little effect to the benthos near the cable trench. As further discussed in Section 4.5.2, the concentrations of suspended sediment from construction activities will not exceed 500 mg/L along any portion of the Project. Modeling has predicted that elevated concentrations of TSS during construction are both short-lived (lasting only 10 minutes for the highest concentrations), and highly localized at the site of disturbance. No sediment plumes lasted more than a few hours. Based upon modeled results, the duration and concentrations of suspended sediments resulting from Project construction activities will have no effect on benthic species (Wilber and Clarke 2001). Given the minimal area of potential disturbance and the short-duration of cable-lay activities, it is anticipated that once the disturbed area has stabilized physically, as described for the installation of the WTGs, benthic recolonization will occur and the areas of disturbance will return to pre-construction physical conditions.

Deepwater Wind intends to install all marine cables to a target depth of 6 ft (1.8 m) beneath the seafloor, although the actual burial depth could vary from 4 ft to 8 ft (1.2 m to 2.4 m) depending on substrate conditions. If less than 4 ft (1.2 m) burial is achieved, Deepwater Wind may elect to install additional

protection such as concrete matting or rock piles over the buried cable to ensure it is kept in place. It is expected that additional protection will be required at a maximum of 1 percent of the entire length of submarine cables. Placement of such additional armoring will result in the permanent conversion of up to approximately 0.39 acre (0.16 hectare) of habitat along all BIWF marine cable routes. Installation of this extra protection will also result in minor temporary impacts from the 8-point anchored barge necessary to support this activity. As described previously, areas disturbed by anchoring are expected to recover quickly to pre-disturbance physical conditions and given the small areas affected, biological recovery would also be rapid. Once armoring is complete, these areas will be suitable for colonization by sessile benthic species characteristic of natural hard substrate communities. Fouling organisms, such as those observed in the Benthic Resource Survey (Appendix F), are likely to colonize these armored areas.

Deepwater Wind is currently considering two options for landing the Export Cable on Block Island including: 1) a short-distance HDD with a jet plow launched directly from the beach at MHW; or 2) a long-distance HDD to a temporary offshore cofferdam located up to 1,900 ft (579.1 m) from shore. The short-distance HDD is Deepwater Wind's preferred option.

If the short-distance HDD and jet plow landfall method is elected, sediment will be dispersed adjacent to the trench on the beach in the intertidal zone. Much of the sand will be placed back into the trench immediately after the jet plow lays the cable. Organisms jet plowed out of the sediment will be exposed or buried. Exposed organisms would be subject to predation by scavengers (e.g., gulls, terns, raccoons). Buried organisms may be unable to survive. Sediment transport modeling of the short-distance HDD landing option indicates that excess water column concentrations and sediment accumulation are limited to areas close to the jet plow track. Concentrations of suspended sediment of 100 mg/L would cover an area of approximately 7.1 acres (2.9 hectares) for approximately 10 minutes, cumulatively, during jet plowing in the nearshore/tidal zone. Modeled sediment thicknesses exceeded 10 mm (0.4 in) directly adjacent to the trench and accumulations did not exceed 1 mm (0.04 in) beyond 65 m (213 ft) from the trench. When compared to naturally occurring conditions within the nearshore/tidal zone of Crescent Beach, results indicate that the effects of cable installation via jet plow are similar in magnitude and between the mean to storm wave conditions known to occur at this beach. The detailed nearshore sediment transport analysis has been included as Appendix H to this ER. Therefore, given the minimal area of potential disturbance and the short duration of activities in the vicinity of the proposed short-distance HDD landfall location, and the dynamic nature of the beach at this landing location, impacts associated with the short-distance HDD landing alternative are expected to be short-term and minor. It is also likely that the beach contour would return naturally to its pre-construction conditions within several tidal cycles of the installation activity.

If the long-distance HDD option is selected, Deepwater Wind will install a 50 ft by 20 ft (15 m by 6 m) temporary cofferdam excavated to a depth of 10 ft (3.3 m). Installation of this cofferdam will result in the direct impact of approximately 0.05 acre (0.02 hectare) of substrate inclusive of the areas directly affected by the jack-up barge required to support installation. It is anticipated that the 333.3 yd<sup>3</sup> (254.8 m<sup>3</sup>) of sediment removed and placed directly adjacent to the cofferdam (see Section 4.2.1.2). Both infaunal and surface dwelling organisms within the footprint of the cofferdam and jack-up barge spuds will likely not survive and will therefore result in the temporary loss of productivity in the immediate area. Benthic resources in the excavated materials will be permanently removed from the ecosystem. Excavation and if necessary the backfill of the cofferdam once HDD activities are complete will also result in the suspension of sediments into the surrounding water column. Worst-case impacts associated with sediment suspension and redeposition from cofferdam activities would result primarily from backfilling. Sediment

transport modeling indicates that these effects will be short-term, minor, and localized. Specifically, the model predicted that accumulations greater than 0.4 in (10 mm) were limited to within 15 m (50 ft) of the cofferdam. Sediment accumulations did not exceed 0.04 in (1 mm) beyond 34 m (110 ft) of cofferdam (see Appendix H). Given the minimal area of potential disturbance and the short duration of activities, it is anticipated that once the disturbed area has stabilized physically, as described for the installation of the WTGs and cables, benthic recolonization will occur and the areas of disturbance will return to pre-construction conditions.

Operation of the BIWF and associated cables will have a minor, long-term effect on benthic resources. The operational WTGs will result in the conversion of soft bottom habitats to hard substrate from the foundation legs and braces, mud mats, and protective cable armoring at the base of each foundation. The total area of direct impact for all five WTGs will be approximately 0.35 acre (0.15 hectare). However, the introduction of the WTG foundation structures into the environment may result in the colonization of organisms similar to those observed in the hard bottom video survey. Colonization of structures has been observed in European wind farm structures (Michel et al. 2007). The colonization of the WTG foundations would not replace the lost soft substrate in-kind, because the organisms that might grow on the structures are not those that live within the substrate; however, it would restore some benthic production to the immediate area.

Routine maintenance of the WTGs during operation will be conducted using anchored vessels. Anchoring will occur in the immediate vicinity of the WTGs. As described for construction, anchoring will disturb the substrate and associated benthic resources. After the anchor is removed, natural processes will allow the substrate to recover to its prior condition and benthic organisms will recolonize the disturbed area similarly to what was described for construction impacts. Extensive maintenance (e.g., replacement of major components of a WTG) would require a stable work platform and therefore use a jack-up barge. Impacts on the seafloor would be similar to those described for construction and recovery of the benthic community would be expected.

Concern has been raised about the potential effects of EMF emitted from the operating Inter-Array and Export Cable on benthic resources. EMF modeling conducted of the Inter-Array, Export, and BITS Cables indicated that, at the maximum predicted load of 34.5 kV and assuming no sheathing around the cable, the maximum magnetic field at the seafloor directly above the cable will be about 22.1 milligauss and will attenuate with distance both vertically and horizontally (see Appendix M). Little is known about whether benthic invertebrates are affected by EMF and, if they are, what their responses would be (Normandeau et al. 2011). Susceptibility experiments have focused on arthropods, but several mollusks and echinoderms could also be susceptible. However, because susceptibility is variable within taxonomic groups, it is not possible to make generalized predictions for groups of marine invertebrates. Sensitivity thresholds vary by species ranging from 0.3-30 millitesla, and responses included non-lethal physiological and behavioral changes (Normandeau et al. 2011). However, of the organisms with magnetite-based sensory systems (e.g., some fish and invertebrates), the EMF level predicted at the seafloor for this Project is less than half the theoretical detection level of these organisms (Appendix M). In addition, given that benthic infauna are typically most abundant in the uppermost 0.5 ft (0.15 m) and Deepwater Wind plans to bury the transmission cables below 6 ft (1.8 m) of sediment, on average, most infauna would have minimal exposure to EMF from the Project's cabling. It is therefore unlikely that EMF from the Inter-Array or Export Cables will alter the benthic community. The complete EMF Modeling Analysis is included as Appendix M.

Similar to construction, impacts associated with decommissioning of the BIWF at the end of its projected 25-year life will be temporarily disruptive to the surrounding area. The WTGs and foundations will be removed in their entirety (legs will be cut below the mud line) and the Inter-Array and Export Cables below the mud line will be abandoned in-place. Removal of the WTGs will have the same type of impacts described for installation. Removal of the piles below the substrate will, however, disturb the sediments to a greater extent than installation, but will allow for the pre-construction benthic community to re-establish itself after removal. The use of an abrasive water-jet cutting tool below the seafloor will suspend sediments into the water column, resulting in redeposition nearby. The sessile fouling community that is expected to have developed on the piles and support structures will also be removed. This will result in a small reduction in the habitat diversity in the area, although it will actually represent a return to pre-Project conditions.

#### *Ecologically and Economically Important Benthic Macroinvertebrates*

As stated previously, there are 10 species of benthic macroinvertebrates of economic importance known to occur within and in the vicinity of the Project Area. Three of these (American lobster, longfin squid, and Atlantic sea scallop) have been identified by the CRMC in the RI Ocean SAMP as species that are ecologically important to the stability and resiliency of the local marine community and require that the effects to these species be particularly considered in the development of projects off the coast of Rhode Island (RI Ocean SAMP 2011). RIDEM has also noted that the Horseshoe crab is important to the bait and biomedical industries and has regional ecological value because its eggs are an important food resource for migrating shorebirds. There is no spawning habitat known to occur in the BIWF Project Area. Impacts on these species from the construction, operation and decommissioning of the BIWF and associated cables will be as described in the previous section.

The Project's direct impacts on benthic habitat associated with these species will be small. The only long-term benthic habitat losses will occur in the WTG footprints (a total of 0.35 acre [0.15 hectare]). The maximum potential habitat conversion from soft to hard substrate will be no more than 0.39 acre (0.16 hectare) along the entirety of the marine cable routes where additional armoring is needed to protect the cables. The conversion of soft substrate to hard substrate and the WTG foundations will provide artificial hard substrate that is likely to serve as habitat for and/or attract some sessile benthic encrusting species.

Despite evidence that impacts to benthic species will be short-term and minor, given the economic and ecological importance of the American lobster Deepwater Wind is conducting a 1 year pre-construction and at least a 1 year post-construction Ventless Trap Survey to provide a site-specific assessment of the local lobster community in the Project Area. The goal of this study is to determine the seasonal and spatial patterns of lobster abundance within the general Project Area under pre- and post-construction conditions.

#### **BITS**

As with the BIWF, the BITS is not expected to have a significant long-term impact on benthic resources during construction, operation, or decommissioning. Construction activities may, however, cause temporary impacts on benthic resources resulting from the disturbance or alteration of habitat.

#### *Marine Vegetation*

The only identified area of marine vegetation in the vicinity of the BITS is one historic and field-verified eelgrass bed located more than 2,000 ft (610 m) south of the proposed BITS landing location on Block



Island. No eelgrass beds were identified at the BITS Alternative 1 landing location on Narragansett Town Beach (see Figures 4.5-1 and 4.5-2).

Because the proposed BITS Cable route will be located within approximately 100 ft (30.5 m) of the BIWF Export Cable route and the proposed landing strategies for bringing the BITS ashore on Block Island are also the same, the evaluation of impacts on this identified historic bed will be similar to that described for the BIWF.

#### *Benthic Macroinvertebrates*

The greatest potential for impacts on benthic resources from the BITS will result from construction activities, including the direct impacts associated with the footprint of the BITS cable and the construction of the temporary cofferdams, if required. Additional direct impacts will result from the use of jack-up barges to support the installation of the temporary offshore cofferdams and anchored vessels to support the placement of protective armoring along portions of the cable routes and at the two cable crossings. Indirect impacts resulting from the suspension and redeposition of sediments from cable laying activities and anchor cable sweep may also occur.

The installation of the BITS via jet plow will disturb the same 5-foot (1.5 m) wide swath of the substrate to a depth of up to about 8 ft (2.4 m), as described for the BIWF Inter-Array and Export Cables. This disturbance will directly affect 39.64 acres (16.14 hectares) of substrate along BITS Alternative 1. As stated previously, sediment redeposition along the offshore portion of the BITS route is not expected to exceed 1 mm (0.04 in) at a distance of 330 ft (100 m) from either side of the trench. The concentrations of suspended sediment from any construction activities will also not exceed 500 mg/L along any portion of the Project and elevated concentrations will be both short-lived and localized at the site of disturbance. The duration and concentrations of suspended sediments resulting from Project construction activities will have no effect on benthic species (Wilber and Clarke 2001). Most of the BITS Cable will be installed by a DP vessel using a jet plow to a target depth of 6 ft (1.8 m) and not require the support of anchored vessels. However, there are two locations along the proposed cable route where the BITS will cross existing active cables (see Figure 4.2-2, Section 4.2.1.3). At these locations, the BITS cable will be laid on the surface and concrete mats will be installed both between the existing cables and on top of the BITS cable for support and protection. Anchoring will be required to support these two cable crossings. The cable protection will permanently convert an area of approximately 0.33 acre (.013 hectare) of soft substrate to artificial hard. Anchor vessel support will also be required along portions of the BITS route where the burial depth of the cable is less than 4 ft (1.2 m). As stated previously, Deepwater Wind expects that additional protection would be required at a maximum of 1 percent of the entire submarine cable. Placement of such additional armoring would result in the permanent conversion of up to 1.0 acre (0.4 hectare) of habitat along BITS Alternative 1.

Installation of the BITS cable will occur over the same 4- to 7-week period as described for the BIWF Inter-Array and Export Cables. Given the similarity of conditions along the BITS as the BIWF, effects to benthic resources from the installation of the BITS will be similar to those described for the BIWF cable. Impacts will likewise result in no long-term losses to benthic resources along the BITS Alternative 1 route.

Deepwater Wind is currently considering two alternative landing mechanisms for the BITS cable on Block Island and at the Narragansett Town Beach, a short-distance HDD and a long-distance HDD. However, because the proposed BITS cable route and temporary cofferdam (if necessary) off of Block Island will be located approximately 100 ft (30.5 m) from the BIWF Export Cable route, and the proposed

methodologies for landing the BITS on Crescent Beach will be the same as described for the Export Cable, the impacts and effects associated with the BITS landing on Block Island will be as described for the BIWF.

On the Rhode Island mainland off of Narragansett Town Beach, should Deepwater Wind select the long-distance HDD methodology, as described previously the temporary cofferdam will result in the direct impact of approximately 0.05 acre (0.02 hectare) of substrate inclusive of the areas directly affected by the jack-up barge required to support installation. Deepwater Wind has proposed that the 333.3 yd<sup>3</sup> (254.8 m<sup>3</sup>) of sediment removed from this location be placed directly adjacent to the cofferdam (see Section 4.2.1.2). Sediment transport modeling indicates that, like the effects of the BIWF cofferdam installation, impacts from the installation of the BITS cofferdam at Block Island and the BITS Alternative 1 cofferdams will be short-term, minor, and localized. Model predictions at the BITS Alternative 1 cofferdam location off of Narragansett Town Beach indicate that accumulations greater than 0.4 in (10 mm) will be limited to within 100 ft (33 m) of the cofferdam. Sediment accumulations did not exceed 0.04 in (1 mm) beyond 190 ft (58 m) of the BITS Alternative 1 cofferdam (see Appendix H). Deposition under the worst-case (cofferdam backfilling activities, if necessary) would not exceed 0.04 in (1 mm) more than 190 ft (58 m) on either side of the Narragansett Town Beach cofferdam. Given the minimal area of potential disturbance and the short duration of activities, it is anticipated that once disturbed area has stabilized physically, benthic recolonization will occur and the areas of disturbance will return to pre-construction conditions.

Use of the short-distance HDD and jet-plow method for the BITS Alternative 1 landing on Narragansett Town Beach will result in similar short-term impacts on the surrounding environment as described for the BIWF Export Cable on Block Island. Specifically, modeling results for the short-distance HDD landing alternative at Narragansett Town Beach indicate that excess water column concentrations and sediment accumulation are limited to areas close to the jet plow track. Concentrations of suspended sediment of 100 mg/L would cover an area of 10 acres (4.0 hectares) for approximately 10 minutes, cumulatively during jet plowing in the nearshore/tidal zone. Modeled sediment thicknesses exceeded 10 mm (0.4 in) directly over to the trench and accumulations did not exceed 1 mm (0.04 in) beyond 55 m (180 ft). When compared to naturally occurring conditions within the nearshore/tidal zone of Narragansett Town Beach, results indicate that the effects of cable installation via jet plow is similar in magnitude and between the mean to storm wave conditions known to occur at this beach. It is also anticipated that the beach contour will return naturally to its pre-construction conditions within several tidal cycles of cable installation. The detailed nearshore sediment transport analysis has been included as Appendix H to this ER.

Due to the cable design and proposed target burial depth, no impacts on benthic resources will result from the operation of the BITS. As described previously, potential EMF emissions from the cable will be well below those likely to be perceived by benthic organism (see Appendix M).

It is anticipated the BITS will be kept in operation in perpetuity. However, should the BITS reach the end of its useful life, the cable will be abandoned in place resulting in no impact on benthic resources from decommissioning.

#### *Ecologically and Economically Important Benthic Macroinvertebrates*

Impacts on the 10 species of benthic macroinvertebrates of economic and ecological importance associated with the construction, operation and decommissioning of the BIWF and associated cables will be as described for the BIWF Inter-Array and Export Cables. For horseshoe crabs, the closest spawning site to the BITS Project Area is in The Narrows, located approximately 0.95 mi (1.5 km) north of the

BITS Alternative 1 landfall location on Narragansett Town Beach (Scott Olszewski, RIDEM, personal communication, 2012). However it is unlikely that installation of the BITS at Narragansett Town Beach will affect spawning habitat for horseshoe crabs due to the fact that this species prefers low energy beaches for spawning.

### **Combined Effects**

Deepwater Wind has minimized impacts on benthic resources by siting the BIWF within the designated Renewable Energy Zone; avoiding direct impacts on important benthic habitats such as eelgrass and hard bottom substrates; and selecting construction techniques and equipment, such as a jet plow and a DP vessel to minimize disturbance and alteration of substrate to the maximum extent possible during construction activities. As such, the resulting combined effects of the BIWF and BITS are not expected to be significant. Construction activities themselves will result in a small combined total area of permanent impact of approximately 57.57 acres (23.43 hectares) across the entire Project Area following BITS Alternative 1. Disturbance from construction would also be of short duration lasting a total of 7 weeks for both the BIWF and BITS. Of the total area disturbed, all areas are expected to return to pre-construction conditions except for approximately 2.07 acres (0.44 hectares) of habitat that would be permanently converted to hard substrate by the WTGs, the additional protective armoring along the cable routes and at the two proposed cable crossings. However, these new hard bottom areas will be suitable for colonization by sessile benthic species characteristic of natural hard substrate communities.

During operations, effects to benthic resources are not likely. Decommissioning activities associated with the BIWF and BITS, similar to construction activities, would result in temporary disturbances to benthic resources, but effects and recovery rates are expected to be similar as described for construction with no long-term effects.

When considered together with the existing benthic resources in the Project Area of the BIWF and BITS, the combined impacts associated with the construction, operation, and decommissioning of the BIWF and BITS are minor and not significant.

### **4.5.2 Finfish Resources**

This section describes the finfish resources (demersal and pelagic) within and surrounding the Project Area. This section also identifies the Project activities that may affect both finfish species and their habitat within the Project Area. Benthic resources, including benthic habitats and shellfish, are discussed in Section 4.5.1. A detailed EFH Assessment is included as Section 4.5.3.

The discussion of finfish resources was based on the review of existing literature including, but not limited to, the RI Ocean SAMP. No site-specific surveys were conducted to date for this Project for finfish; however, Deepwater Wind will perform a 2-year pre-construction and 3-year post-construction fish trawl survey to provide a BACI assessment to confirm the seasonal patterns of the local finfish community and to evaluate site-specific post-construction impacts. Deepwater Wind has also committed to a 1-year pre-construction and 1-year post-construction ventless trap survey, with the option to add additional post-construction surveys, to provide an assessment of the seasonal and spatial patterns of lobster abundance within the general BIWF and BITS Project Area (see Section 4.5.1 for additional information). While this survey targets lobsters, on occasion some finfish species (e.g., black sea bass and tautog) are also captured by lobster traps. Therefore, any finfish collected in the traps will be identified and reported on as part of the overall assessment.

#### 4.5.2.1 Affected Environment

Many habitat and spatial factors affect the distribution of fish within the waters of Rhode Island. Each major habitat type within the Project Area (e.g., hard bottom, soft bottom, rocky reef, and SAV) supports a fish community associated with that habitat type. Other factors within each of these habitats, such as temperature, salinity, pH, physical habitat, and currents, shape the diversity and abundance of fish (Helfman et al. 2009).

Many finfish play an important role in food web dynamics as higher-order predators within the ecosystem. Finfish utilize the abundant stocks of lower trophic levels (producers—phytoplankton—and lower-order consumers such as zooplankton) that then become available as food to larger fish, and higher-order predators such as tuna and sharks. Other finfish species feed on plankton or detritus (e.g., menhaden, herring, etc.), but are equally important to the ecosystem by providing a food source for higher trophic-level fish. There are more than 100 marine and estuarine fish species known to occur within the waters of Rhode Island (Froese and Pauly 2012; NatureServe 2012). Table 4.5-2 summarizes those finfish species that have been identified as having EFH in the proposed Project Area and/or considered commercially or recreationally important to the state of Rhode Island. The table also identifies fish that are considered by the CRMC through the RI Ocean SAMP to be ecologically important to the stability and resiliency of the local marine community of Rhode Island.

In addition to the species identified in Table 4.5-2, one federally listed endangered species, the Atlantic sturgeon, is known to occur, or have historic range, in the waters of Rhode Island. This species is addressed in detail, along with other threatened and endangered marine resources, in Section 4.5.7.

**Table 4.5.2 Economically and Ecologically Important Finfish Species**

Species	EFH	Species of Ecological Importance	Commercially or Recreationally Important	Seasonality
<b>Pelagic</b>				
alewife ( <i>Alosa pseudoharengus</i> )		X		Year-round
American eel ( <i>Anguilla rostrata</i> )				May and September to November
American shad ( <i>Alosa sapidissima</i> )		X		March to November
Atlantic bonito ( <i>Sarda sarda</i> )			X	June to October
Atlantic herring ( <i>Clupea harengus</i> )	X	X	X	Year-round
Atlantic mackerel ( <i>Scomber scombrus</i> )	X		X	May to September
blue shark ( <i>Prionace glauca</i> )	X		X	June to November
blueback herring ( <i>Alosa aestivalis</i> )		X		Year-round
bluefin tuna ( <i>Thunnus thynnus</i> )	X		X	June to October
bluefish ( <i>Pomatomus saltatrix</i> )	X	X	X	May to November
butterfish ( <i>Peprilus triacanthus</i> )	X	X	X	May to October
cobia ( <i>Rachycentron canadum</i> )	X			March to August
dusky shark ( <i>Carcharhinus obscurus</i> )	X		X	June to November
false albacore ( <i>Euthynnus alletteratus</i> )			X	June to October
king mackerel ( <i>Scomberomorus cavalla</i> )	X			March to August
menhaden ( <i>Brevoortia tyrannus</i> )			X	April to December
rainbow smelt ( <i>Osmerus mordax</i> )				Year-round

**Table 4.5.2 Economically and Ecologically Important Finfish Species**

Species	EFH	Species of Ecological Importance	Commercially or Recreationally Important	Seasonality
sandbar shark ( <i>Carcharhinus plumbeus</i> )	X			May to September
sand tiger shark ( <i>Carcharias taurus</i> )	X			May to September
shortfin mako shark ( <i>Isurus oxyrinchus</i> )	X		X	June to December
Spanish mackerel ( <i>Scomberomorus maculatus</i> )	X			March to August
striped bass ( <i>Morone saxatilis</i> )			X	April to November
thresher shark ( <i>Alopias vulpinus</i> )	X		X	June to December
white shark ( <i>Carcharodon carcharias</i> )	X			April to October
yellowfin tuna ( <i>Thunnus albacares</i> )			X	June to October
<b>Demersal</b>				
American plaice ( <i>Hippoglossoides platessoides</i> )	X			Year-round
Atlantic cod ( <i>Gadus morhua</i> )	X	X	X	Year-round
barndoor skate ( <i>Dipturus laevis</i> )			X	Year-round
black sea bass ( <i>Centropristis striata</i> )	X	X	X	May to October
cusck ( <i>Brosme brosme</i> )				Year-round
haddock ( <i>Melanogrammus aeglefinus</i> )	X			Year-round
little skate ( <i>Leucoraja erinacea</i> )	X		X	Year-round
monkfish ( <i>Lophius americanus</i> )	X		X	Year-round
ocean pout ( <i>Zoarces americanus</i> )	X			Year-round
red hake ( <i>Urophycis chuss</i> )	X			March to September
scup ( <i>Stenotomus chrysops</i> )	X	X	X	May to October
silver hake/whiting ( <i>Merluccius bilinearis</i> )	X	X	X	March to September
spiny dogfish ( <i>Squalus acanthias</i> )	X		X	June to October
smooth dogfish ( <i>Mustelus canis</i> )				June to October
summer flounder (fluke) ( <i>Paralichthys dentatus</i> )	X	X	X	May to October
tautog ( <i>Tautoga onitis</i> )			X	March to November
thorny skate ( <i>Amblyraja radiata</i> )			X	Year-round
windowpane flounder ( <i>Scophthalmus aquosus</i> )	X			Year-round
winter flounder ( <i>Pseudopleuronectes americanus</i> )	X	X		Year-round
winter skate ( <i>Leucoraja ocellata</i> )	X	X	X	Year-round
witch flounder ( <i>Glyptocephalus cynoglossus</i> )	X			Year-round
yellowtail flounder ( <i>Limanda ferruginea</i> )	X	X		Year-round

The species highlighted in Table 4.5-2 can be broadly categorized in two groups based on the portion of the water column that they occupy: demersal (bottom dweller) and pelagic (surface or water column dweller) fish species. These groupings will provide the framework for assessing the potential impacts on finfish within the Project Area. The following sections provide additional details regarding the ecologically and economically important species associated with these two groups that occur in the Project Area.

## Demersal Finfish

The demersal zone refers to the bottom substrate within the continental shelf areas. Demersal fish occupy bottom areas and feed on benthic organisms. As such, the demersal fish community has a strong relationship between benthic habitat complexity (e.g., cobble, boulder), with complex habitats containing greater fish diversity (Malek et al. 2010). These species are widely distributed throughout coastal Rhode Island waters. Many demersal species occur year-round in these waters; however, abundance varies with both season and lifestage. However, in recent years, regional demersal fish populations, such as winter flounder, have been in decline, coinciding with an observed change in species composition in the area from a demersal to a pelagic regime (Collie et al. 2004; 2008). This population shift and the decline of these species may be in response to long-term changes in water temperature and could be an early indicator of climate change (Collie et al. 2008; Lucey and Nye 2010).

As shown in Table 4.5-2, there are 14 demersal finfish species that fall within the ecological importance category for the state of Rhode Island, and/or considered commercial/recreational important. These species all have the potential to associate with the waters and habitats of the proposed Project Area. Management entities for each species, as well as the current status of each fish stock, are codified in the MSFCMA. Species-specific regulations are federally managed by the NEFMC, ASMFC, and MAFMC. The management of these species in State waters is under the jurisdiction of the RIDEM.

The Atlantic cod, black sea bass, scup, silver hake, summer flounder, winter flounder, yellowtail founder, and winter skate are demersal species that have been identified in the RI Ocean SAMP as species that are important to both the stability and resiliency of the local marine community. The CRMC requires that the effects on these species be particularly considered in the development of projects off the coast of Rhode Island (RI Ocean SAMP 2011). Demersal species, especially those with egg and larval stages associated with bottom habitat, are particularly vulnerable to loss or degradation of suitable habitat. The eight species just mentioned, along with the barndoor skate, little skate, thorny skate, monkfish, spiny dogfish, and tautog (although tautog eggs are not demersal), are also considered commercially or recreationally important to the state of Rhode Island. Monkfish, summer flounder, and silver hake represent the first, second, and third most economically valuable finfish species, respectively, landed by the Rhode Island commercial fleet over the last 10 years. For recreational anglers, the top three demersal species landed (by weight) in order are summer flounder, scup, and tautog. Overall, these species represent the second, fourth, and fifth most landed recreational finfish species, respectively. These species, except for monkfish, which is a year-round resident to Rhode Island waters, tend to be found within both the BIWF and BITS Project Areas from spring through fall. A detailed discussion of commercial and recreational fishing is provided in Section 4.9.

Of the 14 demersal species identified in Table 4.5-2 as ecologically or commercially/recreationally important, 11 have identified EFH in the Project Area. Detailed information regarding all species, lifestages, seasonal distribution, and relative abundance with designated EFH in the Project Area, as well as potential impact and proposed mitigation measures, is provided in Section 4.5.3. Additionally, information on, as well as potential impact to and proposed mitigation measures for, the endangered Atlantic sturgeon (recently listed as endangered in 2012) is provided in Section 4.5.7.1.

## Pelagic Finfish

The pelagic zone within coastal Rhode Island waters refers to the surface or mid-water depths within the continental shelf areas. The greatest marine fish abundance and diversity typically exists within pelagic

and coastal (neritic) zones because of the high productivity and complexity of habitats (including hard bottom, rocky reefs, etc.) associated with this zone (Helfman et al. 2009).

The diverse pelagic fish can be further grouped into estuarine, marine, anadromous, and catadromous fish. Estuarine fish (e.g., striped bass, bluefish) typically inhabit nearshore waters with salinities ranging from 0 to 30 parts per thousand (ppt or Practical Salinity Units [psu]), whereas marine species (e.g., tuna and sharks) are found in coastal or offshore waters with salinities averaging near 30 psu. Anadromous/catadromous forms, represented primarily by shad/herring (*Clupeidae*), migrate from ocean waters to freshwater or lower-salinity estuarine waters to spawn. Most species in the suborder Percoidei are primarily nearshore pelagic fish, including the sea bass (*Serranidae*) and the bluefish (*Pomatomidae*) (Nelson 2006).

The presence of these species in the Project Area follows a seasonal cycle of abundance that parallels water temperature and food availability (Bohaboy et al. 2010). In general, the start of the major influx of migratory species to the general Project Area occurs in early spring, reaching a maximum in late summer, then declines through fall (RI Ocean SAMP 2011). Spawning seasons vary widely among the pelagic species, but many of the nearshore pelagic species, such as menhaden, spawn during the summer months.

Management entities for pelagic species, as well as the current status of the stocks, are as described for demersal finfish with the exception of finfish classified as “highly migratory species” (e.g., tuna and sharks). Highly migratory species are managed in U.S. waters by NOAA Fisheries.

Table 4.5-1 identifies 25 pelagic species, 17 of which have been identified as species that are ecologically and/or commercially and recreationally important to the state of Rhode Island. The CRMC has specifically recognized the alewife, American shad, Atlantic herring, blueback herring, bluefish, and butterfish as ecologically important to the stability and resiliency of the local marine community. The CRMC requires that the effects on these species be particularly considered in the development of projects off the coast of Rhode Island (RI Ocean SAMP 2011). The top three most commercially important pelagic species by dollar value include the Atlantic mackerel, Atlantic herring, and striped bass. These species represent the fifth, sixth, and tenth most economically valuable commercial finfish species landed by the Rhode Island commercial fleet over the last 10 years, respectively. For recreational anglers, the top three pelagic species landed by weight in order of importance are striped bass, bluefish, and tuna species. Overall, these species represent the first, third, and eighth most landed recreational species in Rhode Island, respectively. See Section 4.9 for a detailed discussion on commercial and recreational fishing. Nine of the pelagic species identified in Table 4.5-2 also have known EFH in the Project Area. Detailed information regarding these species, life stages, seasonal distribution, and relative abundance in the Project Area, as well as potential impact and proposed mitigation measures, is provided in Section 4.5.3.

Four pelagic species known to occur in the general Project Area are anadromous—the alewife, blueback herring, American shad, and rainbow smelt. The alewife and blueback herring, collectively referred to as river herring, are candidate species for listing under the ESA. This group of coastal pelagic fish spend most of their lives in coastal waters, approaching the shore and returning to freshwater only to spawn (Collette and Klein-MacPhee 2002). River herring adults and juveniles occur year-round and are more abundant from April through September. Spawning and early life history stages occur in coastal rivers and estuaries. Spawning migrations into coastal rivers typically occur in the spring. Juveniles emigrate from fresh and brackish waters during late summer and fall, and overwinter in areas near their estuarine nurseries (Millstein 1981). The rainbow smelt, like the river herring, are usually found in coastal waters (Collette and Klein-MacPhee 2002). Some individuals spend the whole year in estuaries; however, most

rainbow smelt leave the harbors and estuaries during the warmest season, but only move out far enough to find cooler water (Collette and Klein-MacPhee 2002). In the fall, juveniles move back into the upper estuaries, concentrating in channels, where they mix with the adult population (McKenzie 1964; Clayton 1976). Although smelt are mobile pelagic fish, they do occur in benthic habitats such as eelgrass (Crestin 1973; Wyda et al. 2002). There is also one catadromous pelagic species, the American eel, which is also known to migrate through the coastal waters of Rhode Island. Juvenile American eels (also known as glass eels) typically migrate into Rhode Island waters during the spring, when they enter the estuaries and move into freshwater rivers. They migrate again as adults back to their oceanic spawning grounds in the Sargasso Sea. The greatest potential for these anadromous and catadromous species to occur in the Project Area is during the migration periods. No EFH for these species has been identified in the Project Area.

#### **4.5.2.2 Potential Impacts and Proposed Mitigation**

Deepwater Wind has minimized impacts on finfish by siting the BIWF within the Renewable Energy Zone. The Renewable Energy Zone was established by the CRMC under the RI Ocean SAMP to specifically minimize potential impacts on natural resources (e.g., important marine habitats and species) and existing human uses. In addition, Deepwater Wind has sited the Project to avoid direct impacts on important habitats such as eelgrass and hard bottom substrates known to be used by some finfish species throughout various life stages. The selected construction techniques and equipment (e.g., jet plowing and HDD) will substantially minimize disturbance and alteration of substrate during construction activities, compared to other construction techniques and equipment (e.g., dredging).

Deepwater Wind is also currently conducting trawl surveys in the vicinity of the proposed BIWF and BITS to further assess the local finfish community in the Project Area. This is a 5-year study, which will collect 2 years of baseline pre-construction data and 3 years of post-construction data and will support the further evaluation of both the construction and operational effects on the local finfish community.

#### **BIWF**

The BIWF is not expected to have long-term impacts on finfish resources identified within and in the vicinity of the Project Area during construction, operation, or decommissioning. Construction activities may, however, cause minor short-term impacts on finfish resulting from the disturbance or alteration of habitat, increased suspension of sediments, and increased noise. Lighting and/or reduced water quality from accidental spills or releases from Project activities may also affect finfish species. In addition, questions have been raised about the potential for finfish species to be affected by EMF from the operating Project submarine cables. Each of these potential impacts on demersal and pelagic finfish species known to occur in the Project Area is addressed separately in the following section.

#### **Demersal Finfish**

##### *Disturbance and Alteration of Habitat*

Demersal finfish species have a strong relationship with bottom habitats throughout various life stages; therefore, the greatest potential for impacts on these species from the BIWF is sediment disturbance and/or loss or alteration of habitat.

As stated in Section 4.5.1, the installation of the five WTGs, including the foundation legs and braces, mud mats, and protective cable armoring at the base of each foundation, will result in a total impact of approximately 0.35 acre (0.15 hectare). In this area, soft substrate will be permanently converted to hard substrate. Construction activities associated with the installation of the WTGs and foundations will also result in the temporary disturbance of 0.85 acre (0.34 hectare) of substrate from the placement of both



jack-up barge spuds and vessel anchors. Additional disturbance is also expected within the top few inches of substrate from the anchor chains during foundation installation as they rest on the seafloor or sweep across the bottom in response to bottom currents. Anchor cable sweep will likely result in some localized increases in TSS; however, it is anticipated that these effects would be less than those evaluated for jet plowing and not be transported very far from the source (see discussion below on jet plowing). Anchors and chain sweep will largely impact soft substrates within the BIWF Project Area; however, should anchoring be required in the southwestern portion of the BIWF work area where some hard bottom habitat was identified during site-specific surveys, then either the anchors and anchor cables could impact hard bottom habitat. Deepwater Wind is working to design an anchor configuration that will minimize impacts on these hard substrate areas.

Installation of the Inter-Array Cable, Export Cable, and the temporary offshore cofferdam, if required, will also result in the temporary disturbance of a maximum of 3.64, 11.27, and 0.05 acres (1.48, 4.59 and 0.02 hectares) of seafloor, respectively, along the cable installation route and within the footprint of the cofferdam. These installation activities will also result in temporary and localized increases in TSS and turbidity in the water column that will be transported and deposited in areas adjacent to construction activities. The BIWF Inter-Array and Export Cables may also require additional protective armoring in areas where the burial depth achieved is less than 4 ft (1.2 m). As stated previously, Deepwater Wind expects that additional protection would be required at a maximum of 1 percent of the entire submarine cable resulting in the maximum permanent conversion of soft substrate to hard substrate of 0.39 acres (0.16 hectare) along the BIWF marine cable routes. Installation of this extra protection will also result in minor temporary impacts from the 8-point anchored barge necessary to support this activity.

The permanent conversion of 0.35 acre (0.15 hectare) associated with the WTGs and 0.39 acres (0.16 hectare) associated with the additional cable armoring from soft bottom to hard bottom represent a very small amount of lost habitat to demersal species. In fact the foundations themselves may represent a beneficial impact by providing additional habitat for some demersal fish species (especially structure-oriented species such as the black sea bass). In addition, once armoring is complete these areas will be suitable for colonization by sessile benthic species that may attract various demersal finfish.

Impacts on demersal fish species from excess suspended sediments from the proposed jet plowing and cofferdam construction, if required, have the potential to result in four types of effects: 1) no effect; 2) behavioral effects (e.g., alarm reaction or avoidance response); 3) sub-lethal effects (e.g., reduction in feeding rate or feeding success); and 4) lethal effects (e.g., direct mortality increased predation or significant degradation of habitat) (Newcombe and Jensen 1996). The severity of impacts is typically associated with both the concentration of suspended sediments and the duration of exposure. The results of the project-specific sediment transport modeling analyses showed that dispersion along the Inter-Array Cable will not exceed 100 mg/L, will decrease to 10 mg/L or less within an hour, and will be confined to an area within 160 ft (50 m) of the jet plow trench. This is also true for along the majority of the offshore portion of the Export Cable route except in regions where there were significant quantities of silt and clay. In these areas, TSS concentrations were higher, ranging from 200 mg/L to 500 mg/L to distances of approximately 650 ft and 260 ft (200 m and 80 m), respectively, from the trench at their maximum distance. Concentrations decreased to 10 mg/L within approximately 3,200 ft (975 m) from the cable route and persisted for no more than 2 hours. The assessment of the cofferdam associated with the long-distance HDD landing alternative analyzed a potential 4-hour backfilling period prior to cofferdam removal as the worst-case construction activity. Model results indicate that sediment concentrations exceeded 100 mg/L; however, the plume at this concentration settled rapidly (within 10 or less minutes)

in close proximity to the cofferdam. Sediment transport modeling of the short-distance HDD landing alternative in the nearshore/tidal zone of Crescent Beach indicates that excess water column concentrations and sediment accumulation would be similar to cable installation via jet plow for the Export Cable and are limited to areas close to the jet plow track in the nearshore/tidal zone. Concentrations of suspended sediment of 100 mg/L would cover an area of 7.1 acres (2.9 hectares) for approximately 10 minutes, cumulatively during jet plowing in the nearshore/tidal zone. Modeled sediment thicknesses exceeded 10 mm (0.4 in) directly adjacent to the trench and accumulations did not exceed 1 mm (0.04 in) beyond 65 m (213 ft) from the trench. When these results are compared to naturally occurring conditions within the nearshore/tidal zone of Crescent Beach, the data shows that the effects of cable installation via jet plow are similar in magnitude and between the average and storm conditions known to occur at this beach. Therefore, cable installation via jet plow will provide a very small contribution to the natural sediment concentration conditions in nearshore areas exposed to wave action.

According to Wilber and Clarke (2001), all levels of TSS modeled for this Project are unlikely, in terms of both concentration and duration, to cause either lethal or sub-lethal effects to fish. At most, demersal fish in the immediate area of impact may experience some temporary physiological stress; however, it is more likely that both jet-plowing and cofferdam activities will elicit a temporary avoidance response (Newcombe and Jensen 1996). In addition, as indicated in Section 4.5.1, the area of sediment deposition in both the offshore and nearshore environment is also limited in volume and spatial extent. Depositional thickness did not exceed 0.4 in (10 mm) in any portion of the Project except in areas immediately adjacent to the trench, and rapidly decreased to less than 0.04 in (1 mm) within a few hundred feet. Both the volume of deposition and area covered would result in negligible impacts on demersal fish. The complete Sediment Transport Analysis has been included as Appendix H.

Operation of the BIWF and associated cables will not have a significant effect on demersal finfish species. However, as stated previously, it is possible that as the WTGs become an established part of the marine environment and are covered by algae and sessile invertebrates, these areas could attract mobile species, including demersal fish, to the Project Area.

Decommissioning of the BIWF at the end of the Project's projected 25-year life will be temporarily disruptive to the surrounding area. The WTGs and foundations will be removed in their entirety (legs will be cut below the mud line) and the Inter-Array and Export Cables below the mud line will be abandoned in-place. Removal of the WTGs will have the same type of impacts described for installation.

### *Noise*

Noise generated from pile-driving (vibratory and impact hammering) and vessel operations could affect some fish species, particularly those with swim bladders, if present during BIWF construction activities. However, some demersal fish, such as flounders, do not have swim bladders and strong hearing capacities and therefore would not be affected by underwater noise in the same manner as a pelagic fish. Section 4.6.2.1 and Appendix N provide additional discussion of some of the basic acoustics associated with underwater noise and includes a discussion of Deepwater Wind's underwater acoustic modeling analysis. Section 4.6.2.1 further describes noise impacts on marine species.

Sounds of short duration that are produced intermittently or at regular intervals, such as sounds from pile-driving, are classified as "pulsed." Sounds produced for extended periods, such as sounds from vibratory hammers, are classified as "continuous." Although continuous noise sources have the potential to elicit certain behavioral effects to marine species, impact pile-driving has the greatest potential to cause harassment or injury through generation of intense underwater sound pressure waves. Deepwater Wind

will employ both a 200 kJ-rated hydraulic hammer to install each of the 20 WTG foundation piles, followed by the use of a 600 kJ-rated hammer to seat the piles to their final design penetration depth of 250 ft (76.2 m). Deepwater Wind will employ the use of a vibratory hammer to support the construction of the temporary cofferdam should the BIWF Export Cable be brought ashore on Block Island using the long-distance HDD landing option.

Although the effects of pile-driving on fish are poorly studied and there appears to be substantial variation in a species' response to sound, intense sound pressure waves can change fish behavior or injure/kill fish through rupturing swim bladders or by causing internal hemorrhaging (Hastings and Popper 2005). Exposure to sound from pile-driving activities may also cause fish to become temporarily stunned, making them more susceptible to predators. In addition, if vibratory pile driving of the temporary cofferdam is required during anadromous fish migrations, species avoidance behavior could result in a temporary barrier to fish migrations. Underwater noise associated with the use of DP vessel thrusters during cable installation may also cause fish to temporarily avoid the area.

The degree to which marine species are exposed to and are affected by sound waves is dependent upon variables such as the peak sound pressure level and frequency, as well as the species and size (e.g., small fish appear to be more susceptible to injury by intense sound waves than larger fish of the same species). Short-term exposure to peak sound pressure levels above 190 dB (re: 1  $\mu$ Pa) are thought to physically harm fish (Hastings 2005).

While noise from Project construction will occur, the precise effect that the noise will have on demersal fish is difficult to define. It is likely that demersal fish will simply disperse from areas where there is abnormally high noise but will likely return once the ambient noise returns to normal levels, without any permanent impacts on individuals. Any potential impacts from construction noise on finfish species is expected to be of short-duration consisting only of those periods associated with the pile-driving of the WTG foundations (approximately 4 days per WTG), the vibratory pile driving of the temporary cofferdam off Block Island, if required, (approximately 2 days to install and 2 days to remove), and the use of DP vessel thrusters during cable installation (approximately 2 to 4 weeks).

During operations, it is likely that the WTGs will produce low-level continuous underwater sound. There are currently no data on impact thresholds for fish exposed to continuous noise. It is likely, however, that noise levels of the operating wind farm will be too low (outside of the hearing range of most fish) to cause injury to demersal species.

#### *Electromagnetic Fields*

Concern has been raised about the potential effects of EMF emitted from the operating Inter-Array and Export Cables on demersal finfish species in the Project Area. Many fish groups that occur in coastal Rhode Island waters have an acute sensitivity to electrical fields, known as electroreception (Bullock et al. 1983; Helfman et al. 2009), with elasmobranchs (e.g., skates) being the most sensitive (Rigg et al. 2009).

EMF modeling conducted of the Inter-Array and Export Cables indicate that, at the maximum predicted load of 34.5 kV and assuming no sheathing around the cable, the maximum magnetic field at the seafloor directly above the cable will be about 22.1 milligauss and will attenuate with distance both vertically and horizontally (see Appendix M). Little is known about how fish are affected by EMF and, if they are, what their responses would be (Normandeau et al. 2011). However, of the species with magnetite-based sensory systems, the EMF level predicted at the seafloor for this Project is less than half the theoretical

detection level of these organisms (Exponent 2012). It is unlikely therefore that EMF from the Inter-Array or Export Cables will affect or alter the demersal finfish community in the Project Area. The complete EMF Modeling Analysis is included as Appendix M.

#### *Accidental Releases and Spills*

During construction, the potential for spills and accidental releases of material such as diesel fuel, lubricants, and hydraulic fluid could affect fish and other aquatic life through acute or chronic toxicity, and sub-lethal effects that could affect reproduction, growth, and recruitment. Depending upon the magnitude of the release, it is possible that some material could wash up onto the intertidal zone and result in harm and mortality to intertidal species. To minimize the likelihood of accidental spills and releases, Deepwater Wind and its contractors will develop and maintain individual Spill Prevention, Control and Countermeasure Plans (SPCC Plans) to prevent, respond to, and mitigate any potential spills of oil, gas, lubricants, or other hazardous materials that could occur during construction and/or operation of the BIWF. The use of comprehensive SPCC Plans will effectively minimize the risk of accidental spills or the introduction of other hazardous materials to the marine environment and their effects to aquatic life.

#### *Lighting*

The reaction of fish to artificial light (either attraction or avoidance) depends on the species, but affects their natural behavior in both ways. During construction, all vessels operating between dusk and dawn will be required to use navigational lights. In addition, temporary deck lighting will be required to illuminate the work area on vessel decks to ensure safety during nighttime operations. However, given the short duration of marine construction (approximately 5 months) and the fact that demersal species tend toward the bottom, impact from artificial light from offshore construction activity will be negligible. During operation, the WTG foundations will be required to be lit with navigational lighting. Deepwater Wind will work with the USCG in coordination with the CRMC and NOAA to ensure the lighting plan will both meet USCG safety standards and minimize the potential impacts associated with artificial lighting on marine organisms to the extent possible.

#### **Pelagic Fish**

Impacts on pelagic species from construction, operation, and decommissioning of the BIWF Project from the disturbance or alteration of habitat, increased noise, lighting, and/or reduced water quality from accidental spills or releases will be similar to those described for demersal species. The magnitude of potential impacts resulting from benthic disturbance would likely be even lower because pelagic fish do not generally occur on/in the benthic habitat to the same extent as demersal fish. Pelagic and epipelagic species are highly mobile due to the environment in which they live and are named for. Effects on pelagic fish will be minimized by the fact that the majority of these fish can move rapidly through the water column, as well as by their transient nature.

Pelagic fish, unlike demersal fish, are not as dependent on a close association to structure such as coastlines or reefs. These fish are far more likely to seek out features within the water column, such as thermoclines and upwelling associated with offshore bottom features like offshore canyons and sea mounts, and are therefore less affected by impacts on bottom substrates and habitats. However, some pelagic fish may be attracted to the structure provided by the WTGs as feeding habitat, or as a means of predator avoidance in a similar manner as artificial reef habitat, or associated with flotsam in the open ocean.

## **BITS**

The BITS is not expected to have a long-term impact on finfish resources identified within and in the vicinity of the Project Area as a result of construction, operation, or decommissioning. Construction activities may however cause temporary impacts on finfish resulting from the disturbance or alteration of habitat, increased TSS on a temporary and localized basis, and increased noise. Lighting and/or reduced water quality from accidental spills or releases from Project activities may also have the potential to affect finfish species, however this will be limited to the construction period only. Questions have also been raised about the potential for finfish species to be affected by EMF from the operating Project submarine cables. Each of these potential impacts on demersal and pelagic finfish species known to occur in the BITS Project Area is addressed separately in the following section.

### **Demersal Finfish**

#### *Disturbance and Alteration of Habitat*

Construction of the BITS will not require the use of anchored vessels or jack-up barges except at areas at existing cable crossings, where additional armoring of the cable is required, and at the temporary cofferdam locations, if required. Cable armoring at existing cable crossings will permanently convert approximately 0.33 acre (0.13 hectare) of soft substrate to hard substrate. This relatively small area, in comparison to the surrounding soft substrate, will not have a significant effect to demersal species. As stated for the BIWF, the effects of anchoring spud placement and the permanent conversion of soft substrate to hard substrate along the limited portions of the marine cable routes (no more than 1 percent) where additional armoring is required will not have a significant effect on demersal species. The greatest potential for impacts from the construction of the BITS will result from increased TSS along the proposed cable routes during jet-plow activities and during the backfilling of the temporary cofferdams if required.

The results of the sediment transport modeling analysis for cable installation via jet plow in the offshore portion of the BITS showed that TSS concentrations along BITS Alternative 1 would be varied based on both current velocities and sediment type. Regardless of this variability, concentrations along the offshore portion of the route did not exceed 200 mg/L to 500 mg/L beyond 1,100 ft and 1,000 ft (350 m and 300 m), respectively from the trench, and typically dissipated to less than 10 mg/L within 12 hours. Assessment of the BITS Alternative 1 cofferdam proposed under the long-distance HDD alternative off of Narragansett Town Beach, showed that concentrations of 200 mg/L from potential backfilling activities were not observed beyond 150 ft (45 m) from the site and persisted for only about 1 hour. Concentrations of 500 mg/L were confined to 80 ft (25 m) from the cofferdam and were short-lived, only lasting for approximately 10 minutes. Sediment transport modeling of the BITS short-distance HDD landing alternative in the nearshore/tidal zone of Crescent Beach is as described for the BIWF. Modeling for the short-distance HDD landing option on Narragansett Town Beach indicates that excess water column concentrations and sediment accumulation in the nearshore/tidal zone would be similar to cable installation via jet plow for the offshore BITS cable route and are limited to areas close to the jet plow track in the nearshore/tidal zone. Concentrations of suspended sediment of 100 mg/L would cover an area of 10 acres (4.0 hectares) for approximately 10 minutes, cumulatively during jet plowing in the nearshore/tidal zone. Modeled sediment thicknesses exceeded 10 mm (0.4 in) directly over to the trench and accumulations did not exceed 1 mm (0.04 in) beyond 55 m (180 ft) from the trench. When these results are compared to naturally occurring conditions within the nearshore/tidal zone of Narragansett Town Beach, the data shows that the effects of cable installation via jet plow are similar in magnitude and between the mean and storm wave conditions known to occur at this beach. The complete Sediment Transport Analysis has been included as Appendix H.

Despite the relatively higher concentrations of TSS and greater areas of suspended sediment associated with BITS jet-plowing and cofferdam activities as compared to the BIWF, none of the modeled levels or durations would result in lethal or sub-lethal effects to fish (Wilber and Clarke 2001). At most, demersal fish in the immediate area of impact may experience some temporary physiological stress; however, it is more likely that both jet-plowing and cofferdam activities will elicit a temporary avoidance response (Newcombe and Jensen 1996). Additionally, jet-plowing operations associated with the short-distance HDD landing alternative will provide a very small contribution to the natural sediment concentration conditions in nearshore areas exposed to wave action. For these reasons, it is expected that installation of the BITS cable will result in negligible impacts on demersal fish.

It is anticipated that the BITS will be kept in operation in perpetuity. However, should the BITS Cable reach the end of its useful life, the cable will be abandoned in-place resulting in no impact on demersal finfish from decommissioning.

#### *Noise*

Impact on demersal finfish species from noise generated during Project construction would be associated with the use of DP vessel thrusters during cable installation and vibratory pile driving of the temporary cofferdams off of Block Island and Narragansett Town Beach (should this landing methodology be selected). Impact from the vibratory pile driving of these BITS facilities and the use of DP vessel thrusters during cable installation will be the same as already described for the BIWF. Any potential impacts from construction noise on finfish species is expected to be of short-duration consisting only of those periods associated with the vibratory pile driving of the temporary cofferdams as required, (approximately 2 days to install and 2 days to remove), and the use of DP vessel thrusters during cable installation (approximately 4 to 6 weeks).

#### *Electromagnetic Fields*

Due to the cable design and proposed target burial depth, no impacts on demersal finfish will result from the operation of the BITS. As described previously for the BIWF, potential EMF emissions from the cable will be well below those likely to be perceived by demersal species (see Appendix M), with no impacts expected on those species.

#### *Accidental Releases and Spills*

Impact on demersal finfish species from accidental spills and releases generated during Project construction and operation will be the same as already described for the BIWF.

#### *Lighting*

Impact on demersal finfish species from lighting during Project construction and operation will be the same as described for the BIWF. There is no marine lighting associated with the operation of the marine portion of the BITS.

### **Pelagic Fish**

Impacts on pelagic species from construction, operation, and decommissioning of the BITS Project and from the disturbance or alteration of habitat, increased noise, lighting, and/or reduced water quality from accidental spills or releases from Project activities will be similar to those described for demersal species. However, the magnitude of potential impacts resulting from benthic disturbance will likely be even lower because pelagic fish do not generally occur on/in the benthic habitat to the same extent as demersal fish. Pelagic and epipelagic species are highly mobile. Therefore, effects to pelagic fish will be minimized by

the fact that the majority of these fish can move rapidly through the water column as well as by their transient nature.

### **Combined Effects**

Deepwater Wind has minimized impacts on finfish by siting the BIWF within the Renewable Energy Zone; siting the Project to avoid direct impacts on important habitats such as eelgrass and hard bottom substrates known to be used by finfish species throughout various life stages; and by selecting construction techniques and equipment such as a jet plow and HDD to minimize disturbance and alteration of substrate to the maximum extent possible during construction activities.

As such, the resulting combined effects of the BIWF and BITS are not expected to be significant. Construction activities themselves will result in a small combined total area of permanent impact of approximately 57.57 acres (23.43 hectares) across the entire Project Area following BITS Alternative 1. Disturbance from construction would also be of short duration lasting a total of approximately 5 months for both the BIWF and BITS. Of the total area disturbed, all areas are expected to return to pre-construction conditions except for approximately 2.07 acres (0.44 hectare) of habitat that would be permanently converted to hard substrate by the WTGs and the additional protective armoring along the cable routes and at the two proposed cable crossings. However, following construction these areas of new hard bottom and structure will be suitable for colonization by sessile benthic species and will likely attract demersal finfish to the Project Area.

Impacts from construction noise associated with the combined BIWF and BITS will only occur during the installation of the WTG foundations and cofferdam and during the use of DP thrusters. Pile-driving and vibratory pile driving of WTG foundations and cofferdams, respectively, will occur in succession and not simultaneously; therefore, there will be no combined effects of underwater noise from BITS and BIWF construction activities on finfish species. Similarly, the installation of cables using the DP vessel will not occur simultaneously with pile-driving, so impacts from increased underwater noise will not result in combined effects on demersal or pelagic fish.

During operation of the BIWF and BITS, combined impacts on finfish resources are not likely. Decommissioning activities associated with the BIWF and BITS, similar to construction activities, will result in temporary disturbances to finfish and are expected to be similar to those described for construction with no long-term combined effects, as the BITS Cable will be abandoned in place.

When considered together, the combined impact associated with the construction, operation, and decommissioning of the BIWF and BITS on finfish species is minor and not significant.

### **4.5.3 Essential Fish Habitat**

The fisheries of the United States are managed within a framework of overlapping federal, state, interstate, and tribal authorities. Individual states typically have jurisdiction over fisheries in marine waters within 3 nm (5.6 km) of their coasts. Federal jurisdiction includes fisheries in marine waters inside the U.S. Exclusive Economic Zone (EEZ), which encompasses the area from 3 nm (5.6 km) out to 200 nm (370.4 km) offshore of any U.S. coastline (NOAA 1996).

Like much of the Northeast region in recent years, many commercial fisheries in Block Island and Rhode Island Sound and adjacent Atlantic Ocean waters have experienced severe declines in fish populations. In 1996, the MSFCMA was reauthorized and amended by the Sustainable Fisheries Act (SFA) (Public Law 104-267). The reauthorized MSFCMA mandated numerous changes to the existing legislation designed to

prevent overfishing, rebuild depleted fish stocks, minimize bycatch, enhance research, improve monitoring, and protect fish habitat. One of the most significant mandates in the MSFCMA that came out of the reauthorization was the EFH provision, which provides the means to conserve fish habitat. Under these provisions, federal agencies that fund, permit, or undertake activities that may adversely affect EFH are required to consult with NOAA Fisheries regarding the potential effects of their actions on EFH.

The NOAA Fisheries and regional Fishery Management Councils develop EFH descriptions for federally managed fish species and include them in their respective fishery management plans. The fishery management plans identify and describe EFH, describe the EFH impacts (fishing and nonfishing), and suggest measures to conserve and enhance EFH.

Congress defines EFH (P.L. 104-297) as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” The NOAA Fisheries further clarified the terms associated with EFH (50 CFR 600.05 through 600.930) by the following definitions:

- **Waters** – Aquatic areas and their associated physical, chemical, and biological properties that are used by fish and, where appropriate, may include aquatic areas historically used by fish;
- **Substrate** – Sediments, hard bottoms, structures underlying the waters, and associated biological communities;
- **Necessary** – The habitat required to support a sustainable fishery and the managed species’ contribution to a healthy ecosystem; and
- **Spawning, breeding, feeding, or growth to maturity** – Stages representing a species’ full life cycle.

#### 4.5.3.1 Affected Environment

The habitats that have been designated as either EFH or habitat areas of particular concern are the affected environment for the purpose of this assessment, as are the fish and invertebrates for which these habitats were designated. The regional Fishery Management Councils and NOAA Fisheries hold the authority to designate and manage EFH under individual fishery management plans.

The NEFMC and the MAFMC each publish EFH data by ocean blocks consisting of 10-minute by 10-minute quadrants of latitude and longitude, based on the annual NOAA Fisheries data collected within those same squares. The proposed Project crosses five 10-minute by 10-minute quadrants. For ease of discussion and evaluation, each quadrant has been assigned a reference number (1 to 5). The location and boundaries of these five EFH quadrants are depicted in Figure 4.5-4 and described in Table 4.5-3.

**Table 4.5-3 Location of EFH Quadrants and the Components of the Project that are Proposed for Each Quadrant**

Reference Number	Project Component	Latitude and Longitude Coordinates for the Boundaries			
		North	East	South	West
1	Working Area, WTGs, Inter-Array Cable, Export Cable	41°10.0'N	71°30.0'W	41°00.0'N	71°40.0'W
2	Working Area	41°10.0'N	71°20.0'W	41°00.0'N	71°30.0'W
3	Export Cable, BITS	41°20.0'N	71°30.0'W	41°10.0'N	71°40.0'W
4	BITS	41°20.0'N	71°20.0'W	41°10.0'N	71°30.0'W
5	BITS	41°30.0'N	71°20.0'W	41°20.0'N	71°30.0'W



**Figure 4.5-4 Location of Representative 10 x 10 Minute Squares with Designated EFH within and adjacent to the Project Area**

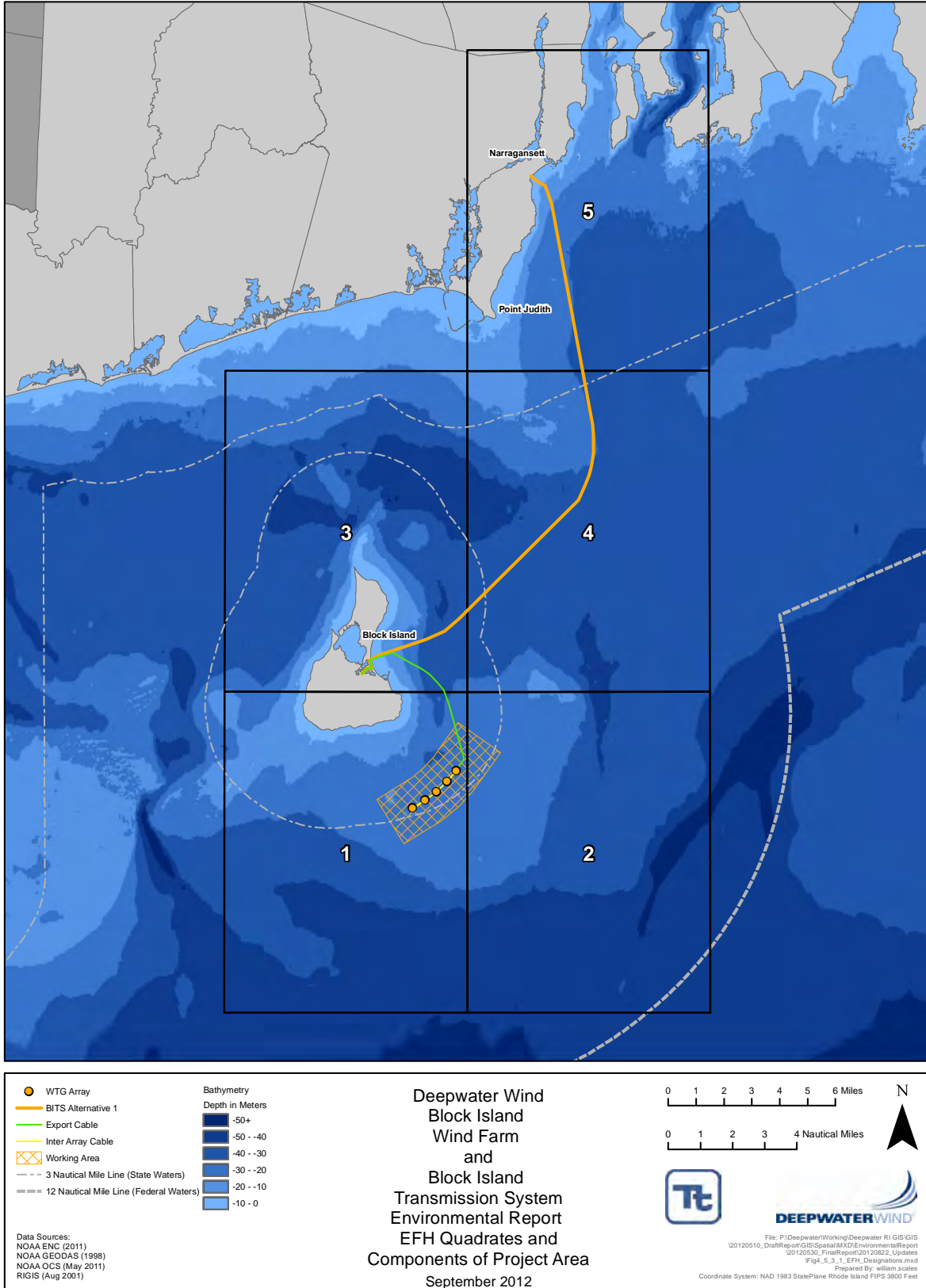


Table 4.5-4 provides a summary of habitat types that occur in the Project Area based on site-specific surveys as detailed in Sections 4.5.1 and 4.5.2 and Appendices D, E, F, H, L, and M. MPs associated with each habitat type are depicted in Figures 4.5-5 and 4.5-6.

**Table 4.5-4 BIWF and BITS Substrate-Types by Milepost**

Route Location	Water Depth Range (ft)	Predominant Substrate
<b>BIWF</b>		
<i>Export Cable</i>		
MP 0-1.1	0-56	Sandy with some cobble or boulders
MP 1.1-2.0	56-109	Sandy with some cobble or boulders
MP 2.0-2.8	109-121	Sand
MP 2.8-6.2	87-115	Sand
<i>Inter-Array Cable</i>		
MP 6.2-8.3	75-93	Sand
<i>Work Area</i>		
NA	56-100	Sandy with some cobble or boulders
<b>BITS</b>		
<i>Alternative 1</i>		
MP 0-2.2	0-118	Sandy with some cobble or boulders
MP 2.2-7.6	118-129	Silty Sand
MP 7.6-12.6	85-128	Sandy Area
MP 12.6-20.7	59-103	Silty Sand
MP 20.7-21.7	0-59	Silty Sand to Sand Area towards mainland

Within the five 10-minute by 10-minute quadrants that encompass the Project Area (see Figure 4.5-4), 37 species of finfish and invertebrates with designated EFH were identified during various lifestages (see Table 4.5-5).

**Table 4.5-5 Essential Fish Habitat Designations for Federally Managed Species in Rhode Island Sound and Adjacent Atlantic Ocean**

Species	EFH Quadrant a/,b/			
	Eggs	Larvae	Juveniles	Adults
Atlantic cod ( <i>Gadus morhua</i> )	1,2,4	1,2,4	1,2	1,2,3,4,5
haddock ( <i>Melanogrammus aeglefinus</i> )		4,5		
whiting ( <i>Merluccius bilinearis</i> )	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5	4
red hake ( <i>Urophycis chuss</i> )	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5	5
witch flounder ( <i>Glyptocephalus cynoglossus</i> )	1,4	1		
winter flounder ( <i>Pseudopleuronectes americanus</i> )	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5
yellowtail flounder ( <i>Limanda ferruginea</i> )	1,2,4	1,2,4	1,2,4	1,2
windowpane flounder ( <i>Scophthalmus aquosus</i> )	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5
American plaice ( <i>Hippoglossoides platessoides</i> )		5	5	5
ocean pout ( <i>Macrozoarces americanus</i> )	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5
Atlantic sea herring ( <i>Clupea harengus</i> )		5	1,2,3,4,5	1,2,3,4,5
monkfish ( <i>Lophius americanus</i> )	1,2,3,4,5	1,2,3,4,5	1,2	1,2,3
bluefish ( <i>Pomatomus saltatrix</i> )			1,4,5	1,2,4,5
long-finned squid ( <i>Loligo pealeii</i> )	N/A <sup>c/,d/</sup> 1,2,3,4,5	N/A <sup>c/,d/</sup> 1,2,3,4,5	1,2,5	1,3,5
short-finned squid ( <i>Illex illecebrosus</i> )	N/A <sup>c/,d/</sup> 1,2,3,4,5	N/A <sup>c/,d/</sup> 1,2,3,4,5		
Atlantic butterflyfish ( <i>Pepilus triacanthus</i> )		1	5	

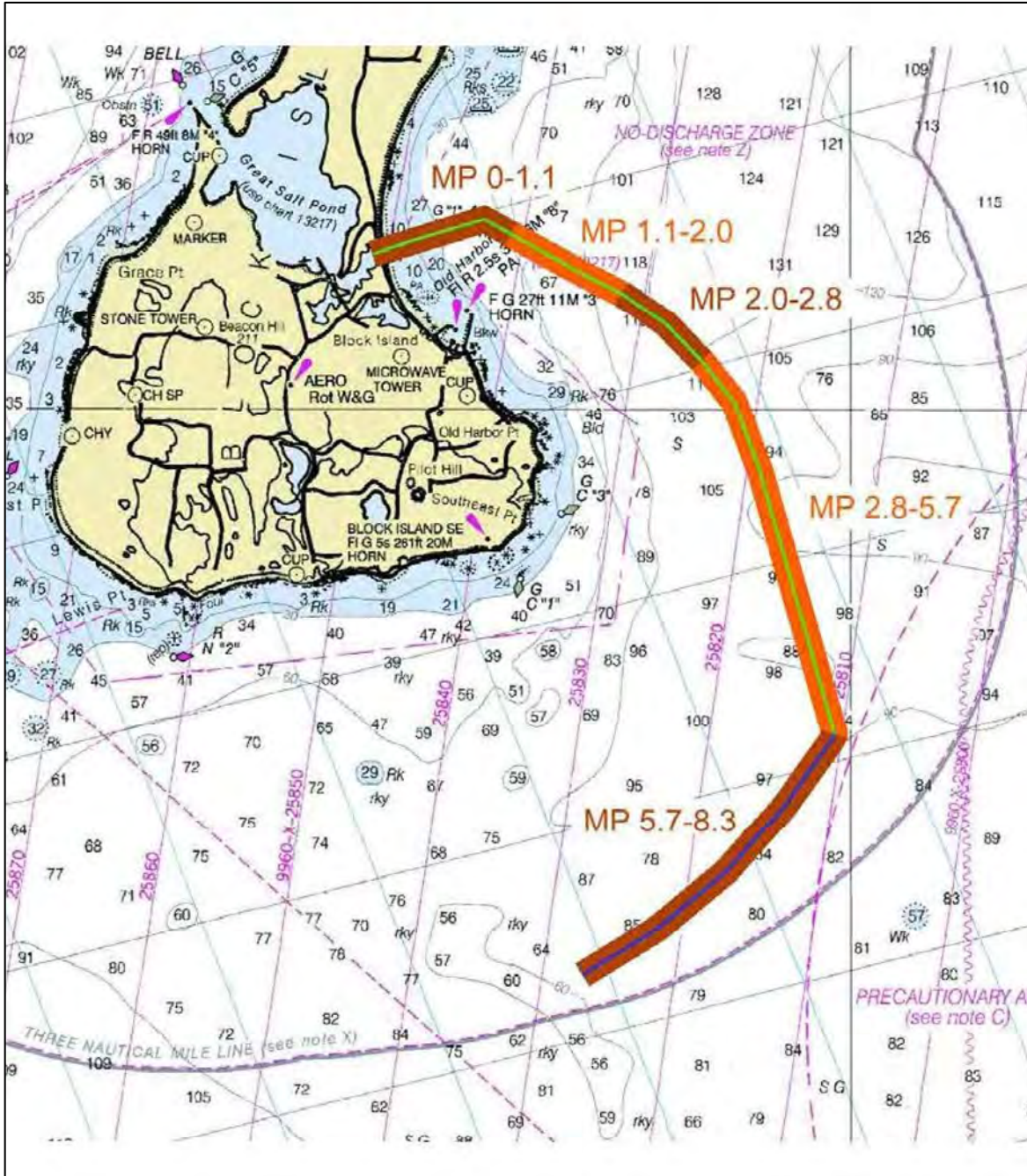
**Table 4.5-5 Essential Fish Habitat Designations for Federally Managed Species in Rhode Island Sound and Adjacent Atlantic Ocean**

Species	EFH Quadrant a/,b/			
	Eggs	Larvae	Juveniles	Adults
Atlantic mackerel ( <i>Scomber scombrus</i> )	4,5	5	5	5
summer flounder ( <i>Paralichthys dentatus</i> )	4	1,2,4,5	2,5	1,2,3,4,5
scup ( <i>Stenotomus chrysops</i> )	N/A <sup>c/,f/</sup> 1,2,3,4,5	N/A <sup>c/,f/</sup> 1,2,3,4,5	1,2,3,4,5	1,2,3,4,5
black sea bass ( <i>Centropristis striata</i> )	N/A <sup>c/,f/</sup> 1,2,3,4,5		1,2,3,4,5	3,5
surf clam ( <i>Spisula solidissima</i> )	N/A <sup>c/,d/</sup> 1,2,3,4,5	N/A <sup>c/,d/</sup> 1,2,3,4,5	5	5
ocean quahog ( <i>Artica islandica</i> )	N/A <sup>c/,d/</sup> 1,2,3,4,5	N/A <sup>c/,d/</sup> 1,2,3,4,5	4	4
spiny dogfish ( <i>Squalus acanthias</i> )	N/A <sup>c/,e/</sup>	N/A <sup>c/,e/</sup>	1,2,4,5	1,2,4,5
king mackerel ( <i>Scomberomorus cavalla</i> )	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5
Spanish mackerel ( <i>Scomberomorus maculatus</i> )	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5
cobia ( <i>Rachycentron canadum</i> )	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5
sand tiger shark ( <i>Carcharias taurus</i> )		1,2,3,4,5		
common thresher shark ( <i>Alopias vulpinus</i> )		1,2,3,4	1,2,3,4	1,2,3,4
blue shark ( <i>Prionace glauca</i> )		1,2,3,4,5	1,2,3,4	1,2,3,4
white shark ( <i>Carcharodon carcharias</i> )			1	
dusky shark ( <i>Carcharhinus obscurus</i> )			1,2,3,5	
shortfin mako shark ( <i>Isurus oxyrinchus</i> )		1,2	1,2,3,4,5	
sandbar shark ( <i>Carcharhinus plumbeus</i> )			1,2,3,4,5	1,2,3,5
bluefin tuna ( <i>Thunnus thynnus</i> )			1,2	1,2,3,4,5
Little skate ( <i>Leucoraja erinacea</i> )			1,2,3,4,5	1,2,3
Winter skate ( <i>Leucoraja ocellata</i> )			1,2,3,4,5	1

<sup>a/</sup> The proposed facilities cross five of EFH 10-minute by 10-minute squares of latitude and longitude along the coast. The numbers presented in this table for each species and lifestage represent the project-assigned square number where the species and specific lifestage have designated EFH.  
<sup>b/</sup> Empty space denotes that EFH has not been designated within the square for the given species and lifestage.  
<sup>c/</sup> N/A indicates some of the species either have no data available on the designated lifestages, or those lifestages are not present in the species' reproductive cycle.  
<sup>d/</sup> Pre-recruits and recruits.  
<sup>e/</sup> Juveniles born live.  
<sup>f/</sup> Insufficient data for the lifestages listed.  
Source: NOAA 2010b

The following sections provide a species-specific account of the habitat requirements for species and their lifestages with designated EFH potentially occurring within or in the vicinity of the BIWF and BITS Project Area. The primary sources of information for the habitat requirements of the EFH species were the EFH source documents developed by the Fishery Management Councils (NEFMC and MAFMC) and issued by NOAA Fisheries. The EFH documents provide descriptions of the habitat for locations where fish have been found in some degree of abundance. The mere occurrence of fish in a particular habitat is not an indication that it is essential or even in its preferred habitat. It is only an indication that the fish was found in a particular habitat when sampling occurred. Regardless of these data limitations, the EFH source documents provide the best available descriptions of the habitat requirements for selected marine species.

Figure 4.5-5 BIWF Export and Inter-Array Survey Area MPs



Deepwater Wind  
Block Island  
Wind Farm  
and  
Block Island  
Transmission System  
Environmental Report  
BIWF Export and Inter Array Survey Area MPs  
September 2012

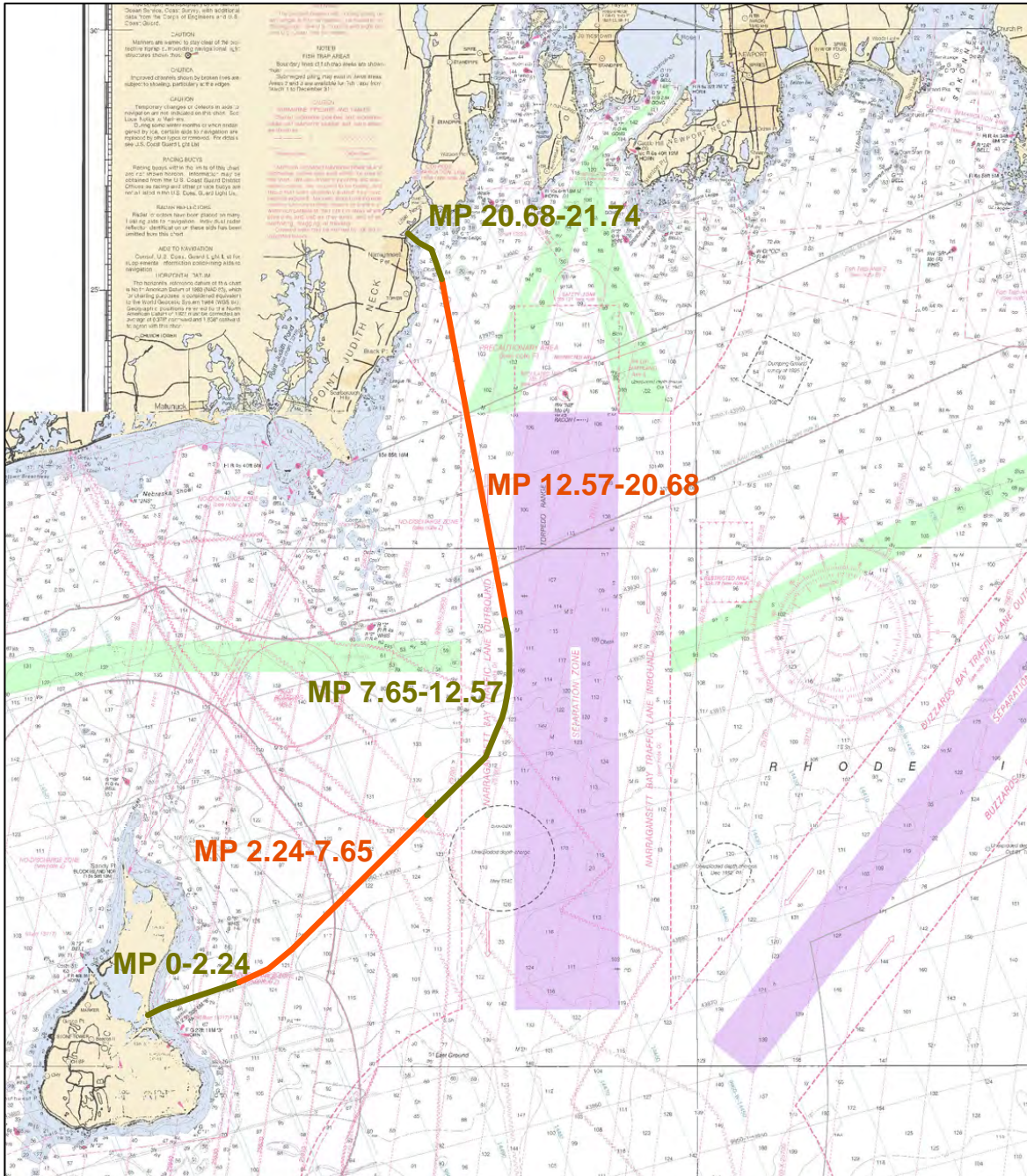
Data Sources:  
OSI

0 0.3 0.6 0.9 1.2 Miles

0 0.3 0.6 0.9 Nautical Miles

File: P:\Deepwater\Working\Deepwater RI GIS\GIS  
 20120510\_DraftReport\GIS\Spatial\MXD\EnvironmentalReport  
 20120530\_FinalReport\20120822\_Updates  
 Fig4\_5-5\_BIWF\_SurveyArea\_MPs.mxd  
 Prepared By: William Scates  
 Coordinate System: NAD 1983 StatePlane Rhode Island FIPS 3800 Feet

Figure 4.5-6 BITS Survey Area MPs



Deepwater Wind  
 Block Island  
 Wind Farm  
 and  
 Block Island  
 Transmission System  
 Environmental Report  
 BITS Survey Area MPs  
 September 2012

Data Sources:  
OSI

0 1 2 3 4 Miles

0 1 2 3 Nautical Miles

File: F:\Deepwater\Working\Deepwater RI GIS\GIS  
 \20120510\_DraftReport\GIS\Spatial\MXD\Environmentals\Report  
 \20120530\_FinalReport\20120622\_Updates  
 \Fig\_4\_5\_3\_BITS\_SurveyArea\_MPs.mxd  
 Prepared By: William Scales  
 Coordinate System: NAD 1983 StatePlane Rhode Island FIPS 3800 Feet

Deepwater Wind has received agency comments in response to BOEM's Notice of Proposed BITS ROW Grant Area and Request, on June 21, 2012 (NOAA Fisheries) and June 22, 2012 (NEFMC), that identified a number of additional species that may have EFH designated within the BIWF and BITS Project area. These species include pollock (*Pollachius virens*), offshore hake (*Merluccius albidus*), white hake (*Urophycis tenuis*), redfish (*Sebastes fasciatus*), Atlantic halibut (*Hippoglossus hippoglossus*), Atlantic sea scallop (*Placopecten magellanicus*), and golden tilefish (*Lopholatilus chamaeleonticeps*). Site-specific investigation within the Project Area has indicated that EFH for these species has not been identified within the five 10-minute by 10-minute quadrants that encompass the BIWF and BITS (see Figure 4.5-4 and Table 4.5-5). Review of the EFH associated with these species indicates that designated EFH exist well outside the Project Area in the deeper waters of the continental shelf, slope, Georges Bank and/or the Gulf of Maine.

### Atlantic Cod

Atlantic cod range from Greenland to North Carolina in the northwest Atlantic. Cod are assessed by NOAA Fisheries as two separate stocks: one in the Gulf of Maine and the other found on Georges Bank and southward. Cod are targeted in coastal Rhode Island waters by both commercial and recreational fishermen (see Sections 4.5.2 and 4.9). This species prefers rocky, pebbly, or sandy bottoms, and temperatures between 32 and 50°F (0 and 10°C) (Collette and Klein-MacPhee 2002). In Rhode Island waters, cod can be found in shallow coastal waters from October through mid-May, and year-round on Cox Ledge. Cod typically move south and into deeper water in the winter and spring.

*Egg:* EFH for cod eggs is surface waters around the perimeter of the Gulf of Maine, Georges Bank, and the eastern portion of the continental shelf off southern New England. Cod eggs are typically found where sea surface temperatures are below 12°C, water depths are less than 361 ft (110 m), and salinity ranges from 32 ppt to 33 ppt. Cod eggs are most often observed beginning in the fall, with peaks in the winter and spring. EFH for cod eggs has been identified in quadrants 1, 2, and 4, and will likely be found in waters associated with the BIWF Project Area and portions of the BITS.

