

Vessels and Vehicles

All vessels associated with the Project (foreign and domestic) will comply with United States Coast Guard requirements. Some of these vessels may originate from the Gulf of Mexico, Atlantic Coast, Europe, or other worldwide ports, depending on charter agreements and vessel availability. The vessel types that are anticipated to support installation of the SFWF, as well as types of onshore vehicles that will be used at ports, are described in Table 3.1-6.

The large vessels anticipated to support most offshore installation activities will have accommodation units that provide board and lodging for crew, construction managers, inspectors, and other personnel (e.g., CVA). Occasional crew changes will be provided by crew transport vessels or when vessels return to port for provisioning or material transport.

Project vessels could employ a variety of anchoring systems, which include a range of size, weight, mooring systems, and penetration depth. Table 3.1-7 provides additional details about the maximum seabed disturbance for these systems.

Material Transportation

The WTGs and other components will be transported to the onshore staging facilities (as described in Table 3.1-5) prior to installation. During installation, transportation barges and material barges will transport components and equipment to the Lease Area. Vessels not transporting material from local ports may travel with components and equipment directly to the Lease Area from locations such as the Gulf of Mexico, Atlantic Coast, Europe, or other worldwide ports. Before arriving at the SFWF, a local port call for inspections, crew transfers and bunkering can occur.

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Table 3.1-6. Project Vessels and Vehicles

Vessels, vehicles, and associated activities planned for use during installation, operations, and decommissioning of South Fork Wind Farm and South Fork Export Cable.

Vessel/Vehicle	Vessel/Vehicle Activity (Average Speed Range of Vessel)	SFWF				SFEC			
		Installation and Decommissioning		Operations		Installation and Decommissioning		Operations	
		Monopile Foundations, WTG, OSS	Inter-Array Cable	Monopile Foundations, WTG, OSS	Inter-Array Cable	SFEC - Offshore	SFEC - Onshore	SFEC - Offshore	SFEC- Onshore
OFFSHORE VESSELS									
Heavy Lift Crane Vessel	Vessel for installation of foundations and substation (0 to 10 knots)	○		□					
Derrick Barge Crane Vessel	Vessel for installation of foundations and substation (0 to 10 knots)	○		□					
Jack-up Installation Vessel	Vessel for installation of foundations, WTG, and substation (0 to 10 knots)	○		□					
Jack-up Material Feeder Barge ^a	Vessel to transport materials to installation vessels (0 to 10 knots)	○	○	□	□	○		□	
Floating Material Barge	Barge transport materials to installation vessels (0 to 7 knots)	○	○	□	□	○		□	
Jack-up Crane Work Vessel	Vessel to complete misc. work (e.g., cable matting) (0 to 4 knots)	○	○	□		○		□	

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		Installation and Decommissioning		Operations		Installation and Decommissioning		Operations	
		Monopile Foundations, WTG, OSS	Inter-Array Cable	Monopile Foundations, WTG, OSS	Inter-Array Cable	SFEC - Offshore	SFEC - Onshore	SFEC - Offshore	SFEC - Onshore
Floating Crane Work Vessel	Flat-topped materials transportation barge (0 to 4 knots)	○	○	□		○		□	
Towing Tug	Towing tug for transportation barge or cable seabed preparation support (0 to 10 knots)	○	○	□	□	○	○	□	
Anchor Handling Tug	Towing tug for positioning anchors (0 to 11 knots)	○	○	□	□	○	○	□	
Rock Dumping/Fallpipe Vessel (FPV) ^b	Vessel used to place rock on seabed in vicinity of foundations (0 to 6.5 knots)	○							
Fuel Bunkering Vessel	Bunker vessel for refueling vessels offshore during installation (10 knots)	○	○	□	□	○	○	□	
Cable Laying Vessel	Vessel used for transporting and installing cable (12.4 knots during		○		□	○		□	

Table 3.1-6. Project Vessels and Vehicles

Vessels, vehicles, and associated activities planned for use during installation, operations, and decommissioning of South Fork Wind Farm and South Fork Export Cable.

Vessel/Vehicle	Vessel/Vehicle Activity (Average Speed Range of Vessel)	SFWF				SFEC			
		Installation and Decommissioning		Operations		Installation and Decommissioning		Operations	
		Monopile Foundations, WTG, OSS	Inter-Array Cable	Monopile Foundations, WTG, OSS	Inter-Array Cable	SFEC - Offshore	SFEC - Onshore	SFEC - Offshore	SFEC - Onshore
	transit, up to 2 miles per day during installation)								
Crew Transport Vessel	For transport of crew and/or supplies to/from worksite (25 knots)	○	○	■	■	○		■	
Support Vessel/Inflatable Boat	For transport of environmental observers (25 knots)	○	○	■	■	○		■	
Cable Installation Equipment	Equipment for installing cable on seafloor		○		□	○		□	
ONSHORE VEHICLES									
Crane	For staging activities at ports and for installation and decommissioning of SFEC - Onshore	○	○	■		○	○	□	□
Front-end Loader		○	○	■		○	○	□	□
Heavy-duty Truck		○	○	□		○	○	□	□
Pickup Truck		○		■			○		□
Self-propelled modular transportation		○		□			○		□
Bulldozer		○					○		□
Excavator		○					○		□

Table 3.1-6. Project Vessels and Vehicles

Vessels, vehicles, and associated activities planned for use during installation, operations, and decommissioning of South Fork Wind Farm and South Fork Export Cable.

Vessel/Vehicle	Vessel/Vehicle Activity (Average Speed Range of Vessel)	SFWF				SFEC			
		Installation and Decommissioning		Operations		Installation and Decommissioning		Operations	
		Monopile Foundations, WTG, OSS	Inter-Array Cable	Monopile Foundations, WTG, OSS	Inter-Array Cable	SFEC - Offshore	SFEC - Onshore	SFEC - Offshore	SFEC - Onshore
Trencher		○					○		□
Dump Truck		○					○		□
Bucket Truck							○		
Telescoping Forklift							○		
HDD Boring Machine	For installation of sea-to-shore transition						○		■
Helicopter	For emergency transport	○	○	□	□	○	○	□	□

Key

- Installation
- Operations - Planned Maintenance
- Operations - Unplanned Maintenance

Notes:

^a A jack-up crane barge would be used for transportation of WTGs, but not for foundations or the OSS.

^b A rock dumping or FPV would be used for placement of scour protection for monopile foundations, but not for installation of WTGs or the OSS.

Table 3.1-7. Seabed Disturbance from Vessels

Maximum seabed disturbance from activities during installation of the South Fork Wind Farm and South Fork Export Cable.

Vessel/Vehicle	Maximum Area of Seabed Disturbance (total acres/ ha per foundation)	Maximum Area of Seabed Disturbance (ft ² / m ² per activity)	Description of Bottom-Disturbing Activity and Maximum Seabed Disturbance	Maximum Depth of Penetration (feet [m])
<i>Bottom-disturbing activity during Typical Installation of Foundations</i>				
Derrick Barge Crane Vessel (anchor)	9.02 (3.7)	392,698 (36,482)	8-point 12-ton delta flipper anchor spread, used 2 times at each foundation, with disturbance of 196,349 ft ²	15 (4.6)
Jack-up Installation Vessel (spud can)	0.62 (0.25)	27,000 (2,508)	Spud cans, up to 4 per vessel, used 4 times at each foundation, with disturbance of 6,750 ft ²	9 (2.7)
Jack-up Material Feeder Barge (spud can) ^a	0.93 (0.38)	40,500 (3,763)	Spud cans, up to 4 per vessel, used 6 times at each foundation, with disturbance of 6,750 ft ²	9 (2.7)
Floating Material Barge (anchor)	27.05 (11)	1,178,094 (109,449)	8-point 12-ton delta flipper anchor spread, used 6 times at each foundation, with disturbance of 196,349 ft ²	15 (4.6)
Jack-up Crane Work Vessel (spud can)	0.15 (0.06)	6,750 (627)	Spud cans, up to 4 per vessel, used 1 time at each foundation, with disturbance of 6,750 ft ²	9 (2.7)
Floating Crane Work Vessel (anchor)	13.52 (5.47)	589,047 (54,724)	Anchor only used if issue with dynamic positioning (DP) system; 8-point 12-ton delta flipper anchor spread, used 3 times at each foundation, with disturbance of 196,349 ft ²	15 (4.6)
<i>Bottom-disturbing activity only in emergency use or if issue with DP system</i>				
Towing Tug			Anchor only used if issue with DP system, would be 12-ton delta flippers, with disturbance of 196,349 ft ²	15 (4.6)
Anchor Handling Tug			Anchor only used if issue with DP system, would be 12-ton delta flippers, with disturbance of 196,349 ft ²	15 (4.6)

Table 3.1-7. Seabed Disturbance from Vessels

Maximum seabed disturbance from activities during installation of the South Fork Wind Farm and South Fork Export Cable.

Vessel/Vehicle	Maximum Area of Seabed Disturbance (total acres/ha per foundation)	Maximum Area of Seabed Disturbance (ft ² / m ² per activity)	Description of Bottom-Disturbing Activity and Maximum Seabed Disturbance	Maximum Depth of Penetration (feet [m])
Rock Dumping/Fallpipe Vessel ^b			Anchor only used if issue with DP system, would be 12-ton delta flipper, with disturbance of 196,349 ft ²	15 (4.6)
Fuel Bunkering Vessel			Anchor only used if issue with DP system, would be 12-ton delta flipper, with disturbance of 196,349 ft ²	15 (4.6)
Cable Laying Vessel			Anchor only used if issue with DP system, would be 12-ton delta flipper, with disturbance of 196,349 ft ²	15 (4.6)
Heavy Lift Crane Vessel (DP)			2-point anchor for emergency use only if issue with DP system	15 (4.6)
Crew Transport Vessel			1-point anchor for stationing on site, 5-ton delta flipper	5 (1.5)
Support Vessel/Inflatable Boat			1-point anchor for stationing on site, 5-ton delta flipper	5 (1.5)

Notes:

^a A jack-up crane barge would be used for transportation of WTGs, but not for foundations or the OSS.

^b A rock dumping or FPV would be used for placement of scour protection for monopile foundations, but not for installation of WTGs or the OSS.

3.1.3.2 Foundation Installation

The general installation sequence includes the following steps:

1. Prepare sea floor, if necessary.
2. Install foundation, including pile driving.
3. Commission platform which includes installation of marking and lighting for Private Aid to Navigation required by the USCG.
4. Complete quality control checks and inspection in accordance with the FIR.

The installation process is described in further detail below. Table 3.1-8 summarizes various installation parameters for the pile driving and Appendix G includes conceptual drawings that depict the installation sequence.

Table 3.1-8. South Fork Wind Farm Parameters: Foundation Installation

Anticipated parameters for installation of foundations.

Foundation Installation Parameter	Design Specification
Pile hammer size (kilojoules)	4,000
Power pack capacity for pile hammer (kilowatts [kW])	6,000
Maximum penetration depth into seabed (feet [m])	164 (50)
Duration of pile driving (hours/foundation)	2-4 hours
Duration of installation (days/foundation)	2-4 days

To allow for site-specific micro-siting, each foundation will be installed within a 1,000-foot (152 m) diameter circle (as shown on Figure 3.1-1 and in the location plat in Appendix F).⁴ Seabed preparation associated with foundation installation, including boulder relocation and anchoring/mooring, will occur within a 1,312-foot (400 m) diameter circle from the location where the monopile will be installed. The seabed disturbance associated with the foundation installation is included in Tables 3.1-1 and 3.1-2.

Prior to commencing installation activities, geophysical surveys may be conducted near each foundation location and the seabed will be checked for debris and levelness within a 200-foot (61-m) diameter circle from the location where the monopile will be installed. As necessary, significant debris, such as large boulders, will be moved outside this area (as described for the Inter-Array Cable in Section 3.1.3.3). Prior to monopile installation, a filter layer of engineered rock will be placed on the seabed by an FPV or rock-dumping vessel.

The foundations will be installed from a jack-up lift barge or derrick barge moored to the seabed or kept in position by the vessel's DP system. The hydraulic pile driving hammer and crane used for lifting foundations and piles will be located on the installation barge. Jack-up vessels use metal legs with spud cans attached to the bottom to lift the work vessel out of the water. Once the vessel has completed its task, the vessel lowers back down to the water and lifts the spud cans off the sea floor and moves to the next work location. If a derrick barge is used as the installation vessel, it will be anchored at the location of the foundation. Once the vessel has completed its task, the

⁴ In accordance with 30 CFR § 585.634(c)(6), micro-siting of foundations will occur within a 500-foot (152 m) radius around locations identified in the indicative layout scenario, which is equivalent to a 1,000-foot (305 m) diameter circle.

vessel lifts its anchors and moves to the next work location. Alternatively, the derrick barge uses a DP system to maintain position instead of anchors. Material barges will be used to transport the foundations to the installation site. Appendix G depicts a typical installation sequence, using a jack-up lift barge, and Tables 3.1-2 and 3.1-8 include relevant dimensional parameters.

Each monopile will be lifted from the material barge, placed onto the seabed, leveled, and made ready for pile driving. Each monopile will then be driven to its final penetration target depth using a hydraulic hammer. Once the monopile is installed to the target depth, a transition section will be bolted to the top of the monopile to complete the installation. A transition piece may include boat landing and access ladders. Alternatively, a “one-piece monopile” (also known as a “transition piece-less monopile”) may be used, in which secondary steel components may be installed instead of a transition piece, potentially including an anode cage, internal and external platforms, and boat landing.

Assuming a 24-hour work window and no delays due to weather, sea conditions, or other circumstances, each monopile will require approximately 2 to 4 days for installation. Duration of pile driving is anticipated to be approximately 2 to 4 hours per pile.

Monopiles may require scour protection because of the diameter of the foundation. Scour protection will consist of engineered rock that will be placed around the base of each monopile in a 225-foot (68 m) diameter circle using either an FPV or a stone dumping vessel. The specific parameters for the diameter, volume, and area of scour protection are depicted in Table 3.1-2. A scour analysis will be completed as part of the FDR to refine these assumptions.

3.1.3.3 Inter-Array Cable Installation

The general installation sequence for the Inter-array Cable includes the following steps:

1. Prepare sea floor.
2. Conduct cable installation trials.
3. Install cable.
4. Install secondary cable protection systems.

The installation process is described in further detail below.

Prior to initiation of cable installation, geophysical surveys may be conducted within the cable corridor and a pre-lay grapnel run (PLGR) will be conducted. The purpose of the PLGR run is to remove possible obstructions and debris, such as abandoned fishing nets, wires and hawsers, from along the cable route. Additionally, boulders may be relocated within sections of the corridor for the cable route. Boulder relocation will occur within 65 feet (20 m) on each side of the centerline. Boulder relocation will typically be completed by a towing tug, with a towed plow generally forming an extended “V” shaped configuration that forces boulders to the extremities of the plow and establishes a clear centerline for the cable installation equipment. Boulder relocation may require multiple passes. Where appropriate, a boulder grab tool deployed from a DP vessel may also be used to relocate isolated or individual boulders. The temporary seabed disturbance from boulder relocation is included in Tables 3.1-1 and 3.1-4.

Prior to boulder relocation, trials are anticipated to occur within the cable corridor to test the equipment is working properly and is appropriate for the seabed conditions. Each trial would include the deployment and towing of boulder clearing equipment and/or use of boulder grab tool along portions of the inter-array cable route, and each trial would be approximately 0.62 mile (1 km, 0.53 nm). It is anticipated that approximately 5 to 10 trials may be necessary in different areas. The trials may also include pre- and post-trial geophysical survey work

potentially utilizing a remotely operated vehicle and bathymetric survey equipment. The temporary seabed disturbance from these trials is included in Table 3.1-4.

The Inter-array Cable is expected to be buried using cable installation equipment that could include either a mechanical cutter, mechanical plow (which may include a jetting system), and/or jet plow, each of which is further described below. The burial method is dependent on suitable seabed conditions and sediments along the cable route.

The maximum temporary seabed disturbance from cable installation equipment is included in Tables 3.1-1 and 3.1-4.

- **Mechanical Cutter:** This technique involves either a cutting wheel or an excavation chain to cut a narrow trench into the seabed allowing the cable to sink under its own weight or be pushed to the bottom of the trench via a cable depressor.
- **Mechanical Plow:** This technique involves pulling a plow along the cable route to lay and bury the cable. The plow's share cuts into the soil, opening a temporary trench which is held open by the side walls of the share, while the cable is lowered to the base of the trench via a depressor. Some plows may use additional jets to fluidize the soil in front of the share. Mechanical plowing is suited to a range of soil conditions except for very soft soils, hard soils and rock. Backfill of the trench is expected shortly after installation due to collapse of the trench walls and/or by natural infill.
- **Jet-Plow:** This technique involves the use of water jets to fluidize the soil temporarily opening a channel to enable the cable to be lowered under its own weight or be pushed to the bottom of the trench via a cable depressor. Typical types of jet-plows include towed jet sleds, tracked jet-remotely operated vehicles, or vertical injectors. Backfill of the trench is expected shortly after installation due to settlement of fluidized sediments and/or trench collapse. Immediately after installation a trench will likely be visible on the seabed as well as tracks/skids from the installation equipment; however, over time this will backfill to the original seabed level.