*Larva:* Cod larvae are found in pelagic waters of the Gulf of Maine, Georges Bank, and the eastern portion of the continental shelf off southern New England. Cod larvae are typically found where sea surface temperatures are below 10°C, water depths are 98 ft to 239 ft (30 m to 70 m), and salinity ranges from 32 ppt to 33 ppt. Cod larvae are most often observed in the spring. EFH for cod larvae has been identified in quadrants 1, 2, and 4, and will likely be found in waters associated with the BIWF and portions of the BITS Project Area.

*Juvenile:* EFH for juvenile cod is bottom habitats with a substrate of cobble or gravel in the Gulf of Maine, Georges Bank, and the eastern portion of the continental shelf off southern New England. Cod juveniles are typically found where water temperatures are below 20°C, depths are 28 ft to 246 ft (25 m to 75 m), and salinity ranges from 30 ppt to 35 ppt. EFH for juvenile cod has been identified in quadrants 1 and 2 and have the potential to occur in the southwest portion of the BIWF work area and the Export Cable (MPs 1.1 to 2.0) where site-specific habitat surveys identified areas of cobble and patches of boulders.

*Adult:* EFH for adult cod is bottom habitats with a substrate of rocks, pebbles, or gravel in the Gulf of Maine, Georges Bank, southern New England, and the middle Atlantic south to Delaware Bay. Cod adults are typically found where water temperatures are below 10°C, depths are 33 ft to 492 ft (10 m to 150 m), and there is a wide range of oceanic salinities. EFH for adult cod has been identified in all five quadrants and have the potential to occur in the southwest portion of the BIWF work area, the Export Cable

(MPs 0.0 to 2.0), and BITS (MPs 0.0 to 2.2) where site-specific habitat surveys identified areas of cobble and patches of boulders.

*Spawning Adult:* EFH for spawning adult cod is bottom habitats with a substrate of smooth sand, rocks, pebbles, or gravel in the Gulf of Maine, Georges Bank, southern New England, and the middle Atlantic south to Delaware Bay. Spawning adult cod are typically found where water temperatures are below 10°C, depths are 33 ft to 492 ft (10 m to 150 m), and there is a wide range of oceanic salinities. Cod are most often observed spawning during fall, winter, and early spring. EFH for spawning adult cod have been identified in all five quadrants. Based on the project-specific habitat surveys, spawning adults have the potential to occur throughout the BIWF and BITS Project Area.

### **Haddock**

Haddock occur in the northwest Atlantic from Cape Charles, Virginia, to Labrador, Canada. Haddock eggs are spawned at the seabed but quickly become buoyant (Collette and Klein-MacPhee 2002). Spawning is likely from January to June (Cargnelli et al. 1999a). Haddock prefer gravel, pebbles, and sand, and avoid ledges, rocks, kelp, and soft mud (Collette and Klein-MacPhee 2002). Haddock larvae have been reported in and around the mouth of Narragansett Bay but are not considered an abundant finfish within coastal Rhode Island waters. Larvae become juveniles in 30 to 42 days (Laurence 1978). These juveniles remain in the upper part of the water column for three to five months feeding on pelagic prey (zooplankton), after which they descend toward the bottom and adopt a demersal lifestyle (Collette and Klein-MacPhee 2002). Benthic juveniles and adults feed primarily on crustaceans, polychaetes, mollusks, echinoderms, and some fish (Collette and Klein-MacPhee 2002).

*Egg:* No designated EFH for this lifestage occurs within the Project Area.

*Larva:* EFH for haddock is surface waters over Georges Bank southwest to the middle Atlantic south to Delaware Bay. Haddock larvae typically occur where sea surface temperatures are below 14°C, water depths are 98 ft to 295 ft (30 m to 90 m), and salinity ranges from 34 ppt to 36 ppt. Haddock larvae are most often observed in these areas from January through July with peaks in April and May. EFH for haddock larvae has been identified in quadrants 4 and 5 and may be found in waters associated with the BITS Project Area.

*Juvenile:* No designated EFH for this lifestage occurs within the Project Area.

*Adult:* No designated EFH for this lifestage occurs within the Project Area.

*Spawning Adult:* No designated EFH for this lifestage occurs within the Project Area.

### **Whiting**

There are two stocks of whiting (silver hake); one in the Gulf of Maine and northern Georges Bank, and the other on southern Georges Bank and the Mid-Atlantic Bight. Whiting are found along the continental shelf of North America, from Canada to the Bahamas, and are most abundant between Newfoundland and South Carolina (Collette and Klein-MacPhee 2002). Whiting are targeted in coastal Rhode Island waters by commercial fishermen (see Sections 4.5.2 and 4.9). This species is usually found on sandy or pebbly ground, or mud (Collette and Klein-MacPhee 2002). Spawning is most often observed from May through November with peaks in June and July. In Rhode Island waters, silver hake are common during spring and summer after migrating in from the continental slope south of Georges Bank.

*Eggs:* EFH for whiting eggs is the surface waters throughout their range. Eggs are typically mixed with the eggs of similar species such as red hake. Generally, the following conditions exist where hake eggs are found: sea surface temperatures below 10°C along the inner continental shelf with salinity less than 25 percent. In Rhode Island waters, whiting eggs are most often observed during July through October in water depths ranging from 160 ft to 500 ft (50 m to 150 m). EFH for whiting eggs has been identified in all five quadrants and will likely be found in waters associated with the BIWF and BITS Project Area.

*Larva:* EFH for larval whiting is surface waters off the coast of Rhode Island from June through November. The larvae are typically observed when sea surface temperatures are below 19°C and salinity is greater than 0.5 percent. EFH for whiting larvae has been identified in all five quadrants and will likely be found in waters associated with the BIWF and BITS Project Area.

*Juvenile:* EFH for juvenile whiting is designated as the bottom habitats with a substrate of shell fragments, including areas with an abundance of live scallops throughout their range, but also includes all substrates. Juvenile whiting migrate to deeper waters of the continental shelf as water temperatures decline in the autumn and return to shallow waters in spring and summer, preferring a wide range of water temperatures. EFH for juveniles has been identified in all five quadrants. Since juvenile whiting can be associated with all bottom types, they will likely be found in waters associated with the BIWF and BITS Project Area.

*Adult:* Habitat usage for adult whiting is varied and can be found as deep as 2,400 ft (122 m), as well as just below the tide line across any substrate. When they are found near the bottom, they are usually on sandy or pebbly ground, or mud (Collette and Klein-MacPhee 2002). EFH for adults has been identified in quadrant 4. Given the habitat type known to occur along the BITS route in quadrant 4, EFH for adult whiting is likely.

*Spawning Adults:* Adult whiting reach sexual maturity at two to three years of age. The area between Cape Cod and Montauk Point, which includes the Rhode Island waters, is a primary spawning ground for silver hake (NEFSC 2004). Spawning adults prefer substrates of mud and transitional sand, and silt-sand. In Rhode Island waters, spawning peaks when water temperatures are between 7 and 13°C. EFH for spawning adults has been identified in quadrant 4. Habitat conditions associated with BITS Alternative 1 suggest that EFH for spawning adults may occur along the majority of the BITS route in quadrant 4.

## **Red Hake**

Red hake are managed as two U.S. stocks: a northern stock from the Gulf of Maine to northern Georges Bank, and a southern stock from southern Georges Bank into the Mid-Atlantic Bight. Red hake are found in the coastal waters off southern Newfoundland to North Carolina, with their center of abundance concentrated along Georges Bank, in the Gulf of Maine off Cape Cod, and in the northern Mid-Atlantic Bight off Long Island, New York. All lifestages of the red hake are also found in estuaries from southern Maine to Chesapeake Bay (Steimle et al. 1999a). Red hake make seasonal migrations to follow preferred temperature ranges. During warmer months, they are most common in depths less than 330 ft (100 m) and depths greater than this during colder months. They commonly occur in coastal bays and estuaries less than 32 ft (less than 10 m) deep (Tyler 1971; Jury et al. 1994; Stone et al. 1994). Historically, red hake were targeted in coastal Rhode Island waters by commercial fishermen; however, the southern stock for red hake is considered overfished (Sosebee 1998). This species is usually found on sandy or pebbly ground, or mud, preferring soft sediments over harder substrate (Collette and Klein-MacPhee 2002). Spawning is most often observed during the months from April through November.



*Eggs:* EFH for red hake eggs is surface waters throughout their range. Eggs are typically mixed with the eggs of similar species such as whiting. Generally, the following conditions exist where hake eggs are found: sea surface temperatures below 10°C along the inner continental shelf with salinity less than 25 percent. In Rhode Island waters, red hake eggs are most often observed during May through November, with peaks in June and July. EFH for red hake eggs have been identified in all five quadrants and will likely be found in waters associated with the BIWF and BITS Project Area.

*Larva:* EFH for red hake larvae is designated as surface waters throughout their range, including waters off the coast of Rhode Island. Larvae are present from May through December with peaks in September and October. The larvae are typically observed when sea surface temperatures are below 19°C and salinity is greater than 0.5 percent. EFH for whiting larvae has been identified in all five quadrants and will likely be found in waters associated with the BIWF and BITS Project Area.

*Juvenile:* EFH for juvenile red hake is designated as the bottom habitats with a substrate of shell fragments, including areas with an abundance of live scallops throughout their range, but also includes all substrates. Juvenile red hake migrate to deeper waters of the continental shelf as water temperatures decline in the autumn and return to shallow waters in spring and summer, preferring a wide range of water temperatures. EFH for juveniles has been identified in all five quadrants. Since juvenile red hake can be associated with all bottom types, they will likely be throughout the BIWF and BITS Project Area.

*Adult:* EFH for adult red hake is designated as bottom habitats in depressions with a substrate of sand and mud in the Gulf of Maine, on Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras, North Carolina. Habitat usage for adult whiting is varied and can be found as deep as 2,400 ft (122 m), as well as just below the tide line across any substrate. Adult red hake are common on soft sediments and much less common on gravel or hard bottoms. They are not confined to the bottom and can be found in the water column (Collette and Klein-MacPhee 2002). EFH for adults have been identified in quadrant 5. Habitat conditions associated with BITS alternative routes in quadrant 5 suggest that EFH for adults are likely to occur along the majority of routes.

*Spawning Adults:* EFH for spawning adult red hake is the same as that designated for adults. Spawning adults and eggs are common in the marine parts of most coastal bays between Narragansett Bay, Rhode Island, and Massachusetts Bay (Jury et al. 1994; Stone et al. 1994). Based on condition of the gonads, red hake spawning occurs at temperatures between 5 and 10°C. Spawning adults prefer soft substrates of mud and transitional sand, and silt-sand. EFH for spawning adults has been identified in quadrant 5. Habitat conditions associated with BITS alternative routes in quadrant 5 suggest that EFH for spawning adults are likely to occur along the majority of routes.

## **Witch Flounder**

Witch flounder are distributed from Cape Hatteras to Labrador, Canada. The areas of highest abundance have been reported to be the Gulf of St. Lawrence, the southwestern edge of the Grand Bank, and deep waters directly north of the Grand Bank. In U.S. waters, witch flounder are most common in the Gulf of Maine off Cape Ann, Massachusetts. Witch flounder is typically a deepwater fish that inhabits depths down to approximately 4,921 ft (1,500 m). The egg and larval stages are pelagic, generally over deep water (Collette and Klein-MacPhee 2002). Witch flounder spawning occurs at or near the bottom; however, the eggs become buoyant. Spawning occurs in the Mid-Atlantic Bight between April and August (Cargnelli et al. 1999b). Witch flounder tend to prefer muddy sand, clay, and mud (Collette and Klein-MacPhee 2002). The pelagic egg and larval stages are spent in the water column over deep water for this species. The juvenile stage occurs in very deep water when fish settle to the bottom and remain

separated from the adult population, occupying deeper waters until they are sexually mature. Witch flounder eggs and larvae have been reported in the waters surrounding Block Island, but they are not considered an abundant finfish within the Project Area.

*Egg:* EFH for witch flounder eggs is the surface waters of the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Witch flounder eggs typically occur over deep water with high salinities and where sea surface temperatures are below 13°C. Witch flounder eggs are most often observed during the months from March through October. EFH for witch flounder eggs has been identified in quadrants 1 and 4, and may be found in waters associated with the BIWF and BITS Project Area.

*Larva:* EFH for larval witch flounder larvae is designated as surface waters to 820 ft (250 m) in the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Witch flounder eggs typically occur over deep water with high salinities and where sea surface temperatures are below 55.4°F (13°C). Witch flounder larvae are most often observed from March through November, with peaks in May through July. EFH for witch flounder larvae has been identified in quadrant 1 and may be found in waters associated with the BIWF Project Area.

*Juvenile:* No designated EFH for this lifestage occurs within the Project Area.

*Adult:* No designated EFH for this lifestage occurs within the Project Area.

*Spawning Adult:* No designated EFH for this lifestage occurs within the Project Area.

## **Winter Flounder**

Winter flounder (blackback flounder or lemon sole) are a right-handed flat fish found in shallow, estuarine habitats along the northwest Atlantic coast. Individual winter flounder are rarely found deeper than 180 ft (55 m), although have been found as deep as 420 ft (128 m) on Georges Bank (Ross 1991). Winter flounder migrate into nearshore waters in the winter months. They prefer muddy sand habitat inshore, particularly eelgrass habitat. Many winter flounder move into estuarine habitats in the fall prior to spawning, typically spawning on shallow, sandy bottom, and move either offshore or to deeper, cooler portions of estuaries during winter and early spring producing both demersal eggs and adhesive eggs (ASMFC 2008). South of Cape Cod, spawning mainly occurs within estuaries and areas where eggs would be minimally displaced by tidal currents where larvae can be retained in suitable nursery areas (Crawford and Carey 1985; Monteleone 1992). However, recent studies evaluating seasonal patterns and reproductive body conditions of adult winter flounder suggests that spawning may be occurring in deeper coastal and offshore areas (Wuenschel et al. 2009; Decelles and Cadrin 2010; Fairchild 2011).

The eggs hatch about 15 to 18 days after being released (Ross 1991). Larvae are found in the upper reaches of estuaries in early spring, and will move to the lower estuary as they grow (ASMFC 2008). Important nursery habitats for larvae and juveniles include saltwater coves, coastal salt ponds, embayments, and estuaries, although some larvae and juveniles have been found in the open ocean (ASMFC 2008). Winter flounder are known to return to the same portion of the bay where they were hatched (Collette and Klein-MacPhee 2002). They are found in both Narragansett Bay and the Sounds off Rhode Island and are considered an important commercial fish species.

*Egg:* EFH for winter flounder eggs is designated as bottom habitats with a substrate of sand, muddy sand, mud, and gravel on Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to the Delaware Bay. Winter flounder eggs in southern New England typically

occur where water temperatures are less than 50°F (10°C), salinities between 10 and 30 ppt, and water depths less than 16 ft (5 m). Eggs have been reported in deeper harbor areas (approximately 50 ft [15 m]) within Upper New York Bay; however the highest percentages of eggs were found in shallower, non-channel areas (Mulvey et al. 2010). Winter flounder eggs are typically observed from February to June. EFH for winter flounder eggs has been identified in all five quadrants and are most likely to be found in waters associated with shallower nearshore portions of the BIWF Export Cable near Block Island (MPs 0.0 to 1.1) and the BITS Alternative 1 route off of Block Island (MPs 0.0 to 2.2) and Narragansett Town Beach (MPs 20.7 to 21.7)). While recent studies suggest that the potential exists for winter flounder eggs to occur in deeper waters associated with the BIWF and BITS Project Area, the presence of sand waves throughout much of the Project Area is a strong indicator that bottom currents move surface sediments routinely making the presence of eggs unlikely in the deeper water portions of the Project.

*Larva:* EFH for winter flounder larvae is designated as pelagic and bottom waters of Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to the Delaware Bay. Winter flounder larvae typically occur where sea surface temperatures are less than 59°F (15°C), salinities between 4 and 30 ppt, and water depths less than 20 ft (6 m). Winter flounder larvae are typically observed from March to July. EFH for winter flounder larvae has been identified in all five quadrants. Winter flounder larvae tend to swim intermittently and their high specific gravity causes them to sink when inactive (Pearcy 1962). These characteristics favor local retention within estuaries and potentially within the vicinity of the spawning sites. Thus, it is likely winter flounder larvae could be found in the same general habitats where eggs are likely to occur.

*Juvenile:* EFH for young-of-the-year winter is bottom habitats that consist of substrates of mud or fine-grained sand on Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to the Delaware Bay. Winter flounder young-of-the-year typically occur where water temperatures are below 82.4°F (28°C), depths from 0.3 ft to 33 ft (0.1 m to 10 m), and salinities between 5 and 33 ppt. Winter flounder age 1+ juveniles typically occur over bottom habitats with a substrate of mud or fine-grained sand, water temperatures below 77°F (25°C), depths from 3 ft to 164 ft (1 m to 50 m), and salinities between 10 ppt and 30 ppt. EFH for juvenile winter flounder has been identified in all five quadrants. However, site-specific habitat surveys have indicated that the only potentially suitable habitat and water depth for juveniles is associated with the nearshore portion of the BITS Alternative 1 (MPs 20.7 to 21.7) route off of Narragansett Town Beach.

*Adult:* EFH for adults is designated as bottom habitats, including estuaries with a substrate of mud, sand, and gravel on Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to the Delaware Bay. Winter flounder adults typically occur where water temperatures are below 77°F (25°C), depths from 3 ft to 328 ft (1 m to 100 m), and salinities between 15 ppt and 33 ppt. EFH for adult winter flounder has been identified in all five quadrants. Site-specific habitat surveys indicate that suitable habitat for adult winter flounder exists throughout the BIWF and BITS Project Area.

*Spawning Adult:* EFH is designated as bottom habitats, including estuaries with a substrate of sand, muddy sand, mud, and gravel on Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to the Delaware Bay. Recent studies suggest winter flounder spawning may be occurring in deeper coastal and offshore areas both north and south of Cape Cod. Therefore, it is reasonable to assume that there may be a contingent of winter flounder that spawn in Rhode Island Sound outside of the estuaries. Buckley et al. (2008) and Crivello et al. (2004) identified several distinct local spawning populations of winter flounder within Narragansett Bay and eastern Long

Island Sound based on larval genetics. These findings further support the idea that there could be local spawning populations offshore in Rhode Island Sound. Winter flounder adults typically occur where water temperatures are below 15°C, depths less than 10 ft (6 m), and salinities between 5.5 and 36 ppt. Winter flounder are most often observed spawning during the months of February to June. Site-specific habitat surveys indicate that there is potential suitable habitat for spawning winter flounder in the shallower nearshore portions of the BIWF Export Cable near Block Island (MPs 0.0 to 1.1) and the BITS Alternative 1 route off of Block Island (MPs 0.0 to 2.2) and Narragansett Town Beach (MPs 20.7 to 21.7). While recent studies suggest that the potential exists for winter flounder eggs to occur in deeper waters associated with the BIWF and BITS Project Area, the presence of sand waves throughout much of the Project Area is a strong indicator that bottom currents move surface sediments routinely making the presence of eggs unlikely in the deeper water portions of the Project.

### **Yellowtail Flounder**

The yellowtail flounder is distributed from Labrador to the Chesapeake Bay. There are three stocks of yellowtail flounder for management purposes: the Cape Cod/Gulf of Maine, Georges Bank, and Southern New England/Mid-Atlantic stocks (NEFSC 2006). Yellowtail flounder are found south of Block Island all year long, and in shallower waters during the winter. They prefer sand and sand-mud bottoms between 33 and 330 ft (10 and 100 m), and are most abundant at temperatures between 46 and 57°F (8 and 14°C) (NEFSC 1999a). They generally avoid rocky areas or soft mud (Collette and Klein-MacPhee 2002). Spawning occurs in spring and summer, peaking in May. Eggs are deposited on or near the bottom, and then float to the surface once fertilized. The larvae drift for about two months before settling to the bottom (NEFSC 2006). Fish from the southern New England stock of yellowtail flounder typically remain within their fishing grounds, but migrate eastward during spring and summer, and then westward during fall and winter as water temperatures change (NEFSC 1999a). Yellowtail flounder are targeted in coastal Rhode Island waters by both commercial and recreational fishermen; however, the stock is considered overfished, and overfishing is presently occurring (NMFS 2010).

*Egg:* Yellow flounder eggs are found in the surface waters of Georges Bank, Massachusetts Bay, Cape Cod Bay, and the southern New England continental shelf south to Delaware Bay. Yellowtail flounder eggs typically occur where sea surface temperatures are below 15°C, water depths are 98 ft to 295 ft (30 m to 90 m), and salinity ranges from 32.4 ppt to 33.5 ppt. Yellowtail flounder eggs are most often observed during the months from mid-March to July, with peaks in April to June in southern New England. EFH for yellowtail flounder eggs have been identified in quadrants 1, 2, and 4, and may be found in waters associated with the BIWF and BITS Project Area.

*Larva:* EFH for yellowtail flounder larvae is the surface waters of Georges Bank, Massachusetts Bay, Cape Cod Bay, the Southern New England shelf, and throughout the middle Atlantic south to the Chesapeake Bay. Yellowtail flounder larvae typically occur where sea surface temperatures are below 17°C, water depths are 33 ft to 295 ft (10 m to 90 m), and salinity ranges from 32.4 ppt to 33.5 ppt. Yellowtail flounder larvae are most often observed from May through July in southern New England and southeastern Georges Bank. EFH for larvae has been identified in quadrants 1, 2, and 4, and may be found in waters associated with BIWF the BITS Project Area.

*Juvenile and Adult:* EFH for juvenile and adult yellowtail flounder is designated as bottom habitats with a substrate of sand or sand and mud on Georges Bank, the Gulf of Maine, and the southern New England shelf south to Delaware Bay. Yellowtail flounder juveniles typically occur where water temperatures are below 15°C, depths are 66 ft to 164 ft (20 m to 50 m), and salinity ranges from 32.4 ppt to 33.5 ppt. EFH for juvenile has been identified in quadrants 1, 2, and 4 and quadrants 1 and 2 for adults. Site-specific

habitat surveys indicate that suitable habitat for both juvenile and adult yellowtail flounder exists throughout the BIWF and BITS Project Area.

*Spawning Adult:* EFH for spawning adults is the same as described for juvenile and adult yellowtail flounder and therefore will occur throughout the BIWF and BITS Project Area.

### **Windowpane Flounder**

Windowpane flounder is distributed from the Gulf of St. Lawrence to Cape Hatteras, but it is most common south of Nova Scotia. The largest catches of this species occur on Georges Bank. Windowpane flounder is a left-eyed flounder with a thin body and nearly round outline that prefers sandy bottom types (Collette and Klein-MacPhee 2002). The eggs of this species are buoyant and spawning occurs typically from February through May (Chang et al. 1999). Larvae settle to the bottom at approximately 10 millimeters (mm) to 20 mm in length (Collette and Klein-MacPhee 2002). Windowpane have been reported to be common in the Rhode Island bottom trawl survey in Narragansett Bay; juveniles were caught throughout the bay in all seasons with no indication of seasonal differences (NOAA Fisheries 1999). Windowpane flounder juveniles serve as important prey species for a number of other finfish species, including spiny dogfish, thorny skate, goosefish, Atlantic cod, black sea bass, weakfish, and summer flounder. The windowpane flounder stock in Rhode Island has long been considered a part of the mixed species trawl fishery, but is no longer captured in quantities that would support a directed fishery for the species.

*Egg:* EFH for windowpane flounder eggs is designated as the surface waters around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras. Windowpane flounder eggs typically occur where sea surface temperatures are less than 20°C and water depths less than 230 ft (70 m). Windowpane flounder eggs are often observed from February to November with peaks in May and October. EFH for windowpane eggs has been identified in all five quadrants and may be found in waters associated with the BIWF and BITS Project Area.

*Larva:* EFH for larval windowpane flounder is designated as the pelagic waters around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras. Windowpane flounder eggs typically occur where sea surface temperatures are less than 20°C and water depths less than 230 ft (70 m). Windowpane flounder larvae are often observed from February to November with peaks in May and October in the middle Atlantic. EFH for windowpane larvae has been identified in all five quadrants and may be found in waters associated with the BIWF and BITS Project Area.

*Juvenile:* EFH for juvenile windowpane flounder are bottom habitats with substrates of mud or fine-grained sand around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras. Windowpane flounder juveniles typically occur where water temperatures are below 77°F (25°C), depths are 3 ft to 328 ft (1 m to 100 m), and salinities range between 5.5 and 36 ppt. EFH for juveniles has been identified in all five quadrants. Site-specific habitat surveys indicate that potentially suitable habitat for juveniles may occur along BITS Alternative 1 (MPs 2.2 to 21.7).

*Adult:* EFH for adult windowpane flounder is designated as bottom habitats with a substrate of mud or fine-grained sand around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to the Virginia-North Carolina border. Windowpane flounder adults typically occur where water temperatures are below 26.8°C, depths are 3 ft to 246 ft (1 m to 75 m), and

salinities range between 5.5 ppt and 36 ppt. EFH for juveniles has been identified in all five quadrants. Site-specific habitat surveys indicate that potentially suitable habitat for adults may occur along BITS Alternative 1 (MPs 2.2 to 21.7).

*Spawning Adult:* EFH for spawning adult windowpane flounder is designated as bottom habitats with a substrate of mud or fine-grained sand in the Gulf of Maine, Georges Bank, and the Mid-Atlantic Bight south to the Virginia/North Carolina border. Also designated as EFH for this lifestage are Delaware Bay, Delaware Inland Bays, and southern New England estuaries and bays. Suitable spawning adult habitat within the Project Area would be similar to those identified for adults.

### **American Plaice**

American plaice is common from the outer coast of Labrador, south from Hamilton Inlet, Newfoundland, on the Grand Banks, in the Gulf of St. Lawrence, and west and south to Cape Cod (Collette and Klein-MacPhee 2002). This species also occurs as far south as Montauk Point, New York, making Rhode Island waters the more southern extent of its range. Adult plaice prefer habitats of fine sand or gravel at water temperatures ranging from 0° to 13°C (most common between 4 and 6°C) (Bowering and Brodie 1991; Johnson et al. 1999). They are found at depths ranging from 65 ft to 1,200 ft (20 m to 366 m), but most frequently occur between 150 and 420 ft (45 and 130 m). Depth preference varies seasonally for both the juveniles and the adults (Johnson et al. 1999). Spawning begins north of Cape Cod in March and continues through the middle of June (Collette and Klein-MacPhee 2002). Spawning occurs at depths less than 300 ft (90 m) and spawning adults migrate from deeper depths into shoaler grounds before spawning (Collette and Klein-MacPhee 2002). The American plaice is considered a part of the mixed species trawl fishery, but at the southern extent of its range in Rhode Island waters is not captured in quantities that would support a directed fishery for the species.

*Eggs:* No designated EFH for this lifestage occurs within the Project Area.

*Larva:* EFH for larval American plaice are designated as the surface waters of the Gulf of Maine, Georges Bank, and southern New England. Where American plaice larvae are found, sea surface temperatures are typically below 14°C and water depths range between 98 and 420 ft (30 and 130 m). Larvae can be found in a wide range of salinities. American plaice larvae are observed between January and August, with peaks in April and May. EFH for American plaice larvae has been identified quadrant 5, and may be found in waters associated with the BITS Alternative 1.

*Juvenile:* EFH for juvenile American plaice is designated as bottom habitats with fine-grained sediments or a substrate of sand or gravel. Generally, American plaice juveniles are found in water temperatures below 17°C and depths between 148 and 492 ft (45 and 150 m). Juvenile American plaice tolerate a wide range of salinities. EFH for juvenile American plaice has been identified in quadrant 5 and may be found along BITS Alternative 1.

*Adult:* Adult plaice prefer habitats of fine sand or gravel at water temperatures ranging from 0° to 13°C (most common between 4° and 6°C) (Bowering and Brodie 1991; Johnson et al. 1999). They are found at depths ranging from 65 ft to 1,200 ft (20 m to 366 m), but most frequently occur between 150 and 420 ft (45 and 130 m). EFH for adults has been identified in quadrant 5 along the BITS route (MPs 12.6 to 21.7).

*Spawning Adults:* EFH for spawning adults is the same as described for adults. However, water temperatures control spawning in American plaice, resulting in varied times and locations in the northwest Atlantic (Bowering and Brodie 1991). They can thrive in temperatures ranging from -0.5°C to

13.0°C (Collette and Klein-MacPhee 2002). Water temperatures from 1.7°C to 7.7°C represent conditions where highest development occurs. Areas of maximum spawning occur in the western Gulf of Maine and over southeastern Georges Bank; optimum spawning temperatures range between 3 and 6°C. These bottom water temperatures exist throughout much of the spawning period within the 330 ft (100 m) isobath from Cape Cod to New Jersey (Colton 1972). Outside this southern boundary, temperatures are too high for survival rather than too high for reproduction (Colton 1972). Given the depth range needed for optimum spawning temperatures, spawning American plaice adults are unlikely to be within the BIWF or BITS Project Area.

### **Ocean Pout**

Two separate stocks of ocean pout have been suggested based on stock identification studies. The first stock is found within the region of the Bay of Fundy and the northern Gulf of Maine, while the second stock ranges from Cape Cod Bay south to Delaware (Wigley 2000). Ocean pout commonly occur from Labrador, Canada and the southern Grand Banks to Maryland (Collette and Klein-MacPhee 2002), but can also occur in the deeper, cooler waters south of Cape Hatteras (Steimle et al. 1999b). Ocean pout are common in Rhode Island waters and considered part of the multi-species groundfish fishery; however, no direct fishery is associated with this species. Spawning occurs in late summer through early winter (peak in September through October) with earlier peaks (August through October) in Rhode Island waters. This species spawns on hard bottom, sheltered areas (Collette and Klein-MacPhee 2002), including rock crevices, artificial reefs, and shipwrecks, at depths of less than 165 ft (50 m) and temperatures of 50°F (10°C) or less (Steimle et al. 1999b). Ocean pout are not migratory and seasonal inshore/offshore movements are not extensive (Wigley 2000).

*Eggs:* EFH is designated as bottom habitats, primarily hard bottom, on the continental shelf from the Gulf of Maine, Georges Bank, and Mid-Atlantic Bight south to Delaware Bay. Additionally, southern New England estuaries and embayments are designated as EFH for this lifestage. EFH for ocean pout eggs has been identified in all five quadrants and have the potential to occur in the southwest portion of the BIWF work area, the Export Cable (MPs 0.0 to 2.0), and BITS (MPs 0.0 to 2.2) where site-specific habitat surveys identified areas of hard substrate.

*Larva:* EFH for ocean pout larva is designated as bottom habitats in the Gulf of Maine, Georges Bank, southern New England, and the Mid-Atlantic Bight south to Delaware Bay. Larvae are relatively advanced in development and are believed to remain in close proximity to hard bottom nesting areas. Generally, ocean pout larvae are found when sea surface temperatures are below 50°F (10°C), depths less than 165 ft (50 m), and salinities greater than 25 percent. Rhode Island estuaries and bays are also designated as EFH for this lifestage. EFH for ocean pout larva have been identified in all five quadrants and have the potential to occur in the southwest portion of the BIWF work area, the Export Cable (MPs 0.0 to 2.0), and BITS (MPs 0.0 to 2.2) where site-specific habitat surveys identified areas of hard substrate.

*Juvenile:* Juvenile ocean pout EFH is designated as bottom habitats, often smooth bottom near rocks or algae in the Gulf of Maine, Georges Bank, southern New England, and the Mid-Atlantic Bight south to Delaware Bay. Generally, the following conditions exist where ocean pout juveniles are found: water temperatures below 14°C, depths less than 80 m, and salinities greater than 25 percent. Southern New England estuaries and bays are also designated as EFH for this lifestage. EFH for ocean pout eggs has been identified in all five quadrants and have the potential to occur in the southwest portion of the BIWF work area, the Export Cable (MPs 0.0 to 2.0), and BITS (MPs 0.0 to 2.2) where site-specific habitat surveys identified areas of hard substrate.

*Adult:* EFH for adult ocean pout is designated as bottom habitats in the Gulf of Maine, Georges Bank, southern New England, and the Mid-Atlantic Bight south to Delaware Bay. Ocean pout adults are typically found where water temperatures are below 15°C, depths are less than 360 ft (110 m), and a salinity range from 32 to 34 percent. EFH for ocean pout adults have been identified in all five quadrants and will likely occur throughout the bottom habitats associated with the BIWF and BITS Project Area.

*Spawning Adults:* EFH for adult ocean pout is designated as hard bottom habitats in the Gulf of Maine, Georges Bank, southern New England, and the Mid-Atlantic Bight south to Delaware Bay. Spawning occurs in late summer through early winter (peak in September through October) with earlier peaks (August through October) in Rhode Island waters. This species spawns on hard bottom, sheltered areas (Collette and Klein-MacPhee 2002), including rock crevices, artificial reefs, and shipwrecks, at depths of less than 165 ft (50 m) and temperatures of 10°C or less (Steimle et al. 1999b). EFH for spawning adults has been identified in all five quadrants and have the potential to occur in the southwest portion of the BIWF work area, the Export Cable (MPs 0.0 to 2.0), and BITS (MPs 0.0 to 2.2) where site-specific habitat surveys identified areas of hard substrate.

### **Atlantic Sea Herring**

Atlantic sea herring is a pelagic species that occurs in large schools, and inhabits coastal and continental shelf waters from Labrador to Virginia. Juvenile herring, which are commonly called sardines, migrate from shallow, inshore waters during the summer to deeper, offshore waters during the winter months. Adult fish older than three years will migrate from their spawning grounds in the Gulf of Maine and Georges Bank to spend the winter months in southern New England and the Mid-Atlantic. Atlantic herring are common throughout Rhode Island waters and support a directed commercial fishery. Herring will spawn during October and November in the southern Gulf of Maine, Georges Bank, and Nantucket Shoals. They prefer rock, gravel, or sand bottoms between 50 ft and 150 ft (15 m and 45 m) in depth for spawning (ASMFC 2008). Herring are filter feeders and feed on plankton, primarily copepods. They usually feed at night, following the zooplanktons that inhabit deeper waters during the day and travel to the surface to feed at night (ASMFC 2008). Herring themselves play a very important role in the ecosystem, as they are a significant source of food for many species of fish, including cod, haddock, silver hake, striped bass, bluefish, monkfish, mackerel, tuna, and spiny dogfish, as well as birds and marine mammals (Collette and Klein-MacPhee 2002).

*Egg:* No designated EFH for this lifestage occurs within the Project Area.

*Larvae:* EFH for Atlantic herring larvae is designated as pelagic waters in the Gulf of Maine, Georges Bank, and southern New England that comprise 90 percent of the observed range of Atlantic herring larvae. Atlantic herring larvae typically occur where sea surface temperatures are below 16°C, water depths from 164 ft to 295 ft (50 m to 90 m), and salinities around 32 ppt. Atlantic herring larvae are observed between August and April, with peaks from September through November. EFH for larval Atlantic sea herring has only been identified in quadrant 5, and may be found in the waters associated with the northern portion of BITS Alternative 1; however, water depth of the Project in this area is somewhat less than the herring's identified typical range.

*Juvenile:* Juvenile Atlantic herring are known to occur in pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras. Atlantic herring juveniles typically occur where water temperatures are below 50°F (10°C), water depths from 49 ft to 443 ft (15 m to 135 m), and a salinity range from 26 ppt to 32 ppt. EFH for juveniles has been



identified in all five quadrants and may be found in waters associated with the BIWF and BITS Project Area.

*Adult:* EFH for juvenile Atlantic herring is pelagic waters and bottom habitats associated with the Gulf of Maine, Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras. Atlantic herring adults typically occur where water temperatures are below 50°F (10°C), water depths from 66 ft to 427 ft (20 m to 130 m), and salinities above 28 ppt. EFH for adults has been identified in all five quadrants and may be found in waters associated with the BIWF and BITS Project Area.

*Spawning Adult:* EFH for spawning adults is designated as bottom habitats with a substrate of gravel, sand, cobble and shell fragments, but also on aquatic macrophytes, in the Gulf of Maine, Georges Bank, southern New England, and the middle Atlantic south to Delaware Bay. Atlantic herring adults typically occur where water temperatures are below 59°F (15°C), water depths are 66 ft to 262 ft (20 m to 80 m), and salinity ranges from 32 ppt to 33 ppt. Herring eggs are spawned in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots. Atlantic herring are most often observed spawning during the months from July through November. EFH for spawning adults has been identified in all five quadrants and their occurrences in the Project Area are the same as described for adults.

### **Monkfish**

Monkfish range from Newfoundland to North Carolina, and in the Gulf of Mexico. They tolerate a wide range of depth, temperature, and habits and are found from the tideline out to depths of greater than 2,000 ft (610 m) on the continental slope. They live on various types of substrate, including sand, gravel, rocks, mud, and beds of broken shells. They have also been found in a variety of temperatures, from 32°F to 70°F (0°C to 21°C), but prefer temperatures of 37°F to 48°F (3°C to 9°C) (Ross 1991). Reproduction for this species occurs in shallow water from spring through early fall; typically from late June through mid-September in New England. They produce large masses of eggs (up to 2.8 million eggs at one time) in a single ribbon that can be up to 25 ft to 36 ft (7 m to 11 m) in length that floats within the water column. Adult monkfish are voracious predators, feeding on skates, herring, mackerel, and silver hake, as well as lobsters and crabs. The most important prey species for monkfish in southern New England are little skate, red hake, sand lance, and other monkfish (Collette and Klein-MacPhee 2002). The monkfish often feeds by lying motionless and waving its “lure” to attract fish. The monkfish is also known to eat seabirds, including cormorants, herring gulls, loons, and other sea birds (Collette and Klein-MacPhee 2002).

*Egg:* EFH for monkfish eggs is designated as surface waters from the Gulf of Maine, Georges Bank, southern New England, and Mid-Atlantic Bight south to Cape Hatteras. EFH for monkfish eggs has been identified in all five quadrants; therefore, eggs associated with this species have the potential to occur throughout the BIWF and BITS Project Area.

*Larva:* EFH for monkfish larvae is designated as the pelagic waters from the Gulf of Maine, Georges Bank, southern New England, and Mid-Atlantic Bight south to Cape Hatteras. EFH for monkfish larvae has been identified in all five quadrants; therefore, larvae associated with this species have the potential to occur throughout the BIWF and BITS Project Area.

*Juvenile:* Juvenile monkfish typically occur in bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud along the OCS in the middle Atlantic, the mid-shelf off southern New England, and all areas of the Gulf of Maine. EFH for juveniles has been identified in

quadrants 1 and 2. Site-specific habitat surveys indicate that potentially suitable habitat for juveniles may occur along southeast portions of the BIWF construction work area.

*Adult:* EFH for adult monkfish are designated as bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud along the OCS in the middle Atlantic, the mid-shelf off southern New England, along the outer perimeter of Georges Bank, and all areas of the Gulf of Maine. EFH for adults have been identified in quadrants 1, 2, and 3. Habitats found within the BIWF Project Area and the southern portions of the BITS will be suitable for adult monkfish.

*Spawning Adult:* Spawning adult monkfish can be found in bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud along the OCS in the middle Atlantic, the mid-shelf off southern New England, along the outer perimeter of Georges Bank, and all areas of the Gulf of Maine. Suitable spawning adult habitat within the Project Area would be similar to that identified for adults.

### **Bluefish**

The bluefish is a schooling species found in most oceans of the world, except the eastern Pacific Ocean. In the western Atlantic Ocean, the bluefish distribution ranges from Nova Scotia and Bermuda to Argentina, but is considered rare between southern Florida and northern South America (Goodbread and Graves 1996). Bluefish adults are highly migratory and perform both north-south and inshore-offshore movements. Bluefish move north in the spring to summer seasons, when their highest abundance is found off the coast of New York and coastal southern New England, including Rhode Island waters (Collette and Klein-MacPhee 2002). In the fall and winter, bluefish move both southward and offshore to overwinter in the South Atlantic Bight, between coastal Florida and the Gulf Stream. Light levels and water temperature are the primary triggers for migrational movements, but offshore and inshore migrations also parallel the movements of their prey (Collette and Klein-MacPhee 2002). There are two discrete spawning events for the western Atlantic bluefish: 1) a spring spawning event occurs near the edge of the continental shelf in the South Atlantic Bight during March through May; and 2) a summer spawning event occurs over the mid-continental shelf in the Mid-Atlantic Bight between June and August in waters with temperatures between 64.4°F and 77°F (18°C and 25°C) and salinities from 25 to 31 percent (Collette and Klein-MacPhee 2002). Bluefish are common in Rhode Island waters and are a popular target for recreational fishermen.

*Eggs:* No designated EFH for this lifestage occurs within the Project Area.

*Larva:* No designated EFH for this lifestage occurs within the Project Area.

*Juvenile:* EFH for juvenile bluefish north of Cape Hatteras is pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ) from Nantucket Island, Massachusetts, south to Cape Hatteras, in the areas of highest abundance for their range, which includes Rhode Island waters. Inshore, EFH is all major estuaries between Penobscot Bay, Maine, and St. Johns River, Florida, which includes Narragansett Bay. EFH for juvenile bluefish has been identified in quadrants 1, 4, and 5, and will likely be found in waters associated with the BIWF and BITS Project Area.

*Adult:* EFH for adult bluefish is the same as that described for juvenile bluefish. EFH for adult bluefish have been identified in quadrants 1, 2, 4, and 5, and will likely be found in waters associated with the BIWF and BITS Project Area.

## Long-Finned Squid

Long-finned squid are distributed from Cape Cod through Cape Hatteras. The greatest abundance of long-finned squid is found in continental shelf and slope waters at depths between 328 ft and 551 ft (100 m and 168 m). They generally migrate inshore to waters off Rhode Island and elsewhere in May or June, and by late November/early December they migrate to deeper waters along the edge of the continental shelf (Macy and Brodziak 2001). Adult long-finned squid are demersal during the day, coming to the surface at night to feed. Egg masses are typically attached to hard substrates. Newly hatched squid are found at the surface, and move deeper in the water column as they grow, becoming demersal when they reach just under 2 in (45 mm) in length (NEFSC 2005). There is evidence that squid spawn throughout the year, with two main spawning periods in the summer and winter (Macy and Brodziak 2001). Adults feed on small fish, while juveniles feed on small crustaceans (Rathjen 1973). Squid are an important prey species to a number of other species, including sharks, haddock, hakes, striped bass, black sea bass, bluefish, scup, mackerel, summer flounder, and tuna (Ross 1991). Long-finned squid are considered common to Rhode Island waters and an important target for both commercial and recreational fisheries (see Sections 4.5.1 and 4.9).

*Pre-recruits:* EFH is the pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras in areas that comprise the highest 75 percent of the catch where pre-recruit long-finned squid were collected in the Northeast Fisheries Science Center (NEFSC) trawl surveys. Generally, pre-recruit long-finned squid are collected from shore to 700 ft depth and temperatures between 39°F and 81°F (3.9°C to 27.2°C). Given this broad range, there is the potential for pre-recruit long-finned squid to occur throughout all five quadrants and the Project Area.

*Recruits:* EFH is the pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras in areas that comprise the highest 75 percent of the catch where recruited long-finned squid were collected in the NEFSC trawl surveys. Generally, recruited long-finned squid are collected from shore to 1,000 ft and temperatures between 39°F and 81°F (3.9°C to 27.2°C). Given this broad range, there is the potential for recruit long-finned squid to occur throughout all five quadrants and the Project Area.

*Juveniles:* EFH is designated as pelagic waters found over the continental shelf in areas that comprise the highest 75 percent of the catch where juvenile long-finned squids have been collected in NEFSC trawl surveys from the Gulf of Maine through Cape Hatteras. EFH for long-finned squid juveniles has been identified in quadrants 1, 2, and 5, and is likely to be found within the BIWF Project Area and the northern portions of BITS Alternative 1.

*Adults:* EFH for adult long-finned squid is designated as pelagic waters found over the continental shelf in areas that comprise the highest 75 percent of the catch where recruited adult long finned squid were collected in the NEFSC trawl surveys from the Gulf of Maine through Cape Hatteras. EFH for adults has been identified in quadrants 1, 3, and 5, and is likely to be found within the BIWF WTGs, Inter-Array Cable and Export Cable, and BITS Alternative 1 along MPs 12.6 through 20.7.

## Short-Finned Squid

Short-finned squid is a pelagic, schooling species generally distributed across the continental shelf and slope. In the western Atlantic Ocean, the northern short finned squid distribution is from the Labrador Sea south to Florida (Wigley 1982). This species is most abundant in the Newfoundland region, is moderately abundant between Newfoundland and New Jersey (Wigley 1982), and is commercially exploited from Newfoundland south to Cape Hatteras (Cargnelli et al. 1999d). Northern short-finned squids are highly

migratory and are capable of long-distance migrations of more than 869 nm between boreal, temperate, and subtropical waters (Cargnelli et al. 1999d). They also undergo inshore-offshore migrations, which may be related to temperature, food, or both (MAFMC 1998). The northern short-finned squid forms dense aggregations in waters ranging from 46.4°F to 57.2°F (8°C to 14°C) in the winter from January to March along the OCS and upper slope, and in the spring from April to May, they migrate shoreward (Wigley 1982). Spawning of the northern short-finned squid is believed to occur in the deep waters of the continental shelf primarily from August through March, depending on location. The principal spawning habitat is hypothesized to occur south of Cape Hatteras over Blake Plateau (Cargnelli et al. 1999a; Hendrickson and Holmes 2004). The only confirmed spawning area was between southern New Jersey to Cape Hatteras along the shelf break in the Mid-Atlantic Bight during May (Hendrickson 2004). Short-finned squid are considered common to Rhode Island waters and are considered an important target for commercial fisheries (see Sections 4.5.2 and 4.9).

*Pre-recruits:* EFH is designated as pelagic waters found over the continental shelf in areas that comprise the highest 75 percent of the catch where pre-recruits were collected in the NEFSC trawl surveys from the Gulf of Maine through Cape Hatteras. No *Illex illecebrosus* egg masses have ever been found in nature (O’Dor and Dawe 1998). The NEFSC bottom trawl surveys captured northern short finned squid pre-recruits (under 3.4 in [10 cm] mantel length) during all seasons. Highest catches were made from the Middle Atlantic region. By summer, pre-recruits were caught throughout the continental shelf, from the shoreline out to the 600-ft (183-m) line, and from North Carolina to Georges Bank. The highest catches were made south of Cape Cod and Long Island. Given this broad range, there is the potential for pre-recruit long finned squid to occur throughout all five quadrants and the Project Area.

*Recruits:* EFH is designated as pelagic waters found over the continental shelf in areas that comprise the highest 75 percent of the catch where recruited adult northern short-finned squid were collected during NEFSC trawl surveys from the Gulf of Maine through Cape Hatteras. Recruits (4.3 in [11 cm] mantel length and greater) undergo seasonal migrations similar to pre-recruits and are also pelagic. The abundance of recruits during spring, autumn, and winter seem to be greater in NEFSC bottom trawl surveys. In winter, recruits were distributed offshore, with only low numbers taken at the 600-ft (183-m) depth contour. Recruits were taken at depths ranging from 32 ft to 1,378 ft (10 m to 420 m) and seem to inhabit shallower (i.e., inshore) waters in summer and autumn than in winter and spring. Recruits were also found at temperatures ranging from 39.2°F to 66.2°F (4°C to 19°C). Given this broad range, there is the potential for recruits of short finned squid to occur throughout all five quadrants and the Project Area.

*Juveniles:* No designated EFH for this lifestage occurs within the Project Area.

*Adults:* No designated EFH for this lifestage occurs within the Project Area.

### **Atlantic Butterfish**

Butterfish are pelagic fish forming loose schools from Newfoundland to Florida (NEFSC 1999b). They will often come close to shore into sheltered bays and estuaries, and have a preference for sandy bottom as opposed to rocky or muddy bottom. They spend much of their time near the surface when they are near to shore, but spend the winter and early spring near the bottom at depths of up to 600 ft to 690 ft (183 m to 210 m) (Collette and Klein-MacPhee 2002). Butterfish are found in Narragansett Bay and Block Island Sound from late spring through fall, appearing off Rhode Island in late April. They spawn usually within a few miles of the coast during the late spring and early summer, and migrate to the edge of the continental shelf during the winter (Collette and Klein-MacPhee 2002). Butterfish eggs are found within Narragansett Bay from June through August (NEFSC 1999b). Butterfish feed primarily on tunicates and

mollusks, as well as cnidarians, polychaetes, crustaceans, and other invertebrates (Collette and Klein-MacPhee 2002). Ctenophores have been found to make up an important component of the diet of juvenile butterfish in Narragansett Bay (Oviatt and Kremer 1977). Butterfish themselves serve as prey to a number of species including hake, bluefish, weakfish, and swordfish, and are used commonly as bait in recreational tuna fisheries (Ross 1991).

*Eggs:* No designated EFH for this lifestage occurs within the Project Area.

*Larva and Juvenile:* Offshore, EFH for larvae and juveniles is the pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras in areas that comprise the highest 75 percent of the catch where butterfish larvae were collected in the NEFSC trawl surveys. Inshore, EFH is the “mixing” and/or “seawater” portions of all the estuaries where butterfish larvae are “common,” “abundant,” or “highly abundant” on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. EFH for larvae have been identified in quadrant 1 and for juveniles in quadrant 5; therefore, these lifestages have the potential to occur within the BIWF Project Area and the northern portion of BITS Alternative 1.

*Adult:* No designated EFH for this lifestage occurs within the Project Area.

### **Atlantic Mackerel**

The Atlantic mackerel is a pelagic fish found from the Gulf of St. Lawrence to Cape Hatteras. There are two separate stocks of mackerel, one of which spends winters between the Chesapeake Bay and Long Island, and moves northward along the New England coast in June and July, and the other which moves inshore to southern New England in late May and migrates north toward Nova Scotia (Ross 1991). They are generally found in Rhode Island waters from May through September, and migrate offshore to the edge of the continental shelf in winter. Mackerel are found in dense schools between 600 ft (183 m) and the surface. They are an open-ocean fish often found over the edge of the continental shelf, but will also inhabit brackish coastal waters. They prefer to spawn near the surface. They spawn in the Mid-Atlantic Bight and in the Gulf of Maine in spring and early summer once the water is warmer than 8°C (Collette and Klein-MacPhee 2002). Mackerel are opportunistic feeders, and feed largely on zooplankters, including copepods, shrimps, and fish larvae. Larger mackerel will feed on larger prey such as squid, silver hake, sand lance, herring, and sculpins (Collette and Klein-MacPhee 2002). They are an important prey species for whales, porpoises, sharks, cod, tuna, bluefish, striped bass, birds, and squid, which eat small mackerel (Ross 1991). Atlantic mackerel are common to Rhode Island waters and are considered an important commercially and recreationally targeted fish.

*Eggs:* EFH is designated as the pelagic waters over the continental shelf in areas that comprise the highest 75 percent of the catch where Atlantic mackerel eggs were collected during the Marine Resources Monitoring, Assessment, and Prediction (MARMAP) ichthyoplankton surveys. Inshore, EFH is the “mixing” and/or “seawater” portions of all the estuaries where Atlantic mackerel eggs are “common,” “abundant,” or “highly abundant” on the Atlantic coast from Passamaquoddy Bay, Maine to James River, Virginia, which includes Rhode Island waters. Generally, Atlantic mackerel eggs are collected from shore to 50 ft (15 m) and temperatures between 41°F and 73.4°F (5°C and 23°C). EFH for Atlantic mackerel eggs has been identified in quadrants 4 and 5 and has the potential to occur along BITS Alternative 1.

*Larva:* EFH for larval Atlantic mackerel includes the pelagic waters overlying the continental shelf in areas that comprise the highest 75 percent of the catch collected in the MARMAP ichthyoplankton surveys. Inshore, EFH is also the “mixing” and/or “seawater” portions of all the estuaries where Atlantic

mackerel larvae are “common,” “abundant,” or “highly abundant” on the Atlantic coast from Passamaquoddy Bay, Maine to James River, Virginia, which includes Rhode Island waters. Generally, Atlantic mackerel larvae are collected in depths between 33 ft and 425 ft (10 m and 130 m) and temperatures between 42.8°F and 71.6°F (6°C and 22°C). EFH for Atlantic mackerel larvae has been identified in quadrant 5, and has the potential to occur along the northern portion of BITS Alternative 1.

*Juvenile:* EFH for the Atlantic mackerel includes the pelagic waters found over the continental shelf in areas that comprise the highest 75 percent of the catch where juvenile Atlantic mackerel were collected in the NEFSC trawl surveys from the Gulf of Maine through Cape Hatteras Inshore, EFH is the “mixing” and/or “seawater” portions of all the estuaries where juvenile Atlantic mackerel are “common,” “abundant,” or “highly abundant” on the Atlantic coast from Passamaquoddy Bay, Maine to James River, Virginia, which includes Rhode Island waters. Generally, juvenile Atlantic mackerel are collected from shore to 1,050 ft (320 m) and temperatures between 39.2°F and 71.6°F (4°C and 22°C). EFH for juveniles has been identified in quadrant 5, and has the potential to occur along the northern portion of BITS Alternative 1.

*Adult:* EFH includes the pelagic waters occurring over the continental shelf in areas that comprise the highest 75 percent of the catch where adult Atlantic mackerel were collected in NEFSC trawl surveys. Inshore, EFH is the “mixing” and/or “seawater” portions of all the estuaries where adult Atlantic mackerel are “common,” “abundant,” or “highly abundant” on the Atlantic coast from Passamaquoddy Bay, Maine to James River, Virginia, which includes Rhode Island waters. Generally, adult Atlantic mackerel are collected from shore to 1,250 ft (381 m) and temperatures between 39.2°F and 60.8°F (4°C and 16°C). EFH for adults has been identified in quadrant 5, and has the potential to occur along the northern portion of BITS Alternative 1.

### **Summer Flounder**

Summer flounder (fluke) are found in both inshore and offshore waters from Nova Scotia to Florida, although they are most abundant from Cape Cod south to Cape Fear, North Carolina (ASMFC 2008). They are left-eyed flatfish (family bothidae). Summer flounder are concentrated in bays and estuaries from late spring through early fall when they migrate offshore to the continental shelf to waters between 120 ft and 600 ft (37 and 183 m) in depth, spending their fall and winters offshore. Adult summer flounder spend most of their lives near the bottom, and prefer to bury themselves in sand substrate. During the summer, they are often found on hard sand, and prefer mud during the fall. They are often found hiding motionless in eelgrass or among the pilings of docks, but swim very quickly if disturbed (Collette and Klein-MacPhee 2002). This species spawns offshore in the fall. Larvae will migrate inshore to coastal and estuarine areas from October through May. Upon reaching the coast, the larvae will move to the bottom, and spend the first year of their lives in bays and other inshore areas. Summer flounder have well-developed teeth that allow them to capture such prey as small fish, squid, sea worms, shrimp, and other crustaceans (ASMFC 2008). Summer flounder are common to Rhode Island waters and are considered part of the multi-species groundfish for commercial fisheries. They are also an important target species for recreational fisheries.

*Egg:* EFH for summer flounder eggs is the pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ) from the Gulf of Maine to Cape Hatteras in the highest 90 percent of all the ranked 10-minute squares for the area where summer flounder eggs are collected in the MARMAP survey. Summer flounder eggs are found between October and May, being most abundant between Cape Cod and Cape Hatteras, with the heaviest concentrations within 9 miles of shore off New Jersey and New York. Eggs are most commonly collected at depths of 30 ft to 360 ft (9.1 m to 109.7 m). EFH for summer

flounder eggs has been identified in quadrant 4, and therefore eggs will likely occur within the waters associated with the BITS Project Area.

*Larva:* EFH for summer flounder larvae is the pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras in the highest 90 percent of all the ranked 10-minute squares for the area where summer flounder larvae are collected in the MARMAP survey. Inshore, EFH is all the estuaries where summer flounder were identified as being present (rare, common, abundant, or highly abundant) in the Estuarine Living Marine Resources (ELMR) Program database for the "mixing" and "seawater" salinity zones. In general, summer flounder larvae are most abundant nearshore (within 12 mi to 50 mi [20.9 km to 80.5 km] from shore) at depths between 30 ft and 230 ft (20.9 m to 370.1 m). They are most frequently found in the northern part of the Mid-Atlantic Bight from September to February. EFH for summer flounder larvae has been identified in quadrants 1, 2, 4, and 5, and therefore larvae will likely occur within the waters associated with both the BIWF and BITS Project Area.

*Juvenile:* Juveniles are typically found in the demersal waters over the continental shelf (from the coast out to the limits of the EEZ) from the Gulf of Maine to Cape Hatteras in the highest 90 percent of all the ranked 10-minute squares for the area where juvenile summer flounder are collected in the NEFSC trawl survey. Inshore, EFH is all of the estuaries where summer flounder were identified as being present (rare, common, abundant, or highly abundant) in the ELMR database for the "mixing" and "seawater" salinity zones. In general, juveniles use several estuarine habitats as nursery areas, including salt marsh creeks, seagrass beds, mudflats, and open bay areas in water temperatures greater than 37°F (2.8°C) and salinities from 10 ppt to 30 ppt range. EFH for summer flounder juveniles has been identified in quadrants 2 and 5, and therefore juveniles will likely occur within the waters associated with the BIWF and northern portion of the BITS Alternative 1 Project Area.

*Adult:* EFH for adult summer flounder is the demersal waters over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras in the highest 90 percent of all the ranked 10-minute squares for the area where adult summer flounder are collected in the NEFSC trawl survey. Inshore, EFH is the estuaries where summer flounder were identified as being common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. Generally, summer flounder inhabit shallow coastal and estuarine waters during warmer months and move offshore on the OCS at depths of 500 ft (152.4 m) in colder months. EFH for adults has been identified in all five quadrants, and may be found in waters associated with the BIWF and BITS Project Area.

## Scup

Scup (porgy) are a migratory species found from Cape Cod to Cape Hatteras. Scup are most commonly found in waters between 55°F and 77°F (13°C and 25°C). They spend the winters in offshore waters from southern New Jersey to Cape Hatteras, and spawn in the summer in inshore waters from southern New England to Long Island, moving to New England waters in May until leaving in October. Scup spawn in inshore waters during the summer, with spawning reaching its peak in June off southern New England. The eggs will hatch about 40 hours after fertilization. Scup form into schools of similarly sized individuals. Juvenile scup inhabit coastal habitats, and will sometimes dominate the fish population of estuarine areas during the summer months (ASMFC 2008). They prefer areas with smooth or rocky bottoms, and are often found around piers, rocks, offshore ledges, jetties, and mussel beds. During the winter, they prefer depths of 240 ft to 600 ft (73 m to 183 m) where the water temperature is at least 45°F (7.2°C). Adult scup feed on bottom invertebrates, including small crabs, squid, worms, clams, mussels, amphipods, jellyfish, and others. They are eaten by a variety of different fish. It is estimated that as many

as 80 percent of all juvenile scup annually are eaten by fish such as cod, bluefish, striped bass, and weakfish (Ross 1991).

*Eggs:* EFH for scup eggs are pelagic waters from New England to coastal Virginia, at depths of less than 98 ft (30 m) in waters between 55°F and 73°F (12.8°C and 22.8°C) and in salinities greater than 15 ppt. There is currently insufficient EFH data for this lifestage in the Project Area; however, it is possible that eggs could occur in the waters associated with all five quadrants.

*Larva:* EFH for scup larvae are pelagic waters from New England to coastal Virginia, at depths of less than 66 ft (20 m). In general, scup larvae are most abundant nearshore from May through September, in waters between 55°F and 73°F (12.8°C and 22.8°C), and in salinities greater than 15 ppt. There is currently insufficient EFH data for this lifestage in the Project Area; however, it is possible that larvae could occur in the waters associated with all five quadrants.

*Juvenile:* Offshore, EFH is the demersal waters over the continental shelf (from the coast out to the limits of the EEZ) from the Gulf of Maine to Cape Hatteras in the highest 90 percent of all the ranked 10-minute squares of the area where juvenile scup are collected in the NEFSC trawl survey. Inshore, EFH is the estuaries where scup are identified as being common, abundant, or highly abundant in the ELMR database for the “mixing” and “seawater” salinity zones. During the summer and spring, juvenile scup are found in estuaries and bays between Virginia and Massachusetts, in association with various sands, mud, mussel, and eelgrass bed type substrates and in water temperatures greater than 45°F (7.2°C) and salinities greater than 15 ppt. EFH for juveniles has been identified in all five quadrants, and may be found in waters associated with the BIWF and BITS Project Area.

*Adult:* Offshore, EFH is the demersal waters over the continental shelf (from the coast out to the limits of the EEZ) from the Gulf of Maine to Cape Hatteras in the highest 90 percent of all the ranked 10-minute squares of the area where adult scup are collected in the NEFSC trawl survey. Inshore, EFH is the estuaries where scup were identified as being common, abundant, or highly abundant in the ELMR database for the “mixing” and “seawater” salinity zones. Generally, wintering adults (November through April) are usually offshore, south of New York to North Carolina, in waters above 45°F (7.2°C). EFH for juveniles has been identified in all five quadrants, and may be found in waters associated with the BIWF and BITS Project Area.

### **Black Sea Bass**

Black sea bass are concentrated from Cape Cod to Cape Canaveral, Florida and prefer to inhabit rock bottoms near pilings, wrecks, and jetties within this range. There are two distinct and overlapping stocks of black sea bass along the Atlantic coast. They are found in inshore waters at depths of less than 120 ft (37 m) in the summer, and move offshore to deeper waters to the south during the winter and prefer water about 48.2°F (9°C) (ASMFC 2008). Larger adults are usually found in deeper waters than smaller individuals, and larger adults typically begin their migration earlier than the younger adults and juveniles, starting in August (Ross 1991). Juvenile sea bass migrate inshore and prefer sheltered habitats such as SAV, oyster reefs, and man-made structures. Black sea bass are protogynous hermaphrodites, beginning life as females and then changing to males when they reach about 9 in to 13 in (23 cm to 33 cm) in length. In the Mid-Atlantic, 38 percent of females will change sex between August and April, after the majority of the fish have already spawned. The northern stock of black sea bass spawns off New England from mid-May until the end of June (Ross 1991), and an average-sized fish will produce roughly 280,000 eggs. The eggs float in the water column, hatching a few days after fertilization. The larvae will drift offshore until they grow to 0.5 in (1 cm) in length, at which point the young sea bass will migrate inshore into



estuaries, bays, and sounds (ASMFC 2008). Black sea bass are common in Rhode Island waters and are considered important to both commercial and recreational fisheries.

*Eggs:* EFH for black sea bass eggs is designated as pelagic waters at depths of about 98 ft (30 m). Generally, black sea bass eggs are found from May through October on the continental shelf, from southern New England to North Carolina. There is currently insufficient EFH data for this lifestage in the Project Area; however, it is possible that eggs could occur in the waters associated with all five quadrants.

*Larvae:* No designated EFH for this lifestage occurs within the Project Area.

*Juvenile:* Offshore, EFH is the demersal waters over the continental shelf (from the coast out to the limits of the EEZ) from the Gulf of Maine to Cape Hatteras in the highest 90 percent of all the ranked 10-minute squares of the area where juvenile black sea bass are collected in the NEFSC trawl survey. Generally, juvenile black sea bass are found in waters warmer than 48.2°F (9°C) with salinities greater than 18 ppt and coastal areas between Virginia and Massachusetts, but winter offshore from New Jersey and south. Juvenile black sea bass are usually found in association with rough bottom, shellfish and eelgrass beds, man-made structures in sandy-shelly areas; offshore clam beds and shell patches may also be used during overwintering. EFH for juveniles has been identified in all five quadrants and may be found in waters associated with the BIWF and BITS Project Area.

*Adult:* Offshore, EFH is the demersal waters over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras in the highest 90 percent of all the ranked 10-minute squares of the area where adult black sea bass are collected in the NEFSC trawl survey. Temperatures above 48.2°F (9°C) seem to be the minimum requirements. Structured habitats (natural and man-made), sand, and shell are usually their substrate preference. EFH for adults has been identified in quadrants 3 and 5, and may be found in waters associated the BIWF Export Cable off of Block Island, as well as the northern portion of BITS Alternative 1.

## Surf Clam

The Atlantic surf clam is a bivalve mollusk that inhabits sandy continental shelf habitats from the southern Gulf of St. Lawrence to Cape Hatteras. This species may reach a maximum size of 8.9 in (226 mm) and a maximum age of approximately 31 years (Cargnelli et al. 1999c). High concentrations of the planktonic eggs and larvae of Atlantic surf clams can occur from May to June and September to October; minor peaks sometimes occur in July in Rhode Island waters. Juveniles settle to the substrate and remain there through adulthood. They burrow in medium to coarse sand and gravel substrates, as well as silty to fine sand, but have not been found to burrow in mud (Cargnelli et al. 1999c). The greatest concentrations of Atlantic surf clams are usually found in well-sorted, medium sand (Cargnelli et al. 1999c). The size and age of sexual maturity is variable. Off New Jersey, Atlantic surf clams may reach maturity as early as three months after settlement, while at the northern extreme of their range maturity may not be reached until four years of age (Cargnelli et al. 1999c). Atlantic surf clams serve as prey for finfish species such as haddock and Atlantic cod (Cargnelli et al. 1999c). In the New York Bight, crabs account for 48.3 to 100 percent of Atlantic surf clam mortality, while naticid moon snails accounted for 2.1 percent (MacKenzie et al. 1985). Surf clams are common to Rhode Island waters and considered an important commercial shellfish species (see Sections 4.5.1 and 4.9).

*Juveniles and adults:* EFH for juvenile and adult surf clams is defined as federal waters from the eastern edge of Georges Bank and the Gulf of Maine throughout the Atlantic EEZ, in areas that encompass the top 90 percent of all the ranked 10-minute squares for the area where surf clams were caught in the

NEFSC surf clam and ocean quahog dredge surveys. Juvenile and adult surf clams are found within substrate to a depth of 3 ft (0.9 m) below the water/sediment interface. Surf clams generally occur from the beach zone to a depth of about 200 ft (61 m), but beyond about 125 ft (38.1 m) abundance is low. EFH for both juveniles and adults has been identified in quadrant 5, and will likely occur along the northern portions of BITS Alternatives 1. While EFH for Atlantic surf clam juveniles and adults has been designated along northern portions of the BITS route, the Benthic Intertidal Survey Report (Appendix F) indicates the presence of juvenile surf clam along the Export Cable and BITS routes at the cable landfall locations at Crescent Beach, suggesting the presence of spawning populations of this species in Rhode Island Sound. Surf clams may be present along the cable routes beyond the intertidal zone in this area, since this species is most common in turbulent waters deeper than the breaker zone (Fay et al. 1983).

### **Ocean Quahog**

The ocean quahog is a bivalve mollusk found in temperate and boreal waters (Weinberg 1995). In U.S. waters, quahogs are managed under the MAFMC Atlantic Surf clam and Ocean Quahog Fishery Management Plan (MAFMC 1997). The ocean quahog is distributed on the continental shelf from Newfoundland to Cape Hatteras (Weinberg 1995). Greatest concentrations are in offshore waters south of Nantucket to the Delmarva Peninsula (Serchuk et al. 1982). The inshore limit of their distribution appears to be defined by the 60.8°F (16°C) bottom isotherm in the summer months (Mann 1989). They are found in relatively shallow water in eastern Maine (but never intertidally) and in deeper, more offshore waters south of Cape Cod, including Rhode Island waters (MAFMC 1997). The eggs and larvae of ocean quahogs are planktonic, drifting with currents until the larvae metamorphose into juveniles and settle to the bottom (MAFMC 1997). The earliest age of maturity was 7 years for both sexes, and maturity occurred at about 1.9 in (49 mm) shell length. Ocean quahogs are common to Rhode Island waters and are considered an important commercial shellfish species (see Sections 4.5.1 and 4.9).

*Juvenile and adults:* EFH for juvenile and adult ocean quahogs is defined as federal waters from the eastern edge of Georges Bank and the Gulf of Maine throughout the Atlantic EEZ, in areas that encompass the top 90 percent of all the ranked 10-minute squares for the area where ocean quahogs were caught in the NEFSC surf clam and ocean quahog dredge surveys. Juvenile ocean quahogs are found offshore in sandy substrates (Kraus et al. 1989, 1992), but may survive in muddy intertidal environments if protected from predators (Kraus et al. 1991). In the Mid-Atlantic Bight, juvenile ocean quahogs are typically found at depths of 148 ft to 246 ft (45 m to 75 m) and at salinities of 32 ppt to 34 ppt. Adult ocean quahogs are usually found in dense beds over level bottoms, just below the surface of the sediment, which ranges from medium to fine-grain sand (Medcof and Caddy 1971; Beal and Kraus 1989; Brey et al. 1990; Fogarty 1981; MAFMC 1997). Although the species has been found at depths of 46 ft to 270 ft (14 m to 82 m), most are found at depths of 82 ft to 200 ft (25 m to 61 m) (Merrill and Ropes 1969; Serchuk et al. 1982). EFH for juveniles and adults has been identified in quadrant 4, and will occur along the entire BITS route through this quadrant.

### **Spiny Dogfish**

Spiny dogfish range from Labrador to Florida. They migrate north during the spring and summer, and south in the fall and winter. Juvenile and adult spiny dogfish are abundant in the Mid-Atlantic waters extending to the southern part of Georges Bank in winter. During the summer months, they are found farther north in Canadian waters, and will move inshore into bays and estuaries (ASMFC 2008). In the fall, they are commonly found closer to shore, and are abundant off Martha's Vineyard and Nantucket, as well as Rhode Island waters (NEFSC 2006). Spiny dogfish are live-born in the fall or winter, and are about 10 in (26 cm to 27 cm) in length at birth. They do not reach maturity for 10 or more years. Mating

occurs in the winter months, and pups are delivered on the offshore wintering grounds (ASMFC 2008). Females will produce a litter of between 1 and 15 pups, usually averaging 6 to 7 pups, and give birth every two years. Spiny dogfish eat a variety of fish of many sizes, including herring and hakes, squid, and ctenophores. They also eat bivalves, especially scallops, off southern New England. The spiny dogfish is common to Rhode Island waters and is considered a commercially important species to Rhode Island fishermen.

*Juvenile and adults:* North of Cape Hatteras, EFH for juvenile and adult spiny dogfish is designated as the waters of the continental shelf from the Gulf of Maine through Cape Hatteras in areas that encompass the highest 90 percent of all ranked 10-minute squares for the area where juvenile dogfish were collected in the NEFSC trawl surveys. Spiny dogfish are usually epibenthic, but occur throughout the water column and are found from nearshore shallows to offshore shelf waters to 2,953 ft (900 m). In the spring, juveniles and adults occur in deeper, generally warmer waters on the outer shelf from North Carolina to Georges Bank. In the fall, they occur in the shallower, moderately warm waters from southern New England into the Gulf of Maine. Their seasonal distribution is similar in coastal areas. Dogfish are transient visitors to estuaries where they prefer higher salinities. EFH for juveniles and adults have been identified in quadrants 1, 2, 4 and 5, and will likely occur in the area of the BIWF and southern portions of the Export Cable, as well as the majority of BITS Alternative 1.

### **King Mackerel**

King mackerel are commonly distributed along the continental shelf in the warmer waters of the western Atlantic Ocean from North Carolina to Brazil, but occasionally stray as far north as Massachusetts (Collette and Klein-MacPhee 2002). This species does not typically occur beyond the continental shelf break (GMFMC and SAFMC 2005). King mackerel have a protracted spawning season, which runs from May to October and eggs are pelagic (Godcharles and Murphy 1986). King mackerel exhibit seasonal movements. During the summer, these fish migrate north occurring in the waters off Virginia and the Carolinas through fall. As the waters become cooler in the winter, they migrate south again to Florida (Godcharles and Murphy 1986; Schaefer and Fable 1994). King mackerel are occasionally found in Rhode Island waters and are not considered important to either commercial or recreational Rhode Island fisheries.

*Eggs, Lava, Juveniles, and Adults:* EFH for all lifestages of this species includes all estuaries; the United States/Mexican border to the boundary between the areas covered by the GMFMC and the SAFMC from estuarine waters out to depths of 600 ft (183 m). EFH also includes sandy shoals of capes and offshore bars, high profile rocky bottom and barrier island ocean-side waters, from the surf to the shelf break zone, but from the Gulf Stream shoreward, including Sargassum. In addition, EFH includes all coastal inlets and all state-designated nursery habitats of particular importance to coastal migratory pelagics. EFH for all king mackerel lifestages has been identified in all five quadrants; however, given the distribution of this species and its rare occurrence in Rhode Island waters, all lifestages of king mackerel are unlikely to be found within the BIWF and BITS Project Area.

### **Spanish Mackerel**

Spanish mackerel are abundant from Chesapeake Bay south through the Gulf of Mexico; however, they occasionally occur as far north as coastal southern New England (Collette and Klein-MacPhee 2002). Spanish mackerel have a protracted spawning season, which runs from April to September (GMFMC and SAFMC 2005; Godcharles and Murphy 1986). The onset of spawning progresses from south to north and occurs over the inner continental shelf in waters 39 ft to 112 ft (12 m to 34 m) deep. Spawning of the

pelagic eggs starts in April off the Carolinas, in mid-June in the Chesapeake Bay, and from late August into September off the coasts of New Jersey and New York (Godcharles and Murphy 1986; Collette and Klein-MacPhee 2002). Spanish mackerel make seasonal migrations along the Atlantic coast. They are found off Florida during the winter and migrate north as the waters warm. They arrive off the Carolinas in April, off Virginia by May, and as far north as Narragansett Bay by July, in some years. They remain in the cooler northern waters until September before beginning their migration south again (GMFMC and SAFMC 2005). Spanish mackerel are rare to Rhode Island waters and are not considered important to either commercial or recreational Rhode Island fisheries.

*Eggs, Larva, Juvenile, and Adult:* EFH for all lifestages of Spanish mackerel includes all estuaries; the United States/Mexican border to the boundary between the areas covered by the GMFMC and the SAFMC from estuarine waters out to depths of 600 ft (183 m). EFH also includes sandy shoals of capes and offshore bars, high profile rocky bottom and barrier island ocean-side waters, from the surf to the shelf break zone, but from the Gulf Stream shoreward, including Sargassum. In addition, EFH includes all coastal inlets and all state-designated nursery habitats of particular importance to coastal migratory pelagics. EFH for all Spanish mackerel lifestages has been identified in all five quadrants; however, given the distribution of this species and its rare occurrence in Rhode Island waters, all lifestages of Spanish mackerel are unlikely to be found within the BIWF and BITS Project Area.

### **Cobia**

Cobia is distributed worldwide throughout tropical, subtropical, and warm-temperate waters, with the exception of the eastern Pacific Ocean (Williams 2001). In the northwest Atlantic, cobia range from Massachusetts to Argentina, including Bermuda, but are most common along the U.S. coast south of Virginia and in the northern Gulf of Mexico (Franks et al. 1999). Spawning occurs in the daylight hours between April and September in estuarine or shelf waters (Ditty and Shaw 1992). Cobia are batch spawners and form large aggregations during spawning (Bester 1999; Williams 2001). Cobia eggs and larvae are pelagic and found at the surface or within the upper meter of the water column (Ditty and Shaw 1992). Cobia also undergo seasonal migrations. Following the spawning season, cobia migrates south to warmer offshore waters of the Florida Keys during the autumn and winter. In the spring, they begin their migration north to the poly/mesohaline waters of coastal Virginia and the Carolinas for the summer and to spawn (Williams 2001). Cobia is not considered common in Rhode Island waters and are not considered important to either commercial or recreational Rhode Island fisheries.

*Eggs, Larva, Juvenile, and Adult:* EFH for all lifestages of cobia includes all estuaries; the United States/Mexican border to the boundary between the areas covered by the GMFMC and the SAFMC from estuarine waters out to depths of 600 ft (183 m). EFH also includes high salinity bays, estuaries, and seagrass habitat. In addition, the Gulf Stream is an EFH because it provides a mechanism to disperse coastal migratory pelagic larvae. EFH also includes sandy shoals of capes and offshore bars, high profile rocky bottom and barrier island ocean-side waters, from the surf to the shelf break zone, but from the Gulf Stream shoreward, including Sargassum. In addition, EFH includes all coastal inlets and all state-designated nursery habitats of particular importance to coastal migratory pelagics. EFH for all cobia lifestages has been identified in all five quadrants; however, given the distribution of this species and its occasional occurrence in Rhode Island waters, all lifestages of cobia are unlikely to be found within the BIWF and BITS Project Area.

## Sand Tiger Shark

Sand tiger sharks are known to have a broad inshore distribution in tropical and warm-temperate waters throughout the world but are nonexistent in the eastern Pacific Ocean (Castro 1983; Collette and Klein-MacPhee 2002). In the western Atlantic, the sand tiger sharks occur from the Gulf of Maine to Florida, the northern Gulf of Mexico, the Bahamas, and Bermuda and southward to Argentina (Castro 1983; Compagno 1984). In warmer months, this species is common from Cape Cod to the Delaware Bay (Castro 1983). Sand tiger sharks mate in the winter and spring, with parturition beginning during the winter from late October to the end of November (Collette and Klein-MacPhee 2002). In Florida, sand tiger sharks are born from November to February (Castro 1983). The neonates then migrate northward to summer nurseries. Sand tiger sharks are migratory in the northern portion of its range moving northward and inshore during the summer and south to deeper waters in the fall and winter (Castro 1983; Compagno 1984). Sand tiger sharks are demersal sharks primarily found in shallow bays and around coral or rocky reefs (depths less than 65.6 ft [20 m]), but also can be found to depths of 627 ft (191 m) over the continental shelf (Compagno 1984; Collette and Klein-MacPhee 2002). Neonate and juvenile sand tiger sharks utilize estuarine waters as nurseries from Massachusetts to South Carolina (McCandless et al. 2002). As with many shark species, the sand tiger shark is common in the waters of Rhode Island and typically targeted by recreational fishing.

*Neonates:* EFH for neonate sand tiger sharks is designated as the shallow coastal waters to 82 ft (25 m) from Cape Cod to Cape Canaveral, Florida. EFH for neonate sand tiger sharks has been identified in all five quadrants, and has the potential to occur throughout the BIWF and BITS Project Area.

*Juvenile:* No designated EFH for this lifestage occurs within the Project Area.

*Adult:* No designated EFH for this lifestage occurs within the Project Area.

## Common Thresher Shark

The thresher shark is an oceanic and coastal species that inhabits the tropical and temperate waters of the world (Compagno 1984). In the northwest Atlantic, they occur from Nova Scotia to Argentina, including the Gulf of Mexico (Branstetter 2002). Reproduction is thought to occur annually throughout the distributional range of the ovoviparous species (Branstetter 2002). Young most commonly occur in the waters of the southeast United States, but have also been observed off southern New England (Branstetter 2002). Juvenile thresher sharks inhabit coastal bays and nearshore waters. Adults are more common over the continental shelf, but also occur in oceanic waters beyond the shelf break (Branstetter 2002; Goldman et al. 2002). They are commonly observed at the surface, but are known to inhabit depths of up to 1,804 ft (550 m). Shark species are common in the waters of Rhode Island and are typically targeted by recreational fishing.

*Neonate, Juvenile, and Adult:* For thresher shark neonates, juveniles and adults, EFH is designated as pelagic waters deeper than 164 ft (50 m) offshore Long Island, New York, and coastal southern New England, including Rhode Island waters. Additional Atlantic EFH has been established off the mid-east coast of Florida, Georgia, South Carolina, and the Gulf of Maine and between North Carolina and Cape Cod. EFH areas have also been designated in localized areas off of Puerto Rico. EFH for common thresher shark neonates, juveniles, and adults has been identified in quadrants 1, 2, 3, and 4, and has the potential to occur in the waters throughout the BIWF and along the BITS route up to approximately Point Judith.

## Blue Shark

The blue shark has a worldwide distribution and is considered one of the widest ranging shark species (Compagno 1984). Even though its range extends into the tropics, it is commonly found in deeper, more temperate waters (Ferrari and Ferrari 2002). In the western Atlantic, this pelagic shark is found from Newfoundland south to Argentina (Compagno 1984). There are no records of this shark in the Gulf of Mexico (Castro 1983). Very little is known about the reproductive locations of this species in the Atlantic, but mating is believed to occur in May and June (Branstetter 2002). Blue shark nurseries are believed to occur in the open oceanic waters of the higher latitudes of their range. The exact migration routes of this species are also poorly understood, but a population of blue sharks from the northwest Atlantic Ocean was reported to migrate to northeastern South America (Castro 1983). This species can inhabit waters with depths up to 1,148 ft (350 m), and although this species is oceanic, it can be found close to shore at night or in areas where the continental shelf is narrow (Castro 1983; Compagno 1984). This shark is often found in large aggregations close to the surface in temperate waters. It prefers relatively cool water from 44.6°F to 60.8°F (7°C to 16°C), but can tolerate water as warm as 69.8°F (21°C) (Castro 1983). As with many shark species, the blue shark is common in the waters of Rhode Island and typically targeted by recreational fishing.

*Neonates:* Neonate blue sharks are young-of-year up to 23.6 in (60 cm) total length. EFH for neonate blue sharks is designated as pelagic waters from New Jersey to Massachusetts from a depth of 82 ft (25 m) out to the EEZ. EFH for blue shark neonates has been identified in all quadrants and has the potential to occur in the waters throughout the BIWF and BITS Project Area.

*Juvenile:* Juvenile blue sharks (24 in to 72 in [61 cm to 183 cm] total length) have EFH designated from offshore Cape Hatteras in waters from the 82-ft (25-m) isobath to the U.S. EEZ boundary. EFH has been established off the mid-east coast of Florida, South Carolina, and the Gulf of Maine. EFH for juvenile blue sharks has been identified in quadrants 1, 2, 3, and 4, and has the potential to occur in the waters throughout the BIWF and along the BITS route up to approximately Point Judith.

*Adult:* Adult blue sharks (72.4 in [184 cm] total length) have designated EFH from offshore Cape Hatteras in waters from 82 ft (25 m) to the U.S. EEZ boundary and extending around Cape Cod, including the southern part of the Gulf of Maine. EFH has been designated in localized areas off Puerto Rico and the Virgin Islands. EFH for adults has been identified in quadrants 1, 2, 3, and 4, and has the potential to occur in the waters throughout the BIWF and along the BITS route up to approximately Point Judith.