Prior to cable installation, trials may occur within the cable corridor to test that the installation equipment is working properly and is appropriate for the seabed conditions. Each trial includes operating the installation equipment within a portion of the corridor, offset from the centerline, and may also include installing a portion of cable. It is anticipated that approximately 5 to 10 trials may be necessary to test the various pieces of equipment. The trial cable would be recovered towards the end of the cable installation process. The temporary seabed disturbance from cable installation trials is included in Table 3.1-4.

Cable lay and burial will be carried out until it reaches a distance of approximately 300 feet (91 m) from each foundation, where the cable will be laid out, cut, and a pulling head will be put on the cable end to allow the cable to be pulled into the foundation. Scour protection will be also be installed, either before or after the Inter-array Cable has been installed.

The most effective method of protecting a submarine cable from damage caused by external forces is to bury the cable under the seabed. The target burial depth of the cable is 4 to 6 feet (1.2 to 1.8 m). Remedial burial activities and/or secondary cable protection may occur in areas where target burial depth is not achieved. Remedial burial may be conducted with a jet-plow or controlled flow excavator. A controlled flow excavator is a non-contact methodology with a jetting tool that draws in seawater from the sides and jets the water from a vertical down pipe at a specified pressure and volume. The down pipe is positioned over the cable alignment, enabling the stream of water to fluidize the sands around the cable, which allows the cable to settle into

the trench under its own weight. Secondary cable protection systems may also be employed, such as articulated concrete mattresses, fronded mattresses, rock bags, or rock placement.

A cable inspection program will be developed, and reviewed by the CVA, to confirm the cable burial depth along the route and identify the need for any further remedial burial activities and/or secondary cable protection.

3.1.3.4 Wind Turbine Generator Installation

After installation of the foundation and the pull-in of the Inter-array Cable (i.e., feeding the cable into each foundation), the WTGs will either be transported from the onshore staging facility by barge to the offshore installation site adjacent to the installation jack-up lift barge, or some WTG components may be transported to the SFWF aboard the installation vessel. In some locations, vessels may use moorings in temporary staging areas adjacent to the installation site. If a U.S.-flagged jack-up lift vessel is available, the WTG components may be loaded directly onto this vessel at the staging port for offshore installation. The WTG installation process is depicted in Appendix G.

After transportation to the SFWF, the WTGs will be installed in accordance with the following general sequence (Figure 3.1-6).

1. The jack-up vessel will be located next to each foundation and will individually lift each WTG component in accordance with the final installation strategy that will be described in the FIR. The towers for the WTGs will be installed in sections with the lower tower section lifted first followed by the other tower sections. Alternatively, the complete tower could be installed in one piece.
2. The nacelle will be lifted and connected to the tower, followed by installation of each blade to the hub. Pending final engineering and vessel availability, some tower sections (potentially including the full tower), and the full rotor (potentially including the hub and three blades) might be pre-assembled onshore.
3. Once the components are installed, workers will finalize securing each WTG component.

Installation of each WTG will require up to 3 days to complete, assuming a 24-hour work window and no delays due to weather, sea conditions, or other circumstances.

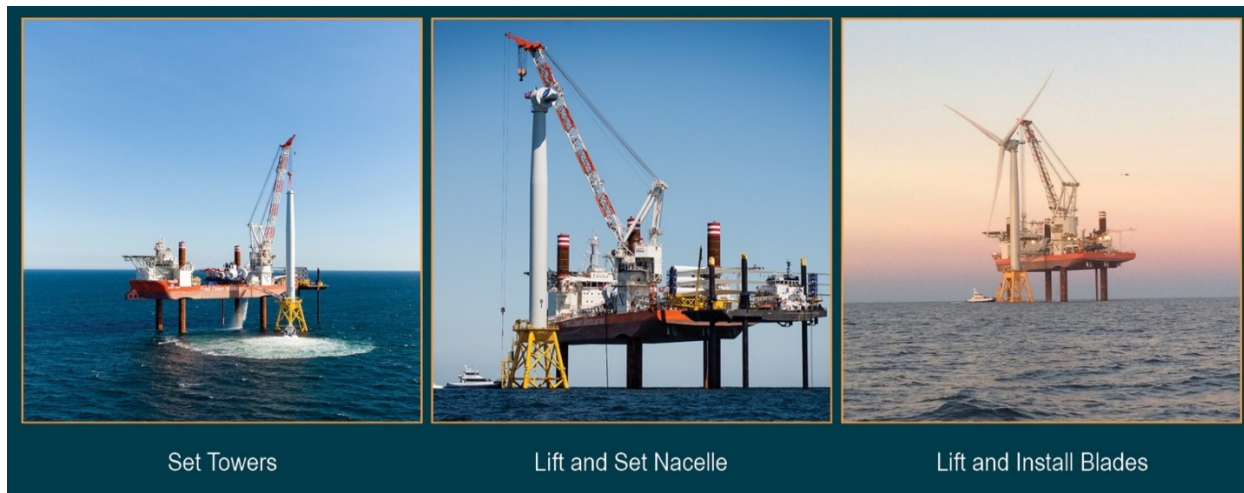


Figure 3.1-6. South Fork Wind Farm Wind Turbine Generator Installation
Photographs depicting the wind turbine generator installation sequence from the Block Island Wind Farm.

3.1.3.5 Offshore Substation Installation

The general installation process for the OSS will be very similar to the WTG installation process. The substation will be placed on the same foundation as a WTG or a similar foundation as the WTGs. The substation will be brought to the foundation on a transportation barge and lifted into place by a jack-up lift barge or a derrick barge.

3.1.4 Commissioning

During commissioning, a variety of electrical and mechanical work and quality testing will occur. Commissioning requires technicians to frequently travel to each WTG and the OSS. Technicians will be transported to and from the SFWF by a CTV.

A typical commissioning process includes the following steps:

- Onshore at the port: tower electrical and mechanical tests, checks, and quality controls to validate functionality of components installed in the tower and in the nacelle, and of the interface between components in tower and nacelle
- Offshore cold commissioning: electrical and mechanical tests, checks, and quality controls to validate mechanical and electrical integrity of the complete WTG prior to energizing
- Offshore hot commissioning: final electrical tests, checks, and quality controls to validate systems interactions, while the WTG is energized but not generating
- Reliability testing: operational test of each WTG in normal conditions, including electrical and mechanical tests, checks, and quality controls to validate reliability and systems interaction

3.1.5 Operations and Maintenance

DWSF will be responsible for the O&M of the SFWF. The SFWF will operate in accordance with the approved COP, and other applicable approvals and permits. The SFWF will operate at maximum capacity while complying with all electric grid requirements from LIPA and New York Independent System Operator (NYISO). The SFWF will be monitored 24 hours a day, 365 days a year from a remote facility. Any issues that cannot be fixed remotely will be addressed locally by trained technicians.

The SFWF O&M Facility, which will be staffed by project technicians, will include storage for an appropriate number of spare parts.

3.1.5.1 Vessel and Vehicle Mobilization and Material Transportation

During operations, vessels for SFWF maintenance activities will typically be mobilized from one of the identified ports, as described in Table 3.1-5. The anticipated vessels and support vehicles that will be used during operations are described in Section 3.1.3.1 and Table 3.1-6.

In the case of unplanned maintenance, vessels may travel directly to the SFWF from locations that will be determined based on the type of maintenance that is required and vessel availability. These vessels may originate from the Gulf of Mexico, Atlantic Coast, Europe, or other worldwide ports.

3.1.5.2 Foundations

During operations, the primary activity related to foundations will be inspections and any resulting maintenance.

A foundation inspection program will be developed during the FDR phase so that nodes/critical components of the foundations are inspected within a 5-year timeframe. Underwater inspection will include visuals and eddy currents tests conducted by divers or remotely operated vehicles. Any observed damage or cracks would be analyzed further and repaired if required.

3.1.5.3 Wind Turbine Generators

Personnel conducting O&M activities will access the SFWF on an as-needed basis with no personnel living offshore. The WTGs are remotely monitored and controlled by the SCADA system. The SCADA system connects the WTGs to the OSS and the OSS to the SFEC - Interconnection Facility with fiber optic cables that will be embedded in the inter-array and export cables. Each WTG will have a wind speed and wind direction measuring device, such as a mechanical anemometer and windvane or other devices able to make such measurements. The SCADA system will provide a live feed of the measured wind speeds within the SFWF, as well as mechanical and electrical status of each WTG. The WTG activation/de-activation and output setpoints will normally be implemented through the fiber optic network that will be housed, in part, within the OSS and the SFEC - Interconnection Facility. This system will store real-time and historical data on performance and environmental conditions and provide a link to appropriate entities to monitor and control the SFWF.

The WTGs are equipped with safety devices to ensure safe operation during their lifetime. These safety devices may vary depending on the WTG selected and will be reviewed by the CVA during the FDR and the FIR phases. They may include, but are not limited to, vibration protection, over-speed protection, and aerodynamic and mechanical braking systems, as well as electrical protection devices.

The WTGs will be maintained in accordance with a dedicated service and maintenance plan, developed by the WTG vendor before the start of operations. It is anticipated that each WTG will require approximately 1 week of planned maintenance and approximately 1 week of unplanned maintenance per year. Planned maintenance will be scheduled during low-wind periods of the year. For the SFWF, this is expected to be during the summer. Unplanned maintenance will occur to address issues that cannot be resolved remotely.

For planned maintenance activities, personnel access will be provided using CTVs (Figure 3.1-7). Unscheduled maintenance, including major repairs, may require the use of jack-up or crane barges if repairs to equipment such as power transformers, reactors, or switchgear are necessary. Helicopters may be used for emergency transport, and/or limited maintenance activities. Temporary diesel generators, with secondary containment, may be used during repairs.

3.1.5.4 Inter-Array Cable

The Inter-array Cable has no maintenance needs unless a fault or failure occurs. Cable failures are only anticipated from damage because of outside influences, such as boat anchors. The armoring of the Inter-array Cable and the burial of the Inter-array Cable to target depth will minimize the risk of damage to the cable system. An O&M phase cable inspection program will be developed by DWSF as part of the FDR and reviewed by the CVA.



Figure 3.1-7. Crew Transfer Vessel
Photograph depicting an example CTV from the Block Island Wind Farm.

3.1.5.5 Offshore Substation

The OSS will be monitored and controlled remotely through the SCADA system. The OSS is equipped with devices to ensure safe operation. These safety devices may vary depending on the substation selected and will be reviewed by the CVA as part of the FDR and FIR. They may include, but are not limited to, smoke detection, arc flash and safety signage, and fire suppression. During emergency events in which the power connection may be lost, a utility generator will operate to keep essential systems functional. Unplanned maintenance, which can include major repairs to heavy components like the main transformer, may require the use of jack-up or crane barges. Helicopters may be used for emergency transport and/or limited maintenance activities.

3.1.6 Conceptual Decommissioning

DWSF will decommission the SFWF in accordance with 30 CFR § 585.902 and 30 CFR §§ 585.905 through 585.912. The first step will be submission of a decommissioning application in accordance with 30 CFR § 585.905. Unless otherwise approved in the decommissioning plan, removal of facilities will be completed in accordance with the approved decommissioning plan and will follow the same relative sequence as construction but in reverse.

The WTG components and OSS will be disconnected and likely be removed using a jack-up lift vessel or a derrick barge. A material barge will then likely transport the components to a recycling yard where the components will be disassembled and prepared for re-use and/or recycling for scrap metal and other materials. The foundations will be cut by an internal abrasive water jet cutting tool at 15 feet (4.6 m) below the seabed in accordance with 30 CFR § 585.910

and returned to shore for recycling in the same manner described for the WTG components and OSS. The Inter-array Cables will be decommissioned in accordance with the approved decommissioning plan. The decommissioning application will include a plan to clear the area after the SFWF facilities have been decommissioned to ensure that no unauthorized debris remains on the seabed.

3.2 South Fork Export Cable

3.2.1 Project Location

The SFEC will be located offshore, in both federal waters and New York State territorial waters, and onshore in East Hampton, New York. As shown on Figure 1.1-2, the SFEC - Offshore extends westward through federal waters from the OSS, passes south of Block Island, and crosses into New York State territorial waters 3 nm (5.6 km, 3.5 m) offshore. DWSF is considering two landing sites for the SFEC in East Hampton - Beach Lane and Hither Hills. As shown on Figure 1.1-3, the SFEC - Onshore extends from the landing site to the SFEC - Interconnection Facility in East Hampton.

Water depths, in the areas where the SFEC is proposed, range from 0 feet (0 m) in New York State waters to approximately 158 feet (48.2 m) in federal waters. The SFEC will be installed to a target burial depth of 4 to 6 feet (1.2 to 1.8 m).

Construction staging for the SFEC - Offshore will be as described for the SFWF, using ports in New York, Rhode Island, Massachusetts, or Connecticut. Construction staging for the SFEC - Onshore will be located in East Hampton, New York.

3.2.2 South Fork Export Cable Facilities

The SFEC will be a 138 kV AC electric cable that will connect the SFWF to the existing mainland electric grid on Long Island.

Table 3.2-1 summarizes the distances for the following segments of the SFEC:

- **SFEC - Offshore:** A submarine export cable (138 kV), buried beneath the seabed, including the SFEC - OCS and the SFEC - NYS:
 - **SFEC - OCS:** the submarine segment of the export cable, buried beneath the seabed, within federal waters on the OCS from the OSS to the boundary of New York State territorial waters.
 - **SFEC - NYS:** the submarine segment of the export cable, buried beneath the seabed, within state territorial waters, from the boundary of the OCS to a sea-to-shore transition vault located in the Town of East Hampton on Long Island, Suffolk County, New York. The SFEC - NYS includes the sea-to-shore transition.
- **SFEC - Onshore:** the terrestrial underground segment of the export cable (138 kV), buried beneath public roads and along the Long Island Railroad (LIRR) ROW, from the sea-to-shore transition to a new interconnection facility (SFEC - Interconnection Facility) where the SFEC will interconnect with the LIPA electric transmission and distribution system at the existing East Hampton substation in the town of East Hampton on Long Island, Suffolk County, New York.

Table 3.2-1. Summary of South Fork Export Cable Segments

Distances for each segment of South Fork Export Cable.

SFEC Section	Beach Lane	Hither Hills
SFEC - Offshore	61.8 miles (99.5 km, 53.7 nm)	49.9 miles (80.4 km, 43.4 nm)
SFEC - OCS	58.3 miles (93.9 km, 50.7 nm)	46 miles (74.6 km, 40.0 nm)
SFEC - NYS ^a	3.5 miles (5.6 km, 3.1 nm)	3.5 miles (5.6 km, 3.1 nm)
SFEC - Onshore	4.1 miles (6.6 km)	11.5 miles (18.5 km)
TOTAL	65.9 miles (106.1 km)	61.4 miles (98.9 km)

Note:

^a The SFEC - NYS includes the sea-to-shore transition, which includes approximately 500 feet (0.1 nm) on land.

Each of the SFEC segments are described in the following sections, and where consistent, references are incorporated for information previously presented for the SFWF Inter-array Cable. The major characteristics that may vary within the Project Envelope are listed in Table 3.0-1. The temporary and permanent footprints for each component are summarized in Table 3.2-2. The tables in the following sections further describe parameters that may vary.

Table 3.2-2. Footprint of South Fork Export Cable Segments

Maximum temporary and permanent seabed footprint for components of South Fork Export Cable.

Project Component/Activity	Temporary	Permanent
SFEC - OCS submarine cable ^a	555.3 acres (224.7 ha)	7.0 acres (2.9 ha)
SFEC - OCS cable protection ^b	N/A	7.7 acres (3.1 ha)
SFEC - NYS submarine cable ^a	18 acres (7.3 ha)	0.4 acres (0.17 ha)
SFEC - NYS cable protection ^b	N/A	0.2 acres (0.08 ha)
SFEC - NYS sediment excavation for an offshore cofferdam for sea-to-shore transition ^c	850 yd ³ (650 m ³)	N/A

Notes:

^a Conservatively assumes the SFEC has a total permanent diameter of 12 inches (0.3 m), and that temporary seabed disturbance includes seabed preparation.