## White Shark

White sharks are found worldwide in temperate, subtropical, and tropical waters. In the northwest Atlantic, it occurs from Newfoundland to Florida, the northern Gulf of Mexico, the Bahamas, and Cuba, as well as from Brazil to Argentina (Castro 1983; Compagno 1984). The white shark is rare south of Cape Hatteras and in the Gulf of Mexico, except during the winter (Castro 1983). The white shark inhabits waters over the continental shelf in the summer and migrates to warmer waters during the winter months (Castro 1983). This species is principally an epipelagic shark, but can be found utilizing depths of over 820 ft (250 m) ranging from the surf zone to offshore, including oceanic islands (Castro 1983; Compagno 1984). This shark commonly occurs in areas of small coastal archipelagos inhabited by pinnipeds (main prey), offshore reefs, banks, and shoals, as well as rocky headlands where deeper water is closer to shore. Larger individuals are more common in subtropical and tropical waters than smaller white sharks (less than 9.8 ft [3 m] in length), which typically are confined to temperate waters (Compagno 1984). As with

many shark species, the white shark is common in the waters of Rhode Island and typically targeted by recreational fishing.

*Neonates:* No designated EFH for this lifestage occurs within the project area.

*Juvenile:* EFH for juvenile white shark has been designated between Maryland and Cape Cod. Offshore EFH has been established along northern New Jersey and Long Island, New York in pelagic waters from the 82-ft to 328-ft (25-m to 100-m) isobath in the New York Bight area. EFH for juvenile white sharks has been identified in quadrant 1, and has the potential to occur in the waters of the BIWF and the southern portion of the Export Cable.

*Adult:* No designated EFH for this lifestage occurs within the Project Area.

### **Dusky Shark**

The dusky shark has a wide-ranging distribution in warm-temperate and tropical continental waters throughout the world and can be found in the western Atlantic from southern Massachusetts and the Georges Bank southward through the northern Caribbean Sea and Gulf of Mexico to Nicaragua and southern Brazil (Compagno 1984; Castro 1993). Dusky sharks are coastal and pelagic in distribution and occur from the surf zone to well offshore and from surface waters to depths of 1,312 ft (400 m) (Compagno 1984; Branstetter 2002). Mating for this species in the western Atlantic occurs in the spring, and birth to live young can occur over several months from late winter to summer (Compagno 1984). Females mate in alternate years as a result of their long gestation period (9 to 16 months). The dusky shark undertakes long seasonal, temperature-related migrations. On both coasts of the United States, this species migrates northward in summer as the waters warm and retreats southward in fall as water temperatures decline (Compagno 1984). Major nursery areas have been identified in coastal waters from Massachusetts to the South Carolina coast, including Bulls Bay, South Carolina (Castro 1993). As with many shark species, the dusky shark is common in the waters of Rhode Island and typically targeted by recreational fishing.

*Neonates:* No designated EFH for this lifestage occurs within the Project Area.

*Juvenile:* EFH designated for juvenile dusky sharks includes coastal and pelagic waters between 82 and 656 ft (25 and 200 m) from the coast of southern New England, including Rhode Island waters. EFH for juvenile dusky sharks has been identified in quadrants 1, 2, 3, and 5, and has the potential to occur in the waters of the BIWF and the majority of BITS Alternative 1.

*Adult:* No designated EFH for this lifestage occurs within the project area.

### **Shortfin Mako Shark**

The shortfin mako shark has a worldwide distribution. It ranges from the Grand Banks and Gulf of Maine in the western Atlantic southward to the tropics, including the Gulf of Mexico (Schultz 2004). It is typically common offshore from Cape Cod to Cape Hatteras (Castro 1983). Few data exist on the migratory patterns of the shortfin mako shark. Within the northern extent of its range, this species is believed to follow the movement of warm-water masses towards the poles in the summer (Compagno 1984). The shortfin mako shark has a two- or three-year reproductive cycle, a gestation period of approximately 18 months, and a late winter to mid-spring parturition (Mollet et al. 2000). The shortfin mako shark is found in warm-temperate to tropical waters around the world, but is rarely found in water temperatures lower than 60.8°F (16°C) (Compagno 1984). This shark is an epipelagic species typically found from the surface to depths of 498 ft (152 m), but has been recorded as deep as 2,427 ft (740 m)

(Compagno 1984). As with many shark species, the shortfin mako shark is common in the waters of Rhode Island and typically targeted by recreational fishing.

*Neonates:* EFH for neonate shortfin mako is designated between 164 ft and 6,561 ft (50 m and 2,000 m) from southeast of Georges Bank to Cape Lookout, and from 82 ft to 164 ft (25 m to 50 m) offshore from the Chesapeake Bay to a line running west of Long Island, New York to just southwest of Georges Bank. Localized areas in the central Gulf of Mexico and around the Florida Keys have been designated EFH, as well as areas off South Carolina (NMFS 2009). EFH for neonate shortfin mako sharks has been identified in quadrants 1 and 2, and has the potential to occur within the waters of the BIWF and southern portions of the Export Cable.

*Juvenile:* EFH designation for juvenile shortfin mako sharks is the same as for neonates and has been identified in all five quadrants. Juvenile shortfin mako sharks have the potential to occur throughout the waters of the BIWF and BITS Project Area.

*Adult:* No designated EFH for this lifestage occurs within the Project Area.

### **Sandbar Shark**

Sandbar sharks are found in shallow coastal waters from Cape Cod southward to Brazil, including the Gulf of Mexico and the Caribbean Sea, but are most common from South Carolina to Florida and in the eastern Gulf of Mexico (Castro 1983; Branstetter 2002). This bottom-dwelling species is found in temperate to tropical waters over the continental shelf and in deep water adjacent to the shelf break. Sandbar sharks are found in water depths ranging from the intertidal zone to 918 ft (280 m) during migration, but are common in 66 ft to 213 ft (20 m to 65 m) depths (Compagno 1984). Sandbar sharks avoid surf zones, coral reefs, or rough benthic substrates, preferring smooth substrates (Castro 1983; Compagno 1984). They are common in inshore areas with mud or sand substrates such as estuaries, river mouths, and harbors, but do not enter freshwater (Compagno 1984). Sandbar sharks make an extensive seasonal migration, moving to the northern part of their range in the summer and the southern part during the winter (Castro 1983). Seasonal temperature changes are the primary trigger for the migration; however, oceanographic features also influence this behavior (Compagno 1984). In the northwest Atlantic, mating occurs from May to June with young being born from March to August after a gestation period of approximately one year (Castro 1983). This species segregates by sex with large females dominating shallow, nursery areas from Delaware Bay to Cape Canaveral, Florida, as well as the Gulf of Mexico (Castro 1983). The Chesapeake Bay is regarded as one of the primary nursery grounds in the mid-Atlantic (Branstetter 2002). As with many shark species, the sandbar shark is common in the waters of Rhode Island and typically targeted by recreational fishing.

*Neonates:* No designated EFH for this lifestage occurs within the Project Area.

*Juvenile:* EFH for juvenile sandbar sharks is designated as all coastal and pelagic waters offshore from Cape Poge Bay and the south shore of Cape Cod to Long Island, New York; shallow coastal areas out to the 82-ft (25-m) isobath from Barnegat Inlet, New Jersey to Cape Canaveral, Florida; and in the Mid-Atlantic Bight during the winter, the benthic areas underlying the shelf break between the 295-ft to 656-ft (90-m to 200-m) isobaths. Additional EFH is designated for this lifestage is in the Florida Keys and off western Florida. EFH for juvenile sandbar sharks has been identified in all five quadrants. Site-specific habitat surveys indicate that suitable habitat for juvenile sandbar shark exists throughout the BIWF and BITS Project Area.



*Adult:* EFH for this adult sandbar shark is shallow coastal waters to the 82 ft (25 m) isobath from Barnegat Inlet, New Jersey to south of Cape Canaveral, Florida. Additional EFH designated for this lifestage is areas north of Barnegat Inlet, New Jersey and regions off western Florida. EFH for sandbar shark adults has been identified in quadrants 1, 2, 3, and 5. Site-specific habitat surveys indicate that suitable habitat for adult sandbar shark exists throughout the BIWF. Additionally, suitable habitat exists for this lifestage in the northern portions of the BITS, including Alternative 1.

### **Bluefin Tuna**

Bluefin tuna have a worldwide distribution in tropical and temperate waters from Argentina and South Africa north to Labrador and northern Scandinavia in the Atlantic Ocean, including the Gulf of Mexico and the Caribbean Sea (Schultz 2004). The western Atlantic bluefin tuna spawns from mid-April to mid-June in the Gulf of Mexico, the Florida Straits, the western edge of the Bahamas Banks, and along the eastern portion of the Florida current at temperatures of 76.8°F to 85.1°F (24.9°C to 29.5°C) (Gusey 1981; Collette and Nauen 1983). The Gulf of Mexico spawning site is considered the primary spawning area of the northwest Atlantic (Mather et al. 1995; Block et al. 2001). The adult bluefin tuna moves seasonally from offshore spawning grounds in the Gulf of Mexico through the Straits of Florida to inshore seasonal feeding grounds in the northern part of their range in the northwestern Atlantic (Jeffreys Ledge, Stellwagen Bank, Cape Cod Bay, Great South Channel, and south of Martha's Vineyard) in the early spring and summer and finally to North Carolina, Blake Plateau, or the Bahamas for the winter (Gusey 1981; Block et al. 2001; Chase 2002). Data on the three-way movements of adults from these feeding areas to wintering areas and back to breeding areas are limited. It is postulated that juveniles have a shorter two-way movement from feeding to wintering areas (Mather et al. 1995; Chase 2002). This species can tolerate a considerable range of temperatures and has been observed at depths greater than 3,280.8 ft (1,000 m) (Block et al. 2001). Although bluefin tuna are epipelagic and oceanic, they often occur over continental shelf waters and in embayments during the summer months (Collette and Klein-MacPhee 2002). Juveniles typically inhabit regions off the continental shelf, from North Carolina to Rhode Island, in waters with depths less than 131 ft (40 m) and temperatures greater than 68°F (20°C) in the summer (June and July) (Schuck 1982; Brill et al. 2002). Juveniles along the continental shelf utilize the entire water column, including the benthic habitat, but spend the majority of their time near the surface (Brill et al. 2002). Fertilized eggs are buoyant (Collette and Klein-MacPhee 2002). Bluefin tuna is common in Rhode Island waters and is considered important to Rhode Island commercial and recreational fisheries (see Sections 4.5.2 and 4.9).

*Eggs:* No designated EFH for this lifestage occurs within the Project Area.

*Larva:* No designated EFH for this lifestage occurs within the Project Area.

*Juvenile:* EFH for this juvenile bluefin tuna is designated as all inshore and pelagic surface waters warmer than 53.6°F (12°C) from the Gulf of Maine to Cape Cod Bay and Nantucket Shoals south to Cape Hatteras between the 82-ft and 656-ft (25-m and 200-m) isobaths. Additional EFH designated for this lifestage is in the Florida Straits. EFH for juvenile bluefin tuna has been identified in quadrants 1 and 2, and has the potential to occur within the waters of the BIWF and southern portions of the Export Cable.

*Adult:* EFH for adult bluefin tuna is designated in the Gulf of Maine, Georges Bank, and the Gulf of Mexico. EFH for adults has been identified in all five quadrants, and has the potential to occur in the waters throughout the BIWF and BITS Project Area.

## Little Skate

The little skate spawns throughout the year, with spawning activity in southern New England peaking in June and July. Female skates produce egg cases two at a time, and may produce between 60 and 150 per year. The young hatch between six and nine months after fertilization, and are about 3.5 in (9 cm) long once hatched. The little skate will grow to about 21 in (53 cm), and the winter skate to 42 in (107 cm) (Ross 1991). Skates are most abundant from shallow waters to depths of up to 360 ft (110 m). The little skate prefers water temperatures between 34°F and 66°F (1°C and 19°C) and is distributed along the coast from Chesapeake Bay to Georges Bank in winter and spring, with large numbers along the Long Island coast. This species is most abundant between Georges Bank and Long Island in summer and fall. Skates feed largely on rock crabs, shrimp, and squid, but also frequently eat amphipods, polychaetes, razor clams, and small fish. Skates are commonly eaten by monkfish (Ross 1991). Little skate are common in Rhode Island waters and are considered important to Rhode Island commercial fisheries (see Sections 4.5.2 and 4.9).

*Eggs:* No designated EFH for this lifestage occurs within the Project Area.

*Larva:* No designated EFH for this lifestage occurs within the Project Area.

*Juvenile:* EFH for juvenile little skate has been designated as bottom habitats with a sandy or gravelly substrate from Georges Bank through the Mid-Atlantic Bight to Cape Hatteras. Additionally, the Chesapeake Bay Mainstem and southern New England and northern Mid-Atlantic Bight estuaries and embayments, including Rhode Island waters, are designated as EFH for this lifestage. EFH for juvenile little skate has been identified in all five quadrants. Site-specific habitat surveys indicate that suitable habitat for juvenile little skate exists throughout the BIWF and BITS Project Area.

*Adult:* EFH for adult little skate has been designated as bottom habitats with a sandy or gravelly substrate or mud ranging from Georges Bank through the Mid-Atlantic Bight to Cape Hatteras. Delaware Bay, Delaware Inland Bays, and Chesapeake Bay Mainstem, as well as bays and estuaries in southern New England through the northern Mid-Atlantic Bight, including Rhode Island waters, are designated as EFH for this lifestage. EFH for adults has been identified in quadrants 1, 2, and 3. Site-specific habitat surveys indicate that suitable habitat for adult little skate exists throughout the waters of the BIWF and the BITS route located in quadrant 3.

## Winter Skate

The winter skate is concentrated on Georges Bank throughout the year and along the eastern shore of Long Island in the winter and spring. Skates are most abundant from shallow waters to depths of up to 360 ft (110 m). The winter skate prefers temperatures between 34°F and 70°F (1°C and 21°C). Winter skates mature at a length of 24 in (61 cm). The eggs are fertilized inside the female's reproductive tract, and then released into the water where much of the embryo's development will take place. It is believed the winter skate spawns in southern New England waters in summer and fall. These species feed largely on rock crabs, shrimp, and squid, but also frequently eat amphipods, polychaetes, razor clams, and small fish. Skates are commonly eaten by monkfish (Ross 1991). Winter skate are common in Rhode Island waters and are considered important to Rhode Island commercial fisheries (see Sections 4.5.2 and 4.9).

*Eggs:* No designated EFH for this lifestage occurs within the Project Area.

*Larva:* No designated EFH for this lifestage occurs within the Project Area.

*Juvenile:* EFH for juvenile winter skate is designated as bottom habitats with a substrate of sand and gravel or mud in Cape Cod Bay, on Georges Bank, the southern New England shelf, and through the Mid-Atlantic Bight to North Carolina. Chesapeake Bay Mainstem and northern Mid-Atlantic Bight estuaries and bay are designated as EFH for this lifestage. EFH for juvenile little skate has been identified in all five quadrants. Site-specific habitat surveys indicate that suitable habitat for juvenile winter skate exists throughout the BIWF and BITS Project Area.

*Adult:* EFH for adult winter skate is designated as bottom habitats with a substrate of sand and gravel or mud in Cape Cod Bay, on Georges Bank, the southern New England shelf, and through the Mid-Atlantic Bight to North Carolina. Chesapeake Bay Mainstem and northern Mid-Atlantic Bight estuaries and bay are designated as EFH for this lifestage. EFH for adult winter skate has been identified in quadrants 1. Site-specific habitat surveys indicate that suitable habitat for juvenile winter skate exists throughout the southern portions of the Export Cable.

#### **4.5.3.2 Potential Impacts and Proposed Mitigation**

Deepwater Wind has minimized impacts to fish and invertebrate species by siting the Project to avoid direct impacts to important habitats such as eelgrass and hard bottom substrates known to be used by some species throughout various lifestages. Deepwater Wind has also minimized impacts on marine habitats by selecting construction techniques and equipment (e.g., jet-plowing, HDD, and DP vessels) that substantially minimize disturbance and alteration of substrate during construction activities. However, despite this effort it is unavoidable that some marine habitats will be temporarily degraded (both water column and bottom habitat) and/or altered from the BIWF and BITS Project activities.

#### **BIWF**

Within the three 10-minute by 10-minute quadrants encompassing the BIWF Project Area, approximately 16.55 acres (6.74 hectares) of benthic habitat will be temporarily affected during construction and 0.74 acre (0.31 hectare) will be permanently affected by operation.

The estimate of the quantity of EFH habitat affected by BIWF construction is dependent on several factors including species lifestyle, the degree of dependence of the species or lifestage on the substrate, and the amount of particular habitat present within the Project Area. Of the EFH species identified as potentially occurring in the BIWF Project Area, many organisms have a completely pelagic lifestyle, including the bluefish, Atlantic sea herring, Atlantic mackerel, bluefin tuna, and most sharks. In addition, most species with designated EFH in the Project Area have pelagic early life histories (eggs and larvae) and are not dependent on benthic habitat. Therefore, modification and/or disturbance of the substrate during construction will not significantly affect these species or lifestages. There may be some temporary impacts on the use of specific areas by these species during construction resulting from increased suspended sediments in the lower water column; however, as stated in Section 4.5.2 any sediment plume generated during Project construction is expected to be small, localized, and temporary and will not produce concentrations that are known to cause harm to fish. In addition, given their mobile nature, pelagic juvenile and adult lifestages should largely avoid these areas.

Mixed groundfish species and mollusks have the greatest potential for impact in the BIWF Project Area during construction because they are directly dependent on the substrate for at least some portion of their life cycle. Specifically, winter flounder eggs, larvae, juveniles, and adults; yellowtail and windowpane flounder juveniles and adults; American plaice juveniles and adults; and surf clams and ocean quahogs all have a close affinity for soft substrates. Species such as cod juveniles, all ocean pout lifestages, monkfish juveniles and adults, and longfin squid eggs have a strong affinity for hard substrates. As stated

previously, the WTGs, Inter-Array Cable, Export Cable, and offshore cofferdam location have all been routed to avoid hard substrate to the maximum extent possible. The only potential direct impacts on hard substrates would be from anchor-chain sweep in the southwest portion of the BIWF work area. Impact on this hard bottom habitat would be limited to the construction of the WTG foundations. Deepwater Wind is currently working to design an anchor configuration that will minimize impacts on this habitat. Discrete areas of boulders also occur along the nearshore portions of the Export Cable. Regardless of substrate type, mobile species (such as cod, ocean pout, monkfish, flounders, hakes, and skates) will likely avoid these areas for the duration of the disturbance. Immobile species (such as surf clams and ocean quahogs) in the direct footprint of the WTG foundations, anchors, jack-up barge spuds and jet plow will likely be crushed. Species such as flounders, ocean pout, hakes, and skates may be covered, or have eggs and larvae covered, by redeposited sediments expelled from the jet-plow trench or cofferdam. Specifically, for winter flounder, demersal eggs and semi-demersal larvae in the path of the jet plowing will be displaced into the water column and resettle to the bottom where some may be buried too deeply to recover. However, as stated in Section 4.5.1 accumulations of 0.4 in (10 mm) will be limited to an area immediately adjacent to the trench. This level of deposition is minor and juvenile and adult fishes will be able to recover from this amount of burial. There is substantial evidence from the site-specific surveys conducted in the Project Area that the physical environment is dynamic and sediment transport near the bottom is a regular occurrence. For winter flounder, specifically, spawning adults have been shown to prefer areas where eggs would be minimally displaced by tidal currents to retain larvae in suitable nursery areas (Crawford and Carey 1985; Monteleone 1992). The presence of sand waves throughout much of the area is a strong indicator that bottom currents move surface sediments routinely making the presence of eggs unlikely in the WTG Array and the Inter-Array Cable and Export Cable routes. In addition, benthic fauna are likely well adapted and able to withstand small amounts of sedimentation and thus will recover quickly. Overall, the area of benthic habitat affected by construction (a maximum total area of 16.54 acres [6.74 hectares]) is small compared to the total area of available surrounding habitat. Impacts on EFH and EFH species will be minor.

Upon completion of construction, except for the permanent conversion of 0.35 acre (0.14 hectare) of soft substrate to hard substrate associated with the five WTGs and a few short sections along the marine cable routes where additional protective armoring may be required (totaling no more than 0.4 acres [0.2 hectare] along the entirety of the BIWF marine cable routes), the substrates within the BIWF WTG Array and along the Inter-Array Cable and Export Cable will remain fundamentally the same as pre-existing conditions, and therefore will allow for continued use by designated EFH species. As detailed in Sections 4.5.1 and 4.5.2 and Appendix F, epifaunal and infaunal species will recolonize the sediments disturbed through the mechanisms of larval recruitment and mobile species of both fish and invertebrates will return to the Project Area, allowing this area to continue to serve as foraging habitat for EFH species. The foundations and additional cable armoring may also provide some additional habitat that would be suitable for both demersal species (especially structure-oriented species like the black sea bass) and colonization by sessile benthic species.

Decommissioning of the BIWF at the end of the Project's projected 25-year life will be temporarily disruptive to the surrounding area. The WTGs and foundations will be removed in their entirety (legs will be cut below the mud line) and the Inter-Array and Export Cables below the mud line will be abandoned in-place. Removal of the WTGs will have the same type of impacts described for installation, resulting in only a temporary short-term disturbance to EFH and EFH species from substrate disturbance and increased TSS in the Project Area. Once the holes created in the seafloor fill with sediments through natural processes, the disturbed area will be recolonized with benthic species. The sessile fouling

community that is expected to have developed on the WTG piles and support structures will also be removed, which will result in a small reduction in the habitat diversity and forage available to EFH species in the Project Area; however, this will actually represent a return to pre-Project conditions.

## **BITS**

Within the three 10-minute by 10-minute quadrants encompassing the BITS Project Area, a maximum 41.02 acres (16.69 hectares) of benthic habitat will be temporarily affected along BITS Alternative 1 during construction. No more than 1.33 acres (0.53 hectare) will be permanently affected by operation of the Project.

Overall the EFH species assemblage in the BITS Project Area will be similar to that described for the BIWF. As detailed for the BIWF, impacts on pelagic EFH species, their lifestages, and habitat will be limited to the temporary and localized suspension of TSS in the water column and associated with the short-term avoidance of the construction area during jet-plowing and cofferdam construction activities.

As evidenced by the site-specific habitat surveys, the BITS largely avoids hard bottom habitat except in the nearshore areas of Block Island (MPs 0.0 to 2.4). Hard bottom substrate in this area could potentially serve as EFH to species such as cod, monkfish juveniles and adults, longfin squid eggs, and all ocean pout lifestages. Evaluation of the soft-substrate conditions along the BITS route would suggest that the silty-sand substrate along deeper portions of BITS Alternative 1 would be suitable EFH for at least one lifestage of flounders, hakes, and American plaice that have a close affinity for soft substrates. As stated previously, regardless of substrate type, mobile species (such as cod, ocean pout, monkfish, flounders, hakes, and skates) along the BITS Alternative 1 route and cofferdam locations will likely avoid these areas for the duration of the disturbance. Immobile species such as surf clams and ocean quahogs in the direct footprint of the cofferdam, jack-up barge spuds, and jet plow will likely be crushed, while species in the adjacent areas may be covered by redeposited sediments from construction activities. However, because the habitat for these species is not a limiting factor in the surrounding environment and there is strong evidence from the benthic surveys that these areas are often subject to both natural and human induced disturbances (e.g., bottom currents and scarring by fishing gear), the effects of the BITS installation would not be significant.

Winter flounder demersal eggs and semi-demersal larvae in the path of the jet plowing will also be displaced into the water column and resettle to the bottom where some may be buried too deeply to recover. As described for the BIWF, shallower and more dynamic environments as evidenced by sand wave are unlikely to represent suitable habitat for winter flounder eggs and larvae along the BITS Alternative 1 route. The deeper portions of the BITS Alternative 1 route are less dynamic with a higher proportion of silt in the sediment. As stated previously, spawning winter flounder adults have been shown to prefer areas where eggs would be minimally displaced by tidal currents to retain larvae in suitable nursery areas (Crawford and Carey 1985; Monteleone 1992). In addition, higher percentages of winter flounder eggs have been observed in shallower, non-channel areas (Mulvey 2010). While there may be the possibility of winter flounder eggs and larvae in deeper, less dynamic portions of BITS Alternative 1 route, this area is minimal in comparison to surrounding potentially suitable spawning habitat within Rhode Island Sound.

As described above for BIWF, except for a few areas where additional cable armoring will occur, the substrates along the BITS corridor will remain fundamentally the same as pre-existing conditions, and will allow for continued use by designated EFH species. Epifaunal and infaunal prey will recolonize

disturbed sediments through mechanisms of larval recruitment. In addition, mobile macroinvertebrates will return to the BITS trench area, which will continue to serve as foraging habitat for EFH species.

It is anticipated the BITS will be kept in operation in perpetuity. However, should the BITS reach the end of its useful life, the cable will be abandoned in-place resulting in no impact on EFH from decommissioning.

### **Combined Effects**

The combined effects of the BIWF and BITS on EFH and EFH species will not be significant. Construction activities themselves will result in a small combined total area of permanent impact of approximately 57.57 acres (23.43 hectares) across the entire Project Area following BITS Alternative 1. Disturbance from construction would also be of short duration lasting a total of seven weeks for both the BIWF and BITS and would largely be associated with the disturbance of soft-bottom habitats. Of the total area disturbed, all areas are expected to return to pre-construction conditions except for approximately 2.07 acres (0.44 hectare) of habitat that would be permanently converted to hard substrate by the WTGs and the additional protective armoring along the cable routes and at the two proposed cable crossings. However, following construction, areas of new hard bottom will be suitable for colonization by sessile benthic species and may provide some additional habitat for structure-oriented species such as the black sea bass, thus allowing these areas to continue to serve as foraging habitat for EFH species.

Decommissioning activities associated with the BIWF and BITS, similar to construction activities, would result in temporary disturbances to EFH and EFH species, but effects and recovery rates are expected to be similar to those described for construction with no long-term effects.

When considered together with the existing EFH in the Project Area of the BIWF and BITS, the combined impacts associated with the construction, operation, and decommissioning of the BIWF and BITS are minor and not significant.

## **4.5.4 Marine Mammals and Sea Turtles**

This section discusses only those marine mammals and sea turtles known to traverse or occasionally visit the waters within or surrounding the Project Area that are not listed as threatened or endangered under the ESA, but are protected under the Marine Mammal Protection Act of 1972 as amended in 1994 (MMPA). This section also describes the species biology, habitat use, abundance, and distribution, as well as the existing threats to these populations. Project activities that may affect both marine mammals and sea turtles and their habitats within the Project Area, including the location of the Project facilities and construction and operation activities and proposed mitigation measures, are also addressed. Those marine mammals and sea turtles listed as threatened or endangered under the ESA are discussed separately in Section 4.5.7.

### **4.5.4.1 Affected Environment**

#### **Marine Mammals**

Cetaceans inhabit all of the world's oceans and are found in coastal, estuarine, and pelagic habitats. Whales are strong swimmers and are known to travel long distances during migrations between feeding and breeding areas. The smaller species are shallow divers, while the larger whales are capable of deep dives. There are two groups of cetaceans, toothed whales and baleen whales. The Odontoceti (toothed whales) all possess teeth, are very gregarious, generally feed on fish and invertebrates, and use echolocation for orientation and prey detection. Baleen whales (Mysticeti) do not have any teeth, but use

a filtration system, consisting of baleen, to sieve prey from the water. Their prey primarily consists of zooplankton and small schooling fish. They usually forage in the upper 650 ft (198 m) of the water column. Baleen whales are known to maintain small, unstable groups or remain as solitary individuals (Wilson and Ruff 1999).

All cetaceans communicate by emitting a variety of underwater sounds. Most marine animals can perceive underwater sounds over a broad range of frequencies from about 10 hertz (Hz) to more than 10,000 Hz (10 kilohertz [kHz]). Many of the dolphins and porpoises use even higher frequency sound for echolocation and perceive these high frequency sounds with high acuity. Marine mammals respond to low-frequency sounds with broadband intensities of more than 120 decibels (dB) re 1 microPascal ( $\mu\text{Pa}$ ), or about 10 dB to 20 dB above natural ambient noise at the same frequencies (Richardson et al. 1991). Toothed whales create three types of sounds: tonal whistles; pulsed sounds of short duration to be used in echolocation; and less distinct pulsed sounds, such as cries, grunts, and barks. Toothed whales become very vocal when together, especially when interacting with each other.

Peak underwater sound detection in most baleen whales, including the endangered species discussed in Section 4.5.7, is in the range of 10 Hz to 10,000 Hz, with greatest acuity below about 10,000 Hz. The lowest recorded ranges of frequencies for sounds of the sei whale are sweeps in the 1.5 kHz to 3.5 kHz range (Richardson et al. 1995). The whales use these low-frequency sounds primarily for long-range communication. Determining the function of baleen whale sounds is difficult because they are normally not kept in captivity where their interaction and use of sounds can be examined (Richardson et al. 1995).

Pinnipeds (seals) are widely distributed and are split into three families: Odobenidae (the walrus), Otariidae (eared seals, including sea lions and fur seals), and Phocidae (earless seals). Phocidae are the most diverse and widespread pinnipeds and the only family of seals with the potential to occur within the BIWF and BITS Project Area. Earless seals (they lack external ears) are particularly adapted for the oceanic environment, having streamlined body and head shape, and swim with efficiency utilizing well-developed rear flippers. Airborne vocalizations by pinnipeds play important roles in social functions, including the delineation of territory, advertisements of dominance status, and female attendance behavior (Kastak and Schusterman 1998). In general, phocids are far more vocal under water than other seal families, with measured frequencies above 1 kHz (Kastak and Schusterman 1998). Low-frequency aerial thresholds have been measured ranging from approximately 100 Hz to 6,400 Hz, and underwater thresholds over a similar frequency range from approximately 75 Hz to 6,400 Hz (Kastak and Schusterman 1998).

Kenney and Vigness-Raposa (2009) report 50 species of marine mammals (whales, dolphins, porpoise, and seals) that are protected by the MMPA and are known to be present, at least seasonally, in the continental shelf waters of the North Atlantic Ocean. Of these 50 marine mammal species, 30 cetacean species, 5 pinnipeds, and the West Indian manatee (*Trichechus manatus*) have been sighted within the coastal waters of Rhode Island (see Table 4.5-6). Most of the species identified are migratory and pass through Rhode Island and Block Island Sounds, the adjacent Atlantic Ocean, and the deeper continental shelf waters during annual migrations from feeding grounds to mating grounds. Some whale species (fin, humpback, and minke whales) are present year-round in the continental shelf waters but are relatively rare in the more shallow waters of Rhode Island Sound; most cetaceans found off the Rhode Island coast are, in general, more likely to be found during the spring and summer (Kenney et al. 1985).

Six species of marine mammals known to occur in Rhode Island waters are listed under the ESA. These species include the blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), North Atlantic right whale (*Eubalaena glacialis*), sei whale (*Balaenoptera borealis*), and sperm whale (*Physeter macrocephalus*). However, these species are highly migratory and do not spend extended periods of time in a localized area. Additionally, the sperm, blue, and sei whales are more pelagic and/or northern species and their presence within the Project Area are unlikely. The West Indian manatee, listed as endangered, has been sighted in Rhode Island waters; however, such events are extremely rare. ESA species are discussed in detail in Section 4.5.7.

The following sections provide additional information on the biology, habitat use, abundance, distribution, and the existing threats to the non-endangered or threatened marine mammals that are both common in Rhode Island waters and have the likelihood of occurring, at least seasonally, in the Project Area. These species include the minkie (*Balaenoptera acutorostrata*), harbor porpoise (*Phocoena phocoena*), short-beaked common dolphin (*Delphinus delphis*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), harbor seals (*Phoca vitulina*), and gray seals (*Halichoerus grypus*). In general, the remaining non-ESA whale species listed in Table 4.5-6 range outside the BIWF and BITS Project Area, usually in more pelagic waters, or are so rarely sighted that their presence in the Project Area is unlikely. Because the potential presence of these species in the Project Area is extremely low, they will not be considered further in this analysis.

**Table 4.5-6 Summary of Marine Mammals Occurrences and Likelihood within Proposed Project Locations**

Species	Status	Seasonality	Likelihood in Project Area
<b>Baleen Whales (Mysticeti)</b>			
North Atlantic Right Whale	Endangered	Spring and Fall	Most likely Spring and Fall (BIWF)
Humpback Whale	Endangered	Year Round	Most likely Spring and Summer (BIWF)
Fin Whale	Endangered	Year Round	Most likely Fall and Winter (BIWF), Spring and Summer (BIWF and BITS)
Blue Whale	Endangered	Incidental	Unlikely
Sei Whale	Endangered	Incidental	Unlikely
Common Minkie Whale	Non-Strategic	Year Round	Spring (BIWF and BITS) and Summer (BIWF) Offshore
<b>Toothed Whales (Odontoceti)</b>			
Sperm Whale	Endangered	Summer - Occasional	Unlikely
Pygmy Sperm Whale	Strategic <sup>al</sup>	Unknown	Unlikely
Dwarf Sperm Whale	Non-Strategic	Unknown	Unlikely
Cuvier's Beaked Whale	Strategic	Year Round - Incidental	Unlikely
Blainville's Beaked Whale	Strategic	Year Round - Incidental	Unlikely
Gervais' Beaked Whale	Strategic	Year Round - Incidental	Unlikely
Sowerby's Beaked Whale	Strategic	Year Round - Incidental	Unlikely
True's Beaked Whale	Strategic	Year Round - Incidental	Unlikely
Bryde's Whale	Non-Strategic	Incidental	Unlikely
Northern Bottle Whale	Non-Strategic	Incidental	Unlikely
Beluga	Non-Strategic	Incidental	Unlikely
Short-finned Pilot Whale	Non-Strategic	Spring - Incidental	Unlikely



**Table 4.5-6 Summary of Marine Mammals Occurrences and Likelihood within Proposed Project Locations (continued)**

Species	Status	Seasonality	Likelihood in Project Area
Long-finned Pilot Whale	Non-Strategic	Spring - Incidental	Unlikely
Killer Whale	Non-Strategic	Incidental	Unlikely
False Killer Whale	Non-Strategic	Incidental	Unlikely
Harbor Porpoise	Strategic	Year Round	Spring, Summer and Fall (BIWF and BITS)
Atlantic White Sided Dolphin	Non-Strategic	Fall and Winter	Winter (BIWF and BITS), Spring and Fall (BIWF)
Short Beaked Common Dolphin	Non-Strategic	Year Round	Most likely Winter and Spring (BIWF and BITS), Summer and Fall (BIWF)
Risso's Dolphin	Non-Strategic	Year Round	Unlikely
Common Bottlenose Dolphin	Coastal stock is strategic	Winter, Spring and Summer	Unlikely
Striped Dolphin	Non-Strategic	Year Round	Unlikely
White Beaked Dolphin	Non-Strategic	Year Round	Unlikely
Atlantic Spotted Dolphin	Non-Strategic	Incidental	Unlikely
Pan-tropical Spotted Dolphin	Non-Strategic	Incidental	Unlikely
<b>Earless Seals (Phocidae)</b>			
Harbor Seal	Non-Strategic	Winter, Spring and Summer	Fall, Winter, and Spring (BIWF and BITS)
Grey Seal	Non-Strategic	Winter, Spring and Summer	Winter, Spring and Summer (BIWF)
Harp Seal	Non-Strategic	Winter, Spring	Unlikely
Hooded Seal	Non-Strategic	Summer, Fall	Unlikely
Ringed Seal	Non-Strategic	Incidental	Unlikely
<b>Order Sirenia</b>			
West Indian Manatee	Endangered	Summer - Unlikely	Unlikely
<sup>a/</sup> A strategic stock is defined as any marine mammal stock: 1) for which the level of direct human-caused mortality exceeds the potential biological removal level; 2) which is declining and likely to be listed as threatened under the ESA; or 3) which is listed as threatened or endangered under the ESA or as depleted under the MMPA ( <a href="http://www.ncseonline.org/nle/crsreports/biodiversity/biodv-11.cfm">http://www.ncseonline.org/nle/crsreports/biodiversity/biodv-11.cfm</a> ). Source: Warring et al 2010; RI SAMP 2010; Kenney and Vigness-Raposa 2009			

### Common Minke Whale

Minke whales are among the most widely distributed of all the baleen whales. They occur in the North Atlantic and North Pacific, from tropical to polar waters. Common minke whales range between 20 ft and 30 ft (6 m and 9 m) long (with maximum lengths of 30 ft to 33 ft [9 m to 10 m]) and are the smallest of the North Atlantic baleen whales (Jefferson et al. 1993; Wynne and Schwartz 1999; Kenney and Vigness-Raposa 2009). The primary prey species for minke whales are most likely sand lance, clupeids, gadoids, and mackerel (Kenney and Vigness-Raposa 2009). Minke whales are almost absent from OCS waters off the western Atlantic in winter; however, they are common in the fall and abundant in spring and summer (CeTAP 1982; Kenney and Vigness-Raposa 2009). The most recent estimate for a subpopulation of minke whales occurring between the Gulf of Maine to the Gulf of St. Lawrence is 3,312 (Waring et al. 2010). Minke whales have been observed in Rhode Island waters during all four seasons. The relative abundance models created by Kenney and Vigness-Raposa (2009) predicted that minke whales would be common in Rhode Island coastal waters between spring and summer, but not during fall or winter. Some documented sightings occurred within the Rhode Island waters in the fall; however, they were not observed during recent surveys conducted in support of the RI Ocean SAMP (Kenney and Vigness-Raposa 2009).

As is typical of the baleen whales, minke whales are usually seen either alone or in small groups, although large aggregations sometimes occur in feeding areas (Reeves et al. 2002). Minke populations are often segregated by sex, age, or reproductive condition. Known for their curiosity, minke whales often approach boats.

Minke whales are impacted by ship strikes and bycatch from bottom trawls, lobster trap/pot, gillnet, and purse seine fisheries. From 2003 to 2007, the minimum annual rate of mortality for the North Atlantic stock from anthropogenic causes was approximately 2.4 per year (Waring et al. 2010). In addition, hunting for Minke whales continues today, by Norway in the northeastern North Atlantic and by Japan in the North Pacific and Antarctic (Reeves et al. 2002). International trade in the species is currently banned. Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NOAA Fisheries considers this species as “non-strategic” (Waring et al. 2010).

### Harbor Porpoise

The harbor porpoise is likely to occur frequently in Rhode Island waters (Kenney and Vigness-Raposa 2009). Porpoise can occur within all seasons, but are most likely to reach their highest densities in spring when migration brings them toward the Gulf of Maine feeding grounds from their wintering areas offshore and in the mid-Atlantic. Kenney and Vigness-Raposa (2009) report that harbor porpoises are among the most abundant cetaceans in Rhode Island coastal waters. Harbor porpoises are the smallest North Atlantic cetacean, measuring at only 4.6 ft to 6.2 ft (1.4 m to 1.9 m), and feed primarily on fish, but also prey on squid and crustaceans (Reeves and Read 2003; Kenney and Vigness-Raposa 2009). Sighting records from the 1978 to 1981 CeTAP surveys showed porpoises in spring exhibited highest densities in the southwestern Gulf of Maine in proximity to the Nantucket Shoals and western Georges Bank, with presence throughout the southern New England shelf and Gulf of Maine (CeTAP 1982). While strandings have occurred throughout the south shore of Long Island and coastal Rhode Island, many sightings have occurred offshore in the OCS area (Kenney and Vigness-Raposa 2009). The North Atlantic harbor porpoise population is likely to be over 500,000 (Kenney and Vigness-Raposa 2009). The current population estimate for harbor porpoise in the Gulf of Maine/Bay of Fundy is 89,054 (Waring et al. 2007; Kenney and Vigness-Raposa 2009).

The most common threat to the harbor porpoise is from incidental mortality from fishing activities, especially from bottom-set gillnets. It has been demonstrated that the porpoise echolocation system is capable of detecting net fibers, but they must not have the “system activated” or else they fail to recognize the nets (Reeves et al. 2002). Roughly 365 harbor porpoises are killed by human-related activities in U.S. and Canadian waters each year. In 1999, a Take Reduction Plan to reduce harbor porpoise bycatch in U.S. Atlantic gillnets was implemented. The plan that pertains to the Gulf of Maine focuses on sink gillnets and other gillnets that can catch groundfish in New England waters. The ruling implements time and area closures, some of which are complete closures, as well as requiring pingers on multispecies gillnets. In 2001, the harbor porpoise was removed from the candidate species list for the ESA; a review of the biological status of the stock indicated that a classification of “Threatened” was not warranted (Waring et al. 2009). However, this species has been listed as “strategic” because average annual human-related mortality and injury exceeds the potential biological removal (Waring et al. 2010).

### Atlantic White-sided Dolphin

The Atlantic white-sided dolphin can be found in cold temperate to subpolar waters in the North Atlantic within deep OCS and slope waters (Jefferson et al. 2008). In the western North Atlantic, this species

occurs from Labrador and southern Greenland to the coast of Virginia (Jefferson et al. 2008). They are the most abundant dolphin in the Gulf of Maine and the Gulf of St. Lawrence, but seem relatively rare along the North Atlantic coast of Nova Scotia (Kenney and Vigness-Raposa 2009). Atlantic white-sided dolphins range between 8.2 ft to 9.2 ft (2.5 and 2.8 m) in length, with females being approximately 20 cm shorter than males (Kenney and Vigness-Raposa 2009). This species is highly social and is commonly seen feeding with fin whales. White-sided dolphins feed on a variety of small species, such as herring, hake, smelt, capelin, cod, and squid, with regional and seasonal changes in the species consumed (Kenney and Vigness-Raposa 2009). Sand lance is an important prey species for these dolphins in the Gulf of Maine during the spring. Other fish prey include mackerel, silver hake, herring, smelt, and several other varieties of gadoids (Kenney and Vigness-Raposa 2009). There are seasonal shifts in the distribution of Atlantic white-sided dolphins off the northeastern U.S. coast, with low abundance in winter between Georges Basin and Jeffrey's Ledge and very high abundance in the Gulf of Maine during spring. During the summer, Atlantic white-sided dolphins are most abundant between Cape Cod and the lower Bay of Fundy. During the fall, the distribution of Atlantic white-sided dolphins is similar to that in the summer, although they are less abundant (DoN 2005). A recent population estimate for Atlantic white-sided dolphins off the U.S. east coast places this species at 63,368 individuals (Waring et al. 2010). Seasonal abundances off the northeast U.S. in spring through fall are 38,000 to 42,000 animals (CeTAP 1982; Kenney and Vigness-Raposa 2009). This species can be found in Rhode Island waters during all seasons of the year, but is usually most numerous in areas farther offshore at depth range of 330 ft (100 m) (Kenney and Vigness-Raposa 2009; Bulloch 1993; Reeves et al. 2002). There have, however, been several unconfirmed reports of this species occurring in Narragansett Bay, usually between fall and winter (Kenney and Vigness-Raposa 2009).

The biggest human-induced threat to the Atlantic white-sided dolphin is bycatch, because they are occasionally caught in fishing gillnets and trawling equipment. An estimated average of 266 dolphins were killed each year by fishery-related activities in U.S. waters during 2004 to 2008 (Waring et al. 2010). Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NOAA Fisheries considers this species as "non-strategic" (Waring et al. 2010).

#### Short-Beaked Dolphin

The short-beaked dolphin is one of the most widely distributed cetaceans and occurs in temperate, tropical, and subtropical regions (Jefferson et al. 2008). Short-beaked dolphins feed on squids and small fish, including species that school in proximity to surface waters as well as mesopelagic species found near the surface at night (IUCN 2010; NatureServe 2010). This species is found between Cape Hatteras and Georges Bank from mid-January to May, although they migrate onto Georges Bank and the Scotian Shelf between mid-summer and fall, where large aggregations occur on Georges Bank in fall (Waring et al. 2007). While this dolphin species can occupy a variety of habitats, short-beaked common dolphins occur in greatest abundance within a broad band of the northeast edge of Georges Bank in the fall (Kenney and Vigness-Raposa 2009). According to the species stock report, the best population estimate for the western North Atlantic common dolphin is approximately 120,743 individuals (Waring et al. 2009). This species is the second most common cetacean in Rhode Island waters, and is known to occur during all four seasons (Kenney and Vigness-Raposa 2009).

The short-beaked common dolphin is also subject to bycatch. It has been caught in gillnets, pelagic trawls, and during longline fishery activities. During 2004 to 2008, it was estimated that on average approximately 167 dolphins were killed each year by human activities (Waring et al. 2010). This species

is also the most common dolphin species to be stranded on the Rhode Island Coast (Kenney and Vigness-Raposa 2009). Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NOAA Fisheries considers this species as “non-strategic” (Waring et al. 2009; 2010).

### Harbor Seal

Harbor seals are the most abundant seals in eastern United States waters and are commonly found in all nearshore waters of the Atlantic Ocean and adjoining seas above northern Florida; however, their “normal” range is probably only south to New Jersey. While harbor seals occur year-round north of Cape Cod, they only occur during winter migration south of Cape Cod (Rhode Island to New Jersey) (Waring et al. 2007; Kenney and Vigness-Raposa 2009). During the summer, most harbor seals can be found north of New York, within the coastal waters of central and northern Maine, as well as the Bay of Fundy (DoN 2005). Harbor seals are relatively small pinnipeds, with adults ranging between 5.6 ft and 6.2 ft (1.7 and 1.9 m) in length, with females being slightly smaller than males (Jefferson et al. 1993; Wynne and Schwartz 1999; Kenney and Vigness-Raposa 2009). Harbor seals prey upon small to medium-sized fish, followed by octopus and squid, and lastly by shrimp and crabs (Kenney and Vigness-Raposa 2009). Fish eaten by harbor seals include commercially important species such as mackerel, herring, cod, hake, smelt, shad, sardines, anchovy, capelin, salmon, rockfish, sculpins, sand lance, trout, and flounders (Kenney and Vigness-Raposa 2009). Harbor seals are the only marine mammal that reside in Rhode Island waters, including Block Island and Narragansett Bay. Harbor seals are common in all seasons except during the fall, and are known to be found on haul-out sites in proximity to Block Island (Kenney and Vigness-Raposa 2009). The most important haul-out site is on the edge of New Harbor, approximately 9 mi (14.5 km) from the proposed BIWF Project.

Historically, these seals have been hunted for several hundred to several thousand years. Harbor seals are still killed legally in Canada, Norway, and the United Kingdom to protect fish farms or local fisheries (Reeves et al. 2002). From 2003 to 2007, the average rate of mortality for the Western North Atlantic harbor seal stock from anthropogenic causes was approximately 467 per year (Waring et al. 2010). Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NOAA Fisheries considers this species as “non-strategic” (Waring et al. 2010).

### Gray Seal

The gray seal occurs in cold temperate to sub-arctic waters in the North Atlantic, and is partitioned into three major populations occurring in eastern Canada, northwestern Europe, and the Baltic Sea (Jefferson et al. 2008; Kenney and Vigness-Raposa 2009). The western North Atlantic stock is considered to be the same population as the one found in eastern Canada, and ranges between New England and Labrador (Waring et al. 2007). As exhibited in harbor seal populations, gray seals occur most often in the waters off of Maine during winter and spring, and spend summer and fall off northern Maine and in Canadian waters (DoN 2005). Gray seals exhibit sexual dimorphism, with adult males reaching 7.5 ft (2.3 m) long and females reaching 6.6 ft (2.0 m) (Jefferson et al. 1993; Wynne and Schwartz 1999; Kenney and Vigness-Raposa 2009). Gray seals feed on numerous fish species and cephalopods (Kenney and Vigness-Raposa 2009). Gray seal scat samples from Muskeget Island, Massachusetts, included species such as sand lance, skates, flounder, silver hake, and gadids (Kenney and Vigness-Raposa 2009). The gray seal is primarily found in coastal waters and forages in OCS regions (Lesage and Hammill 2001). The gray seal colony of Massachusetts has more than 5,600 seals total and there are more than 1,700 individuals in Maine (Waring et al. 2007). This species has been reported with greater frequency in Rhode Island waters in

recent years, likely due to a population rebound in southern New England and the mid-Atlantic (Kenney and Vigness-Raposa 2009); however, most gray seals present are juveniles dispersing in the spring. The only consistent haul-out locations within the vicinity of Rhode Island are along the sandy shoals around Monomoy and Nantucket in Massachusetts (Kenney and Vigness-Raposa 2009). According to Kenney and Vigness-Raposa (2009), gray seal occurrence is low in the Rhode Island waters; however, as stated previously, the population for this species has been increasing, therefore increasing the potential for interaction with these species in the Project Area.

The biggest threats to gray seals are entanglements in gillnets or plastic debris (Waring et al. 2004). The total estimated human-caused mortality from 2003 to 2007 to gray seals was approximately 1,160 per year (Waring et al. 2010). Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NOAA Fisheries considers this species as “non-strategic” (Waring et al. 2010).

### Sea Turtles

There are five reported species of sea turtles (leatherback [*Dermochelys coriacea*], loggerhead [*Caretta caretta*], Kemp’s ridley [*Lepidochelys kempii*], green [*Chelonia mydas*], and hawksbill turtle [*Eretmochelys imbricata*]) that are known to be present, or have the potential to be present, in the waters of Rhode Island (Kenney and Vigness-Raposa 2009). Of these, the leatherback and loggerhead sea turtles are considered common, the Kemp’s ridley sea turtle is considered regular, and the green sea turtle is considered rare within the RI Ocean SAMP (Kenney and Vigness-Raposa 2009). However, the leatherback is found in deeper, offshore waters and only juveniles for both the Kemp’s ridley and green sea turtles range into Rhode Island waters, preferring deep ocean environments (Kenney and Vigness-Raposa 2009). The hawksbill turtle prefers warmer temperate waters and rarely ventures into higher latitudes. This species can generally be found in tropical, shallow coastal waters and is unlikely to occur in the Project Area. All five of the sea turtle species listed as either threatened or endangered under the ESA are discussed in detail in Section 4.5.7.

#### 4.5.4.2 Potential Impacts and Proposed Mitigation

Construction, operation, and decommissioning activities associated with the BIWF and BITS Project have the potential to impact marine mammals and sea turtles through reductions in prey availability, loss of habitat, entanglement, acoustic harassment, vessel strike, and degradation water quality from fuel spills and marine debris. Reductions in prey species availability to marine mammal and sea turtles are, however, unlikely. As demonstrated in Sections 4.5.1 and 4.5.2 impacts on benthic and finfish resources from substrate disturbance, and increased TSS will be localized and short-term resulting in no significant impacts on marine species that would be targeted for consumption by whales and/or turtles. Impacts from loss of habitat will also be negligible, and will only be associated with the presence of the five WTGs (a combined area of 0.35 acre [0.15 hectare]). Entanglement is also highly unlikely because the only lines deployed in support of the Project will be associated with the marine vessel anchor cables and jet-plow towing cable. Steel anchor cables used on the construction barges are typically 2 in to 3 in (5 cm to 7 cm) in diameter and typically under significant tension while deployed, thereby eliminating the potential for entanglement. Similarly, the jet-plow cable will be under constant tension, and in this taut condition will not represent an entanglement risk.

Noise, increased vessel activity, and water quality degradation from accidental fuel spill or releases of marine trash/debris from Project construction, operation, and decommission activities do have the

potential to affect both marine mammals and sea turtles. These are addressed separately in the following sections.

## **BIWF**

### Noise

As stated previously, most marine animals can perceive underwater sounds over a broad range of frequencies from about 10 hertz (Hz) to more than 10,000 Hz (10 kilohertz [kHz]). Many of the dolphins and porpoises use even higher frequency sound for echolocation and perceive these high frequency sounds with high acuity. Marine mammals respond to low-frequency sounds with broadband intensities of more than about 120 decibel (dB) re 1 *micropascal* ( $\mu\text{Pa}$ ), or about 10 dB to 20 dB above natural ambient noise at the same frequencies (Richardson et al. 1991).

Sound is important to marine mammals for communication, individual recognition, predator avoidance, prey capture, orientation, navigation, mate selection, and mother-offspring bonding. Potential effects of anthropogenic sounds to marine mammals can include physical injury (e.g., temporary or permanent loss of hearing sensitivity), behavioral modification (e.g., changes in foraging or habitat-use patterns), and masking (the prevention of marine mammals from hearing important sounds).

The MMPA defines any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild as Level A harassment (NOAA 2005; GPO 2005). Any act that has the potential to disturb marine mammals or their stock in the wild by causing disruption of behavioral patterns including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering is referred to as Level B harassment (NOAA 2005; GPO 2005). For underwater noise, NOAA defines the zone of injury as the range of received levels from 180 linear decibels (dBL) referenced to 1  $\mu\text{Pa}$  root mean square (RMS) (180 dBL re 1 $\mu\text{Pa}$ ) for all marine mammals. For Level B harassment, the threshold is defined as 160 dBL re 1 $\mu\text{Pa}$  for impulsive sound and 120 dBL re 1 $\mu\text{Pa}$  for continuous sound for all marine mammals. It is important to note that actual perceptibility of underwater sound is dependent on the hearing thresholds of the species under consideration and the inherent masking effects of ambient sound levels. The criterion established by NOAA does not consider species-specific hearing capabilities and is therefore very conservative.

NOAA has further established regulatory criteria to protect marine mammals from both temporary and/or permanent hearing loss. A temporary or reversible elevation in hearing threshold is termed a temporary threshold shift (TTS), while a permanent or unrecoverable reduction in hearing sensitivity is termed a permanent threshold shift (PTS) (NOAA 2006). NOAA (2006) has established a TTS of 195 dB re 1 micropascal-squared seconds ( $\mu\text{Pa}^2\text{-s}$ ) and a PTS of 215 dB 1  $\mu\text{Pa}^2\text{-s}$  for all marine mammals based on the additional noise (dB) above TTS required to induce PTS in experiments with terrestrial mammals.

Project activities that have the potential to cause Level A and/or Level B harassment as defined by the MMPA include impact pile-driving of the WTG foundations, vibratory pile-driving of the temporary cofferdams, if required, and the noise associated with the intermittent use of DP vessel thrusters at full thrust. Deepwater Wind conducted a detailed underwater acoustic modeling assessment to better understand both the level and extent of underwater noise generated by Project activities and their potential to impact marine species. Table 4.5-7 summarizes the result of the analysis as they relate to the NOAA threshold criteria. Additional information regarding the underwater noise analysis can be found in Section 4.6.2. The complete Underwater Acoustic Assessment Report is included as Appendix N.

**Table 4.5-7 Maximum Distances to MMPA Thresholds from BIWF and BITS Project Construction Activities**

Source	Distance to 180 dBL MMPA Threshold (m)	Distance to 160 dBL MMPA Threshold (m)	Distance to 120 dBL MMPA Threshold (m)
Impact Pile-Driving (Hammer Energy = 600 KJ) <sup>a/</sup>	400	5,100	> 40,000
Impact Pile-Driving (Hammer Energy = 200 KJ) <sup>b/</sup>	60	3,100	34,300
DP Vessel Maneuvering (Water Depth = 10 m)	< 50	-	8,500
DP Vessel Maneuvering (Water Depth = 20 m)	< 50	-	9,000
DP Vessel Maneuvering (Water Depth = 40 m)	< 50	-	9,000
Vibratory Pile-Driving (Block Island)	-	< 200	8,400
Vibratory Pile-Driving (Narragansett)	-	< 200	7,600

<sup>a/</sup> Will be used only to drive piles to final penetration depth.  
<sup>b/</sup> Primary hammer for foundation pile installation.

The results of the underwater acoustic modeling as depicted in Table 4.5-7 are consistent with similar offshore construction activities. As evidenced in Table 4.5-7, none of the proposed Project construction activities will result in TTS or PTS and sound levels associated with Level A harassment will only occur very close to the source (no more than 400 m for impact pile-driving). However, given the very short duration of impact pile-driving (approximately 2 days per WTG foundation) and the fact that the largest proposed hammer will only be employed as needed to achieve final foundation penetration depth, it is unlikely that pile-driving will result in injury to marine mammals occurring in the Project Area at the time of construction. Project activities could, however, result in temporary Level B harassment of marine mammals during impact pile-driving, vibratory pile-driving, and during the use of DP thrusters during cable installation. Deepwater Wind will obtain all necessary permits from NOAA to address impacts on marine mammals from Level B harassment and to establish appropriate mitigation measures. Deepwater Wind has committed to the following measures, which have been successfully implemented during similar offshore construction activities, to minimize impacts on marine mammals to the maximum extent possible:

- **Establishment of Safety and Exclusion Zones** – Safety zones (defined as the Level A harassment zone of influence [ZOI] out to the 180 dB isopleth) and exclusion zones (defined as the Level B harassment ZOI out to the 120 dB and 160 dB isopleths for continuous and impulse noise, respectively) will be established to minimize impacts to marine mammals and sea turtles for each of the following construction methods:
  - *Impact Pile Driving of WTG Foundations* – A preliminary 500-m radius (0.27-nm radius) safety zone for marine mammals and sea turtles will be established around each WTG foundation. In addition, an exclusion zone will be established and monitored during impact pile driving out to the maximum radial distance determined for Level B harassment associated with impulse noise (approximately 5.2 km [2.8 nm]).
  - *Vibratory Pile Driving of Cofferdams* – Cofferdam construction, if required, will not produce sound levels at 180 dB at any appreciable distance. Therefore, injury to marine mammals and sea turtles is not expected and no Level A harassment safety zone is proposed. However, an exclusion zone will be established and monitored during vibratory pile driving out to the maximum radial distance determined for Level B harassment associated with impulse noise (approximately 200 m [0.1 nm]).

- *DP Vessel Operations* – A preliminary 50-m (approximately 0.03-nm) radius safety zone for marine mammals and sea turtles will be established around the DP vessel during cable installation. In addition, an exclusion zone will be established and monitored during DP vessel use out to the maximum radial distance determined for Level B harassment associated with continues noise (approximately 9 km [4,9 nm]).
- **Field Verification of Safety and Exclusion Zones** – Field verification of the preliminary safety and exclusion zones will be conducted for each of the following construction methods:
  - *Impact Pile Driving of WTG Foundations* – Field verification of the preliminary 500-m radius (0.27-nm radius) safety zone and 5.2 km (2.8 nm) exclusion zone for impact pile driving will be conducted during the first day of impact pile driving. Acoustic measurements will include the driving of the last half (deepest pile segment) for any given open-water pile and will include measurements from two reference locations at two water depths (a depth at mid-water and a depth at approximately 1 m above the seafloor). If the field measurements determine that the actual Level A and Level B harassment ZOIs are less than or extend beyond the proposed safety zone and exclusion zone radii, a new zone(s) will be established accordingly. Implementation of the revised zone(s) will however be contingent upon agency review and approval.
  - *Vibratory Pile Driving of Cofferdams* – Should cofferdams be required, field verification of the preliminary 200-m (0.1 nm) exclusion zone and the any modification to the zone will be performed as described for impact pile driving.
  - *DP Vessel Operations* – Field verification of the preliminary 50-m (approximately 0.03-nm) radius safety zone and 9 km (4.9 nm) exclusion zone associated with DP vessel use during cable installation will be performed during the first full day of DP vessel operation using acoustic measurements from two reference locations at two water depths (a depth at mid-water and a depth at approximately 1 m above the seafloor). As necessary, new zone(s) will be modified and implemented as described for impact pile driving.
- **Protected Species Observers** – Visual monitoring of the established safety zones and exclusion zones established for impact pile driving of WTG foundations, vibratory pile driving of cofferdams (if require), and DP vessel operation during cable installation will performed by qualified and NOAA Fisheries approved protected species observers (PSO). It is anticipated a minimum of two PSOs will be stationed aboard each noise producing construction support vessel (e.g., derrick barge, jack-up barge, and cable lay vessel). In addition, given the distance of the exclusion zone associated with the impact pile driving and DP thruster use, at least two additional PSOs will be stationed aboard an observation vessel dedicated to patrolling the exclusion zone. Alternatively, monitoring of the exclusion zones for impact pile driving and DP thruster use could be performed via aerial observation. Each PSO will monitor 360 degrees of the field of vision. The PSOs will begin monitoring the exclusion zone at least 30 minutes prior to soft start of noise-producing activities (impact pile driving, vibratory pile driving and DP thruster use during cable installation). Use of noise-producing equipment will not begin until the associated exclusion zone is clear of all marine mammals and sea turtles for at least 30 minutes. Monitoring of both the exclusion zones and the safety zones will continue throughout the construction activity and end approximately 30 minutes after use of noise-producing equipment is completed.



Data on all observations will be recorded based on standard PSO collection requirements. This will include dates and locations of construction operations; time of observation, location and weather; details of marine mammal and sea turtle sightings (e.g., species, age classification [if known], numbers, behavior); and details of any observed “taking” (behavioral disturbances or injury/mortality). In addition, prior to initiation of construction work, all crew members on barges, tugs and support vessels, will undergo environmental training, a component of which will focus on the procedures for sighting and protection of marine mammals and sea turtles.

- **Ramp-up/Soft-Start Procedures** – A ramp-up or soft-start will be used at the beginning of each pile segment during impact pile driving and vibratory pile driving in order to provide additional protection to marine mammals and sea turtles near the Project Area by allowing them to vacate the area prior to the commencement of pile-driving activities. The soft-start requires an initial set of 3 strikes from the impact and/or vibratory hammer at 40 percent energy with a one minute waiting period between subsequent 3-strike sets. The procedure will be repeated two additional times. If marine mammals are sighted within the impact pile driving or vibratory pile driving exclusion zones prior to or during the soft-start, activities will be delayed until the animal(s) has moved outside the exclusion zone and no marine mammals or sea turtles are sighted for a period of 30 minutes.
- **Shut-down Procedures** – The exclusion zone around the noise-producing activities (impact pile driving, vibratory pile driving and DP thruster use during cable installation) will be monitored, as previously described, by PSOs for the presence of marine mammals and sea turtles before, during and after any noise-producing activity. If the exclusion zone is obscured by fog or poor lighting conditions, impact and vibratory pile driving will not be initiated until the entire exclusion zone is visible for a 30-minute period. In addition, noise-producing activities will not be started when the exclusion zone cannot be adequately monitored (i.e., obscured by fog, inclement weather, poor lighting conditions). If a soft start has been initiated before the onset of inclement weather, the noise-producing activities may continue through these periods if deemed necessary to ensure the safety and integrity of the Project. PSOs will work in coordination with the Project’s on-site construction manager (or other authorized individual) to stop or delay any construction activity, if deemed necessary. The following outlines the shut-down for each of the construction activities, unless a situation arises where ceasing the activity would compromise safety (both human health and environmental) and/or the integrity of the Project:
  - *Impact Pile Driving of WTG Foundations* – For impact pile driving, from an engineering standpoint, any significant stoppage of driving progress will allow time for displaced sediments along the piling surface areas to consolidate and bind. Attempts to restart the driving of a stopped piling may be unsuccessful and create a situation where a piling is permanently bound in a partially driven position. It is expected that while conducting impact pile driving operations, any marine mammals in the area will move away from the sound source. However, in the event that a marine mammal is observed within or approaching the exclusion zone during impact pile driving operations, PSOs will immediately report the sighting to the on-site construction manager (or other authorized individual). Upon this notification, Deepwater Wind proposes that the hammer energy will be reduced by 50 percent to a “soft start” level. This reduction in hammer energy will effectively reduce both the size of the safety and exclusion zones and the potential for exposure of marine mammals and sea turtles to sound energy. By maintaining impact

pile driving at a reduced energy level, momentum in piling penetration can be maintained minimizing risk to both Project integrity and to marine mammals and sea turtles.

After decreasing impact pile driving energy, PSOs will continue to monitor marine mammal and/or sea turtle behavior and determine if the animal(s) is moving towards or away from the safety zone. If the animal(s) continues to move towards the sound source then impact piling operations will be halted prior to the animal entering the safety zone. Ramp-up procedures for impact pile driving may be initiated when PSOs report that the exclusion zone has remained clear of marine mammals and/or sea turtles for a minimum of 30 minutes since last the sighting.

- *Vibratory Pile Driving of Cofferdams* – Cofferdam construction, if required, will not produce sound levels at 180 dB at any appreciable distance therefore no safety zone for this activity has been established. However, as with impact pile driving, if marine mammals enter or approach the 200-m exclusion zone for vibratory pile driving, Deepwater Wind proposes to reduce vibratory hammer power to 50 percent. As stated previously, reducing hammer energy will effectively reduce the size of the exclusion zone and the potential for exposure of marine mammals and sea turtles to sound energy. By maintaining vibratory pile driving at a reduced energy level, momentum in piling penetration can be maintained minimizing risk to both Project integrity and to marine mammals and sea turtles.

After decreasing vibratory pile driving energy, PSOs will continue to monitor marine mammal and/or sea turtle behavior and determine if the animal(s) is moving towards or away from the safety zone. If the animal(s) continues to move towards the sound source then vibratory piling operations will be halted prior to the animal entering the safety zone. Ramp-up procedures for vibratory pile driving may be initiated when PSOs report that the exclusion zone has remained clear of marine mammals and/or sea turtles for a minimum of 30 minutes since the last sighting.

- *DP Vessel Operations* – During cable installation a constant tension must be maintained to ensure the integrity of the cable. Any significant stoppage in vessel maneuverability during jet plow activities has the potential to result in significant damage to the cable. Therefore, during DP vessel operations if marine mammals enter or approach the established exclusion zone, Deepwater Wind proposes to reduce DP thruster power to 50 percent, except under extraordinary circumstances when ceasing DP thruster use would compromise safety (both human health and environmental) and/or the integrity of the Project. As stated previously, reducing thruster energy will effectively reduce both the size of the safety and exclusion zones and the potential for exposure of marine mammals and sea turtles to sound energy. Full power thruster may resume when PSOs report that the exclusion zone has remained clear of marine mammals and/or sea turtles for a minimum of 30 minutes since last the sighting.
- **Time of Day Restrictions** – Impact pile driving for jacket foundation installation and vibratory pile driving cofferdams (if necessary) will occur during daylight hours starting approximately 30 minutes after dawn and ending 30 minutes prior to dusk unless a situation arises where ceasing the pile driving activity would compromise safety (both human health and environmental) and/or the integrity of the Project. If a soft-start has been initiated before dark or prior to the onset of inclement weather (e.g., fog, severe rain events), the pile driving of that segment may be

completed. No new pile driving activities will be initiated until 30 minutes after dawn or after the inclement weather has passed. Cable installation will be conducted 24 hours per day. Night vision equipment will be used by PSOs to monitor the DP thruster safety zone and exclusion zone.

- **Reporting** – Deepwater Wind will report as required to jurisdictional/interested agencies including but not limited to the USACE, NOAA Fisheries, and BOEM to provide notification of commencement and completion of construction activities, after any re-establishment of safety and/or exclusion zones, any observed significant behavioral reactions by marine mammals or sea turtles (e.g., fleeing the area) or injury or mortality to any marine mammals or sea turtles, and provide a final technical report after completion of the construction activities.

Given the proposed mitigation measures and the proposed short duration of construction activities, impacts on marine mammals from Level B harassment are expected to be short-term and minor.

Operation and decommissioning of the BIWF, as further discussed in Section 4.6.2 and Appendix N, are unlikely to cause acoustic impacts on marine mammals unless DP vessels are employed. Acoustic modeling of underwater sound has not been completed for the operational condition as there are currently no representative data to refer in estimating source levels for similar 6 MW WTGs with jacket foundations. However, measurements completed of other smaller-scale offshore wind farms indicate that the distance to the 120 dB threshold from a single turbine is approximately 328 ft to 656 ft (100 m to 200 m), (Nedwell 2007). Based on these results it is evident that underwater noise levels from the BIWF are too low to cause injury in marine mammals. Deepwater Wind will monitor and observe underwater noise during a 1-week real-time monitoring period to collect data on the full range of WTG operational conditions. Should DP vessels be used during either operation or decommissioning, Deepwater Wind will follow, as appropriate, the marine mammal avoidance and mitigation procedures employed during construction.

#### Vessel Collision

Construction of the BIWF will require the support of up to 14 types of vessels throughout various stages of construction (see Section 3.3.4.2 and Table 3.3-3 for additional information). Studies have reported a change in the distribution and behavior of marine mammals in areas with increased vessel traffic, namely associated with whale-watching activities and likely due to increases in ambient noise from concentrated vessel activity (Erbe 2002; Jelinski et al. 2002; Nowacek 2004). Therefore, it is reasonable to assume that increased vessel activity associated with Project construction could result in avoidance of the area by marine mammals. This could prove beneficial for these species because they are less likely to be struck by oncoming vessels if they are not within the areas of Project construction activity.

Vessel collisions are more of a threat to baleen whales than any other marine species (Wiley et al. 1995). Research indicates that most vessel collisions with whales resulting in serious injury or death occur when a ship is traveling over speeds of 14 knots (Laist et al. 2001). Ship speed, which seems to be the greatest factor in vessel collisions, is likely to be low during construction activities, except for the smaller crew/supply boats that can travel at speeds up to 15 knots. Thus, considering most whale species will easily be able to maneuver around the vessels being used for construction of the Project, and their habit of avoiding areas with increased vessel traffic due to increased ambient noise, the likelihood of a collision is low. In addition, as discussed further in Section 4.5.7, the BIWF and portions of the Export Cable are located within the Right Whale Seasonal Migration Area, which restricts speeds during the months of November to April to 10 knots.

During construction and operation of the Project, Deepwater Wind will adhere to all necessary speed level restrictions and marine mammal activity in the Project Area and will be monitored to ensure that the chances for possible collisions are minimized. Environmental training of construction personnel will stress individual responsibility for marine mammal awareness and reporting. All personnel onboard construction vessels will receive training, a component of which will be training on marine mammal sighting and reporting. Sightings will be reported to the environmental inspector for a determination of the appropriate response.

The operation of the BIWF will require support and maintenance vessels. These vessels will adhere to the same vessel speed and strike avoidance procedures as employed during construction, thus minimizing the potential for interactions with marine mammals.

Decommissioning will likely require the support of a similar suite of vessels as described for construction. As with construction and operation, decommissioning vessels will adhere to the same vessel speed and strike avoidance procedures as employed during construction, thus minimizing the potential for interactions with marine mammals.

#### Fuel Spills and Marine Debris

Marine debris can physically harm marine mammals and other marine species through ingestion or entanglement. Accidental fuel spills and releases can also harm these species if ingested or inhaled.

Fuel or chemical spills, were they to occur, will be relatively small. If a fuel spill occurs, marine mammals will likely move away from the most concentrated areas, and the presence of the vessels involved in spill control and cleanup will discourage the presence of marine mammals. Deepwater Wind and its contractors will maintain individual SPCC Plans during construction. In addition, each member of the construction crew will be responsible for ensuring that debris is not discharged into the marine environment.

Impacts on marine mammals from fuel spills or marine debris during both operation and decommissioning are not likely. There will be small amounts of lubrication grease and oil within the WTG to support the operation of the WTG's bearing, pitch and hydraulic systems as well as the WTG transformer. Additionally, a transformer to step up the generator voltage will be located in a ventilated room in each nacelle. For cooling purposes, the transformer will be filled with mineral or comparable insulating oil that will be monitored for temperature, fluid level, and pressure. All operational support vessels would be required to maintain the same individual SPCC Plans and follow the same mitigation procedures as those required during construction.

### **BITS**

#### Noise

As evidenced in Table 4.5-7, none of the proposed Project construction activities will result in TTS, PTS, or Level A harassment. The only Project activities that could result in temporary Level B harassment of marine mammals are associated with the intermittent use of DP thrusters during cable installation. As stated previously, Deepwater Wind will obtain all necessary permits from NOAA Fisheries to address impacts on marine mammals from Level B harassment and to establish appropriate mitigation measures. Likewise, Deepwater Wind has committed to employ the same mitigation measures as described for the BIWF when vibratory pile driving is occurring or DP thrusters are being use, including:

- Establishment of Safety and Exclusion Zone

- Field Verification of Safety Exclusion Zone
- Protected Species Observers
- Ramp-up Procedures
- Shut-down Procedures
- Time of Day Restrictions (during cofferdam construction)
- Reporting

Cable installation will be conducted on a 24 hour per day basis. Night vision equipment will be used accordingly to monitor the DP thruster exclusion zone and safety zone, as described for PSO use. Given the proposed mitigation measures and the fact the DP vessels typically only operate thrusters intermittently and in short bursts, impacts on marine mammals are expected to be short-term and minor.

Operation and decommissioning of the BITS, as further discussed in Section 4.6.2 and Appendix N, is unlikely to cause acoustic impacts on marine mammals unless DP vessels are employed. Should DP vessels be used during either operation or decommissioning, Deepwater Wind will follow, as appropriate, the marine mammal avoidance and mitigation procedures employed during construction.

#### Vessel Collision

The environmental consequences of vessel collision associated with construction, operation, and decommissioning of the BITS will be the same as those described for the BIWF.

#### Fuel Spills and Marine Debris

The environmental consequences of the degradation of water quality from fuel spills and marine debris associated with construction, operation, and decommissioning of the BITS will be the same as those described for the BIWF.

#### **Combined Effects**

During construction, depending on the schedule of certain activities such as cable-lay, impact pile-driving, and vibratory pile-driving (if cofferdams are necessary), there may be the potential for combined impacts on marine mammals from underwater noise generated by both the BIWF and BITS throughout the duration of the 5-month offshore construction period. Noise generated by construction of both the BIWF and BITS will be short-term and temporary. Noise levels associated with construction activities will also not be continuous but will rather vary throughout the construction period based on equipment usage. Although construction will generate a high amount of intermittent noise, the noise will cease upon completion of construction; therefore, construction of the BIWF and BITS will have no long-term effects to marine mammals.

The operation of the BIWF will cause low-level noise from each WTG. The distance to the 120 dB threshold is estimated at 328 ft to 656 ft (100 m to 200 m) from a single turbine. Noise levels of operating WTGs are too low to cause injury in marine mammals. Deepwater Wind will monitor underwater noise during a 1-week real-time monitoring period to collect data on the full range of WTG operational conditions. No noise would be associated with the operation of BITS. The BIWF will require an ROV and/or diver-support vessel to conduct underwater inspections of WTGs and foundations. This vessel will adhere to the same vessel speed and strike avoidance procedures as employed during construction. The BITS will require no maintenance unless a fault or failure occurs.

For these reasons the combined effects of the construction, operation, and decommissioning will be minor but not significant.

#### 4.5.5 Terrestrial Habitat and Wildlife

This section discusses the terrestrial wildlife habitats and species within and surrounding the onshore portions of the Project Area. Birds, bats, and threatened and endangered species known to occur within the terrestrial portion of the Project Area on Block Island and the Rhode Island mainland, are discussed separately in Sections 4.5.6 and 4.5.7, respectively. Wetlands are addressed separately in Section 4.10.

##### 4.5.5.1 Affected Environment

###### Terrestrial Habitat

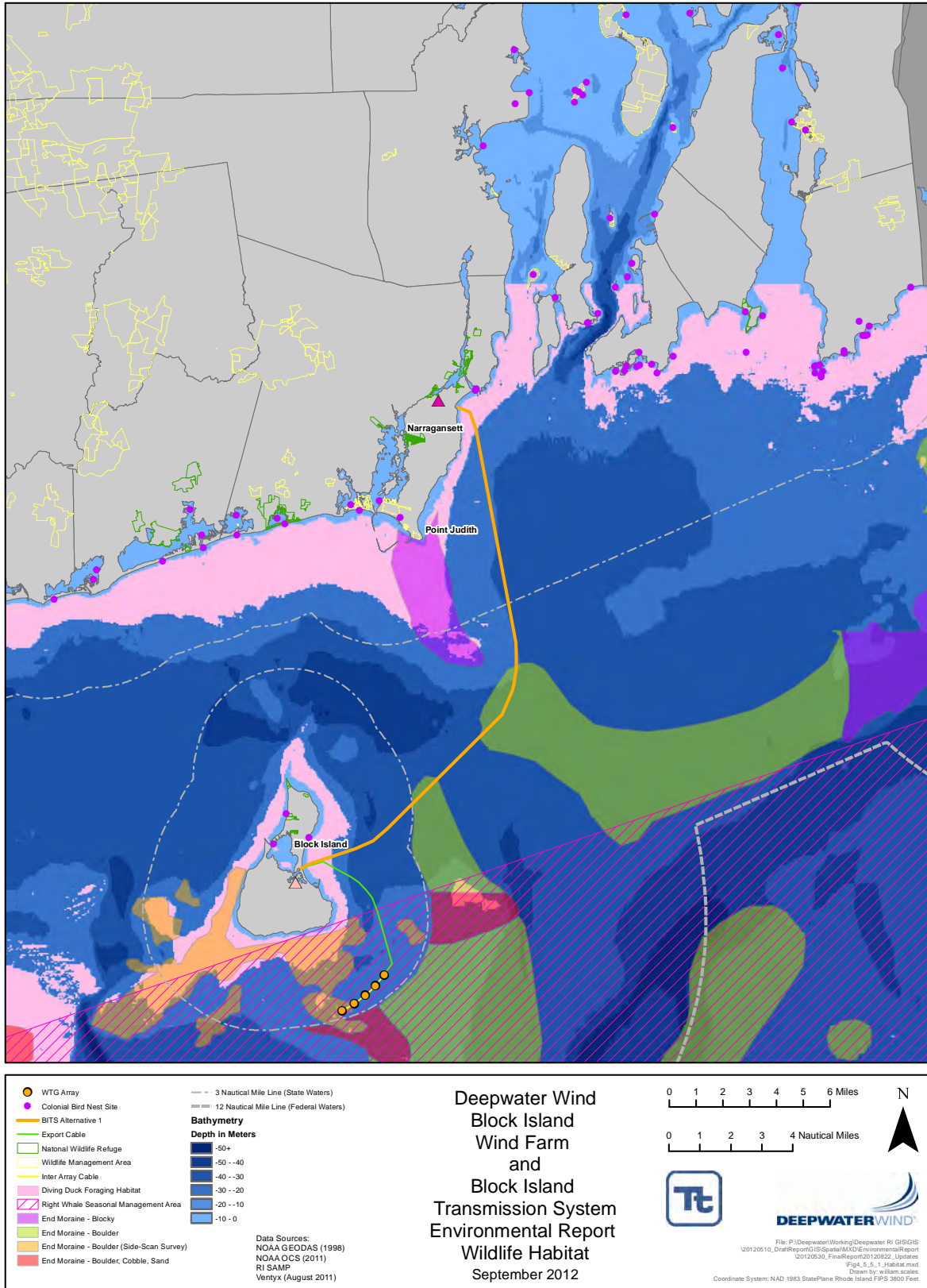
Coastal and terrestrial habitats on Block Island persist under a regime dominated by natural disturbance (hurricanes, Nor'easters, and ice storms) and human impacts (development, habitat fragmentation, and the introduction of non-native species). On Block Island, existing terrestrial habitat conditions and associated wildlife species are the result of historical land use patterns. Land clearing for agriculture started during the pre-European period but accelerated in the 1600s with European colonization of the island (Land and Comings 2001). The largest patches of natural habitat on Block Island occur on conservation lands held by The Nature Conservancy, the Block Island Land Trust, and other smaller conservation associations.

In addition to conservation areas, National Wildlife Refuges (NWRs) managed by the USFWS and Wildlife Management Areas (WMAs) managed by RIDEM also provide high quality wildlife habitat for native species. Neither the BIWF nor the BITS terrestrial facilities cross any conservation lands, NWRs, or WMAs. However, there are WMAs and NWRs proximate to the Project Area. The Block Island NWR is a complex of refuge units located north of the Great Salt Pond approximately 1.6 mi (2.6 km) north of the proposed Block Island Substation (Figure 4.5-7). The Pettaquamscutt Cove NWR, a unit of the John Chafee National Wildlife Refuge Complex, is located 0.27 mi (0.44 km) northeast of the proposed Narragansett Switchyard (BITS Alternative 1).

Existing habitat and natural communities near the Project Area have been especially affected by human activities. Natural community descriptions from *Natural Communities of Rhode Island* (Enser and Lundgren 2006) were used to classify community types occurring in the Project Area. Natural community classifications were based on the dominant plant species as well as a general assessment of hydrology and soils. Wildlife habitat near the Project facilities on Block Island, including the BIWF Export Cable and BITS cable, and the Block Island Substation, consist of previously developed upland areas, as well as subtidal, intertidal, and wetland habitats. Upland areas include Forested Uplands and remnants of Maritime Shrubland and Maritime Forest communities (Enser and Lundgren 2006). Areas of Maritime Dune and Maritime Beach Strand exist adjacent to the proposed BIWF Export Cable and BITS landfall sites at Crescent Beach. The Export Cable and BITS will be affixed to an existing bridge over a small tidal creek system flowing between Harbor and Trims Ponds and will also pass by, but not through, Coastal Salt Pond and Intertidal (low and high) Marsh habitat areas.

Natural areas on Block Island, as on the Rhode Island mainland, are generally fragmented and support a high density of non-native species. Dense infestations of oriental bittersweet (*Celastrus orbiculatus*), multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), and beach rose (*Rosa rugosa*) occur along the proposed Export Cable and the BITS routes to and from the Block Island Substation.

Figure 4.5-7 Terrestrial Wildlife Habitats



Habitats on the Rhode Island mainland near the BITS Alternative 1 route consist largely of previously disturbed upland habitat. Natural communities present at the BITS Alternative 1 Narragansett Town Beach landfall location include remnants of Marine Intertidal Sand/Gravel Beach and Marine Intertidal Rocky Shore, with developed areas of riprap, sea walls, parking lots, and pier structures intruding on fragments of natural habitat (Enser and Lundgren 2006). BITS Alternative 1 follows existing roadways, including Narragansett Avenue and Mumford Road, both of which are within a suburban matrix with little to no natural habitat. BITS Alternative 1 then passes south of forested wetlands (Red Maple – Deciduous Shrub Swamp) and near portions of mixed hardwood Forested Uplands, with an understory dominated by invasive shrubs, including multi-flora rose (*Rosa multiflora*) and honeysuckle (*Lonicera* spp.). High marsh and open water marine systems occur in Pettaquamscutt Cove north of BITS Alternative 1, but are not within or adjacent to the proposed route. Habitat at the Narragansett Switchyard includes previously disturbed and developed uplands, and adjacent early successional mixed hardwood forest with patches of Japanese knotweed (*Polygonum cupidatum*).

### Terrestrial Wildlife

Species expected to be present in natural habitat areas near the terrestrial portions of the Project Area on Block Island and the Rhode Island Mainland are listed in Table 4.5-8. Besides those species listed in Table 4.5-8, no other terrestrial mammals are known to occur on Block Island with the exception of feral cats, domestic pets, and livestock (DeGraag and Yamasaki 2001).

**Table 4.5-8 Terrestrial (Non-Avian) Wildlife Species Potentially Occurring near the Project Area**

Common Name	Species Name	Block Island	Rhode Island Mainland	Status
<b>Amphibians</b>				
Jefferson salamander	<i>Ambystoma jeffersonianum</i>		X	
Blue-spotted salamander	<i>Ambystoma laterale</i>		X	
Spotter salamander	<i>Ambystoma maculatum</i>		X	
Eastern newt	<i>Notophthalmus viridescens viridescens</i>	X	X	
Eastern red-back salamander	<i>Plethodon cinereus</i>		X	
American toad	<i>Anaxyrus americanus</i>		X	
Gray treefrog	<i>Hyla versicolor</i>		X	
Spring peeper	<i>Pseudacris crucifer</i>	X	X	
Green frog	<i>Rana clamitans</i>	X	X	
Pickerel frog	<i>Lithobates palustris</i>		X	
Northern leopard frog	<i>Lithobates pipiens</i>		X	
Wood frog	<i>Lithobates sylvaticus</i>		X	
<b>Reptiles</b>				
Spotted turtle	<i>Clemmys guttata</i>	X	X	P
Wood turtle	<i>Clemmys insculpta</i>		X	SSC
Eastern painted turtle	<i>Chrysemys picta picta</i>	X	X	
Eastern box turtle	<i>Terrapene carolina</i>		X	P
Musk turtle	<i>Sternotherus odoratus</i>		X	
Eastern snapping turtle	<i>Chelydra serpentina serpentina</i>	X	X	
Diamondback terrapin	<i>Malaclemys terrapin</i>	X	X	SE
Northern water snake	<i>Nerodia sipedon</i>	X	X	
Eastern garter snake	<i>Thamnophis sirtalis sirtalis</i>	X	X	
Northern brown snake	<i>Storeria dekayi dekayi</i>	X	X	
<b>Mammals</b>				
Virginia opossum	<i>Didelphis virginiana</i>		X	
Norway rat	<i>Rattus norvegicus</i>	X	X	
House mouse	<i>Mus musculus</i>	X	X	
White-footed mouse	<i>Peromyscus leucopus</i>	X	X	
Shrews	<i>Sorex spp</i>		X	



**Table 4.5-8 Terrestrial (Non-Avian) Wildlife Species Potentially Occurring near the Project Area**

Common Name	Species Name	Block Island	Rhode Island Mainland	Status
Moles	<i>Parascalops spp</i>		X	
Block Island meadow vole	<i>Microtus pennsylvanicus provectus</i>	X		
Eastern cottontail	<i>Sylvilagus floridanus</i>		X	
Eastern chipmunk	<i>Tamias striatus</i>		X	
Gray squirrel	<i>Sciurus carolinensis</i>		X	
Southern flying squirrel	<i>Glaucomys volans</i>		X	
Meadow jumping mouse	<i>Zapus hudsonius</i>		X	
Raccoon	<i>Procyon lotor</i>		X	
Mink	<i>Mustela vison</i>		X	
Woodchuck	<i>Marmota monax</i>		X	
Red squirrel	<i>Tamiasciurus hudsonicus</i>		X	
Muskrat	<i>Ondatra zibethicus</i>		X	
Red fox	<i>Vulpes vulpes</i>		X	
Gray fox	<i>Urocyon cinereoargenteus</i>		X	
Striped skunk	<i>Mephitis mephitis</i>		X	
Coyote	<i>Canis latrans</i>		X	
White-tailed deer	<i>Odocoileus virginianus</i>	X	X	
Hoary bat	<i>Lasiurus cinereus</i>	X	X	
Silver-haired bat	<i>Lasionycteris noctivagans</i>	X	X	
Eastern red bat	<i>Lasiurus borealis</i>	X	X	
Tricolored bat	<i>Perimyotis subflavus</i>	X	X	
Big brown bat	<i>Eptesicus fuscus</i>	X	X	
Little brown bat	<i>Myotis lucifugus</i>	X	X	
Northern long-eared myotis	<i>Myotis septentrionalis</i>	X	X	

SE – State Listed Endangered Species, SSC – State Species of Special Concern, P – Protected Non-game Species  
Source: Enser 2006

Shorebirds, raccoons, and other terrestrial mammals may occur at the proposed landfall locations. Forest nesting birds, terrestrial mammals, amphibians, and reptiles common to southern Rhode Island may occur along forested uplands adjacent to, but not within, the BITS Alternative 1 route. Forested wetlands occur in close proximity to the BITS Alternative 1 route. Wetlands typically provide habitat for waterfowl, songbirds, amphibians, and reptiles when standing water is present. Wetlands are more thoroughly evaluated in Section 4.10 and Appendix J.

Bird, bat, and rare, threatened, and endangered species are discussed in detail in Sections 4.5.6 and 4.5.7. The Rhode Island mainland and Block Island, in particular, support a diverse avian community especially during the migration and breeding periods. Impacts on birds are addressed in Sections 4.5.6. One federally listed endangered species is known to occur on Block Island, the American burying beetle (*Nicrophorus americanus*). This species is discussed in detail in Section 4.5.7.

#### 4.5.5.2 Potential Impacts and Proposed Mitigation

##### BIWF

The Export Cable from the cable landfall site at the Town Beach to the Block Island Substation will be installed entirely within existing road rights-of-way. The Block Island Substation will be located within a predominantly cleared area at the BIPCO property. It is unlikely that any portions of the proposed Export Cable route or the Block Island Substation area provide breeding or substantive foraging habitat for terrestrial wildlife because these areas have already been developed. Any terrestrial wildlife would be expected to occur in remnant natural habitat patches areas adjacent to existing roadways and the BIPCO

property. Wildlife may traverse existing roadways and the Block Island Substation area or utilize resources adjacent to the proposed action areas, but wildlife is not expected to breed at the Block Island Substation site or along the BIWF Export Cable route on Block Island.

Some temporary displacement of terrestrial wildlife may occur during construction activities, although this displacement is not expected to reduce individual or population level fitness as impacts will be limited in spatial and temporal scale, and the proposed Project Area is not known to harbor any critical habitat for wildlife. Additionally, Deepwater Wind will implement appropriate erosion prevention and sedimentation control measures during construction, which will minimize potential impacts on wildlife habitat, especially for amphibians and reptiles that may occur in wetlands near the Project Area. Therefore, disturbance or displacement impacts during construction are anticipated to be minor and short-term and will not result in significant effect on terrestrial habitat or wildlife.

A small section of overhead line will be installed at the BIPCO property to interconnect the Export Cable with the Block Island Substation. Minimal clearing of vegetation will be required to install the overhead line. Installation of the overhead line will, however, require the relocation of an osprey (*Pandion haliaetus*) nest from an existing utility pole. No other osprey nests or other nest structures are known to occur along the BIWF Export Cable route. Potential impacts on birds and proposed mitigation measures, including the osprey nest, are addressed in Section 4.5.6.

The Export Cable will be brought ashore using either a long-distance HDD or a short-distance HDD. Use of HDD will minimize impacts on terrestrial mammals, reptiles, and invertebrates that may occur at Crescent Beach by avoiding alterations of Maritime Dune and Maritime Beach Strand habitat.

By utilizing already developed roadways, minimizing workspace clearing, and installing the Block Island Substation in previously cleared areas of the BIPCO facility, Deepwater Wind has minimized impacts on terrestrial wildlife, as well as wildlife habitat, including upland and wetland areas in the vicinity of the Project Area during both construction and operation.

## **BITS**

As described for the BIWF, the BITS facilities have been located within previously altered areas to the extent possible. Given the limited size of the area of impact and the types of habitat within the proposed BITS Project Area alternatives, it is unlikely that the BITS Project Area on Block Island or the Rhode Island mainland provides critical breeding or foraging habitat for terrestrial wildlife. Some temporary displacement of terrestrial wildlife will likely occur during construction activity; however, this displacement is not expected to reduce individual or population level fitness as impacts will be limited in spatial and temporal scale, and the proposed Project Area is not known to harbor any critical habitat for wildlife. Like the BIWF, the BITS cable will be installed using an HDD, which will minimize impact on habitats and species associated with the beach environment. Further, Deepwater Wind will implement appropriate erosion prevention and sedimentation control measures during construction, which will minimize potential impacts on wildlife habitat, especially for amphibians and reptiles that may occur in wetlands near the Project Area. Disturbance or displacement impacts during construction are therefore anticipated to be minor and short-term and will not result in significant impacts on terrestrial habitat or wildlife.

The BITS cable on Block Island will be collocated with the Export Cable. Therefore, impacts on Block Island are as described for the BIWF, and the BITS will not result in any additional impacts on terrestrial habitat or wildlife on Block Island. Installation of the overhead portion of the BITS Alternative 1

terrestrial cable will require clearing of 30 ft (9.1 m) on either side of the centerline from the manhole on Narragansett Town Beach to the Narragansett Switchyard during construction. During operation, vegetation will be maintained along this segment of the line within an 18-ft (5.5-m) right-of-way on either side of the centerline. From the Narragansett Switchyard to its interconnection with existing TNEC distribution system, the BITS Alternative 1 will transition underground for approximately 0.3 mi (0.5 km). The underground portion of BITS Alternative 1 will be installed in a concrete-encased double circuit duct. Installation of this underground segment will require a 40-ft (12.1-m) wide temporary construction right-of-way that coincides with a public parking lot and the public road right-of-way. The Narragansett Switchyard will result in clearing of up to 0.9 acres (0.36 hectares) of vegetation during construction and 0.4 acres (0.16 hectares) during operation (Table 3.2-5).

BITS Alternative 1 has been designed to minimize impacts to sensitive habitat by utilizing existing TNEC utility poles to the extent possible. Vegetation clearing in the temporary right-of-way for the BITS Alternative 1 overhead and underground portions of the line will be minimal since the cable will be primarily installed on existing TNEC poles and along existing rights-of-way. The Narragansett Switchyard has been sited to be in upland areas only. However, clearing for construction of the Switchyard will occur within the CRMC jurisdiction buffer of a wetland complex. Deepwater Wind has completed wetlands delineations for the BITS Alternative 1 route and Narragansett Switchyard, which have been provided as Appendix J to this ER. These impacts to habitat for terrestrial wildlife will be limited and short-term. Impacts to wetlands are discussed in detail in Section 4.10. Species occurring near the proposed locations for the BITS facilities would be habituated to forest fragmentation and edge effects.

### **Combined Effects**

Both the BIWF and BITS facilities have been located in previously disturbed areas to the extent possible. Therefore, disturbance or displacement impacts from both projects during construction and operation will be minor. Minimal clearing of vegetation will be required for the overhead line on the BIPCO property, the BITS Alternative 1 overhead and underground line on the Rhode Island mainland, and the Narragansett Switchyard. Areas that are temporarily cleared during construction will result in a limited, short-term impact on terrestrial wildlife habits. Permanent clearing will represent a minor portion of the available habitat near the Project Area. The operation of the Project will not result in any significant impacts on terrestrial habitat and wildlife and will not result in any significant combined effects.

#### **4.5.6 Avian and Bat Species**

This section discusses the avian and bat species within the Project Area and adjacent offshore, nearshore, and onshore areas. This section also identifies the Project activities that may affect both birds and bats and their habitat within the Project Area. Threatened and endangered avian and bat species known to occur within the Project Area are discussed separately in Section 4.5.7. Terrestrial wildlife species are discussed in Section 4.5.5.

The avian and bat discussion that follows is based on available literature, including but not limited to the RI Ocean SAMP (Paton et al. 2010) and the results of a site-specific, pre-construction avian and bat assessment completed for the Project between February 2009 and September 2011. The Project-specific surveys began shortly after initial data collection efforts by the RI Ocean SAMP avian program in 2009. The RI Ocean SAMP study covered a broader region of the Rhode Island and Block Island Sounds than the Project surveys. The Project-specific surveys were performed in the offshore area where the WTGs are proposed, as well as adjacent offshore and nearshore areas. Surveys were also conducted along the

southern coast of Block Island, and a portion of the north shore of the Great Salt Pond. Collectively, these areas form the study area for the Project avian and bat assessment.

The avian and bat assessment program was developed in consultation with USFWS, RIDEM, and RI Ocean SAMP biologists. The purpose of the baseline assessment was to characterize the bird and bat communities within and adjacent to the Project Area and to use this information to assess the potential impacts on these resources. Specifically, the goals of the assessment were to 1) determine the general species composition of the birds during both the summer and winter residency, and spring and fall migration periods; 2) estimate the overall encounter rate of birds; and 3) identify the spatial and temporal distribution patterns, including flight ecology, of the bird and bat communities.

Several methods of survey and evaluation were implemented for the assessment. Sampling techniques included visual surveys, acoustic monitoring, radar, and videography. Overall, the avian and bat assessment consisted of the following surveys and evaluations:

- Onshore sea watch avian surveys from Block Island (July 2009 – June 2010).
- Onshore raptor migration surveys from Block Island (fall 2009 and spring 2010).
- Bat acoustic monitoring (onshore and offshore) (summer-fall 2009 and spring, summer, and fall 2010).
- Avian acoustic monitoring along the south coast of Block Island (August – October 2009, April - May 2010).
- Offshore boat-based avian surveys (July 2009 – June 2010, August and September 2011).
- Offshore high-definition aerial videography (August 2009 – April 2010).
- MERLIN avian radar surveys (February 2009 – September 2011).
- VESPER vertical profiling radar (fall 2009 and spring 2010).
- NEXRAD desktop evaluation (2006 – 2010).

On sea-watch point counts, boat-based transects, and aerial videography surveys, species were identified and data on abundance and spatial and temporal distributions were collected. MERLIN and VESPER radars provided additional information on passage rates and flight heights. Bat and avian acoustics were used to gain insight on nocturnal activity. Analysis of the NEXRAD data provided a regional-scale screening assessment of migratory bird activity.

The assessment focused on the onshore and offshore areas of Block Island and the effect of WTGs and did not quantify bird or bat activity at the proposed onshore facilities at the Rhode Island Mainland cable landfall alternatives or at the Quonset Point staging area. Each of these areas was evaluated by biologists to determine the potential for adverse impacts on avifauna from the proposed BIWF and BITS Projects. Habitats at the BITS landfall site alternatives and at the Quonset Point staging area were deemed unlikely to provide important nesting or foraging habitat for avifauna. Additionally, because impacts on bird habitat at the cable landfall sites and the Quonset Point staging areas would be short in duration and limited in scale, it was determined that quantitative assessments of birds and bats at these locations were unnecessary. Pre-construction bird and bat surveys at the proposed landfall site alternatives were deemed unnecessary during review of the Biological Studies Work Plan for the BIWF, with USFWS and RIDEM (Tetra Tech 2009).

The complete pre-construction avian and bat assessment report is provided as Appendix O to this ER.

#### 4.5.6.1 Affected Environment

##### Avian Species

The offshore waters of the BIWF Project Area, including where WTGs are proposed, are known to provide habitat for avian species, including seabirds, pelagics, gulls, terns, and shorebirds (Gochfield et al. 1998; O'Brien 2006). The terrestrial portions of the BIWF and BITS Project Area may be used by other avian species groups, such as wading birds, raptors, and songbirds during seasonal migration. Block Island itself is known to support resident populations of wading birds, ducks, shorebirds, raptors, gulls, and songbirds, as well as seasonal migrants. Songbirds, raptors, and other birds likely nest, and/or migrate through natural habitat areas adjacent to the proposed BIWF Export Cable and BITS routes and Block Island Substation. Osprey are known to nest in close proximity to the Block Island Substation and may be affected by the installation of a portion of the Export Cable near BIPCO. Table 4.5-9 lists the common avian species guilds observed in the BIWF and BITS Project Area. Additional information for these species is provided in the subsections below, as well as in Appendix O.

**Table 4.5-9 Common Avian Species Groups in the Project Area**

Species Group present in Offshore Portions Project Area	Family	Number of Species Expected or Known to Occur in the Area	Primary Occurrence Period				Offshore or Onshore	Estimate of Average Flight Heights*
			Winter	Spring	Summer	Fall		
Loons	Gaviidae	3	X			X	Offshore	< 26 m (85 ft)
Grebes	Podicipedidae	2	X				Offshore	<10 m (33 ft)
Shearwaters	Procellariidae	5			X		Offshore	<10 m (33 ft)
Storm-petrels	Hydrobatidae	2			X		Offshore	<10 m (33 ft)
Gannets	Sulidae	1	X	X		X	Offshore	<10 m (33 ft)
Cormorants	Phalacrocoracidae	2					Both	10 m to 125 m (33 - 410 ft)
Waterfowl	Anatidae	14	X	X		X	Primarily Offshore	<10 m (33 ft)
Raptors	Acciptridae, Falconidae	At least 5		X	X	X	Both	10 m to 125 m (33 - 410 ft)
Shorebirds	Charadriidae, Haematopodidae, and Scolopacidae	19		X	X	X	Both	<10 m (33 ft)
Gulls and kittiwakes	Laridae	6	X	X	X	X	Both	Highly Variable
Jaegers	Laridae	3		X	X	X	Offshore	<10 m (33 ft)
Terns	Laridae	7		X	X	X	Both	< 26 m (85 ft)
Alcids	Alcidae	6	X				Offshore	<10 m (33 ft)
Songbirds	Multiple (Passeriformes)	8 in offshore areas, >100 terrestrial species		X	X	X	Primarily Onshore	< 26 m (85 ft)

\*Paton et al. 2010 and Appendix O

Results of the Project-specific surveys revealed general overall patterns and trends in avian abundance and distribution in the Project Area. Overall bird abundance was lower offshore than nearshore and onshore, and overall bird abundance offshore was higher in winter. The onshore point count surveys showed that wintering waterfowl and gulls dominate the nearshore waters of Block Island during much of

the year. Flight heights of waterfowl were typically low, while gulls, on average, flew higher. Northern gannet, alcids, shearwaters, and other pelagic birds were present at lower abundances along the coast of Block Island than in offshore waters. Overall bird counts and encounter rates were relatively high in the onshore and nearshore areas when compared with counts from offshore.

Both the offshore boat-based surveys and aerial videography surveys demonstrated that offshore waters had a much lower abundance of birds when compared with onshore locations. Due to the presence of a greater proportion of low-flying waterfowl and seabirds, it was found that flight heights were lower offshore than onshore. All surveys identified gulls as a large component of the avian community in the BIWF study area. Gulls typically flew higher than most other species observed.

A USGS Breeding Bird Survey (BBS) route is present near the BITS Alternative 1 landfall and the Quonset Point staging area (Sauer et al. 2008). The USGS BBS Quonset Route covers a large stretch of inland Rhode Island mainland habitat, ending a few miles west of the Quonset Business Park near Mill Cove. The results of a review of all USGS BBS conducted along the Quonset Route showed no occurrences of state or federally listed threatened or endangered species and indicate a generally low level of species diversity.

Results related to threatened, endangered, and special concern species are discussed in Section 4.5.7.

### **Loons**

Common loon (*Gavia immer*) and red-throated loon (*Gavia stellata*) regularly occur in Rhode Island Sound; a third species, Pacific loon (*Gavia pacifica*), may also be present at low densities (Proctor and Lynch 2005). Loons may be attracted to certain portions of the Project Area where food resources are concentrated. A telemetry study revealed that loons wintering in Rhode Island Sound generally travel from New York and Vermont (Paton et al. 2010). Over half of the loons observed in the RI Ocean SAMP study area flew below 85.3 ft (26 m). During the BIWF ship-based avian surveys, both common and red-throated loons were observed. As in the RI Ocean SAMP studies, loons were seen primarily in the winter months (October through May), although they were also present in June, August, and September in the BIWF study area. Common loons generally flew less than 85.3 ft (26 m) above the water (97.4 percent), as did red-throated loons (100 percent).

### **Grebes**

Horned grebe (*Podiceps auritus*) and red-necked grebe (*Podiceps grisegena*) were observed in the Project Area during the winter months almost exclusively in nearshore areas. Grebe observations were highest in March, suggesting that migration occurs in the area during early spring (Paton et al. 2010). Grebes were not observed during the Project ship-based surveys, but were observed during land-based point counts on Block Island during the months of January, February, March, and April. Grebes are nocturnal migrants and, although flight heights during migration are not well known, both species tend to fly low above the water during the day, and may do so at night as well (Spear and Ainley 1997; Stedman 2000).

Pied-billed grebe (*Podilymbus podiceps*) may use the coastal waters adjacent to the BITS Alternative 1 landfall site during the winter. Pied-billed grebe is a Rhode Island state-listed endangered species; however, this status is limited to the breeding population of the state. Pied-billed grebe winter, but do not breed in coastal water.

## Cormorants

Two species of cormorants (Phalacrocoracidae) were observed in the RI Ocean SAMP and BIWF study areas; double-crested cormorant (*Phalacrocorax auritus*) and great cormorant (*Phalacrocorax carbo*). Double-crested cormorant was substantially more abundant than great cormorant throughout Rhode Island Sound (Paton et al. 2010). Double-crested cormorant were present in both the RI Ocean SAMP and BIWF study area from spring through fall, and great cormorant were present in winter. During the RI Ocean SAMP surveys, 81 percent of detected cormorants flew below 32.8 ft (10 m). Conversely, during the BIWF ship-based surveys, 85.7 percent of double-crested cormorant flew between 85.3 ft and 410.1 ft (26 m and 125 m), while all great cormorants were observed flying less than 32.8 ft (10 m) above the water. Paton et al. (2010) noted that cormorants tended to fly lower (>49.2 ft [ $<15$  m]) during local movements and higher (>328.1 ft [ $>100$  m]) during migratory flights. The higher flight heights of double-crested cormorants in the BIWF study area may be an indication that they are migrating through the area and not foraging there. Both double-crested and great cormorants spend much of their time roosting and preening out of the water and are generally found no more than 3.1 mi (5 km) from shore foraging in open water less than 26.2 ft (8 m) deep (Hatch and Weseloh 1999; Hatch et al. 2000). Cormorants were observed on 15 percent of ship-based surveys in the Project Area, and accounted for 1.3 percent of all bird encounters.

During the summer, cormorants (Phalacrocoracidae) may occur in waters adjacent to the Alternative 1 landfall site, as well as near Quonset Point.

## Waterfowl

Historical datasets indicate that seaducks and diving ducks (Anatidae) are present throughout the year, but are most abundant from November to April (Paton et al. 2010). During fall migration, seaducks begin to arrive in the BIWF and RI Ocean SAMP study areas in October and November. An influx of seaducks into the SAMP and BIWF study areas was noted in February and abundance peaked in March. Overall, during the RI Ocean SAMP and BIWF studies, seaducks were more abundant starting in November through March. During the RI Ocean SAMP surveys, the most frequently encountered seaduck species were common eider (*Somateria mollissima*), surf scoter (*Melanitta perspicillata*), and black scoter (*Melanitta americana*); observations of long-tailed duck (*Clangula hyemalis*) were uncommon. Goldeneyes, buffleheads, and mergansers were rarely observed during the RI Ocean SAMP ship-based surveys. During BIWF ship-based studies, common eider, long-tailed duck, black scoter, surf scoter, white-winged scoter, and red-breasted merganser were observed. Additional duck species observed in offshore waters during the BIWF land-based surveys included common goldeneye, American black duck, bufflehead, greater scaup, and harlequin duck. Most observations of seaducks were made nearshore during the RI Ocean SAMP surveys. Similarly, the majority of seaduck observations in the BIWF study area were made during land-based sea watch surveys. Little is known about specific seaduck roosting locations in Rhode Island Sound, but individuals were observed moving offshore around dusk during both the RI Ocean SAMP and BIWF studies. Seaducks forage in water up to 82 ft (25 m) in depth, which partly explains their greater abundance in shoal waters south and southwest of Block Island (Paton et al. 2010). The majority of seaducks observed during the RI Ocean SAMP and BIWF studies flew below 32.8 ft (10 m) above the water.

Other species of waterfowl, including dabbling ducks, Canada goose (*Branta canadensis*), brant (*Branta branta*), tundra swan (*Cygnus columbianus*), and mute swan (*Cygnus olor*), occur during migration nearshore and may be abundant seasonally. These species were rarely observed offshore during the BIWF ship-based surveys, but were frequently observed nearshore on Block Island.

The waters adjacent to BITS Alternative 1 and the Quonset Point staging area provide foraging habitat for wintering ducks, including common eider (*Somateria mollissima*), scoter species (*Melanitta* spp.), scaup species (*Aythya* spp.), American black duck (*Anas rubripes*), bufflehead (*Bucephala albeola*), goldeneye (*Bucephala* spp.), and merganser species (*Mergus* and *Lophodytes* spp.); brant (*Branta bernicla*), long-tailed duck (*Clangula hyemalis*), and harlequin duck (*Histrionicus histrionicus*) may also occur during the winter.

### **Seabirds (Shearwaters, Storm-petrels, Northern Gannet, and Alcids)**

It is estimated that thousands of shearwaters and storm-petrels annually migrate through and forage in the RI Ocean SAMP study area (Paton et al. 2010). The RI Ocean SAMP and BIWF survey efforts at the proposed WTG sites indicate that the occurrence of pelagic birds, such as shearwaters and storm-petrels, was episodic and likely related to shifting patches of food resources and changes in weather conditions (Prince and Morgan 1987; Paton et al. 2010). Studies have shown that shearwaters and storm-petrels are the most commonly detected species (following gulls) in summer months, when they are expected to be more abundant (Powers 1983; Manomet 1988). Shearwaters generally only occur in Rhode Island Sound during the non-breeding austral winter period, generally in May through September (Proctor and Lynch 2005; Lee and Haney 1996; Harrison 1987). Like shearwaters, storm-petrels (Hydrobatidae) occur in the RI Ocean SAMP and BIWF study areas only in the summer (Harrison 1987).

Four species of shearwater were seen during the RI Ocean SAMP surveys: Manx shearwater (*Puffinus puffinus*), sooty shearwater (*Puffinus griseus*), greater shearwater (*Puffinus gravis*), and Cory's shearwater (*Calonectris diomedea*). Each of these species was also observed during the BIWF studies, as well as a fifth species, the Audubon's shearwater (*Puffinus lherminieri*). Two species of storm-petrel, Wilson's storm-petrel (*Oceanites oceanicus*) and Leach's storm-petrel (*Oceanodroma leucorhoa*), are known to occur regularly throughout Rhode Island Sound (Paton et al. 2010 and Appendix O). Only Wilson's storm-petrel was observed in the BIWF study area. All storm-petrels detected during the RI Ocean SAMP surveys flew below 10 m, as did 99 percent of storm-petrels in the BIWF study area.

Northern gannet migrate from Atlantic Canada to lower latitudes passing through southern New England waters. Sub-adult gannets have also been observed during the summer in Rhode Island Sound. Northern gannet (*Morus bassanus*) were frequently encountered in the RI Ocean SAMP study area during winter (Paton et al 2010). Northern gannet were also found both nearshore and offshore in April, May, November, and December (Paton et al. 2010). Gannets were observed year-round in the BIWF study area, although abundances changed seasonally. Peak gannet densities were noted in fall and winter in the RI Ocean SAMP and BIWF study areas. The highest concentrations of northern gannets were detected 4 km off the coast of mainland Rhode Island and in the vicinity of Block Island, as well as near the edge of Block Canyon (Paton et al. 2010). During the RI Ocean SAMP surveys, the majority (54 percent) of gannets were observed flying below 32.8 ft (10 m), 36 percent flew between 32.8 ft to 82 ft (10 m to 25 m), and 10 percent flew between 85.3 ft and 410.1 ft (26 m and 125 m). Similar flight ecology was observed in the BIWF study area, where 78 percent of gannets flew less than 32.8 ft (10 m) above the water, and 20 percent flew between 32.8 ft to 82 ft (10 m and 25 m).

During the winter, alcids migrate south to Rhode Island Sound from northern breeding areas to forage on bait fish and demersal invertebrates. Six species of alcids (Alcidae) occur off the coast of Rhode Island during winter; razorbill (*Alca torda*), common murre (*Uria aalge*), thick-billed murre (*Uria lomvia*), dovekie (*Alle alle*), black guillemot (*Cephus grylle*), and Atlantic puffin (*Fratercula arctica*) (Proctor and Lynch 2005; Lavers et al. 2009; Paton et al. 2010). Four of these species were encountered in the BIWF study area: dovekie, black guillemot, razorbill, and thick-billed murre. Alcids represented



6.6 percent of all birds encountered offshore, in the BIWF study area, and were seen on over 12 percent of surveys.

Alcids occurred in the RI Ocean SAMP study area from December to mid-March; peak abundances were encountered in January. In the BIWF study area, alcids were detected from January to April and exhibited the highest abundances in February. Razorbills were the most frequently observed alcid during the RI Ocean SAMP and BIWF surveys. Waters near Block Island were estimated to support higher densities of razorbill than elsewhere in Rhode Island Sound (Paton et al. 2010). The BIWF studies also indicated that razorbills were the most frequently observed alcid in the study area, with an estimated density of 3.17 individuals per square kilometer in the BIWF study area.

### Gulls and Allies

Herring gull (*Larus argentatus*) and great black-backed gull (*Larus marinus*) were the most common, year-round residents of the SAMP and BIWF study areas (Paton et al. 2010; Proctor and Lynch 2005). Laughing gull (*Leucophaeus atricilla*) and ring-billed gull (*Larus delawarensis*) occurred during spring and fall migration, while black-legged kittiwake (*Rissa tridactyla*) and Bonaparte's gull (*Chroicocephalus philadelphia*) occurred during winter. The majority (58 percent) of gulls were observed flying below 10 m during the RI Ocean SAMP study. In the BIWF study area, gulls also flew predominately below 10 m.

Only three individual jaegers were seen during RI Ocean SAMP ship-based surveys. These individuals belonged to three different species: pomarine jaeger (*Stercorarius pomarinus*), parasitic jaeger (*Stercorarius parasiticus*), and long-tailed jaeger (*Stercorarius longicaudus*). Jaegers were detected migrating through the area from May through October (Paton et al. 2010). Jaegers were not observed during the BIWF studies.

Terns were resident in the RI Ocean SAMP study area during summer and migrated through the area during spring and fall. Relatively few terns were observed during ship-based surveys for the RI Ocean SAMP and the BIWF. A total of seven species of tern were documented during the RI Ocean SAMP land-based surveys: Caspian tern (*Hydroprogne caspia*), royal tern (*Thalasseus maximus*), common tern (*Sterna hirundo*), Forster's tern (*Sterna forsteri*), roseate tern (*Sterna dougallii*), least tern (*Sternula antillarum*), and black tern (*Chlidonias niger*). Tern numbers were greatest during the post-breeding season (Paton et al. 2010). Terns were also seen during the BIWF studies. Common tern, Forster's tern, and least tern were detected offshore.

There were three observations of black skimmer (*Rynchops niger*) made in September during land-based RI Ocean SAMP surveys.

During the summer, gulls (Laridae) and terns (*Sterna* spp.) may occur in waters adjacent to Alternative 1 landfall site, as well as near Quonset Point.

### Shorebirds

In Rhode Island Sound, shorebird migration generally occurs from August through September, and again in May and June (Paton et al. 2010). Three species have been observed overwintering in Rhode Island: purple sandpiper (*Calidris maritima*), sanderling (*Calidris alba*), and dunlin (*Calidris alpina*). Shorebirds (Charadriidae and Scolopacidae) occur in the offshore portion of the BIWF Project Area during the spring and fall migration, and onshore during the summer residency period. Overall, 19 species of shorebirds were seen during the RI Ocean SAMP studies; however, only six shorebird species were observed during the offshore avian assessment ship-based surveys: semipalmated plover (*Charadrius semipalmatus*), lesser yellowlegs (*Tringa flavipes*), whimbrel (*Numenius phaeopus*), purple sandpiper, short-billed

dowitcher (*Limnodromus griseus*), and red-necked phalarope (*Phalaropus lobatus*). Phalaropes were only observed in waters over the Inner Continental Shelf during the offshore RI Ocean SAMP ship-based surveys (Paton et al. 2010). During the BIWF ship-based visual surveys, shorebirds were observed migrating over open water where WTGs are proposed and were also observed nesting on Block Island. Sanderling was the only species observed during ship-based surveys in the BIWF study area. During land-based counts on Block Island, 15 shorebird species were encountered, including piping plover (*Charadrius melodus*). Most shorebirds were detected in nearshore areas in proximity to intertidal foraging habitat.

### Songbirds

Songbirds and other landbirds were rarely encountered offshore during the RI Ocean SAMP ship-based surveys. Eight passerine species were observed in the RI Ocean SAMP study area: mourning dove (*Zenaida macroura*), blackpoll warbler (*Setophaga striata*), yellow-rumped warbler (*Setophaga coronata*), bank swallow (*Riparia riparia*), tree swallow (*Tachycineta bicolor*), dark-eyed junco (*Junco hyemalis*), savannah sparrow (*Passerculus sandwichensis*), and snow bunting (*Plectrophenax nivalis*). Eight individual swallows were seen during the BIWF ship-based surveys, consisting of one bank swallow and seven unidentified swallows. All of the songbirds observed offshore in Rhode Island Sound, with the exception of blackpoll warbler, breed in Rhode Island and adjacent states, and are considered to be relatively common (Hunt and Eliason 1999; Otis et al. 2008). Blackpoll warbler do not breed in Rhode Island but breed in northern New England and throughout boreal forests in Canada, where they are fairly common and abundant (Hunt and Eliason 1999). Large numbers of landbirds were observed during the RI Ocean SAMP land-based surveys, though these observations were concentrated in terrestrial habitat and at the immediate coastline. During the Project point count survey on Block Island, 1,274 individual songbirds were detected, representing 25 species. At least 122 passerine species have been seen on Block Island, most of which do not breed on the island but may occur during migration (Langs and Comings 2001).

Results of avian acoustic monitoring and avian radar system surveys indicate that nocturnal passerine migrants occur at the proposed turbine locations during both spring and fall migration. Radar surveys, visual observation surveys, and acoustic monitoring demonstrated that songbirds utilized Block Island as a resting and staging area during migration, as well as for breeding during the summer (Paton et al. 2010; Appendix O).

All migratory birds, including songbirds, are protected under the federal Migratory Bird Treaty Act (MBTA) of 1918 (16 USC 703-712; Ch. 128; July 13, 1918; 40 Stat. 755).

### Raptors

Raptors, primarily accipiters and falcons, were observed on Block Island and migrating to and from Block Island during the BIWF surveys. During the land-based point count survey, 12 raptors were observed; 2 osprey (*Pandion haliaetus*), 1 sharp-shinned hawk (*Accipiter striatus*), 2 Cooper's hawks (*Accipiter cooperii*), 6 northern harrier (*Circus cyaneus*), and 1 unidentified accipiter. During the onshore raptor migration surveys performed on the south coast of Block Island in fall 2009, 79 raptors were observed, 65 of which were peregrine falcons; the remaining observations were of Cooper's hawk, merlin (*Falcon columbarius*), and northern harrier. A substantial number of peregrine falcons (*Falco peregrines*) were observed migrating along the south coast of Block Island, and over open water north of the island. No raptors were observed greater than 100 m from the southern and eastern Block Island shoreline, and none in areas where WTGs are proposed.

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 USC 668-668d). No eagles were observed in, or near the Project Area, and it is highly unlikely that eagles occur in the area where the WTGs are proposed (DeGraaf and Yamasaki 2001). No suitable foraging habitat occurs in the BIWF Project Area (Buehler 2000). Bald eagles may migrate through the BITS Project Area but are not known to regularly occur on Block Island, and only occur locally on the Rhode Island mainland (Buehler 2000; Audubon Society of Rhode Island 2003). Golden eagles are not known to occur in Rhode Island or over the open ocean (Kochert et al. 2002).

## Bats

Block Island supports a diversity of habitats with open meadows, shrub edges, wetlands, and agricultural fields that may provide foraging, roosting, and migratory stopover habitat for bats (Nature Conservancy 2009). Upland habitats include Maritime Woodland, Maritime Shrubland, Maritime Grassland, bluffs, dunes, and beach strands (Enser 2006). Other habitats include emergent and interdunal swale wetlands, ponds and lakes, coastal salt ponds, streams, beach, mudflats, disturbed grasslands, hayfields, and other agricultural fields. Tree habitat available for foraging or roosting bats is generally limited on Block Island, with trees occurring in scattered patches of Maritime Woodland, within the more common shrublands, or in association with residential development. Grassland habitat occurs on rolling morainal topography, generally exposed to periodic wind and salt spray. The dune community is dominated by grasses and low shrubs where vegetation is patchy due to disturbances such as erosion, sand deposition, and dune migration. Beach strand habitat is a sparsely vegetated community on unstable sand, gravel, or cobble beaches above mean high tide.

Areas associated with the land uses on Block Island provide potential foraging and roosting habitat for some bat species. These land uses include commercial and community development, tourism, roads, trails, rural residential with manicured lawns, agriculture, and open space. Bat species may use buildings as roosts, forage at street lights, use trails as flyways, and forage over freshwater ponds and along edge habitats. Protected conservation areas, such as Rodman's Hollow, Fresh Swamp Preserve, Hodge Family Wildlife Preserve, and the USFWS Block Island NWR, provide wildlife habitat (Lang and Comings 2001).

Rhode Island is within the range of nine bat species: big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), little brown bat (*Myotis lucifugus*), eastern small-footed myotis (*Myotis leibii*), northern myotis (*M. septentrionalis*), silver-haired bat (*Lasionycteris noctivagans*), tricolored bat (*Perimyotis subflavus*), and historical range of Indiana bat<sup>14</sup> (*Myotis sodalis*) (Harvey et al. 1999; RIDEM 2006; BCI 2009). The most common of these species in Rhode Island are the little brown bat, big brown bat, eastern red bat, and tricolored bat (Rhode Island Department of Health and RIDEM 2006). In Rhode Island, big brown bat is considered a species of Greatest Conservation Need (RIDEM 2006).

Based on literature review, the available habitat, and Block Island's offshore location, not all bat species that occur in Rhode Island are likely to occur on Block Island. During the summer, four bat species are probable residents on Block Island: the big brown bat, little brown bat, eastern red bat, and hoary bat. The eastern small-footed myotis, northern myotis, and silver-haired bat are unlikely summer residents on

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<sup>14</sup> The federally endangered Indiana bat is included as a species of Greatest Conservation Need in *Rhode Island's Comprehensive Wildlife Conservation Strategy* (RIDEM 2005) though its occurrence is listed as hypothetical for the state. The *Indiana Bat (Myotis sodalis) Draft Recovery Plan: First Revision* (USFWS 2007) does not include Rhode Island as within the range of the Indiana bat.

Block Island because the large, dense forest stands, old-growth forest, or more mountainous areas preferred by these species are not present. The tricolored bat is unlikely to occur on Block Island or the surrounding waters during summer or migration because it is generally incapable of lengthy migration (Tuttle 1991) and thus may not fly over the ocean. The Indiana bat is a hypothetical species in Rhode Island and is highly unlikely to occur on Block Island. During migration, species that are likely to be found on Block Island and the surrounding waters include the big brown bat, little brown bat, hoary bat, silver-haired bat, and eastern red bat (Harvey et al. 2011).

Field surveys on Block Island documented resident populations of bats and indicated that there is some evidence that the island may act as a migration stopover point for long-distance migratory tree roosting species. The surveys demonstrated that Block Island, and to a lesser extent nearshore waters immediately surrounding the island, provided habitat for at least five species of bat including big brown bat (*Eptesicus fuscus*), little brown myotis (*Myotis lucifugus*), eastern red bat (*Lasiurus borealis*), silver-haired bat (*Lasionycteris noctivagans*), and hoary bat (*Lasiurus cinereus*). Passive and active acoustic monitoring efforts demonstrated that the occurrence of bats was largely limited to the island and nearshore waters and no observations were recorded at the proposed WTGs locations; however, bats were detected elsewhere offshore at a very low rate.

#### 4.5.6.2 Potential Impacts and Proposed Mitigation

##### BIWF

###### *Avian Species*

Construction of the BIWF has the potential to affect avian species within the Project Area as a result of direct habitat loss or change (direct effects) or through temporary displacement or disturbance. Birds may be displaced from areas near the turbine locations during construction (Drewitt and Langston 2006). Disturbance to birds during construction of the BIWF may include disruption of normal behavior patterns of individuals in the BIWF Project Area during a brief period of their annual life cycle. Activities such as increased vessel traffic, loud noises, and temporary work lighting may disturb birds feeding, staging, transiting, or migrating through the BIWF Project Area. A lack of validated research on displacement effects in general (Stewart et al. 2005), and specifically for seabirds and other avian species using the marine environment, makes predicting the level of impact difficult. European studies suggest that disturbance and avoidance impacts may occur up to 2.5 mi (4 km) from the construction site (BOWind 2008).

The marine construction activities are anticipated to occur over a 6-month period from April to September during the time when overall relative abundance and densities in the BIWF Area are lowest. Any displacement or disturbance impacts are unlikely to have an effect on population fitness because the abundance of avian and bats in the area during the proposed construction period is low, and construction activity will be short in duration, limited in spatial area, and not expected to appreciably increase vessel traffic above current levels (see Marine Uses, Section 4.9).

During construction of BIWF onshore facilities on Block Island and the Rhode Island Mainland, temporary displacement of foraging water birds may occur. No long-term or significant impacts on nesting shorebirds are anticipated because the location of the proposed onshore facilities and cable landfall sites are not known to support breeding shorebirds, and construction practices such as HDDs will help to minimize potential impacts to Maritime Intertidal habitats. Additionally, the area affected by onshore facilities and the reduced footprint of the equipment necessary for the installation of the upland

portions of the Export Cable will be relatively small compared to the adjacent available nesting and foraging habitat.

Potential impacts during operation of the BIWF include direct impacts on individual birds colliding with turbine blades or towers and direct impacts on bird habitat, including the seafloor, water column, and adjacent airspace. Birds may also be affected by avoidance of the WTG area. Avoidance behavior can impact birds in two ways: the turbines may displace birds from foraging in the area resulting in indirect habitat loss and/or the WTGs may act as a barrier to movement (Fox et al. 2006). Deepwater Wind will implement a post-construction monitoring program during operation of the BIWF to evaluate actual impacts from the BIWF. The program will include beached bird surveys prior to construction and during operation, bat monitoring during construction, ship-based bird monitoring during operation, nocturnal migrant collision monitoring during operation, and avian radar monitoring for 2 non-consecutive years (Table 4.5-10).

**Table 4.5-10 Pre- and Post-Construction Monitoring Plan for Birds and Bats at the BIWF**

Effort		Timing	Focus
<b>Survey Expanded Pre-construction Monitoring*</b>			
Beached Bird Surveys	Twice per month at each of three Block Island beaches	One full year pre-construction, and during years 1 and 3 of operation	Baseline and post-construction beached bird carcass wash up rates on southern Block Island
<b>Construction Monitoring</b>			
Bat Acoustic Vessel Monitoring	Nightly on a maximum of two construction vessels operating with deck lights on, with a minimum of two bat acoustic detectors on each vessel	Nightly during the warm period (March 15 – October 15) during construction only	Bat activity during construction
<b>Post-construction Monitoring</b>			
<b>Beached Bird Surveys</b>	Twice per month at each of three Block Island beaches.	During the first and third year that the BIWF wind farm is operational	Baseline and post-construction beached bird carcass wash up rates on southern Block Island
Ship-based Bird Monitoring	Once per month	Year round, years 1 and 3 of operation	Displacement of migrating and foraging birds
Nocturnal Bird Flight and Collision Monitoring	Nightly during the spring, late-summer, and fall migration periods	March 15 – September 15, years 1 and 3 of operation	Nocturnal migrant activity and collision rates at select WTGs
Avian Radar Monitoring	24 hours per day during spring and fall migration.	March 15 – September 15, years 1 and 3 of operation	Migration activity, flight behavior, passage rates, and avoidance behavior in BIWF
*Initial pre-construction monitoring for birds and bats occurred 2009 - 2011			

### *Direct Habitat Loss*

Birds that forage on the seafloor may be impacted by direct habitat loss from installation of the BIWF turbine foundations. Seaducks and allies often forage on epibenthic organisms, primarily mollusks and crustaceans on the seafloor (Goudie et al. 2000). The foundations of the BIWF turbines are expected to impact an area of the seafloor no larger than 3,061 square feet (ft<sup>2</sup>) (284.4 square meters [m<sup>2</sup>]). The amount of subsea habitat that would be lost as a result of construction of the BIWF is a small percentage (3,061.3 ft<sup>2</sup> [284.4 m<sup>2</sup>] or less than one one hundredth of 1 percent) of the subsea habitat available within Rhode Island Sound (approximately 1,544.4 mi<sup>2</sup> [4,000 km<sup>2</sup>]) (Paton et al. 2010). Assuming conservatively that perhaps 1 percent of the Rhode Island Sound's substrate is actually suitable foraging habitat for sea ducks (approximately 15.4 mi<sup>2</sup> [40 km<sup>2</sup>]), the BIWF WTG footprint will impact less than 1 percent of available epibenthic foraging habitat for birds in the Sound. Additionally, the WTG area is generally too deep for seaducks to forage in. Paton et al. (2010) estimated seaduck foraging depths did not

exceed 82 ft (25 m) during the RI Ocean SAMP studies, and most species that forage on the bottom do so in shoal waters approximately 32.8 ft (10 m) deep (Goudie et al. 2000). There is potential that some suitable foraging habitat, perhaps for pursuit divers (loons) or other species that forage on pelagic fishes, will be lost, but the magnitude of this loss will be extremely low given the amount of available habitat in the vicinity of the Project Area. Potential impacts on birds foraging in the area of the proposed WTGs are more fully addressed under “Displacement of Foraging and Resting Birds during Operation.”

#### *Direct Collision*

Little information is available on fatality rates at operational offshore wind farms. It is not possible to conduct traditional mortality searches for birds or bats killed by turbines offshore. Although technology has been employed to help evaluate fatality rates, including thermal imaging systems (Desholm 2003), there are currently little data on collisions at operating offshore wind farms to use for predictive purposes. Additionally, certain avian populations and species may be more resilient to increased mortality than others because of reproductive strategy and population size, as well as differences in adult and juvenile survival rates (Fox et al. 2006). Birds are thought to be more susceptible to collision with brightly lit structures, especially in offshore areas (Hüppop and Hilgerloh 2012).

Raptor mortality has received attention at land-based wind farms because of the relatively greater impact of mortality to long-lived species with low reproductive rates, and sensitive species concerns (e.g., bald and golden eagles). Previous research suggests that raptor use prior to construction may be a factor in determining impact post-construction (e.g., Erickson 2007). No raptors were observed at the proposed BIWF WTG locations during any of the site-specific avian surveys. Raptors were observed only on or near Block Island. Therefore, the potential collision risk posed to raptors from the BIWF is likely very low.

In order to assess the potential for impacts resulting from collision with WTGs, the data collected on avian species abundance and flight behavior were analyzed in relation to the rotor-swept zone (RSZ) for the WTGs. Diurnal flight heights for all birds in all areas of the BIWF study area were generally low and below the RSZ of the proposed turbines, as detailed in Appendix O. Flight heights during other biological periods, including dawn, night, and dusk, were generally higher than during the day, and either just above or just within the upper portion of the RSZ of the proposed BIWF turbines. This type of analysis provides a conservative assessment of the potential impact; the calculated potential number of individuals passing through the RSZ prior to installation of the WTGs is likely to be lower during operation due to avoidance effects, which would reduce the actual mortality risk. As a result, only a very low percentage of those individuals calculated to pass through the RSZ are likely to actually collide with turbines.

Deepwater Wind has reduced potential impacts on avian species in the design of the Project. The WTG Array was sited away from areas known to concentrate birds, such as coastal shallow areas and mudflats, based on preliminary Project survey results. Deepwater Wind further minimized the potential for collision impact by proposing to use a 6 MW WTG that would allow the requisite number of WTGs to be decreased from eight to five. The use of red FAA lights on each WTG also reduces the potential for the WTGs to act as an attractant to migrant avian species (Gauthreaux and Belser 2006). In addition, the WTG foundation design will consider anti-perching devices and design measures to avoid attracting avifauna to the WTGs, which should reduce the potential for collisions with habituated birds that may occur in the WTG area.

The WTGs are the primary collision risk posed to birds from the BIWF, but there is also risk of collision with onshore transmission lines. By burying the Export Cable from the beach to the BIPCO property, the risk of non-turbine collision has been avoided.

#### *Displacement of Foraging and Resting Birds during Operation*

Displacement of birds during operation of the BIWF may result in a shift in the distribution of foraging birds away from the BIWF WTG Array. This displacement would constitute an effective loss of a portion of available foraging habitat and may result in reduced food consumption or elevated energy expenditure that could affect individual and population fitness (Fox et al. 2006). Species thought to be most likely to be displaced from the area where WTGs are proposed include loons, seaducks, alcids, and shearwaters (Perrow et al. 2006). Previous research at European offshore wind farms demonstrated that displacement from the turbine area was not complete and that individuals were still able to forage in the inter-turbine areas (Guillemette and Laresen 2007). For areas where birds did not forage or foraged less prior to construction, there was effectively no displacement (Guillemette and Laresen 2007).

Disturbance to the seafloor and benthic macro-invertebrates may also have an indirect impact on foraging behavior of some water birds. Seaducks, and other species with similar foraging ecology, have been shown to be at some level of risk from offshore wind development, primarily due to indirect impacts, such as Turbine Array avoidance behavior. Alternatively, artificial reef habitat, which is often created by turbine foundations, may attract some species of seaduck to forage within the area of the WTGs.

Avoidance behavior is expected to be exhibited at a distance of 0.6 mi to 1.2 mi (1 km to 2 km) for most species (gulls and seaducks), and perhaps up to 3.5 mi (4 km) for some species (loons) (Kahlert et al. 2000; Petersen et al. 2006). Those species that forage at higher densities in the BIWF Project Area are likely to be more susceptible to displacement (Guillemette and Larsen 2007). The pre-construction avian assessment included an evaluation of species foraging within 0.6 mi, 1.2 mi, and 2.5 mi (1 km, 2 km, and 4 km) buffers of the WTG Array (Appendix O).

Individual species exhibited different preferences for foraging within portions of the BIWF study area. Loons exhibited some foraging preferences within the 1 km buffer, as did shearwaters, storm-petrels, and terns (Appendix O). Cormorants were not observed foraging within 0.6 mi, 1.2 mi, and 2.5 mi (1 km, 2 km, or 4 km) of the BIWF WTG Array. Seaducks were also not observed foraging within 0.6 mi to 1.2 mi (1 km and 2 km) of the WTG area, but 93 percent of all foraging seaducks encountered during the boat-based surveys were observed within 2.5 (4 km) of the BIWF WTG Array. It is probable that the waters within the 0.6 mi to 1.2 mi (1 km and 2 km) buffers are too deep for seaducks to forage. Northern gannets did not show a strong preference for areas within 0.6 mi to 1.2 mi (1 km or 2 km) of the Project Area, although 38 percent of all foraging gannets encountered were within 2.5 mi (4 km) of the BIWF WTG Array.

Table 4.5-11 lists the percentage of total count of each species or species group observed foraging or resting on the water within the BIWF study area at a 0.6 mi, 1.2 mi, and 2.5 mi (1 km, 2 km, and 4 km) buffer. Percentages are also assumed to be the portion of the population foraging in the BIWF Project Area that could incur effective loss of foraging habitat after construction of the BIWF.

**Table 4.5-11 Species Group Observed Foraging within 0.6 mi, 1.2 mi, and 2.5 mi (1 km, 2 km, and 4 km) of WTG Array**

Species / Species Group	1 km	2 km	4 km	Total Birds Encountered (n)
Loons	30%	43%	62%	338
Cormorants	0%	0%	0%	5
Shearwaters	92%	92%	95%	120
Storm-petrel	60%	63%	77%	65
Northern gannet	20%	20%	38%	250
Alcids	17%	31%	66%	149
Waterfowl	0%	0%	93%	333
Gulls	16%	22%	33%	748
Terns	35%	45%	85%	20
Overall*	27%	28%	56%	2,034

\* Includes birds that were not identifiable; species and species groups include only positively identified birds.

For most species, including those found to be particularly susceptible to displacement in European studies, including loons, cormorants, and certain waterfowl, only a small portion of the population occurring within the BIWF Study Area would incur effective loss of foraging habitat. Shearwaters showed the highest concentration of foraging individuals within 0.6 mi (1 km) of the WTG Array and, consequently, may be more susceptible to displacement effects. Seaducks often exhibit high fidelity to foraging areas and would likely be disproportionately susceptible to displacement (Robertson et al. 2000). The RI Ocean SAMP designates seaduck foraging habitat in water depths less than or equal to 65.6 ft (20 m) as Areas Designated for Preservation. Deepwater Wind has sited the WTGs in deeper waters outside of the seaduck foraging habitat, as shown on Figure 4.5-7, and seaducks were not observed foraging within 1.2 mi (2 km) of the BIWF WTG Array. Therefore, the risk of displacing foraging seaducks from the WTG area is expected to be very low.

At a regional scale, the worst-case scenario assumes total loss of all effective foraging habitats within the entire 2.5 mi (4 km) buffer, or about 2.1 percent of available habitat in Rhode Island Sound; however, it is likely that the actual loss of habitat will be considerably less. Only a minor percentage of all birds recorded in the BIWF study area were found within even 0.6 mi (1 km) of the BIWF WTG Array. Also, calculations of the scale of foraging habitat that could be effectively lost because of avoidance of the BIWF assume both complete avoidance and that all areas of habitat are equally suitable. In reality, it is unlikely that birds will exhibit complete avoidance; moreover, the habitat (water depth, bottom type) within each buffer area is not homogenous and therefore not equally suitable for foraging.

Because the size of the habitat area that may be effectively lost as a result of the BIWF is a small proportion of the total available foraging habitat for all species in the region (even in the worst-case scenario of complete avoidance and displacement within 2.5 mi [4 km]), and the use of the BIWF area by foraging birds is relatively low, the displacement of foraging birds from installation of the BIWF will not be a significant impact on the avian population of Rhode Island Sound.

#### *Barrier Effect*

An avoidance response caused by the sight of novel structures (e.g., WTGs) in the marine environment could create a barrier to movement for some species (Petersen and Fox 2007). This barrier to movement would cause individuals to increase flight distances to circumvent the BIWF WTG Array. Lengthening flight paths would increase energy consumption by individuals and could result in a reduction in fitness if



the increase in energy demands to circumvent the wind farm were great enough (Fox et al. 2006) Avoidance of the BIWF by birds could also manifest as a long-term change in migrating or transiting behavior in response to the WTGs. Changes to flight routes have the potential to cause a reduction in fitness for birds migrating or transiting through the Project Area (Fox et al. 2006).

Post-construction studies at operational offshore wind farms in Europe evaluated barrier effects and avoidance. At Nysted and Horns Rev wind farms, avoidance behavior was observed at a distance of between 0.9 mi and 1.2 mi (1.5 and 2 km) from the turbine that resulted in a change in flight direction for between 71 percent and 86 percent of the birds that were on a trajectory to enter the wind farms (Petersen et al. 2006). Loons and gannets never flew between the turbines at Nysted, although other species flew between the turbines with no sign of avoidance (great black-backed gull and herring gull). The Danish studies also concluded that avoidance responses differed by time of day and by species (Petersen et al. 2006; Fox et al. 2006). Birds at Nysted and Horns Rev made modifications to flight trajectory closer to the turbines during the night than during the day (Petersen et al. 2006). Additional data from Nysted indicate that many of the birds at night may have modified flight paths vertically (i.e., increased flight altitude) to avoid the wind farm (Petersen et al. 2006).

The installation of the BIWF WTGs is likely to elicit some level of visually stimulated avoidance response by individual birds using the airspace within and around the BIWF Project Area. The degree to which the BIWF presents a barrier to movement is likely to be more significant for some species (loons and northern gannets) than for others (gulls). This is especially true for those species that do not commonly encounter man-made structures in the environment, such as pelagic seabirds and alcid. The avoidance threshold (i.e., at what distance birds begin to avoid the turbines) may be as much as 4 km in any one direction, although it is generally within 0.9 mi and 1.2 mi (1.5 km to 2.0 km) (Fox et al. 2006; Petersen et al. 2006). Avoidance thresholds may be indicative of the magnitude of potential impact posed by barrier effects from the BIWF (Garthe and Hüppop 2004; Peteresen et al. 2006; Drewitt and Langston 2006). The magnitude of the potential impact is likely also directly related to the number of individuals that occur in the area, as well as the ability of species to accommodate increases in flight distance during migration or daily transit flights. As the avoidance threshold increases from the BIWF, the number of birds that could be at risk may also rise.

The BIWF boat-based surveys sampled the occurrence of birds within a 0.6 mi, 1.2 mi, and 2.5 mi (1 km, 2 km, and 4 km) buffer. The results suggest that only a small percentage of the overall population of birds occurring in the BIWF study area could be at risk from barrier effects at an avoidance threshold of 0.6 mi (1 km). This conclusion is centered on the results of the boat-based surveys, during which an average of 19 percent of birds observed per day were observed within a 0.6 mi (1 km) buffer. Assuming that all of the birds encountered were on a trajectory towards the BIWF, and all will exhibit complete avoidance of the wind farm after construction, then approximately 19 percent of birds in the BIWF study area would likely be required to change their flight trajectory (i.e., fly a longer route, or in a different direction) to avoid the BIWF at a distance of 0.6 mi (1 km). At an avoidance threshold of 1.2 mi (2 km), the magnitude of potential risk increases to approximately 27 percent of birds, and at 2.5 mi (4 km) it is predicted to be at most approximately 47 percent of birds in the BIWF study area. In reality, it is highly unlikely that all of the birds observed during the boat-based surveys were on a trajectory towards the BIWF WTG Array area. Studies on avoidance thresholds and rates for birds in flight at existing offshore wind farms indicate that avoidance is not 100 percent and that the turbines do not present a complete barrier to movement for many species (Fox et al. 2006; Desholm 2003).

The most abundant species in the BIWF study area (loons, gannets, terns, seaducks, shearwaters, alcids, and gulls) are all capable of making long-distance migratory flights (Ryder 1993; Lee and Haney 1996; Goudie et al. 2000; Nisbet 2002; Lavers et al. 2009; Evers et al. 2010). The increased draw on energy budgets of birds avoiding and circumventing the BIWF WTGs is unlikely to have an effect on individual or population fitness. Loons, gannets, terns, seaducks, shearwaters, alcids, gulls, as well as landbirds that occur in the BIWF Project Area routinely undertake migrations of hundreds of kilometers, and therefore the need to fly a few extra kilometers out of their normal course would not likely adversely affect individuals or populations.

Deepwater Wind has minimized potential barrier effects to migrating and transiting birds in the BIWF area by orientating the turbines in parallel with the average avian flight direction through the WTG area, which is predominantly northeast-southwest. Birds, and bats, traveling northeast to southwest would be confronted with a smaller barrier (i.e., a single turbine profile as opposed to the entire five WTG string). The proposed turbine string orientation minimizes the potential for increased flight distances for the majority of migrating and transiting birds in the BIWF Project Area. Deepwater Wind has also reduced the number of WTGs and sited the WTGs within state waters as far as possible offshore. Further, the relative size of the turbine site in relation to Rhode Island Sound is small and therefore will likely not pose a barrier to migration. The scale of the Project Area is predicted to impact less than one-tenth of 1 percent of the available air space and water surface available in this region of Rhode Island Sound. There will be substantial air space and water surface available adjacent to the proposed Project Area for foraging and migrating birds. As a result, operation of the BIWF is not expected to cause a significant barrier to migration. Post-construction monitoring data, including passage rates and trajectories of birds approaching the BIWF turbines, will help to define the magnitude of the potential barrier effects.

Effects to avian species during decommissioning of the wind farm are expected to be similar to those evaluated for the construction phase of the BIWF.

### ***Bats***

Construction activity is not expected to impact bats because bats are not common in the BIWF or BITS Project Area. However, construction vessels operating at night with bright deck lights illuminated have some potential to attract bats if insects congregate near the work lights. Deepwater Wind will monitor bat activity in the BIWF during construction on select vessels that need to operate at night with deck lights on.

Recent research has demonstrated that tree and tree-crevasse roosting migratory bats have been the predominant species found during post-construction mortality studies at operational wind farms in North America (Arnett et al. 2008). Results from these mortality studies show the three bat species most commonly encountered during ground searches were long-distance (Lasiurine) migratory bats: hoary bat, silver-haired bat, and eastern red bat (Kunz et al. 2007; Arnett et al. 2008). The migratory species, hoary bat, silver-haired bat, eastern red bat, as well as evening bat, were positively identified from recordings made during the BIWF surveys, primarily on Block Island. Overall, there was very little bat activity offshore. Bats are susceptible to many of the same impacts as birds. Specifically, bats may collide with turbines and may avoid the BIWF WTG Array. Bats are known to collide with moving blades as well as stationary turbine components and may also be physically harmed by air turbulence around turbines, both at land-based and offshore facilities (Langston and Drewitt 2008). Turbine lighting, weather conditions, and visibility are the most significant factors affecting collision risk.

Patterns of activity in the Project Area detected during the Project surveys do not suggest the presence of a large bat migration corridor in the vicinity of the BIWF WTG Array. Additionally, although bats are known to forage offshore, they were not observed regularly during the BIWF surveys and are not expected to use the BIWF Project Area or adjacent waters for regular foraging. No bats were observed foraging within 0.6 mi or 1.2 mi (1 or 2 km) of the WTG Array. As a result, bats are not considered susceptible to disturbance or displacement impacts. Because of the low occurrence rates of bats offshore, especially within the BIWF WTG area, the risk of bats colliding with the BIWF turbines is also expected to be very low. Deepwater Wind will undertake post-construction monitoring for bats at the BIWF turbines.

## **BITS**

### ***Avian Species***

Installation of the BITS will temporally disturb some benthic invertebrate (bivalves and other seaduck prey) communities and therefore may impact species that forage on benthic invertebrates (i.e., seaducks). Although avian surveys were not performed over the entire area where the subsea BITS cable is proposed, the water depth along the BITS corridor is generally greater than what is accessible by seaducks (approximately 82 ft [25 m]) (Winiarski et al. 2011). For the portion of the subsea Export Cable that was surveyed during the BIWF avian assessment, no seaducks (common eider and scoters, etc.) were observed from April through August, when the cable installation would occur. Installation of the cable will not impact foraging seaducks, because the water depth along most of the cable route is too deep, and seaduck abundances are generally lower in the BIWF Project Area during the proposed April to September construction period. In addition, any benthic invertebrate communities are expected to quickly recolonize disturbed areas following BITS construction (see Section 4.5.1).

There is potential for the BITS cable installation activity to disturb birds nesting along coastal Block Island and Rhode Island. Any breeding birds on either Block Island or on mainland Rhode Island in coastal and upland areas adjacent to the waters where the BITS cables are being laid will not be affected. There will be no impact on these populations because the cable-laying vessel will be generally more than 2.2 nm (4 km) from shore during most of the installation period, and because the vessel will move progressively and predictably in a manner not dissimilar to other recreational and commercial vessel traffic in the area.

The submarine cable will not result in any impacts on birds during operation. The RI Ocean SAMP expressly states that underwater cables are not prohibited from seaduck foraging habitat in waters designated as an Area Designated for Preservation. The Narragansett Switchyard and the overhead and underground cables on the Rhode Island mainland will not result in any significant impacts on avian species. Both the Block Island Substation and Narragansett Switchyard locations are adjacent to areas that were previously developed, and currently have other sources of ambient lighting (e.g., street lights); therefore, additional lighting at the proposed Block Island Substation and Narragansett Switchyard is unlikely to attract nocturnal migrants, or have substantial impacts on wildlife. However, lighting at the Block Island Substation and Narragansett Switchyard should be minimized to the extent practicable to reduce potential impacts on birds and other wildlife, including bats.

A segment of the onshore portion of the BITS on Block Island will require relocating an osprey nest. The nest is currently located on the top of a utility pole west of the BIPCO property that will be upgraded as part of the BITS Project. Ospreys are protected under the MBTA. However, the USFWS has indicated that if no eggs or offspring are present (i.e., the nest is inactive), then the MBTA does not expressly

prohibit the nest from being destroyed (USDOJ 2003). An inactive osprey nest is defined as a nest not under construction, a nest after the young of the year have fledged and are no longer occupying the nest, or a nest after September 15 when no eggs or young are present (VDGIF 2010; USFWS 2011). Deepwater Wind will consult with RIDEM and USFWS to develop a specific plan for nest relocation; however, in order to mitigate the potential impact of the nest removal to the osprey population of Block Island, Deepwater Wind will construct a new nesting platform in the vicinity of the removed nest. The new platform will be in a location deemed appropriate by USFWS and RIDEM biologists. The replacement platform will be as tall as or taller than the removed nest, located as close as possible to the original nest location, strong enough to support 200 lbs., and have a minimum width of 3 ft (0.9 m) horizontally in any one direction. Remnants of the removed nest will be placed onto the old nest platform to encourage the osprey pair to return.

Because removal of the BITS cable is not proposed, decommissioning will not result in any impacts on avian species.

#### *Bats*

There is very limited potential for adverse impacts on bats from the construction, operation, and decommissioning of the BITS, because no bat roosts, hibernacula, or important foraging areas are known to occur within the BITS Project Area.

Deepwater Wind's proposed development of the Quonset Point staging area and the BITS is unlikely to affect bat foraging or migration activity. The onshore facilities will result in minimal clearing of natural vegetation or alteration of existing wetland areas, which could provide foraging habitat.

### **Combined Effects**

#### *Avian Species*

Construction and operation of the BIWF and BITS Projects will not have any combined impacts on bird populations. Impacts during construction will be short in duration and limited in scale and will not cause birds to incur risks that could affect individual or population fitness. Potential impacts associated with the BIWF will not multiply the potential impacts of the BITS Project. There is greater potential for risk to birds during the operation of the BIWF from the WTGs than from any other BIWF or BITS construction activities (these potential impacts are fully addressed in Section 4.5.6.2). The BITS Project is not expected to impact birds during the construction period, and there are no known impacts during operation. By combining project components, such as transmission line structures onshore, and thereby reducing the overall footprint of both projects, the potential for impact on birds from the BITS and the BIWF has been reduced.

The potential combined impacts of additional wind energy development in the Rhode Island Sound area are unknown. At this time no other commercial scale offshore wind projects are proposed in the immediate vicinity of Block Island.

#### *Bats*

No cumulative impacts on bats are expected as a result of the construction and operation of the BIWF and BITS Projects. Potential impacts on bats during construction and operation from the BIWF and BITS Projects are discussed in detail in Section 4.5.6.2. There are no known impacts on bats from the installation or operation of a subsea transmission cable.

#### 4.5.7 Threatened and Endangered Species

The federal ESA of 1973, as amended (16 USC 1531 et seq.), prohibits unauthorized taking, possession, sale, and transport of listed species. Under Section 7 of the ESA, federal agencies must consult with the USFWS and NOAA Fisheries to ensure that any action authorized, funded, or carried out by that agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habit. NOAA Fisheries has jurisdiction over most listed marine species and anadromous fish species, while the USFWS has jurisdiction over terrestrial and freshwater species and some marine species with land-based habitats that are unlikely to occur in the Rhode Island Sound, such as manatees, polar bears, sea otters, and walrus. Section 4.5 of this ER and associated appendices are intended to support a biological assessment for the Project for NOAA Fisheries' and USFWS' review of the potential effects to federally listed terrestrial and marine species. This section focuses specifically on discussing those species listed as endangered, threatened or candidate under federal and state laws and regulations.

This section also considers state-protected species. The Rhode Island ESA (RIGL §§ 20-37-1 et seq.) further prohibits the importation, sale, transportation, storage, traffic, ownership, or other possession or use of any animal or plant listed under the federal ESA. Under the state ESA, RIDEM may also declare animals and plants as endangered. Species of special concern as designated by federal and state agencies are also briefly considered in this section.

##### 4.5.7.1 Affected Environment

Most of the Project Area is located in the marine environment of the coastal and deeper waters of Rhode Island Sound. Construction vessels may also transit the waters of the Block Island Sound. The terrestrial portion of the Project Area consists mainly of a recreational beach environment and previously disturbed areas surrounded by existing residential, commercial, institutional, and industrial development. The protected species that may occur in the Project Area were determined through literature and agency consultation with consideration for the range of environments that specifically comprise the Project Area within the greater context of Washington County, Rhode Island, and Rhode Island Sound. Table 4.5-12 lists the federally and state-listed terrestrial and marine species that were considered for this assessment and their likelihood of occurrence in the Project Area.

**Table 4.5-12 Threatened and Endangered Species Potentially Occurring within the Project Area**

Common Name	Scientific Name	Status	Likelihood of Occurrence In Project Area
<b>Insects</b>			
American burying beetle	<i>Nicrophorus americanus</i>	FE	Low
<b>Birds</b>			
Roseate tern	<i>Sterna dougalli</i>	FE	Low (late summer migration)
Piping plover	<i>Charadrius melodus</i>	FT	Low
Red knot	<i>Chalidris canutus rufa</i>	FC	Low (late summer migration)
Least tern	<i>Sterna antillarum</i>	ST	Moderate
<b>Fish</b>			
Atlantic sturgeon	<i>Acipenser oxyrinchus</i>	FE <sup>a/</sup>	Moderate (spring and fall migrations)
<b>Marine Mammals</b>			
North Atlantic right whale	<i>Eubalaena glacialis</i>	FE	Low (spring and fall)
Humpback whale	<i>Megaptera novaeangliae</i>	FE	Low (spring and summer)
Fin whale	<i>Balaenoptera physalus</i>	FE	Moderate (year-round)
Blue whale	<i>Balaenoptera musculus</i>	FE	Unlikely
Sei whale	<i>Balaenoptera borealis</i>	FE	Unlikely
Sperm whale	<i>Physeter macrocephalus</i>	FE	Unlikely

**Table 4.5-12 Threatened and Endangered Species Potentially Occurring within the Project Area**

Common Name	Scientific Name	Status	Likelihood of Occurrence In Project Area
West Indian manatee	<i>Trichechus manatus</i>	FE	Unlikely
<b>Sea Turtles</b>			
Loggerhead Turtle	<i>Caretta caretta</i>	FE	Low (Summer and Fall)
Leatherback Turtle	<i>Dermochelys coriacea</i>	FE	Low (summer and fall)
Kemp's Ridley Turtle	<i>Lepidochelys kempii</i>	FE	Low (summer)
Hawksbill Turtle	<i>Eretmochelys imbricata</i>	FE	Unlikely
Green Turtle	<i>Chelonia mydas</i>	FT	Low (spring)
<sup>a/</sup> Endangered designation applies to New York Bight Distinct Population Segment. FE - Federally Endangered Species FT - Federally Threatened Species FC - Federal Candidate Species ST - State-Threatened Species Source: Boyd 1982; Enser 2006; RI Ocean SAMP 2011; Kenney and Vigness-Raposa 2009.			

Federal and state agencies also monitor species that do not receive protected status through federal or state statute, but are of concern or interest to those agencies. Table 4.5-13 lists species of concern that may occur in the Project Area. The USFWS monitors bird populations under a federal mandate and compiles a list of birds of conservation concern (BCC). Species listed as BCC are not listed under the ESA, but are of greater conservation concern to the USFWS than other species; BCC listing is a precautionary measure to assure that these species receive extra attention to avoid listing under the ESA (USFWS 2008a). BCC listing does not incur any additional protection to BCC species other than that already accorded them under the MBTA or other relevant statutes (USFWS 2008a). NOAA Fisheries considers species of concern as species for which NOAA Fisheries has some concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the ESA (NOAA 2010c). In Rhode Island, NOAA Fisheries identified nine finfish species as species of concern that may be present in the RI Ocean SAMP study area (RI Ocean SAMP 2011). Species of concern status by NOAA Fisheries does not carry any procedural or substantive protections under the ESA.

**Table 4.5-13 Non-Listed Species of Special Concern Potentially Occurring in Project Area**

Common Name	Species Name	Status
<b>Avian</b>		
Red-throated loon	<i>Gavia stellata</i>	BCC
Greater shearwater	<i>Puffinus gravis</i>	BCC
Great cormorant	<i>Phalacrocorax carbo</i>	BCC
Peregrine Falcon	<i>Falco peregrinus</i>	BCC
Hudsonian godwit	<i>Limosa haemastica</i>	BCC
Red knot	<i>Calidris canutus</i>	BCC
Semipalmated sandpiper	<i>Calidris pusilla</i>	BCC
Purple sandpiper	<i>Calidris maritima</i>	BCC
Great blue heron	<i>Ardea herodias</i>	SSC
Black-crowned night heron	<i>Nycticorax nycticorax</i>	SSC
Osprey	<i>Pandion haliaetus</i>	SSC
Northern harrier	<i>Circus cyaneus</i>	SSC
American oystercatcher	<i>Haematopus palliatus</i>	SSC
Willet	<i>Catoptrophorus semipalmatus</i>	SSC
<b>Fish</b>		
Alewife	<i>Alosa pseudoharengus</i>	SOC

**Table 4.5-13 Non-Listed Species of Special Concern Potentially Occurring in Project Area**

Common Name	Species Name	Status
Atlantic halibut	<i>Hippoglossus hippoglossus</i>	SOC
Atlantic wolfish	<i>Anarhichas lupus</i>	SOC
Blueback herring	<i>Alosa aestivalis</i>	SOC
Dusky shark	<i>Carcharhinus obscurus</i>	SOC
Porbeagle shark	<i>Lamna nasus</i>	SOC
Rainbow smelt	<i>Osmerus mordax</i>	SOC
Sand tiger shark	<i>Carcharias taurus</i>	SOC
Thorny skate	<i>Amblyraja radiata</i>	SOC
BCC – Bird of Conservation Concern (USFWS) SOC – Species of Concern (NOAA Fisheries) SSC – Species of Special Concern (RIDEM) Source: USFWS 2008a; NOAA 2010c; NOAA 2011; RI Ocean SAMP 2011.		

Sections 4.5.1 through 4.5.6 provide discussion of the affected environment and potential impacts and proposed mitigation relevant to these types of species of concern. Additional information regarding life history and habitat for many of these species is included in the RI Ocean SAMP (2011). This section focuses on species that are expressly listed as protected species under the federal and state endangered species laws to support Section 7 consultation with the USFWS and NOAA Fisheries and interagency consultation with RIDEM.

## Insects

### American Burying Beetle

The American burying beetle (*Nicrophorus americanus*) is the largest carrion beetle in North America. Populations of the federally endangered beetle occur in two widely disparate areas, Oklahoma and Block Island, Rhode Island (USFWS 1991). This species was listed as federally endangered in July 1989.

The core of the beetle's Block Island habitat is on the southern and southwestern portions of the island in Rodman Hollow and on adjacent conservation lands. Block Island's beetle population is most closely associated with scrub-shrub habitat dominated by shadbush (*Amelanchier* spp.), bayberry (*Myrica* spp.) and goldenrods (*Solidago* spp.). Beetles may also occur in mowed fields. Ring-necked pheasant (*Phasianus colchicus*) and other bird species on Block Island are thought to be the most important sources of carrion for the beetle due to the low diversity and abundance of small and medium sized mammals on the island (USFWS 1991). Habitat loss is the primary threat to American burying beetle across its range (USFWS 1991).

Although the species occurs on Block Island, it has not been documented near the proposed landfall site or at the proposed Block Island Substation (M. Amaral, personal communication, June 28, 2010). USFWS surveys for American burying beetle performed at sites south of the Great Salt Pond, Block Island, and north of the proposed Export Cable route and Block Island Substation did confirm the presence of American burying beetle. However, habitat at the proposed Block Island Substation is not considered suitable for American burying beetle because the area is heavily developed and most surfaces have been either paved or heavily altered (USFWS 1991). Additionally, on June 14, 2010, Michael Amaral of the USFWS and Christopher Raithel of RIDEM conducted a survey for American burying beetle at the location of the proposed Block Island Substation on the BIPCO property (M. Amaral, personal communication, June 28, 2010). The purpose of the survey was to determine if American burying beetles were present at the site. Two baited pitfall traps were deployed in natural habitat at the

proposed Block Island Substation location. No American burying beetles were captured, although other species of common carrion beetle species were captured. The American burying beetle is not known to occur on the Rhode Island mainland.

### Avian Species

During the BIWF avian survey effort from 2009 to 2011, no federally listed endangered or threatened species were observed (Appendix O). Roseate terns were not observed during the BIWF studies, although other tern species, primarily common tern (*Sterna hirundo*), were observed in the Project Area, including the area of the proposed WTG Array. Shorebirds were rarely observed within the BIWF Project Area, but were observed on Block Island. No red knot or piping plover were observed offshore in or near the proposed WTG Array.

#### Roseate Tern

Roseate tern (*Sterna dougallii dougallii*) is a migratory seabird that breeds in both the Caribbean and North Atlantic, and winters along the northern and eastern coasts of South America (USFWS 1998). The North Atlantic *S. d. dougallii* population of roseate tern was listed as endangered under the ESA in 1987. No critical habitat areas have been designated for the North Atlantic population of roseate tern (USFWS 1998).

The causes of roseate tern population decline in the North Atlantic relate to historical impacts on the species that occurred prior to the twentieth century through the 1970s (Gochfeld et al. 1998). Egging (harvesting of tern eggs for human consumption) is thought to have significantly affected roseate tern colonies in the Atlantic (Gochfeld et al. 1998). Accumulation of organochlorines, including DDT (dichlorodiphenyltrichloroethane) and polychlorinated biphenyls, in tern tissues and eggs (especially in New York and Massachusetts pairs) is thought to have caused substantial declines in nest success during the latter part of the twentieth century (Gochfeld et al. 1998). Current threats to the species include habitat loss, predation of nests, and increasing gull populations (USFWS 2010). Recent re-colonization of historic nesting sites in Maine and elsewhere indicate the North Atlantic roseate tern population may be recovering (USFWS 2010).

Roseate terns can be found in southern New England during their breeding period, which occurs typically from late May when eggs are laid through late July when young fledge and leave the nest. Roseate terns breed on small islands and barrier beaches, usually with common tern (*Sterna hirundo*) (USFWS 1998). The closest roseate tern breeding colonies to the Project Area are Great Gull Island off the north end of Long Island, New York, and Bird Island, Ram Island, and Penikese Island in Buzzards Bay, Massachusetts. These colonies are located more than 12.4 mi (20 km) from the proposed WTG Array (USFWS 2010). The roseate tern does not nest on Block Island and is no longer known to breed on the Rhode Island mainland (USFWS 2010).

Foraging during the breeding period primarily occurs in nearshore waters, inlets, and sheltered bays in shallow waters (less than 9.8 ft [3 m] deep), generally within 4.3 mi (7 km) of breeding colonies with occasional forays to forage in deeper water, at a distance of perhaps up to 13.7 mi (22 km) from the colony (Burger et al. 2011). Foraging habits during the post-breeding period may shift to become more pelagic, up to 18.6 mi (30 km) from breeding areas (Gochfeld 1998; USFWS 1998). Studies of foraging roseate terns indicate that the average height above the water from which terns imitate dives to capture prey was less than 16.4 ft (5 m), and infrequently exceeded 39.4 ft (12 m) (Burger et al. 2011). Roseate terns may rest at or forage near the cable landfall site on Block Island in very low numbers, although terns do not regularly occur at Crescent Beach, and are more common on the western side of the island near the



entrance to New Harbor (Appendix O). Few birds were observed foraging in the area of the proposed WTG Array during the BIWF ship-based surveys, which indicates that the area does not support consistent concentrations of small pelagic fish, which would attract roseate terns and other aerial foragers. Roseate terns are known to rest and forage along the coast of the Rhode Island mainland, primarily during migration.

Historical surveys and RI Ocean SAMP studies indicate that roseate tern move through the Rhode Island Sound area in late summer during the post-breeding season, probably towards pre-migration staging areas in and near Monomoy NWR south of Cape Cod (USFWS 1998, 2010; Paton et al. 2010). Migratory flight heights are thought to be generally above RSZ height, although the influence of wind and weather conditions may cause individuals to fly closer to the water (Burger et al. 2011). The majority of late summer post-breeding movements of roseate terns in Rhode Island are concentrated near the Rhode Island mainland coast, north of Block Island and well north of the proposed WTG Array (Paton et al. 2010). During the RI Ocean SAMP boat-based surveys, only eight roseate tern observations were recorded during offshore ship-based surveys, with seven of the eight observations occurring west and north of Block Island and one observation occurring south of Block Island in a sample grid located 5 nm from the proposed WTG Array (Paton et al. 2010). The species was detected most frequently during RI Ocean SAMP land-based surveys and all detections were made between mid-July and late-August (Paton et al. 2010). The species was not observed during Project boat-based surveys (Appendix O).

#### Piping Plover

Piping plover (*Charadrius melodus melodus*) is a migratory shorebird that breeds along the North Atlantic coast and winters in the southern United States, around the Caribbean, and in Central America (Elliott-Smith and Haig 2004). Piping plover nest on coastal beaches and in dune habitat, and forage in the inter-tidal zone (Elliott-Smith and Haig 2004). The Atlantic coast nesting subspecies (*C. m. melodus*) population was listed as threatened in 1986 (USFWS 1996). The Atlantic coast piping plover population declined during the latter part of the nineteenth century as a result of the millinery trade. The population rebounded in the middle of the twentieth century following passage of the MBTA in 1918 (USFWS 2009). Recent threats to the Atlantic coast population include loss of nesting habitat, increased predation, and increased recreational use of nesting beaches correlated to low nesting success rates (USFWS 2009). Critical habitat for the piping plover has been designated for the Great Lake breeding population and for the wintering population in the southern United States (USFWS 2009). No critical habitat designations exist within New England for piping plover.

Piping plover are known to nest at 12 beaches on Block Island and the Rhode Island mainland (Edwards et al. 2006; Hartlaub et al. 2008; RI Ocean SAMP 2011). Piping plover are known to nest on Block Island in low densities, but do not nest there every year and did not nest in 2010; no breeding data were available for 2011 at the time of this report (USFWS 2012). Piping plover are also known to have nested on Narragansett Town Beach on the Rhode Island mainland. Narragansett Town Beach does not support breeding pairs every year and supports low numbers of birds compared to other nesting beaches on Rhode Island, such as East Beach in Watch Hill, Road Island (Edwards et al. 2006). A habitat assessment was conducted near the BITS Alternative 1 cable landfall location at Narragansett Town Beach in October 2009 (Tetra Tech 2009). This assessment helped determine that the Town Beach was largely intertidal sandy habitat with some remnants of natural dunes, surrounded by residential and commercial development, including impervious paved surfaces upslope from the beach dune remnants. There is some suitable foraging and/or staging habitat for piping plover on Narragansett Town Beach; however, there is

likely too much recreational beach use during the nesting period for plovers to successfully nest at the location of the proposed landfall site BITS Alternative 1 (Edwards et al. 2006).