^b Conservatively assumes additional cable protection, consisting of concrete matting, fronded mattresses, rock bags, or rock placement (8 feet long by 20 feet wide [2.4 m long by 6.1 m wide]), for up to 5 percent of the SFEC - OCS (7.0 acres) and up to 2 percent of the SFEC - NYS (0.2 acres), and for seven locations (0.6 acres) where the SFEC - OCS will cross utility crossings, each of which may need up to 180 linear feet (54.9 m) of concrete matting.

^c Cofferdam will enclose an area that is 75 feet long by 25 feet wide to a depth of up to 12 feet (22.9 m long by 7.6 m wide to a depth of up to 3.7 m).

m³ = cubic meter

yd³ = cubic yard

3.2.2.1 South Fork Export Cable - Offshore (SFEC - OCS and SFEC - NYS)

The SFEC - Offshore will be a buried submarine power cable, comprised of one segment of single three-core conductor and fiber optic cable for communication and control (Figure 3.2-1). The cable is the same in federal waters and New York State territorial waters. The SFEC will carry 138 kV 3-phase HVAC power, and will operate as a bi-directional conduit for power flow.



Figure 3.2-1. South Fork Export Cable Cross Section

Three-dimensional rendering of the typical design of the submarine cable.

The SFEC will be approximately 8 to 12 inches (20 to 30 cm) in diameter, including a continuous three-conductor and fiber optic bundle that will be encased in a water sealed jacket, which is wrapped in either a single or double-steel armor wire. The bundle will be wrapped in a polyester yarn which will likely exhibit bright black and yellow striping for identification and handling. The power conductors will be made of either copper or aluminum alloys with a cross sectional area of less than 1,000 (copper) or 1,500 (aluminum) square millimeters (1.55 [copper] or 2.32 [aluminum] square inches) and insulated with cross-linked polyethylene (XLPE). The export cable does not contain lubricants, liquids, or oils.

The SFEC - Offshore will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m) beneath the seabed between the SFWF - OSS and the start of the sea-to-shore transition at a location at least 1,750 feet (533 m) offshore from the MHWL. It is anticipated that a maximum of 5 percent of the SFEC – OCS (up to 2.9 linear miles [4.7 km, 2.5 nm]), and up to 2 percent of the SFEC – NYS (up to 0.07 mile [0.11 km, 0.06 nm]) may not achieve the target burial depth if hard substrate is encountered. In those areas, the export cable may require secondary cable protection (e.g., engineered concrete mattresses), as described for the Inter-array Cable (see Section 3.1.2.3). The 5 percent estimate for the SFEC – OCS does not include (i) the protection needed at seven identified cable crossings or (ii) other areas where burial may not be permitted due to potential culturally or archeologically sensitive areas.

Appendix F includes a figure depicting areas of the SFEC - OCS where boulder relocation may occur and/or where secondary cable protection may be needed. Appendix G includes a typical cross-section of the export cable, a cross-section of the trench and burial depth for the cable, and a conceptual drawing of cable protection where burial depth may not be achieved. The Site Characterization Report (Appendix H1) includes additional information about the cable burial assessment.

The Project Envelope includes maximum parameters for the offshore segments of the export cable (Table 3.2-3).

Table 3.2-3. South Fork Export Cable Parameters: Outer Continental Shelf and New York State Export Cable

Anticipated parameters for the export cable.

Parameter	OCS	New York State
Cable diameter	8-12 inches (20 - 30.5 cm)	
Target burial depth ^a	4 - 6 feet (1.2 - 1.8 m)	
Maximum trench depth	10 feet (3 m)	
Maximum length of cable	57.9 miles (93.2 km, 50.3 nm)	3.5 miles (5.6 km, 3.0 nm)
Maximum Permanent Footprint		
Export cable ^b	7.0 acres (2.8 ha)	0.4 acres (0.17 ha)
Cable joints ^c	0.1 acres (.05 ha)	N/A
Secondary cable protection ^d	7.1 acres (2.8 ha) 305,974 ft ² (28,426 m ²)	0.2 acres (0.08 ha) 7,351 ft ² (683 m ²)
Cable protection for existing utility crossing ^e	0.6 acres (0.23 ha) 25,230 ft ² (2,344 m ²)	N/A
Total maximum permanent footprint	14.8 acres (6.0 ha)	0.6 acres (0.26 ha)
Temporary Seabed Disturbance (not including permanent footprint)		
Cable installation ^f	198.0 acres (80.1 ha)	18 acres (7.3 ha)
Cable installation trials ^g	9.3 acres (3.75 ha)	N/A
Boulder relocation ^g	357.3 acres (144.4 ha)	N/A
Cable joint installation ^g	4.9 acres (2 ha)	N/A
Total temporary seabed disturbance	555.3 acres (224.7 ha)	18 acres (7.29 ha)

Notes:

^a Burial depth is measured from the seabed to the top of the cable.

^b Conservatively assumes the SFEC - OCS has a length of 57.9 miles (93.2 km, 50.3 nm) and the SFEC - NYS has a length of 3.5 miles (5.6 km, 3.0 nm), and the cable diameter is 12 inches (0.3 m).

^c Conservatively assumes up to 2 cable joints may be installed for the SFEC – OCS. Each joint has a length of 36 feet (11 m) and a diameter of 3 feet (0.9 m), requires cable protection for 88 feet (27 m), and requires additional cable on each side of the joint for a length of 1312 feet (400 m).

^d Conservatively assumes secondary cable protection will be needed for up to 5 percent of the SFEC – OCS and up to 2 percent of the SFEC – NYS, where burial depth may be less than 4 feet (1.2 m). Cable protection will consist of concrete mattresses fronded mattresses, rock bags, or rock placement (conservatively assumed to be 8 feet [2.4 m] long by 20 feet [6.1 m] wide).

^e Conservatively assumes secondary cable protection, consisting of concrete mattress (8 feet long by 20 feet wide [2.4 m long by 6.1 m wide]), for up to seven existing cable systems, each of which may need up to 3,600 ft² (334 m²) of matting for 180 linear feet (54.9 m).

^f Conservatively assumes that temporary seabed disturbance will include installation equipment with a maximum temporary disturbance of either i) 25 feet (7.5 m) for 49.6 miles (79.9 km, 43.1 nm) for the SFEC – OCS and up to 3.5 miles (5.6 km, 3.0 nm) for the SFEC – NYS or ii) 43 feet (13 m) for up to 9 miles (14 km, 7.5 nm) for the SFEC – OCS.

^g Conservatively assumes additional temporary disturbance for other seabed preparation and cable installation activities, including installation trials, boulder relocation, and cable joint(s). Up to five installation trials may occur, each of which has a temporary disturbance of 25 feet (7.5 m) wide and 3,280 feet (1,000 m) long. Boulder relocation may occur within 66 feet

Table 3.2-3. South Fork Export Cable Parameters: Outer Continental Shelf and New York State Export Cable

Anticipated parameters for the export cable.

(20 m) of each side of the cable centerline and will include total disturbance of 131 feet (40 m) wide for up to 50 percent of the total length of the SFEC – OCS; the temporary seabed disturbance includes the width in addition to cable installation (32.5 m for 32.8 km and 27 m for 14 km). Placement of cable joint(s) may include use of controlled flow excavator for up to two joints, each of which has a temporary disturbance of 33 feet (10 m) wide and 3,280 feet (1,000 m) long.

3.2.2.2 South Fork Export Cable - Sea to Shore Transition

The sea-to-shore transition connects the SFEC - NYS to the SFEC - Onshore. The offshore and onshore cables will be spliced together so the cable can be routed to the SFEC - Interconnection Facility by an underground electrical duct bank. The sea-to-shore transition will include a new onshore transition vault, cable installed using HDD under the beach and intertidal water and may also include a temporary cofferdam located offshore beyond the intertidal zone. If conditions require a cofferdam, it will be installed using either sheet pile or gravity cell (as described in Section 3.2.3.4). Figure 3.2-2 provides a conceptual illustration of the sea-to-shore transition; while the illustration is based on a landing site at Beach Lane, the concept would be similar for a landing site at Hither Hills. Figure 3.2-3 shows an approximate aerial view of each landing site and Appendix G3 includes conceptual plans of the sea-to-shore transition for both Beach Lane and Hither Hills.

Beach Lane

The cable will be installed at least 30 feet (9.1 m) below the current profile of the beach.

A new underground transition vault will be placed within the roadway approximately 800 feet (243 m) onshore from the MHWL. The vault will be positioned along the northern side of Beach Lane with a manhole cover at the surface. Pedestrian and vehicle access will be maintained throughout installation.

A temporary cofferdam may be located offshore, approximately 1,750 feet (533 m) from the MHWL. The cofferdam will be sited at a location with approximately 25 to 40 feet (7.6 to 12.2 m) of water depth.

Hither Hills

The cable will be installed at least 30 feet (9.1 m) below the current profile of the beach.

A new underground transition vault will be placed within the pavement approximately 650 feet (198 m) onshore from the MHWL. The vault will be positioned within the northern parking lot adjacent to State Highway 27. Pedestrian and vehicle access will be maintained throughout installation.

A temporary cofferdam may be located approximately offshore, 1,900 feet (579 m) from the transition vault location in the Hither Hills parking lot. The cofferdam will be sited at a location with approximately 40 to 60 feet (12.2 to 18.3 m) of water depth.

Appendix G includes conceptual plan and profile drawings for the HDD installation work area, for the cofferdam installed by gravity cell or by sheet pile, and for the transition vault.

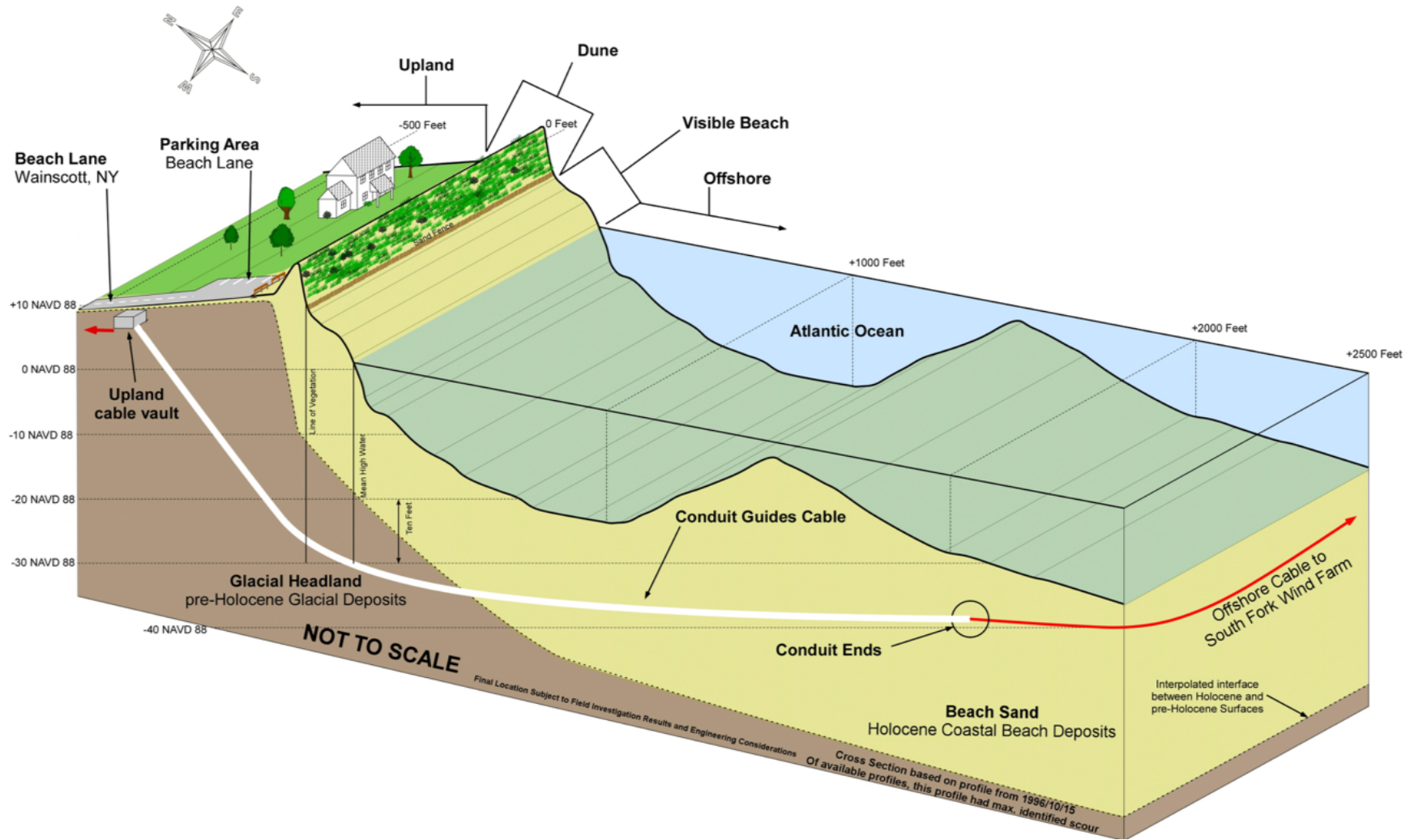


Figure 3.2-2. SFEC - Sea-to-Shore Transition Illustration
Illustration of sea-to-shore transition at the Beach Lane landing site.

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Source: Aerial image © 2018 Google.

Figure 3.2-3. South Fork Export Cable - Landing Sites
Aerial views (approximate) of the two landing site options at Beach Lane, East Hampton and Hither Hills, Montauk.

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3.2.2.3 South Fork Export Cable - Onshore

The SFEC - Onshore begins at the transition vault located onshore at the sea-to-shore transition and ends at the SFEC - Interconnection Facility (Figure 3.2-4). The SFEC - Onshore will be installed within a new underground duct bank. The SFEC - Onshore will be an underground power cable, comprised of three single core cables with a conductor of either copper or aluminum and two separate fiber optic cables, which will provide communication and control. Duct banks will be designed to accommodate up to two circuits. The SFEC - Onshore will carry 138 kV 3-phase HVAC power, and will operate as a bi-directional conduit for power flow.

Each conductor will be approximately 2 to 4 inches (3 to 10 cm) in diameter, including a single-core cable, with compact round, uncoated copper wires. The cable will be insulated with XLPE. The conductors will be sheathed by a semi-conductive insulation screen and wrapped in a high-density polyethylene (HDPE) jacket.

The duct bank will be located underground within public ROWs and alongside the tracks within the LIRR ROW. The SFEC - Onshore will not include any overhead lines. Most of the SFEC - Onshore that is located on public roads will be located within the existing paved section of the ROW. The specific configuration of the duct bank could vary along the route; the maximum width would be 36 inches (91 cm) and the maximum depth would be 40 inches (101 cm).

Appendix G includes a typical cross-section of the underground export cable, as well as typical cross-sections of the cable trench, duct bank, and manhole cable splice vaults.

3.2.2.4 South Fork Export Cable - Interconnection Facility

The SFEC - Interconnection Facility will be newly constructed to connect the SFEC with the existing 69 kV LIPA substation, located off Cove Hollow Road in the town of East Hampton, New York. The SFEC - Interconnection Facility will be located adjacent to the existing LIPA substation (Figure 3.2-2), on the same parcel in the town of East Hampton's Commercial Industrial zoning district.

The footprint of the SFEC - Interconnection Facility will be up to 228 by 313 feet (69.5 by 95.4 m), including the exterior wall, with a maximum equipment height of approximately 43 feet (13.1 m).

The configuration of the SFEC - Interconnection Facility and the interconnection to the East Hampton substation will be developed as part of the NYISO interconnection process and will include all the equipment necessary to safely connect the SFEC with the NYISO transmission system.

Appendix G includes conceptual plan and profile drawings for the interconnection facility.

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Source: Aerial image © 2018 Google. Annotation © 2018 CH2M HILL, Inc.

Figure 3.2-4. South Fork Export Cable - Interconnection Facility Lease Area
Location of South Fork Export Cable - Interconnection Facility adjacent to existing East Hampton Substation.

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3.2.3 Construction

This section describes the construction process of the SFEC based on typical methods, vessels, and equipment.

Before construction begins, DWSF will finalize contracts with vendors (including fabrication and installation contractors), develop mobilization plans, and make arrangements at the port facilities to support Project activities, including fabrication, as needed.

3.2.3.1 Ports, Vessels and Vehicles, and Material Transportation

As described for the SFWF, multiple port locations may be utilized (Table 3.1-5, Figure 3.1-8).

The anticipated vessels and vehicles that will be used for construction of the SFEC are described in Table 3.1-6. Vessels that will not be transporting material from local ports may travel directly to the work sites from locations that will be determined prior to construction. Some of these vessels may originate from the Gulf of Mexico, Atlantic Coast, Europe, or other worldwide ports, depending on charter agreements and vessel availability. A cable lay vessel, similar to what may be used to install the SFEC- Offshore is shown in Figure 3.2-5.



Figure 3.2-5. Cable Lay Vessel
Photograph depicting an example cable lay vessel.

3.2.3.2 South Fork Export Cable - Outer Continental Shelf Waters

The general installation sequence for the export cable includes the following steps:

1. Conduct cable installation trials.
2. Prepare sea floor.
3. Install cable, including cable joint(s).
4. Install secondary cable protection systems.

The installation of the SFEC – OCS will follow similar methods as those described in Section 3.1.3.3 for the Inter-array Cable of the SFWF, including geophysical surveys, PLGR and boulder relocation. The associated temporary seabed disturbance is included in Table 3.2-3.

In addition to the cable installation equipment described for the Inter-array Cable, the SFEC – OCS installation may also include use of a displacement plow which mechanically displaces materials from the trench so that the cable can be laid in the trench. The tool is commonly used to target challenging ground conditions (i.e., very hard soils and/or where subsurface boulder risk is high). In addition, the vessel used for cable burial may use a pull-ahead anchor deployed in front of the vessel to assist during cable burial operations.

Additional activities for the installation of the SFEC – OCS will occur and are described below.

Cable installation trials may occur within the cable corridor for the SFEC – OCS to test that the installation equipment is working properly and is appropriate for the seabed conditions. The trial will occur for a maximum length of up to 3,281 feet (1000 m) in up to five sections, at a depth similar to the target burial depth. Each trial includes operating the installation equipment within the corridor, offset from the centerline, and may also include installing a short section of cable. The trial cable would be recovered towards the end of the cable installation process. The trials may also include pre- and post-trial geophysical survey work potentially utilizing a remotely operated vehicle and bathymetric survey equipment. The temporary seabed disturbance from cable installation trials is included in Table 3.2-3.

Due to the length of the SFEC – OCS, up to two offshore cable joints may be installed to splice two sections of the SFEC – OCS cable. The location of the joints will depend on cable installation and manufacturing and will be confirmed during the FDR/FIR and reviewed by the CVA. The cable joint and cable are lowered to the seabed and either placed within the trench or post-buried. A controlled flow excavator may be used at this location to either prepare the seabed for cable placement or complete post-burial activities for the cable joint. The seabed disturbance from installation of a cable joint is included in Table 3.2-2.

Cable lay and burial, as described for the Inter-array Cable of the SFWF, will be carried out along the entire route until approximately 300 feet (92 m) of the OSS. At that point, cable will be attached to the OSS, in the same process as described for connecting the Inter-array Cable to WTG in Section 3.1.3.3. Scour protection at the foundation for the OSS will then be installed once the cables are connected.

As described for the Inter-array Cable, the burial method is dependent on suitable seabed conditions and sediments along the SFEC route. Therefore, in areas where seabed conditions might not allow for cable burial, remedial burial may occur using a controlled flow excavator and/or other methods of cable protection may be employed, such as articulated concrete mattresses, fronded mattresses, rock bags, or rock placement.

SFEC – OCS will cross seven existing telecommunications cable systems, some of which are active and others that are inactive, on the seabed. DWSF is consulting with these cable owners to implement a mutually agreeable crossing process (Appendix F). This process will be consistent with industry practice and will typically use articulated concrete mattresses. Where appropriate, inactive cable systems will be cut and cleared from the burial route for a short distance on each side. Any cut and cleared cables will typically have the exposed ends weighted with clump weights or short-section chain so that the cable cannot be snagged by other seabed users, such as fishermen.

A cable inspection program will be developed, and reviewed by the CVA, to confirm the cable burial depth along the route and identify the need for remedial burial activities and/or secondary cable protection that may be needed.

3.2.3.3 South Fork Export Cable - New York State Territorial Waters

Installation of the SFEC - NYS will follow the same methods described above for the SFEC – OCS, except that no boulder relocation, installation trials, or cable joint installation are expected to occur within New York State waters. No other cable systems along the proposed cable route have been identified within New York State waters.

3.2.3.4 South Fork Export Cable - Sea-to-Shore Transition

Installation of the SFEC - Offshore will start with HDD within the sea-to-shore transition. The installation process will be the same at Beach Lane or Hither Hills, although the specific locations of the transition vault and cofferdam will be different at each site.

The workspace for the HDD and drill entry point will be located at least 650 feet (198 m) onshore from the MHWL at both Beach Lane and Hither Hills. The HDD (as well as the conduit and the cable) will end at least 1,750 feet (533 m) offshore from the MHWL at both Beach Lane and Hither Hills and will be installed under the beach and intertidal zone.

The onshore workspace for the HDD will include a temporary sheetpile anchor wall to provide stability of the HDD rig during drilling activities. The temporary anchor wall is anticipated to be approximately 29.5 feet (9 m) in length and driven to a depth of approximately 19.7 feet (6 m). In addition to the anchor wall, the workspace may also require the installation of other temporary sheetpiles to aid in anchoring of the rig or to provide soil stabilization of the excavated area.

Before HDD begins, a temporary cofferdam may be installed at the endpoint of the HDD, where the conduit exits from the seabed. Alternatively, the HDD might be installed without a cofferdam. The cofferdam, up to 75 feet by 25 feet (22.9 by 7.6 m), serves as containment for the drilling returns during the HDD installation and keeps the excavation free of debris and from silting back in. The cofferdam, if required, may be installed as either a sheet piled structure into the sea floor or a gravity cell structure placed on the sea floor using ballast weight. Installation of the cofferdam and drilling support will be conducted from an offshore work barge anchored near the cofferdam. A 5-point anchor barge may be employed at the cofferdam site to incorporate a second HDD drill spread in a push-pull drilling operation, which would facilitate removal of drill cuttings, insertion of HDPE conduit, and grouting. The location will be clearly marked to indicate to vessels that the cofferdam is present below the water surface, and DWSF will coordinate navigational marking and publication of its location with United States Coast Guard.

- *Sheet Pile Installation.* If the cofferdam is installed using sheet pile, a vibratory hammer will be used to drive the sidewalls and endwalls into the seabed. Installation of a sheet pile cofferdam may take approximately up to 3 days. The sidewalls and endwalls will be driven to a depth of approximately 6 feet (1.8 m); sections of the shoreside endwall will be driven to a depth of up to 30 feet to facilitate the HDD entering underneath the endwall. After the sheet piles are installed, the inside of the cofferdam will be excavated to approximately 12 feet (3.7 m). This depth allows access to the HDD pilot hole for installation of the HDPE conduit. Up to 850 cubic yards (yd³; 650 cubic meters [m³]) of material will be excavated from the pilot hole and sidecast during installation to naturally disperse. The cofferdam walls will be cut off at a depth of 4 feet (1.2 m) above the sea floor. The piles will be removed using the vibratory hammer, after HDD

operations and conduit are installed. Metal sheeting will be removed, placed on the work barge, and hauled back to shore.

- *Gravity Cell Installation.* If the cofferdam is installed using a gravity cell, the cell will be lowered onto the seafloor by a crane that is on a work barge. The sidewalls and seaside wall and end wall will be multi skinned to accommodate a rock ballast fill that will stabilize the cofferdam on the seabed. The cofferdam may be of a multi-sectional design to allow transportation and assembly at the site. Assembled interior dimensions of the cofferdam will be similar to a sheet pile cofferdam with similar volumes of excavated material which is sidecast, allowing access to the HDD conduit by the cable trencher. Once the HDD is complete and the conduit installed, the ballast is lifted out of the cofferdam and the un-ballasted cofferdam lifted off the seabed, placed on the work barge, and hauled to back to shore.

For the construction of the HDD a drilling fluid of bentonite-water-based mud or another non-toxic drilling fluid will be used to cool the drill bit, maintain bore hole stability, and control fluid loss during operations. Drilling mud will be injected into the drill pipe onshore using pumps that are located within the HDD workspace. The mud will be jetted through a rotating drill bit attached at the end of the drill pipe. Jetting of the mud will cool the drill bit and suspend drill cuttings within the mud solution. Mud and cuttings will flow back to the surface in the gap between the drill pipe and bore hole, which will stabilize the bore hole. Once the mud flows back to the bore hole entry, it will be collected and reused.

The drill bit will enter the cofferdam under the cofferdam shoreside end wall; sufficient clearance will be allowed in the design to facilitate the pilot hole, drill head, and HDPE conduit. Once the pilot hole has exited in the cofferdam, the hole will be opened to a diameter of approximately 32 inches (81 cm) to install the conduit. When no cofferdam is used, a small construction vessel will monitor the completion of the HDD drilling. This vessel will ensure that no drilling mud will be released.

The conduit, consisting of a thick-walled HDPE pipe with a maximum diameter of 24 inches (61 cm), will be inserted through the entire length of the bore hole through which the submarine cable will be installed. The conduit may be assembled either adjacent to the HDD workspace or offsite. After completion of drilling, the conduit will be capped, either moved across the surface of the beach (if needed) or transported from offsite, and floated to the endpoint of the HDD. The HDD equipment will be used to pull the HDPE pipe through the drill hole to create a stable conduit for bringing the cable ashore.

After installation of the HDPE conduit, a transition vault will be installed onshore around the drill pit. A pull line will be placed inside the finished conduit to facilitate pulling the SFEC through the conduit. After the SFEC is pulled through the conduit, the submarine and fiber optic cables will be spliced to the SFEC - Onshore cable within the transition vault. The transition vault will be sealed, covered, and repaved with manhole covers at the surface.

The temporary cofferdam will be removed after installation of the SFEC - NYS has started. The remaining cofferdam walls will be removed, either by vibratory hammer (for sheet pile cofferdam) or by lifting (for gravity cell cofferdam). The excavated sediments placed in the immediate vicinity of the cofferdam will be allowed to disperse naturally. Cable protection may be placed at the HDD exit point (e.g., one cable mattress).⁵

⁵ A mattress placed at the HDD exit point is included within the 0.2 acres (0.08 ha) for cable protection along the SFEC – NYS.

The onshore work areas have been sized to accommodate an HDD rig, mud pumps, generators, a slurry plant, de-silter, backhoe, boom truck, crane, pickup truck, as well as areas for parking and other equipment and facilities necessary to support installation.

Depending on site-specific conditions and other external factors, the HDD installation activities are expected to take 10 to 16 weeks, including equipment mobilization and breakdown. In residential areas, HDD activities will be limited to a typical 12-hour working window, with exceptions for extenuating circumstances and for two specific activities (conduit installation and cable pull-in) that require 24-hour operation for a short period of time. HDD activities will be completed outside the summer season, with active drilling expected to be completed before March 31.

3.2.3.5 South Fork Export Cable - Onshore

The construction for the SFEC - Onshore includes the following activities:

- Site preparation, including minimal vegetation clearing as needed
- Excavation for underground duct bank
- Duct bank installation
- SFEC - Onshore installation and splicing
- HDD, where appropriate, for crossing of infrastructure

The SFEC - Onshore will be installed in an underground duct bank consisting of concrete encased conduits, with cable vaults for installation and maintenance access.

The SFEC - Onshore will be installed within the ROW of the existing roadways or the ROW of the LIRR. Existing pavement, gravel, or dirt will be removed and a trench of up to 4 feet (1.2 m) wide and 8 feet (2.4 m) deep will be excavated. Once each portion of the trench is excavated, the conduit will be assembled and lowered into the trench and the area around the conduit will be filled with concrete. Once the conduit is installed, the trench will be backfilled with compacted soil. Initially, temporary pavement will be applied followed by full pavement of the affected lane or the road as appropriate.

The SFEC - Onshore will be installed following the installation of the duct bank and cable vaults. The SFEC - Onshore will be installed by pulling the cable from manhole to manhole. The SFEC - Onshore will be spliced in each manhole.

3.2.3.6 South Fork Export Cable - Interconnection Facility

The construction for the SFEC - Interconnection Facility includes the following activities:

- Site preparation, excavation, and grading
- Construction of foundations for the control building, transformer, reactors, and switchgear
- Construction of electrical grounding, duct banks, and underground conduits
- Installation of appropriate drainage systems and station service including electrical and water
- Installation of all aboveground structures including transformer, reactors, switchgear, cable systems, and lightning protection.

Any temporary staging areas required during construction, such as laydown areas, temporary equipment storage, and work offices will be located within or adjacent to the location identified on Figure 3.2-4.

3.2.4 Commissioning

Once the SFEC has been installed, DWSF will commence commissioning to meet standards for grid interconnection reliability and provide a baseline of the cable characteristics including a baseline time domain reflectometer, and high potential test.

During these steps, commissioning testing will include:

- Visual and function tests of bonding and grounding system
- Continuity tests of conductor and armoring
- Resistance and capacitance tests for insulation and conductors
- Grounding measurements
- Time domain reflectometer for both optical (fiber) and electrical (power) to establish reference baseline performance metrics

3.2.5 Operations and Maintenance

DWSF will be responsible for the operation of the SFEC. As described for the SFWF, the SFEC will be monitored 24 hours a day, 365 days a year from a remote facility. The SFEC is not expected to require planned maintenance; however, inspections and tests will be conducted regularly based on manufacturer-recommended schedules; regular monitoring and any repairs will be based on manufacturer-suggested methods. DWSF will maintain at least 500 feet (152.4 m) of spare cable and underwater splices to facilitate mechanical cable repair that could become necessary through a fault or mechanical damage event.

Monitoring will include a periodic review of anomalies in cable charging current and power factor, as well as review of protection device operation records.

3.2.5.1 Vessel and Vehicle Mobilization and Material Transportation

As described for the SFWF, during operations, vessels for the SFEC - Offshore maintenance activities will typically be mobilized from one of the identified ports, as described in Table 3.1-5. Onshore personnel vehicles for the SFEC - Onshore maintenance activities will be mobilized from the O&M facility. The vessels and vehicles anticipated to be used during operations are described in Table 3.1-6.

In the case of unplanned maintenance, vessels may travel directly to the work sites from locations to be determined prior to operations. Some of these vessels may originate from the Gulf of Mexico, Atlantic Coast, Europe, or other worldwide ports, depending on charter agreements and vessel availability.

3.2.5.2 South Fork Export Cable - Offshore (OCS and NYS)

The SFEC - Offshore has no maintenance needs unless a fault or failure occurs. Cable failures are only anticipated because of damage from outside influences, such as boat anchors. Burial of the cable to the target burial depth will minimize the risk of damage to the cable system. An O&M-phase cable inspection program will be developed by DWSF, included in the FDR, and reviewed by the CVA.

Mechanical inspections will include a cable burial assessment and debris field investigation of the SFEC. The mechanical inspection is planned to occur on a 5-year basis or following a storm event that may necessitate an unplanned inspection.

If mechanical damage to the SFEC - Offshore should occur, the cable will fault immediately. DWSF will identify the location of the fault, and mobilize a repair barge, which would be equipped with water pumps, jetting devices, hoisting equipment, and other tools typically used in repairs of submarine cables. The cable would be exposed with hand-operated jet tools and cut in the middle of the damaged area. The cable would be raised to the repair barge where the damaged portion of the cable would be cut so that cable splicing can occur. The repaired cable would then be reburied to the appropriate depth by hand-operated jet tools.

3.2.5.3 South Fork Export Cable - Onshore

The SFEC - Onshore has no maintenance needs unless a fault or failure occurs. Cable failures are only anticipated because of damage from outside influences, such as unexpected digs from other parties. If repair is needed, spare cable and splice kits would be used to replace the affected area.

3.2.5.4 South Fork Export Cable - Interconnection Facility

The SFEC - Interconnection Facility will be monitored and controlled remotely through the SCADA system that is linked with fiber optic cables to the SFWF O&M facility. During emergencies in which the power connection may be lost, a utility generator will operate to keep essential systems functional.

Inspections and tests will be conducted regularly based on manufacturer-recommended schedules and repairs will be based on manufacturer-suggested methods.

3.2.6 Conceptual Decommissioning

DWSF will decommission the SFEC in accordance with 30 CFR § 585.902 and 30 CFR §§ 585.905 through 585.912. The first step will be submission of a decommissioning application in accordance with 30 CFR § 585.905. Unless otherwise approved in the decommissioning plan, removal of facilities will be completed in accordance with the approved decommissioning plan and will follow the same relative sequence as construction but in reverse.

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Section 4—Site Characterization and Assessment of Potential Impacts

The site characterization and assessment of potential impacts for the Project is structured in accordance with 30 CFR 585 and the BOEM guidelines on the information requirements for a COP for OCS renewable energy activities on a commercial lease, as required by 30 CFR 585.626(a) and (b). The approach also considers the additional detailed information and certifications, as specified under 30 CFR 585.627, which support BOEM’s compliance with NEPA regulations and other applicable laws and regulations.

The approach to site characterization and impact assessment involves the following steps, as illustrated on Figure 4.0-1.