The Atlantic coast population of piping plover nest on high beaches with little human disturbance (USFWS 2012). Piping plover generally forage close to shore (Normandeau 2011) and are not likely to occur in the area of the proposed WTG Array except during migration. Piping plover generally migrate in a narrow band along the coastline and are rarely seen far from shore (Burger et al. 2011). Migrating plovers, therefore, have a low likelihood of occurrence in the area of the proposed WTG Array, which is located 3 nm (5.6 km) from the Block Island coast and more than 15 nm (27.8 km) from the Rhode Island mainland coast. Migratory flight heights are not well known, although non-migratory flight heights are known to be well below the RSZ of modern WTGs (Burger et al. 2011). Piping plover were observed during the BIWF onshore sea watch surveys; however, piping plover were not observed near any of the proposed onshore facilities, including the cable landfall site at Town Beach on Block Island (Appendix O). Furthermore, migrating piping plover were not observed near the area of the proposed WTG Array during either the RI Ocean SAMP avian surveys or the BIWF boat-based surveys (Paton et al. 2010; Appendix O).

### Red Knot

Red knot is a holarctic breeding shorebird with a subspecies (*C.c. rufa*) population that winters along the coasts of South America, primarily in southern Chile and Argentina, and migrates through the United States during migration to and from the high arctic (Harrington 2001). Historical impacts on the species included excessive market and sport hunting during the late nineteenth and early twentieth centuries (Harrington 2001). Little is known about red knot population dynamics, but the occurrence of large numbers during migration at staging sites in the mid-Atlantic may leave the species vulnerable from threats to these important foraging habitats (Niles et al. 2007). Loss of wintering habitat is also a significant threat to the *C.c. rufa* population (Niles et al. 2007). Red knot are known to occasionally collide with structures in their environment (Harrington 2001). The *C.c. rufa* population of red knot was proposed as a candidate for ESA listing in August of 2006 (Niles et al. 2007).

In southern New England, including Rhode Island, red knot occur in the greatest numbers during southward migration, which peaks in early August. Southbound migrants may cross the Atlantic from staging areas along the eastern seaboard and migrate directly to Brazil in a single sustained flight (Harrington 2001; Niles et al. 2007). During northward migration, fewer red knots occur in Rhode Island. The bulk of the population stops in the Delaware Bay area during late April and May (Harrington 2001; Niles et al. 2007). A few critical migration stopover points are known to concentrate large numbers of the *C.c. rufa* population, but none of these stopover areas occur on Block Island or on the Rhode Island mainland. There are no historic records of large numbers of red knots using coastal areas of Rhode Island during spring or fall migration as there are elsewhere in the Northeast (Niles et al. 2007). Red knots do occur in low numbers (less than 100) at stopover areas on the Rhode Island mainland, including Napatree Point, Ninigret Pond, and Quicksand Pond, none of which are considered critical staging areas (Niles et al. 2007). Red knot migrate further from shore than many other migrating shorebirds, and therefore, have a higher potential to occur in the area of the proposed WTG Array. However, red knots do not regularly occur on Block Island and were not observed during the BIWF avian surveys (Appendix O).

A habitat assessment was also conducted at the proposed Quonset Point staging area on February 24, 2010 (Tetra Tech 2010). The area exhibited signs of previous development and the survey revealed no suitable foraging habitat for red knot.

### Least Tern

The least tern (*Sterna antillarum*) is listed as a state-threatened species, but is not listed under the federal ESA. Least terns occur fairly commonly throughout southern New England coastal areas in appropriate habitat. The species is thought to be declining throughout its range due to loss of nesting habitat, human disturbance (off-road vehicles on beaches, and other recreational uses), and increased rates of predation from mammalian predators and gulls (RIDEM 2005). Nesting sites include predator free islands and protected beaches.

Least terns forage in shallow waters of estuaries, bays, and tidal rivers (RIDEM 2005). In 2005, the species nested at a total of 10 beaches in Rhode Island, although nesting success was generally low because of predation and human disturbance (RIDEM 2005). Least terns generally occur in Rhode Island from April until September 15, and are known from the Napatree Point, Sandy Point Island, Briggs Beach, Quicksand Beach, and Trustom Pond NWR, but not from Block Island (RIDEM 2005). A single least tern was observed in July 2009 during the offshore portion of the BIWF surveys, and no least terns were observed on Block Island during the 2009 to 2011 surveys (Appendix O).

### **Fish Species**

Threatened and endangered finfish are listed under the ESA (16 U.S.C. 1531 et. seq.) by the NOAA Fisheries Office of Protected Resources. The Atlantic sturgeon (*Acipenser oxyrinchus*), which was considered a species of concern at the time of the writing of the RI Ocean SAMP, may be present in the Rhode Island waters. Populations of the Atlantic sturgeon have since been listed under the ESA. In February 2012, NOAA Fisheries designated the New York Bight, Chesapeake Bay, South Atlantic, and Carolina Distinct Population Segments (DPSs) as endangered (75 Federal Register 61872). NOAA also designated the Gulf of Maine DPS as threatened (75 Federal Register 61872). The range of all five DPSs overlaps, therefore Atlantic sturgeon originating from any of the five DPSs has the potential to be present within the Project Area. The New York Bight DPS includes all anadromous Atlantic sturgeon that are spawned in the watersheds that drain into the coastal waters of the Long Island Sound, the New York Bight, and Delaware Bay from Chatham, Massachusetts to the Delaware-Maryland border on Fenwick Island. Within this range, Atlantic sturgeon have been documented from the Hudson and Delaware rivers, as well as the mouth of the Connecticut and Taunton rivers, and throughout Long Island Sound (NOAA 2012). There have only been incidental catches of Atlantic sturgeon in the waters of Rhode Island in recent years, with the majority occurring nearshore (less than 3 mi [4.8 km] from shore) (NOAA 2007).

### Atlantic Sturgeon

The Atlantic sturgeon (*Acipenser oxyrinchus*) was listed as endangered in 2012 for the New York Bight DPS. Comprehensive information on current or historic abundance of Atlantic sturgeon is lacking for most river systems, including Narragansett Bay. However, population estimates of spawning adults are available for the Atlantic sturgeon subpopulation in the Hudson River (Atlantic Sturgeon Status Review Team 2007). In the Hudson River the mean annual spawning stock size has been estimated to be approximately 870 individuals (Kahnle et al. 2007). A trending increase in the capture of juvenile Atlantic sturgeon over consecutive years indicates that these fish are spawning successfully in this river system (Atlantic Sturgeon Status Review Team 2007). A substantial Atlantic sturgeon fishery existed into the late 1800s, with landings as high as 3,500 metric tons. Stock abundance of Atlantic sturgeon steadily declined throughout the 20th century, largely due to overfishing and habitat degradation/destruction (Shepherd 2006). Primary threats to Atlantic sturgeon include habitat degradation and loss, ship strikes, and general depletion from historical fishing (NOAA Fisheries Service 2012). The New York Bight DPS of Atlantic sturgeon is endangered due to precipitous declines in population sizes and the protracted period in which

sturgeon populations have been depressed, the limited amount of current spawning, and the impacts and threats that have and will continue to prevent population recovery (NOAA Fisheries Service 2012).

The Atlantic sturgeon is a long lived, late maturing, estuarine-dependent, anadromous species. This species has a long, sharply “v”-shaped snout, the presence of bony scutes between the anal fin base and the lateral scute row, and the presence of pale intestines. It is black-blue above and pale below, and can grow to 14 ft (4.3 m) (NOAA Fisheries 2011; Page and Burr 1991). Atlantic sturgeon are euryhaline, and do not spend a large part of their life in estuaries, and migrate between the sea and freshwater. Coastal features or shorelines where migratory Atlantic sturgeon commonly aggregate include the Bay of Fundy, Massachusetts Bay, Rhode Island, New Jersey, Delaware, Delaware Bay, Chesapeake Bay, and North Carolina. Historically, Atlantic sturgeon were present in 38 rivers in the United States from St. Croix, Maine, to the Saint Johns River, Florida, 35 of which have been confirmed to have had a historical spawning population. Atlantic sturgeon are currently present in these remaining rivers, and spawning occurs in at least 20 of these rivers (Atlantic Sturgeon Status Review Team 2007).

Atlantic sturgeon spawn in freshwater, but spend most of the adult life stage in the marine environment. Females may live to over 60 years; however, males are thought to live about 30 years. Spawning adults migrate upriver from April to May in mid-Atlantic waters and May to July in Canadian waters. Juveniles and adults generally return to brackish and coastal environments in the fall (Collette and Klein-MacPhee 2002). This species is highly migratory; mark-recapture studies have documented movements of sturgeon from the Hudson and Delaware Rivers to as far north as coastal Maine and south to North Carolina (Shepherd 2006). Atlantic sturgeon spawning is thought to occur in large rivers where flow rates are between 1.5 feet per second (ft/s) to 2.5 ft/s (0.5 m/s to 0.8 m/s) and depths of 36 ft to 89 ft (11 m to 27.1 m). Atlantic sturgeon require hard bottom substrates for spawning (Collette and Klein-MacPhee 2002). Sturgeon eggs adhere to hard bottom substrates (e.g., cobble), and hatch four to six days later. Newly hatched larval fish begin migrating downstream to rearing habitats after eight to twelve days; as sturgeon develop into the juvenile stage they continue moving downstream into brackish waters, and eventually become resident in estuarine waters for months or years. Subadults move to coastal waters after reaching lengths of 30 in to 36 in (76.2 cm to 91.4 cm). Despite Atlantic sturgeon extensive migrations, adults return to their natal streams for spawning. Males return first and remain in the natal stream for the entire spawning period, whereas females leave the spawning grounds soon after eggs are laid (Atlantic Sturgeon Status Review Team 2007). Spawning intervals are irregular; males are thought to spawn every 1 to 5 years, and females every 2 to 5 years (Smith 1985; Collins et al. 2000; Caron et al. 2002; Vladykov and Greeley 1963; Van Eenennaam et al. 1996; Stevenson and Secor 1999).

These fish are primarily bottom-oriented feeders, generally over soft sediments, as their prey items generally live in the sediment. Atlantic sturgeon are opportunistic feeders preying on polychaetes, isopods, decapod crustaceans, amphipods, gastropods, bivalves, and small fish (Collette and Klein-MacPhee 2002).

The seasonal migratory patterns and transient nature of juvenile and adult Atlantic sturgeon indicate there is the potential for this species to be present in both Block Island and Rhode Island Sounds; however, this species is not generally expected to occur in large numbers within the Project Area. Additionally given this species preference for hard bottom riverine spawning habitat, which has been avoided by the Project, impacts to breeding Atlantic sturgeon from Project construction, operation and decommissioning is unlikely.

## Marine Mammals

There are seven marine mammal species listed under the ESA with the potential to occur in Rhode Island waters: blue whale (*B. musculus*), fin whale (*B. physalus*), humpback whale (*M. novaeangliae*), right whale (*E. glacialis*), sei whale (*B. borealis*), sperm whale (*P. macrocephalus*), and West Indian manatee (*T. manatus*). These species are highly migratory and do not spend extended periods of time in a localized area. There are no marine mammal sanctuaries in the waters off Rhode Island. The waters of Rhode Island (including the Project Area) are primarily used as a stopover point for these species during seasonal movements north or south between important feeding and breeding grounds. The typical migratory routes for right whales and other baleen whales lie further offshore and outside of the Project Area (Kenney and Vigness-Raposa 2009; RI Ocean SAMP 2010). While the fin, humpback, and right whales have the potential to occur within the Project Area, the sperm, blue, and sei whales are more pelagic and/or northern species and their presence within the Project Area is unlikely. Additionally, the West Indian manatee has been sighted in Rhode Island waters; however, such events are extremely rare. Because the potential for the sperm whale, blue whale, sei whale, or West Indian manatee to occur within the Project Area during the marine construction period or in the area of the WTG Array during operation of the BIWF is unlikely, these species will not be described further in this analysis.

### North Atlantic Right Whale

The North Atlantic right whale (*Eubalaena glacialis*) is a strongly migratory species that moves annually between high-latitude feeding grounds and low-latitude calving and breeding grounds. This species was listed as a federally endangered species in 1970. The historic range of this species reached its southern terminus between Florida and northwestern Africa and its northern terminus between Labrador and Norway (Kenney 2002). The present range of the western North Atlantic right whale population extends from the southeastern United States, which is utilized for wintering and calving, to summer feeding and nursery grounds between New England and the Bay of Fundy and the Gulf of St. Lawrence (Kenney 2002; Waring et al. 2007). A right whale satellite tracking study within the northeast Atlantic (Baumgartner and Mate 2005) reported that this species often visited waters exhibiting low bottom water temperatures, high surface salinity, and high surface stratification, most likely for higher food densities. The winter distribution of North Atlantic right whales is largely unknown, although offshore surveys have reported between one and 13 detections annually in northeastern Florida and southeastern Georgia (Waring et al. 2007). A few documented events of right whale calving have been from shallow coastal areas and bays (Kenney 2002). North Atlantic right whales may be found in feeding grounds within New England waters between February and May, with peak abundance in late March (NMFS 2005). While in New England, right whales feed mostly on copepods belonging to the *Calanus* and *Pseudocalanus* genus (Waring et al. 2007).

The North Atlantic right whale was the first species targeted during commercial whaling operations and was the first species to be greatly depleted as a result of whaling operations (Kenney 2002). North Atlantic right whales were hunted in southern New England until the early twentieth century. Shore-based whaling in Long Island involved catches of right whales year-round, with peak catches in spring during the northbound migration from calving grounds off the southeastern United States to feeding grounds in the Gulf of Maine (Kenney and Vigness-Raposa 2009). Abundance estimates for the North Atlantic right whale population vary. From the 2003 United States Atlantic and Gulf of Mexico Marine Mammal Stock Assessments, there were only 291 North Atlantic right whales in existence, which is less than what was reported in the Northern Right Whale Recovery Plan written in 1991 (NOAA Fisheries 1991a; Waring et al. 2004). This is a tremendous difference from pre-exploitation numbers, which are thought to be around

1,000 individuals. When the right whale was finally protected in the 1930s, it is believed that the North Atlantic right whale population was roughly 100 individuals (Waring et al. 2004). In 2005, the Western North Atlantic population size was estimated to be at least 345 individuals (Waring et al. 2010)

Contemporary anthropogenic threats to right whale populations include fishery entanglements and vessel strikes, although habitat loss, pollution, anthropogenic noise, and intense commercial fishing may also negatively impact their populations (Kenney 2002). Ship strikes of individuals can impact northern right whales on a population level due to the intrinsically small remnant population that persists in the North Atlantic (Laist et al. 2001). Between 2002 and 2006, a study of marine mammal strandings and human-induced interactions reported that right whales in the western Atlantic were subject to the highest proportion of entanglements (25 of 145 confirmed events) and ship strikes (16 of 43 confirmed occurrences) of any marine mammal studied (Glass et al. 2008). Bycatch of North Atlantic right whale has also been reported in pelagic drift gillnet operations by the Northeast Fisheries Observer Program, however, no mortalities have been reported (Glass et al. 2008). The NOAA marine mammal stock assessment for 2007 reports that the low annual reproductive rate of right whales, coupled with small population size, suggests anthropogenic mortality may have a greater impact on population growth rates for the species than for other whales (Waring et al. 2007).

To address potential for ship strike, NOAA Fisheries designated the nearshore waters of the Mid-Atlantic Bight as the Mid-Atlantic U.S. Seasonal Management Area (SMA) for right whales. NOAA Fisheries requires that all vessels 65 ft (19.8 m) or longer must travel at 10 knots or less within the right whale SMA from November 1 through April 30 when right whales are most likely to pass through these waters (NOAA 2010d). The WTG Array and portions of the Export Cable are located within the right whale Mid-Atlantic SMA (Figure 4.5-7).

Right whales have been observed in or near Rhode Island during all four seasons; however, they are most common in the spring when they are migrating and in the fall during their southbound migration (Kenney and Vigness-Raposa 2009). Based on modeled seasonal abundance patterns conducted in support of the RI Ocean SAMP, right whales have the potential to occur in the Project Area during these seasons (Kenney and Vigness-Raposa 2009).

### Humpback Whale

The humpback whale (*Megaptera novaeangliae*) was listed as endangered in 1970 due to population decrease resulting from overharvesting. Humpback whales feed on small prey that is often found in large concentrations, including krill and fish such as herring and sand lance (Waring et al. 2007; Kenney and Vigness-Raposa 2009). Humpback whales from all of the North Atlantic migrate to the Caribbean in winter, where calves are born between January and March (Blaylock et al. 1995). Humpback whales exhibit consistent fidelity to feeding areas within the northern hemisphere (Stevick et al. 2006). There are six subpopulations of humpback whales that feed in six different areas during spring, summer and fall. These populations can be found in the Gulf of Maine, the Gulf of St. Lawrence, Newfoundland/Labrador, western Greenland, Iceland, and Norway (Waring et al. 2007). Humpback whales migrate from these feeding areas to the West Indies (including the Antilles, the Dominican Republic, the Virgin Islands and Puerto Rico) where they mate and calve their young (NMFS 1991b; Waring et al. 2007). While migrating, humpback whales utilize the mid-Atlantic as a migration pathway between calving/mating grounds to the south and feeding grounds in the north (Waring et al. 2007).

Humpback whales were hunted as early as the seventeenth century, with most whaling operations having occurred in the nineteenth century (Kenney and Vigness-Raposa 2009). By 1932, commercial hunting

within the North Atlantic may have reduced the humpback whale population to as little as 700 individuals (Breiwick et al. 1983). Humpback whaling ended worldwide in 1966 (NatureServe 2010). Contemporary anthropogenic threats to humpback whales include fishery entanglements and vessel strikes. Glass et al. (2008) reported that between 2002 and 2006, humpback whales belonging to the Gulf of Maine population were involved in 77 confirmed entanglements with fishery equipment and nine confirmed ship strikes. Humpback whales that were entangled exhibited the highest number of serious injury events of the six species of whale studied by Glass et al. (2008). A whale mortality and serious injury study conducted by Nelson et al. (2007) reported that the minimum annual rate of anthropogenic mortality and serious injury to humpback whales occupying the Gulf of Maine was 4.2 individuals per year. During this study period, humpback whales were involved in 70 reported entanglements and 12 vessel strikes, and were the most common dead species reported. The humpback whale population within the western North Atlantic has been estimated to include approximately 5,505 individuals and 11,570 for the total North Atlantic populations (NMFS 1991b; Waring et al. 2007). Through photographic population estimates, humpback whales within the Gulf of Maine (the only region where these whales summer in the United States) have been estimated to consist of 600 individuals in 1979 (NMFS 1991b). According to the species stock assessment report, the best estimate of abundance for the Gulf of Maine stock of humpback whales is 847 individuals (Waring et al. 2010).

Humpbacks occur off southern New England in all four seasons, with peak abundance in spring and summer. Based on modeled seasonal abundance patterns conducted in support of the RI Ocean SAMP, humpback whales have the potential to occur in the Project Area during these seasons (Kenney and Vigness-Raposa 2009).

#### Fin Whale

The fin whale (*Balaenoptera physalus*) was listed as federally endangered in 1970. Fin whales' range in the North Atlantic extends from the Gulf of Mexico, Caribbean Sea, and Mediterranean Sea in the south to Greenland, Iceland, and Norway in the north (Jonsgård 1966; Gambell 1985a). They are the most commonly sighted large whales in continental shelf waters from the Mid-Atlantic coast of the United States to Nova Scotia (Sergeant 1977; Sutcliffe and Brodie 1977; CETAP 1982; Hain et al. 1992; Waring et al. 2008). Fin whales, much like humpback whales, seem to exhibit habitat fidelity (Waring et al. 2007; Kenney and Vigness-Raposa 2009). However, fin whales habitat use has shifted in the southern Gulf of Maine, mostly likely due to changes in the abundance of sand lance and herring, both of which are major prey species along with squid, krill, and copepods (Kenney and Vigness-Raposa 2009). While fin whales typically feed in the Gulf of Maine and the waters surrounding New England, mating and calving (and general wintering) areas are largely unknown (Waring et al. 2007). Fin whale abundance off the coast of the northeastern United States is highest between spring and fall, with some individuals remaining during the winter (Hain et al. 1992). A recent estimate of fin whale abundance conducted between Georges Bank and the Gulf of St. Lawrence during the feeding season in August 2006 places the western North Atlantic fin whale populations at 2,269 individuals (Waring et al. 2007). Fin whales are the second largest living whale species on the planet (Kenney and Vigness-Raposa 2009). The gestation period for fin whales is approximately 11 months and calve births occur between late fall and winter. Females can give birth every two to three years.

Present threats to fin whales are similar to those that threaten other whale species, namely fishery entanglements and vessel strikes. Fin whales seem less likely to become entangled than other whale species. Glass et al. (2008) reported that between 2002 and 2006, fin whales belonging to the Gulf of Maine population were involved in only eight confirmed entanglements with fishery equipment.

Furthermore, Nelson et al. (2007) reported that fin whales exhibited a low proportion of entanglements (eight reported events) during their 2001 to 2005 study along the western Atlantic. On the other hand, vessel strikes may be a more serious threat to fin whales. Eight and ten confirmed vessel strikes with fin whales were reported by Glass et al. (2008) and Nelson et al. (2007), respectively. This level of incidence was similar to that exhibited by the other whales studied. Conversely, a study compiling whale/vessel strike reports from historical accounts, recent whale strandings, and anecdotal records by Laist et al. (2001) reported that of the 11 great whale species studied, fin whales were involved in collisions most frequently (31 in the United States and 16 in France).

Fin whales are present in the Rhode Island waters during all four seasons. In spring, summer, and fall, the main center of their distribution is in the Great South Channel area to the east of Cape Cod, which is a well-known feeding ground (Kenney and Winn 1986). Winter is the season of lowest overall abundance, but they do not depart the area entirely. Fin whales are the most common large whale encountered in continental shelf waters south of New England and into the Gulf of Maine. In recent years, fin whales are often encountered by local whale-watching operations and are likely to occur in the Project Area.

### Sea Turtles

Five sea turtle species are historically reported to occur within the coastal and offshore Rhode Island waters, namely the loggerhead turtle (*Caretta caretta*), leatherback turtle (*Dermochelys coriacea*), Kemp's ridley turtle (*Lepidochelys kempii*), green turtle (*Chelonia mydas*), and hawksbill turtle (*Eretmochelys imbricata*). Of these, the leatherback and loggerhead sea turtles are considered common, the Kemp's ridley sea turtle is considered regular, and the green sea turtle is considered rare within the RI Ocean SAMP (Kenney and Vigness-Raposa 2009). However, the leatherback is found in deeper, offshore waters and only juveniles for both the Kemp's ridley and green sea turtles range into Rhode Island waters, preferring deep ocean environments (Kenney and Vigness-Raposa 2009). The hawksbill turtle prefers warmer temperate waters and rarely ventures into higher latitudes. This species can generally be found in tropical, shallow coastal waters and is unlikely to occur in the Project Area. The only sea turtles that are might be encountered in the BIWF and BITS Project Area are the loggerhead, leatherback, Kemp's ridley, and green turtles during summer and fall, although the loggerhead turtle is more likely encountered in offshore waters and the remaining sea turtle species range outside the Project Area, usually in more pelagic waters, or are so rarely sighted that their presence in the Project Area is unlikely.

#### Loggerhead Sea Turtle

The loggerhead sea turtle (*Caretta caretta*) was listed as federally endangered in 1978. Threats to the loggerhead sea turtle include both naturally caused and anthropogenic destruction and alteration of nesting habitats, marine debris, coastal noise and light pollution, beach vehicle traffic, boat strikes, and fishery incidents (TEWG 2000; NMFS and USFWS 2007a).

The loggerhead sea turtle is one of the two, larger-shelled species of sea turtle found in the North Atlantic, with carapace (shell) lengths reaching 213 cm (Kenney and Vigness-Raposa 2009). The carapace and head of the loggerhead are distinct. The shell is shaped like an oval that tapers towards the rear and the head is much larger relative to its overall size compared to other sea turtles (NMFS 2010). Juvenile loggerhead sea turtles have been reported in high numbers around the Azore islands, feeding on pelagic invertebrates including siphonophores, jellies, salps, barnacles, isopods, and gastropods (TEWG 2000; Bolten 2003). Loggerhead sea turtles return to coastal waters during the later stages of juvenile development. The later juvenile diet, which is dominated by crabs, changes to an adult diet consisting of bivalves, gastropods, anemones, sea pens, crabs, and seaweeds (Kenney and Vigness-Raposa 2009).



The western Atlantic population of loggerhead sea turtles can be further divided into five distinct subgroups. The northernmost subpopulation nests between Georgia and the Carolinas. There are two more nesting subpopulations within the United States, which can be found in southern Florida and the Florida Panhandle. Finally, two more nesting subpopulations exist in Dry Tortugas and the Yucatan (NMFS and USFWS 2007a). The western North Atlantic population of loggerhead turtles has been estimated at 53,000 to 92,000 nests and 32,000 to 56,000 nesting females (TEWG 2000; NMFS and USFWS 2007a). Between 1989 and 1998, the northern subpopulation harbored between 4,370 and 7,887 nests per year, while the south Florida population exhibited 48,531 to 83,442 nests per year (TEWG 2000). Since nesting occurs no further north than the Carolinas, no loggerhead sea turtle nesting areas occur in the New England area (NMFS and USFWS 2007a).

In the northeastern United States, there are few loggerhead sea turtle sightings north of Long Island. South of Long Island, occurrence is strongly seasonal, predominantly in the summer. Overall, although loggerheads are much more abundant off the Northeast than leatherbacks, they are less likely to be seen in cooler and nearshore waters (Kenney and Vigness-Raposa 2009). Loggerhead sea turtles may occur seasonally in Rhode Island waters during summer and fall. Based on modeled seasonal abundance patterns conducted in support of the RI Ocean SAMP, loggerhead sea turtles have the potential to occur in the Project Area during the summer and fall (Kenney and Vigness-Raposa 2009).

#### Leatherback Sea Turtle

The leatherback sea (*Dermochelys coriacea*) turtle was listed as federally endangered in 1970. While there are natural threats for leatherback sea turtles (e.g. recent large-scale habitat loss as a result of the 2004 tsunami in the Indian Ocean), most threats to this species are anthropogenic and include coastal tourism, habitat alteration and loss, artificial lighting on breeding beaches, pollution, global warming, marine debris ingestion (e.g. balloons); however, vessel strikes and commercial fishing are the largest threats to this species (NMFS and USFWS 2007b; TEWG 2007). Commercial longline fishing may be the most serious contemporary threat. Longline fishing data collected and summarized by NMFS-SEFSC (2001) found that between 1992 and 1999, the longline fishing industry takes of leatherback sea turtles were between 308 and 1,054 animals. Furthermore, the U.S. shrimp trawl fishery has been estimated to take 650 leatherback sea turtles a year (NMFS and USFWS 1992).

This species is one of the largest reptiles and the only turtle in the world that lacks keratin plates or scutes (Kenney and Vigness-Raposa 2009). The leatherback sea turtle instead has a bony shell, which is covered by a soft layer of leathery skin. Females dig nests on sandy beaches and hatchlings emerge from these nests after two months (Kenney and Vigness-Raposa 2009). Hatchlings usually emerge with a shell length just less than 2 in (5 cm) and are believed to move into pelagic waters upon leaving natal beaches (TEWG 2007). Leatherback hatchlings feed on aquatic plants and invertebrates while adults feed mostly on jellyfish and other gelatinous invertebrates, especially lion's mane jellyfish (Kenney and Vigness-Raposa 2009). Leatherback sea turtles are the most pelagic sea turtle, but may also be found in coastal areas. The most recent estimate of leatherback turtle population size within the North Atlantic is between 34,000 and 94,000 individuals (TEWG 2007). Within the seven Atlantic populations of leatherback sea turtles identified by the Turtle Expert Working Group (TEWG), notable differences in nesting densities have been reported. Over the last 10 to 15 years, the number of nesting leatherback sea turtles has increased for the Florida, the Northern Caribbean, the Southern Caribbean, the West African, and the Brazilian populations and decreased in the Western Caribbean population. Nesting activity in South Africa has not been recorded in the Atlantic (NOAA Fisheries and USFWS 2007b).

Leatherback sea turtles exhibit the most expansive distribution of any sea turtle, with nesting occurring within tropical and subtropical climates and foraging occurring well into subpolar regions (NOAA Fisheries and USFWS 2007b). The TEWG identified seven leatherback sea turtle populations in the eastern and western Atlantic. These populations can be found in Florida, Western Caribbean, Northern Caribbean, Southern Caribbean, West Africa, South Africa, and Brazil (TEWG 2007). Foraging areas occupied by the leatherback sea turtle seem to vary based on seasonality. A satellite tracking study of ten leatherbacks reported that most individuals were located on the North American OCS between spring and fall, and off the OCS during the winter (Eckert et al. 2006). The seasonal distribution of leatherback sea turtles extend to the western North Atlantic and reaches northward into Canadian waters (NMFS-SEFSC 2001). Seasonal movements have been described by Shoop and Kenney (1992) to occur between Cape Hatteras and the Gulf of Maine, eastward to the 6,561.7 ft (2,000 m) isobath. While leatherback sea turtle detections have been reported throughout the U.S. East Coast during summer, densities decrease from Cape Hatteras to the Gulf of Maine, with a large concentration occurring south of Long Island (Shoop and Kenney 1992). Leatherback sightings decrease during the spring and fall and especially in winter (Shoop and Kenney 1992).

While leatherback sea turtles are the most likely sea turtle species to be encountered in the greater Rhode Island Sound, the leatherback prefers deep ocean environments (Kenney and Vigness-Raposa 2009). Leatherbacks are a likely migrant through New England waters, having been found migrating between Bermuda and Nova Scotia along coastal waters (Evans et al. 2007). The areas where leatherbacks can be abundant are in oceanic waters on the continental shelf ; however, there is a potential for this species to occur in the Rhode Island Sound as they migrate through deep open ocean areas (Kenney and Vigness-Raposa 2009). While the leatherback sea turtle has the potential to occur in the Project Area in the summer and fall, the likelihood of occurrence is low considering this species' preference for open ocean environments along the Continental Shelf.

#### Kemp's Ridley Sea Turtle

The Kemp's ridley sea turtle (*Lepidochelys kempii*) was listed as federally endangered in 1970. Threats to the Kemp's ridley include habitat destruction (both anthropogenic and storm-events) and tourism at nesting beaches, disease and predation, egg harvesting, fishery interactions and cold-stunning (USFWS and NOAA Fisheries 1992; NOAA Fisheries and USFWS 2007c).

This species is one of the least abundant sea turtles in the world. The Kemp's ridley is usually found only in the Gulf of Mexico and the northern portions of the Atlantic Ocean, with more than half of the nesting population of this turtle species occurs along a 25-mi (40-km) beach line in Tamaulipas, Mexico (USFWS and NOAA Fisheries 1992). Historically, the Kemp's ridley sea turtle was abundant in the Gulf of Mexico (Hildebrand 1982). While nesting has decrease from approximately 40,000 in 1947 to a minimum of 740 in 1985, these numbers have again increased to about 7,866 along the stretch of beach in Tamaulipas, Mexico (USFWS and NMFS 1992; TEWG 2000).

Kemp's ridley sea turtles are a smaller-shelled species, with adult carapace lengths reaching 31.5 in (80 cm). This species normally takes 10 to 17 years to reach sexual maturity and nest between April and July, with hatchlings emerging from their nests within 45 to 48 days (NMFS and USFWS 2007c). Once hatchlings of this species emerge, they enter the open water and passively drift in the Gulf of Mexico and North Atlantic for one to four years. At this point, juveniles feed benthically (mostly on crabs) in shallow habitats, and then transition to adult habitats, muddy and sandy bottom areas, where their prey base includes shrimp, sea urchins, sea stars, and assorted mollusks (NatureServe 2010). Foraging areas for the

Kemp's ridley in the Atlantic include Chesapeake Bay, Pamlico Sound, Charleston Harbor, Delaware Bay, and Long Island Sound (NMFS and USFWS 2007c).

Estimates of the Kemp's ridley sea turtle population off the northeastern U.S. are lacking, as adults of this species are too small to be detected during aerial surveys. Most individual Kemp's ridley sea turtles found in the North Atlantic have been in the juvenile stage. Historical occurrences of this species in southern New England waters were not reported until the late 20th century; however, this species may have been mistaken for hawksbill sea turtles. More recently, only 14 records of this species have been reported in or near Rhode Island Sound (Kenney and Vigness-Raposa 2009). Kenney and Vigness-Raposa (2009) suggested that abundance estimates may be biased due to the small size of this turtle, as well as the shallow bay habitats this species are usually excluded from marine surveys. Kemp's ridley sea turtles are relatively common in eastern Long Island and Cape Cod. This species may be found in lower abundance in the greater Rhode Island Sound due to the lack of suitable habitat. Transients may occasionally be present; however, at lower numbers than leatherback or loggerhead sea turtles (Kenney and Vigness-Raposa 2009). Therefore, while the Kemp's ridley sea turtle has the potential to be a transient to the Project Area during the summer, this species is not generally expected to occur in the Project Area.

### Green Sea Turtle

The green sea turtle (*Chelonia mydas*) was listed as federally endangered in 1978. Historically, this species was harvested within the United States and the Caribbean, with over a million pounds of green sea turtles harvested in 1890 alone (Doughty 1984). Present-day threats to green sea turtles include natural and human-induced destruction and alteration of nesting habitats, marine debris, shark predation, coastal noise and light pollution on nesting beaches, beach vehicle traffic, boat strikes, and fishery incidents (Epperly et al. 1995; TEWG 2000; NMFS and USFWS 2007d).

Green sea turtles reach approximately 59 in (150 cm) in length during the adult life stage (Kenney and Vigness-Raposa 2009). This species exhibits a late maturation age of 20 to 50 years (Balazs 1982). After hatching, green sea turtles spend between 5 and 6 years drifting passively, feeding mostly on grasses and algae, but may also consume jellyfish, salps, and sponges. Later in life, green sea turtles move into adult foraging habitats, nearshore areas, where they almost exclusively feed on sea grasses and algae, a unique trait among sea turtles. Green sea turtles can be found throughout the world's oceans, including within the Pacific, Indian, and Atlantic, as well as the Mediterranean Sea (NOAA Fisheries and USFWS 2007d). In the western Atlantic during the summer, this species can be found in estuarine waters within Long Island Sound, Chesapeake Bay, and the many North Carolina Sounds into southern tropic areas during the summer months (Musick and Limpus 1997; Morreale and Standora 1998). During the winter, green sea turtles occur in more southern United States waters including those around Cape Hatteras (Epperly et al. 1995).

Population estimates of this species off the northeastern U.S. coast are lacking (Thompson 1988), because adults of this species are too small to be detected during aerial surveys. However, data are available for nesting populations. Between 2001 and 2006, an average of 5,039 nests per year was found in Florida nesting areas (ranging between 581 and 9,644 nests per year; NMFS and USFWS 2007d). Historically, green sea turtles have rarely been detected in southern New England. More recently, one confirmed green sea turtle sighting occurred in March 2005 south of Long Island (Kenney and Vigness-Raposa 2009). Green sea turtles have not been recorded within Rhode Island Sound, and are less common in the Rhode Island region compared to leatherback or loggerhead sea turtles (Kenney and Vigness-Raposa 2009). While the green sea turtle has the potential to be a transient to the Project Area during the spring, this species is not generally expected to occur in the Project Area.

#### 4.5.7.2 Potential Impacts and Proposed Mitigation

##### BIWF

###### Invertebrates

###### *American Burying Beetle*

Because the Export Cable and Block Island Substation will be located in previously disturbed areas and there is no known habitat within the Project Area from the beach to the BIPCO property, the BIWF is not likely to affect this species. As described in Section 4.5.7.1, habitat for the American burying beetle at the proposed Block Island Substation is not considered suitable for American burying beetle because the area is heavily developed and most surfaces have been either paved or heavily altered (USFWS 1991). Additionally, no American burying beetles were captured during a USFWS and RIDEM survey at the location of the proposed Block Island Substation on the BIPCO property (M. Amaral, personal communication, June 28, 2010).

###### Avian Species

Potential impacts on threatened and endangered avian species and proposed mitigation would not be materially different from impacts on other avian species as described in Section 4.5.6.

###### *Roseate Tern*

There are no roseate tern breeding colonies near the Project Area. The roseate tern is not anticipated to migrate through the area of the proposed WTG Array in significant numbers. High densities of foraging terns are not expected or known to occur in the Project Area. The cable landfall location on Block Island is a previously disturbed coastal area with existing pedestrian and vehicle traffic and is not generally considered suitable for nesting birds. Based on the lack of suitable habitat in the Project Area, the low likelihood of direct or indirect impacts from the proposed WTG Array, and the mitigation measures for potential impacts on terrestrial habitats and avian species, as described in Sections 4.5.5 and 4.5.6, respectively, the BIWF may affect but is not likely to adversely affect the roseate tern. Because there is no critical habitat for roseate tern in or near the Project Area, the BIWF will not affect critical habitat for this species.

###### *Piping Plover*

Piping plover migrate closer to shore and are not known or expected to migrate through the area of the proposed WTG Array in significant numbers. The cable landfall location on Block Island is a previously disturbed coastal area with existing pedestrian and vehicle traffic and is not generally considered suitable for nesting shorebirds. Based on the lack of suitable habitat in the Project Area, the low likelihood of direct or indirect impacts from the proposed WTG Array, and the mitigation measures for potential impacts on terrestrial habitats and avian species, as described in Sections 4.5.5 and 4.5.6, respectively, the BIWF may affect but is not likely to adversely affect the piping plover. Because there is no critical habitat for piping plover in or near the Project Area, the BIWF will not affect critical habitat for this species.

###### *Red Knot*

Red knot migrate farther from shore than many other shorebirds and may, therefore, potentially occur in the area of the proposed WTG Array, primarily during southward migration. Construction offshore is expected to occur in early summer, after red knot northward migration and before peak southward migration. During operation, the WTG Array is not anticipated to act as a barrier to red knot movement, or cause substantive increases in energy demands in order to circumvent it, because the WTG Array

represents a minute portion of the available habitat along the red knot's migration route. The cable landfall location on Block Island is a previously disturbed coastal area with existing pedestrian and vehicle traffic, and is not generally considered suitable for nesting shorebirds. Based on the lack of suitable habitat in the Project Area, the low likelihood of direct or indirect impacts from the proposed WTG Array, and the mitigation measures for potential impacts on terrestrial habitats and avian species as described in Sections 4.5.5 and 4.5.6, respectively, the BIWF may affect but is not likely to adversely affect the red knot. Because there is no critical habitat for red knot in or near the Project Area, the BIWF will not affect critical habitat for this species. If red knot are listed under ESA in the near future, it is unlikely that any habitat in Rhode Island will be designated Critical Habitat, because the species is not known to occur regularly in the state. Additionally, because there were no sightings of red knot during the site specific avian surveys, nor during the RI Ocean SAMP surveys, this is little evidence indicating that red knot regularly migrate, forage, or stage in the Rhode Island Sound region (Winiarski et al. 2011).

#### *Least Tern*

Least tern are not known to breed in or near the Project Area (Hartlaub et al. 2008). Significant migration or foraging of least tern in the area of the proposed WTG Array has not been observed, and is unlikely. The deep water within the area of the WTG Array is not considered suitable foraging habitat for least tern (Thompson et al. 1997). The cable landfall location on Block Island is a previously disturbed coastal area with existing pedestrian and vehicle traffic and is not generally considered suitable for nesting terns. Based on the lack of suitable habitat in the Project Area, the low likelihood of direct or indirect impacts from the proposed WTG Array, and the mitigation measures for potential impacts on terrestrial habitats and avian species as described in Sections 4.5.5 and 4.5.6, respectively, the BIWF may affect but is not likely to adversely affect least terns.

#### Fish Species

##### *Atlantic Sturgeon*

Potential impacts on the Atlantic sturgeon would not be materially different from impacts on other fish species and species with designated EFH as described in Sections 4.5.2 and 4.5.3, respectively. No spawning habitat will be affected by Project activities, as Atlantic sturgeon spawn in hard-bottom, freshwater habitats. The seasonal migratory patterns and transient nature of juvenile and adults of this species indicates that the potential exists for Atlantic sturgeon to be present in Block Island Sound and Rhode Island Sound; however, this species is not generally expected to occur in large numbers within the Project Area. Juvenile and adults of this species would be expected to temporarily relocate during construction of the WTG Array and submarine cables. Operation of the BIWF is not anticipated to affect Atlantic sturgeon and there is no critical habitat for this species designated in or near the Project Area; therefore, the BIWF will not affect critical habitat for this species.

#### Marine Mammals

Potential impacts on endangered marine mammal species and proposed mitigation would not be materially different from impacts on other marine mammal species as described in Section 4.5.4.2. Mitigation as described in detailed in Section 4.5.4.2 would include but not be limited to:

- Establishment of Safety Exclusion Zone
- Field Verification of Safety Exclusion
- Protected Species Observers
- Ramp-up Procedures

- Shut-down Procedures
- Time of Day Restrictions (during cofferdam installation and removal)
- Reporting
- Adherence to Defined Vessel Speed Restrictions

Given the transient nature of individuals potentially occurring within the Project Area, the lack of important breeding or feeding grounds in the Project Area, and the harassment minimization measures to be implemented during construction, construction of the BIWF may affect but is not likely to adversely affect marine mammal species. During operation, marine mammals are unlikely to occur near the area of the proposed WTG Array and vessel activities associated with routine maintenance would not result in an appreciable increase in vessel activity beyond existing levels. Therefore, operation of the BIWF is not anticipated to affect marine mammal species. There is no critical habitat for marine mammals in or near the Project Area; therefore, the BIWF will not affect critical habitat for these species.

#### Sea Turtles

Potential impacts on threatened and endangered sea turtle species and proposed mitigation would not be materially different from impacts on marine mammal species as described in Section 4.5.4.2 and listed above for threatened and endangered marine mammal species. Given the transient nature of individuals potentially occurring within the Project Area, the lack of important habitat in the Project Area, and the harassment minimization measures to be implemented during construction and operation of the BIWF may affect but is not likely to adversely affect protected sea turtle species. During operation, sea turtles are unlikely to occur near the area of the proposed WTG Array and vessel activities associated with routine maintenance would not result in an appreciable increase in vessel activity beyond existing levels. Therefore, operation of the BIWF is not anticipated to affect sea turtle species. There is no critical habitat for sea turtles in or near the Project Area; therefore, the BIWF will not affect critical habitat for these species.

#### **BITS**

##### Invertebrates

##### *American Burying Beetle*

Because the portion of the BITS on Block Island will be located in previously disturbed areas, there is no known habitat for the American bury beetle within the Project Area from the beach to the BIPCO property. As described in Section 4.5.7.1, habitat for the American burying beetle at the proposed Block Island Substation is not considered suitable for American burying beetle because the area is heavily developed and most surfaces have been either paved or heavily altered (USFWS 1991). Additionally, no American burying beetles were captured during a USFWS and RIDEM survey at the location of the proposed Block Island Substation on the BIPCO property (M. Amaral, personal communication, June 28, 2010). The American burying beetle is not known to occur on the Rhode Island mainland; therefore, the BITS are not likely to affect this species.

##### Avian Species

Potential impacts on threatened and endangered avian species and proposed mitigation would not be materially different from impacts and mitigation as described for other avian species in Section 4.5.6.

### *Roseate Tern, Red Knot, Least Tern*

Based on the lack of suitable habitat in the Project Area, the minimal aboveground facilities associated with the BITS during operation, and the mitigation measures for potential impacts on terrestrial habitats and avian species as described in Sections 4.5.5 and 4.5.6, respectively, the BITS is not likely to affect the roseate tern, red knot, or least tern. Because there is no critical habitat for any of these species in or near the Project Area, the BITS will not affect critical habitat for these species.

### *Piping Plover*

Deepwater Wind has avoided potential impacts on nesting piping plover by choosing a heavily trafficked portion of Narragansett Town Beach for an alternative cable landfall site. Therefore, the potential for impacts to piping plover are negligible during construction. Given the minimal aboveground facilities associated with the BITS during operation, and the mitigation measures for potential impacts on terrestrial habitats and avian species as described in Sections 4.5.5 and 4.5.6, respectively, the BITS may affect but is not likely to adversely affect the piping plover. Because there is no critical habitat for piping plover in or near the Project Area, the BITS will not affect critical habitat for this species.

### Fish Species

#### *Atlantic Sturgeon*

Potential impacts on the Atlantic sturgeon would not be materially different from impacts on other fish species and species with designated EFH as described in Sections 4.5.2 and 4.5.3, respectively. No spawning habitat will be affected by Project activities, as Atlantic sturgeon spawn in hard-bottom, freshwater habitats. Most of the Project Area is located offshore of Block Island and in the deeper waters of Rhode Island Sound. The seasonal migratory patterns and transient nature of juvenile and adults of this species indicates that the potential exists for Atlantic sturgeon to be present in Rhode Island Sound; however, this species is not generally expected to occur in large numbers within the Project Area. Juvenile and adults of this species would be expected to temporarily relocate during installation of the BITS cable. Operation of the BITS is not anticipated to affect Atlantic sturgeon and there is no critical habitat for this species designated in or near the Project Area; therefore, the BITS will not affect critical habitat for these species.

### Marine Mammals

Potential impacts on endangered marine mammal species and proposed mitigation would not be materially different from impacts and mitigation as described for other marine mammal species in Section 4.5.4.2. Mitigation as described in detailed in Section 4.5.4.2 would include but not be limited to:

- Establishment of Safety Exclusion Zone
- Field Verification of Safety Exclusion
- Protected Species Observers
- Ramp-up Procedures
- Shut-down Procedures
- Time of Day Restrictions
- Reporting
- Adherence to Defined Vessel Speed Restrictions

Given the transient nature of individuals potentially occurring within the Project Area, the lack of important breeding or feeding grounds in the Project Area, and the harassment minimization measures to be implemented during construction, construction of the BITS may affect but is not likely to adversely affect listed marine mammal species. Because maintenance activities for the BITS submarine cable are not anticipated to increase vessel activity appreciably beyond existing levels, operation of the BITS will not affect listed marine mammal species. There is no critical habitat for marine mammals in or near the Project Area; therefore, the BITS will not affect critical habitat for these species.

### Sea Turtles

Potential impacts on threatened and endangered sea turtle species and proposed mitigation would not be materially different from impacts on marine mammal species as described in Section 4.5.4.2 and listed above for threatened and endangered marine mammal species. Given the transient nature of individuals potentially occurring within the Project Area, the lack of important habitat in the Project Area, and the harassment minimization measures to be implemented during construction, construction of the BITS may affect but is not likely to adversely affect protected sea turtle species. During operation, sea turtles are unlikely to occur near the area of the proposed WTG Array and vessel activities associated with routine maintenance would not result in an appreciable increase in vessel activity beyond existing levels. Therefore, operation of the BITS is not anticipated to affect sea turtle species. There is no critical habitat for sea turtles in or near the Project Area; therefore, the BITS will not affect critical habitat for these species.

### **Combined Effects**

As demonstrated individually in the impacts discussion for the BIWF and BITS, Deepwater Wind has avoided and minimized impacts to the extent possible in the design of the BIWF and BITS and has proposed mitigation measures, as applicable. Therefore, the combined effects of construction, operation, and decommissioning of the Project overall are not likely to have a significant effect on threatened or endangered species.

## **4.6 Acoustic Environment**

Noise will be generated during Project construction and operation, and since BIWF and BITS have both onshore and offshore components, the potential effects of both in-air and underwater sound must be considered. This section discusses both in-air and underwater sound and how noise generated from the construction and operation of the Project may contribute to the surrounding acoustic environment.

The primary construction noise-generating activities identified include pile-driving during WTG foundation installation, vibratory pile-driving during cofferdam installations, and vessel activity related to cable-laying. Operational noise-generating activities include the WTGs, switchyards, and a nautical hazard prevention device (i.e., foghorn). The evaluation of noise impacts is typically most critical at noise sensitive receptors (NSRs), which for the purposes of the in-air environment are structures such as residences, hospitals, and schools, and in the underwater environment are marine mammals, sea turtles, and fish. To assess the potential impacts on these NSRs from the aforementioned activities, the following detailed acoustic modeling analyses of both in-air and underwater noise were performed:

- In-air sound propagation modeling using the Computer Aided Noise Abatement (CadnaA) software program (version 4.2.140), a comprehensive 3-dimensional acoustic modeling program specifically developed for the power generation industry with calculations made in accordance with ISO Standard 9613-2, “Attenuation of Sound during Propagation Outdoors.”



- Underwater sound propagation modeling using both the Acoustic Toolbox User Interface Post processor (AcTUP) written in Matlab from HLS Research is a Graphical User Interface (GUI) distributed by the Center for Marine Science and Technology using the Range Dependent Acoustic Model (RAM) (Collins et al. 1996). Data were post-processed using an interpolative tool developed to determine average sound within an acoustic wave-guide.

Detailed descriptions of the methodology and results of each acoustic modeling exercise can be found in Appendix N. The character of the existing environment and the impact to and effects on the environment from construction and operation of the proposed BIWF and BITS are described below.

#### 4.6.1 In-Air Acoustic Environment

Sound levels are presented on a logarithmic scale to account for the large pressure response range of the human ear, and are expressed in units of decibels (dB). A decibel is defined as the ratio between a measured value and a reference value usually corresponding to the lower threshold of human hearing defined as 20 micropascals ( $\mu\text{Pa}$ ). Typically, a noise analysis examines 11 octave (or 33 1/3 octave) bands ranging from 16 hertz (Hz) (low) to 16,000 Hz (high), which encompasses the human audible frequency range. Since the human ear does not perceive every frequency with equal loudness, spectrally varying sounds are often adjusted with a weighting filter. The A-weighted filter is applied to compensate for the frequency response of the human auditory system, known as dBA. Unweighted sound levels are referred to as linear. Linear decibels are used to determine a sound's tonality and to engineer solutions to reduce or control noise as techniques are different for low and high frequency noise. Sound levels that are linear are presented as dBL.

An inherent property of the logarithmic decibel scale is that the sound pressure levels of two separate sources are not directly additive. For example, if a sound of 50 dBA is added to another sound of 50 dBA, the result is a 3-decibel increase (or 53 dBA), not an arithmetic doubling to 100 dBA. With respect to how the human ear perceives changes in sound pressure level relative to changes in "loudness," scientific research demonstrates the following general relationships between sound level and human perception for two sound levels with the same or very similar frequency characteristics:

- 1 dBA is the practical limit of accuracy for sound measurement systems and corresponds to an approximate 10 percent variation in the sound pressure level. A 1 dBA increase or decrease is a non-perceptible change in sound.
- 3 dBA increase or decrease is a doubling (or halving) of acoustic pressure level and corresponds to the threshold of change in loudness perceptible in a laboratory environment. In practice, the average person is not able to distinguish a 3 dBA difference in environmental sound outdoors.
- 5 dBA increase or decrease is described as a perceptible change in sound level and is a discernible change in an outdoor environment.
- 10 dBA increase or decrease is a tenfold increase or decrease in acoustic pressure level, but is perceived as a doubling or halving in loudness (i.e., the average person will judge a 10 dBA change in sound level to be twice or half as loud).

Estimations of common noise sources and outdoor acoustic environments, and the comparison of relative loudness are presented in Table 4.6-1.

**Table 4.6-1 Sound Pressure Levels ( $L_p$ ) and Relative Loudness of Typical Noise Sources and Soundscapes**

Noise Source or Activity	Sound	Subjective	Relative Loudness
Jet aircraft takeoff from carrier (50 ft)	140	Threshold of pain	64 times as loud
50-hp siren (100 ft)	130		32 times as loud
Loud rock concert near stage or Jet takeoff (200 ft)	120	Uncomfortably loud	16 times as loud
Float plane takeoff (100 ft)	110		8 times as loud
Jet takeoff (2,000 ft)	100	Very loud	4 times as loud
Heavy truck or motorcycle (25 ft)	90		2 times as loud
Garbage disposal, food blender (2 ft), or pneumatic drill (50 ft)	80	Loud	Reference loudness
Vacuum cleaner (10 ft)	70	Moderate	1/2 as loud
Passenger car at 65 mph (25 ft)	65		
Large store air-conditioning unit (20 ft)	60		1/4 as loud
Light auto traffic (100 ft)	50	Quiet	1/8 as loud
Quiet rural residential area with no activity	45	Faint	
Bedroom or quiet living room or bird calls	40		1/16 as loud
Typical wilderness area	35		
Quiet library, soft whisper (15 ft)	30	Very quiet	1/32 as loud
Wilderness with no wind or animal activity	25	Extremely quiet	
High-quality recording studio	20		1/64 as loud
Acoustic test chamber	10	Just audible	
	0	Threshold of hearing	

Adapted from: Beranek (1988) and EPA (1971)

The analysis of acoustic data requires special consideration of sound levels that will generally fluctuate over time. To account for the time-varying nature of environmental noise, a single descriptor known as the equivalent sound level ( $L_{eq}$ ) is often used. The  $L_{eq}$  value is the sound energy averaged over a complete measurement period. It is defined as the steady, continuous sound level over a specified time that has the same acoustic energy as the actual varying sound levels over the same time. The metrics commonly used for environmental sound studies, including the  $L_{eq}$ , are reported as dBA. The equivalent sound level has been shown to provide both an effective and uniform method for describing time-varying sound levels and is widely used in acoustic assessments of wind energy facilities. Several other statistical descriptors can also be assessed to provide further understanding of the existing soundscapes. The statistical sound levels ( $L_n$ ) provide the sound level exceeded for that percentage of time over the given measurement period. An  $L_{10}$  level is often referred to as the intrusive noise level and is the sound level that is exceeded for 10 percent of the time during a specified measurement period. The  $L_{90}$  level is the sound level that is exceeded for 90 percent of the measurement time period and is often referred to as the residual sound level. The  $L_{90}$  can be an indicator of the potential audibility of a new sound source. The  $L_{max}$  is the maximum sound level during the measurement period and the  $L_{min}$  is the minimum sound levels during the measurement period.

#### 4.6.1.1 Affected Environment

The Project Area consists of undeveloped natural areas, some commercial land use, and mixed residential land use ranging from low density to medium-high density in certain locations. Block Island is a popular tourist destination and therefore population density is expected to vary based on the season. Actual ambient measurements have not been conducted to document the existing acoustic environment; however,

ambient sound levels are expected to be low. Background sound levels will vary both spatially and temporally depending on a number of localized coastal area factors and the proximity to area sound sources, roadways, and natural sounds. Diurnal effects result in sound levels that are typically quieter during the night than during the daytime, except during periods when evening and nighttime insect noise may dominate the soundscape. Closer to the coastline, waves breaking on the seashore may also contribute to the soundscape. In addition, environmental sounds related to local land uses and activities, population densities, vehicle and nautical traffic, and proximity to existing recreational, commercial, and industrial sound sources will play a role in the existing conditions or background sound levels. The BIWF and BITS are expected to contribute to the acoustic environment on a short-term basis during construction as well as during operation.

The criteria for the in-air acoustic assessment are thresholds established by guidelines or regulations at the federal, state, or local level.

### **Federal**

In 1974, the EPA published Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (EPA 1974). This report represents the only published study that includes a large database of community reaction to noise to which a proposed project can be readily compared. For outdoor residential areas and other locations where quiet is a basis for use, the recommended EPA guideline is an  $L_{dn}$  of 55 dBA. The EPA also provides a limit for  $L_{eq(24)}$  of 70 dBA to avoid adverse effects to public health and safety at publicly accessible property lines or the extent of work areas where extended periods of public exposure are possible. The EPA limit is not a regulatory limit but intentionally conservative to protect the most sensitive portion of the population with an additional margin of safety. The EPA cause-and-effect criteria limits are summarized in further detail in the In-Air Acoustic Report (Appendix N).

### **State**

The state of Rhode Island does not have environmental noise regulations with numerical decibel limits directly or indirectly applicable to the Project. Rhode Island allows each individual community to establish noise regulations through community by-laws.

### **Local**

Local noise requirements have been identified on Block Island (Town of New Shoreham), as well as on the mainland towns of Narragansett and South Kingstown as described in the following subsections.

#### **Town of New Shoreham Noise Ordinance**

Chapter 12-1 of the Town of New Shoreham Code of Ordinance pertains to noise with the objective of establishing standards for control of noise pollution in the town. The code sets maximum permissible sound levels for various activities to protect health, safety, and general welfare. Table 4.6-2 lists the maximum permissible sound levels allowed at or within the real property boundary of a receiving land use. When determining Project compliance at NSRs the most stringent Category I sound limits were used, which apply to all residential use zones and also happen to be identical to sound limits provided for Category III.

**Table 4.6-2 New Shoreham Maximum Permissible Sound Levels by Receiving Land Use**

Location of Receiving Land	Time	Sound Limit (dBA)
Category I: Residential A Zone Residential B Zone Residential C Zone Residential C/Mixed Use Zone	7:00 a.m. to 9:00 p.m.	65 dBA
	9:00 p.m. to 7:00 a.m.	55 dBA
Category II: New Harbor Commercial Zone Old Harbor Commercial Zone Mixed Use Zone Service Commercial Zone	7:00 a.m. to 12:00 a.m.	70 dBA
	12:00 a.m. to 7:00 a.m.	65 dBA
Category III: Beaches Public Waters	7:00 a.m. to 9:00 p.m.	65 dBA
	9:00 p.m. to 7:00 a.m.	55 dBA
Category IV: Special Event	Daytime special events shall be exempt from the sound limits (dBA) until December 31, 2005.	

In addition, for any source of sound that emits a pure tone, the maximum sound level limits in Table 4.6-2 are reduced by 5 dBA. In terms of construction, the ordinance states that a noise disturbance cannot be created across a residential property boundary or within a noise sensitive area.

### Narragansett Noise Ordinance

The Narragansett Code of Ordinances identifies maximum permissible sound levels by receiving land use (Part II, Chapter 22 [Environment], Article III, Section 22-47). Table 4.6-3 presents these limits in terms of broadband levels that are allowed at or within the real property boundary of a receiving land use. In addition, the regulation states that for any source emitting a narrow band sound, the maximum sound level limits presented below will be reduced by 5 dBA. Construction is restricted to avoiding the creation of a noise disturbance across a residential real property boundary unless a variance is obtained from the town council. When determining Project compliance at NSRs the Residential maximum permissible limits shown in Table 4.6-3 were used.

**Table 4.6-3 Narragansett Maximum Permissible Sound Levels by Receiving Land Use (dBA)**

Location of Receiving Land Use	Time	Sound Limit (dBA)
Zoning District: Residential	7:00 a.m. to 10:00 p.m.	65 dBA
	10:00 p.m. to 7:00 a.m.	55 dBA
Zoning District: Business Zones BA, BB, BC	1:00 a.m. to 7:00 a.m.	55 dBA
	All other times	75 dBA
Zoning District: Industrial Zones IA and IB	1:00 a.m. to 7:00 a.m.	55 dBA
	All other times	75 dBA

#### 4.6.1.2 Potential Impacts and Proposed Mitigation

As stated previously, sound propagation modeling was conducted using the CadnaA software program (version 4.2.140), a comprehensive 3-dimensional acoustic modeling program specifically developed for the power generation industry. Using this program, calculations are made in accordance with ISO

Standard 9613-2 “Attenuation of Sound during Propagation Outdoors.” The industry standard CadnaA acoustic modeling software is widely used by sound engineers due to its adaptability to describing complex acoustic scenarios. CadnaA has proven to be a highly accurate and effective acoustic modeling tool for a wide variety of sound sources (including wind energy projects) considering appropriate adjustments, site-specific terrain, and topographical features.

Terrain conditions, vegetation type, ground cover, the density and height of foliage, and sea state conditions can also influence the absorption that takes place when sound travels over land or water. Topographical information was imported into the acoustic model using the official USGS digital elevation dataset. This dataset was selected to accurately represent terrain in three dimensions and ground absorption coefficients representative of the onshore and offshore Project study area. For the acoustic modeling analysis, sound attenuation through foliage and diffraction around and over existing anthropogenic structures such as buildings was ignored.

The ISO 9613-2 standard calculates received sound pressure levels for meteorological conditions favorable to propagation, i.e., downwind sound propagation or what might occur typically during a moderate atmospheric ground level inversion, which is typically assumed to be the regulatory worst case. Conversely, there may be anomalous meteorological conditions from time to time that will aid in the long range propagation of sound, potentially causing Project sound levels to increase, specifically at points of reception located farther away. Anomalous meteorological conditions may include well-developed moderate ground-based temperature inversions, such as commonly occur at nighttime and during early morning hours, and wind gradients, which may occur at any time. Though somewhat infrequent, Project operational sound levels resulting from anomalous meteorological conditions were also considered in the acoustic modeling analysis, though at short to medium range distances and for elevated sound sources such as a wind turbine, the overall effects of anomalous meteorological conditions on sound propagation are relatively small.

The following discussion summarizes the results of the analysis for BIWF and BITS. The full acoustic analysis has been included as Appendix N.

## **BIWF**

During construction of the BIWF in-air acoustic impacts will result from impact pile-driving for WTG foundation installation, the HDD drill rig, and vibratory pile-driving for the temporary cofferdam at Block Island, if the long-distance HDD alternative. During operation, in-air acoustic impacts will result from sound from the fog horn, the WTGs and operation of the BIWF Generation Switchyard located within the Block Island Substation.

HDD is required to land the Export Cable onshore. This landing will be accomplished using either a long-distance HDD or a short-distance HDD. Regardless of the landing option, HDD activities will likely be scheduled on a continuous basis for 12 hours per day during typical daytime hours unless a situation arises where ceasing the HDD activity would compromise safety (both human health and environmental) and/or the integrity of the Project. The HDD drill rig itself is expected to be the dominant sound source. For the long-distance HDD, the total sound pressure level for the proposed drill rig is 92 dBA at 50 ft (15.2 m) (based on maximum estimate provided by the contractor). For the short-distance HDD, the total sound pressure level for the proposed drill rig is 70 dBA at 50 ft (15.2 m) (based on maximum estimate provided by the contractor). All HDD activities proposed on Block Island will take place in the Crescent Beach parking lot on the eastern side, along Corn Neck Road.

Results of the acoustic modeling analysis indicated that both the short-distance HDD and long-distance HDD will be in compliance with the Town of New Shoreham 65 dBA daytime noise limit at nearby NSRs. However, neither the short-distance HDD nor the long-distance HDD would be in compliance with the 55 dBA nighttime noise limit in the Town of New Shoreham at nearby NSRs. Deepwater Wind has committed to limiting HDD activities to daytime hours unless a situation arises where ceasing the HDD activity would compromise safety (both human health and environmental) and/or the integrity of the Project. If HDD is required during nighttime hours, Deepwater Wind commits to the following mitigation measures: a two-sided temporary sound wall with a height of at least 12 ft (3.7 m) would be required for the long-distance HDD scenario; and a south-facing one-sided 15-ft (4.6 m) wall would be required for compliance during short-distance HDD.

Should the Export Cable be landed via a long-distance HDD, vibratory pile-driving will be required to install a temporary cofferdam offshore of Block Island. Impact pile-driving will also be necessary for WTG foundation installation. Vibratory pile drivers install piling into the ground by applying a rapidly alternating force to the pile. Impact piling is performed using hammers that drive the pile by first inducing downward velocity in a metal ram. Pile-driving can generate high noise levels, but all Project pile-driving will occur offshore and will be of short-term duration. Impact pile driving for WTG foundation installation is scheduled for 4 days per jacket with a 24-hour work schedule. Each jacket will require 7 days to complete the installation. Jackets will be installed one at a time at each WTG location for a total of 5 weeks of jacket installation, assuming no delays due to weather or other circumstances.

Should the long-HDD option be selected, vibratory pile driving will occur for a period of two days during cofferdam installation and two days during cofferdam removal. Based on data provided by potential HDD contractors and data studies measuring pile driving noise broadband sound power levels for impact and vibratory pile-driving were estimated to be 129 and 126 dBA, respectively. Impacts at NSRs related to impact pile-driving were predicted to be well below the New Shoreham 55 dBA nighttime limit; however, compliance issues were found for the vibratory pile-driving at the cofferdam location. Should Deepwater Wind elect to land the Export Cable using a long-distance HDD, to mitigate potential effects, Deepwater Wind will limit vibratory pile-driving to daytime periods and consult with the contractor in order to determine whether there are any effective vibratory pile driving mitigation techniques available.

The Project will include the new BIWF Generation Switchyard (to be located within the proposed Block Island Substation), which will consist of metal-clad 34.5 kV switchgear, an isolation transformer, and an O&M building located inside a new fenced substation area. There are three main sound sources associated with a transformer: core noise, load noise, and noise generated by the operation of the cooling equipment. Both transformers and shunt reactors were included in the acoustic modeling analysis, as identified in the site plans. Transformer and shunt reactor sound source levels were estimated based on dimension and megavolt-ampere (MVA) rating information provided by the manufacturer. Octave band spectra for the transformers and shunt reactors are provided in Appendix N. Modeling results show that the two potential locations of the proposed BIWF Generation Switchyard on the BIPCO property (Block Island Substation Alternatives A and B) may be periodically audible off-site, but will be in compliance with the Town of New Shoreham requirements.

Sound generated by WTGs comprises both aerodynamic and mechanical sound, the former being the dominant sound component from utility-scale WTGs. The operational assessment was performed using the Project design layout dated October 19, 2011, consisting of five Siemens SWT-6.0-120 WTGs. The Siemens WTG has a maximum rotor diameter of 541 ft (165 m) and a maximum potential hub height of 388 ft (118 m) above MLW. Siemens, the WTG manufacturer, provided broadband and octave band

sound power data for the SWT-6.0-120. The maximum sound power reported by the manufacturer was 111 dBA at a wind speed of 17.9 mph (8 m/s), which is inclusive of a 1.5 dBA k-factor. It is expected that the installed version of the SWT-6.0-120 WTG will have similar sound data to that used in the acoustic modeling analysis; however, it is possible that the final manufacturer warranty data could vary slightly. A modeling analysis was conducted for sound propagation under downwind and anomalous conditions using historic meteorological data for the site. Under all modeled scenarios, received sound levels at identified shoreline NSRs are expected to be below 25 dBA, which is well below the Town of New Shoreham 55 dBA nighttime limit.

The platform of the centrally located WTG #3 will be equipped with a foghorn. Requirements as detailed in 33 CFR 67 call for a foghorn to be installed less than 150 ft (45.7 m) above mean sea level (MSL) with a sound signal audible to 0.5 nm (0.9 km). Regulation 33 CFR 67 also requires the foghorn emit a tone of 119.8 dB at a frequency of 822 Hz that will sound for a period of 2 seconds during a 20-second cycle (18 seconds silence). Foghorn noise was analyzed under two meteorological conditions, including standard day downwind propagation conditions and anomalous conditions, similar to what is being considered for the WTG operational assessment. Received sound levels will remain below 25 dBA under downwind conditions and 30 dBA under short-term anomalous conditions. The proposed foghorn is expected to periodically result in low-level sound at shoreline NSRs; however, the operation of foghorns is exempt from restriction under 33 CFR 67.

## **BITS**

In-air sound sources associated with BITS include vibratory pile-driving for cofferdam installation and HDD activities at Crescent Beach and Narragansett Town Beach; sound from the BITS Island Switchyard located within the Block Island Substation and the Narragansett Switchyard. Because the BITS HDD activities on Block Island will be identical to the activities described for the BIWF Export Cable and the BITS Island Switchyard, which will be collocated with the BIWF Generation Switchyard at the Block Island Substation, the results and proposed mitigation measures are the same as described for the BIWF (see Appendix N).

The Narragansett Switchyard will have equipment including 34.5 kV metal clad switchgear and two shunt reactors. The equipment will be located within a fenced substation area and the metal clad switchgear will be mounted inside a switchgear building. Sound generated by the shunt reactors was modeled and octave band spectra for shunt reactors are provided in Appendix N. Modeling results show that the low level sound generated from the two shunt reactors being installed at the Narragansett Switchyard will be well below the applicable 65 dBA daytime and 55 dBA nighttime Narragansett maximum permissible sound limits.

The sound source levels and methodology used to model the short- and long-distance HDD at Narragansett Town Beach are identical to that used to model HDD on Block Island (see Appendix N).

Similar to the proposed HDD activities on Block Island, both short- and long-distance HDD activities at the Alternative BITS 1 landing location in Narragansett show potential compliance issues at nearby NSRs. As mentioned above, Deepwater Wind will make every reasonable effort to restrict construction activities such as HDD to daytime hours. For the long-distance HDD Beach Parking Lot site in Narragansett, it was determined that a four-sided temporary sound wall with a total height of 15 ft (4.6 m) would be sufficient to attain compliance with the applicable 65 dBA daytime limit at the closest NSR. For the short-distance HDD a three-sided sound wall 20 ft (6.1 m) high a three-sided sound wall 20 feet high will be required to adhere to the Narragansett nighttime limit and may be used during daytime, if

determined to be necessary to comply with the daytime limit. If compliance cannot be achieved with the Town of Narragansett nighttime limits, Deepwater Wind will obtain a variance of the Narragansett Noise Ordinance from the town council for the period when HDD is being conducted.

The sound source levels and methodology used to model vibratory pile-driving at the Narragansett Town Beach site are identical to those used to model vibratory pile-driving near Block Island (see Appendix N). Similar to Block Island, vibratory pile-driving was found to have compliance issues with the applicable Narragansett noise ordinance. Therefore, to mitigate potential effects, Deepwater Wind will limit vibratory pile-driving to daytime periods.

### **Combined Effects**

Depending on the construction schedule for individual noise producing elements (impact pile-driving, vibratory pile-driving, HDD construction) and other construction activities may result in combined sound impacts from BITS and BIWF throughout the construction period. Construction will generate short-term temporary noise levels that will not be continuous, but will vary as equipment usage and distance to NSRs change throughout the construction period. Although construction will generate high intermittent noise, it will cease upon completion of construction. Deepwater Wind will minimize potential construction noise impacts using feasible mitigation measures as needed.

Combined noise effects related to the operation of BIWF and BITS components are expected to be negligible. The reason for this is primarily the separation distance between the BIWF WTGs and the BITS permanent operational facilities such as the switchyards. The BIWF WTGs are located approximately 3 mi (4.8 km) southeast of Block Island, and the switchyard facilities are even farther away.

### **4.6.2 Underwater Acoustic Environment**

Underwater acoustic sound is a result of pressure generated by waves of sound energy travelling through water as vibrations of fluid particles. The underwater acoustic environment is complex and location-specific due to factors such as bathymetry and wave propagation at the surface. Due to such factors, sound energy may not be able to propagate uniformly in all directions from a source indefinitely. Sound energy may be reflected at the surface and bottom or may be scattered and lost within the water column due to seafloor boundaries. Under rougher sea state conditions, ambient underwater sound levels may increase, masking sound sources.

The existing underwater acoustic environment is expected to have ambient sound levels fluctuating by 20 dB or more due to weather and vessel traffic variables. Actual ambient sound levels within the Project Area are expected to vary based on a composite of both surface agitation and shipping noise, depending on location (proximity to shore), season, and time of day. Other intermittent sounds in the acoustic seascape include biological sources (including marine mammals), precipitation, seismic events, and construction and industrial activities. The sum of anthropogenic and natural noise depends on source levels and factors that affect sound propagation conditions, including water depth, and ocean bottom topography. Local sea and tidal current conditions that create underwater turbulence and internal waves would also affect sound propagation and resulting localized ambient conditions. Sound levels received underwater are presented as linear or unweighted decibels (dBL).

When evaluating sound propagation in the underwater environment, in comparison to the in-air environment, many complexities arise. The reference sound for underwater sound pressure is 1  $\mu\text{Pa}$ ; however, in-air sound uses a reference of 20  $\mu\text{Pa}$ . Due to the difference in acoustic impedance, a sound



wave that has the same intensity in air and in water will in water have a pressure that is 60 times larger than in air, with a displacement amplitude that will be 60 times less. Assuming pressure is maintained as a constant, the displacement amplitude in water will be 3,580 times less than in air. To help demonstrate this relationship, Table 4.6-4 provides the corresponding values of sound pressure in air and in water having the same intensities at a frequency of 1 kiloHertz (kHz) as it relates to human-perceived loudness. This somewhat simplistic comparison does not account for the frequency-dependent hearing capabilities of various species (e.g., marine species) or individual hearing response mechanisms.

**Table 4.6-4 Sound Pressure Levels and Comparison to Relative Human Loudness Thresholds**

Pressure in Air re 20 $\mu$ Pa/Hz	Pressure in Water re 1 $\mu$ Pa/Hz	Relative Loudness (Human Perception of Different Reference Sound Pressure Levels in Air)
0	62	Threshold of Hearing
58	120	Potentially Audible Depending on the Existing Acoustic Environment
120	182	Uncomfortably Loud
140	202	Threshold of Pain
160	222	Threshold of Direct Damage

Source: Kinsler and Frey 1962

In the underwater environment, sound metrics can be linked to the character of the sound source, for instance, whether it is continuous or impulsive. Continuous noise is a sound that varies gradually over time and for extended periods such as shipping noise. An example of non-continuous or impulsive noise is impact pile-driving. The intensity of continuous noise is generally given in terms of the root mean square (RMS) sound pressure level (SPL). The RMS SPL (also referred to as the time-averaged level) is calculated by taking the square root of the average of the square of the pressure waveform over the duration of the time period. Exposure to this sound level over the measurement period would result in the same noise dose as being exposed to the actual varying sound levels over that same period. Impulse sounds are characterized by  $L_{peak}$ , which is the maximum instantaneous sound pressure level. This metric is very commonly quoted for impulsive sounds, but does not take into account the pulse duration or bandwidth of a signal. For pulsed noise, the RMS sound pressure level may be measured over the pulse duration where the time interval is most often taken to be the “90 percent energy pulse duration” rather than a fixed time window when computing pile-driving safety radii. The 90 percent energy pulse duration is computed for each seismic shot as the window containing 90 percent of the pulse energy, and RMS SPLs computed in this way are commonly referred to as 90 percent RMS SPLs. In addition, because the window length is used as a divisor, pulses that are more spread out in time have a lower RMS SPL for the same total acoustic energy. The final sound metric relevant to the Project underwater analysis is the sound exposure level (SEL or  $L_{SEL}$ ), which is a measure of the total sound energy contained in one or more pulses. Unlike the sound pressure level, the sound exposure level may also be applied as a dosage metric, meaning that its value increases with the number of exposure events. Additional reference information for the underwater environment such as absorption, spreading, scattering, reflection, and cut-off frequency are presented in detail in Appendix N.

#### 4.6.2.1 Affected Environment

A noise budget within the Rhode Island Renewable Energy Zone was created as part of the RI Ocean SAMP through the use of a Passive Acoustic Listening device deployed off the coast of Block Island. The study found that the four main sources of underwater noise were: wind (3,361  $pW/m^2$ ; 97 dB re 1 $\mu$ Pa); shipping (3,244  $pW/m^2$ ; 97 dB re 1 $\mu$ Pa); rain (1,167  $pW/m^2$ ; 92 dB re 1 $\mu$ Pa); and biological noise (341  $pW/m^2$ ; 87 dB re 1 $\mu$ Pa) (Miller et al. 2010).

Underwater noise has the potential to affect marine species (e.g., fish, marine mammals, and sea turtles). The potential effects of underwater noise on marine mammals and sea turtles are federally managed by NOAA under the MMPA to minimize the potential for both harm and harassment. Under the MMPA, Level A harassment is statutorily defined as any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild; however, the actionable sound pressure level is not identified in the statute. The MMPA defines Level B harassment as any act of pursuit, torment, or annoyance that has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering. NOAA has defined the threshold level for Level B harassment at 120 dBL re 1  $\mu$ Pa. Within this zone, Project sound may approach or exceed ambient sound levels (i.e., threshold of perception or zone of audibility); however, actual perceptibility will be dependent on the hearing thresholds of the species under consideration and the inherent masking effects of ambient sound levels.

NOAA defines a zone of injury to marine mammals as the range of received sound pressure levels from 180 dBL referenced to 1  $\mu$ Pa RMS (180 dBL re 1 $\mu$ Pa), for all odontocetes and sperm whales within the 180 dB re 1 $\mu$ Pa sound exposure limit. This threshold considers instantaneous sound pressure levels at a given receiver location. The National Marine Fisheries (NOAA Fisheries) 180 dBL re 1  $\mu$ Pa guideline is designed to protect all marine species from high sound pressure levels at any discrete frequency across the entire frequency spectrum. It is a very conservative criterion as it does not consider species-specific hearing capabilities.

More recent regulatory criteria for marine mammals were promulgated by NOAA as part of a ruling on a permit application for a military sonar exercise. These criteria establish thresholds at which temporary or permanent hearing loss is expected for marine mammals. A temporary or reversible elevation in hearing threshold is termed a temporary threshold shift (TTS), while a permanent or unrecoverable reduction in hearing sensitivity is termed a permanent threshold shift (PTS). NOAA (2006) established a TTS of 195 dB re 1  $\mu$ Pa<sup>2</sup>-s and a PTS of 215 dB 1  $\mu$ Pa<sup>2</sup>-s for marine mammals based on the typical values for the additional dB above TTS required to induce PTS in experiments with terrestrial mammals. The revised TTS and PTS thresholds are defined as an energy flux density (EFD), which is the acoustic energy passing through a particular point per-unit decibel; therefore, TTS and PTS are given in the units of dB re 1 $\mu$ Pa<sup>2</sup>-s, the integration of RMS sound pressure over a one-second duration. Being time energy-based, the TTS and PTS thresholds take into account cumulative sound exposure. A summary of the NOAA and NOAA Fisheries cause and effect noise criteria are summarized in Table 4.6-5.

**Table 4.6-5 Summary of NOAA and NOAA Fisheries Cause and Effect Noise Criteria**

	Received Sound Level	Effect
NOAA Fisheries	>120 dBL re 1 $\mu$ Pa (RMS)	Non-Specific Risk Level B Harassment
NOAA Fisheries	180 – 190 dBL re 1 $\mu$ Pa (RMS)	Non-Specific Risk Level A Harassment
NOAA	195 dBL re $\mu$ Pa <sup>2</sup> -s	Temporary Threshold Shift (TTS)
NOAA	215 dBL re $\mu$ Pa <sup>2</sup> -s	Permanent Threshold Shift (PTS)
Source: NOAA 2006		

The CRMC through the RI Ocean SAMP (2011) has also set goals for minimizing underwater noise from offshore renewable energy and other offshore development. These include:

- A goal for the wind farm applicant and operator is to have operational noise from wind turbines average less than or equal to 100 dB re 1  $\mu\text{Pa}^2$  in any 1/3 octave band at a range of 328.1 ft (100 m) at full power production.
- The applicant and manufacturer should endeavor to minimize the radiated airborne noise from the wind turbines.
- A monitoring system including acoustical, optical and other sensors should be established near these facilities to quantify the effects.

It is important to note, however, that these goals are not operational standards that take into consideration the limits of the existing offshore wind technology, but rather operational conditions that developers should strive for as the industry matures.

#### 4.6.2.2 Potential Impacts and Proposed Mitigation

Acoustic modeling was completed with the widely-used the Range Dependent Acoustic Model (RAM) (Collins et al. 1996). RAM is based on the parabolic equation (PE) method using the split-step Padé algorithm for improved numerical accuracy and efficiency in solving range dependent acoustic problems. A marching solution whereby some initial field is specified at some short range using a discrete normal mode solution to fine the starting field at a range at which it is safe to neglect the continuous mode contribution. The parabolic differential equation is then marched in range dimension along a given transect. The computational advantage of parabolic approximation is the elliptic reduced wave equation is numerically solved in the entire range-depth plane simultaneously. This modeling methodology has been reviewed in scientific literature and therefore it is assumed to be compliant with standard underwater noise modeling techniques for a screening level analysis in open offshore shallow water environments. It also allows for further analysis with other geospatial data such as habitat suitability and species distribution, which can allow for species impact determinations and adaptive management.

The transmission loss values produced by the model for each source location are used to attenuate the spectral acoustic output levels of the corresponding noise source to generate an estimate of the absolute received sound levels at each point along a transect; these are then summed across frequencies to provide broadband received levels at the MMPA level A and B harassment criteria.

The following presents a summary of the underwater noise generated during construction and operation. Impacts on marine species from underwater noise are discussed in detail in Section 4.5.4.2.

#### BIWF

The primary source of underwater noise is impact pile-driving necessary for WTG foundation installation. Noise increases with pile size (diameter and wall thickness), hammer energy, and subsurface hardness. According to available Project design information, the piles are expected to be between 42 and 54 inches (106.7 and 137.1 cm) in diameter, with a maximum wall thickness of 1.5 inches (3.8 cm); and a design penetration between 160 and 250 ft (48.8 and 76.2 m) below the seabed. The expected received sound levels of impact piling during the construction were calculated to determine relationships between impact force and pile diameters. Source levels were derived following an extensive literature review of documents, technical reports, and peer-reviewed research papers. These source levels were then normalized to 1,640.4 ft (500 m) for BIWF site-specific conditions and impact hammer forces. For the

underwater acoustic analysis, Deepwater Wind assumed that the pile-driving would start with a 200 KJ rated hydraulic hammer, followed by a 600 KJ rated hammer to reach final design penetration. A 1,000 kW unit will power the hammers. Pile-driving will take 4 days per jacket based on a 24 hour per day work schedule. Each jacket will require 7 days to complete the installation. Jacket installation work will be sequential and not concurrent. To be conservative, Deepwater Wind has assumed the full impact force of 600 KJ may be required during WTG construction. The  $RMS_{90\%}$  at 1,640.4 ft (500 m) ranged from 171 dBL to 176 dBL for 200 KJ and from 177 KJ to 182 KJ for the full impact force of 600 KJ; however, the actual sound power of impact pile-driving may vary considerably. Modeling results showed that the estimated maximum critical distance to the 180 dBL MMPA threshold is 1,328.7 ft (405 m), with the estimated maximum distance to the 160 dBL and 120 dBL MMPA thresholds being 16,732.3 ft (5,100 m) and 24.9 mi (40 km), respectively. More information on results including figures displaying critical distance information can be found in Appendix N.