- Identification and Analysis of Impact-producing Factors - Project activities and infrastructure, as described in Section 3, that could impact resources were identified as impact-producing factors (IPFs). Where Project specifications are not available because final design has not been completed, the Project design envelope was considered to include the range of possible impact-producing activities.⁶ A summary of Project activities, by phase, are compared to the IPFs considered in this impact assessment as a matrix and shown in Table 4.0-1. The extent of potential impact, resulting from IPFs, was identified and described for each IPF in Section 4.1.
- Characterization of Affected Environment – The environmental setting of the Project, including the footprint of the SFWF and the SFEC within federal and state waters of New York, and within the town of East Hampton, New York, is described for physical, biological, socioeconomic, cultural, and visual resources that have the potential to be impacted by Project activities. The affected environment for each resource includes a regional overview of the resource followed by characterization of the resource relative to the SFWF and the SFEC. The affected environment for each resource is described separately for the SFWF, SFEC - OCS, SFEC - NYS, and SFEC - Onshore.
- Impact Assessment – The impact assessment used in this document approximately follows an assessment of significance as discussed in 40 CFR 1508.27. The impact assessment for the SFWF and SFEC involves the evaluation of potential overlap of the IPF, in time and space, on the affected environment for each resource, during each Project phase, as shown in Table 4.0-1. The type and degree of potential impacts from proposed Project activities varies based on the characteristics of the resource (e.g., presence/absence, conservation status, abundance) and the IPF that may affect each resource. Potential impacts are discussed separately for the SFWF and SFEC.

Potential impacts are characterized as direct or indirect and whether they result from construction, O&M, and/or decommissioning of the Project. Anticipated impacts are characterized as short-term or long-term and by intensity, as negligible, minor, moderate, or major. The following impact levels are used to provide consistency in the assessment of potential impacts:

⁶ DWSF has provided supplemental information about the O&M Facility locations – including a characterization of the affected environment and impact assessment – in Appendices BB1 to BB3.

- **Direct or Indirect:** 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 period. In general, short-term impacts are those that occur only for a limited period or only during the time required for construction activities. Impacts that are short-lived, such as noise from routine maintenance work during operations, may also be short-term if the activity is short in duration and the impact is restricted to a short, defined period. Long-term impacts are those that are likely to occur on a recurring or permanent basis or impacts from which a resource does not recover quickly. In general, direct impacts associated with construction and decommissioning are considered short-term because they will occur within the no more than 2-year construction phase. Indirect impacts are determined to be either short-term or long-term depending on if resource recovery may take several years. Impacts associated with O&M are considered long-term because they occur over the 25-to-30-year life of the Project.
- **Negligible, Minor, Moderate, or Major Impacts:** Negligible, minor, moderate, or major impacts are relative terms used to characterize the magnitude of an impact.
 - Negligible impacts are generally those impacts that, if perceptible, would not be measurable.
 - Minor impacts are those impacts that, if adverse, would be perceptible but, in context, avoidable with proper mitigation; and, if impacts are measurable, the affected system would be expected to recover completely without mitigation once the impact is eliminated.
 - Moderate impacts are those that, if adverse, would be measurable but would not threaten the viability of the affected system and would be expected to absorb the change or impact if proper mitigation or remedial action is implemented.
 - Major impacts are those impacts that, if adverse, would be measurable but not within the capacity of the affected system to absorb the change, and without major mitigation, could be severe and long lasting.
- **Proposed Environmental Protection Measures –** For each resource, if measures are proposed to avoid or minimize potential impacts, the impact evaluation included consideration of these environmental protection measures.

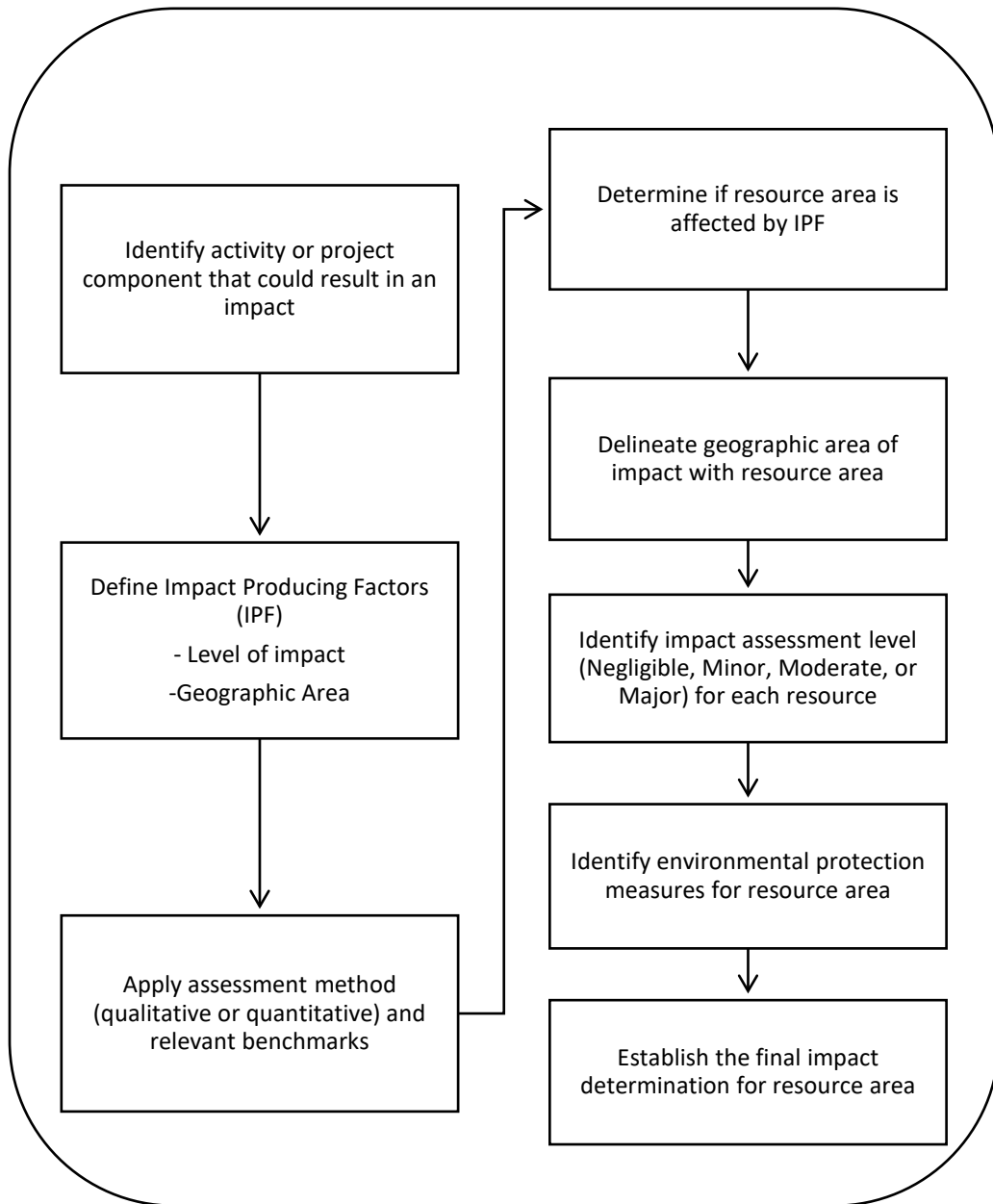


Figure 4.0-1. Illustration of Steps Involved in the Proposed Impact Assessment

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Table 4.0-1. Anticipated Project Activities and Possible Impact-producing Factors during Construction, Operations & Maintenance, and Decommissioning of the South Fork Wind Farm and South Fork Export Cable

SFWF and SFEC Activities	Seafloor/ Land Disturbance	Sediment Suspension/ Deposition	Noise	Electro- magnetic Field	Discharges/ Releases	Trash Debris	Traffic	Air Emissions	Visible Structures	Lighting
CONSTRUCTION										
<i>Equipment and Material Transportation</i>										
Vessels	•	•	•		•	•	•	•		•
<i>Port-side Support Activities</i>										
Cranes and heavy equipment	•		•				•	•		
Vehicles	•		•				•	•		
<i>SFWF WTG Installation</i>										
Vessels and heavy equipment	•	•	•		•	•	•	•		•
Seafloor preparation	•	•								
Pile driving (Monopile)	•	•	•							
Placement of scour protection	•	•			•					
<i>SFWF Inter-Array Cable Installation</i>										
Vessels (dynamically positioned and other)	•	•	•		•	•	•	•		•
Seafloor preparation	•	•								
Cable installation equipment	•	•								
<i>SFEC Installation</i>										
Vessels (dynamically positioned and other)	•	•	•		•	•	•	•		•
Seafloor preparation	•	•								
Cable installation equipment	•	•								

Table 4.0-1. Anticipated Project Activities and Possible Impact-producing Factors during Construction, Operations & Maintenance, and Decommissioning of the South Fork Wind Farm and South Fork Export Cable

SFWF and SFEC Activities	Seafloor/ Land Disturbance	Sediment Suspension/ Deposition	Noise	Electro- magnetic Field	Discharges/ Releases	Trash Debris	Traffic	Air Emissions	Visible Structures	Lighting
<i>SFEC Sea-to-Shore Transition</i>										
Vessels and heavy equipment	•	•	•		•	•	•	•		•
Sheet pile driving (Vibratory hammer)	•	•	•							
Cofferdam excavation	•	•	•		•					
HDD			•		•	•				
Transition vault excavation	•		•							
Construction vehicles	•		•				•	•		
<i>SFEC Onshore</i>										
Site preparation (clearing, grading)	•		•		•	•		•		
Trenching	•		•		•	•		•		
Vehicles	•		•				•	•		
<i>SFEC - Interconnection Facility</i>										
Site preparation (clearing, grading)	•		•		•	•		•		
Substation construction	•		•		•	•		•	•	
Vehicles	•		•				•	•		
<i>OPERATIONS AND MAINTENANCE</i>										
<i>Material and Personnel Transportation</i>										
Vessels	•	•	•		•	•	•	•		•
Aircraft			•					•		
Vehicles	•		•				•	•		
SFWF WTG Operation			•		•				•	•
SFWF Inter-Array Cable Operation				•						
SFEC Offshore Cable Operation				•						
SFEC Onshore Cable Operation				•						

Table 4.0-1. Anticipated Project Activities and Possible Impact-producing Factors during Construction, Operations & Maintenance, and Decommissioning of the South Fork Wind Farm and South Fork Export Cable

SFWF and SFEC Activities	Seafloor/ Land Disturbance	Sediment Suspension/ Deposition	Noise	Electro- magnetic Field	Discharges/ Releases	Trash Debris	Traffic	Air Emissions	Visible Structures	Lighting
SFEC Substation Operation			●		●				●	●
<i>DECOMMISSIONING</i>										
Vessels	●	●	●		●	●	●	●		●
SFWF Foundation Removal (Monopile)	●	●	●		●	●				
SFWF WTG Disassembly			●			●				
SFEC Offshore Cable Removal	●	●	●		●	●	●	●		
SFEC Onshore Cable (Abandonment)	●	●								
SFEC Substation (Repurposed or demolished)	●	●							●	●

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4.1 Summary of Impact-producing Factors

The IPFs identified for the SFWF and SFEC, based on the construction, O&M, and decommissioning activities described in Section 3, are listed below. In this section, each IPF is characterized qualitatively and quantitatively (when possible) in accordance with the scope of each phase and activity. As presented in Table 4.1-1, the IPFs that have been evaluated and result in impacts that are negligible or greater are cross-referenced to each corresponding resource and COP section number.

- Seafloor and Land Disturbance
- Sediment Suspension and Deposition
- Noise
- Electromagnetic Fields (EMF)
- Discharges and Releases
- Trash and Debris
- Traffic
- Air Emissions
- Visible Structures
- Lighting

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Table 4.1-1. Summary of the Evaluation of Impact-producing Factors associated with the South Fork Wind Farm and South Fork Export Cable and Affected Physical, Biological, Cultural and Socioeconomic Resources

Impact-producing Factor	Physical Resources				Biological Resources							Cultural Resources			Socioeconomic Resources									
	Air Quality	Water Quality & Water Resources	Geological Resources	Physical Oceanography & Meteorology	Coastal Habitat	Benthic & Shellfish Resources	Finfish & Essential Fish Habitat	Marine Mammals	Sea Turtles	Avian Species	Bat Species	Above-ground Historic Properties	Marine Archaeological Resources	Terrestrial Archaeological Resources	Visual Resources	Population, Economy, & Employment	Housing & Property Values	Public Services	Recreation & Tourism	Commercial & Recreational Fishing	Commercial Shipping	Coastal Land Use & Infrastructure	Other Marine Uses	Environmental Justice
<i>Impact Evaluation Section Number</i>	4.2.1.2	4.2.2.2	4.2.3.2	4.2.4.2	4.3.1.2	4.3.2.2	4.3.3.2	4.3.4.2	4.3.5.2	4.3.6.2	4.3.7.2	4.4.1.2	4.4.2.2	4.4.3.2	4.5.2	4.6.1.2	4.6.2.2	4.6.3.2	4.6.4.2	4.6.5.2	4.6.6.2	4.6.7.2	4.6.8.2	4.6.9.2
Seafloor and Land Disturbance		•	•	•	•	•	•	•	•	•	•		•	•					•	•		•		
Sediment Suspension and Deposition		•	•	•	•	•	•	•	•	•			•							•				
Noise						•	•	•	•	•	•	•				•	•		•	•				•
Electromagnetic Field						•	•	•	•											•				
Discharges and Releases		•			•	•	•	•	•	•									•	•		•		
Trash and Debris		•			•	•	•	•	•	•									•	•		•		
Traffic						•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•
Air Emissions	•																							
Visible Structures				•				•	•	•	•	•		•	•	•			•	•	•	•	•	•
Lighting						•	•	•		•	•	•			•	•			•		•	•	•	

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4.1.1 Seafloor/Land Disturbance

The Project activities with the potential to adversely affect the seafloor and land during construction include installation of foundations for up to 15 WTGs and one OSS, the installation of the Inter-array Cable, submarine export cable, and terrestrial export cable, and the construction of the interconnection facility. During O&M, disturbance to the seafloor and land could result from the presence of infrastructure and temporarily anchored maintenance vessels. Over the life of the Project, the placement of foundations and scour protection will alter the seabed and associated habitat by replacing the existing seabed and habitat with hard structures that create a reefing effect that results in colonization by assemblages of both sessile and mobile animals. Decommissioning activities will have similar impacts to the seafloor and land as construction.

SFWF and SFEC activities that could result in potential impacts by seafloor and land disturbances were presented in Table 4.0-1 and are further described below. Resources potentially impacted by seafloor and land disturbance are identified in Table 4.1-1, and further described in Sections 4.2 through 4.6.

4.1.1.1 South Fork Wind Farm

During construction of the SFWF, seafloor disturbance will be associated with several of the following activities:

- Seafloor preparation, including clearing and/or leveling of the seafloor, such as boulder relocation where necessary, prior to foundation and cable installation
- Pile driving for the monopile foundation for WTG and/or OSS
- Placement of rock scour protection at the base of each foundation
- PLGR, submarine cable trenching, or burial for the SFWF Inter-array Cable
- Anchoring of vessels and equipment during construction (including the use of spuds)

SFWF design parameters were discussed in Section 3.1.2. The extent of anticipated seabed disturbance during the construction and O&M phase for the monopile foundation is presented in Table 3.1-1 and repeated here in Table 4.1-2. As noted above, seafloor disturbance impacts will likely occur during O&M by the presence of the bottom-founded infrastructure and maintenance vessels temporarily anchored at the WTGs. Impacts on physical, biological, cultural, and socioeconomic resources from seafloor and land disturbances are evaluated in the sections identified in Table 4.1-1.

Table 4.1-2. SFWF: Summary of Seafloor Disturbance

Maximum temporary and permanent seabed footprint for components of the SFWF

Project Component/Activity	Construction (Temporary)	Operation (Permanent)
Monopile Foundation ^a	14.8 acres (6 ha)	14.6 acres (5.9 ha)
Foundation cable protection ^a	N/A	7.5 acres (4.2 ha)
Vessel anchoring/mooring ^c	820.8 acres (332 ha)	N/A
Inter-array Cable ^b	340 acres (137.6 ha)	2.5 acres (1.0 ha)

Table 4.1-2. SFWF: Summary of Seafloor Disturbance

Maximum temporary and permanent seabed footprint for components of the SFWF

Project Component/Activity	Construction (Temporary)	Operation (Permanent)
Inter-array Cable protection ^b	N/A	10.2 acres (4.1 ha)

Notes:

^a Conservatively assumes up to 16 foundations will be installed, including 15 foundations for WTGs and 1 foundation for the OSS. Permanent footprint also includes scour protection for 16 foundations and secondary cable protection for 16 foundations. Temporary disturbance includes seabed preparation.

^b Conservatively assumes the Inter-array Cable has a maximum length of 21.4 miles (34.4 km, 18.5 nm) and a diameter of 12 inches (0.3 m). Permanent footprint also includes secondary cable protection. Temporary disturbance includes seabed preparation.

^c Conservatively assumes that, during typical installation, three vessels will use anchors and that three vessels will use spud cans, and all six vessels will visit each of the 16 foundations.

ha = hectare(s)

Seafloor Preparation

Preparation of the seafloor for the SFWF foundations and Inter-array Cable will generally involve a levelness check and the removal of boulders, debris, and other obstructions for the foundation installation area. The PLGR will be completed to clear the Inter-array Cable route of possible obstructions and debris, such as abandoned fishing nets, wires, and hawsers. Seafloor preparation is temporary, direct disturbance to the seafloor prior to construction and installation activities that will occur in the same area with a similar extent of disturbance.

Foundation Installation

Pile driving will be used to install the monopile foundations to support the WTGs and OSS. Pile driving will disturb the seafloor at the point of pile penetration and the immediately adjacent area. During operations and maintenance, foundations will provide habitat that may be different from the existing seabed and that extends the entire water column. Similar bottom disturbance impacts will occur during decommissioning.

Monopile foundation systems involve driving a single, large-diameter, steel monopile into the seafloor to support each WTG or OSS. A monopile foundation is approximately 36 feet (11 m) in diameter and has a footprint of 1,025 ft² (95 m²). When considering the area of installed scour protection around the base of the monopile, the estimated seabed disturbance from each installed monopile foundation will be 39,765 ft² (3,694 m²) (see Table 3.1-2).

Inter-Array Submarine Cable

Disturbance to the seafloor from Inter-array Cable installation results from PLGRs, trenching for cable burial, and travel of the cable-laying equipment. The Inter-array Cable is expected to be installed using cable installation equipment that could include either a mechanical cutter, mechanical plow (which may include a jetting system), and/or jet plow. Additionally, boulders may be relocated within sections of the corridor for the cable route. Boulder relocation may occur within 66 feet (20 m) on each side of the centerline where necessary (see Section 3.1.2.3 for more detail). The Inter-array Cable will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m) in the seabed. Where the Inter-array cable emerges from the trench and is attached to the foundation, cable protection (e.g., engineered concrete mattresses) may be placed on the seabed near the WTG foundation. In addition, it is anticipated that a maximum of 10 percent of the Inter-array Cable (2.1 miles [3.4 km, 1.9 nm]) may not achieve the target burial depth if hard

substrate or other unforeseen obstacles are encountered. Secondary cable protection systems may be placed in those areas.

The design envelope parameters for the SFWF Inter-array Cable were defined in Table 3.1-4. Seafloor disturbance from Inter-array Cable installation is narrowly confined to the cable trench, the track width of the cable-laying equipment, and area of cable protection. The total estimated temporary seabed disturbance from Inter-array Cable installation, including seabed preparation, is 340 acres (137.6 ha). The total estimated permanent footprint of the Inter-array Cable, including secondary cable protection and cable protection at the approach to the foundations, is 20.2 acres (9.3 ha).

The depth of disturbance will be limited to the cross-section of the trench cut for cable laying. Some sediment transport is expected outside of the cable trench due to currents and is dependent on the sediment grain-size, composition, and forces imposed on the sediment column necessary to achieve desired cable burial depths. However, suspended sediments from the trench will likely settle back into the trench or in areas immediately adjacent to the trench. The potential effects on sediment resuspension and deposition are discussed in the following section.

Vessel Anchoring

Anchoring results in a range of shallow seafloor disturbances from the penetration of spuds or anchors, dragging of anchors and from the “sweeping” of anchor chains. The extent and severity of seafloor disturbances from vessel anchoring are influenced by several factors including spud/anchor size and configuration, wave and current conditions, vessel drag distances and the physical and biological characteristics of the seafloor where anchoring occurs. Post-construction seafloor surveys of the Block Island Wind Farm documented the variability of the residual impacts of construction activities in the context of benthic habitat types and the mobile or stable nature of the seafloor. Dynamic, mobile, and sandy seafloor types were observed to recover more quickly than stable seafloor types consisting of cobble and gravel (INSPIRE, 2017).

Temporary anchoring of vessels within the SFWF will occur during construction, O&M, and decommissioning for durations varying according to work activity as detailed in Section 3.1.3.1. Anticipated seabed disturbances from Project vessels were presented in Table 3.1-7. All vessel anchoring associated with the SFWF will occur within the maximum work area (MWA) (Figure 3.1-1) encompassing the WTGs and Inter-array Cable. During construction, jack-up or heavy lift barges, equipped with up to four spud cans per vessel for positioning, will be used for WTG installation. Other vessels, including tugs, material barges and CTVs may be occasionally anchored using single or multiple anchors. Throughout Inter-array Cable installation, less frequent anchoring by the dynamically positioned vessel (DPV) for cable-laying is anticipated. During O&M, anchoring will be limited to vessels required to be onsite for an extended duration. Typically, CTVs are not expected to anchor when visiting the SFWF. During decommissioning, seafloor disturbances from anchoring will be similar to those expected during construction.

4.1.1.2 South Fork Export Cable

During construction of the SFEC, seafloor and land disturbance activities will be similar to those previously identified for the SFWF Inter-array Cable in addition to the following:

- Installation of the sea-to-shore transition consisting of a new onshore transition vault and HDD of the cable under the beach and intertidal water areas, which may also include a temporary cofferdam.

- Construction of the new interconnection facility, on land adjacent to the existing LIPA substation in East Hampton, New York
- Trenching and installation of the onshore segment of the export cable

Section 3.2 provides a discussion of the SFEC and Table 3.2-2 presents a summary of the design parameters for the SFEC – OCS, SFEC – NYS, and SFEC – Onshore. Estimated areas of seabed disturbance during construction of the SFEC are summarized in Table 4.1-3. Sea floor and land disturbance associated with decommissioning activities are expected to be similar to those associated with construction.

Table 4.1-3. Seafloor Disturbance

Maximum temporary and permanent seabed footprint for components of the SFEC

Project Component/Activity	Temporary	Permanent
SFEC – OCS submarine cable ^a	555.3 acres (224.7 ha)	7.0 acres (2.9 ha)
SFEC – OCS cable protection ^b	N/A	7.7 acres (3.1 ha)
SFEC – NYS submarine cable ^a	18 acres (7.3 ha)	0.4 acres (0.17 ha)
SFEC – NYS cable protection ^b	N/A	0.2 acres (0.08 ha)
SFEC – NYS sediment excavation for an offshore cofferdam for sea-to-shore transition ^c	850 yd ³ (650 m ³)	N/A

Notes:

^a Conservatively assumes the SFEC has a total permanent diameter of 12 inches (0.3 m), and that temporary seabed disturbance includes seabed preparation.

^b Conservatively assumes additional cable protection, consisting of concrete matting or fronded mattresses, rock bags or rock placement (conservatively assumed to be 8 feet long by 20 feet wide [2.4 m long by 6.1 m wide]), for up to 5 percent of the SFEC - OCS (7.0 acres) and up to 2 percent of the SFEC - NYS (0.2 acres, and for seven locations (0.6 acres) where the SFEC - OCS will cross utility crossings, each of which may need up to 180 linear feet (54.9 m) of cable protection.

^c Cofferdam will enclose an area that is 75 feet long by 25 feet wide to a depth of up to 12 feet (22.9 by 7.6 m to a depth of up to 3.7 m).

m³ = cubic meter

yd³ = cubic yard

Seafloor Preparation

Site preparation of the seafloor along the SFEC – OCS and SFEC – NYS will be similar to the activities described for the SFWF Inter-array Cable in Section 3.1.3.3, except that no boulder relocation or installation trials are expected to occur within New York State waters.

SFEC Sea-to-Shore Transition

SFEC-Offshore installation will begin at the offshore sea-to-shore transition point, which may include installation of a temporary cofferdam. The cofferdam will be fabricated of sheet pile or a pre-cast, multi-sectional gravity cell, as explained in Section 3.2.3.4. The cofferdam will enclose an area up to 75 feet long by 25 feet wide to a depth of up to 12 feet (22.9 by 7.6 m to a depth of up to 3.7 m). It will be located at least 1,750 feet (533 m) offshore from the mean high-water line (MHWL) at the landing site in approximately 25 to 60 feet (7 to 18 m) of water depending on the landing site (see Figure 3.2-2). The cofferdam will occupy approximately 0.04 acres (0.02 ha) of seafloor. The area within the cofferdam or gravity cell may require the removal of sediment to

facilitate the completion of the HDD process and pull back of conduit and cable. Cable protection may be placed at the HDD exit point (e.g., one cable mattress).⁷

No disturbance to the seafloor is expected between the offshore cofferdam location and the shore because the cable will be installed via HDD.

SFEC - OCS and SFEC - NYS Installation

The installation of the submarine export cable will follow similar methods described in Section 3.1.3.3 for the SFWF Inter-array Cable, except that no boulder relocation, installation trials, or cable joint installation are expected to occur in New York State waters. Disturbance to the seafloor is characterized by the parameters provided in Table 4.1-4. Within the SFEC trench footprint, the seafloor sediments will be fluidized and/or moved by the cable installation equipment. Once the cable is laid into the trench, the suspended sediment is expected to settle back into the trench. Except for approximately 14.6 acres (6.0 ha) for the SFEC-OCS and 0.6 acres (0.26 ha) for the SFEC-NYS of permanent impact to the seafloor caused by the presence of the cable, cable joints, secondary cable protection, and cable protection for existing utility crossing, the direct impact of trenching/cable installation is temporary. Estimated temporary seabed disturbance for the SFEC-OCS is 330.9 acres (133.9 ha) and for the SFEC-NYS is 18 acres (7.29 ha). The installation of each offshore joint is expected to take 7 to 10 days and, if controlled flow excavation occurs, it would take an additional 48 to 72 hours to complete.

Table 4.1-4. SFEC Parameters: OCS and NYS Export Cable

Anticipated parameters for the export cable

Parameter	OCS	New York State
Cable diameter	8-12 inches (20 - 30.5 cm)	
Target burial depth ^a	4 - 6 feet (1.2 - 1.8 m)	
Maximum trench depth	10 feet (3 m)	
Maximum length of cable	57.9 miles (93.2 km, 50.3 nm)	3.5 miles (5.6 km, 3.0 nm)
<i>Maximum Permanent Footprint</i>		
Export cable ^b	7.0 acres (2.8 ha)	0.4 acres (0.17 ha)
Cable joints ^c	0.1 acres (.05 ha)	N/A
Secondary cable protection ^d	7.1 acres (2.8 ha) 305,974 ft ² (28,426 m ²)	0.2 acres (0.08 ha) 7,351 ft ² (683 m ²)
Cable protection for existing utility crossing ^e	0.6 acres (0.23 ha) 25,230 ft ² (2,344 m ²)	N/A
Total maximum permanent footprint	14.8 acres (6.0 ha)	0.6 acres (0.26 ha)
<i>Temporary Seabed Disturbance (not including permanent footprint)</i>		
Cable installation ^f	198.0 acres (80.1 ha)	18 acres (7.3 ha)
Cable installation trials ^g	9.3 acres (3.75 ha)	N/A

⁷ A mattress placed at the HDD exit point is included within the 0.2 acres (0.08 ha) for cable protection along the SFEC – NYS.

Table 4.1-4. SFEC Parameters: OCS and NYS Export Cable

Anticipated parameters for the export cable

Parameter	OCS	New York State
Boulder relocation ^g	357.3 acres (144.4 ha)	N/A
Cable joint installation ^g	4.9 acres (2 ha)	N/A
Total temporary seabed disturbance	555.3 acres (224.7 ha)	18 acres (7.29 ha)

Notes:

^a Burial depth is measured from the seabed to the top of the cable.

^b Conservatively assumes the SFEC - OCS has a length of 58.3 miles (93.9 km, 50.7 nm) and the SFEC - NYS has a length of 3.5 miles (5.6 km, 3.0 nm), and the cable diameter is 12 inches (0.3 m).

^c Conservatively assumes up to two cable joints may be installed for the SFEC – OCS. Each joint has a length of 36 feet (11 m) and a diameter of 3 feet (0.9 m), requires cable protection for 88 feet (27 m), and requires additional cable on each side of the joint for a length of 1312 feet (400 m).

^d Conservatively assumes secondary cable protection will be needed for up to 5 percent of the SFEC – OCS and up to 2 percent of the SFEC – NYS, where burial depth may be less than 4 feet (1.2 m). Cable protection will consist of concrete mattresses, fronded mattresses, rock bags, or rock placement (conservatively assumed to be 8 feet long by 20 feet wide [2.4 m long by 6.1 m wide]).

^e Conservatively assumes secondary cable protection, consisting of concrete mattress (8 feet long by 20 feet wide [2.4 m long by 6.1 m wide]), for up to seven existing cable systems, each of which may need up to 3,600 ft² (334 m²) of matting for 180 linear feet (54.9 m).

^f Conservatively assumes that temporary seabed disturbance will include installation equipment with a maximum temporary disturbance of either i) 25 feet (7.5 m) for 49.6 miles (79.9 km, 43.1 nm) for the SFEC – OCS and up to 3.5 miles (5.6 km, 3.0 nm) for the SFEC – NYS or ii) 43 feet (13 m) for up to 9 miles (14 km, 7.5 nm) for the SFEC – OCS.

^g Conservatively assumes additional temporary disturbance for other seabed preparation and cable installation activities, including installation trials, boulder relocation, and cable joint(s). Up to five installation trials may occur, each of which has a temporary disturbance of 25 feet (7.5 m) wide and 3,280 feet (1,000 m) long. Boulder relocation may occur within 66 feet (20 m) of each side of the cable centerline and will include total disturbance of 131 feet (40 m) wide for up to 50 percent of the total length of the SFEC – OCS; the temporary seabed disturbance includes the width in addition to cable installation (32.5 m for 32.8 km and 27 m for 14 km). Placement of cable joint(s) may include use of controlled flow excavator for up to two joints, each of which has a temporary disturbance of 33 feet (10 m) wide and 3,280 feet (1,000 m) long.

Some sediment transport is expected outside of the cable trench and is dependent on the sediment grain-size, composition, and forces imposed on the sediment column necessary to achieve desired cable burial depths. However, suspended sediments from the trench will likely settle back into the trench or in areas immediately adjacent to the trench. The potential effects on sediment resuspension and deposition are discussed in the following section.

Vessel Anchoring

Seafloor disturbance from temporary vessel anchors during SFEC installation may occur at the sea-to-shore transition during cofferdam construction location and intermittently along the SFEC cable corridor, if the DP cable-laying vessel or other support vessels must anchor. Short-term, localized seafloor disturbance will occur from vessels anchoring during SFEC installation. During O&M, anchoring will be limited to infrequent or emergency trips by maintenance vessels along the submarine export cable route. During decommissioning, seafloor disturbance associated with anchoring will generally be similar to that described for construction.

SFEC – Onshore Construction

Land disturbance will result from site clearance, excavation and filling associated with the construction of the onshore sea-to-shore transition, installation of the onshore cable, and construction of the interconnection facility. The construction sequence of these various activities

was presented in Sections 3.2.2.2 and 3.2.2.3. Land disturbance will be localized to the immediate construction areas and limited to the duration of cable installation activities. Construction of the upland transition vault and HDD operations will temporarily impact previously disturbed areas at the seaward end of Beach Lane or parking lot of the Hither Hills State Park.

The onshore cable will be installed underground in a duct bank between the onshore transition vault and Interconnection facility. The duct bank will be located underground within public ROWs and alongside the tracks within the LIRR ROW. Multiple SFEC routes are under consideration and will result in the cable being installed in previously disturbed upland areas, avoiding sensitive resources, and upon completion, no appreciable change in land cover or imperviousness is expected. Excavation, grading and fill along the roadways and existing ROWs (for example, LIRR) may require cutting or trimming of vegetation and removal of large rocks from the construction work area to facilitate safe construction.

The SFEC – Interconnection Facility will occupy a 2.4-acre (0.97 ha) wooded parcel in a residential and commercial area in East Hampton. The footprint of the SFEC – Interconnection Facility will be up to 228 by 313 feet (69 m by 95 m), including the exterior wall, with a maximum equipment height of approximately 43 feet (13.1 m). Tree clearing, except for a vegetative buffer around the substation, as well as excavation, grading, and filling, will be conducted on the lease parcel to house the interconnection facility. The wooded area will be converted to an industrial use with expected changes to onsite drainage patterns that will be addressed during the environmental management and construction planning phase of the Project.