Vibratory pile-driving needed to install the cofferdams for the HDD exit site at Block Island will generate underwater sound levels. In general, vibratory pile-driving is less noisy than impact pile-driving. For estimating source levels and frequency spectra, the vibratory pile driver was estimated assuming a 1,800 kN vibratory force. Vibro-hammering was modeled using adjusted 1/3-octave band vibro-hammering source levels from measurements of a similar offshore construction, and adjusted to account for the estimated force necessary for the driving of the BIWF cofferdam sheet piles. At the Block Island site, modeling results showed that the estimated maximum critical distances to the 160 dBL and 120 dBL MMPA thresholds were approximately less than 656.2 ft (200 m) and 27,559.1 ft (8,400 m), respectively. More information on results including figures displaying critical distance information can be found in Appendix N.

A DP vessel will be used to install the BIWF Export Cable and Inter-Array Cable. DP vessels are known to generate underwater sound. Representative sound source data were reviewed to estimate representative DP vessel source level, which is dependent on the hydrodynamic and hydroacoustic design and depth of the thruster that will be used for the installation of the BIWF Export Cable. Hydroacoustic modeling calculations were completed at three representative locations along the BIWF cable routes consisting of water depths of 32.8 ft, 65.6 ft, and 131.2 ft (10 m, 20 m, and 40 m). At all depths, the estimated maximum critical distance to the 160 dBL MMPA threshold was less than 164 ft (50 m). The estimated maximum critical distance to the 120 dBL MMPA threshold was approximately 27,887.1 ft (8,500 m) for 32.8 ft (10 m) water depth, 29,527.6 ft (9,000 m) for 65.6 ft (20 m) water depth, and 29,855.6 ft (9,100 m) for 131.2 ft (40 m) water depth. More information on results including figures displaying critical distance information can be found in Appendix N.

WTGs produce low-level sound during operation. There are limited published data on wind turbines of this design and jacket type foundation. The distance to the 120 dB threshold is estimated at 328.1 ft to 656.2 ft (100 m to 200 m) from a single turbine. Noise levels of the operating wind farm are too low to cause injury in marine mammals, and the ranges to the injury thresholds for continuous noise were not computed from the model results. There are no data on impact thresholds for fish, invertebrates, and marine birds exposed to continuous noise. Deepwater Wind will conduct a 1-week real-time monitoring period to collect data on the full range of WTG operational conditions.

## **BITS**

Underwater sound sources associated with BITS include vibratory pile-driving for cofferdam installation at the Narragansett Town Beach location and the use of DP vessels to lay cable. A cofferdam will also be installed for the BITS off of Block Island. However, because the BITS cofferdam will be located in close proximity to the BIWF cofferdam, results of the modeling analysis have been assumed to be the same. In addition, because the BIWF Export Cable and Inter-Array Cable will be installed using the same equipment and technique along similar depth contours and the BITS, results of the modeling analysis for the BIWF cable installation have been assumed to be the same as for the BITS.

Underwater vibratory pile-driving model results at Narragansett indicated that the 160 dBL and 120 dBL MMPA thresholds would be reached at approximate maximum critical distances of less than 656.2 ft and 24,934.4 ft (200 m and 7,600 m) from the source, respectively. More information on results including figures displaying critical distance information can be found in Appendix N.

A 34.5-kV submarine cable will connect the WTGs to a new substation on Block Island (Block Island Substation). The Export Cable and BITS transmission cable have a 6- to 10-inch (15.2-cm to 25.4 cm) diameter and will require a trench width of up to 5 ft (1.5 m) and a plow skid width up to 15 ft (4.6 m) during construction. The Export Cable will be buried at a target depth of 6 ft (1.8 m) beneath the seafloor. The actual burial depth will depend on substrate encountered along the route and could vary from 4 ft to 8 ft (1.2 m to 2.4 m). DP vessels are required to lay the cable and will generate underwater sound. Representative sound source data were reviewed to estimate representative DP vessel source level, which is dependent on the hydrodynamic and hydroacoustic design and depth of the thruster that will be used on the BITS Project cable-lay and installation of the BIWF Export Cable. Hydroacoustic modeling calculations were completed at three representative locations along the cable-lay line consisting of water depths of 32.8 ft, 65.6 ft, and 131.2 ft (10 m, 20 m, and 40 m). At all depths, the estimated maximum critical distance to the 160 dBL MMPA threshold was less than 164 ft (50 m). The estimated maximum critical distance to the 120 dBL MMPA threshold was approximately 27,887.1 ft (8,500 m) for 32.8 ft (10 m) water depth, 29,527.6 (9,000 m) for 65.6 ft (20 m) water depth, and 29,855.6 ft (9,100 m) for 131.2 ft (40 m) water depth. More information on results including figures displaying critical distance information can be found in Appendix N.

## **Combined Effects**

During construction, depending on the schedule of certain activities such as cable-laying, impact pile-driving, and vibratory pile-driving, there may be the potential for combined sound impacts from BITS and BIWF for the duration of the construction period. Construction will generate short-term temporary noise levels that will not be continuous, but will vary as equipment usage and change throughout the construction period. Although construction will generate high intermittent noise, it will cease upon completion of construction. Deepwater Wind will avoid impacts on marine mammals and sea turtles pursuant to the MMPA through the implementation of mitigation procedures as determined with NOAA Fisheries (see Section 4.5.4.2).

The operation of the BITS will result in no underwater noise. When considered together with the BIWF whose impacts are expected to be negligible, there will be no cumulatively considerable impacts from the operation of these two facilities.

## 4.7 Marine and Terrestrial Cultural Resources

Cultural resources include archaeological sites, standing structures, objects, districts, traditional tribal properties, and other properties that illustrate important aspects of prehistory or history or have important and long-standing cultural associations with established communities or social groups. In the area of the proposed Project, there is potential to find cultural resources both in submerged marine contexts and in upland terrestrial contexts (RI Ocean SAMP 2011; RIHPHC 2002). Sites that relate to earliest periods of known human occupation in the area may be located in what are currently submerged marine environments and also on Block Island and in the Rhode Island mainland.

Cultural resources are protected by several laws and regulations. Section 106 of the NHPA of 1966, as amended (16 USC 470f), requires that federal agencies consider the effects of their actions on sites listed in or eligible for inclusion in the National Register of Historic Places (NRHP). The Archaeological Resources Protection Act (15 USC 470aa-mm) and Abandoned Shipwreck Act (43 USC 2101 et seq.) also protect terrestrial and submerged cultural resources. Issuance of an individual Section 10/404 permit by USACE and a ROW Grant by BOEM requires that these agencies follow the NHPA Section 106 process and comply with other applicable cultural resource protection laws. USACE, as Lead Federal Agency, has initiated the Section 106 process and engaged the State Historic Preservation Offices (SHPOs) and Tribal Historic Preservation Offices (THPOs) that may have an interest in the Project Area. In October 2011, USACE sent letters to the Rhode Island SHPO (Rhode Island Historical Preservation and Heritage Commission [RIHPHC]), Massachusetts SHPO, New York SHPO, Connecticut SHPO, Narragansett THPO, and Wampanoag of Gay Head (Aquinnah) (Wampanoag) THPO, as well as the National Park Service (NPS) to determine interest in participating in the Section 106 process for the Project (Appendix A). Deepwater Wind has also facilitated consultation with the RIHPHC, the Narragansett THPO, and the Wampanoag THPO to support survey protocol development and design of the Project in a way that avoids and minimizes impacts on cultural resources to the extent practicable.

The identification of cultural resources in the Project Area and the evaluation of potential impacts have involved several meetings with agency and tribal representatives, oral interviews, and the completion of desktop and field studies. The cultural resource studies that have been completed for the Project include the following surveys and assessments:

- **Marine archaeological sensitivity assessment (2009)** that involved site file review to identify the locations and types of previously identified sites and review of the results of previous archaeological investigations conducted in the vicinity of the Project Area.
- **Marine archaeological field survey (2011)** that involved an archaeologist aboard the geophysical survey vessel to participate in geophysical data collection and collection and examination of vibratory core samples. The goal of the study was to identify NRHP-listed and NRHP-eligible submerged archaeological properties, geological features with pre-contact period archaeological sensitivity, and remote sensing anomalies or targets with the potential to be post-contact submerged cultural resources. The survey was conducted in accordance with RIHPHC and BOEM guidelines and in consultation with the Narragansett and Wampanoag THPOs. Representatives of the Narragansett and Wampanoag THPOs were present on the survey vessel that allowed them to review real-time data. They also participated in the interpretation of the geophysical results and reviewed the archaeological cores.

- **Marine Archaeological nearshore landfall field survey (2012)** that involved an archaeologist's review of the geophysical survey data collected in the shallow water portion of the Project route during high tide and a DGPS-guided visual reconnaissance (non-disturbance) walkover survey of the Project landfalls sites through the intertidal zone at peak low tide. The survey was performed in accordance with RIHPHC and BOEM guidelines and completed in consultation with the Narragansett and Wampanoag THPOs.
- **Terrestrial archaeological resources sensitivity assessment (2009, 2012 update)** to assess the potential for the Project Area to contain cultural resources potentially eligible for listing in the State or NRHP and to make recommendations regarding the need for additional archaeological investigations.
- **Terrestrial archaeological Phase I(C) field survey on Block Island (2011)** that consisted of documentary research, a field walk over, archaeological shovel testing, and the examination and curation of the recovered cultural materials in accordance with the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (48 Federal Register 44716, 1983), the RIHPHC's *Performance Standards and Guidelines for Archaeological Projects* (2007), and the Narragansett Indian Archeological/Anthropological Committee's *Standards and Guidelines for Archeological Survey* (1994). The field work was conducted between late fall of 2011 and the spring of 2012 under a permit from the RHPHPC and in consultation with the Narragansett and Wampanoag THPOs. One potentially NRHP-eligible site, the Harbor Pond Site, was noted as potentially eligible to the NRHP. The RIHPHC concurred with the APE for the Block Island terrestrial archaeology and concurred that Phase II investigations are required to determine if the site is eligible to the NRHP (August 15, 2012).
- **Terrestrial archaeological Phase I(C) field survey in Narragansett, Rhode Island (2012)** that consisted of documentary research, a field walk over, archaeological shovel testing, and the examination and curation of the recovered cultural materials in accordance with the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (48 Federal Register 44716, 1983), the RIHPHC's *Performance Standards and Guidelines for Archaeological Projects* (2007), and the Narragansett Indian Archeological/Anthropological Committee's *Standards and Guidelines for Archeological Survey* (1994). The field work was conducted in August 2012 under a permit from the RHPHPC and in consultation with the Narragansett and Wampanoag THPOs.
- **Aboveground historic properties desktop review (2009, 2011 update)** that involved site file review to identify known historic aboveground properties that are listed in, determined eligible for, or evaluated as eligible to the NRHP and/or the Rhode Island State Register of Historic Places.
- **Aboveground historic properties identification and NRHP eligibility evaluation (2011 to 2012)** that identified historic properties that may have views of the Project, surveyed and evaluated NRHP-eligibility of undesignated aboveground cultural resources and cultural landscapes on Block Island, and collected field verification and historical significance information necessary to assist in a preliminary assessment of Project visual effects to NRHP-listed and -eligible properties. The survey protocol was prepared in accordance with the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (48 Federal Register 44716, 1983) and RIHPHC standards.

The marine cultural (Appendix P), terrestrial archaeological (Appendix Q), and aboveground historic properties resources reports (Appendix R) provide detailed pre-contact and historic period contexts for Block Island, Rhode Island Sound, and the Rhode Island mainland based on literature review, records search, and oral interviews. These reports will be provided to the SHPOs and THPOs engaged in the Section 106 process for the Project. Sections 4.7.1 through 4.7.3 of this ER summarize the results of the surveys, characterize the cultural resources in the Project Area, and discuss potential impacts and mitigation measures related to NRHP-listed and eligible cultural resources.

#### **4.7.1 Marine Cultural Resources**

Deepwater Wind conducted a desktop review and Phase I marine archaeological remote sensing survey to identify NRHP-listed and NRHP-eligible submerged archaeological properties, geological features with pre-contact period archaeological sensitivity, and remote sensing anomalies or targets with the potential to be post-contact submerged cultural resources. In a letter to the USACE dated August 15, 2012, the RIHPHC indicated their concurrence with the APE defined for Phase I marine archaeology. The remote sensing survey involved review of the geophysical and geotechnical data collected within a 984-ft (300-m) survey corridor centered on the Export Cable and BITS cable in both the offshore and nearshore environments and an approximately 9,840-ft (3,000-m) survey corridor centered on the WTGs (Appendix P). The study also involved DGPS-guided visual reconnaissance (non-disturbance) walkover survey of the Project landfalls sites on Block Island and Narragansett through the intertidal zone at peak low tide. In addition, the study involved review of the borings obtained at the WTG locations (Appendix E-3). The results are presented in separate reports for the BIWF and the BITS in Appendix P to this ER. These reports contain sensitive site location information, and therefore will be made available only to the reviewing agencies, SHPOs, and THPOs engaged in the Section 106 process for the Project. This section discusses known submerged cultural resources within Rhode Island Sound and presents a summary of the marine cultural resources survey results.

##### **4.7.1.1 Affected Environment**

###### **Pre-Contact Cultural Resources**

Pre-contact submerged cultural resources are associated with the area's earliest inhabitants. Such early sites may have been located in former coastal uplands that, following the retreat of the Wisconsin glaciation and the subsequent rise of sea level, became submerged beneath the Rhode Island Sound. Paleoshoreline reconstructions for the area included in the RI Ocean SAMP (2011) indicate that all or nearly all of the Project Area would have been exposed land hypothetically available for human habitation at the start of the PaleoIndian period (ca. 13,000 years BP). Rapidly rising sea level, however, would have left only about 30 to 40 percent of the Project Area still subaerially exposed at the end of the PaleoIndian period (ca. 10,000 BP) and start of the Early Archaic period (10,000 to 7,500 BP) and about 1,000 years after the date of the earliest known PaleoIndian archaeological deposit in New England (i.e., the Gramly Site in Maine), and would have seen all but the shallowest portions of the area completely inundated by ca. 5,000 BP, corresponding with the end of the Middle Archaic period (7,500 to 5,000 BP) period.

Generally, the prerequisite for preservation of inundated settlement sites is burial in terrestrial or low-energy marine sediments prior to their transgression by rising ocean waters (Waters 1992). In these cases, sites may be preserved if they remain below the depth of shoreface erosion during and after the marine transgression process, and if they have not undergone substantial sediment reworking as a result of



impacts from modern wave and tidal current regimes that affect to varying degrees formerly terrestrial landscapes once they are submerged.

Archaeological site file research of files maintained by the RIHPHC revealed that no previously documented pre-contact period archaeological deposits or Native American underwater archaeological sites have been recorded to date within the Project Area. The marine archaeological Phase I survey involved review of the geophysical and geotechnical data collected for the Project to identify evidence of submerged paleosols within the survey corridor that represent former potential living surfaces that may contain pre-contact archaeological sites or direct evidence of pre-contact archaeological sites that would consist of lithic (stone) artifacts, shell middens, charcoal associated with burned cobbles, and possibly pottery typical of pre-contact period archaeological sites.

Subbottom profiling equipment was first utilized to identify potential buried paleochannels within the entire survey area (984 ft [300 m] corridor centered on the Export and BITS cables and approximately 9,840 ft (3,000 m) corridor centered on the WTG Array). Two different types of remote sensing methodologies were used for the survey. A shallow subbottom profiler (chirp) was used to achieve profiles 3 ft (1 m) in areas of compact and/or coarser material to 66 ft (20 m) in areas where finer unconsolidated sediments were present. An intermediate subbottom profiler (boomer) was used to achieve profiles of up to 49 ft (15 m) through coarse glacial till to over 197 ft (60 m) in finer sediments where conditions were more ideal for signal penetration. Buried paleochannel geomorphological features and their depths below the surface of the seafloor were identified and mapped within the survey area. The marine archaeologist, a representative of Deepwater Wind, and representatives of the Narragansett and Wampanoag THPOs engaged in a series of review sessions to identify potential paleosols. Based on these meetings, 15 sampling locations (12 for BITS and 3 for BIWF) were selected for further analysis via geotechnical vibrocore.

Geotechnical vibratory cores were then collected to a depth of 10 ft [3 m] and reviewed by the marine archaeologist and representatives of the Narragansett and Wampanoag THPOs. The geotechnical data did not contain any evidence of stratified archaeologically sensitive paleosols or evidence of the presence of pre-contact archaeological sites. The subbottom profile reflectors suggestive of buried relict features (i.e., buried paleochannels) were all either located below the recovered core depth of up to 10 ft (3 m), the maximum anticipated submarine cable burial depth, or had been truncated or so extensively disturbed by transgressive and post-transgressive processes associated with sea level rise and inundation that no evidence of buried terrestrial deposits (i.e., paleosols) were observed to be present. Review of the boring information collected at the location of the WTGs also did not indicate the presence of pre-contact archaeological sites.

### **Post-Contact Cultural Resources**

Another category of cultural resources relates to the maritime history of the Block Island and Rhode Island Sound area. Potential cultural resources include remnants of maritime vessels and associated artifacts that date to the prehistoric and historic time periods. These cultural resources may meet the criteria to be eligible to the NRHP. For example, the archaeological remnants of vessels could range from prehistoric canoes, Euroamerican vernacular fishing vessels, seventeenth century merchant ships, to military vessels from the eighteenth, nineteenth or twentieth centuries, and miscellaneous associated artifacts.

Figure 4.7-1 shows known shipwrecks in Block Island Sound and Rhode Island Sound publicly recorded in NOAA spatial databases. Some of the shipwrecks correspond to popular dive sites in Rhode Island waters. The RI Ocean SAMP designates these dive sites as Areas of Particular Concern that should be avoided in the siting of offshore renewable energy facilities. As shown in Figure 4.7-1, there are no shipwrecks or offshore dive sites within the Project Area or within the BIWF work area.

Side-scan sonar data and magnetic data collected within the survey corridor were reviewed to identify potential submerged post-contact cultural resources. A total of 80 side-scan sonar targets were identified during the BIWF survey and 171 side-scan sonar targets were identified during the BITS survey. The distribution of the identified side-scan targets was typical of southern New England coastal waters, with the greatest concentrations of targets occurring in areas proximal to human activities (e.g., near landfalls, navigation channels, traffic lanes, harbors). All of the targets identified in the BITS and BIWF survey corridors were interpreted as isolated debris/modern trash, geological features, and navigation aids.

Analysis of magnetic data in the BIWF survey corridor resulted in a total of 419 magnetic anomalies, none of which were identified as potential submerged cultural resources (i.e., shipwrecks). Correlation of the magnetic data with the side-scan sonar data and subbottom profiler data sets indicated that all of the magnetic anomalies appeared to be associated with either naturally occurring geological formations containing mafic rock with magnetic properties or with isolated occurrence of debris or modern trash, and therefore were assessed as having little or no probability for representing submerged cultural resources.

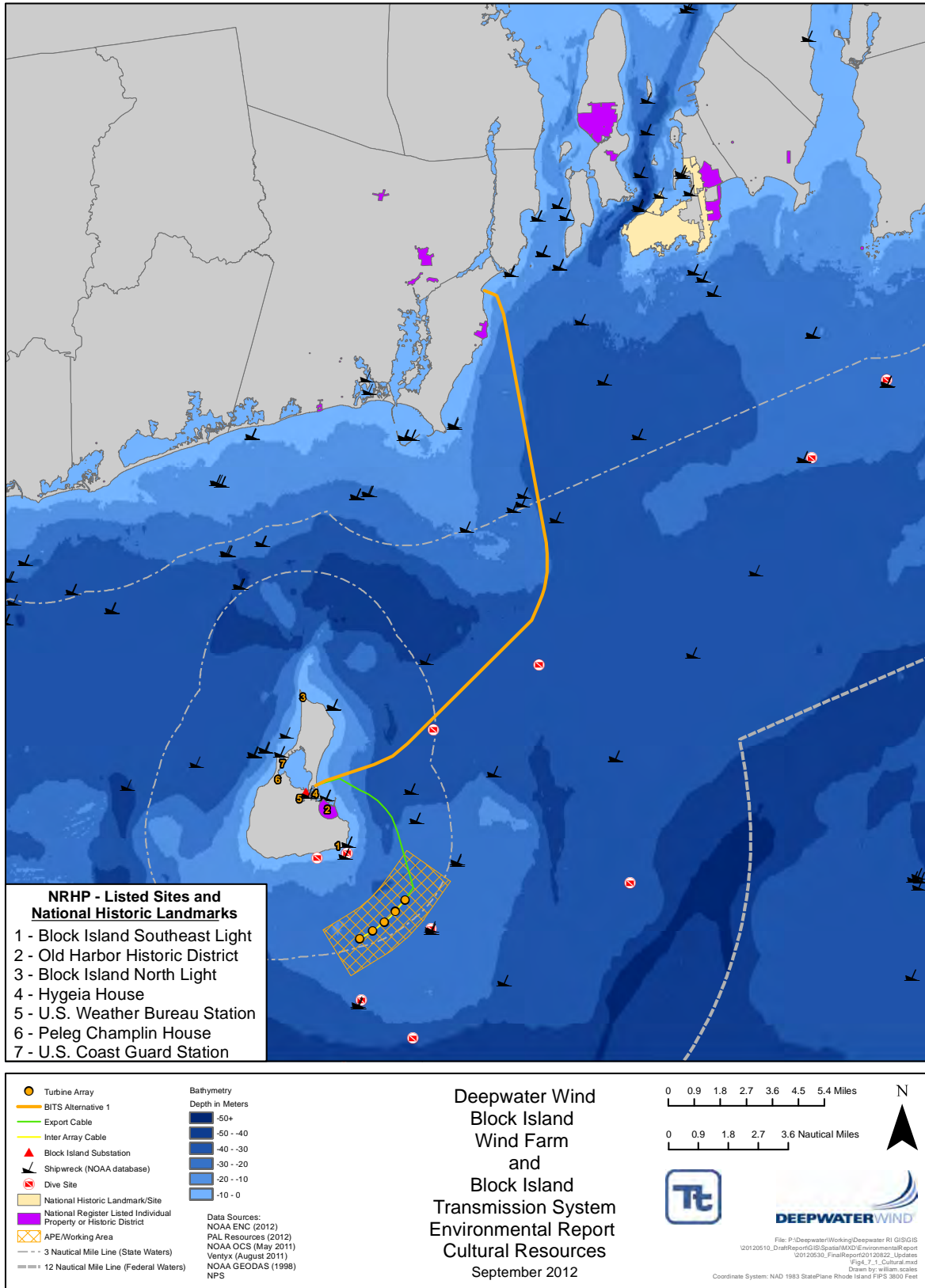
Analysis of magnetic data in the BITS survey corridor inventoried a total of 1,169 magnetic anomalies. The majority of these were assessed as having little or no probability for representing submerged cultural resources. Two anomaly clusters, each consisting of two to four magnetic anomalies, were identified along the BITS Alternative 1 route as having moderate to high potential to be submerged cultural resources (i.e., shipwrecks). These two clusters were located 100 ft (30.5 m) and 350 ft (107 m), respectively, from the BITS Alternative 1 centerline. The cluster closest to the BITS Alternative 1 centerline consisted of four magnetic anomalies.

#### **4.7.1.2 Potential Impacts and Proposed Mitigation**

##### **BIWF**

Deepwater Wind sited the WTGs, Inter-Array Cable, and Export Cable outside of known submerged cultural resources, and the site-specific investigation did not identify any evidence of archaeologically sensitive paleosols or pre- and post-contact period cultural materials within the footprint of the BIWF components. Disturbance to potential submerged cultural resources may occur as a result of anchor drop and anchor sweep from the derrick barge associated with the installation of the WTGs. The approximately 9,840-ft (3,000-m) survey corridor around the WTGs was defined based on the anticipated maximum radius for the derrick barge anchors. The potential for archaeologically sensitive submerged resources was assessed within this area. Deepwater Wind has committed to avoid anchor drop within areas with potential paleochannels within 15 ft (4.6 m) of the seafloor, the maximum depth of the anchor. Avoidance of these features will be achieved through maintenance of a buffer zone distance of 100 ft (30 m) in all directions around the detectable limits of these features. At the cable landfall site, because seasonal deposition of sand onto the intertidal zone and beach during the fair weather conditions of summertime (Kennett 1982:304-305) has buried and obscured older elements of the shoreface that could contain cultural deposits, Deepwater Wind will perform archaeological monitoring during the excavation of the approximately 6 ft to 10 ft (1.8 m to 3 m) wide, 12 ft (3.7 m) deep, and 60 ft (10.8 m) long trench on Crescent Beach from which the jet plow will be launched/come ashore. This archaeological monitoring will be performed by a qualified archaeologist working in conjunction with an on-site Tribal monitor(s).

Figure 4.7-1 Cultural Resources



Deepwater Wind will also maintain an Unanticipated Discovery Plan that will include stop work and notification procedures to be followed in the event that a submerged cultural resource is encountered during installation of the BIWF.

There are no documented NRHP-listed or NRHP-eligible sites within the Project Area and no archaeologically sensitive or potentially eligible sites were identified by the site-specific surveys within the Project footprint. In addition, Deepwater Wind has committed to measures that will avoid impacts to cultural resources during construction. Thus, the BIWF is not anticipated to result in any impacts on marine cultural resources.

### **BITS**

Deepwater Wind sited the BITS submarine cable outside of known submerged cultural resources, and the site-specific investigation did not identify any evidence of archaeologically sensitive paleosols or pre- and post-contact period cultural materials in the BITS footprint. The BITS submarine cable route avoids the two anomaly clusters identified during the field survey that have the potential to be cultural resources that may meet the criteria to be NRHP-eligible. During construction, the plow skid for the jet-plow will have a total width of up to 15 ft (4.6 m), or 7.5 ft (2.3 m) on either side of the centerline. Because the nearest anomaly cluster is located approximately 100 ft (30.5 m) from the BITS Alternative 1 centerline at a sufficient distance from the installation activities, installation of the BITS is not anticipated to affect these sites. As described for the BIWF, at the cable landfall site on Crescent Beach and Narragansett Town Beach, because seasonal depositions have buried and obscured older elements of these shorefaces that could contain cultural deposits, Deepwater Wind will perform archaeological monitoring during the excavation of the BITS approximately 6 ft to 10 ft (1.8 m to 3 m) wide, 12 ft (3.7 m) deep, and 60 ft (10.8 m) on Crescent Beach and the 6 ft to 10 ft (1.8 m to 3 m) wide, 12 ft (3.7 m) deep, and 70 ft (21.3 m) long trench on Narragansett Town Beach from which the jet plow will be launched/come ashore. As stated previously this archaeological monitoring will be performed by a qualified archaeologist working in conjunction with on-site Tribal monitor(s).

Deepwater Wind will also maintain an Unanticipated Discovery Plan that will include stop work and notification procedures that will be followed in the event that a submerged cultural resource is encountered during installation of the BITS.

There are no documented NRHP-listed or NRHP-eligible sites within the Project Area and no archaeologically sensitive or potentially eligible sites were identified by the site-specific surveys within the Project footprint. In addition, Deepwater Wind has committed to measures that will avoid impacts to cultural resources during construction. Thus, the BITS is not anticipated to result in any impacts on marine cultural resources.

### **Combined Effects**

Deepwater Wind has sited the Project facilities outside of potentially significant cultural resources that have been identified in desktop reviews and the site-specific field surveys. Deepwater Wind will also implement an Unanticipated Discovery Plan that will include stop work and notification procedures in the event that a submerged cultural resource is encountered during installation of the Project. Therefore, construction and operation of the Project is not anticipated to result in any direct or significant impacts on pre-contact or post-contact period submerged cultural resources.

## 4.7.2 Terrestrial Archaeological Resources

Several studies to identify and evaluate terrestrial archaeological resources have been conducted to support the siting and design of the Project since 2009. Desktop studies consisting of archival research were completed to identify known sites and areas with potential to contain cultural resources. Field reviews were conducted in the fall and winter of 2009, spring of 2010, and fall of 2011. To identify previously undocumented sites that may occur within the Area of Potential Effect (APE), Deepwater Wind conducted a Phase I(C) archaeology survey to locate and identify Native American and/or post-contact period sites potentially eligible for listing in the NRHP or state register within the Project Area (Appendix Q). The APE for the survey included the terrestrial BIWF Export Cable and BITS route on Block Island and the Block Island Substation alternative locations. Deepwater Wind has also completed a Phase I(C) archaeological survey (i.e., subsurface testing) for the BITS facilities in Narragansett. Survey results are also provided separately in Appendix Q-1.

### 4.7.2.1 Affected Environment

Terrestrial archeological cultural resources within the APE may include archeological sites that date to as early as pre-contact time periods (also known as prehistoric time periods) dating to as early as 12,000 years ago and as recently as contact periods (also known as historic time periods) dating from around AD 1500 to 1650. Sites may potentially represent a wide range of types, such as small lithic scatters, village sites, Euroamerican agricultural sites, nineteenth century tourism-related sites, twentieth century industrial sites, and military coastal defense sites.

The APE on Block Island is located within the Great Salt Pond Archaeological District. The Great Salt Pond Archaeological District represents a core area of Native American settlement, land use, and resource acquisition that dates to the Middle Woodland through Contact Periods (ca. 200 B.C. through A.D. 1676) (Robinson 1987; McBride 1989a, 1989b). Archaeological site inventories maintained at the RIHPHC document more than 35 Native American archeological sites previously recorded within 1 mi (1.6 km) of the BIWF Export Cable and BITS cable route. Known Native American archaeological sites are concentrated around the margins of the Great Salt Pond and associated estuary ponds such as Harbor Pond. These sites include special purpose resource extraction sites, shell middens, Native American burials and a fortified seventeenth century palisaded fort with evidence for sedentary settlement and wampum production. The Project facilities do not traverse through any of these sites. The nearest sites are located 65 ft (20 m) and 330 ft (100.6 m) from the BITS Export Cable and BITS cable route on the Block Island.

Subsurface testing within the APE on Block Island resulted in the identification of nineteenth and twentieth century cultural materials recovered from disturbed fill contexts with a few Native American quartz flakes and two probable stone netsinkers or weights. These nineteenth and twentieth century cultural materials and pre-contact Native American flakes and stone weights represent incidental inclusions in fill strata and are not considered significant archaeological properties eligible for listing in the NRHP. Subsurface testing also demonstrated that the majority of the cable route from the manhole at the Crescent Beach to the BIPCO property has been disturbed to depths exceeding 3.3 ft (1 m) below the ground surface.

One concentration of pre-contact Native American cultural materials was found within the APE in an apparently undisturbed context included quartz, quartzite, argillite, and chert chipping debris, a quartz scraper, and several quartz bifacially flaked tools. The Phase I(C) investigation recommends that these

materials be considered as one site that may be eligible for listing in the NRHP as a contributing element to the Great Salt Pond Archaeological District.

The Block Island Substation Alternative A location is proposed at a grassed area located along the eastern edge of the BIPCO property. Archaeological testing within this area did not identify any significant cultural resources. The Block Island Substation Alternative B site is located in an area that has previously been disturbed by construction, maintenance, and operation of the existing BIPCO facility. Therefore, there is minimal potential for the Block Island Substation Alternative B location to contain archaeological resources that may be eligible to the NRHP and no further archaeological testing is recommended.

On the Rhode Island mainland, the BITS Alternative 1 terrestrial facilities are located in an area of late nineteenth century construction. State site files document 10 Native American and four historic period archaeological sites within 1 mi of the BITS on the Alternative 1 terrestrial cable route. Native American sites include small short-duration resource extraction and acquisition sites, Late Woodland village settlements, and Native American burial sites. Historic archeological sites include post-contact period cultural materials, burial grounds, and eighteenth, nineteenth and twentieth century domestic sites. The BITS Alternative 1 route will not traverse through any of these sites. The nearest previously documented sites to the BITS Alternative 1 terrestrial cable route are located approximately 1,500 ft (500 m) and 1,800 ft (600 m), respectively, from the BITS Alternative 1 HDD staging area at the Narragansett Town Beach parking lot. Storm events, demolition, construction, and parking lot improvements have erased surface physical evidence for nineteenth century land use at the Narragansett Town Beach.

Phase I(C) archaeological testing was also completed at the proposed location for the Narragansett Switchyard. A site visit and walkover established that the majority of the area has been disturbed by previous cutting, filling, and land use of the property. No National Register eligible pre-contact Native American or post-contact period historical resources were identified within the Narragansett Switchyard APE during the survey. No additional archaeological surveys are recommended for the Narragansett Switchyard. Representatives of the Narragansett Indian Tribe were onsite during the Phase I(C) survey and concurred with the assessment and conclusions. The Phase I(C) Archaeological Survey is available in Appendix Q. In a letter dated August 30, 2012, the RIHPHC concurred that this was an area of extensive disturbance and fill, and that the switchyard will have no effect on any significant cultural resources. A record of this correspondence is included in Appendix A.

The BITS Alternative 1 landfall location on Narragansett Town Beach and the terrestrial overhead and underground route through the Town of Narragansett are all located within areas characterized as low sensitivity for containing potentially NRHP-eligible cultural resources (Appendix Q). An appropriate level of archaeological testing will be coordinated preconstruction and conducted in consultation with the RIHPHC, Narragansett THPO, and the Wampanoag THPO.

#### **4.7.2.2 Potential Impacts and Proposed Mitigation**

##### **BIWF**

Deepwater Wind has sited the terrestrial BIWF Export Cable and the Block Island Substation within previously disturbed areas to the extent practicable and has taken into consideration the results of terrestrial archaeological studies and agency and tribal input during development of the proposed Project. As a result, the Project design avoids impacts on cultural resources in general. The BIWF will not disturb any NRHP-listed archaeological sites as a result of construction, operation, or decommissioning.

The subsurface archaeological testing revealed one previously unknown site that is potentially eligible for listing in the NRHP. Deepwater Wind is planning to consult with RIHPHC and USACE and will conduct a Phase II investigation to determine if the site meets the criteria for listing in the NRHP. If the site is recommended as eligible to the NRHP, and if it will be affected by the Project, Deepwater Wind will again consult with RIHPHC and USACE to determine an appropriate mitigation of adverse effects to a significant archaeological site. Mitigation would be formalized in a Memorandum of Agreement (MOA) that would be signed by the RIHPHC, USACE, Deepwater Wind, and other interested parties. Mitigation measures may include activities such as data recovery at the site and possibly development of materials for public interpretation of the site and the historic district.

Additionally, Deepwater Wind has developed an Unanticipated Discoveries Plan for construction that specifies stop work and notification procedures in the event a site of potential cultural significance is encountered during construction. The plan is included as an appendix to the terrestrial archaeological report included as Appendix Q to this ER that has been submitted to reviewing agencies under separate cover due to the sensitive nature of the site information contained in the report.

Based on the measures taken to avoid direct disturbance of cultural resources, the absence of previously documented NRHP-listed sites within the Project Area, and the implementation of mitigation measures for sites that may potentially be eligible for listing in the NRHP, the BIWF is not anticipated to result in significant impacts on terrestrial cultural resources or to NRHP-listed or eligible sites.

## **BITS**

The terrestrial BITS cable and BITS Island Switchyard will be collocated with the BIWF facilities on Block Island. Therefore, potential impacts on terrestrial cultural resources and mitigation measures for construction, operation, and decommissioning of the BITS on Block Island are as described for the BIWF.

In Narragansett, Deepwater Wind has sited the BITS terrestrial facilities within previously disturbed areas to the extent practicable and has taken into consideration the results of terrestrial archaeological studies and agency and tribal input during development of the proposed Project. Additionally, for BITS Alternative 1, the BITS cable would be installed aboveground along existing poles from the manhole at the Narragansett Town Beach Parking Lot to the proposed Narragansett Switchyard, which would minimize ground disturbance along this route. As a result, the Project design avoids potential impacts on archaeological cultural resources in that area. The BITS will not disturb any sites listed in the NRHP as a result of construction, operation, or decommissioning. Deepwater Wind has completed subsurface testing within the APE at the Narragansett Switchyard to identify previously unknown sites that may be eligible for the NRHP. Conclusions of the survey indicated that no National Register eligible pre-contact Native American or post-contact period historical resources were identified within the Project APE. RIHPHC has concurred that the switchyard will have no effect on any significant cultural resources (August 30, 2012 letter to PAL). The BITS Alternative 1 landfall location on Narragansett Town Beach and the terrestrial overhead and underground route through the Town of Narragansett are all located within areas characterized as low sensitivity for containing potentially NRHP-eligible cultural resources (Appendix Q). An appropriate level of archaeological testing will be coordinated preconstruction and conducted in consultation with the RIHPHC, Narragansett THPO, and the Wampanoag THPO.

Additionally, Deepwater Wind has developed an Unanticipated Discoveries Plan for construction that specifies stop work and notification procedures in the event a site of potential cultural significance is encountered during construction. The plan is included as an appendix to the terrestrial archaeological

report that has been submitted to reviewing agencies under separate cover due to the sensitive nature of the site information contained in the report.

Based on the measures taken to avoid direct disturbance of cultural resources, the absence of previously documented NRHP-listed sites within the Project Area, and the implementation of avoidance or mitigation measures for any sites identified by future surveys that may be potentially eligible for listing in the NRHP, the BITS is not anticipated to result in significant impacts on terrestrial cultural resources or to NRHP-listed or eligible sites.

### **Combined Effects**

Based on the measures taken to avoid direct disturbance of cultural resources, the absence of previously documented NRHP-listed sites within the APE, and the implementation of avoidance or mitigation measures for sites that may potentially be eligible for listing in the NRHP, the Project is not anticipated to result in significant impacts on NRHP-listed or eligible terrestrial archaeological sites.

### **4.7.3 Aboveground Historic Resources**

Historic properties are defined as districts, buildings, structures, objects, or sites that are listed or determined eligible for inclusion in the NRHP. Deepwater Wind conducted an aboveground historic resources survey to identify previously recorded and designated aboveground historic properties near the Project Area and to identify any additional properties that may be eligible for listing in the NRHP (Appendix R). Deepwater Wind has consulted with the USACE, RIHPHC and SHPOs since 2009 to prepare the survey protocol and identify the sites recommended for evaluation. The report provided in Appendix R provides data and analysis associated with the BIWF and BITS facilities on Block Island. The data and analysis associated with the BITS facilities in Narragansett will be submitted in a separate report in a supplemental filing.

Based on agency consultation and viewshed mapping within a preliminary 30-mi (48.3 km) APE, the working APE for the BIWF aboveground historic resources field survey was defined as all locations on Block Island and the Rhode Island mainland with potential views of one or more WTGs (see Figure 2-1 of Appendix R). The working APE for the BITS aboveground historic properties survey was defined to include the area where the Block Island Substation may be visible within 0.5-mi (0.8-km) of the proposed facility (Figure 2-2 of Appendix R). In a letter to the USACE dated August 15, 2012, the RIHPHC concurred with the APE for the aboveground survey.

The aboveground historic properties evaluation was coordinated with the visual impact assessment for the Project (see Section 4.8 and Appendix S for further discussion of visual resources). The viewshed analysis informed the selection of the historic properties recommended for evaluation and the identified historic properties were subsequently included as a category of visually sensitive receptors in the Visual Impact Assessment (VIA). The VIA considered 198 historic sites either designated as National Historic Landmarks or sites or districts listed in the NRHP in Rhode Island, New York, and Connecticut.

This section of the ER focuses on describing the currently NRHP-listed historic properties on Block Island and summarizing the potential impacts of views of the WTG Array from these sites. The VIA included as Appendix S revealed that visibility is limited along most of the Rhode Island mainland, resulting in minimal to no impact from most sites. Therefore, these sites are not discussed in detail in this section. Additionally, the aboveground historic resources survey resulted in several sites recommended as eligible for inclusion in the NRHP. These sites are discussed in detail in the historic properties report in Appendix R. The formal eligibility determination for these properties and the overall effects assessment



for the Project will be completed through the Section 106 consultation process with the federal lead agencies, the RIHPHC and other interested parties, as applicable.

#### 4.7.3.1 Affected Environment

Currently NRHP-listed historic properties within the working APE for the Project on Block Island are listed in Table 4.7-1 and shown on Figure 4.7-1 (see also Table 4-1 and Figure 4-1 of Appendix R). These properties on Block Island consist of one National Historic Landmark (NHL), one historic district, and five individual properties that are listed in the NRHP.

The RIHPHC also specifically requested that the aboveground historic survey evaluate the eligibility of properties previously considered eligible for listing in the NRHP by the RIHPHC or prior surveys. Properties previously considered NRHP-eligible by the RIHPHC consist of two areas/districts and five individual properties (Table 4-2 and Figure 4-1 of Appendix R). Overall, the aboveground historic properties survey identified a total of 15 areas/districts and 33 individual properties on Block Island, including one NHL, within the Project working APE that are listed in, considered eligible by the RIHPHC and/or based on this survey are recommended as eligible for inclusion in the NRHP (see Table 4-1 through Table 4-4 and Figure 4-2 in Appendix R). In a letter to the USACE dated August 15, 2012, the RIHPHC concurred with the properties recommended as NRHP-eligible districts and with the recommendations for individual properties as NRHP-eligible with the exception of two properties, both World War II lookout towers on Block Island. Specifically, the RIHPHC determined that these two properties are more appropriately considered as contributing resources in a larger Coastal Defenses of Rhode Island district than as individually eligible properties.

The aboveground historic resources survey of the Project working APE on the Rhode Island mainland encompassed the communities of Charlestown, Jamestown, Little Compton, Narragansett, Newport, South Kingstown, and Westerly, Rhode Island (see Figure 2-1 of Appendix R). The survey identified a total of 91 historic properties consisting of 23 areas/districts and 68 individual properties that are listed in, formally determined eligible to, or considered potentially eligible to the NRHP by the RIHPHC (see Table 5-1, Table 5-2, and Figure 5-1 of Appendix R).

**Table 4.7-1 National Historic Landmarks and Properties Listed in or Determined Eligible for NRHP Listing within Project Working APE on Block Island**

Name	Location	Area/District	Date of Construction	NR Status*
Block Island Southeast Light	Southeast Light Road	n/a	1874	NHL
Old Harbor Historic District	Intersection of Water, High, and Spring Streets	Old Harbor Historic District	18th through 20th centuries	NRDIS
Block Island North Light	Sandy Point	Corn Neck Road	1837	NRIND
Hygeia House	Beach Avenue	Beach Avenue	1885, 1907	NRIND
U.S. Weather Bureau Station	Beach Avenue	Beach Avenue	1903	NRIND
Peleg Champlin House	Rodman Pond Lane	n/a	ca. 1820	NRIND
U.S. Coast Guard Station	121 Coast Guard Road	n/a	1936	NRDOE
*NR Status Key: NHL – National Historic Landmark NRDIS – National Register Listed District NRIND – National Register Listed Individual Property NRDOE – National Register Determination of Eligibility by Keeper of the National Register Source: Appendix R (Table 4-1)				

The seven properties on Block Island that are currently listed in the NRHP are described in more detail in the following sections. The aboveground historic properties report provides a discussion of the other properties on Block Island and on the Rhode Island mainland that were evaluated by the study (see Appendix R).

### **Block Island Southeast Light**

The Block Island Southeast Light (NHL – 1997; NRHP – 1990) is located along the southeastern coast of Block Island. The lighthouse consists of a 5-story tower with a 2.5-story duplex keeper's house designed in the Gothic Revival style by the U.S. Light House Board in 1873. T.H. Tynan of Staten Island erected the masonry structure from 1874 to 1875. The lighthouse has brick walls set on a granite block foundation, granite trim, and a cast-iron lantern that contains a first-order Fresnel lens relocated from Cape Lookout Lighthouse in North Carolina. The keeper's house has a side gable roof sheathed with replacement slate shingles. The site, which still functions as an active lighthouse, was moved further back from the shoreline from its original location in 1993 due to threats from cliff erosion. Southeast Light was listed in the NRHP in 1990 due to its expression of nineteenth century architectural style, standardized Light House Board design, and its historical role in navigation. The lighthouse was subsequently designated as a NHL in 1997 (Reynolds 1995) The lighthouse has open views of Block Island Sound in three directions (southwest, south, and southeast) toward the WTG Array.

### **Old Harbor Historic District**

The Old Harbor Historic District (NRHP – 1974) encompasses all properties within a 2,000-ft (609.6 m) radius from the Village Square at the intersection of Water, High, and Spring streets. The district is located on the east side of the island and comprises Block Island's residential, institutional, and commercial downtown at Old Harbor. The district contains approximately 42 contributing properties that exhibit a range of primarily nineteenth century architectural styles or are associated with Block Island's maritime, developmental, and recreational history. The Old Harbor Historic District was listed in the NRHP in 1974 and noted as being significant in the areas of architecture, commerce, maritime, and recreation (Gibbs 1974a). Large nineteenth-century hotels fronted by full-length verandas, such as the Spring House, are located within this historic district. The Spring House is individually eligible for listing in the NRHP and has views to the northeast, east, and southeast from outdoor seating areas. The shoreline and south part of the Old Harbor Historic District have unobstructed views of Block Island Sound to the east, and views southeast toward the WTGs partially shielded by topography. The north section of the Old Harbor Historic District has potential views of the Block Island Substation.

### **Block Island North Light**

The North Light (NRHP – 1974) is located at Sandy Point on the north tip of Block Island, off Beach Avenue. The lighthouse faces north and is within a 28-acre property managed by the USFWS. North Light consists of a 2.5-story, Italianate style keeper's house with a rear kitchen ell and a cast-iron lantern set atop the gable roof of the house. The structure was built of granite block in 1867 on the site of three earlier lighthouses. North Light is the oldest lighthouse on Block Island and exhibits a standardized design used for five other extant lighthouses in the United States. North Light continues to serve as an aid to navigation for the waters off northern and western Block Island. North Light was listed in the NRHP in 1974 for its role in island navigation and maritime history and its architectural design (Gibbs 1974b). The WTG Array is potentially visible across the island to the southeast from the North Light tower lantern.

### **Hygeia House**

The Hygeia House (NRHP – 2001) is located on the north side of Beach Avenue within the potentially National Register-eligible Beach Avenue area and faces southeast toward Old Harbor. The property is a 2.5-story, French Second Empire style, wood-frame building constructed as a hotel in 1885 and relocated to its current site in 1907. The building has an asphalt-shingled mansard roof with brackets and dormers, clapboard-sheathed walls, and a stone foundation. The Hygeia House was listed in the National Register in 2001 for its historic associations with Block Island’s tourism industry and its architectural design (Dillon 2000). The Block Island Substation may be visible to the southwest, and the Hygeia House has limited views southeast toward the WTG Array.

### **U.S. Weather Bureau Station**

The U.S. Weather Bureau Station (NRHP – 1983) is located on the north side of Beach Avenue within the potentially NRHP-eligible Beach Avenue area and faces southeast. The property is a symmetrical, two-story, Classical Revival style, wood-frame building designed by Harding and Upham of Washington D.C. and constructed for the U.S. Department of Agriculture in 1903. The building has an overhanging flat roof, wood-shingled walls set on a raised brick foundation, and a full-width entrance portico with a central pediment. The building served as a meteorological observatory and observer’s residence for 46 years during the foundational years of the national weather service. The formal design of the building was intended to encourage public trust in the weather service’s forecasts. The U.S. Weather Bureau was listed in the National Register in 1983 for its historic associations with the development of the weather service and its high-style architectural design (Greenwood 1983). The Block Island Substation will be potentially visible to the southwest and the U.S. Weather Bureau Station has limited views southeast toward the WTG Array.

### **Peleg Champlin House**

The Peleg Champlin House (NRHP – 1982) is located on Rodman Pond Lane on the west side of Block Island and faces south. The property is located on a 3.3-acre inland farmstead with mowed fields, stone walls, and three outbuildings. The house is a 1.5-story, 5-bay by 2-bay, wood-frame Cape Cod cottage constructed for farmer Peleg Champlin circa 1820. The house has a wood-shingled, side-gable roof, wood-shingled walls, rubblestone foundation, rear ell, center chimney, and center entrance. The Peleg Champlin House was listed in the National Register in 1982 for its representation of the Cape Cod building type and nineteenth-century construction methods on Block Island (Greenwood and Abbot 1982). The Peleg Champlin House does not have views southeast toward the proposed WTG Array.

### **U.S. Coast Guard, Block Island Station**

The U.S. Coast Guard (USCG) Block Island Station (NRHP – 1991) is located at the end of Coast Guard Road on the west side of Great Salt Pond. The station (or administrative) building is part of a complex that includes a wood-frame boathouse (built 1934), wood-frame garage (1938), brick Officer in Charge Building (1947), and brick Officer in Charge Garage (1947). The station is a 2.5-story, 5-bay by 3-bay, wood-frame building completed with a standardized Colonial Revival style design by the Works Progress Administration in 1934-1935. The building has an asphalt shingled side-gable roof, clapboard-sheathed walls, and a brick foundation. An octagonal observation tower is centered on the facade (east elevation) above an entrance porch. The station opened on January 1, 1936 as the first and only Coast Guard facility on Block Island. The USCG Block Island Station was determined eligible for National Register listing by the Keeper of the National Register in 1991 for its associations with the Coast Guard in New England and for its representation of a standardized Works Progress Administration design (NPS 1991; Weinstein and

Ellis 1989). The associated outbuildings were not included in the National Register determination. These buildings are recommended eligible for National Register listing as part of the USCG Block Island Station. The Station's function was to guard the entrance to Great Salt Pond from the west side of the island. It is visible from some distance across Salt Pond and has views east and southeast, with intervening topography and vegetation, toward the WTG Array.

#### **4.7.3.2 Potential Impacts and Proposed Mitigation**

Direct impacts with potential to affect historic properties include construction that alters the character of a property through physical modifications or change of use of the property. Indirect effects may result from the introduction of new or altered visual (setting), noise, vibration, traffic, and air quality factors.

#### **BIWF**

There are no NRHP-listed or potentially eligible aboveground historic properties within the APE that would be directly disturbed during construction of the BIWF. Therefore, construction and operation of the BIWF will not result in direct impacts on historic properties.

Indirect impacts on historic properties during operation of the BIWF due to alteration in the visual setting were evaluated during the aboveground historic properties assessment (Appendix R) and the visual impact assessment (Appendix S). This section discusses the potential visual impact on NRHP-listed historic properties on Block Island. The VIA revealed that visibility is limited along most of the Rhode Island mainland resulting in minimal to no impact for most sites. Therefore, these sites are not discussed in detail in this section. Additionally, the aboveground historic properties survey resulted in several sites recommended as eligible for inclusion in the NRHP. These sites are discussed in detail in the historic properties report in Appendix R.

The location of the seven NRHP-listed historic properties on Block Island in relation to the viewshed of the WTGs and the Block Island Substation is shown in Figure 4-4 and Figure 4-5 of Appendix R. Section 4.8 and Appendix S provide further discussion of the visibility of the WTGs within the 30-mi (48.3-km) study area and the methods used to assess the potential visual impacts of the Project, including viewshed mapping, field reviews, and visual simulations. In a letter to the USACE dated August 15 2012, the RIHPHC concurred that the method of evaluating effect by assessing the extent and the character of the Project's visibility within the visually sensitive setting was appropriate. Visual effects assessment studies are in progress and the results will be provided to RIHPHC as part of the Project's ongoing consultation and will be included for review by the USACE as a supplemental filing.

#### **Block Island Southeast Light**

Southeast Lighthouse, listed in the NRHP as a NHL, is located approximately 3 mi (4.8 km) from the nearest WTG. Views from the site towards the ocean are unobstructed to the horizon in the southwest, south, and southeast directions, which will result in visibility of all five WTGs. A visual simulation of the potential view from the Southeast Lighthouse is provided as Figure 11 in Appendix S-1. Full views of the WTGs at a distance of 3 mi (4.8 km) will result in some modification of the setting of the Southeast Light. The WTGs introduce additional modern man-made vertical elements to the view that will contrast with the historical character of the Southeast Light. Nighttime views will include a horizontal line of lights marking the tops of the WTGs flashing at regular intervals.

As discussed in Section 4.8, Deepwater Wind designed the Project to avoid visual impacts to the extent practicable. The WTGs are located as far as possible offshore, while still remaining in state territorial

waters within the RI Ocean SAMP Renewable Energy Zone. Deepwater Wind has reduced the number of WTGs from eight to five and will install WTGs with a uniform design, speed, height, and rotor diameter. The white or light grey color (less than 5 percent grey tone) of the WTGs generally blends well with the sky and water context and eliminates the need for daytime Federal Aviation Administration (FAA) warning lights or red paint marking of the blade tips. In addition, the clarity of views of the WTGs will be influenced by weather conditions such as fog, precipitation, and cloud cover most of the year as described in Section 4.8. Deepwater Wind will continue to support Section 106 consultation as it proceeds during the permitting process.

### **Old Harbor Historic District**

The shoreline and southern portion of the Old Harbor Historic District has unobstructed views of Block Island Sound to the east. The aboveground historic properties report assessed that the northern section of the Old Harbor Historic District will have partial views of the BIWF Project to the southeast; the WTGs will be partially blocked from view by existing topography and structures. To represent potential views from the Old Harbor Historic District, Deepwater Wind prepared a visual simulation from the Spring House Hotel, a National Register-eligible structure located in the Old Harbor Historic District (Figure 12 in Appendix S-1). The Spring House Hotel is located approximately 4 mi (6.4 km) northwest of the nearest proposed WTG. The simulation shows that partial views of the WTG Array will be available, with the upper portions of the easternmost WTGs rising above the houses and land. The western WTGs are screened by the rising landform and houses further to the west. Overall, the small number of visible WTGs, the abundance of other structures in the view, and the small portions of the WTGs that may be viewed minimize the visual impact of the WTG Array.

### **Block Island North Light**

The North Light is located at the very northern tip of Block Island approximately 8 mi (12.9 km) northwest of the nearest proposed WTG. The view will be essentially unchanged once the WTGs are installed. The visual simulation from this site demonstrated that a single blade tip would extend above the background trees that define the visible horizon; however, the blade tip is virtually impossible to see. Although movement of the blades on this WTG will increase visibility, the limited visibility of the rotating blades will result in minimal visual interruption and impact on aesthetic quality. A visual simulation of the potential view from the North Light is provided as Figure 14 in Appendix S-1.

### **Hygeia House**

Topographic and vegetation viewshed analysis and field review indicated that the Hygeia House will potentially have views of the WTG Array to the southeast. These views would be available above the land and structures on the southeastern portion of Block Island. Overall, the small number of visible WTGs and the abundance of other structures in the view help to minimize their visual impact.

### **U.S. Weather Bureau Station**

The U.S. Weather Bureau Station is located on a neighboring property of the Hygeia House. Similar to the Hygeia House, the U.S. Weather Bureau Station is anticipated to have limited views of the WTG Array to the southeast.

### **Peleg Champlin House**

Based on the field review completed for the aboveground historic properties assessment, the Peleg Champlin House will not have views of the WTG Array.

## U.S. Coast Guard Block Island Station

The USCG Block Island Station is located on a peninsula made up by the Great Salt Pond to the east and Rhode Island Sound to the west. The USCG Block Island Station has views east and southeast with intervening topography and vegetation toward the WTG Array, which is would be located 6.4 mi from the site. Topographic and vegetation viewshed analysis, as well as field review, indicate that the USCG Block Island Station (discussed as ‘Great Salt Pond’ in Appendix S-1) will have partial views of the WTG Array. A visual simulation of the potential view from the USCG Block Island Station is available as Figure 25 in Appendix S-1.

The Inter-Array Cable and Export Cable are submarine cables that will not result in visual impacts during operation. The terrestrial portion of the Export Cable will be buried up to the BIPCO property and therefore will not result in visual impacts during operation. The overhead segment of the Export Cable on the BIPCO property and the BIWF Generation Switchyard will be located on an existing power producing facility, and as a result, will not introduce a new type of visual element into the existing landscape.

The overhead lines on the BIPCO property will be up to 40 ft (12.2 m) in height and the tallest component of the BIWF Generation Switchyard will be 21.7 ft (6.6 m) in height. Although the aboveground onshore facilities associated with the BIWF are not expected to significantly alter the existing visual landscape, the VIA included a viewshed analysis within 0.5 mi (0.8 km) of the Block Island Substation, which includes both the BIWF Generation Substation and BITS Island Switchyard, and the overhead line on the BIPCO property. The results of the viewshed mapping indicate that between 25 percent and 28 percent of the land area within 0.5 mi (0.8 km) could have a direct line of sight to the Block Island Substation, depending on the alternate location on the BIPCO property. The viewshed analysis also indicated that approximately 61.5 percent of this study area could have a direct line of sight to one or more of the proposed overhead electrical poles.

Of the historic properties on Block Island, the Old Harbor Historic District, Hygeia House, and U.S. Weather Bureau Station are located within the viewshed and may have potential views of the BIWF onshore facilities. The aboveground historic properties report indicates that the Hygeia House and U.S. Weather Bureau Station may have potential views of the onshore BIWF facilities to the southwest and the northern portion of the Old Harbor Historic District may have views of the onshore BIWF facilities to the northwest. Visual simulations from viewpoints within the Block Island onshore facilities viewshed are available as Figures 10 to 12 in Appendix S-2.

Overall, visibility of the proposed BIWF Generation Switchyard and associated overhead lines will be limited and generally compatible with the existing facilities/landscape components on and adjacent to the BIPCO property, which includes facilities such as diesel generators, a substation, electrical lines, and support facilities such as maintenance/storage yards, an office building, stored materials, and vehicles. While the BIWF onshore facilities will introduce additional such facilities, they will have a minimal visual impact on the surrounding viewshed. Deepwater Wind has minimized potential visual impacts by burying the terrestrial cable to the extent practical. Proposed design measures to minimize visual impact from aboveground facilities include using wooden poles for the overhead segments to minimize contrast with adjacent vegetation and structures, using earth tone paint to minimize contrast with the surrounding area and match colors on existing buildings on the BIPCO property. Deepwater Wind has committed to additional mitigation including screen plantings along the frontage of Ocean Avenue to screen views of the existing BIPCO facilities. These measures may also improve the quality of existing views from Ocean Avenue. Substation lighting will be designed to the minimum standard necessary for substation safety and security.

Based on the measures taken to avoid and minimize impacts to the extent possible and the measures that will be implemented, as necessary, to mitigate visual impacts from sensitive visual receptors, the BIWF is not anticipated to result in significant adverse effects to NRHP-listed or eligible aboveground historic properties.

### **BITS**

BITS facilities on Block Island, including the BITS cable and BITS Island Switchyard, will be collocated with the BIWF Generation Switchyard and Export Cable. Accordingly, the BITS facilities on Block Island will have the same impacts on NRHP-listed or eligible aboveground historic properties as described above.

The aboveground historic properties evaluation was coordinated with the visual impact assessment for the Project (see Section 4.8 and Appendix S for further discussion of visual resources). The VIA field surveys of BITS Alternative 1 facilities on the Rhode Island mainland were conducted in January and February 2012. Photographs and field notes were collected on each property regarding the setting, views, architectural or landscape characteristics, materials, and features, as well as estimated date of construction, condition, and evident alterations. The data and analysis associated with the BITS facilities in Narragansett will be submitted in a separate report in a supplemental filing. The data analyses that have been completed to date indicate that potential views of the overhead transmission lines, Narragansett Switchyard will be limited to the roads, yards, parkland, and homes immediately adjacent to the proposed facilities.

### **Combined Effects**

As discussed in the potential impacts and proposed mitigation section, the Project will not cause any direct impacts on NRHP-listed and eligible properties. Indirect impacts on NRHP-listed and eligible properties are anticipated due to alteration of the existing visual setting of the properties, which is described in more detail in Section 4.8 and Appendix S. Analyses conducted in support of the Project indicate that three NRHP-listed properties or districts (Hygeia House, U.S. Weather Bureau Station, and Block Island Historic District) potentially have indirect impacts from both BIWF and BITS facilities. The BIWF and BITS facilities on Block Island will be collocated with existing electric generation and transmission facilities, located on compatible industrial properties, or buried to avoid adverse visual impacts. Also, views of the BIWF and BITS onshore facilities and the BIWF WTG Array from each of these sites are partially obstructed by topography, vegetation, and structures and, accordingly, combined effects are not anticipated to be significant or adverse.

## **4.8 Visual Resources**

This section describes the existing landscape and visually sensitive resources within the visual study area of the BIWF and BITS. Deepwater Wind conducted a BIWF VIA to evaluate impacts of the proposed WTG Array on visually sensitive resources and receptors on Block Island, the Rhode Island mainland, New York, Connecticut, and Massachusetts (Appendix S-1). A second BITS VIA was prepared to evaluate the visibility and visual impact of above-ground BIWF and BITS facilities on Block Island (Appendix S-2). The assessment involved the following methodologies:

- **Sensitive Site Inventory** – On-line data sources and a reconnaissance-level field review identified potentially sensitive visual/aesthetic public resources within the visual study areas for the BIWF and BITS Project facilities.

- **Definition of Landscape Similarity Zones and Viewer Groups** – Landscape Similarity Zones (LSZs) that occur within the visual study areas were defined to provide a framework for the analysis of available visual resources and viewer circumstances. Typical viewer groups within the study areas, including residents, travelers, and tourists/vacationers, were also defined and described.
- **Viewshed Analysis** – The area of potential visibility of the Project facilities was determined within the visual study areas.
- **Cross Section Analysis** – Cross section analyses illustrate the screening effect of vegetation and structures as it applies to views from selected public resources.
- **Field Verification** – Site visits to selected sensitive sites and areas with potential Project visibility within each study area provided documentation of the existing view from each location.
- **Visual Simulations** – Visual simulations to illustrate visibility and appearance of Project facilities from key viewpoints within each study area were developed using photos obtained during field verification, facility specifications, and AutoCAD® and 3D Studio Max® software.
- **Evaluation of Visual Impacts** – A panel of four landscape architects evaluated the visual effect of the proposed Project.

An additional BITS VIA is currently being prepared to evaluate the visibility and visual impact of above-ground BITS facilities on Narragansett. The data and analysis associated with the BITS VIA in Narragansett will be submitted in a separate report in a supplemental filing.

#### 4.8.1 Affected Environment

Visual quality depends on the existing visual landscape and viewer groups. The visual landscape surrounding the WTGs consists of open ocean and coastal features present in southeastern Block Island, such as cliffs and beaches. The three distinct viewer groups in this area are local residents, through travelers, and tourists/vacationers. On Block Island, the landscape within the visual study area consists of shoreline bluffs, low-density residential development, beaches, and commercial development associated with the tourist center of Old Harbor. In the immediate vicinity of the Block Island Substation, the visual landscape is dominated by the existing BIPCO power generation facility. The visual landscape on the mainland along the BITS Alternative 1 route consists primarily of beaches, seasonal and permanent residential development, and some commercial and institutional development.

The BIWF and BITS VIAs included an inventory of the visual resources and receptors located within the 30-mi (48.3-km) visual study area defined for the WTGs (Figure 4, Appendix S-1) and the 0.5-mi (0.8-km) visual study area defined for aboveground onshore facilities on Block Island (Figure 4, Appendix S-2). The 30-mi (48.3-km) radius was based on the height of the proposed WTGs, guidance from European studies, and the desire to address potential Project visibility from certain visually sensitive resources on the Rhode Island mainland. The 0.5-mi (0.8-km) BITS visual study area for aboveground onshore facilities is based on standard industry practices for electrical substations and transmission lines.

##### 4.8.1.1 WTG Array

The WTG Array visual study area for the purpose of this ER is defined as the 30-mi (48.3-km) radius around the WTG Array (Figure 4, Appendix S-1). Open water and ocean cover approximately 86 percent of this area. The onshore portions of the WTG Array visual study area include the entirety of Block Island and portions of the Rhode Island mainland, Connecticut, and New York. There are over 677 visually



sensitive resources in the WTG Array visual study area, including 198 historic sites (i.e., properties designated as National Historic Landmarks or sites and districts listed on the NRHP), 14 state parks, 20 state WMAs, 5 NWR, 75 designated scenic areas, 5 state scenic overlooks, and 6 designated scenic byways (Figure 6, Appendix S-1). A complete list of the visually sensitive resources is included in Appendix S-1. The viewer/user groups within the WTG Array visual study area are local residents, through travelers, and tourists/vacationers.

A desktop study of historic properties identified a total of 27 National Historic Landmarks within the WTG Array visual study area, which include 26 located in Rhode Island (1 on Block Island, 1 in North Kingstown, and 24 in Newport) and 1 located in Connecticut (PAL 2012). The National Historic Landmark on Block Island is the Southeast Lighthouse, located on Mohegan Bluff approximately 3.0 mi (4.8 km) from the closest proposed WTG. Beyond this resource, the next closest National Historic Landmark is located in Newport, over 23 mi (37 km) away from the closest WTG.

Of the 14 state parks that occur within the WTG Array visual study area, five are located in Rhode Island, two are located in Connecticut, and the remaining seven are located in New York. State Parks closest to the WTG Array are Fishermen's State Park and Burlingame State Park on the Rhode Island mainland and Montauk State Park and Amsterdam State Park in New York. Fishermen's State Park located near Point Judith in the town of Narragansett is approximately 17 mi (27.4 km) from the closest WTG. The park is just over 90 acres (36.4 hectares) in size and offers facilities such as recreational vehicle and tent campsites, picnic areas, a playground, basketball courts and tennis courts. Montauk State Park, located west on the eastern tip of Long Island, is also 17 mi (27.4 km) from the closest WTG. The park is heavily wooded and features nature trails, scenic ocean views, surf fishing and the historic Montauk Lighthouse. Burlingame State Park along the southern shore of Watchaug Pond in the Town of Charlestown, Rhode Island, is approximately 19 mi (30.6 km) from the closest WTG. The park has approximately 3,100 acres (1,254.5 hectares) of recreational opportunities, including camping, fishing, swimming, picnicking, boating, hiking, and hunting. Amsterdam State Park on the bluffs of Montauk Point in the Town of East Hampton, New York is located 19 mi (30.6 km) from the closest WTG. The park encompasses over 122 acres (49.4 hectares) of undeveloped oceanfront and includes extensive freshwater and tidal wetlands and upland maritime shrubland communities, supporting several rare and endangered species.

Twenty state WMAs totaling over 25,000 acres (10,117.1 hectares) occur within the WTG Array visual study area; 15 of them are located on the Rhode Island mainland and the remaining five are located in Connecticut. WMAs closest to the WTG Array include Burlingame WMA, Charlestown WMA, South Shore WMA, Succotash Marsh WMA, and Woody Hill WMA, all of which are in Rhode Island. These WMAs are located between 16.5 (26.6 km) and 29 mi (46.7 km) from the WTG Array.

Five NWRs occur within the WTG Array visual study area. These resources are all located within Rhode Island, including four on the mainland (generally in proximity to salt ponds, Narragansett Bay and the Pettaquamscutt River at least 17 mi [27.4 km] from the WTG Array) and one on Block Island. The Block Island NWR is located approximately 6 mi (9.7 km) from the closest WTG and is best known for the large concentration and wide variety of migratory songbirds that pass through each fall (USFWS 2012).

A number of scenic areas, scenic overlooks, and scenic byways exist throughout the WTG Array visual study area. The visual study area encompasses 75 of Rhode Island's designated scenic areas that cumulatively include over 57,600 acres (23,310 hectares). Most of the state scenic areas in Rhode Island are landscapes characterized by active agricultural use that have been designated as noteworthy or distinctive scenic landscapes or views by RIDEM. Four Rhode Island State Scenic Overlooks occur

within the WTG Array visual study area; each located over 19 mi (30.6 km) from the closest WTG. These resources include the Boston Neck Overlook in the Town of Narragansett, Eldred Avenue Overlook in the Town of Jamestown, Ministerial Road Area in the Town of South Kingstown, and Purgatory Chasm in the Town of Middletown (RIDOT 2012). Portions of six state scenic byways run through the WTG Array visual study area: four in Rhode Island and two in Connecticut. The only scenic byway within the visual study area with views of the Atlantic Ocean is Paradise Avenue in the towns of Middletown and Portsmouth, which follows approximately 1.5 mi (2.4 km) of coastline along Sachuest Bay and 2.5 mi (4 km) along the Sakonnet River as it enters Rhode Island Sound (RIDOT 2012; USDOT 2012).

Over 12,160 acres (4,921 hectares) of conservation lands are within the WTG Array visual study area in Rhode Island. These include two designated State Conservation Areas (Ningret Conservation Area and Almy Pond Conservation Area), 79 state conservation easements, 58 conservation areas protected by the Audubon Society, and 141 conservation areas protected by The Nature Conservancy. Development and use of these areas are limited to protect the property's identified unique features and natural or scenic condition (Ruggiero 2009). These conservation lands are located between 3 mi (4.8 km) and 6.5 mi (10.5 km) from WTG Array on Block Island and between 17 mi (27.4 km) and 30 mi (48.3 km) from the WTG Array on the Rhode Island mainland.

Although not formally inventoried, the 30-mi (48.3-km) radius WTG Array visual study area also includes public resources that could be considered regionally or locally valuable or sensitive due to the type or intensity of land use they receive. These include local park and recreational facilities, campgrounds, golf courses, nature preserves, tourist attractions, fish and game clubs, schools, churches, cemeteries, areas of concentrated human settlement (areas referred to as villages and town centers in this study), and heavily traveled highways.

Additionally, Deepwater Wind conducted a shadow flicker analysis to evaluate potential impacts from the WTGs (see Appendix T). The analysis indicated that shadow flicker will not impact the Block Island shoreline. Shadow flicker impacts will be restricted to overwater areas surrounding the WTGs, boaters traversing the area near the WTGs may experience periods of shadow flicker. However, due to the temporary nature of shadow flicker and boat traffic, impacts are expected to be minor and short-term.

#### **4.8.1.2 Block Island Onshore Facilities**

The BITS visual study area for the Block Island Substation comprised of both the BIWF Generation Switchyard and BITS Island Switchyard, and the overhead transmission lines on the BIPCO property, for the purpose of this ER and based on standard industry practice, is defined as the 0.5-mi (0.8-km) radius area around the facilities (Figure 4, Appendix S-2). The onshore facilities on Block Island will be predominantly located within existing public road rights-of-way and the 25-acre (10.1-hectares) industrially used BIPCO property. Throughout the BITS visual study area, homes and commercial buildings are interspersed with wetlands, salt ponds, scrub forest, and small open fields. A small section of open ocean and associated sand beach and dunes occur on the northeastern edge of the BITS visual study area (Figure 5, Appendix S-2). There are 22 visually sensitive resources in this visual study area, including three sites or districts listed on the NRHP, Crescent Beach, Veterans Park, three designated scenic areas, protected conservation lands, and the Block Island State Airport (Figure 6, Appendix S-2). The viewer/user groups of this area include local residents and tourists/vacationers.

The historic sites and districts in the BITS visual study area are Old Harbor District, Hygeia House, and the U.S. Weather Bureau Station (see Section 4.7.3 and Appendix R). The Old Harbor Historic District encompasses all properties within a 2,000-ft (609.6-m) radius of the Village Square at the intersection of

Water, High, and Spring Streets. This district contains approximately 42 contributing properties that exhibit a range of primarily nineteenth-century architectural styles, or are associated with Block Island's maritime, developmental, and recreational history. The Hygeia House is located on the north side of Beach Avenue and faces southeast toward Old Harbor. This site is a 2.5-story, French Second Empire style, wood-frame building constructed as a hotel in 1885 and relocated to its current site in 1907. The U.S. Weather Bureau Station is also located on the north side of Beach Avenue and faces southeast. This site is a symmetrical, two-story, Classical Revival style, wood-frame building constructed for the U.S. Department of Agriculture in 1903.

The three recreational resources located within the BITS visual study area include Middletown Square Park, Veterans Park, and Crescent Beach. Middletown Square Park and Veterans Park are small local recreation sites and Crescent Beach is a 2.5-mi (4-km) long public beach that extends along the eastern shore of Block Island from Old Harbor to Clay Head.

This BITS visual study area also includes several conservation areas that are under the protection of the State of Rhode Island, the Town of New Shoreham, and non-governmental organizations. Development and use of these areas is limited in order to protect the property's identified unique features and natural or scenic condition (Ruggiero 2009).

#### **4.8.1.3 BITS Alternative 1 Onshore Facilities**

The visual study area for the BITS Alternative 1 overhead transmission cable and Narragansett Switchyard, for the purpose of this ER and based on industry standard, is defined as the 0.5-mi (0.8-km) radius area surrounding the facilities in the Town of Narragansett. The BITS Alternative 1 route will primarily be located along an existing transmission right-of-way. This area is dominated by residential development, and also includes Sprague Park, Narragansett Town Beach, Narragansett public school facilities, undeveloped forest land, several small ponds, estuaries, and a portion of the Atlantic Ocean. Viewers in this area are primarily residents involved in domestic activities, local travel, and outdoor recreation. Based on preliminary field assessments, it appears that Project visibility within the BITS Alternative 1 visual study area will be largely restricted to the roads, yards, parkland, and homes immediately adjacent to the proposed facilities.

### **4.8.2. Potential Impacts and Proposed Mitigation**

#### **4.8.2.1 BIWF**

During construction, marine vessel traffic will increase in Narragansett Bay, off of Block Island, and in the open ocean. The construction vessels will not represent a significant increase over the existing vessel traffic in the area and accordingly will not have appreciable visual impacts.

Installation of the BIWF Export Cable and construction of the BIWF Generation Switchyard on Block Island will result in minor and temporary visual impacts typically associated with the presence of construction equipment and workspace signage on local roads and in the local landscape. Construction activity will result in some visible site disturbance, such as tree clearing, earth moving, and facility installation, all of which could temporarily alter the visual character of the landscape. Seventeen new 40-ft (12.2-m) transmission poles will be installed on the BIPCO property if Deepwater Wind selects substation Alternative A and 20 new 40-ft (122-m) transmission poles will be installed if Deepwater Wind selects substation Alternative B. Because the overhead electric lines will be located only on BIPCO property, which is generally clear of vegetation, additional clearing will be minimal. Construction impacts will be short-term and localized. Deepwater Wind will construct onshore facilities during fall, winter or

spring to avoid impacts to the summer tourist season which will mitigate construction phase visual impacts on seasonal residents and recreational and tourist/vacationers.

To evaluate potential visual impacts during operation of the BIWF, the BIWF VIA included a viewshed analysis of the potential visibility of the aboveground facilities and visual simulations of the facilities from select sensitive viewpoints. The viewshed mapping considered screening from topography and mapped forest vegetation, but did not include screening provided by structures, local vegetation, curvature of the Earth, or weather conditions (Figure 8, Appendix S-1). Viewshed mapping demonstrated that the WTG Array has the potential to be visible from a relatively small portion of the 30-mi (48.3-km) WTG visual study area (Figure 4, Appendix S-1). Topography alone will screen the WTG Array from view in over 55 percent of the land area (including inland water bodies) in the WTG Array visual study area. Topography in combination with mapped forest vegetation will screen the WTG Array from view in over 88 percent of this land area. The majority of visually sensitive resources with potential views of the WTG Array are beaches, parks, designated scenic areas, NWRs, and WMAs located on Block Island, within 1 mi (1.6 km) of the Rhode Island mainland coast, and directly on the coast of Connecticut. Visually sensitive resources on Block Island are at least 3 mi (4.8 km) from the WTG Array, the Rhode Island mainland coast is at least 15 mi (24.1 km) from the WTG Array, and the Connecticut coast is at least 20 mi (32.2 km) from the WTG Array. Potential visibility was limited or non-existent from most of the state forests, WMAs, state parks, and conservation areas in the WTG Array visual study area.

Visibility of the WTG Array will be greatest from locations on Block Island due to their proximity to the BIWF and the limited screening provided by vegetation on the island. Potential visibility of the WTGs from ground-level viewpoints will be concentrated in areas immediately adjacent to the southern shoreline. The higher elevation of the southern shoreline will help to screen views of the WTG Array from many locations on Block Island, including downtown, most of the Old Harbor Historic District, and the northern portion of the Island.

The results of the viewshed analysis likely overestimate potential visibility because the effects of screening by buildings, street/yard trees, weather conditions, or curvature of the earth were not included in the assessment. Field review revealed that open views toward the Project were concentrated along the shoreline, and largely restricted to beaches, bluffs, dunes, salt ponds, small open fields, and residential yards where lack of foreground trees allowed for unscreened views of the ocean. Specifically, on Block Island, views of the WTGs were available from the south shore, from Spring Street to Snake Hole Road. Views were also available from the Clay Head Bluffs, beach areas along the eastern shoreline, the northwest side of Great Salt Pond, and the Block Island Ferry route. Field review of 143 visually sensitive resources revealed that 77 (54 percent) are not likely to have views of the Project. Of the remaining 67 sites, many have the potential to view only a portion of the WTG Array, or have potential views from only a portion of the site.

In addition, given the distance of the Project from most viewers and the white or light grey color (less than 5 percent grey tone) of the WTGs, visibility will be difficult under cloudy conditions. Weather Service data indicate that cloudy/overcast conditions (80 to 100 percent cloud cover) typically occur during 42 percent of the year. Only 27 percent of the days are characterized as clear (0 to 30 percent cloud cover). Although data on the frequency of ocean fog and summer haze are not available, these weather conditions occur frequently in coastal settings, and will serve to further reduce actual Project visibility, especially from mainland and more distant viewpoints. Another factor that could influence actual Project visibility is the potential screening from curvature of the earth. This phenomenon is difficult to predict

given the potential offsetting effect of light refraction; however, at the range of distances the BIWF could be viewed from the Rhode Island mainland and adjacent states (i.e., 16 mi to 38 mi [25.7 km to 61.2 km]), curvature of the earth could theoretically block the lower 100 ft to 500 ft (30.5 m to 152.4 m) of the turbines from sea level vantage points. Therefore, the visibility will likely be less than indicated by the viewshed mapping.

Visual simulations of the proposed Project indicate that the visibility and visual contrast of the WTGs will vary greatly based on the character of the surrounding landscape and distance of the viewer from the Project. In general, all land-based views will be beyond 3 mi (4.8 km), and the closest mainland viewpoints will be over 15 mi (24.1 km) away. Guidance for offshore wind projects in the United Kingdom suggests visual effects will be minor at distances over 14.9 mi (24.1 km), and that a distance of 21.7 mi (35.4 km) generally represents the limit of visual impact (Enviros Consulting 2005).

Based on the results of the sensitive site inventory, viewshed mapping and consultation with agencies, 25 sites were selected for visual simulation of views of the WTG Array (Table 4.8-1). These sites were selected based on their sensitivity as visual receptors and likely visibility of the WTG Array (i.e., only open views were selected). The majority of the visual simulations indicated relatively minor impacts from more distant viewpoints on the mainland, which consistently demonstrated that the WTGs appear as an extremely small cluster or vertical white lines on the horizon that cannot be clearly identified as WTGs and under most weather/sky conditions would be difficult to perceive. The more appreciable impacts were concentrated on the southern shoreline of Block Island, where visual impact was mostly attributable to the WTGs contrast with water resources (open ocean), user activity (residential and tourist-related), and land use (undeveloped land and ocean). However, research and public attitude surveys indicate that WTGs will not necessarily be considered an aesthetic liability by the viewing public even when clearly visible (Warren et al., 2005). Visual simulations from viewpoints on Block Island are available as Figures 11 to 14 and 23 to 31 in Appendix S-1. Visual simulations from viewpoints on the Rhode Island mainland are available as Figures 15 to 18, 22, and 32 to 38 in Appendix S-1. Visual simulations from New York, Connecticut, and Massachusetts are available as Figures 19, 20, and 21, respectively, in Appendix S-1.

**Table 4.8-1 Viewpoints Selected for Visual Simulations of Turbine Array in Rhode Island, Massachusetts, Connecticut, and New York**

Figure # (Appendix S-1)	Viewpoint Name	Location	Sensitive Resource(s)	Viewing Distance (Miles)
11	Southeast Lighthouse, Block Island	New Shoreham, RI	Block Island South East Light – NHL <sup>a/</sup>	3.0
12, 13	Old Harbor, Block Island	New Shoreham, RI	Spring House Hotel – NRE <sup>b/</sup>	3.8
14	North Light, Block Island	New Shoreham, RI	Block Island North Light – NRL <sup>c/</sup>	7.9
15	Watch Hill	Westerly, RI	Watch Hill Light – NRD <sup>d/</sup>	21.6
16	Point Judith	Narragansett, RI	Point Judith Lighthouse – NRL	16.3
17	Newport (Brenton Point State Park)	Newport, RI	Brenton Point Park – NRD	23.8
18	Sakonnet Point	Little Compton, RI	Sakonnet Light Station – NRL	28.2
19	Gay Head, Martha's Vineyard	Aquinnah, MA	Gay Head Lighthouse – NRL	38.3
20	Montauk Lighthouse	East Hampton, NY	Montauk Point Lighthouse – NRL	16.9
21	Stonington	Stonington, CT	Stonington Harbor Lighthouse – NRL	24.5
22	Quonochontaug	Westerly, RI	Babcock House/Whistling Chimneys and Sheffield House – NRE	18.8
23, 24	Clay Head Trail	New Shoreham, RI	Designated Scenic Area, Conservation Land	6.2
25	Great Salt Pond	New Shoreham, RI	Designated Scenic Area, Significant Public Use (Boating)	6.4

**Table 4.8-1 Viewpoints Selected for Visual Simulations of Turbine Array in Rhode Island, Massachusetts, Connecticut, and New York**

Figure # (Appendix S-1)	Viewpoint Name	Location	Sensitive Resource(s)	Viewing Distance (Miles)
26, 27	Payne Road	New Shoreham, RI	Designated Scenic Area, Shoreline Residential Area, Conservation Land	3.6
28	Second Bluff	New Shoreham, RI	Historic District, Designated Scenic Area	3.2
29	Crescent Beach	New Shoreham, RI	Public Beach	5.0
30	Snake Hole Road	New Shoreham, RI	Designated Scenic Area, Conservation Land	3.9
31	Block Island Ferry	New Shoreham, RI	Historic District in foreground, Significant Public Use (Ferry)	9.5
32	Misquamicut State Beach	Westerly, RI	Public Beach, Designated Scenic Area	20.4
33	Beavertail State Park	Jamestown, RI	State Park, Designated Scenic Area, Beavertail Lighthouse – NRL	23.1
34	Cards Pond Road	South Kingstown, RI	Agricultural Setting	17.5
35	Trunston Pond NWR	South Kingstown, RI	Wildlife Refuge, Designated Scenic Area Public Beach	17.3
36	Galilee	Narragansett, RI	Salty Brine State Beach, Designated Scenic Area, Significant Public Use (Boating)	17.3
37	Spray Rock Road	Westerly, RI	Designated Scenic Area, Shoreline Residential Area	18.9
38	Trunston Pond NWR	South Kingstown, RI	Wildlife Refuge, Designated Scenic Area, Observation Deck	17.5
<sup>a/</sup> NHL=National Historic Landmark <sup>b/</sup> NRE=National Register Eligible <sup>c/</sup> NRL=National Register Listed <sup>d/</sup> NRD=National Register District (Contributing Property)				

Nighttime viewshed analyses and visual simulations were also conducted for the WTG Array based on the assumption that all of the WTGs will include FAA obstruction warning lights at a height of 410 ft (125 m) above MLW. Viewshed analysis indicated that the FAA warning lights on the WTGs could potentially be viewed from 37.5 percent of the land within WTG Array visual study area. Visual simulations showed that the red FAA warning lights contrast with their dark setting and the flashing of these lights could draw viewer attention and differentiate them from other existing light sources. However, the visual impact of these lights is minimized by their small number, moderate intensity, and perceived occurrence among other existing lights. Nighttime visual simulations from viewpoints on Block Island and the Rhode Island mainland are available as Figures 13, 24, 27, and 35 to 27 in Appendix S-1.