All earth disturbances from onshore construction activities will be conducted in compliance with the New York SPDES General Permit for Stormwater Discharges associated with Construction Activities and an approved Stormwater Pollution Prevention Plan (SWPPP).

4.1.2 Sediment Suspension and Deposition

Sediment suspension and deposition are naturally occurring processes in a highly dynamic oceanographic environment. On the continental shelf, tidal circulation and storm waves play important roles in the transport of sediment. Meteorological and oceanographic conditions within the SFWF and SFEC are discussed in Section 4.2.4. However, these processes are altered in areas of disturbance where construction activities occur, or infrastructure is placed where it previously was not. Suspension of sediments into the water column, which is measured as turbidity, resulting from SFWF and SFEC construction, O&M, and decommissioning activities, may adversely impact water quality and marine life. Once in suspension in the water column, sediments are transported by currents, eventually settling back onto the seafloor, resulting in deposition. Deposition may adversely impact marine life by smothering or altering benthic habitats. The placement of infrastructure on the seafloor may change the local hydrodynamics of the area, causing the movement of surrounding sediment and potential undermining of foundations and submarine cables.

Changes to turbidity and deposition from Project activities depend on the nature of the activity, characteristics of the seafloor (stable or mobile), physical sediment characteristics, and hydrodynamics in the area of disturbance. SFWF and SFEC activities that could lead to sediment suspension and deposition are described below. The physical, biological, cultural, and socioeconomic resources impacted from sediment suspension and deposition are identified in Table 4.1-1.

4.1.2.1 South Fork Wind Farm

Construction

Sediment suspension and deposition resulting from bottom-disturbing construction and decommissioning activities are expected to be localized and short-term. Temporary sediment suspension and deposition within the SFWF will result from the following activities:

- Seafloor preparation, including boulder relocation
- Pile driving installation of monopile foundations
- Burial of the Inter-array Cable
- Vessel anchoring

Decommissioning activities involving the removal of installed Project components will also result in sediment suspension and deposition, similar to construction, if similar vessels, equipment, and methods are used. Once constructed, the SFWF will result in localized changes to seafloor topography and bottom currents because of the presence of foundations and scour protection. The seafloor overlaying the buried Inter-array Cable is expected to return to pre-construction conditions over time and no long-term changes to sediment mobility and depositional patterns are expected.

Seafloor Preparation and Foundation Placement

Sediment suspension and deposition will be caused by bottom-disturbing activities during installation of the monopile foundation. The effect of these activities is expected to be localized to the activity and short-term. Any physical disturbances from seafloor clearing or leveling, boulder relocation, placement of scour protection, vessel anchoring, or pile driving will cause small plumes of finer sediments to mobilize up into the water column where limited transport is anticipated. When the activity stops, the sediment suspension will abate, and sediment is expected to settle out onto the seafloor.

SFWF Inter-Array Cable Installation

The installation (or removal) of the Inter-array Cable is the activity expected to result in the greatest amount of sediment suspension and deposition in the SFWF area. The mechanical and/or hydrostatic forces of the cable-laying process will result in temporary increases in sediment suspension and cause deposition in the vicinity of the Inter-array Cable corridors.

RPS performed hydrodynamic and sediment dispersion modeling to assess potential environmental impacts from cable installation by the jet plow,⁸ one of three potential types of equipment for cable installation and assumed would produce the maximum amount of suspended sediments. The complete Hydrodynamic and Sediment Transport Modeling Results are provided as Appendix I.

The modeling for the SFWF Inter-array Cable assumed one pass of the cable-laying equipment between two WTGs within 1 day as a representative case. Model scenarios considered two seasonal tidal conditions to construct representative cases. It estimated the seabed footprint of sediment resuspension from jet plow trenching as approximately 3 feet (0.9 m) (trench surface width). The model assumed a total volume of the trench between the two WTGs of 3,063 cubic

⁸ Appendix I describes a “jet plow.” For consistency, Section 4 uses the term “jet plow” when discussing the results described in this Appendix. Both terms describe a method of submarine cable installation equipment that primarily use water jets to fluidize soil, temporarily opening a channel to enable the cable to be lowered under its own weight or be pushed to the bottom of the trench via a cable depressor.

yards (yd³; 2,342 cubic meters [m³]). Most of this material was assumed to remain undisturbed at the seabed since the jet plow does not directly excavate sediment from the trench. For modeling, it was assumed that the equipment would operate at a constant (sedimentation) production rate of 160 yd³/hour (122 m³/hour) (based on an advance rate of 220 feet/hour [67 m/hour]). The jet plow was assumed to have a nominal power of 1,600 kW and would circulate 1,674 yd³ (1,400 m³) of seawater per hour. The key results of the modeling relating to sedimentation and deposition from the SFWF Inter-array Cable installation using a jet plow (Appendix I) are as follows:

- The maximum predicted total suspended solids (TSS) concentration from the Inter-array Cable burial activities is 100 milligrams per liter (mg/L).
- Water column concentrations of 100 mg/L are predicted to extend up to 131 feet (40 m) from the source and TSS concentrations are predicted to return to ambient levels (<10 mg/L) within 0.3 hours from the conclusion of trenching.
- The maximum predicted deposition thickness is estimated to be 0.4 inch (10 mm) and limited to within 26 feet (8 m) of the burial route, covering an estimated cumulative area of 0.1 acre (0.04 ha).

Modeling results suggest that project-related sedimentation and deposition using a jet plow will not extend beyond the SFWF MWA and remain in federal waters. Water quality impacts will be short-term and relatively localized. Low amounts of sediment deposition will occur near the cable-laying activity.

Operations and Maintenance

During SFWF O&M, sediment suspension and deposition around the WTG foundations will be altered due to the localized changes in seafloor topography and hydrodynamics. The sediment around the WTG foundations will experience scour and backfilling subject to wave and current action with localized increases in turbidity. Potential adverse impacts from these processes will be mitigated by installing scour protection for the monopile foundation. Scour protection is discussed in more detail in Section 3.1.3.2, and the impact parameters for scour protection are presented in Table 3.1-2.

4.1.2.2 South Fork Export Cable

Section 3.2.3 presented a description of the sequence of cable installation activities. Installation of the SFEC by cable installation equipment, cofferdam installation, and vessel anchoring will result in sediment suspension and changes in depositional patterns along the proposed cable corridor. Decommissioning of the SFEC or removal of the submarine cable, would result in similar temporary impacts to construction phase impacts. Where the SFEC target burial depth is achieved, the seafloor is expected to return to pre-construction conditions over time and no long-term changes to sediment mobility and depositional patterns would be expected during O&M, apart from areas where armoring is required. In the rare instance that the SFEC must be visually inspected or repaired during O&M, excavation in and around the SFEC would result in short-term, localized sediment suspension and deposition.

Construction

SFEC – OCS and SFEC – NYS Cable Installation

Installation of the SFEC between the sea-to-shore transition to the OSS will be conducted using a DP cable-laying vessel and one of three potential types of cable installation equipment as described for the SFWF Inter-array Cable. The potential for sedimentation and deposition from

this activity is similar to that explained for the SFWF Inter-array Cable. However, the length and location of the SFEC is different than the Inter-array Cable. Sediment transport modeling was conducted to assess potential environmental impacts from cable installation by the jet plow, one of three potential types of equipment for cable installation.

As further detailed in Appendix I, sediment transport analysis for the SFEC included simulation of the cable installation between the sea-to-shore transition at Beach Lane and the SFWF OSS (61 miles [98.3 km]) assuming a jet plow. The model assumed a total volume of the SFEC trench of 214,943.4 yd³ (164,366 m³). Most of this material was assumed to remain undisturbed at the seabed since the jet plow does not directly excavate sediment from the trench. For modeling, it was assumed that the equipment would operate at a constant [sedimentation] production rate of 160 yd³/hour (122 m³/hour) (based on an advance rate of 220 feet/hour (67 m/hour)). The jet plow was assumed to have a nominal power of 1,600 kW and would circulate 1674 yd³ (1,400 m³) of seawater per hour. The key results of the modeling relating to sedimentation and deposition from the SFEC installation using a hydraulic jet plow (Appendix I) are as follows:

- The sediment plume that arises during trenching is transient, and generally oscillates with the tide.
- In New York State waters, the plume is oriented in a northeast/southwest configuration, reflecting the tidal current patterns near Long Island, which are aligned with the nearshore topography. As the trencher moves into deeper waters, past Montauk, the plume assumes more of a north/south orientation.
- The highest TSS concentrations are predicted to occur in locations (Figure 26, Appendix I) where the jet plow equipment passes over pockets of finer sediments (e.g., between VC-217 and VC-220, and again between VC-235 and the end of the route) but concentrations above 30 mg/L otherwise remain within approximately 100 m of the source during the simulation. The cross-section view presented in Figure 37, Appendix I (bottom) suggests that peak TSS concentrations will remain near the seabed, and plumes above 10 mg/L are not predicted to extend vertically beyond 9.8 feet (3 m) of the source at any time during the simulation.
- Sedimentation (Figures 38 through 44, Appendix I) is limited to the area immediately adjacent to the burial route (typically within 328 feet [100 m]) and the pattern of deposition appears more uniform when compared with the TSS concentrations in the water column.
- The maximum predicted TSS concentration during the SFEC - NYS segment of the simulation is 578 mg/L. TSS concentrations at or above 100 mg/L are predicted to extend a maximum of 120 m from the source and TSS concentrations are predicted to remain elevated above ambient levels (greater than 10 mg/L) for 1.3 hours after the trencher passes into federal waters. Sediment deposition does not reach the level of 0.39 inch (1.0 cm) within New York State waters (that is, maximum predicted deposition thickness resulting from the SFEC - NYS is 0.39 inch [9.9 mm]).
- For the portion of the installation in federal waters (SFEC-OCS) the maximum predicted TSS concentration is 1,347 mg/L. TSS concentrations at or above 100 mg/L are predicted to extend a maximum of 1,115 feet (340 m) from the source and TSS concentrations are predicted to remain elevated above ambient levels (greater than 10 mg/L) for 1.4 hours after the conclusion of trenching. The maximum predicted deposition thickness is 0.45 inch (11.4 mm). Sedimentation at or above 0.39 inch (1.0 cm) extends a maximum of 29.5 feet (9 m) from the burial route and covers a cumulative area of 4.3 acres (1.74 ha) of the seabed.

SFEC – Onshore Installation

Excavation, grading, filling, and construction vehicle movements associated with HDD operations, cable trenching, duct installation, laydown and staging, and interconnection facility construction during construction of the SFEC – Onshore increases the potential for soil erosion and sedimentation of local waterways by stormwater.

SFEC construction activities causing earth disturbance and the potential for soil erosion and sedimentation will be further addressed by the New York Public Service Commission's (NYPSC's) Article VII Certification and associated Environmental Management and Construction Plan (EM&CP, Construction Plan) detailing site-specific construction activities and the environmental best management practices (BMPs) to be implemented, which will be filed prior to construction. The SFEC will also be constructed in accordance with an approved SWPPP and the conditions of the SPDES General Permit for Stormwater Discharges from Construction Activity.

Operations and Maintenance

Sediment suspension and deposition may result from armoring placed over the SFEC – OCS and SFEC – NYS where target burial is not achieved or where crossing of existing telecommunications cables requires armoring. The introduction of rock or engineered concrete mattresses to areas of the seafloor can cause local disruptions to circulation, currents, and natural sediment transport patterns. Under normal circumstances these segments of the SFEC are expected to remain covered as accretion of sediment covers the cable and the armoring. In nonroutine situations, these segments may be uncovered, and re-burial might be required.

4.1.3 Noise

Noise is defined as unwanted sound, be it underwater or in-air (or airborne). Sound becomes an adverse impact when it interferes with the normal habits or activities of fish, wildlife or people. Recognition or perception of sound as noise, however is very subjective and circumstantial based on the receptor's experience as well as the characteristics of sound (DOI-MMS, 2007). The reception or perception of sound depends on many factors including the sound source (power level), frequency, distance between source and reception (sound pressure level [SPL]), receptor's hearing capability and physiology, and a suite of environmental factors including media (air, water, sediment), temperature, barriers, and other sounds. In this section, sources of noise from Project activities are identified and discussed as potential IPFs.

Noises generated by the SFWF and SFEC will transmit through the water and/or air. Underwater noises are those noises that transmit through the water column as the result of working engines or machines below the surface of the water (for example, vessel propeller or thruster) or noise transmitted through an underwater structure as waves of energy that propagate sound throughout the water column (for example, spinning WTG, impact or vibratory pile driving). In-air noises refer to those noises that are generated above the surface of the water and transmit through the atmosphere. For some activities, both in-air and underwater noises will be generated. During impact or vibratory pile driving, the pile driving hammer impacts the top of the steel pile generating sound waves through the air above the water and down through the water column. Noise-emitting activity and equipment abovedeck on work vessels can also generate sound both above and below the water in a similar way.

SFWF and SFEC activities that are expected to generate noise are presented in Table 4.0-1. The primary sources of noise associated with the SFWF and SFEC will occur during construction. Decommissioning may result in similar noise generation if it involves the removal of Project

components with comparable equipment and methods as construction. Operational noises will result from the operation of the WTG (SFWF) and the interconnection facility (SFEC) with occasional vessel and vehicle noise produced from routine maintenance activities. Most of the construction noises will be underwater: vessel noise, including DPV thrusters; impact pile driving; vibratory hammer pile driving; and cable installation equipment. However, general construction, including HDD operations and port activity, as well as pile driving will generate in-air noise.

Three studies were conducted to evaluate project-related noise in support of this COP. Appendix J contains the three acoustic assessments: 1) Evaluation of Potential In-air Noise Impacts for the SFWF and SFEC; 2) Underwater Acoustic Modeling of Construction Noise; and 3) SFWF and SFEC Onshore Sound Study. Summary-level information from the results of these studies is included in this discussion of noise as an IPF. Also, the results of the acoustics assessments provide the basis for the evaluations of potential impacts on biological and socioeconomic resources in the affected environment presented in Sections 4.3 and 4.6.

4.1.3.1 South Fork Wind Farm

Underwater and in-air sound will be generated during SFWF construction and decommissioning by pile-driving, power equipment used to install the WTGs (for example, cranes, compressors) and Inter-array Cable, and the movement of vessels, including DPVs. Construction vehicles and equipment will generate noise at ports used for construction staging. Possible O&M noises will result from the rotors of operational turbines, vessels, and infrequently from O&M activities onshore. The different sound-generating activities are further described and assessed below.

Vessel Noise

Ship traffic is widely recognized as the leading contributor of noise to the ocean environment and varies depending on several factors related to vessel size, load, draft, propeller size, and mission or activity (DOI-MMS, 2007). Vessel noise is also seen as the main contributor to ambient ocean noise in the low-frequency (LF) band that is audible by marine life (NRC, 2003; Hildebrand, 2009). A large portion of the noise from vessel traffic comes from engines and propeller cavitation, and those noises predominately occupy the LF spectral bands (Richardson et al., 1995). In the open water, vessel traffic can influence ambient background noise at distances of thousands of kilometers; however, the effects of vessel traffic noise in shelf and coastal waters are variable due to sound reflection, refraction, and absorption by the bathymetric and geological characteristics of the area.

During SFWF construction and decommissioning, the operation of vessels will transmit sound through both water and air. The vessels will be used to ferry workers and transport materials to offshore construction sites, lay Inter-array Cable, and provide work platforms for construction. Underwater vessel noise will result from turning propellers or DP thrusters; engine and other vessel noises being projected through vessel hulls; and the interactions of waves with the vessel's hull. Construction vessel noises are expected to be produced within the SFWF during installation and assembly of foundations, WTGs, OSS, and Inter-array Cable. Otherwise, noise from vessel movements will occur primarily at the beginning or end of each construction day, between Project ports, and whenever vessels move to or from the construction site transporting crews or equipment. During SFWF O&M, vessel noise will result from routine trips to the wind farm or in cases of emergency. Vessel noise during decommissioning is expected to be similar to construction vessel noise if the SFWF is removed using comparable vessels, equipment, and methods. Apart from the DPVs used to install the Inter-array Cable, project-related construction, O&M, and decommissioning vessels are not expected to contribute significantly to the

underwater or in-air noise from regular vessel traffic present in the waters in and around the SFWF and the port areas to be utilized by the Project.