Overall, using the USACE Visual Resources Assessment Procedure (VRAP), it was determined that with the proposed Project in place, the threshold of acceptable visual impact was not exceeded for any of the LSZs identified within the visual study area. The most appreciable impact was assigned to viewpoints in the Shoreline Bluffs, Shoreline Residential, and Maintained Recreation Area LSZs on the south shore of Block Island. While scores for two individual viewpoints did exceed thresholds, cumulative score for the simulations representing these LSZs did not exceed the thresholds. This may reflect the fact that several measures that reduce or mitigate visual impact have already been incorporated into the design of the BIWF. These include the following:

- The Project will be located approximately 3 mi (4.8 km) offshore of Block Island in the area identified by the RI Ocean SAMP as suitable for offshore wind power development.
- The total number of turbines has been reduced from eight (3.6 MW each) to five (6 MW each).

- All turbines will have uniform design, speed, height, and rotor diameter.
- The white or light grey color (less than 5 percent grey tone) of the turbines generally blends well with the sky at the horizon, and eliminates the need for daytime FAA warning lights or red paint marking of the blade tips.
- The Project will utilize FAA warning lights with a narrow beam path (approximately 3 degrees) and the longest off-cycle permitted by the FAA.
- USCG warning lights at the base of the towers will have a maximum visual range of 4 nm (7.4 km).
- The placement of any manufacturer's logo advertising devices on the turbines will be prohibited.

Although the Visual Impact Assessment concluded that no additional visual mitigation is required, Deepwater Wind has indicated a willingness to consider additional financially reasonable and technically feasible mitigation measures.

The Inter-Array Cable and Export Cable are submarine cables and will not result in visual impacts during operation. The terrestrial portion of the Export Cable will be buried up to the BIPCO property, except where it crosses the bridge between Trims Pond and Harbor Pond, and therefore, will not result in visual impacts during operation. The overhead segment of the Export Cable and the BIWF Generation Switchyard will be located on the BIPCO property and, as a result, will not introduce a new type of visual element into the existing landscape.

Although the aboveground onshore facilities associated with the BIWF are not expected to appreciably alter the existing visual landscape, the BITS VIA prepared for the facilities on Block Island included a viewshed analysis within 0.5 mi (0.8 km) of the Block Island Substation, which includes both the BIWF Generation Substation and BITS Island Switchyard, and the overhead line on the BIPCO property. The overhead lines on the BIPCO property will be up to 40 ft (12.2 m) in height and the tallest component of the BIWF Generation Switchyard will be 21.7 ft (6.6 m) in height. Hills within 1,000 ft (304.8 m) of the proposed substation sites are effective in blocking long-distance views from most locations in the 0.5 mi (0.8 km) visual study area. The results of the viewshed mapping indicate that between 25 percent and 28 percent of the land area within 0.5 mi could have a direct line of sight to the Block Island Substation, depending on the alternate location selected on the BIPCO property. The viewshed analysis also indicated that approximately 61.5 percent of this study area could have a direct line of sight to one or more of the proposed overhead electrical poles.

Field review confirmed that open views toward the facilities on the BIPCO property were largely restricted to viewpoints on public roads (Ocean Avenue) immediately adjacent to the BIPCO property and elevated points within the western portion of the BITS visual study area (Center Road north of the Beach Avenue intersection). Open views were also documented from across nearby salt marshes and the ponds to the east and north along Corn Neck Road, Beach Avenue and Ocean Avenue, including the terminus at Great Salt Pond. No views were documented from Center Road at the airport north to the intersection with Beach Avenue, or from the village/town center area of New Shoreham. Views toward the BIPCO property from visually sensitive resources identified within the BITS visual study area were either well screened by vegetation, topography, and/or structures, or far enough away that the proposed facilities will be difficult to perceive.

Visual simulations from viewpoints within the BITS visual study area for the Block Island onshore facilities are available as Figures 10 to 12 in Appendix S-2. Three viewpoints were selected for simulation based on review of data regarding viewer activity and sensitive public resources and field evaluation of potential Project visibility. These included locations at the BIPCO office (520 ft [158.5 m] from the Block Island Substation), on Ocean Avenue (350 ft [106.7 m] from the Block Island Substation), and on Beach Avenue (2,000 ft [609.6 m] from the Block Island Substation).

Overall, views of the proposed Block Island Substation and associated overhead lines will be limited, and their appearance generally compatible with the existing facilities/landscape components on and adjacent to the BIPCO property. While the BIWF onshore facilities will introduce additional electrical infrastructure facilities, they will have a minimal visual impact on the surrounding area. Deepwater Wind has minimized potential visual impacts by burying the terrestrial cable to the extent practical. Proposed design measures to minimize visual impact from aboveground facilities include using wooden poles for the overhead segments to minimize contrast with adjacent vegetation and structures and using earth tone paint to minimize contrast with the surrounding area and to match colors on existing buildings on the BIPCO property. Deepwater Wind will mitigate potential impacts to the extent practicable with measures such as landscape plantings along the frontage of Ocean Avenue to screen views of the existing BIPCO facilities. These measures may also improve the quality of existing views from Ocean Avenue. Substation lighting will be designed to the minimum standard necessary for substation safety and security.

Views from the historic sites and districts within 0.5 mile of the proposed on-shore BIWF facilities include the Old Harbor District, Hygeia House, and the U.S. Weather Bureau Station (see Section 4.7.3 and Appendix R). The Hygeia House and U.S. Weather Bureau Station are located on adjacent properties on Beach Avenue. Potential visual impacts from these sites are best represented in the visual simulation shown on Figure 10 in Appendix S-2, which shows that the Export Cable overhead transmission structures on the BIPCO property will be visible among the existing transmission structures and buildings on the BIPCO site. Potential views from Old Harbor District can be inferred from Figure 11 in Appendix S-2, which is from the same direction as the Old Harbor District but is approximately 0.2 mi (0.3 km) closer to the proposed facilities. The Export Cable overhead transmission structures will be visible on the BIPCO property; however, proposed screen plantings will mitigate visual impacts.

#### **4.8.2.2 BITS**

On Block Island, the BITS terrestrial cable will be collocated with the BIWF Export Cable, and the BITS Island Switchyard will be part of the Block Island Substation. Construction and operation phase impacts are the same as discussed for of the BIWF facilities on Block Island in Section 4.8.1.5.

For BITS Alternative 1, installation of the overhead electrical line from the landfall site at the Narragansett Town Beach to the Narragansett Switchyard will involve enhancement of up to 30 of TNEC's existing distribution poles and installation of up to eight new poles. During construction, installation of the BITS terrestrial cable and Narragansett Switchyard will result in minor and temporary visual impacts typically associated with the presence of construction equipment and workspace signage. Visible site disturbance such as tree clearing, earth moving and facility installation will be minimal because the BITS Alternative 1 cable will be installed primarily on existing poles. Because the proposed enhanced and new poles are located within existing utility and public road rights-of-way, additional clearing or trimming of roadside vegetation will be minimal.

A visual impact assessment for the BITS Alternative 1 above-ground cables and Narragansett Switchyard on the Rhode Island mainland will be submitted as a supplemental filing. Deepwater Wind has, however,



attempted to minimize visual impacts from overhead cables by installing the cables in areas with existing distribution lines where these features are an accepted part of the landscape. Installation of upgraded roadside utility poles 5 ft to 15 ft (1.5 m to 4.6 m) taller than the existing poles will generally result in minimal change to the visual character/quality of the landscape.

For the purposes of this ER, a preliminary field review was conducted for the Narragansett Switchyard (BITS Alternative 1) to evaluate the existing landscape and identify areas where the switchyards may be visible. The visibility of the proposed Narragansett Switchyard is likely to be very limited because it will be located on a lightly used town road and surrounded on three sides by forest vegetation. Direct views from the south will be largely blocked by an existing DPW garage. Visibility of switchyard components should also be limited due to their modest height of less than 22 ft (6.7 m) and the relatively small footprint of the proposed facility, which will minimize required tree clearing. Much of the electrical equipment within the switchyard will be enclosed within buildings that will be consistent in color and form with the adjacent DPW garage and Narragansett Community Center. If a wall (rather than a fence) is proposed around the switchyard, Deepwater Wind has indicated that the exterior wall treatment (color, texture, scale) would also be designed to match the surrounding structures. If adequate screening around the Narragansett Switchyard cannot be preserved, a landscaping plan will be developed and implemented to screen views of the switchyard from adjacent public roads. A combination of earthen berms and/or plantings of shrubs and low trees would be used to screen open views of the facility.

#### **4.8.2.3 Combined Effects**

As discussed in the potential impacts and proposed mitigation section, Deepwater Wind has avoided and minimized visual impacts to the extent practical in the siting and design of the BIWF and BITS and has proposed mitigation measures, as applicable. The WTG Array will introduce a new component to the landscape that will alter views in parts of its WTG Array visual study area, but will not cause significant or adverse impacts. The BIWF and BITS facilities on Block Island and the BITS facilities on the Rhode Island mainland will be collocated with existing electric generation and transmission facilities, located on compatible industrial properties, or buried to avoid adverse visual impacts. Therefore, the combined effects of construction, operation, and decommissioning of the Project overall will not be cumulatively significant on the surrounding views.

### **4.9 Marine Uses**

This section discusses the marine uses within and surrounding the Project Area, including commercial and recreational fishing, recreational boating, US Navy maritime uses, offshore diving, and offshore wildlife viewing. This section also identifies the Project activities that may affect marine uses within the Project Area, including location of the Project facilities and construction and operation activities. Commercial and recreational uses as described in the following section are a contributing factor to the local economy and are further discussed in Section 4.12.

#### **4.9.1 Affected Environment**

##### **4.9.1.1 Commercial and Recreational Fishing**

###### **Commercial Fishing**

Commercial fishing, including ground fish, pelagic, and invertebrate fisheries, is an important economic activity within the state and federal waters off the coast of Rhode Island (see Section 4.12.1.5). Rhode Island has two major commercial fishing ports, Point Judith and Newport, as well as several smaller

fishing ports throughout the state, including Block Island, used by both commercial and recreational fishermen (RI Ocean SAMP 2011). These Rhode Island fishing ports serve commercial fishermen and fishing vessels from Rhode Island and other states along the East Coast. Out-of-state vessels from as far away as North Carolina and Florida make use of the infrastructure present in the state to unload and sell fish (RI Ocean SAMP 2011).

The predominant fishing port in Rhode Island, the Port of Galilee in Point Judith, is home to the Town Dock Company and the Point Judith Fishermen's Company, as well as several other fish processors, dockside fuel suppliers, restaurants, bait shops, commercial marine suppliers, recreational suppliers, and vessel repair shops. Most of the fishermen working out of Point Judith operate there throughout the year, although some change targeted fisheries several times annually to maximize profits (Sedgwick et al. 1980). In 2009, there were 179 federally permitted vessels with their home port in the Point Judith area (RI Ocean SAMP 2011). In 2010, Point Judith ranked 25<sup>th</sup> in terms of pounds landed and 26<sup>th</sup> in terms of dollars landed out of all major ports in the United States. In the New England Region, this port is ranked 4<sup>th</sup> both in pounds and dollars landed (National Ocean Economics Program 2012).

For the state of Rhode Island, from 2000 through 2010, the top commercial fish species by pounds landed has alternated between squid and Atlantic herring. The most economically valuable species landed in Rhode Island is American lobster (National Ocean Economics Programs 2012). These species and associated habitats are discussed in detail in Sections 4.5.2 and 4.5.3. Of the gear types deployed in 2010, the otter trawl (groundfish) fishery is the most prevalent commercial fishing gear in terms of value and landings, representing 39.2 percent of total landings by pounds and 18 percent of total dollars (NOAA Fisheries 2009). The trap/pot fishery (primarily lobster) is the second most commonly used commercial fishing, representing only 7.5 percent by pounds but 16.1 percent by dollars in 2010, and is the top value fishery in Rhode Island (NOAA Fisheries 2009; RI Ocean SAMP 2011).

Commercial fishing is generally segregated into either mobile or fixed gear fishing. Mobile gear fisheries are those in which fishing gear such as an otter trawl or scallop dredge are deployed while in motion aboard a vessel, while fixed gear fisheries use gear such as lobster pots, fish traps, and gillnets, which are set in one location and then checked or retrieved later. These fisheries are managed by a several different federal and state management entities. Fishing within state waters requires a Rhode Island commercial permit, managed by RIDEM. Fishing within federal waters requires both a federal and state commercial permit, since vessels fishing in federal waters must transit through state waters. Management entities for each species, as well as the current status of each fish stock, are codified in the MSFCMA, 16 U.S.C. 1801 et. seq. Species-specific regulations are managed by the NEFMC, the ASMFC, and the MAFMC. Lobsters in both state and federal waters are managed under the Interstate Fisheries Management Program administered by the ASMFC. The ASFMC manages three separate stocks of lobsters: the Gulf of Maine, Georges Bank, and Southern New England stocks. Lobsters are further divided into seven management areas; Rhode Island waters fall within Management Area 2. The fishery is managed through size limits, trap limits, and the practice of cutting a notch in the tail (v-notching) of egg-bearing females. Management measures also include regulations dictating minimum wire gauge and escape vent sizes on the traps.

Mobile fishing gear utilized in Rhode Island commercial fisheries includes otter trawls, mid-water trawls, purse seines, gill nets, dredges, and rod and reel. Otter trawls are considered the most common variety of mobile gear. Otter trawlers in this area target a variety of species during various seasons throughout the year in Rhode Island waters, including butterfish, squid, yellowtail flounder, scup, fluke, cod, hake, monkfish, and winter flounder. Bottom trawling also occurs throughout the year and is concentrated in the

waters between Block Island and the Rhode Island mainland, as well as the waters south and southeast of Block Island. Figure 4.9-1 represents general fishing effort based on NOAA vessel trip report (VTR) data as reported in the RI Ocean SAMP (2011). Limited otter trawl fishing is known to occur within the BIWF Project Area, including the proposed temporary BIWF work area (see Section 3.3.4, Table 3.3-1 Project and Figure 4.9-1). Trawling also exists along the BIWF Export Cable and the BITS cable construction corridors.

The “mixed species” trawl fishery that occurs throughout the year in Rhode Island targets some combination of the following: squid, butterfish, scup, and whiting (RI Ocean SAMP 2011). Rhode Island mid-water trawlers target herring and mackerel during the fall and winter months, as do purse seiners from Rhode Island and other states in the region (RI Ocean SAMP 2011). According to the RI Ocean SAMP (2011), these gear types have been used infrequently in the waters surrounding Block Island between 1998 through 2008.

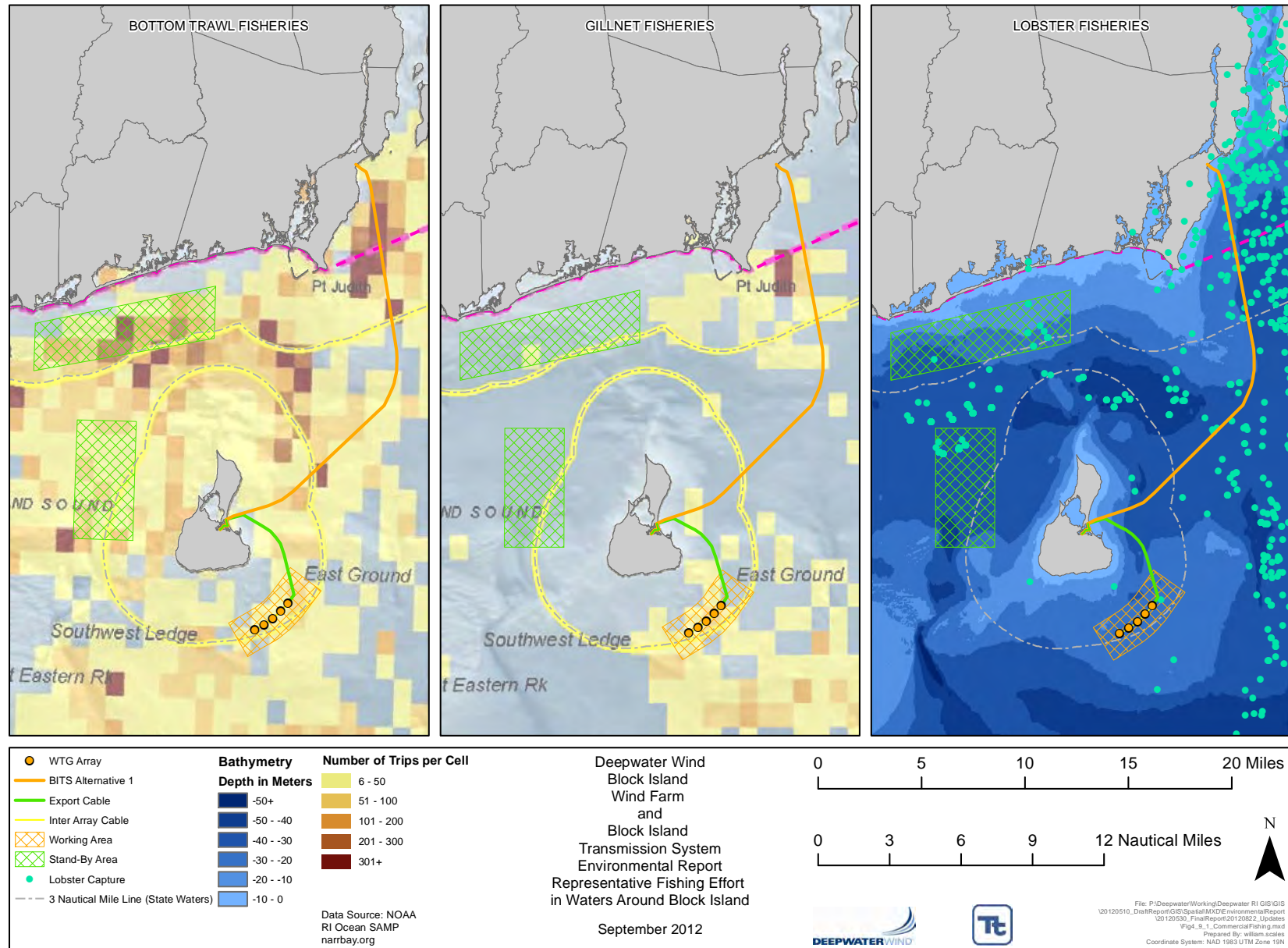
In the scallop fishing industry, both general access permit holders and limited access permit holders use dredges to harvest sea scallops within Rhode Island waters year-round; however, scallop dredging is concentrated in deeper waters, well south of the Project Area (RI Ocean SAMP 2011).

Rod and reel fishermen commercially harvest scup, fluke, and tuna in Rhode Island. This segment of the commercial fishing population represents the highest number of fishing trips by any gear type with an average of nearly 9,000 trips per year between 2008 and 2010 (RI Ocean SAMP 2011). Rod and reel fishing occurs year-round, but is most intensive from April through November and is concentrated in state waters. The rod and reel fishery typically targets bottom types that provide structure or areas of steep depth changes such as shoals, ridges, lumps, banks, ship wrecks, and reefs. The majority of the BIWF and BITS Project are located in areas of uniform, flat sediment types (mud and silt) that are not known to be productive rod and reel fishing areas.

Commercial fishing using fixed gear includes gillnets, lobster pots, fish pots, and floating fish traps. Lobster pot fishing is common throughout the Project Area from spring through the start of winter at which time the lobsters and fishermen move to the edge of the continental shelf. Rhode Island commercial lobstermen typically fish 800 pots (full access fishery limits) in strings of 10 to 25 pots usually set in several distinct locations. This fishery maintains the top value (by dollar) position in Rhode Island despite the fact that the fishery has been affected by the marked increase of Epizootic Lobster Shell Disease (shell disease) in recent years. Lobster pots are ubiquitous in the waters off the coast of Rhode Island. However, recent captures of tagged lobsters during URI’s ongoing lobster tagging study provide a representative picture of where lobster fishing effort exists (see Figure 4.9-1). As depicted in Figure 4.9-1, limited lobster fishing occurs in the BIWF work area, and along the Export Cable route. Lobster fishing does, however, occur along the BITS and will likely be heaviest in the northern segment of Alternative 1 near the mouth of Narragansett Bay where historic data show captures are heaviest (see Figure 4.9-1).

The gillnet fishery in Rhode Island is dominated by bottom founded nets; however, pelagic nets are also fished throughout the Rhode Island and Block Island Sounds. Gillnet fishermen in Rhode Island traditionally target scup, bluefish, fluke, skate, and ground fish. Bottom gillnets are also the primary gear used for monkfish harvest (RI Ocean SAMP 2011). Gillnet fishing occurs year-round, with areas of concentrated effort just outside the mouth of Narragansett Bay, offshore in the waters southeast and east of Block Island, and in the Cox Ledge area (RI Ocean SAMP 2011). As depicted in Figure 4.9-1, limited gillnet fishing occurs within the BIWF Work Area, and along the Export Cable route. Interactions with the gillnet fishery will likely be highest along the BITS Alternative 1 route off the coast of Point Judith.

Figure 4.9-1 Representative Fishing Effort in Waters around Block Island



Floating fish traps are also deployed along the Rhode Island coast (RI Ocean SAMP 2011). These traps take advantage of the many species of fish that travel parallel to the coastline and therefore may be entrained by a properly located trap. There are no known floating fish traps within the Project and therefore no impacts to fish traps are expected.

Aquaculture in Rhode Island is becoming a major commercial fishing sector. American oyster (*Crassostrea virginica*) aquaculture makes up the bulk of this industry. However, the majority of the commercial aquaculture activities takes place in estuaries and other protected environments in areas such as small local bays. The majority of the Project Area is located in deeper offshore environments unsuitable for aquaculture. No known aquaculture sites have been identified in the nearshore areas associated with BITS Alternative 1 in Narragansett Bay.

### **Recreational Fishing**

Marine recreational fishing, including both recreational anglers and recreational fishing aboard private boats and party/charter boats, is a major recreational activity for Rhode Islanders, as well as a major tourist attraction that brings many visitors from out of state. The results of the NOAA Fisheries Marine Recreational Fisheries Statistics Survey Program indicate that during the period 1999 through 2008, an average of nearly 385,000 people participated in recreational ocean fishing in the state of Rhode Island each year. Furthermore, those 385,000 people reportedly made an average of over 785,000 fishing trips each year (RI Ocean SAMP 2011). Both Rhode Island residents and non-residents must register with the RIDEM Division of Fish & Wildlife for an annual saltwater fishing license to fish the waters off Rhode Island. The RIDEM Division of Fish & Wildlife also sponsors a recreational saltwater fishing license reciprocity program with any state that honors Rhode Island licenses, which currently includes Massachusetts, Connecticut, Maine, and New York. Out-of-state fishermen have been shown to consistently comprise approximately 45 percent of the recreational fishermen in Rhode Island, which is one of the highest percentages of out-of-state anglers for the Atlantic and Gulf coasts (RI Ocean SAMP 2010; RI Sea Grant 2012). As discussed further in Section 4.12.1.5, the recreational fishing industry in Rhode Island has a significant impact on the state's economy.

Recreational fishing vessels operate out of numerous Rhode Island ports, including Point Judith, Narragansett, and Block Island. Out-of-state anglers can include vessels from Montauk, New York, Connecticut, and southeastern Massachusetts, including the Elizabethan Islands and Martha's Vineyard. Saltwater fishing tournaments are also frequently held during the summer months in Rhode Island waters. The Rhode Island Saltwater Anglers Association (RISAA) currently sponsors 15 special fishing tournaments each year that target a variety of different species (e.g., cod, black sea bass, bluefish, striped bass, haddock, tuna and fluke) (RI Ocean SAMP 2011). Other tournaments held annually out of local ports in Rhode Island include such places as Snug Harbor and Block Island (RI Ocean SAMP 2011).

There are three types of saltwater recreational fishing activities common in Rhode Island, including shore-based fishing, fishing by private vessels, and fishing by charter vessels. Of these three types, fishing by private vessel comprises over 45 percent of the total within the state. Conversely, party/charter vessel fishing comprises just 5 percent. Shore-based fishing accounts for the final 50 percent of Rhode Island's saltwater fishing (RI Ocean SAMP 2011).

Recreational fishing occurs year-round, but is most intensive from April through November. The most commonly targeted recreational species in the state include Atlantic bonito, Atlantic cod, black sea bass, bluefish, scup, striped bass, summer flounder, winter flounder, tautog, yellowfin tuna, and bluefin tuna (NOAA Fisheries 2009).

According to data presented in the RI Ocean SAMP (2011), recreational fishing activities are concentrated in state waters surrounding Block Island and Point Judith, including areas associated with the proposed BIWF and BITS Project. Recreational boat anglers target bottom types that provide structure or areas of steep depth changes such as shoals, ridges, lumps, banks, ship wrecks, and reefs. Areas of uniform, flat sediment types (mud and silt) are not known to be productive recreational fishing areas. A majority of the BIWF and BITS Project components are located in soft, uniform bottom types. Hard substrates, such as cobbles and boulders, known to attract finfish species have been avoided to the maximum extent possible.

#### **4.9.1.2 Recreational Boating**

Recreational boating is one of the most popular pastimes in the state of Rhode Island, as well as a major tourist attraction that brings many visitors from out of state. As discussed further in Section 4.12.1.5, the recreational boating industry in Rhode Island is an important aspect of the Rhode Island recreation and tourism economy.

Recreational boating activity varies seasonally with peak season occurring between May and October. The majority of recreational boating in Rhode Island Sound takes place within 3 nm (5.6 km) of shore in state waters (USCG 2006). Recreational boaters generally use a number of routes across the entire Project Area, some of which pass through the WTG Array or within the 2.8 nm (5.2 km) area between the WTG Array and Block Island.

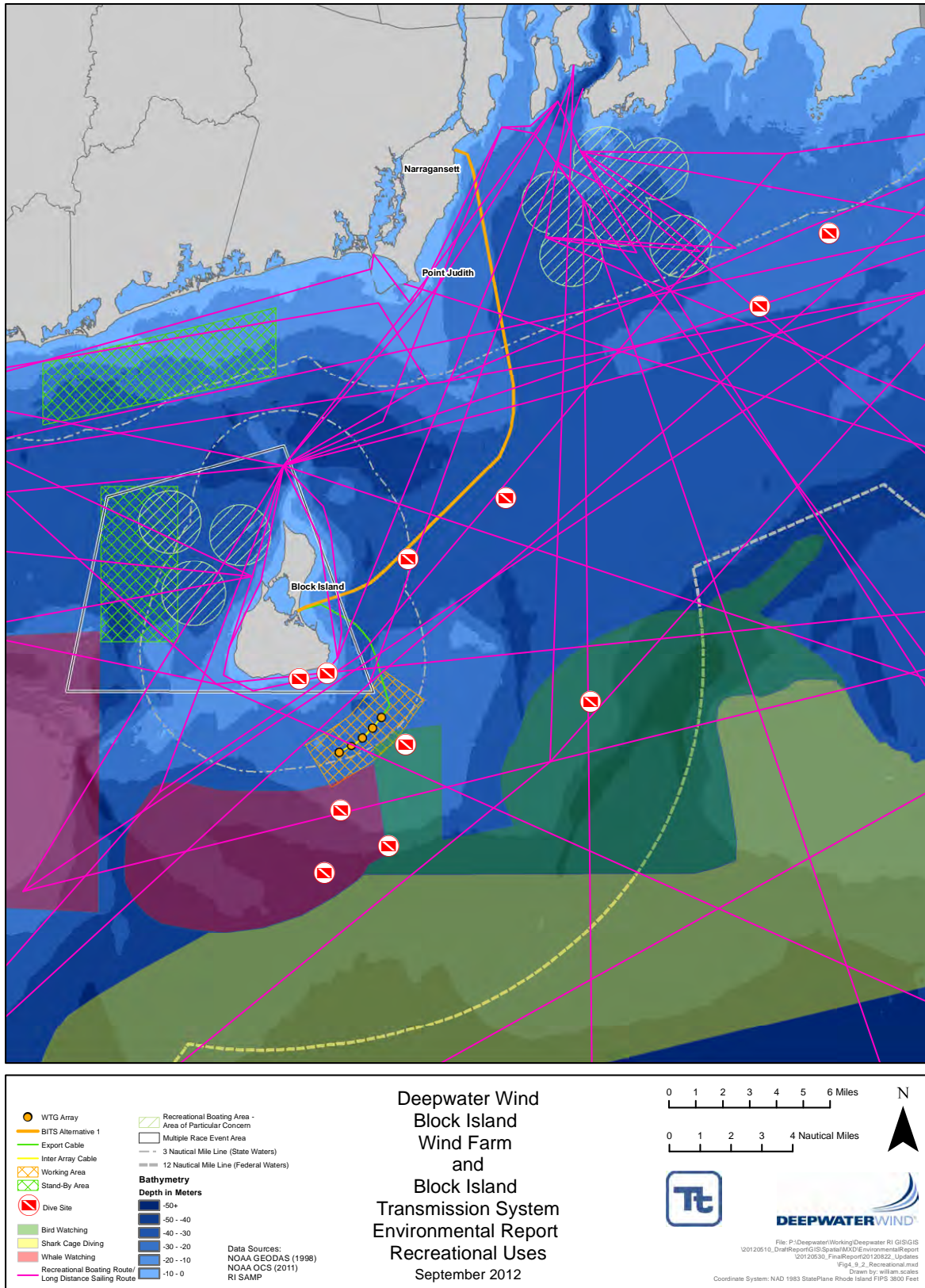
Organized buoy and distance sailboat races are prevalent in the waters off the coast of Rhode Island, drawing hundreds of boats and spectators each year. Rhode Island-based buoy races typically occur between the months of June and September in near-shore waters and within the same general area each year. Annual buoy races in the Project Area include the Block Island Race Week, which occurs each year in June. Distance races take place in both nearshore and offshore and occur annually or biannually during the months of May through October. These distance races occur throughout Block Island and Rhode Island sounds and include routes that circle Block Island and traverse the Project Area. Given the importance of sailboat races to the Rhode Island economy, the CRMC has designated two areas of heavy recreational boating and sailboat racing as an Area of Particular Concern (APC), for protection under the CZMA. These areas are depicted in Figure 4.9-2 and include waters to the west of Block Island within an area proposed as the Project's temporary construction vessel standby area.

Other boat-based activities occurring in and near the Project Area include parasailing, canoeing, kayaking, and sea duck hunting. Canoeing and kayaking activities take place close to shore in sheltered waters and sea duck hunting occurs predominantly within a mile of the coastline.

#### **4.9.1.3 US Navy Maritime Uses**

Newport is home to the Naval Undersea Warfare Center and the Newport Naval Station, an installation containing the Navy's Center of Learning Excellence for Officer and Senior Enlisted Education and Training. Over 17,000 students pass through the station's training and education programs annually. The US Navy Atlantic Fleet's Narragansett Bay Operating Area (OPAREA), a surface and subsurface exercise/operating area, extends approximately 100 nm (185.2 km) south and 220 nm (407.4 km) west off the coasts of Massachusetts, Rhode Island, and New York. Training exercises generally occur in deeper waters offshore. Submarines may remain in shallower portions of the Narragansett Bay OPAREA to prepare for formal voyages.

Figure 4.9-2 Recreational Use Areas



There are two restricted areas near the Project Area: a Torpedo Testing Area and a Mine Laying Area. The US Navy practice area used as a Torpedo Testing Area is a 2 nm (3.7 km) wide corridor that begins at the precautionary area at the approach to the Narragansett Bay and extends south within the Narragansett TSS separation area for approximately 11.5 nm (21.3 km). The Torpedo Testing Area is located within 1 nm (1.9 km) of BITS Alternatives 1 (see Figure 3.3-1 in Section 3.3.4). The Naval Undersea Warfare Center in Newport oversees and directs use of this area as a torpedo range.

The Mine Laying Area is a 1 nm by 1.5 nm (1.9 km by 2.8 km) area located approximately 4 nm (7.4 km) off of Lands End in Newport and east of the Narragansett TSS just outside state waters. This area is located approximately 4 nm (7.4 km) east of BITS Alternatives 1 (see Figure 3.3-1 in Section 3.3.4). The US Naval Base in Newport oversees and directs use of this area as a naval practice minefield.

#### 4.9.1.4 Offshore Diving

Historic shipwrecks, interesting benthic communities, and sharks are the focus of boat-based scuba diving in the waters off of Rhode Island. Recreational diving occurs most frequently between May and December. The time and location of a dive are largely determined by underwater visibility; better conditions offshore are found from May through September or October and inshore from May through November. Many of the dive trips are offered by the 10 licensed dive boats that operate in Rhode Island Sound (RI Ocean SAMP 2011). There is currently only one Rhode Island-based charter company offering shark cage diving trips. Shark trips occur between June and October, but most occur in August and September when visibility is best (RI Ocean SAMP 2011).

The RI Ocean SAMP identified 12 important dive sites in the waters of Rhode Island Sound. Of these sites, two are located in proximity to the BIWF and BITS Project Area. Shipwreck “Idene” is located outside of the BIWF work area to the southeast. Shipwreck “Miss Jennifer” is located less than 0.6 mi (0.9 km) southeast of the BITS Alternative 1 (Figure 4.9-2). Neither of these shipwrecks are protected cultural resources under federal statutes such as the NHPA and the Abandoned Shipwreck Act.

Shark cage diving areas are located outside of the Project Area in waters approximately 11 mi (17.7 km) south and southeast of the BIWF.

#### 4.9.1.5 Offshore Wildlife Viewing

Offshore wildlife viewing of whales and birds is a popular activity in Rhode Island Sound and is a major source of revenue for Rhode Island (see Section 4.12.1.6). Whale watching occurs mostly during the peak tourism season when demand is highest (typically June and August) and the whales are most active in the area. Trips occur daily for a total of about 40 trips per season and can accommodate 100 to 150 people per charter for a total of about 4,000 to 6,000 people per year. The whale species most commonly observed are finback, minke, and humpback whales. Right whales are occasionally observed. Whale sightings most frequently occur in the Deep Hole region approximately 4.3 nm (8 km) west of Block Island and in an area that borders the southern edge of the BIWF work area (RI Ocean SAMP 2011). As depicted on Figure 4.9-2, the BIWF work area is located adjacent to an area identified by the RI Ocean SAMP as a popular whale watching location.

Bird watching in Rhode Island Sound is also popular, especially after storm events when seabirds may occur closer to shore. Bird watching charters are offered year-round by private charter companies or occur together with whale watching charters. Bird sightings occur throughout the year and are dependent on avian migration patterns. The largest bird watching charter vessel serves an estimated 400 people per



year. The most popular bird watching areas are near the Deep Hole region and southeast of Block Island in an area that overlaps with the southeastern portion of the BIWF work area (RI Ocean SAMP 2011). This area is depicted in Figure 4.9-2).

## **4.9.2 Potential Impacts and Mitigation**

### **4.9.2.1 BIWF**

Deepwater Wind has minimized impacts on marine uses by siting the BIWF within the Renewable Energy Zone. The Renewable Energy Zone was established by the CRMC under the RI Ocean SAMP to specifically minimize potential impacts on natural resources and existing human uses (e.g., commercial and recreational fishing, boating, diving, wildlife viewing). In addition, the spacing between the WTGs of approximately 0.5 mi (0.8 km) will allow for access both around and through the BIWF, which the CRMC has identified as a critical means of mitigating the potential adverse impacts of offshore structures on the marine community (RI Ocean SAMP 2011).

#### **Commercial Fishing**

Construction of the BIWF will result in moderate, temporary impacts on commercial fishing as a result of the temporary displacement of fishing activities from within the BIWF Project Area, including the proposed temporary Work Area and Export Cable route (see Figure 3.3-1 in Section 3.3.4). Temporary impacts on targeted commercial ground fish, pelagic, and invertebrate species from loss and/or conversion of habitat, increased underwater noise, increased sediment disturbance from construction activities, and/or an accidental spill or releases could also affect commercial fisheries and are discussed in detail in Section 4.5.2.

Construction of the BIWF is anticipated to take place over a 13- to 15-week construction period inclusive of an approximate 11 week WTG, foundation, and Inter-Array Cable installation period and a 2- to 4-week Export Cable installation period. To ensure the safety of the public, work crews, and equipment, Deepwater Wind will temporarily restrict access to the proposed BIWF work areas during construction, requiring that both mobile (trawl and rod and reel) and fixed (gillnets and traps/pots) fisheries to temporarily relocate outside of the construction area. While data shows that fixed and mobile gear activity within the BIWF Project area as compared to other locations throughout the Rhode Island and Block Island Sounds is low, restriction of these areas will result in the temporary displacement of fishing activities. Impacts from this displacement is however expected to be short-term and minor as the area and period of restricted access will vary based on the specific activity during the 11-week construction period with access to the area being opened to use as soon as practicable. Deepwater Wind will also not restrict fishing activity in the proposed construction vessel standby areas.

As stated previously, Deepwater Wind is funding a fisheries liaison to support communication with the local fishing community. Open dialog and coordination between Deepwater Wind and the local industry during the planning and construction phase will assist in minimizing impacts. The CRMC will also require, as part of their State Assent, that Deepwater Wind fund a Fisheries Liason Officer to support communications throughout the duration of offshore construction. In addition, Deepwater Wind will implement a communication plan during construction to inform the public and the fishing community of construction activities and vessel movement. The establishment of designated construction vessel traffic routes and construction standby areas will also assist in further minimizing unanticipated interactions with the commercial fishing industry. For these reasons, the construction of the BIWF will not have a significant long-term negative affect on commerical fisheries.

Operation of the BIWF will result in the permanent loss of 0.35 acres (0.15 hectares) of potential mobile fishing ground and introduce a potential obstacle to traditional navigation routes. However, per CRMC requirements, Deepwater Wind has spaced the turbines to allow access both through and around the WTG Array, and does not propose any operational phase vessel exclusions within the project area. Additionally, Deepwater Wind has designed a cable burial depth that is sufficient to allow continued use of mobile gear in the Project Area. For these reasons, operation of the BIWF will not have a significant adverse effect on commercial fisheries traditionally known to occur in the Project Area.

It is possible that the WTGs will develop into areas of reef habitat as they become an established part of the marine environment and covered by algae and sessile invertebrates. It is likely that marine organisms will settle in and around the new WTG foundation structures as has been observed within the Gulf of Mexico and on the Pacific Coast around fixed oil rigs (BOEM 2010). The arrival of settled organisms on the WTGs will likely lead to increased densities of commercially targeted mobile species in the Project Area.

Decommissioning of the BIWF at the end of the Project's projected 25-year life will be temporarily disruptive to commercial fishing activities in the Project Area. The WTGs and foundations will be removed in their entirety (legs will be cut below the mud line) and the Inter-Array and Export Cables below the mud line will be abandoned in-place. As with construction, both mobile (trawl and rod and reel) and fixed (gillnets and traps/pots) fisheries will be required to temporarily relocate outside of the BIWF area during decommissioning of the WTGs and foundations. Upon completion of decommissioning activities, the Project Area is expected to return to preconstruction conditions and there will be no restrictions on use within the area. For these reasons, decommissioning of the BIWF will have only minor, short-term effects to commercial fishing.

### **Recreational Fishing**

The environmental consequences of construction, operation and decommissioning of the BIWF on recreational fishing activities will be as described for commercial fishing. However, recreational fishermen will have the potential added benefit from the introduction of the WTG foundations as new marine structures on the seabed that will likely attract targeted recreational species such as cod, tautog and black sea bass, as well as small bait-fish that will in turn attract predatory species such as bluefish and striped bass.

### **Recreational Boating**

The BIWF has been sited to avoid the CRMC's designated sailing areas of concern and, to the extent possible, known recreational boating and long-distance sailing routes (Figure 4.9-2), and therefore is not expected to have a significant impact on recreational boating activities and sailing events in Rhode Island waters during construction, operation, or decommissioning. Construction of the BIWF will, however, result in some temporary effects to recreational boating activities and events resulting from increased construction vessel traffic to and from the Project site and the temporary restriction of boating activities within the BIWF work area and Export Cable route. Deepwater Wind does not propose to restrict recreational boating activities within the construction vessel standby areas. These impacts are expected to be short-term and minor given the approximately 6-month BIWF construction time frame and the fact that traffic associated with the Project's construction vessels (see Section 3.3.4.2, Table 3.3-2) is not anticipated to represent a significant increase over the current levels of vessel traffic within the surrounding area. To assist in minimizing impact as much as possible during construction, Deepwater Wind will implement a communication plan during construction to inform the public and the boating

community of construction activities and vessel movement. The establishment of designated construction vessel traffic routes and construction standby areas will also assist in further minimizing unanticipated interactions with the recreational boating community. Deepwater Wind will also coordinate its construction schedule and the location of its vessels within the designated standby areas with local sailboat race organizations and local municipalities to avoid disruptions to these popular sailing events.

Deepwater Wind does not propose any operational phase vessel exclusions around the WTGs or other areas of the Project. Therefore, the BIWF is not expected to impact recreational boating or racing events. Furthermore, to ensure boaters have the ability to safely navigate through the BIWF, the WTGs will be:

- lit, marked, and maintained as Private Aids to Navigation (PATON);
- painted white or light grey color (less than 5 percent grey tone); and
- WTG will be equipped with a sound warning device (i.e., fog horn).

Impacts associated with decommissioning of the BIWF at the end of the Project's projected 25-year life will be similar to construction phase impacts. Decommissioning impacts will be temporarily disruptive to recreational boating activities in the Project Area. As with construction, recreational boaters will be temporarily restricted within the BIWF work area during decommissioning of the WTGs and foundations. Upon completion of decommissioning activities, the Project Area will return to pre-construction conditions and there will be no restrictions on use within the area. For these reasons, impacts associated with decommissioning of the BIWF will be short-term and will not result in any long-term effects to recreational boating activities.

### **US Navy Maritime Uses**

The Torpedo Testing Area and Mine Laying Area are clearly marked on navigation charts and defined in navigation publications and local NTMs. The BIWF and Export Cable are located more than 6 nm (11.1 km) from the Torpedo Testing Area and the Mine Laying Area and 0.06 nm (0.11 km) from the Narragansett Bay OPAREA at its closest point. Because the Naval Undersea Warfare Center and US Naval Base prohibit vessel navigation in these areas during training activities, Deepwater Wind has considered them in Project planning and has sited Project facilities, construction and transit routes outside of these areas (see Figure 3.3-1, Section 3.3.4). The construction, operation, and decommissioning of the BIWF will neither affect nor be affected by these areas (see also Section 4.11 and Appendix U).

### **Offshore Diving**

The BIWF has been sited to avoid the CRMC's designated offshore diving areas of particular concern (Figure 4.9-2) and, to the extent possible, hard-bottom habitat. The BIWF is also located well outside of any known shark diving areas. While Project construction will not directly impact any identified offshore dive sites, construction activities could temporarily affect the presence of the mobile marine species that would typically inhabit these areas as a result of increased underwater noise from construction activities. However, given the anticipated 6-month WTG installation period, these impacts will be short-term and will not have significant long-term effects on the integrity of these sites. It is possible that as the WTGs become an established part of the marine environment and are covered by algae and sessile invertebrates, they will become areas of reef habitat that could be attractive to divers.

Impacts associated with decommissioning of the BIWF at the end of the Project's projected 25-year lifespan will be similar in nature to construction impacts and will be temporarily disruptive to diving activities in the Project Area. Upon completion of decommissioning activities, the Project Area will be returned to preconstruction conditions and there will be no restrictions on diving within the area.

## Offshore Wildlife Viewing

The BIWF has been sited outside known offshore wildlife viewing areas for whales and birds as identified by the RI Ocean SAMP (2011) (Figure 4.9-2). Whales may temporarily avoid the BIWF Project Area during WTG foundation installation due to increased underwater noise from pile-driving activities (see Section 4.5.4.2). To mitigate potential impacts to whales, Deepwater Wind will implement a comprehensive marine mammal monitoring program inclusive of construction shut-down procedures and soft starts (see Section 4.5.4.2). Whale watching may be temporarily displaced to other viewing areas during the 3-month installation period if whales avoid the construction area due to noise. However, this displacement will be limited to the construction period and will not result in a significant long-term effect on whale watching activities in the Project Area. No impacts are expected during operations. Refer to Section 4.5.4.2 for additional information on Project effects on marine mammals.

There is little validated research on the potential displacement effects of wind farm construction activities on bird species, specifically for seabirds and other species using the marine environment. It is predicted that construction activities may provoke temporary avoidance behavior in these species. Post-construction surveys at offshore wind farms in the North Sea have demonstrated that birds may avoid offshore WTGs. During operation of the BIWF, the WTGs may displace birds from foraging in the area, resulting in indirect habitat loss and/or the BIWF may act as a barrier to movement (see Section 4.5.6.2). This temporary displacement may result in minor impacts to bird watching in the immediate vicinity of the WTGs; however, bird watching activities could continue to occur further offshore.

Decommissioning, as with construction, is expected to have minor and short-term effects on wildlife viewing from the temporary displacement of these activities from the Project Area. However, as with construction, wildlife viewing for marine mammals and birds would be limited to the period of disturbance and could continue in areas further away from decommissioning activities.

### 4.9.2.2 BITS

#### Commercial Fishing

The BITS is not expected to have a significant impact on commercial fisheries. Construction of the BITS will, result in moderate, temporary impacts on commercial fishing resulting from the temporary displacement of fishing activities along the BITS cable route (see Figure 3.3-1, Section 3.3.4). Temporary construction impacts on targeted commercial ground fish and invertebrate species could result from conversion of habitat, increased underwater noise, and sediment disturbance. Accidental spills or releases could also affect commercial fisheries and are discussed in detail in Section 4.5.2.

As described for the BIWF in Section 4.9.2.1, to ensure the safety of the public, work crews, and equipment, Deepwater Wind will temporarily restrict access along portions of the BITS construction corridors during the approximate 6-month installation. As detailed in Section 4.9.1.1, this displacement will have the greatest influence on bottom trawlers along the northern portion of BITS Alternative 1 where fishing activity has been historically high. Impacts from this displacement is, however, expected to be short-term as Deepwater Wind will not restrict fishing along the BITS construction corridor for the entirety of the 6 month installation period. It is Deepwater Wind's intent to open areas to fishing as cable-lay is completed. The areas opened and closed to fishing will be communicated to the public through notices to mariners, the project website, and the Fisheries Liaison. As stated previously, Deepwater Wind is also funding a fisheries liaison to support communication with the local fishing community to support early coordination and planning to ensure impacts to commercial fisheries along the BITS route are

minimized to the extent possible. For these reasons, impacts associated with the construction of the BITS will not result in long-term negative impacts on Rhode Island commercial fisheries.

Deepwater Wind proposes to bury the BITS to a target depth of 6 ft (1.8 m) beneath the seafloor and has proposed additional protections for areas along the cable that achieved less than 4 ft (1.2 m) burial (estimated for no more than 1 percent of the BITS route) and at two existing cable crossings to protect the cable from interactions with fishing gear. These measures will allow for the continued use of the BITS to commercial fishermen, resulting in no significant long-term effects on commercial fishing in the Project Area.

It is anticipated that the BITS will be kept in operation in perpetuity. However, should the cable reach the end of its useful operational life, it will be abandoned in-place. For these reasons, decommissioning of the BITS will have no significant short or long-term effect to commercial fishing.

### **Recreational Fishing**

The environmental consequences of construction, operation and decommissioning of the BITS on recreational fishing activities will be as described for commercial fishing.

### **Recreational Boating**

The BITS has been sited to avoid the CRMC's designated sailing areas of concern (Figure 4.9-2) and is not expected to have long-term impacts on recreational boating activities and sailing events in Rhode Island waters during construction, operation, or decommissioning. Construction of the BITS will, however, result in some temporary effects to recreational boating activities and events resulting from increased construction vessel traffic to and from the Project site and the temporary restriction of boating activities along the BITS route during construction. To mitigate unanticipated interaction, Deepwater Wind will implement a communication plan to inform the public and the boating community of construction activities and vessel movements along the route. The establishment of designated construction vessel traffic routes and construction standby areas will also assist in further minimizing unanticipated interactions with the recreational boating community. Deepwater Wind will also coordinate its construction schedule and the location of its vessels with local sailboat race organizations and local municipalities to avoid disruptions to these popular sailing events.

Because the BITS will be buried beneath the seafloor and eventually abandoned in place, operation and decommissioning of the BITS will have no impact on recreational boating activities.

### **US Maritime Uses**

The Torpedo Testing Area and Mine Laying Area are clearly marked on navigation charts and defined in navigation publications and local NTMs. The BITS was specifically sited to avoid these areas (BITS Alternative 1 is located approximately 1 nm [1.9 km] from the Torpedo Testing Area and approximately 4 nm [7.4 km] west of the Mine Laying Area) (see Figure 3.3-1). Deepwater Wind has also considered these areas in Project planning and has sited the proposed construction and Project transit routes to avoid them (see Figure 3.3-1). Outside of Project vessel transits in the vicinity of these naval practice areas, the construction, operation and decommissioning of the BIWF will have no effect to, nor should it be affected by, the use of these areas (see also Section 4.11 and Appendix U).

### **Offshore Diving**

The BITS and associated construction areas have been sited to avoid the CRMC's designated offshore diving areas of particular concern (Figure 4.9-2) and, to the extent possible, interesting benthic

communities. The BITS Project is also sited well outside of any known shark diving areas. As stated in Section 4.9.1.4, the closest identified diving site, named “Miss Jennifer,” is located approximately 0.5 nm (0.9 km) southeast of the BITS route. While construction of the BITS will not directly impact any identified offshore dive site, construction activities occurring in the vicinity of “Miss Jennifer” could temporarily affect the presence of the mobile marine species that would typically inhabit this area as a result of increased underwater noise, and increased turbidity. However, as detailed further in Section 4.7.1.1, these impacts will be short-term and minor and therefore will not have a significant long-term effect to the integrity of this site.

Because the BITS will be buried beneath the seafloor and eventually abandoned in place, operation and decommissioning of the BITS will have no impact on recreational diving activities.

### **Offshore Wildlife Viewing**

The BITS has been sited outside known offshore wildlife viewing areas for whales and birds as identified by the RI Ocean SAMP (2011) (Figure 4.9-2). As described in Section 4.5.4.2, impacts to marine mammals during construction will be limited to the underwater noise generated the cable-lay vessel’s DP thrusters. It is not expected that these activities will result in the displacement of whales from the construction area or whale watching vessels. To ensure potential impacts to whales are minimized to the extent possible, Deepwater Wind will implement a comprehensive marine mammal monitoring program inclusive of construction shut-down procedures. Refer to Section 4.5.4.2 for additional information on Project effects on marine mammals.

Installation of the BITS will temporarily disturb some benthic invertebrate (bi-valves and other seaduck prey) communities and may impact bird species that forage on benthic invertebrates (i.e., seaducks). The water depth along the BITS corridor is generally greater than what is accessible by seaducks (approximately 82 ft [25 m]) (Winiarski et al. 2011) and therefore installation of the cable is not anticipated to impact foraging seaducks. Benthic invertebrate communities are expected to quickly recolonize disturbed areas following BITS construction (see Section 4.5.1).

It is anticipated that the BITS will be kept in operation in perpetuity. However, should the cable reach the end of its useful operational life it will be abandoned in-place. For these reasons, decommissioning of the BITS will have no effect to offshore wildlife viewing activities.

### **4.9.2.3 Combined Effects**

Deepwater Wind has minimized impacts on marine uses from both the BIWF and BITS by siting the BIWF within the Renewable Energy Zone, providing sufficient spacing between the WTGs to allow access both around and through the Project Area, and siting both the BIWF and BITS facilities outside areas identified by the CRMC as marine use areas of particular concern.

Recreational fishing, boating, sailing, diving, and offshore wildlife viewing activities principally occur outside of the Project Area. The exception is commercial fishing, which has been shown to occur throughout the Project Area with varying intensity depending on location and gear-type. The construction of the BIWF and BITS will result in moderate, short-term impacts to both mobile and fixed commercial fisheries during portions of the approximate 6-month construction time period. Decommissioning activities associated with the BIWF would, as with construction, result in moderate, short-term impacts to mobile and fixed commercial activities. Since the BITS would be abandoned in place there would not be any additional decommissioning impact. When considered together with the existing available fishing

areas, the combined impacts associated with the construction, operation, and decommissioning of the BIWF and BITS will not be long-term or significant.

#### **4.10 Land Use**

This section discusses the existing land uses and wetlands, zoning, and recreational resources within and surrounding the onshore Project facilities based on review of local comprehensive plans, spatial data, site knowledge, and a resource delineation study completed for the Project. Potential impacts on land uses include direct impact from development and indirect impact from views of the Project facilities.

In addition to municipal zoning, this section also discusses the coastal zoning administered by the CRMC through the Rhode Island Coastal Resources Management Program (RICRMP). CRMC review and approval of activities and development in the coastal zone involves consideration for existing coastal uses, which are classified into one of six categories and shoreline types. Through the RI Ocean SAMP, the CRMC also designated a subcategory for an offshore Renewable Energy Zone southeast of Block Island. Deepwater Wind has sited the WTGs, the primary component of the BIWF, within the designated Renewable Energy Zone. Section 4.10.1.2 provides a description of the coastal water types and where the Project facilities are located in relation to these areas.

##### **4.10.1 Affected Environment**

###### **4.10.1.1 Existing Land Use**

The proposed onshore Project facilities will be located in the Towns of New Shoreham and Narragansett in Washington County, Rhode Island. Construction staging and laydown for the WTGs will occur out of the Quonset Point port facility in North Kingstown, Washington County, Rhode Island. Washington County consists of approximately 329 mi<sup>2</sup> (852 km<sup>2</sup>) that encompass the southern and coastal communities of Rhode Island west of Narragansett Bay and has a population density of 385.7 persons per mi<sup>2</sup> (148.8 persons per km<sup>2</sup>) (U.S. Census Bureau 2011).

This section discusses the existing land uses in the areas surrounding the proposed onshore facilities. Figures 4.10-1 and 4.10-2 depict land use types as designated in the land use and land cover classification system developed by Anderson et al (1976).

###### **New Shoreham**

The Town of New Shoreham (Block Island) encompasses approximately 6,000 acres (2,428 hectares) of land 12 mi (19.3 km) south of the Rhode Island Mainland (Town of New Shoreham 2009a). Existing land use on Block Island consists primarily of open space, seasonal and permanent residences, beaches and other recreational areas, and municipal facilities that provide utility and other services to the island. According to the Town of New Shoreham Comprehensive Plan (2009b), approximately one-third, or 2,000 acres (809.4 hectares), of the land is developed, 1,800 acres (728.4 hectares) have been committed to open space, and another 1,000 acres (404.7 hectares) consist of wetland and coastal features that limit development. Development consisting of commercial, municipal, and higher density residential areas is concentrated at the center of Block Island near the Old Harbor, New Harbor, and Block Island State Airport.

Figure 4.10-1 Block Island Land Use

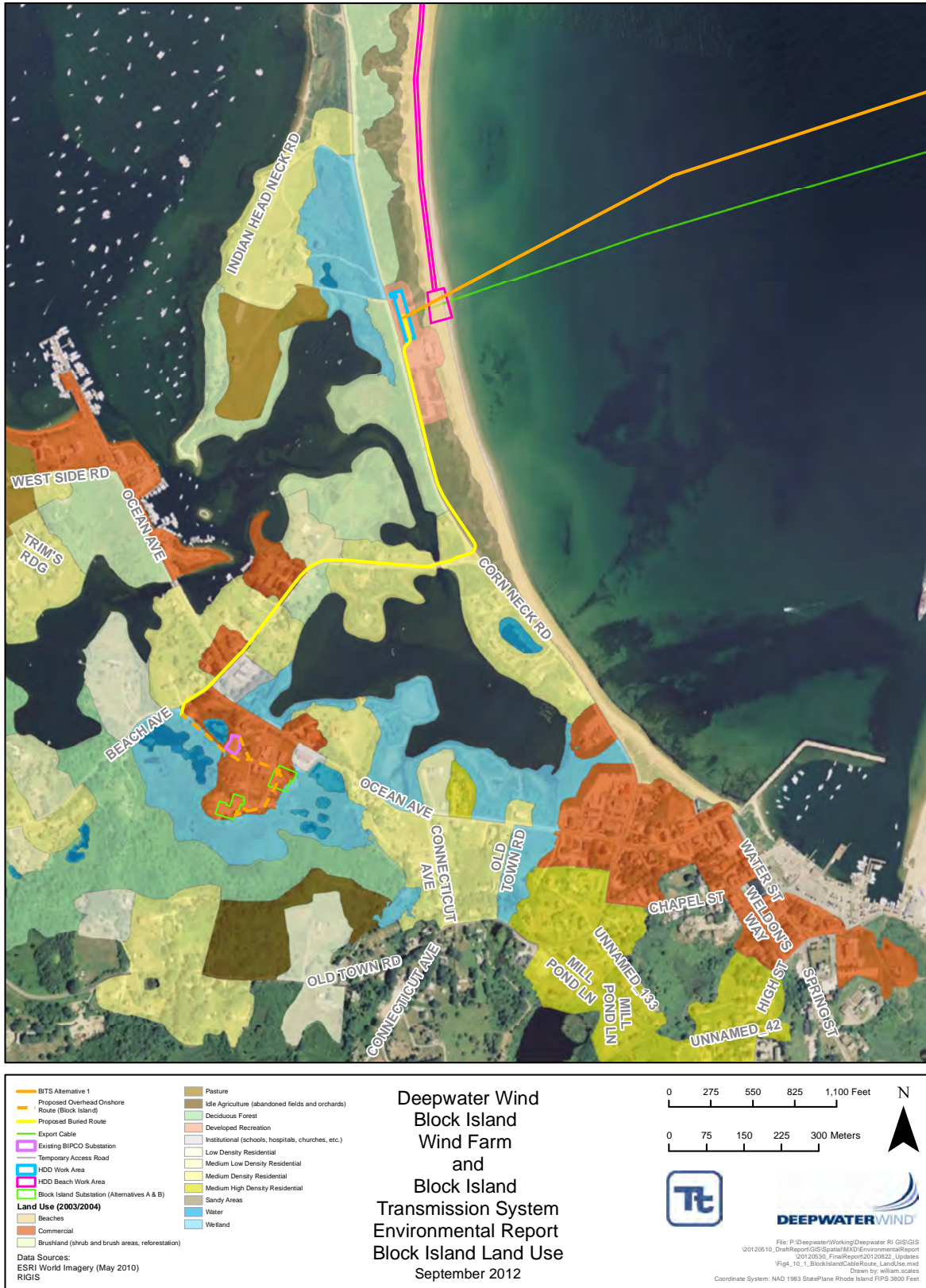
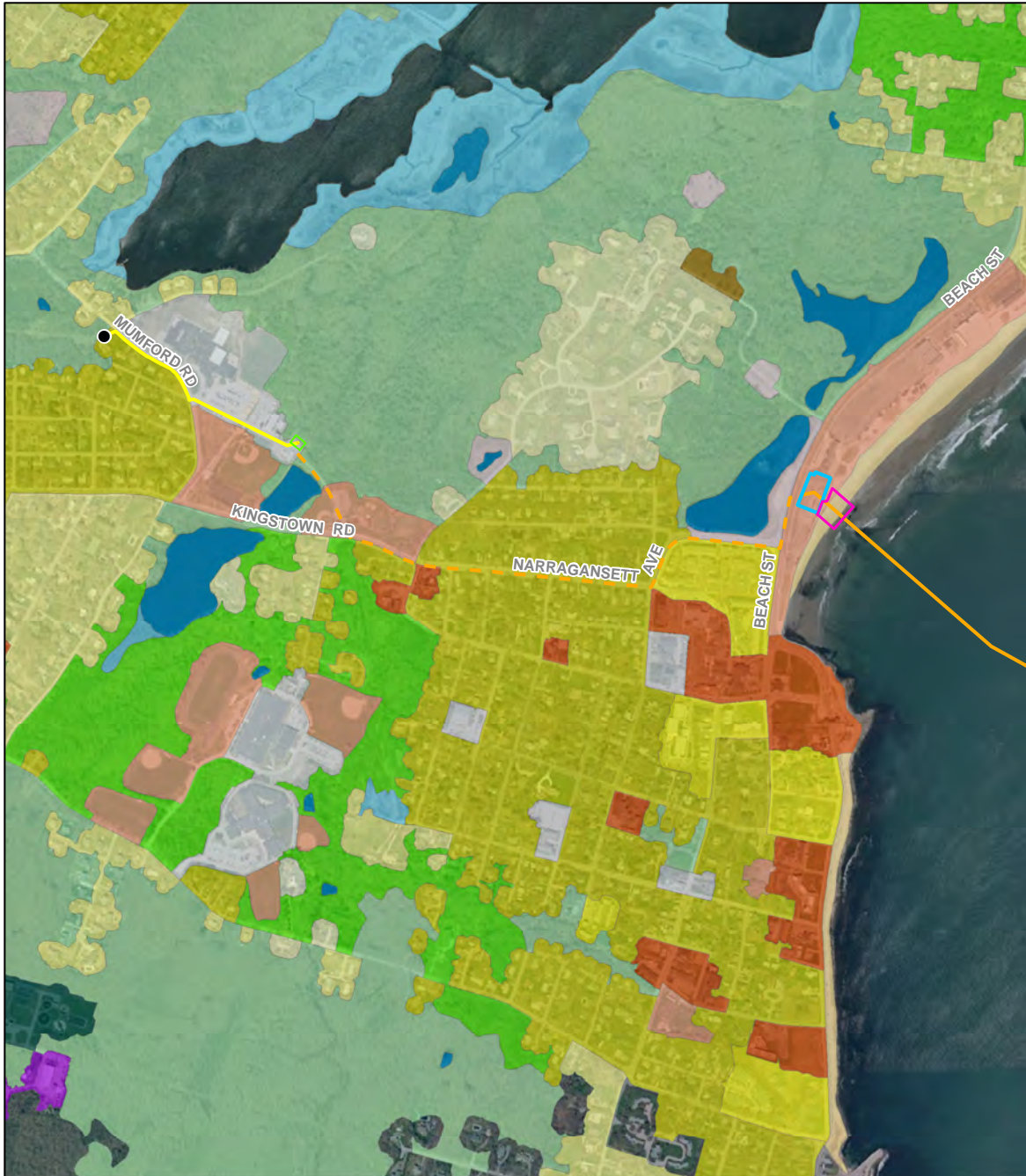




Figure 4.10-2 BITS Mainland Alternative 1 Land Use



<ul style="list-style-type: none"> <li> BITS Alternative 1</li> <li> BITS Mainland Cable Route (Alt 1)</li> <li> Proposed Buried Route</li> <li> Interconnection Point with National Grid 3302 Feeder Line</li> <li> Narragansett Switchyard</li> <li> HDD Work Area</li> <li> HDD Beach Work Area</li> </ul>	<ul style="list-style-type: none"> <li> Institutional (schools, hospitals, churches, etc.)</li> <li> Low Density Residential</li> <li> Medium Low Density Residential</li> <li> Medium Density Residential</li> <li> Medium High Density Residential</li> <li> High Density Residential</li> <li> Power Lines</li> <li> Roads</li> <li> Transitional Areas</li> <li> Vacant Land</li> <li> Water</li> <li> Water and Sewage Treatment</li> <li> Wetland</li> </ul>	<p>0 325 650 975 1,300 Feet</p> <p>0 75 150 225 300 Meters</p> 
<p><b>Land Use (2003/2004)</b></p> <ul style="list-style-type: none"> <li> Beaches</li> <li> Commercial</li> <li> Industrial</li> <li> Cropland</li> <li> Pasture</li> <li> Deciduous Forest</li> <li> Mixed Forest</li> </ul>	<p><b>Data Sources:</b> ESRI World Imagery (May 2010) RGIS</p>	<p><b>Deepwater Wind Block Island Wind Farm and Block Island Transmission System Environmental Report BITS Mainland Route (Alt 1) Land Use September 2012</b></p>  
<p><small>File: P:\Deepwater\Working\Deepwater RI GIS\GIS\20120510_DraftReport\GIS\Spatial\MXD\EnvironmentalReport\20120510_FinalReport\20120822_Updates\Fig_10_2_BITSMainland_Alt1_LandUse.mxd Drawn by: William Scates</small></p> <p><small>Coordinate System: NAD 1983 StatePlane Rhode Island FIPS 3800 Feet</small></p>		

The proposed Project facilities onshore Block Island will be located primarily within existing road rights-of-way just north of Old Harbor. Old Harbor is considered the downtown of New Shoreham and is home to the Island's commercial ferry landing. The Export Cable and BITS will make landfall on Block Island at manholes located in the parking lot of Crescent Beach (also known as Fred Benson Town Beach) on Corn Neck Road. This area is categorized as developed recreation land use (see Figure 4.10-1). From these manhole locations, the Export Cable and BITS will be collocated in the same underground concrete duct bank under existing Rhode Island Department of Transportation (RIDOT) roadway rights-of-way to the BIPCO property. The roadways that coincide with the cable route, Corn Neck Road and Beach Avenue, traverse beach, brushland, residential, commercial, and institutional lands (Figure 4.10-1). Most of the route along Corn Neck Road and across the bridge on Beach Avenue has limited development. Closer to the BIPCO property, developed land uses include a police department and several inns associated with the tourist center of the Old Harbor.

The BIPCO property, classified as commercial land use, houses the diesel-powered energy generation facilities that currently produce power for Block Island. Existing facilities within the BIPCO property include office buildings, storage buildings, generator buildings, substation, cell phone tower buildings, cooling pond, a garage, and a temporary housing residence.

### **Narragansett**

The Town of Narragansett encompasses 8,668 acres (3,507.8 hectares) of land that consists of three end-to-end peninsulas with islands and barrier beaches on the southern coast of Rhode Island where the Rhode Island Sound transitions to the Narragansett Bay (Town of Narragansett 2008). According to the Town of Narragansett Comprehensive Plan (2008), approximately 79 percent of land in Narragansett has been developed: 34 percent for residential, 3 percent for business, 9 percent for industrial, 4 percent for municipal, and 29 percent has been committed to a specific use such as open space.

In Narragansett, BITS Alternative 1 will make landfall at a manhole located in the parking lot of Narragansett Town Beach in an area categorized as developed recreation land use (see Figure 4.10-2). From this location BITS Alternative 1 will transition to an overhead line and traverse existing RIDOT and Town of Narragansett road rights-of-ways along its interconnection point at the Narragansett Switchyard. BITS Alternative 1 will require the enhancement of up to 30 existing poles and the installation of eight new poles. The enhanced poles will be up to 10 ft (3 m) higher than the existing poles along the route. The BITS Alternative 1 overhead route is surrounded by areas classified as developed recreation, residential, forest, and institutional land uses (see Figure 4.10-2). The buried portion of the BITS Alternative 1 cable route from the Narragansett Switchyard to the TNEC interconnection point is located within road rights-of-way that traverse areas classified as institutional and residential.

#### **4.10.1.2 Zoning**

In Rhode Island, each city or town is responsible for zoning and providing municipal functions and services to its residents.

### **New Shoreham**

The Town of New Shoreham manages land use and development on Block Island through the Town of New Shoreham Zoning Ordinance, adopted 1994, amended August 17, 2011. The collocated terrestrial Export Cable and BITS cable traverse the Residential A (RA) zone near Crescent Beach and Corn Neck Road, and the Mixed zone near Beach Avenue. The Block Island Substation and BIPCO substation improvements within the BIPCO property are within the Service Commercial zone (Town of New

Shoreham 2009a). The Residential A zone is made up of rural land remote from the village center primarily served by narrow lanes. New development in this zone should be integrated into the existing rural landscape of fields, ponds, wetlands, and the stone walls that exist throughout the town. Mixed zones are transitional areas between the year-round and seasonal residential areas and the mixed residential area. This zone is intended for a mix of residential dwellings and specially approved retail and service uses. The Service Commercial zone includes the area connecting Old Harbor and New Harbor (Town of New Shoreham 2011).

Deepwater Wind obtained a special use permit and variance for pole height and setbacks from the Town of New Shoreham Zoning Board in April 2012 for the Block Island Substation and BIPCO Substation upgrades on the BIPCO Property (Appendix A). A special use permit is not required for the cable from the landfall at Crescent Beach to the BIPCO Property; however, Deepwater Wind will obtain an easement from the Town of New Shoreham for the cable landfall at Crescent Beach.

### **Narragansett**

The Town of Narragansett manages land use and development in the town through their own zoning ordinance. The landing location for BITS Alternative 1 at the Narragansett Town Beach will be located in the Urban Renewal District. As stated previously, BITS Alternative 1 will follow existing RIDOT and Town of Narragansett road rights-of-ways to the Narragansett Switchyard that traverse the Urban Renewal (UR), Residential High Density (Hotels) (R-10A), and Public Use (P) Districts. Along this portion of the route, BITS Alternative 1 will require the enhancement of up to 30 existing poles and the installation of eight new poles. The enhanced poles will be up to 10 ft (3 m) higher than the existing poles along the route. From the Switchyard to the existing TNEC Feeder, the cable will be buried underground within existing road rights-of-way in the Public Use District (Town of Narragansett 2008).

The Urban Renewal District comprises land within the Narragansett urban renewal project area, which along the Project Area contains condominiums. The residential districts are differentiated by their densities, access to a public water system, agricultural uses, and natural limitations such as wetlands and waterbodies within the zones. The Public Use District is reserved for public and semi-public use and no residential, commercial, or industrial development is permitted with the exception of development that is deemed necessary by the governmental entity that owns the land. The Limited Industrial Zone contains land and structures used by research industries and open land suitable for limited industrial development.

The Town of Narragansett will require a special use permit for the Narragansett Switchyard and the poles on Town property. A special permit will also be required for all work within 100 ft (30.5 m) of a wetland in accordance with the wetland by law of the zoning ordinance. Deepwater Wind will also obtain, if necessary, a variance of the Narragansett Noise Ordinance from the town council for the period when HDD is being conducted.

### **Coastal Resources Management Council**

The CRMC is responsible for the preservation, protection, development, and restoration of the coastal zone of Rhode Island through the Rhode Island CRMP, as discussed in Section 1.3. CRMC review and approval of activities and development in the coastal zone involves consideration for existing coastal uses, which are classified into one of six categories and shoreline types. The six categories consist of the following (RICRMP Section 200):

- Type 1 (Conservation Areas), which abut shorelines in natural undisturbed conditions where alterations such as construction of docks or dredging are considered unsuitable;
- Type 2 (Low-Intensity Use), which are adjacent to the predominantly residential areas, where docks are acceptable but more intense forms of development such as marinas and new dredging would be considered unsuitable;
- Type 3 (High-Intensity Boating), which are dominated by commercial facilities that support recreational boating;
- Type 4 (Multipurpose Waters), which are open waters of the bay and the sounds, where a balance must be maintained among fishing, recreational boating, and commercial traffic;
- Type 5 (Commercial and Recreational Harbors), where a mix of commercial and recreational activities is expected; and
- Type 6 (Industrial Waterfronts and Commercial Navigation Channels), which are areas where water-dependent industrial and commercial activities take precedence over all other activities.

Through the RI Ocean SAMP, the CRMC also established a subcategory of Multipurpose Waters in a designated offshore Renewable Energy Zone (Type 4E) southeast of Block Island. In assessing the natural resources and existing human uses present in state waters, the CRMC found that this area is the most suitable area for offshore renewable energy development in state waters (RI Ocean SAMP 2011). Deepwater Wind has located the WTGs, the primary component of the BIWF, within the designated Renewable Energy Zone.

The BIWF Export Cable traverses Type 4E and Type 4 waters and makes landfall in Type 1 waters (Figure 4.10-3). The BITS cable traverses Type 4 waters off of Block Island and makes landfall in Type 1 waters (Figure 4.10-3). The northern portion of Block Island's Crescent Beach where the Export Cable and BITS cable landfall is proposed is further categorized as a Moderately Developed Barrier (RICRMP Section 210.2).

The BITS submarine cable traverses Type 4 waters. On the Rhode Island Mainland, the BITS Alternative 1 cable traverses Type 1 waters at its landing location on Narragansett Town Beach (Figure 4.10-4). The Narragansett Town Beach is also classified as a Moderately Developed Barrier (RICRMP Section 210.2).

Approximately 70 percent of Rhode Island's 420 mi (676 km) of coastline has been assigned to Type 1 or Type 2 waters (RICRMP Section 200). Energy-related activities/structures in Type 1 waters that consist of utility lines are reviewed as Category B activities in areas considered Moderately Developed Barriers, such as the cable landfall on Block Island and the cable landfall for BITS Alternative 1. Energy-related activities/structures in Type 2 waters are reviewed as Category B activities in areas considered tidal waters, such as the cable landfall for BITS Alternative 1. The submarine portions of the Export Cable and BITS through Type 4 waters traverse tidal areas where they are reviewed as Category B activities.

Deepwater Wind is submitting an application to the CRMC with this ER for a Category B Assent for all Project facilities located within the state coastal zone.

Figure 4.10-3 Block Island CRMC Coastal Zoning

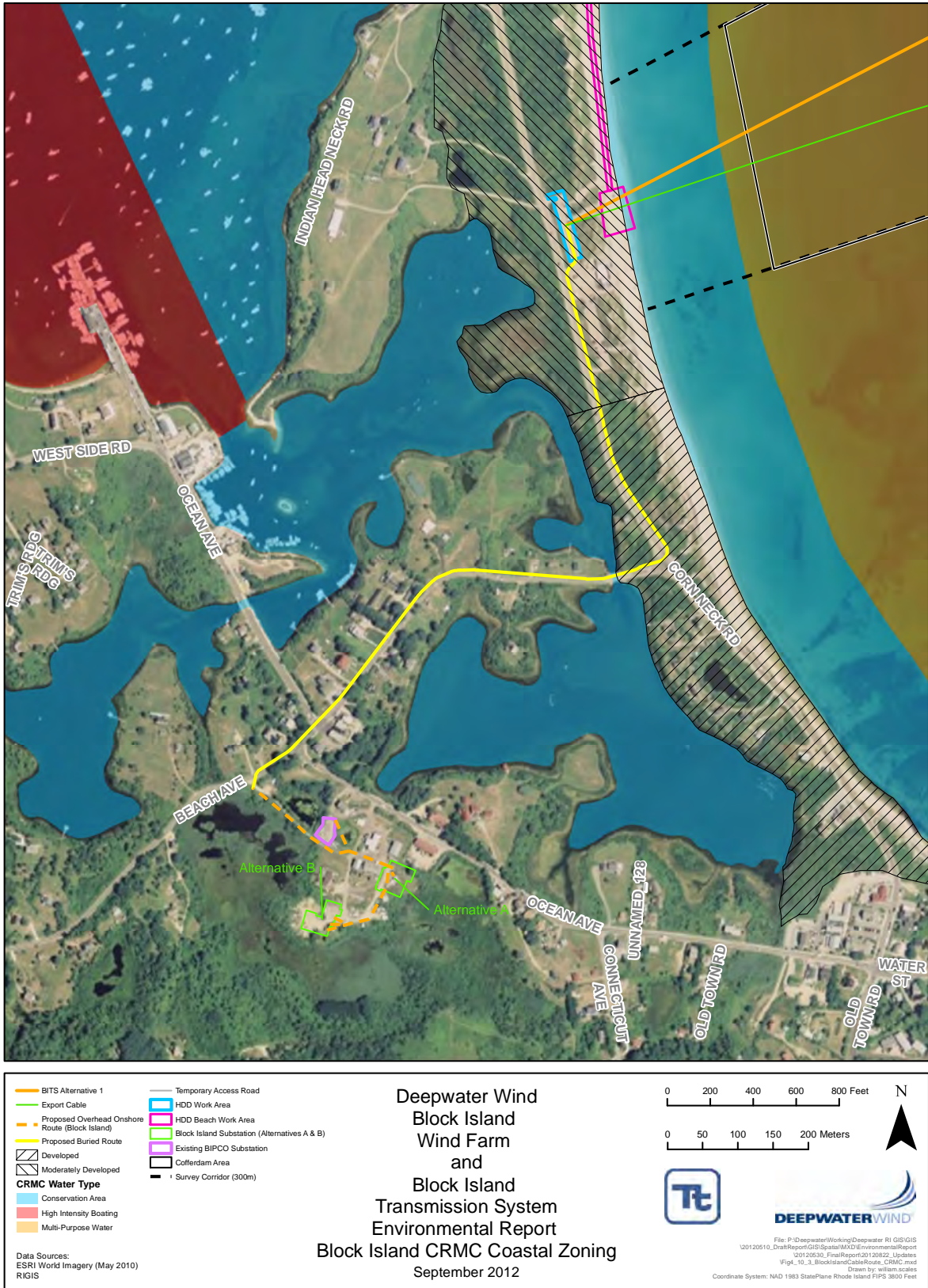




Figure 4.10-4 BITS Mainland Alternative 1 CRMC Coastal Zoning



<ul style="list-style-type: none"> <li>● Interconnection Point with National Grid 3302 Feeder Line</li> <li>— BITS Alternative 1</li> <li>— Proposed Overhead Onshore Route (Narragansett Ave.)</li> <li>— Proposed Buried Route</li> <li>— Narragansett Switchyard</li> <li>— HDD Working Area</li> <li>— HDD Beach Work Area</li> </ul>	<ul style="list-style-type: none"> <li>▨ Moderately Developed</li> <li><b>CRMC Water Type</b></li> <li>■ Conservation Area</li> <li>■ Multi-Purpose Water</li> </ul>	<p>Deepwater Wind Block Island Wind Farm and Block Island Transmission System Environmental Report BITS Mainland Route (Alt 1) CRMC September 2012</p>	<p>0 300 600 900 1,200 Feet</p> <p>0 75 150 225 300 Meters</p> 
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Data Sources:  
ESRI World Imagery (May 2010)  
RIGIS



File: P:\Deepwater\Working\Deepwater RI GIS\GIS\20120510\_DraftReport\GIS\Spatial\MXD\EnvironmentalReport\20120530\_FinalReport\Fig\_10\_5\_BITSMainland\_Alt\_1\_CRMC.mxd  
Drawn by: william.scales  
Coordinate System: NAD 1983 StatePlane Rhode Island FIPS 3800 Feet

#### 4.10.1.3 Wetlands

Rhode Island has established a jurisdictional boundary for projects that fall within regulatory jurisdiction of the CRMC or RIDEM. Freshwater wetlands in the vicinity of the coast generally fall under the jurisdiction of the CRMC. For linear projects located on both sides of the jurisdiction boundary, RIDEM and CRMC determine the lead agency on a case-by-case basis. CRMC requires setbacks for coastal features such as tidal wetlands, freshwater wetlands, dunes, and beaches that extend at a minimum of either 50 ft (15.2 m) from the inland boundary of the feature or 25 ft (7.6 m) inland of the edge of a Coastal Buffer Zone, whichever is further landward. In addition, a CRMC permit is required for construction or alteration activity on a shoreline feature or within 200 ft (61 m) of shoreline features or tidal wetlands. Within Rhode Island, the USACE New England District considers all tidal waters and their tributaries to the head of the tide to be navigable waters of the United States. Placement of structures and work in or affecting tidal or navigable waters, including utility lines, aerial transmission lines, pipelines, and HDD activities seaward of MHW, is considered a Category 2 activity requiring USACE notification and approval.

Onshore Project Area wetlands and surface waters were field delineated by AECOM in November and December of 2011 and by Natural Resources Services, Inc., in April and August 2012. The results of the delineation efforts are described in reports provided in Appendix J. Most of the delineated wetland and surface water boundaries associated with the onshore portion of the BITS Alternative 1 route have been verified by the Rhode Island RI DEM (Appendix J). A request will be submitted to RIDEM and/or the CRMC, as appropriate, to verify the balance of jurisdictional features associated with the Rhode Island mainland and Block Island onshore routes and switchyard locations.

Wetlands and surface waters associated with Project facilities on the Rhode Island mainland also include freshwater and tidal features (Table 4.10-1). Along the BITS Alternative 1 route the Project crosses or parallels two surface waters: Lake Canonchet/Little Neck Pond (W1), which is fringed by a freshwater scrub-shrub swamp; and Crooked Brook (S1), a perennial stream that flows north across the BITS Alternative 1 route. Vegetation along the Lake Canonchet/Little Neck Pond edge is dominated by a sparse cover of false indigo (*Amorpha fruticosa*), common winterberry, common reed, arrowwood, greenbriar (*Smilax* sp.) and willow (*Salix* sp.). Open water areas are vegetated with water lily (*Nymphaea odorata*) and broadleaved cattail. Progressing west, BITS Alternative 1 route crosses Crooked Brook and runs parallel to an unnamed tributary to the brook. A wetland (W3) associated with the unnamed tributary, which flows into Crooked Brook and located south of Kingstown Road, is regularly maintained by mowing and vegetation was unidentifiable during the field survey. The route is also adjacent to a pond that discharges to Sprague's Brook (see Figure 4.10-4). A scrub-shrub/forested wetland complex is located east of the location of the proposed Narragansett Switchyard. Dominant vegetation in this wetland consists variously of black cherry (*Prunus serotina*) and red maple (*Acer rubrum*) in the tree canopy; high bush blueberry (*Vaccinium corymbosum*), arrowwood, and red maple in the shrub layer; and Canada lily of the valley (*Maianthemum canadense*), skunk cabbage (*Symplocarpus foetidus*), and cinnamon fern (*Osmunda cinnamomea*) in the herb layer. Near the landfall for the BITS Alternative 1 at Narragansett Town Beach, the overhead portion of the route parallels barrier beach and adjacent upland dunes.

Table 4.10-1 Wetlands and Surface Waters Associated with Project Area

Municipality	Project Component	ID	Cowardin Classification	Tidal/ Freshwater	Jurisdiction			Verified Boundary	Connectivity	Comments
					RIDEM	CRMC	USACE			
New Shoreham	BIWF Export Cable and BITS Alt 1	WF1	PUBV	Freshwater	X		X		Connected to tidally influenced Trim Pond via Beach Road culvert	
New Shoreham	BIWF Export Cable and BITS Alt 1	WF1	PEM1E	Freshwater	X		X		Connected to tidally influenced Trim Pond via Beach Road culvert	
New Shoreham	BIWF Export Cable and BITS Alt 1	WF1	E2EM/E1UB	Tidal	X		X		Connected to tidally influenced Trim Pond via Beach Road culvert	
New Shoreham	BIWF Export Cable and BITS Alt 1	WF2	not mapped	Freshwater	X		X		Isolated but adjacent	Man-made detention pond
New Shoreham	BIWF Export Cable and BITS Alt 1	WF3	E1UBL	Tidal		X	X		Atlantic Ocean	
New Shoreham	BIWF Export Cable and BITS Alt 1	WF4	PUBV/PEM1E	Freshwater	X		X		Connected to W1 via culvert under access road	
New Shoreham	BIWF Export Cable and BITS Alt 1	WF5	E1UBL	Tidal		X	X		Atlantic Ocean	
New Shoreham	BIWF Export Cable and BITS Alt 1	WF6	PUBV	Freshwater		X	X		Isolated but adjacent	Man-made farm or fire pond
New Shoreham	BIWF Export Cable and BITS Alt 1	WF7	E1UBL	Tidal		X	X		Harbor Pond discharges to Atlantic Ocean	
New Shoreham	BIWF Export Cable and BITS Alt 1	WF8	E1UBL	Tidal		X	X		Harbor Pond discharges to Atlantic Ocean	Western End of Beach Ave Bridge over Harbor Pond
New Shoreham	BIWF Export Cable and BITS Alt 1	Crescent Beach Dune-2	not mapped	Non-wetland		X			Adjacent to Atlantic Ocean	Horizontally Directional Drilled
New Shoreham	BIWF Export Cable and BITS Alt 1	Crescent Beach Dune-1	not mapped	Non-wetland		X			Adjacent to Atlantic Ocean	Horizontally Directional Drilled
New Shoreham	BIWF Export Cable and BITS Alt 1	Crescent Beach - Barrier Beach	M2US2P	Tidal		X	X		Atlantic Ocean	Horizontally Directional Drilled
Narragansett	BITS Alt 1	Narragansett Beach - Sea Wall	M2US2P	Tidal		X	X		Atlantic Ocean	Horizontally Directional Drilled



**Table 4.10-1 Wetlands and Surface Waters Associated with Project Area (continued)**

Municipality	Project Component	ID	Cowardin Classification	Tidal/ Freshwater	Jurisdiction			Verified Boundary	Connectivity	Comments
					RIDEM	CRMC	USACE			
Narragansett	BITS Alt 1	Dune	not mapped	Non-wetland		X			Adjacent to Atlantic Ocean	Horizontally Directional Drilled
Narragansett	BITS Alt 1	W1	PUBH	Freshwater		X	X		Little Neck Pond/Lake Canonchet connected to Pettaquamscutt Cove	
Narragansett	BITS Alt 1	S1 (Crooked Brook)	Perennial Stream	Freshwater	X		X		Crooked Brook	Channel north of Kingstown Rd.(culverted under road)
Narragansett	BITS Alt 1	S1A (Crooked Brook)	Perennial Stream	Freshwater	X		X		Crooked Brook	Channel south of Kingstown Rd
Narragansett	BITS Alt 1	S1B	Intermittent Stream	Freshwater	X		X		Tributary to Crooked Brook	Drainage channel south of Kingstown Rd conveying flow to Crooked Brook
Narragansett	BITS Alt 1	W3	PEM	Freshwater	X		X		Adjacent to Crooked Brook	Vegetation is regularly maintained by mowing
Narragansett	BITS Alt 1	A/B	PFO1C	Freshwater		X			Adjacent to Sprague's Brook	Forested/scrub-shrub wetland
Narragansett	BITS Alt 1	D	PUBH	Freshwater		X	X		Discharges to Sprague's Brook	Pond

#### 4.10.1.4 Recreational Resources

Block Island and the southern coast of Rhode Island are popular tourist destinations during the summer months for a number of activities, including beach going, surfing, bird watching, nature walks, sports such as golf, paddling, and biking, and coastal attractions such as historic lighthouses (RI Tourism Division 2012). Maintained recreation areas are present near the Project Area. Recreational areas are protected public or semi-public areas that have managed landscapes, which may include nature preserves, active recreational areas, and open lawns at public parks and lighthouses.

##### **New Shoreham**

Approximately 168,000 people visit Block Island beaches each year (RI Ocean SAMP 2011). The Town of New Shoreham has been taking actions to both preserve open space and to provide for recreation on Block Island and has prepared the Town of New Shoreham Open Space and Recreation Plan (prepared March 1988, updated April 22, 1994). Approximately 1,871 acres (757.2 hectares) of Block Island's 6,188 acres (2,504.2 hectares; 30 percent) are protected as open space through public or non-profit ownership. Another 557 acres (225.4 hectares; 9 percent) of wetlands or waterbodies are protected from development (New Shoreham Planning Board 2009b).

The BITS cable and Export Cable come ashore at Crescent Beach, a town-owned beach located along Corn Neck Road. The beach extends for several miles from Surf Hotel north to Clayhead and offers free beach access, free parking, lifeguards, restroom/shower facilities, food concessions, beach gear and kayak rentals, and events, including exercise classes, art shows, and concerts.

The Beach Avenue Trail on Block Island Conservancy property is located near the Export Cable and BITS route north of Beach Avenue near its intersection with Corn Neck Road (Town of New Shoreham 2000). This trail is used extensively during spring and summer months because it is close to Crescent Beach. The Beach Avenue Trail offers views of Trims Pond and Indian Head Neck to the north and the Narragansett Inn to the west (Block Island Conservancy 2012).

The Southeast Lighthouse is a National Historic Landmark located on the southern coast of New Shoreham at the former Block Island USCG Station and is currently owned by the Southeast Light Foundation. The Southeast Lighthouse is approximately 3 mi (4.8 km) northwest of the nearest proposed WTG location. The lighthouse was built on Mohegan Bluff in 1874, is still operational, and serves as a tourist attraction on Block Island. Existing views from the lighthouse consist of gently rolling lawns surrounded by a white fence and steep bluffs that drop to the ocean shoreline.

##### **Narragansett**

The geology and seaside location of Narragansett present a variety of recreational opportunities. The total town acreage of Narragansett is 9,117 acres (3,689.5 hectares), 9.42 percent of which is private recreational land; 6.89 percent is farm, forest, and open space; and 55.17 percent is public.

The Narragansett Comprehensive Plan (2008) defines three distinct recreational areas in Narragansett: the North End, the Pier, and the South End. BITS Alternative 1 is located in a recreational area referred to as the Pier. The BITS Alternative 1 landfall is located in the parking lot of Narragansett Town Beach. During peak summer months, the beach may have up to 10,000 visitors per day. Narragansett Town Beach is located next to Narragansett's downtown known as Narragansett Pier, which consists of a North and South Pavilion, the Beach Club and the Cabanas, and offers parking, food concessions, restrooms, first-aid, and a surfing area (Town of Narragansett 2008).

BITS Alternative 1 terrestrial cable route traverses state-owned recreational land (Town of Narragansett 2008). These recreational areas include Sprague Memorial Field located next to Narragansett Elementary School surrounding Sprague Pond and contain baseball fields, tennis courts, and a playground. Additionally, much of the BITS Alternative 1 follows RI Route 1A, which is also referred to as Scenic Route 1A.

The BIWF will be visible from two visually sensitive recreational resources, including Point Judith Lighthouse and Salty Brine State Beach. The Point Judith Lighthouse is National Register Listed and is approximately 16.5 mi (26.6 km) north of the nearest proposed WTG location. This is the closest mainland viewpoint of the BIWF. Salty Brine Beach provides a working seascape view with boat traffic throughout the day and is approximately 17 mi (27.4 km) north of the nearest BIWF turbine site (edr Environmental Services, LLC 2012). Section 4.8 and Appendix S provide further information on recreational areas within the viewshed of the Project.

## **4.10.2 Potential Impacts and Proposed Mitigation**

### **4.10.2.1 BIWF**

The Export Cable will be collocated with the BITS terrestrial cable within existing road rights-of-way from the manhole at the Town Beach Parking Lot to the BIPCO property. The Export Cable will require a temporary construction right-of-way width of 5 ft (1.5 m) along the 0.8 mi (1.3 km) upland route to the BIPCO property. Because the Export Cable will be underground along this route except where the cable crosses the bridge between Trims Pond and Harbor Pond, a permanent maintenance right-of-way will not be required. Aboveground facilities associated with the BIWF, namely the overhead portion of the Export Cable and the BIWF Generation Switchyard (located within the Block Island Substation) on the BIPCO property, will be located in an area with existing energy infrastructure. The total area of the Block Island Substation, along with other improvements on the BIPCO property, will result in a total area of disturbance of up to 1 acre (0.4 hectare) during construction and 0.5 acre (0.2 hectare) during operation.

Impacts to USACE jurisdictional wetlands have been avoided to the maximum extent practical by careful design of the project cable routes and the proposed switchyard locations. Construction of the Export Cable and BITS Cable on Block Island will result in the aerial crossing of a tidal estuarine wetland at the location between Trims Pond and Harbor Pond. For this crossing, the cable will be suspended on the north side of the Beach Avenue Bridge for an approximately 45-ft (14-m) span. Work will be completed from Beach Avenue. Deepwater Wind is requesting USACE permit authorization for the aerial crossing of Trims Pond/Harbor Pond.

Vegetation clearing, where necessary, will be conducted within an 18-ft (5.5-m) wide (9 ft [2.7 m] on either side of the centerline) permanent right-of-way, which generally coincides with the public road right-of-way along Corn Neck Road and Beach Avenue. On the BIPCO property, vegetation will be cleared to the elevation of the gravel access road, which is generally 8 ft to 10 ft (2.4 m to 3 m) above the surface elevation of the wetlands located to either side of the access road. Vegetation will be cleared by hand or by using a truck mounted brush hog operated from the surface of the gravel access road. The truck will remain on the gravel road and will not drive into the wetlands. Shrubs and other low growing vegetation will generally be preserved and protected, although some shrubs and low-growing vegetation may be unavoidably cut. Cut vegetation will be removed from the wetland by hand and will be chipped or cut into short sections and removed from the site. Scrub-shrub/emergent wetlands in the 100-ft (30.5-m) permanent right-of-way for the overhead cable on the BIPCO property will be affected by vegetation

clearing. Deepwater Wind is requesting USACE permit authorization for construction and maintenance activities within the 100-ft (30.5-m) permanent right-of-way for the overhead cable on the BIPCO property.

Deepwater Wind has designed the Project to avoid and minimize impacts on surrounding land uses and sensitive areas, such as wetlands and dunes, by selecting a route along existing rights-of-way to the maximum extent practical, considering the locations of the resources identified through field surveys, and siting the switchyard in an area with existing energy infrastructure. Deepwater Wind has also submitted a joint application to the USACE, CRMC, and RIDEM for potential impacts on the wetlands surrounding the BIPCO property. As discussed in Section 4.3, Deepwater Wind will implement stormwater pollution prevention best management practices and erosion control measures in accordance with permit requirements during construction to avoid and minimize any potential impacts on wetlands, beaches, and other sensitive land use areas. Therefore, the BIWF will be compatible with surrounding land uses and zoning and is not expected to result in significant impacts on surrounding land uses during construction or operation.

Deepwater Wind has also considered the recreation activities and tourist season on Block Island in developing the proposed BIWF construction schedule. Onshore HDD construction activities, terrestrial cable installation, and substation construction are scheduled to occur from December 2013 to May 2014 when the Block Island population and use of beaches and other recreational areas is relatively less than during the peak summer months. Residences along the Project Area and recreational users walking, jogging, or surfing during the spring months may experience some temporary disturbance from construction activities and noise.

Potential impacts on recreational areas during operation from views of the BIWF facilities are discussed in Section 4.8 and the visual impact analysis included as Appendix S.

#### **4.10.2.2 BITS**

For the Town of New Shoreham, the BITS facilities will be collocated with the BIWF facilities and will accordingly have the same impacts on land use, as described in the preceding section.

On Narragansett, installation of the BITS Alternative 1 terrestrial cable will require clearing of 30 ft (9.1 m) on either side of the centerline from the manhole located in the parking lot of Narragansett Town Beach to the Narragansett Switchyard during construction, with a permanently cleared area during operation of 18 ft (5.5 m) on either side of the centerline. The Narragansett Switchyard alternative will result in clearing of up to 0.9 acres (0.36 hectares) of vegetation during construction with 0.4 acres (0.16 hectares) remaining permanently cleared during operation (see Table 3.2-5).

Impacts to wetlands from BITS Alternative 1 facilities on Block Island will be the same as those described for the BIWF Export Cable in Section 4.10.2.1. Construction of the onshore portions of BITS Alternative 1 in Narragansett will result in temporary (0.7 acre [0.28 hectare]) and permanent (0.35 acre [0.14 hectare]) impacts to vegetation located within the 200-ft (61-m) buffer associated with Wetland A/B (see Table 4.10-1). As the location of the proposed Narragansett Switchyard is within the 200-ft (61-m) buffer of contiguous wetlands, its construction and maintenance will require a variance for the removal of native vegetation from within the 200-foot buffer.

The proposed alteration conforms to applicable goals and policies of the Coastal Resources Management Program as it is associated with a utility, which constitutes a public infrastructure and as such provides benefits to the public as a whole as opposed to individual or private interests. The proposed alteration will not result in significant adverse environmental impacts or use conflicts since the switchyard location as currently proposed represents the optimal location for this feature. Furthermore, as the proposed switchyard and its construction laydown area are designed to use the available space as efficiently as possible and to minimize buffer disturbance and the modification requested is the minimum variance to the applicable standard necessary to allow a reasonable alteration or use of the site.

Deepwater Wind is also requesting a variance from the setback established under the Narrow River SAMP to construct and maintain the Narragansett Switchyard. As the contiguous freshwater wetland is located close to the proposed switchyard location, its construction and continued maintenance will require a variance from the standard setback requirement. Two permanent features (a proposed drainage pond and dry swale) associated with the switchyard would be located less than 25 ft (7.6 m) from Wetland A/B.

The remaining activities associated with installation of the terrestrial portion of the BITS Alternative 1 cable will occur either within paved roadways and associated graveled shoulders, or in areas of maintained vegetation. The project has been designed to avoid removal or disturbance of native vegetation along the proposed cable route and the natural vegetative condition of the buffer zone will be preserved.

Deepwater Wind has designed the Project to avoid or minimize impacts to surrounding land uses and sensitive areas such as wetlands and dunes by selecting a route along existing rights-of-way to the maximum extent practical, considering the locations of resources identified through field surveys, and siting the Block Island Substation in an area with existing energy infrastructure. During construction, Deepwater Wind will also avoid impacts to dune areas with the use of the HDD for cable installation. As discussed in Section 4.3, Deepwater Wind will implement stormwater pollution prevention best management practices and erosion control measures during construction to avoid or minimize any potential impacts on wetlands, beaches, and other sensitive land use areas. Therefore, the BITS will be compatible with surrounding land uses and zoning and is not expected to result in significant impacts on surrounding land uses during construction or operation.

Deepwater Wind has also considered the recreation activities and tourist season in Narragansett in developing the proposed BITS construction schedule. Onshore HDD construction activities, terrestrial cable installation, and substation construction are scheduled to occur from December 2013 to May 2014 outside of the peak recreation and tourist summer season in Narragansett. Residences along the cable route and recreational users walking, jogging, or surfing during the spring months may experience some temporary disturbance from construction activities and noise. Therefore, the BITS will be compatible with surrounding land uses and zoning and is not expected to result in significant impacts on surrounding land uses during construction or operation.

Potential visual impacts on recreational areas are discussed in Section 4.8 and the visual impact analysis included as Appendix S.

### 4.10.2.3 Combined Effects

Deepwater Wind has minimized impacts to land uses from the BIWF and BITS by selecting cable routes along existing rights-of-way in areas of compatible use to the maximum extent practical, and conducting terrestrial construction activities outside of the peak tourist season. During construction, Deepwater Wind will also avoid impacts to dune areas with the use of the HDD for cable installation. Residences along the cable routes and recreational users walking, jogging, or surfing during the spring months may experience some temporary disturbance from construction activities and noise; however, this will be minor and limited to the construction period only. No impacts from the operation of the BIWF or BITS are anticipated.

Given the siting considerations and construction time periods proposed for the BIWF and BITS to avoid both land use and zoning conflicts, the combined impacts associated with the construction, operation, and decommissioning of the BIWF and BITS are minor and not significant.

## 4.11 Transportation and Navigation

This section discusses the marine, land, and air transportation networks surrounding the Project Area. This section also identifies the Project activities that may affect transportation and traffic conditions within the Project Area, including location of the Project facilities, and construction and operation activities. A detailed navigational risk assessment has also been conducted for the Project in accordance with USCG guidance for Offshore Renewable Energy Installations (OREIs) contained in Navigation Vessel Inspection Circular (NVIC) 02-07, and through consultation with the USCG and marine transportation stakeholders. The report is included as Appendix U to this ER.

### 4.11.1 Affected Environment

#### 4.11.1.1 Marine Transportation and Navigation

There are two main shipping lanes within Rhode Island Sound, the charted approach to Narragansett Bay and the charted approach to Buzzards Bay. To prevent collisions, commercial ship traffic passing through the approaches to Narragansett Bay and Buzzards Bay is directed by Traffic Separation Schemes (TSS), consisting of shipping lanes, separation zones, and precautionary areas. Smaller commercial and recreation vessels that are not entering or departing Buzzards Bay and Narragansett Bay can be found throughout Block Island and Rhode Island Sounds. The inbound and outbound shipping lanes are 1-nm-wide (1.9-km-wide) and have a separation zone that is 2-nm-wide (3.7-km-wide). Precautionary areas mark the offshore and inshore limits of these approaches (Figure 3.3-1). The precautionary area at the offshore limit of the Narragansett TSS is adjacent to the Block Island Renewable Energy Zone; no WTGs are located within the precautionary area. The BITS cable route will be installed beneath the outbound shipping lane of the Narragansett TSS for approximately 8 nm (14.8 km).

A Recommended Vessel Route runs east and west approximately 3 mi to 4 mi (4.8 km to 6.4 km) south of the Rhode Island coast for vessels transiting from Long Island Sound to Narragansett Bay or Buzzards Bay and the Cape Cod Canal (Figure 3.3-1). There is also a Recommended Vessel Route stretching from both the north ends of the outbound and inbound traffic lanes through the east passage of Narragansett Bay to the Conanicut Island. The Recommended Vessel Routes are safe, established routes to reduce the risk of grounding or conflict with recreational and fishing vessels.

Automatic Identification System (AIS) data analyzed for the Rhode Island Sound shows the commercial ship traffic activity and density surrounding the Project Area. AIS data captures self-propelled vessels that are 65 ft (19.8 m) in length, although many recreational and uncovered vessels carry AIS as well. Areas with 50 or more vessel counts within a 0.62 mi (1 km) by 0.62 mi (1 km) grid are considered areas of High Intensity Marine Traffic (Figure 4.11-1). On average, AIS vessels pass within 2 mi (3.2 km) of the Project Area every 2 to 3 days. Other vessels that may be expected to be in the Project Area are fishing vessels, yachts, tug/barge units, and recreational boats. Approximately one of these vessels passes through the Project Area every 3 days. Ship traffic appears to be concentrated in the Narragansett Bay and Buzzards Bay TSS, along the southern coastline of Rhode Island, and in the federal waters southwest of Block Island near Montauk Point, New York, and passing into Long Island Sound. The Project Area is routinely navigated by a variety of commercial and recreational vessels, with recreational vessels, such as sailing and power-driving craft, being more prevalent seasonally during the spring to fall. These waters are among the busiest waterways in New England as they provide access to Narragansett Bay, Long Island Sound, and Buzzards Bay.

Multiple passenger ferries operate within the Block Island and Rhode Island Sounds (Figure 3.3-1). Ferry service is provided year-round to Block Island's Old Harbor located along the eastern side of the island. The three major ferry operators are Block Island Ferry Services, Viking Fast Ferries, and Interstate Navigation Ferry Services. These operators provide year-round service from Point Judith, Rhode Island, and seasonal service from Newport, Rhode Island; New London, Connecticut; and Montauk, New York. The ferries follow pre-determined routes and may make up to 130 trips per week combined during peak season (CGH 2012).

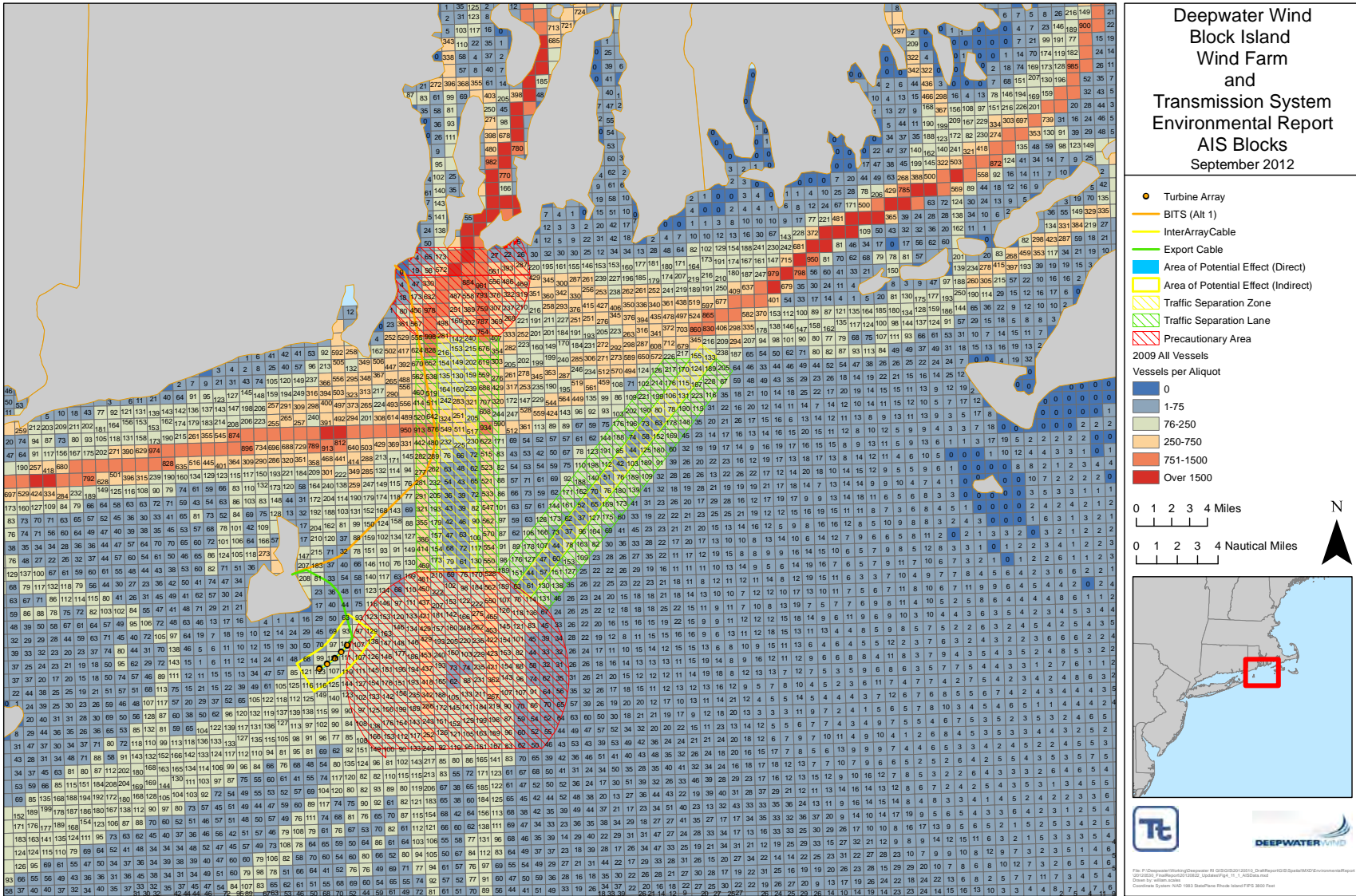
Cruise ships and local sightseeing vessels, such as those owned and operated by Royal Caribbean International and Cunard Lines, frequently travel through the Rhode Island Sound en route to Newport or to tour the local area. Commercial vessels also travel through the Rhode Island Sound to reach the Port of Providence, which sees significant ship calls from tankers, and Davisville, Newport, and Fall River, Massachusetts, which see significant ship calls from dry cargo vessels.

Submarines generally travel in deeper waters outside of the Project Area. Submarine traffic that originates from New London, Connecticut, travels on the surface through the southwest portion of Block Island Sound to reach deepwater Naval Fleet Operations Submarine Lanes that have a depth of 100 fathoms (600 ft) (RI Ocean SAMP 2011). The WTG Array is outside of the naval operations area (Figure 3.3-1).

#### **4.11.1.2 Land Transportation**

On the mainland, the onshore portion of BITS Alternative 1 is expected to cross RI Route 1A (also known as Beach Street) and to be within 2,000 ft (609.6 m) of RI Route 108 (Figure 3.1-2). RI Route 1A is 34.4 mi (55.4 km) long and is divided into five separate sections. BITS cable route Alternative 1 is expected to cross the fifth section of RI Route 1A, which is 12.7 mi (20.4) long and follows Kingstown Road, Beach Street at the Narragansett Town Beach, Boston Neck Road into Narragansett's business district, crosses RI Route 138, and terminates at Brown Street and West Main Street in North Kingstown. RI Route 108 is 8.6 mi (13.8 km) long and extends from Ocean Road in Narragansett to Route 138 in Kingston. In the area near BITS Alternative 1, US Route 1 experiences traffic counts of about 40,000 vehicles per day, RI Route 1A experiences traffic counts of about 9,200 vehicles per day, and adjacent portions of RI Route 108 experience traffic counts ranging from 5,400 to 18,600 vehicles per day (RIDOT 2009).

Figure 4.11-1 AIS Data





There are no federal or state highways on Block Island. The local roads in closest proximity to the anticipated Block Island cable route are Corn Neck Road, Beach Avenue, and Ocean Avenue (Figure 3.1-1). Traffic counts are not available for these roads.

The Quonset Point Port Facility/Business Park, located in North Kingstown, will serve as a logistics hub for the development of the offshore wind facility and will operate 24 hours per day. The major roads in closest proximity to the Quonset Point Port Facility/Business Park are US Route 1, RI Route 402, and RI Route 403. RI Route 402 is 1.2 mi (1.9 km) long and extends from Route 2 in East Greenwich to US Route 1 in North Kingstown. RI Route 403 is 4.5 mi (7.2 km) long and extends from US Route 4 in East Greenwich to the intersection of Roger Williams Way and Commerce Park Road in Quonset. US Route 1 in this area experiences traffic counts of 19,500 vehicles per day (RIDOT 2009). Traffic counts are not available for RI Route 402 or RI Route 403.

#### **4.11.1.3 Aviation**

There are three public-use and four private-use airports within approximately 20 nm (37 km) of the WTG Array. The three public-use airports are Block Island State Airport and Westerly State Airport in Rhode Island and Montauk Airport in New York. The latter two airports have runways of at least 3,200 ft (975.36 m). The private landing facilities are the Shore Heliport and Stonington Airpark in Connecticut and Westerly Hospital and East Arnolda Farm in Rhode Island. Located on central Block Island, the Block Island State Airport is in closest proximity to the WTG Array. The airport's two adjacent runways are oriented generally east to west and have established instrument approach procedures (AirNav 2011).

### **4.11.2 Impacts and Proposed Mitigation Measures**

#### **4.11.2.1 BIWF**

##### **Marine Transportation and Navigation**

The proposed vessels and vessel transit routes for construction of the BIWF are described in Section 3.3.4 and represented on Figure 3.3-1. These construction vessels are anticipated to temporarily increase vessel traffic in the Project Area but not significantly over the current number of vessels operating in and around Rhode Island Sound. The vessel activity related to construction of the BIWF will be concentrated at the locations of the WTG Array and Export Cable, which are outside of high vessel density areas as identified by AIS data. Some temporary diversion of commercial traffic near Old Harbor is anticipated during installation of the BIWF cable, which is scheduled to occur 24 hours per day. The relative increase in vessel traffic will be greater in the area of the WTG Array and Export Cable compared to the rest of the Rhode Island Sound. However, this increase will also be short-term.

Construction activities could potentially stop due to weather constraints or other limits necessitating work stoppage, including wind and wave conditions. In such an event, construction vessels could temporarily locate to one of the designated stand-by areas for the Project construction, as shown on Figure 3.3-1. Construction vessels may also wait in these areas under normal weather conditions until they are needed at the construction site. Vessels in this area will sail at slow speed in circles awaiting the call to mobilize to the construction site. Deepwater Wind sited these areas outside of Recommended Vessel Routes, TSS, and areas of high density vessel traffic as shown by the AIS data on Figure 4.11-1. In addition, the boundaries of these areas will be communicated to the marine vessel public through Local Notices to Mariners (LNMs) and Deepwater Wind's website. Deepwater Wind will not impose any restrictions on other vessels transiting through these stand-by areas or the rest of the Project Area areas during construction.

The presence of construction vessels in the Project Area will not affect vessel safety. Deepwater Wind will follow the required procedures for filing LNM and float plans with the USCG prior to commencing construction. In addition, Deepwater Wind will develop a construction communication plan that will include use of a website for public notices and a CRMC-approved Fisheries Liaison who will coordinate specifically with the fishing community during construction.

The short-term nature of the construction impacts and the proposed mitigation measures would result in a temporary and minor impact on marine traffic and transportation during construction of the BIWF.

During the operational phase, maintenance vessels will operate in and around the BIWF as policy and procedures dictate and as maintenance or other situations require. The routine maintenance and operation of BIWF are not expected to cause any traffic disruption in the Project Area. Deepwater Wind will submit an LNM to the USCG as appropriate for maintenance activities that require a vessel to remain on site for the duration of the activity. Additionally, the Inter-Array Cable is unlikely to be used for anchoring a vessel under normal circumstances due to seafloor composition and water depth.

The presence of the five WTGs off of Block Island will not negatively impact commercial navigation safety. Based on the results of the navigational risk assessment in Appendix U, the WTGs will not increase the risk of collision between vessels or the risk of allision between a vessel and a WTG. The location of the BIWF at the outer limit of the Precautionary Area for Narragansett and Buzzards Bays and the lighting and marking of the WTGs minimizes potential for increased risk to vessel traffic in the areas of highest vessel density. The WTGs will be lit, individually marked, and maintained as PATON. To distinguish the end turbines from those in the middle, WTGs 1 and 5 will each have 2 synchronized flashing lights (ISO 50 FPM) of 4 nm (7.4 km) visibility, while WTGs 2 through 4 will each have 2 synchronized flashing lights (ISO 20 FPM) of 2 nm (3.7 km) visibility. The WTGs will be painted bright white or light grey color (less than 5 percent grey tone), and will have sound signals that will be decided through direct consultation with the USCG.

The WTGs may interrupt lighthouse navigation lighting characteristics from the Block Island Southeast Light (USCG Light List Number 640) during passage through the approach to the TSS for Narragansett Bay. Overall, however, the lighting and marking on the WTGs will enhance the mariner's position fixing ability in the area. The WTGs may only pose a risk during exceptional circumstances such as a disabled ship or human error. Also, it is possible that smaller recreational vessels may encroach on the WTGs, particularly if the foundation structures serve as fish havens.

### **Land Transportation**

Construction activities of the Export Cable on Block Island will temporarily disrupt normal traffic operations within the Project Area. Deepwater Wind anticipates that equipment and components of the Export Cable will be transported to the construction site using normal roads and rights of way, as well as using existing ferries/commercial transportation means.

Construction activities are scheduled to occur in winter and spring to avoid the busier summer tourist season on Block Island. Deepwater Wind will work with the Rhode Island Department of Transportation (RIDOT) and local officials to communicate construction plans and prepare appropriate public notices. As a result, the impacts on local traffic and transportation on Block Island are expected to be short-term and minor.

During operation, the Export Cable will be buried within a concrete-encased duct bank within existing road rights-of-way. Operation and maintenance activities at the Block Island Substation will attract occasional vehicles, but is not expected to interrupt normal traffic operations on the Island.

### **Aviation**

Construction of the BIWF will have minimal temporary impacts on air navigation. Deepwater Wind will submit a notice to the FAA for any cranes that require a temporary notice during the construction of the BIWF and the BITS.

On April 2, 2012, Deepwater Wind submitted to the FAA a Notice of Proposed Construction or Alteration for each of the five WTGs to seek a determination about operation of the BIWF. The FAA has begun their aeronautical review of the WTGs and a decision is still pending.

Deepwater Wind has developed a proposed FAA marking and lighting scheme for the WTGs in accordance with FAA Advisory Circular AC 7460-1K as summarized above in the Marine Transportation and Navigation section. Each WTG will have an aeronautical light on top of the nacelle. Deepwater Wind proposes to install the FAA L-864 medium-intensity, red-colored flashing lights for nighttime lighting. The lights on each WTG will flash simultaneously at a rate of 20 flashes per minute. Aeronautical lights will be placed on top of the nacelle to allow visibility from 360 degrees. The WTGs will be painted a white or light grey color (less than 5 percent grey tone) to improve their daytime visibility.

### **4.11.2.2 BITS**

#### **Marine Transportation and Navigation**

Impacts on marine vessel traffic and safety associated with the construction of the BITS will generally be as described for the BIWF (see Section 4.11.2.1). However, the BITS cable route traverses areas with higher vessel traffic density than the location of the BIWF. The BITS submarine cable route coincides with the Narragansett Bay TSS outbound lane for approximately 8 nm (14.8 km). Some temporary dislocation or diversion of commercial traffic within the TSS and near Old Harbor is anticipated during marine installation of the BITS, which is scheduled to occur 24 hours per day. As a result, the relative increase to commercial vessel traffic will be less for the BITS than the BIWF. Impacts on commercial vessel traffic during construction of the BITS are expected to be short-term and minor.

Deepwater Wind will implement the same impact avoidance, minimization, and mitigation measures for construction of the BITS as for the BIWF, including filing LNMs and float plans with the USCG and developing a communication plan for construction that involves maintaining a Project website and coordinating with the fishing community through a fisheries liaison. Adherence to the International Regulations for Preventing Collisions at Sea 1972 (COLREGS) and the “Rule of Good Seamanship” by vessel operators will mitigate risks posed to safe navigation by the construction activities of the BIWF and BITS.

The BITS will be a submarine cable and, as a result, will not have any impacts on marine transportation and navigation during the operational phase. The BITS cable is unlikely to be used for anchoring a vessel under normal circumstances due to bottom configuration and water depth. Additionally, vessels are discouraged from anchoring in or near a TSS. Under exceptional circumstances when anchoring in the TSS may be required, the undersea cabling depicted on navigation charts will assist mariners in identifying appropriate areas for anchoring, thus minimizing any potential risks to BITS infrastructure.

Decommissioning activities will have no additional impacts to marine transportation and navigation as decommissioned cables will be abandoned in place.

### **Land Transportation**

Impacts on land transportation and traffic of the BITS on Block Island will be as described for the BIWF, because the BITS cable will be collocated in the same trench with the Export Cable (see Section 4.11.2.2).

On the Rhode Island mainland, the transport of materials, personnel, and equipment in and out of the Quonset Point Port Facility/Business Park will likely result in minor and temporary increases in traffic along the surrounding major roadways. All equipment will be transported over the road (RI Routes 4 and 403) and will have a maximum size comparable to containers during transportation. In addition, construction of the BITS Alternative 1 will also likely result in the temporary disruption of normal traffic operations within the Project Area. As stated previously, construction activities are scheduled to occur in winter and spring to avoid the summer tourist season. Deepwater Wind will work with the RIDOT and local officials to communicate construction plans and prepare appropriate public notices. As a result, the impacts on local traffic and transportation on the Rhode Island mainland are expected to be short-term and minor.

### **Aviation**

The BITS will not have any impact on airspace navigation. Offshore, the cable will be submerged. Onshore, the substation and any overhead line poles are not tall enough and not located near public or private airports and, as a result, will not affect airspace navigation and will not require notice to the FAA.

#### **4.11.2.3 Combined Effects**

The greatest combined effects to marine transportation and navigation, land transportation, and aviation will be during construction of the Project. However, the combined effects, due to the locations, construction schedules and configurations of the Project facilities, are not anticipated to be significant.

Construction vessels required for installation of offshore BIWF and BITS cables, facilities onshore Block Island, and the Turbine Array are anticipated to temporarily increase vessel traffic in the Project Area and would result in a temporary and minor impact on marine traffic and transportation. This cumulative increase, with consideration of the construction schedule (Table 3.7-1), will not be significant in comparison to the current number of vessels operating in and around the Rhode Island Sound.

With the exception of the installation of facilities onshore Block Island and use of the Quonset Point Port Facility/Business Park, the BIWF and BITS facilities are located such that combined effects to land transportation are not anticipated. The BIWF and BITS cables and switchyards on Block Island will be collocated along existing roadways and on existing BIPCO property. Installation of the BIWF and BITS cables within the same trench along existing roadways and the Block Island Substation within existing BIPCO property will not cumulatively interrupt the normal flow of traffic or use of the roadways more than the individual installation of the BIWF or BITS facilities. Additionally, the transport of materials, personnel, and equipment in and out of the Quonset Point Port Facility/Business Park will likely result in minor and temporary increases in traffic along the surrounding major roadways; however, the increase will not be significant in the context of existing traffic levels along the surrounding major roadways.

The BITS will not have any impact on airspace navigation and so there will be no cumulative effects on aviation.

## 4.12 Socioeconomics

This section discusses the socioeconomic resources that could be affected by the construction and operation of the proposed BIWF and BITS, including commercial and recreational fishing, recreation and tourism, housing, transportation, public services, and environmental justice. Additional details on commercial and recreational fishing are found in Sections 4.7.1 and 4.9. Further information on recreation and tourism are also found in Section 4.10. The potential for the Project to impact transportation and traffic is discussed in Section 4.11.

### 4.12.1 Affected Environment

The proposed onshore Project facilities will be located in the towns of New Shoreham and Narragansett in Washington County, Rhode Island. Staging and laydown areas for offshore construction will be located at the Quonset Point port facility in North Kingstown, also in Washington County, Rhode Island.

#### 4.12.1.1 Population, Economy and Employment

Population statistics for Washington County, Rhode Island, and the communities affected by the construction and operation of the BIWF and BITS are presented in Table 4.12-1.

**Table 4.12-1 Existing Economic Conditions in the Vicinity of the BIWF and BITS Projects**

Geography	2010 Population	Population Density (persons per square mile)	2010 Per Capita Income	2010 Civilian Labor Force	2010 Unemployment Rate	Top 3 Industries
Rhode Island	1,052,567	1,018.1	\$27,667	551,014	7.0%	E, R, M
Washington County	126,979	385.7	\$33,439	69,573	5.6%	E, A, R
New Shoreham	1,051	103.8	\$48,212	609	1.9%	A, C, E
Narragansett	15,868	1,125.4	\$37,159	8,815	3.3%	E, A, P
North Kingstown	26,486	607.5*	\$40,201	14,551	4.1%	E, M, R

Sources: U.S. Census Bureau 2010a, 2010b.  
 Note: As of the writing of this ER, the U.S. Census Bureau has not released Summary File 2 for the state of Rhode Island, which includes income and employment data. American Community Survey 5-year and 3-year 2010 estimates were reviewed to obtain this information for this ER.  
 \*Calculated based on land area obtained from internet sources.  
 E = Educational Services, and health care and social assistance; R = Retail trade; M = Manufacturing; A = Arts, entertainment, and recreation, and accommodation and food services; C = Construction; P = Professional, scientific, management, administrative and waste management services.

Population trends in Rhode Island between 2000 and 2010 have shown a 0.4 percent increase from 1,048,319 to 1,052,567 persons. Washington County's population increased between 2000 and 2010 by 2.8 percent from 123,546 to 126,979 persons (U.S. Census Bureau 2011a, 2011b). The towns of New Shoreham, Narragansett, and North Kingstown have a combined population of 43,405 and comprise 34.2 percent of Washington County's total population. The population on Block Island increases more than ten times from the permanent winter population of approximately 1,000 to 11,000 persons during the summer tourist season (Town of New Shoreham 2009).

The number of people in the civilian labor force in Washington County increased from 67,250 in 2000 to 69,801 in 2010. From 2000 to 2010, the civilian labor force within each town increased between 3.0 percent and 7.7 percent, with the exception of Narragansett, where there was a 5.1 percent decline. According to the U.S. Census Bureau, of the people counted in the civilian labor force (Table 4.12-1), 1.9 percent in New Shoreham, 3.3 percent in Narragansett, and 4.1 percent in North Kingstown are

unemployed compared to 5.6 percent in Washington County (U.S. Census Bureau 2011b). In 2010, the major industry group by employment in New Shoreham was arts, entertainment, recreation, and accommodation and food services. The major industry group by employment in Narragansett and North Kingstown was educational services, health care, and social assistance. Section 4.13.7.1 describes recreational tourism in Rhode Island as an economic resource.

#### 4.12.1.2 Housing and Property Values

Housing statistics for Washington County, Rhode Island, and the communities affected by the BIWF and BITS Project are presented in Table 4.12-2. In 2010, Washington County had 14,414 vacant housing units with a housing vacancy rate of 23.2 percent. The relatively high vacancy rate in Washington County reflects the seasonal status of much of the housing. Of the vacant housing units in New Shoreham, Narragansett, and North Kingstown, 69.3 percent, 24.4 percent, and 3.3 percent are categorized as housing for seasonal, recreational, or occasional use (U.S. Census Bureau 2010b). There are also numerous temporary housing options such as apartments, bed-and-breakfast facilities, campgrounds, and recreational vehicle sites that could serve as temporary housing for the anticipated BIWF and BITS workforce.

Median value of owner-occupied units in 2010 ranged from \$347,300 in North Kingstown to \$1,000,000+ in New Shoreham; median value for owner-occupied units for the state was \$254,500.

**Table 4.12-2 BIWF and BITS Project Area Housing Statistics**

Geography	Total Housing Units	2010 Housing Vacancy Rate (%)	Median Value of Owner-Occupied Units (dollars)
Rhode Island	463,416	13.2	\$254,500
Washington County	62,251	23.2	\$342,300
New Shoreham	1,683	73.6	\$1,000,000+
Narragansett	9,910	31.1	\$426,200
North Kingstown	11,327	8.8	\$347,300

#### 4.12.1.3 Public Services

A wide range of public services and facilities are available in Washington County, including hospitals, full-service law enforcement, paid and volunteer fire departments, and schools. Table 4.12-3 provides a summary of the public services in the vicinity of the BIWF and BITS Project Area.

**Table 4.12-3 Public Services in the Vicinity of the BIWF and BITS Project**

Geography	Hospital (Type)	Number of Hospital Beds	Fire Department (Type)	Number of Fire stations/ Personnel	Number of Law Enforcement Personnel	Number of Schools
Washington County	2 acute care hospitals	225				
New Shoreham	1 clinic	0	Volunteer	1/40	4	1
Narragansett	0	N/A	Paid	3/35	39	3
North Kingstown	0	N/A	Paid	4/64	36	8

Sources: New Shoreham website, Narragansett Fire Fighters website, Narragansett website, North Kingstown website and personal communication, Rhode Island Department of Elementary and Secondary Education's 2011-2012 enrollment data, Wilson 2012.

There are two hospitals in Washington County with a combined total of 225 beds. South County Hospital in Wakefield, Rhode Island, is an independent, non-profit, 100-bed acute care hospital that serves southern Rhode Island. Westerly Hospital in Westerly, Rhode Island, is a 125-bed community hospital that provides Washington County, Rhode Island, and New London County, Connecticut residents with medical, surgical, laboratory and rehabilitative services. The Town of New Shoreham offers basic healthcare and emergency services at the Block Island Medical Center. Block Island residents and guests have access to landside medical resources in Washington County. Kent Hospital in Warwick, Rhode Island, also is a medical resource available to the Washington County community. Newport Hospital in Newport, Rhode Island, is within a 30-minute drive from many of the communities of southern Rhode Island. In addition, the medical resources of Providence, Rhode Island, are available to all Rhode Island residents.

The towns of New Shoreham, Narragansett, and North Kingston have Police Departments with approximately 79 police officers. Two of the Fire Departments in these towns are paid and one is a volunteer, with each department having between one and four fire stations.

The towns of Narragansett and North Kingston offer six public elementary schools, three public middle schools, and two high schools. The town of New Shoreham has only one public school that serves grades K through 12.

#### **4.12.1.4 Transportation and Traffic**

The BIWF and BITS Project Area is accessible through a network of interstate highways and major arterial roads, airports, and public transit, including railway, bus, and ferry systems. Descriptions of these transportation systems and the potential impact on the construction and operation of the BIWF and BITS on these systems are detailed in Section 4.11.

#### **4.12.1.5 Commercial and Recreational Fishing**

##### **Commercial Fishing**

Commercial fishing, including ground fish, pelagic, and invertebrate fisheries, is an economically important activity within Rhode Island Sound. Accounting for dollar value, catch is dominated by lobster and squid, followed by shellfish (quahog and scallop) and other fish such as monkfish, summer flounder, and scup (see also Section 4.9.1). The fish species taken commercially are managed by the New England Fishery Management Council, Mid-Atlantic Fishery Management Council, the Atlantic States Marine Fisheries Commission, and NOAA Fisheries through a number of fisheries management plans.

Table 4.12-4 provides a summary of total annual NOAA Fisheries reviewed commercial landings by weight and dollar value for species landed in the state of Rhode Island.

The majority of the BIWF and BITS Project Area supports commercial fishing activities, including both fixed and mobile gear. Fishing effort is variable both seasonally and yearly, depending on individual fisherman preferences, vessel type, species, regulatory environment, and market demand. Fishing effort also varies in location and intensity throughout the year because fishermen follow their target species on their seasonal migrations. In the waters around the BIWF WTGs and Inter-Array Cable, lobster traps dominate areas of hard bottom where trawling is unlikely to occur. However, the northern portions of the BIWF WTG area, including the Inter-Array and Export Cables, are considered to be moderately to heavily trawled and limited gillnet activity occurs here from spring through fall (RI Ocean SAMP 2011). In addition, during this time period, trawlers targeting squid can be found in the area south of Point Judith

and Charlestown. Similarly, along the BITS, moderate to heavy trawling occurs in the deeper waters of the approach to the West Passage of Narragansett Bay with lobster gear nearshore (RI Ocean SAMP 2011). Activity increases from spring through fall, with gillnets also being fished in the waters off Point Judith (RI Ocean SAMP 2011).

**Table 4.12-4 Annual Commercial Fish Landings for Rhode Island**

Year	Metric Tons	Pounds	Dollar Amount
1999	57,118.6	125,923,640	\$86,034,495
2000	55,053.7	121,371,349	\$80,965,288
2001	52,940.6	116,712,882	\$68,657,137
2002	46,960.8	103,529,841	\$64,717,705
2003	44,205.7	97,455,982	\$66,087,688
2004	52,180.7	115,037,493	\$77,564,724
2005	44,255.0	97,564,603	\$91,407,656
2006	51,077.8	112,606,107	\$98,488,398
2007	34,104.3	75,186,322	\$73,547,814
2008	32,629.7	71,935,477	\$68,890,449
2009	38,326.5	84,494,523	\$61,663,113
2010	35,143.2	77,476,775	\$62,676,833
<b>Average Annual Totals:</b>	<b>45,333.1</b>	<b>99,941,250</b>	<b>\$75,058,442</b>
Source: NOAA 2012			

### Recreational Fishing

Marine recreational fishing, including both recreational anglers and recreational fishing aboard private boats and party and charter boats, is a major recreational activity for Rhode Islanders, as well as a major tourist attraction that brings in visitors from out-of-state, and in turn has a significant economic impact. As reported in the RI Ocean SAMP (2011), according to the NOAA Fisheries Marine Recreational Fisheries Statistics Survey program, during 1999 through 2008, an average of nearly 385,000 people participated in recreational ocean fishing in Rhode Island each year, making over 785,000 fishing trips annually. These figures include both Rhode Island residents and out-of-state fishermen. While the economic value to Rhode Island associated with recreational fishing peripheral activities (charter fees, gas, bait, provisions, lodging) is difficult to quantify, licensing fees alone generated \$249,746 with the issuance of 38,224 licenses in 2011 under the Rhode Island Saltwater Recreational Fishing License Program enacted in April 2010 (RIDEM 2011).

The most commonly targeted recreational species include Atlantic bonito (*Sarda sarda*), Atlantic cod (*Gadus morhua*), black sea bass (*Centropristis striata*), bluefish (*Pomatomus saltatrix*), scup (*Stenotomus chrysops*), striped bass (*Morone saxatilis*), summer flounder (*Paralichthys dentatus*), winter flounder (*Pseudopleuronectes americanus*), tautog (*Tautoga onitis*), and yellowfin tuna (*Thunnus albacares*) (NOAA 2009c) (see also Section 4.9.1). Input provided by fishermen to the RI Ocean SAMP mapping effort indicates that all state waters surrounding Block Island, including the BIWF and BITS Project Area, are fished recreationally for these species. Out of the three types of saltwater recreational fishing activities (shore, private/rental vessels, and party/charter vessels), fishing by private vessel makes up over 45 percent of saltwater fishing within the state of Rhode Island while party/charter vessel fishing makes up roughly 5 percent (RI Ocean SAMP 2011). Shore-based fishing, while making up 50 percent of Rhode Island saltwater fishing, by definition, does not occur within the proposed locations for BIWF WTGs,



Inter-Array and Export Cables, and BITS, except potentially at locations where the Export Cable and BITS come ashore.

#### 4.12.1.6 Recreation and Tourism

Rhode Island tourism is centered on marine recreational activity like boating, sailing, diving, and wildlife viewing, as well as seaside travel destinations and shore-based activities such as surfing or beach going (see also Section 4.9.1). These recreational uses generate major economic benefits for the state of Rhode Island. The economy of Block Island consists mainly of businesses and services directly or indirectly related to the resort and vacation sector (Town of New Shoreham 2009).

Recreation and tourism in the state of Rhode Island are largely seasonal, with coastal communities doubling and tripling in population during the summer months. The seasonal nature of Rhode Island's coastal tourism is most pronounced on Block Island. New Shoreham has a year-round population of approximately 1,000 people, with population increasing to approximately 11,000 people during the summer months.

According to the RI Ocean SAMP, tourism and hospitality is Rhode Island's fourth largest industry based on employment, contributing \$6.8 billion in spending and generating 12 percent of all state and local tax revenue in 2007. In 2007, over 5.7 million visitors were determined to visit the region adjoining the RI Ocean SAMP area, with a large portion of visitors coming from out of state. The RI Ocean SAMP reports that according to the National Ocean Economics Program, in 2004 the recreation and tourism industry in both coastal counties adjacent to the RI Ocean SAMP area (Washington County and Newport County) included 779 different establishments and 10,086 employees. The industry was also calculated to have paid over \$161 million in wages and produced \$393 million in gross domestic product in 2004.

Marine events such as sailboat races also contribute considerably to the economies of host cities and towns. Participants and spectators of marine events support local economies through their spending before, during and after a race or other marine event (see Table 4.12-5). The majority of Rhode Island-based sailboat racing takes place in Narragansett Bay; however, those races involving larger vessels occur offshore within the RI Ocean SAMP area each year. Block Island hosts many buoy sailboat races during the annual Block Island Race Week usually occurring the third week of June.

**Table 4.12-5 Distribution of Expenditures Associated with Competitive Sailboat Racing Events**

Expenditures	Average Range of Total Spending Per Event
Race-related costs	60-70%
Lodging	10-15%
Food	10-15%
Transportation	10%
Shopping	3-5%
Entertainment	2%

Source: R.I. Economic Monitoring Collaborative 2008 as cited in RI Ocean SAMP 2011

#### 4.12.1.7 Environmental Justice

Executive Order 12898 requires federal agencies to take appropriate steps to identify and address disproportionately high and adverse health or environmental effects of federal actions on minority and low-income populations. According to CEQ environmental justice guidance under NEPA (CEQ 1997), minorities are those groups that include American Indian or Alaskan Native; Asian or Pacific Island;

Black, not of Hispanic origin; or Hispanic. Minority populations are defined where either (a) the minority population of the affected area exceeds 50 percent or (b) the minority population of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. The CEQ guidance also directs low-income populations to be identified based on the annual statistical poverty thresholds from the Census Bureau. For the purpose of analysis in this ER, low-income populations are defined as those individuals with reported income below the poverty level.

Table 4.12-6 summarizes the percentage of state, county, and town populations that would be considered minority or low-income for the purpose of analysis in this ER. Because the minority populations in the communities surrounding the Project Area do not exceed 50 percent, and the percentage of minorities and people with income below poverty level are not significantly higher than for the state of Rhode Island, there are no environmental justice communities near the Project Area.

**Table 4.12-6 Income and Minority Population Levels**

Geography	Total Population	2010 Percentage of People with Income Below Poverty Level	Hispanic or Latino (% of total population)	Minority not Hispanic or Latino (% of total population)	Total Minority (% of total; Hispanic or Latino plus Minority not Hispanic or Latino)
Rhode Island	1,052,567	14.0	12.4	11.2	23.6
Washington County	126,979	8.7	2.4	5.2	7.6
New Shoreham	1,051	11.2	2.9	2.4	5.3
Narragansett	15,868	17.2	1.7	3.7	5.4
North Kingstown	26,486	6.7	2.4	4.5	6.9

Sources: U.S. Census Bureau 2010a, 2010b.  
 Note: As of the writing of this ER, the U.S. Census Bureau has not released Summary File 2 for the state of Rhode Island, which includes income and employment data. The American Community Survey 5-year estimates (2006-2010) and 3-year estimates (2008-2010), as available for each community, were reviewed to obtain this information for this ER.

## 4.12.2 Potential Impacts and Proposed Mitigation

### 4.12.2.1 BIWF

#### Population, Economy, and Employment

Fabrication and construction activities for the BIWF will require a workforce of up to 400 personnel (both in Rhode Island and out of state) during the peak of the anticipated eight-month construction period. Deepwater Wind will hire local workers, if available, for WTG pile fabrication and construction, and anticipates that up to 100 personnel for project management, fabrication, and construction would be hired locally within the state of Rhode Island (approximately 25 percent of the total construction workforce). Additional construction personnel hired from outside the state of Rhode Island will typically include mariners, cable manufacturing personnel, and other specialists who may temporarily relocate to the communities surrounding the Project Area during the construction period.

Operation of the BIWF will require a full-time, onshore staff of approximately two employees over the 25-year life of the BIWF and the marine and landside resources required to maintain and service the facilities.

Decommissioning of the BIWF will likely require a workforce of 150 personnel during an estimated two-month decommissioning period. Deepwater Wind will hire local workers for decommissioning and disposal if available.

Population impacts within the communities surrounding the Project Area will result primarily from the temporary influx of construction personnel. The total population change will equal the total number of non-local construction workers plus any family members that may accompany them. However, because of the short duration of construction activities, it is unlikely that non-local workers will relocate families to the area. Because Deepwater Wind estimates that 25 percent of the workforce will be local hires, only about 20 to 40 non-local workers are anticipated to relocate to the Project Area during construction. This small, temporary increase will not result in a substantial or permanent impact on the population, but the employment of both local and non-local workers may benefit the local economy during each phase of the Project (construction, operation, and decommissioning).

In addition to the direct economic benefits associated with the jobs and wages resulting from the Project, the development of the BIWF will also likely facilitate new and existing business expansion opportunities. In addition, Deepwater Wind's investments in the state of Rhode Island in support of the Project will help the state reap the economic development benefits from the anticipated growth of the offshore wind industry in the Northeast (RIEDC 2010 as amended). In 2010, the RIEDC commissioned a study to evaluate the overall economic benefits of the BIWF Project. Based upon the results of the study, the RIEDC concluded that estimated economic benefits attributable to the BIWF is \$129 million in constant 2010 dollars terms and \$102 million in net present value terms as of January 1, 2013 (RIEDC 2010 as amended).

### **Housing**

As stated in Section 4.13.1.2, adequate housing is available to accommodate the anticipated non-local construction workforce. The Project is expected to have a small, temporary but positive impact on the area rental industry through increased demand and higher rates of occupancy. However, no significant impacts on the local housing markets are expected.

Given the housing vacancy rates and the number of other temporary housing options available in the communities near the Project Area, the non-local workforce associated with the Project should not encounter difficulty in finding temporary housing and will not be expected to cause housing shortages.

### **Public Services**

Construction of the BIWF is not expected to affect public services or infrastructure, particularly given the relatively small number of non-local workers anticipated to relocate temporarily to the Project Area. The influx of non-local workers associated with the BIWF Project will be small relative to the current populations in the Project Area. Washington County and the communities in the Project Area have adequate infrastructure and services to meet the needs of the non-local workers.

During operations, Deepwater Wind O&M personnel will be trained to perform their jobs properly and safely, including proper training in the operations of all equipment, workplace safety, and incident response. Deepwater Wind has prepared a Draft Emergency Response Plan for the Project (included as an appendix to Appendix U) in the event of an emergency situation. This plan will be reviewed with the USCG and state and local emergency response agencies prior to the construction and operation of the Project. In addition, prior to the commencement of construction, operation, and decommissioning activities, a facility-specific environmental compliance manual will be prepared for the Project outlining

specific construction and operating obligations. This manual, in conjunction with an Emergency Response Plan for the construction and operation of the BIWF, will ensure that no adverse impacts on public services in area communities result throughout the Project life cycle.

### **Commercial and Recreational Fishing**

During construction of the BIWF, active commercial and recreational fishing activities may be temporarily disrupted during the installation of the WTGs and associated Inter-Array and Export Cables; however, given the approximate five-month marine construction time frame for the BIWF, any impacts are expected to be short-term, minor, and localized.

To avoid direct conflicts with commercial and recreational fishing activities, the construction area will be well marked and Deepwater Wind will provide advance notification to help commercial and recreational fishermen avoid fishing in the Project Area during specific construction activities. For safety reasons, Deepwater Wind may also request commercial fishermen to deploy gear away from the Project construction area for certain periods of time to help further avoid conflicts. To support interactions with the commercial and recreation fishing industry, Deepwater Wind will develop a communication plan for the construction of the Project. The communication plan will include use of a CRMC-approved Fisheries Liaison who will support and coordinate the interaction with the fishing community. This communication plan coupled with public notice of the BIWF will help to ensure minimal disruption to regular fishing activities in the Project Area and avoid potential gear issues with the fishing industry.

During operation of the BIWF, Deepwater Wind does not propose to implement any exclusion areas within the WTG Array or along the proposed Inter-Array or Export Cables. However, Deepwater Wind is considering an approximately 300-ft (91.4-m) safety radius on the seafloor around each turbine foundation to ensure protection of the J-tube structure at the base of each turbine used to interconnect the Inter-Array and Export Cables with the WTGs. Within this area, Deepwater Wind would discourage the use of mobile fishing gear types that have direct contact with the bottom, such as otter trawls and dredges. Fixed gear, such as traps and gillnet, will not be subject to this restriction.

The design life of the jacket foundations is 25 years. Decommissioning, as with construction, will be temporarily disruptive to active commercial and recreational fishing activities in the area. The impacts on the commercial and recreational fishing industry resulting from the decommissioning of BIWF structures will not be materially different from construction; therefore, impacts on commercial and recreational fishing activities are expected to be short-term, minor, and localized.

### **Recreation and Tourism**

Construction of the BIWF could temporarily affect coastal and marine recreational activities such as boating, sailboat racing, wildlife viewing and recreational fishing within the proposed construction area for the WTGs and along the cable corridors associated with the Inter-Array and Export Cables. However, given the approximate five-month marine construction schedule for the BIWF, these impacts are expected to be short-term and minor. In addition, construction within the Project Area will only affect discrete portions of the Rhode Island Sound and will not preclude recreational activities from occurring in the surrounding portions of the Sound. As described previously, Deepwater Wind will implement a communication plan during construction to inform the public and associated businesses of construction activities and vessel movement. In addition, Deepwater Wind will coordinate its construction schedule with local sailboat race organizations and local municipalities to avoid disruptions to these popular sailing events.

During operation of the BIWF, no navigation exclusion areas would be implemented for any vessels. Therefore, no adverse impacts on recreation and tourism are expected. The wind farm itself may become a tourist attraction, contributing additional revenues to state and local economies.

Decommissioning, as with construction, will be temporarily disruptive to coastal and marine recreation and tourism activities in the area. However, the decommissioning of the BIWF will not be materially different from construction; therefore, impact on recreation and tourism are expected to be short-term, minor, and localized.

### **Environmental Justice**

As discussed in Section 4.12.1.7, there are no environmental justice communities near the Project Area. Therefore, the BIWF will not result in disproportionately high and adverse effects to minority and low-income populations. Furthermore, the Project is expected to provide a beneficial economic impact on local communities through employment opportunities, construction payroll expenditures, purchases of construction goods and materials, and local expenditures by workers, regardless of race or income group.

#### **4.12.2.2 BITS**

##### **Population, Economy, and Employment**

Construction of the BITS, including the onshore and offshore portion of the BITS line and the associated onshore facilities, including the switchyard on Block Island and the switchyard in Narragansett, will require a workforce of approximately 150 personnel during the anticipated eight-month construction period. Deepwater Wind will hire local workers for construction if available, and local personnel could account for up to 50 percent of the total BITS construction workforce. Additional construction personnel hired from outside the state of Rhode Island will typically include mariners, cable manufacturing personnel, and other specialists who may temporarily relocate to the communities near the Project Area during the construction period.

Operation of the BITS is anticipated to be managed by TNEC and therefore performed by existing TNEC workforce throughout the operational life of the Project.

Because the purpose of the BITS is not only to provide a transmission path for energy from the BIWF to the Rhode Island mainland, but also to electrically interconnect Block Island to the Rhode Island onshore transmission grid, there are no plans to decommission the BITS at this time.

Population impacts within the Project Area will be similar to those described for the BIWF in Section 4.12.2.1 and primarily result from the temporary influx of construction personnel. As described previously, because of the short duration of construction activities, it is likely that only a small number of non-local workers will relocate families to the area. This small, temporary increase will therefore not result in a substantial or permanent impact on the population.

As described for the BIWF, the employment of both local and non-local workers associated with the construction and operation of the BITS may benefit the local economy by providing a beneficial economic impact on local communities through employment opportunities, construction payroll expenditures, purchases of construction goods and materials, and local expenditures by workers.

### **Housing**

Impacts on housing associated with the construction and operation of the BITS will be as described for the BIWF (see Section 4.12.2.1).

## **Public Services**

Impacts on public services associated with the construction and operation of the BITS will be as described for the BIWF (see Section 4.12.2.1).

## **Commercial and Recreational Fishing**

Impacts on commercial and recreational fishing and proposed mitigation measures associated with the construction of the BITS will be as described for the BIWF (see Section 4.12.2.1).

No navigation exclusion areas will be implemented for any vessels along the proposed BITS route during operations. The cable is to be buried so that the operational depth below surface features will have a target depth of 6 ft (1.8 m). Two short crossings of existing cables will require cable laying on the seafloor and the installation of protective concrete mats and sand bags; however, these areas represent a minute area compared to the area available for trawl fishing in the Rhode Island Sound. Therefore, no impacts on commercial and recreational fishing during operation are expected.

## **Recreation and Tourism**

Impacts on and proposed mitigation measures for marine recreation and tourism activities for the construction and operation of the BITS will be as described for the BIWF (see Section 4.12.2.1).

Onshore construction of the BITS and associated substation facilities may cause temporary disruptions to activities such as wildlife viewing, seaside travel, and beach going (see also Section 4.10.1). These disruptions will be from the temporary increased traffic within the Project Area from BITS construction activities along and within existing roadways and the use of local roadways by construction vehicles and associated personnel (see also Section 4.11). However, given Deepwater Wind's intent to concentrate onshore construction activities between winter and early spring, these impacts are expected to be short-term and minor.

Upon completion of BITS construction, the cable on Block Island will be buried at least 4 ft (1.2 m) below the road surface. As a result, the cable will not affect seaside recreational areas on Block Island. On the mainland, the cable will be either buried or installed overhead, but will follow existing road rights-of-way through seaside recreational areas. Therefore, operation of the BITS will have no long-term effect to tourism and recreation.

## **Environmental Justice**

Impacts on Environmental Justice communities associated with the construction and operation of the BITS will be as described for the BIWF (see Section 4.12.2.1).

### **4.12.2.3 Combined Effects**

The construction and operation of both the BIWF and BITS will slightly and favorably impact the Project Area population, local economy, and employment, as well as housing, by wage and tax income to local communities and reduced temporary housing vacancy rates. By so doing, the Projects will cumulatively contribute to the economic well-being of the Rhode Island area.

Construction and operation of both the BIWF and BITS are not expected to have a cumulative effect to public services or infrastructure, particularly given the relatively small number of non-local workers anticipated to relocate temporarily to the Project Area during both construction and operation. The combined workforce for the construction of the BIWF and BITS will include up to 550 personnel at the peak of construction with 25 to 50 percent of the workforce consisting of local hires. During both

construction and operation, Deepwater Wind personnel will be trained to perform their jobs properly and safely, including proper training in the operations of all equipment, workplace safety, and incident response. In addition, the influx of non-local workers associated with the Project will be small relative to the current populations in the Project Area. Washington County and the communities in the Project Area have adequate infrastructure and services to meet the needs of the non-local workers.

Recreational fishing principally occurs outside of the Project Area. Commercial fishing has, however, been shown to occur throughout the Project Area with varying intensity depending on location and gear-type. The combined construction of the BIWF and BITS would provide an inconvenience to both mobile and fixed commercial fisheries for the eight-month construction time period, as they would be required to relocate their gear outside of the proposed BIWF and BITS construction work areas. During operations, commercial bottom trawlers would also be permanently restricted from fishing in an approximately 300-ft (91.4-m) area around each WTG. However, when considered together with the existing available fishing areas, the combined impact associated with the construction and operation of the BIWF and BITS is minor and not significant.

Recreational activities such as boating, sailing, diving, and offshore wildlife viewing principally occur outside of the Project Area. The construction of the BIWF and BITS would provide a temporary inconvenience to recreational users and tourists during the construction time period, as they would be required to maneuver around construction work areas. However, given the relatively short construction period, the cumulative impact associated with the construction of the BIWF and BITS is minor and not significant. The Project may, however, have a favorable long-term combined effect to the Rhode Island recreation and tourism economy as the BIWF itself could be considered a tourist attraction.

As discussed in Section 4.12.1.7, there are no environmental justice communities near the Project Area, therefore, the BIWF and BITS will have no impact on populations identified as environmental justice communities.

### **4.13 Public Health and Safety**

Offshore wind energy is a non-emitting, non-combustible, waste-free energy source that poses minimal risks to public health and safety. Deepwater Wind is committed to carrying out its business activities with a primary focus on health, safety, and well-being of its employees, contractors, third parties, and general public.

This section addresses the health and safety issues relevant to an offshore wind energy project and associated facilities, including public access, hazardous materials, non-routine events, and electric and magnetic fields (EMF). Public health and safety issues related to marine vessel traffic, aviation, and onshore transportation are discussed in Sections 4.9 and 4.11. Onshore emergency response facilities are discussed under public services in Section 4.12.

#### **4.13.1 Affected Environment**

The affected environment as it relates to public health and safety depends on the location of facilities in relation to existing infrastructure, public areas, and community groups that may be affected by health and safety risks related to the Project. The area immediately surrounding the Turbine Array and submerged BITS cable consists of open ocean; there are no permanent structures or other facilities near the marine portion of the Project Area. Commercial and recreational vessels are transient features of the affected environment surrounding the Turbine Array, Inter-Array Cable, and submarine Export Cable and BITS cable.

The proposed onshore Project facilities will be located in the towns of New Shoreham and Narragansett in Washington County, Rhode Island. Facilities on Block Island are located near a public beach, low-density residential, institutional, and commercial development, and an existing power generation facility. Public areas and community groups in the vicinity of the BITS Alternative 1 route consists primarily of beaches, seasonal and permanent residential development, and some commercial and institutional development. Staging and laydown for offshore construction will occur at the Quonset Point port facility in North Kingstown, also in Washington County, Rhode Island.

### ***Electric and Magnetic Fields***

Electric and magnetic fields (EMF) are associated with the operation of AC power lines or devices. Voltage moves the electricity through wires and produces an electric field. Current, which is a measure of how much electricity is flowing, produces a magnetic field. Electric and magnetic fields are characterized by the frequency at which their direction and magnitude oscillate each second. The fields produced by the use of electricity in North America oscillate at a frequency of 60 cycles per second (i.e., 60 Hz). Both electric and magnetic fields decrease relatively quickly with distance from their source. Typical sources of EMF include transmission and distribution lines, home and office appliances, tools, building wiring, and current flowing on water pipes. The contribution of these sources to overall exposure varies (Bailey 2009). Transmission and distribution lines may be the dominant, though not the only source, of EMF in residences very close to these types of power lines. Other sources can be dominant in other locations. A survey of nearly 1,000 residences in the United States reported that currents flowing on water pipes and other components of grounding systems are twice as likely as outside power lines to be the source of the highest magnetic fields measured in homes (Zaffanella 1993).

**Table 4.13-1 ICNIRP and ICES Recommended Guidelines for EMF Exposure**

Guideline	Exposure	
	Electric Field <sup>a/</sup>	Magnetic Field <sup>b/</sup>
<b>ICNIRP</b>		
Occupational	8.3 kV/m	10,000 mG
General Public	4.2 kV/m	2,000 mG
<b>ICES</b>		
Occupational	20 kV/m	27,100 mG
General Public	5 kV/m <sup>c/</sup>	9,040 mG
<sup>a/</sup> The strength of electric fields is expressed in units of kilovolts per meter (kV/m). <sup>b/</sup> The strength of magnetic fields are expressed as magnetic flux density in units of milligauss (mG). <sup>c/</sup> Within power line rights-of-way, the guideline is 10 kV/m under normal load conditions. Source: ICNIRP 2010; ICES 2002.		

Over the past 40 years, research has been conducted to address the question of whether exposure to extremely low-frequency EMF produces adverse health consequences (NIEHS 1999; IARC 2002; NRPB 2004; WHO 2007a, 2007b). The current scientific consensus is that the cumulative body of research does not support the conclusion that the statistical association between magnetic field exposure and health effects such as childhood leukemia observed in some epidemiologic EMF studies is causal (WHO 2007b; Bailey 2009). Scientific organizations have developed exposure guidelines based on reviews and evaluations of relevant health research to address the concerns related to EMF exposure. The guidelines proposed by the International Commission on Non-ionizing Radiation Protection (ICNIRP) and the International Commission on Electromagnetic Safety (ICES) are generally considered as appropriate exposure limits (WHO 2007a). Table 4.13-1 summarizes the ICNIRP and ICES exposure guidelines.



## 4.13.2 Potential Impacts and Mitigation

### 4.13.2.1 BIWF

Potential health and safety hazards related to marine and land-based construction will be short-term and minimal. Deepwater Wind will develop an overall health and safety plan prior to construction of the Project and will ensure that all contractors and third parties perform their work in accordance with the overall plan and their own specific health and safety plans. Workers will receive training in health, safety, and emergency response prior to commencing work on the Project. Additionally, as discussed in Section 4.9, Deepwater Wind will develop a communications plan during construction to inform the general public and commercial and recreational fishermen, mariners, and recreational boaters in particular of construction activities and vessel movements. Communication will be facilitated through maintaining a Project website and submitting local notices to mariners and vessel float plans, as appropriate, to the USCG.

During operation, the BIWF has been designed to avoid and minimize potential public health and safety and will not result in significant impacts on public health and safety related to these issues during operation.

#### *Public Access*

Potential impacts and proposed mitigation related to public access to temporary work areas during construction of the BIWF are as described in Section 4.9 for marine uses and Section 4.11 for transportation.

The WTG design provides a “haven of safe refuge” for boaters who may experience an emergency in the vicinity of the WTG Array. The presence of a platform on the tower will allow for the individual or individuals on board a stricken vessel to get out of the water and wait for rescue, while the tower structure itself could serve as a mooring for a drifting vessel. Access to the interior of the turbine will be restricted by the locked door at the base of the tower.

The Inter-Array Cable and submarine portions of the Export Cable will be submerged at sufficient depths to prevent public access. As stated in Section 3.2.1.3, where burial depths of less than 4 ft are achieved, Deepwater Wind may elect to install additional protection such as concrete matting or rock piles.

The Block Island Substation will be located on private property within a fenced, locked area that will prevent public access to the substation.

#### *Hazardous Materials*

As standard practice, marine construction vessels operate under oil spill prevention and response plans that comply with USCG requirements relating to prevention and control of oil spills and the discharge of wastes. While the WTGs themselves will not contain substantial amounts of lubricating oil or other hazardous materials that may affect water quality if released into the marine environment, Deepwater Wind will prepare a Spill Prevention and Response Plan to address the limited low quantity of such materials. As a result, operation of the BIWF will not result in any public health or safety impacts due to release of hazardous materials.

#### *Non-Routine Events*

Non-routine events include foundation or WTG failure and/or collapse, lightning strike and fires, and ice throw from the WTG blades.

Failure of the foundation or WTG collapse is extremely unlikely. In addition, there are no permanent structures or facilities near the WTGs that would be affected, and the likelihood of a vessel transiting underneath a WTG at the time of collapse is extremely low. The WTGs will not operate in extreme wind conditions. The blades will automatically pitch out of the wind if wind speeds exceed 61 mph (30 m/s). The WTGs will be designed in accordance with engineering standards for offshore wind turbines (IEC 61400-1/3), which require load case simulations with extreme gust conditions in combination with grid loss. Further, as stated in Section 4.2, the Project Area is located in an area of low seismic hazard potential. Therefore, seismic activity is unlikely to result in WTG collapse either from fluidization of sediments or stress on the structure resulting from ground motion.

The WTG design includes lightning and fire prevention and protection measures. Lightning rods will be installed on the external bracket of the nacelle to protect the aviation and navigation obstruction lighting. Secondary induced voltages will be suppressed by surge arrestors. Cables from the obstruction lights will be routed in metallic hoses and in structural metallic parts for lightning protection. The interior components of the nacelle will be protected by the canopy housing the machinery. The WTGs will be equipped with control sensors, including fire and smoke alarms. Firefighting equipment will be available in each WTG in accordance with the applicable regulations.

The WTGs have also been designed to minimize the effects of icing conditions in the Project Area. As discussed in Section 4.1.2.1, the pitch and shape of the blades, the blade coating material, and color have all been designed to impede the buildup of ice and snow both during operations and when WTGs are immobile. In addition, the SCADA monitoring system and turbine control management system are designed to detect the buildup of ice and/or snow on the WTG and shut down operations as necessary.

The navigational risk assessment in Appendix U provides further discussion regarding marine safety and includes a draft emergency response plan that addresses non-routine events and emergencies relevant during both construction and operation of the BIWF. The emergency response plan outlines the procedures for Project communication and coordination with the USCG and other agencies in the event of an emergency in the area surrounding the Turbine Array. Responsibilities will be reviewed and approved by agencies prior to construction.

### ***Electric and Magnetic Fields***

Because the only terrestrial facilities associated with the BIWF that would produce EMF are collocated with the BITS facilities on Block Island, the EMF discussion for the BIWF facilities is presented as part of the BITS discussion, which includes and EMF discussion related to other BITS facilities.

#### **4.13.2.2 BITS**

Potential health and safety hazards related to marine and land-based construction will be short-term and minimal. Additional safety and communication measures are as discussed for marine uses in Section 4.9. During operation, the BITS has been designed to avoid and minimize potential public health and safety impacts related to public access, hazardous materials, non-routine events, and EMF, and will not result in significant impacts on public health and safety related to these issues during operation.

### ***Public Access***

The Block Island Substation and the switchyard associated with either BITS alternative on the Rhode Island mainland will be located within a fenced, locked area that will prevent public access to the switchyards.

### ***Hazardous Materials***

The BITS submarine cable will not consist of any hazardous materials. The switchyards and other land-based facilities associated with the BITS will not involve the use of any EPA-reportable quantities of hazardous materials. As discussed in Section 4.3.2.1, the switchyard transformers will each contain 4,000 gallons (15,142 liters) or less of mineral insulating transformer oil and will be mounted on a concrete foundation with a concrete oil containment pit. The pit will be able to hold 120 percent of the oil contained in the isolation transformer. Given the implementation of the spill prevention measures, operation of the BITS is not expected to result in the release of materials that would affect public health and safety.

### ***Non-Routine Events***

The switchyards associated with the BITS on Block Island and Narragansett will be designed to include fire protection measures. Heat and smoke detectors will be installed within the switchgear and O&M buildings. The switchyards will be designed to have separation of the oil-filled equipment from other equipment by an adequate separation distance or fire walls if sufficient space is not available.

### ***Electric and Magnetic Fields***

An EMF analysis was conducted for the terrestrial portions of the Export Cable and BITS on Block Island (Appendix M-2). Because the Export Cable and BITS cable are collocated on Block Island, the EMF analysis modeled both cables together. The results are presented in the context of the BITS impact discussion. The analysis modeled magnetic fields for the cable under Crescent Beach for both the long- and short-distance HDD cable burial depths, the buried segment along the majority of the cable route, the aboveground segment along the bridge between Trims Pond and Harbor Pond, and the aboveground segment on the BIPCO property (see Figure 3 of Appendix M-2). The EMF analyses made conservative assumptions regarding conductor types and cable sheathing under consideration for the Project in order to produce upper bounds for the results to the extent possible.

The EMF analyses for BIWF and BITS marine and terrestrial cables indicate that the modeled magnetic and electric fields that would result from the Project are orders of magnitude less than the exposure limits recommended by the ICNIRP and ICES (Table 4.13-1). The EMF analysis modeling results show that magnetic fields at the landfall location on Crescent Beach and along the underground portions of the route would be below 25 mG along the centerline and would decrease to 1.2 mG or less at 40 ft (12.2 m) from the centerline. These levels are roughly comparable to those found beneath local distribution lines that run along most city streets and are more than 80 times lower than the limits recommended by the ICNIRP (2010).

Magnetic fields at the aboveground cable along the bridge between Trims Pond and Harbor Pond would be a maximum of 74 mG above the bridge and 112 mG below the bridge along the centerline, decreasing to 0.9 mG both above and below the bridge at 40 ft (12.2 m) from the centerline. The modeled magnetic field levels at these aboveground locations are comparable to magnetic fields that may be found in homes next to major appliances and are more than 15 times lower than recommended exposure limits (ICNIRP 2010). The magnetic fields produced by the aboveground portion of the cable route at the BIPCO property would result in maximum levels of approximately 76 mG along the centerline, which would be a decrease from the modeled levels from the existing line of 178 mG.

The electric field produced by the buried segment of the cable route under the Crescent Beach and along the road rights-of-way to the BIPCO property would not result in appreciable, measurable levels because

the electric field would be effectively blocked by the ground. For the aboveground portion of the route along the bridge, electric fields would be more than 10 times lower than recommended exposure limits (ICNIRP 2010; ICES 2002). The EMF modeling results show that electric fields along the centerline on the BIPCO property would be 0.4 kV/m and would diminish to 0.2 kV/m or less at 40 ft (12.2 m) from the centerline.

Given the low EMF levels that would be produced by the facilities on Block Island and Narragansett, the BITS will not result in significant impacts on human health and safety as a result of EMF exposure.

#### **4.13.2.3 Combined Effects**

Potential health and safety hazards related to marine and land-based construction will be short-term and minimal. During operation, the Project has been designed to avoid and minimize potential public health and safety impacts related to public access, hazardous materials, non-routine events, and EMF and will not result in significant impacts on public health and safety related to these issues during operation.

## 5.0 CUMULATIVE IMPACTS

CEQ implementing NEPA regulations (40 CFR 1508.7) define cumulative impacts as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions.” The geographic extent of the cumulative impacts discussion and the determination of which “past, present, and reasonably foreseeable future actions” to include in the analysis are determined by each agency as appropriate based on the nature of the action. For the purpose of analysis in this ER, “reasonably foreseeable future actions” are defined as other proposed energy related infrastructure that are similar in nature to the proposed Project that are planned to occur in the immediate action area of the Project Area and have either received permits necessary for construction or have an active application under review with permits pending. Existing actions occurring within the immediate action area of the Project Area that affect resources are included in the existing condition information presented for each resource (Section 4.0).

The proposed BIWF WTG Array is located within the Rhode Island Renewable Energy Zone, which was designated as a suitable site within Rhode Island state waters for offshore renewable energy development. There are currently no other renewable energy projects or other offshore development projects existing or proposed within the Rhode Island Renewable Energy Zone. Based on communication with local officials, Deepwater Wind is not aware of other reasonably foreseeable energy-related infrastructure projects in the action area of the onshore facilities associated with the Project. Therefore, no cumulative impacts are anticipated.

It should be noted that an affiliated Deepwater Wind entity has responded to a BOEM Call for Information and Nominations for Commercial Leasing for Wind Power on the OCS Offshore Rhode Island and Massachusetts (Call), published in the Federal Register on August 18, 2011. The area identified in the Call (Call Area) is within a larger area of mutual interest identified by Massachusetts and Rhode Island. In its response, the affiliated Deepwater Wind entity proposed a larger wind energy project to be located within the Call Area. This project is a separate and distinct project from the BIWF and BITS. It is located within open water at a sufficient distance from the BIWF such that it is outside of the action area of the BIWF and BITS and cumulative impacts are not anticipated. Construction of this Project is subject to a number of conditions, including the completion of an environmental assessment by BOEM on the environmental consequences associated with issuing commercial wind leases and approving site assessment activities on those leases (within all or some of the Call Area), the determination of competitive interest in the Call Area, the issuance of a commercial lease by BOEM, an assessment of the environmental consequences of a construction and operations plan for a project in the Call Area, and the approval by BOEM of such construction and operations plan. Assuming those conditions (and others) are satisfied, construction of this Project is expected to occur after the BIWF and BITS are constructed, and as a result, impacts from concurrent construction activities are also not anticipated. Notably, no permits have been received for any project in the Call Area, nor are any permit applications pending.

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