The underwater noise from the cavitation on the propeller blades of the DPV thrusters is considered the dominant IPF of all the project-related vessel noises. DPV thrusters are known to generate significant underwater noise with continuous source levels ranging from 150 to 180 decibels (dB) referenced to (re) 1 micropascal (μPa) at 1 m (BOEM, 2013; Matthews, 2012). The predictive noise modeling conducted by JASCO Applied Sciences (JASCO) demonstrates representative sound propagation from DPVs completing cable-laying activities for the SFWF Inter-array Cable and the SFEC (Appendix J). The DPV thrusters generate nonimpulsive sound with the distance to unweighted SPLs (L_p) from the DP ranged from 164 feet (50 m) to the 166 dB isopleth, to greater than 8.7 miles (14 km) to the 120 dB isopleth. The implications of DP thruster propagation in terms of impacts to finfish, marine mammals, and sea turtles are discussed in Sections 4.3.3, 4.3.4, and 4.3.5, respectively, and Appendix P1.

Inter-Array Cable Installation Sound

Installation of the SFWF Inter-array Cable may involve using a jet plow. The jet plow is expected to generate sound underwater as it progresses along the seafloor but not above the water's surface. The sound is predominantly from the high-pressure water jetted into the seafloor from the jet plow to create a trench for the cable to lay into. This underwater hydraulic sound is expected to be masked by DPV thrusters that will be operating at the same time. Therefore, the jet plow is not considered a source of a noise IPF. Other cable installation equipment that may be used for the Inter-array Cable is not expected to generate noticeable levels of underwater noise.

Aircraft Noise

Helicopters may be used for emergency transport and/or maintenance activities between the SFWF and onshore landing locations and will not generate a noise IPF. As discussed in Appendix J, sound levels from helicopters flying back and forth to the SFWF are not expected to last for extended periods of time at points other than existing helipads or to reach levels of potential impact to wildlife or people.

General Construction Noise – Ports and other Onshore Facilities

During construction of the SFWF, heavy equipment, vehicles, and power tools will be used to support fabrication, installation, and maintenance activities. It is expected that most, if not all, of these activities will occur at existing ports in Connecticut, Massachusetts, New York and/or Rhode Island where there will be other ongoing industrial activities, independent of the SFWF. Construction sounds specifically related to SFWF activities at existing port facilities are expected to be similar to operational sounds associated with routine activities at these existing ports and therefore, are not considered a noise IPF.

Pile Driving Noise

In-air and underwater noise will result from the use of impact pile drivers to install the SFWF monopile foundations. Pile driving sound levels vary with pile size (diameter and wall thickness), subsurface/ geotechnical characteristics, hammer energy and type of pile driver. Pile driving sounds propagate both above and below the sea surface although sound transmission is different in water than in air making it difficult to compare airborne and underwater sound levels.

Impact pile-drivers typically utilize a weight (sometimes referred to as a piston or hammer) to impact the top of a pile to force it into the seafloor. The repetitive hammer blows drive the pile into the seafloor, similar to hammering a nail into a piece of wood. Piles are driven until the

desired resistance is achieved (typically measured in blow counts per foot or inch) or the pile fails to advance (known as refusal). The primary sources of noise associated with impact driving are the impact of the hammer on the pile/drive cap and the noise radiated from the pile.

In-Air Noise from Pile driving

Driving of monopiles will generate in-air impulse sounds as the hammer strikes the pile. This sound source will only last as long as the duration of pile driving and take place exclusively offshore within the SFWF work area. In-air noise is expected to reach 94 A-weighted decibels (dBA) at 50 feet from the source to 60 dBA at 2,400 feet from the source (Appendix J2). No pile driving noise from the SFWF is expected to reach the shore.

Underwater Noise from Pile driving

Underwater noise from pile driving is considered an important IPF because of its potential impacts on marine life such as marine mammals, sea turtles, and certain finfish. To define underwater impulsive sounds from pile driving, an acoustic modeling study was completed by JASCO and is presented in Appendix J1. JASCO used its acoustic propagation model, Full Waveform Range-dependent Acoustic Model (FWRAM) to predict the propagation of underwater sound. The sound propagation modeling incorporates site-specific environmental data that describes the bathymetry, sound speed in the water column, and seabed geoacoustics in the SFWF. Two locations were selected within the SFWF to model representative sound fields associated with potential monopile foundation pile driving. DWSF also supplied the following information for the model: pile-driving equipment, pile specifications, pile-driving schedules, soft start procedures, and noise attenuation technologies.

Modeling estimated the distances of impulse sound propagation to certain acoustic thresholds as published by federal and state agencies for finfish, marine mammals, and sea turtles. These distances are used to define this particular IPF, so the impact evaluations could be completed. These evaluations are presented in Sections 4.3.3, 4.3.4, and 4.3.5, and Appendix P1.

4.1.3.2 South Fork Export Cable

The potential for noise to be generated during construction or decommissioning of the SFEC is the result of vessel use, including the DPV for cable installation; aircraft use; sheet pile cofferdam installation by vibratory hammer; installation of the SFEC – Onshore; and construction of the SFEC - Interconnection Facility. During SFEC O&M, there will be no underwater noise. Only the OSS is expected to generate in-air sound.

Vessel Noise

Vessel noise, both underwater and in-air, during construction, O&M, and decommissioning of the SFEC is expected to be similar to the vessel noise described for the SFWF above. As is expected to be the case with the installation of the SFWF Inter-array Cable, the DPV thrusters will be the dominant underwater sound source during SFEC construction and decommissioning. Unlike the installation of the SFWF Inter-array Cable that will occur within the offshore SFWF work area, DPV operations performing SFEC installation will occur over approximately 50 to 60 miles (80.5 to 96.6 km) from the SFWF to the sea-to-shore transition point just off the shore (approximately 2,100 feet [640 m]) of Long Island.

Submarine Cable Installation Sound

As described for the installation of the SFWF Inter-array Cable, SFEC cable installation is not expected to generate impact-producing sound beyond that described above for the DPV thruster.

Aircraft Noise

Aircraft noise from nonroutine helicopter use is expected to generally be the same as discussed for SFWF above.

General Construction Noise – Ports and other Onshore Facilities

During the construction of the SFEC, vehicle, vessel, and equipment sounds associated with staging and support activities at existing ports are similar to those described for the SFWF above.

Offshore Cofferdam Installation

As described in Section 3.2.3.4, a temporary cofferdam may be located approximately 1,700 feet (518 m) offshore from the MHWL at the potential landing site (Beach Lane or Hither Hills) to facilitate cable pull-in at the sea-to-shore transition. The cofferdam will be sited at a location with approximately 25 to 60 feet (7 to 18 m) of water depth. The cofferdam will be installed using either sheet pile or gravity cell.

If the temporary cofferdam is constructed of steel sheet pile, vibratory hammer pile driving will be used for installation and removal. Vibratory hammering, which is a nonimpulsive (or continuous) sound source, differs from the impact hammering, which is an impulsive sound source, in several ways. The propagation characteristics of the vibratory hammering differ from the impact hammering because the location is close to shore and the duration of the installation is estimated to be short (roughly 12 to 24 hours). The threshold criteria for vibratory hammering also differs from the impact hammering being used for SFWF foundation installation.

The distance from shore and the likelihood the sound will be masked by ambient sounds or other construction noises diminish the circumstances that people will be exposed to disturbing noise. The in-air noise evaluation in Appendix J2 estimated cofferdam installation noise levels at 62 dBA at the shoreline, which is within both applicable state and local noise standards.⁹

Underwater continuous or nonimpulsive sound from cofferdam installation is expected to propagate over considerable distances and is a concern with respect to potential noise-related impacts on marine life. JASCO included vibratory hammer sound predictions in its underwater acoustic modeling study presented in Appendix J1. Modeling estimated the distances of nonimpulsive sound propagation to certain acoustic thresholds as published by federal and state agencies for finfish, marine mammals, and sea turtles. These evaluations are presented in Sections 4.3.3, 4.3.4, and 4.3.5, respectively, and Appendix P1.

SFEC - Onshore Installation Noise

Construction activities would introduce temporary noise sources associated with the different phases of SFEC - Onshore installation. The following summarizes the different phases of construction:

- An HDD rig, mud pump, crane, generator, backhoe, and other HDD installation activities are expected to take approximately 10 to 12 weeks and HDD activities would be completed outside the summer season. Construction at the sea-to-shore transition site would also include site preparation and excavation for the vault, including an excavator, crane, and sheetpile driver. The onshore workspace for the HDD will include a temporary sheetpile anchor wall to provide stability of the HDD rig while conducting drilling activities. The temporary anchor wall is anticipated to be approximately 29.5 feet (9 m) in length and driven to a depth of

⁹ See Section 3 – Regulatory Context of the SFEC Sound Study (VHB 2018) in Appendix J for applicable noise standards.

19.7 feet (6 m). In addition to the anchor wall, the workspace may also require the installation of other temporary sheetpiles to aid in anchoring of the rig or to provide soil stabilization of the excavated area.

- The SFEC – Onshore cable route begins at the sea-to-shore transition vault and would run to the SFEC – Interconnection Facility at Cove Hollow Road. A duct bank would be located underground along public road ROWs and the LIRR ROW and would not include any overhead lines before arriving at the SFEC – Interconnection Facility. Wherever possible, the SFEC - Onshore route would be located within the existing paved section of the road ROW. Underground cable construction typically includes concrete saws, jackhammers, or hoe rams to remove existing pavement and small backhoes, trenchers, and dump trucks to install the cable and replace the paved surface. SFEC - Onshore cable installation is expected to take approximately 9 to 12 months and would occur during daytime hours.
- Construction of the SFEC – Interconnection Facility would take approximately 6 to 9 months and would occur during daytime hours. Substation construction would include the following activities:
 - Site preparation, excavation, and grading (this is typically the loudest phase of substation construction)
 - Construction of foundations for the control building, transformer, reactors, and switchgear
 - Construction of electrical grounding, duct banks, and underground conduits
 - Installation of appropriate drainage systems and station service including electrical and water
 - Installation of all above ground structures including transformer, switchgear, and cable systems

VHB (2020) modeled construction noise for the SFEC - Onshore components listed above using standard methods for energy and transmission line projects in a manner that is consistent with federal guidelines (Appendix J3). The construction noise model accounts for the types of construction equipment, the number of each type of equipment, the amount of time they typically operate during a work period (usage factor), and the distance between receptor locations and the equipment. For typical daytime construction activities, construction noise is evaluated according to the 8-hour energy-average $L_{eq}(8h)$. For construction activities that may occur continuously, such as HDD, construction noise is evaluated according to the 24-hour energy-average $L_{eq}(24h)$.

Noise emissions of construction equipment is based on reference data from the Federal Highway Administration's (FHWA's) Roadway Construction Noise Model (RCNM) and other project-specific equipment specifications. RCNM includes a database of sound emissions for commonly used construction equipment such as dump trucks, backhoes, concrete saws, air compressors, and portable generators.

For stationary construction, including site preparation for HDD operations and construction at the SFEC – Interconnection Facility, Cadna-A has been used to predict sound at nearby receptor locations. The model includes specific locations of the equipment, heights of the construction noise sources, terrain, and location and height of intervening objects such as sound walls surrounding the HDD site. The model provides construction sound level contours from the sites. For construction of the SFEC - Onshore, which moves linearly along public road ROWs and the

LIRR ROW, the FHWA RCNM model is used to predict construction noise levels. The model provides sound level versus distance results (Table 4.1-5).

Table 4.1-5. Construction Equipment Noise Emissions

Construction Activity	Construction Equipment	Sound Level (dBA)	Utilization Factor
SFEC - Onshore Construction in Roadway or Railway	Dump Truck ^a	76 dBA at 50 feet	40%
	Backhoe ^a	78 dBA at 50 feet	40%
	Jackhammer, Hoe Ram, or Concrete Saw ^a	90 dBA at 50 feet	20%
	Generator (75 kW) ^b	56 dBA at 50 feet	40%
SFEC – Interconnection Facility Construction	Crane ^a	76 dBA at 50 feet	10%
	Backhoe ^a	78 dBA at 50 feet	40%
	Dump Truck ^a	76 dBA at 50 feet	40%
HDD Onshore Site Preparation	Impact Pile Driver ^a	101 dBA at 50 feet	20%
	Excavator ^a	81 at 50 feet	40%
	Crane ^a	76 at 50 feet	10%
HDD Onshore Entry / Exit Site	HDD Rig ^c	70 dBA Sound Power	100%
	Mud pump ^d	67 dBA Sound Power	50%
	Crane ^a	76 dBA at 50 feet	10%
	Generator (75 kW) ^b	56 dBA at 50 feet	40%
	Backhoe ^a	78 dBA at 50 feet	40%

Sources:

^a RCNM, 2011.

^b Whisper Watt Ultra Silent 75 kW Generator.

^c Vermeer, Caterpillar

^d eNoise Control Case Study (Sound Power Level, 98 dBA).

SFEC – Interconnection Facility Noise

Operation of the SFEC – Interconnection Facility would introduce new sources of noise (Appendix J includes site-specific noise-modeling). The SFEC – Interconnection Facility is assumed to include: One main power and one dynamic volt-amperes-reactive (DVAR) transformer rated for 650 kV Basic Insulation Level (BIL) and 108 mega-volt-amperes (MVA); two oil-cooled reactors rated for 35 mega-volt-amperes-reactive (MVA_r); and, one control house with exterior HVAC equipment. Based on the results of the modeling:

- Sound from the SFEC – Interconnection Facility is modelled to be 37 dBA at the closest receptor property line location. At all other receptor locations, sound from the SFEC – Interconnection Facility would be 35 dBA or lower.

- Nighttime ambient sound measures near the substation site indicate that existing ambient nighttime sound levels range from 37.3 to 42.2 dBA (L_{eq}). Sound from the SFEC – Interconnection Facility is modelled to be below existing nighttime ambient sound levels at all receptor locations. The greatest increase in future noise would be 2.6 dBA at the closet receptor property line location. At all other receptor locations, future sound levels would increase 2 dB or less. Future increases in sound of less than 3 dBA is typically below the threshold of perception.

For additional data on the measured ambient sound levels and predictive operational sounds from the SFEC – Interconnection Facility, please see Tables 10 and 11 in Appendix J3.

4.1.4 Electromagnetic Field

4.1.4.1 SFWF Inter-Array Cable and SFEC

Operations

EMF are physical fields produced by electrically charged objects. Like all wiring and equipment connected to the electrical system, the electric and magnetic fields (EMF) surrounding cables such as the SFWF inter-array and the SFEC, will oscillate with a frequency of 60 Hertz (Hz). The magnetic field results from the flow of electricity along the cable and the magnetic flux density is reported in units of milligauss (mG), where 1 Gauss (G) = 1,000 mG. The magnetic field will be strongest at the surface of the cable and will decrease rapidly with distance from the cables. An electric field is created by the voltage applied to the conductors within the cable, but this electric field is totally shielded from the marine environment by grounded metallic sheaths and steel armoring around the cable. However, the oscillating nature of the 60-Hz magnetic field will induce a weak electric field around the cable that, similar to the magnetic field, will vary in strength based on the flow of electricity along the cable. The electric field is measured in units of millivolts/meter (mV/m).

Two assessments of electric and magnetic fields were conducted in support of the Project by Exponent. Appendix K contains the offshore and onshore EMF assessments that examined the potential for EMF generation from the SFWF Inter-array Cable and the SFEC offshore segments and SFEC – Onshore, respectively. The modeling of magnetic field and induced electric fields at the Project site was used in the analysis of the available scientific literature on the sensitivity of marine species to EMF. Resources potentially impacted by SFWF and SFEC EMF are identified in Table 4.1-1, and further described in Sections 4.3 through 4.6. The key findings from the offshore and onshore EMF reports (Exponent, 2018a, b) are provided as follows:

- Offshore, modeling results under winter normal conductor (WNC) conditions confirm that the maximum magnetic fields at 3.3 feet (1 m) above the seabed are below 200 mG everywhere along the offshore portion of the Project.
- Calculated magnetic-field levels for offshore are further found to be below reported thresholds for effects on the behavior of magnetosensitive fish and calculated induced electric-field levels are found to be below reported detection thresholds of local electrosensitive fish.
- Onshore, the proposed cables were modeled for line loadings equal to the WNC ratings as well as the maximum assumed output of the SFWF turbines. Modeling results under WNC conditions show that the maximum magnetic field ± 50 feet from the duct bank centerline in all portions of the route are below 200 mG for the proposed configurations of the transmission lines.

- The electric field from the underground and submarine transmission cables is blocked by the cable armoring as well as the earth and therefore will not be a direct source of any electric field outside the cables.

4.1.5 Discharges and Releases

Discharges and releases of liquids and solid waste to the ocean or land pose a threat to water quality and risks to marine life from exposure, ingestion, or entanglement. Routine or accidental (non-routine) fuel spills, wastewater discharges and solid waste releases associated with SFWF and SFEC activities are possible but considered unlikely during normal construction, O&M, and decommissioning activities. Appendix F includes additional information about the potential discharges and potential methods of treatment.

4.1.5.1 South Fork Wind Farm

Construction and Decommissioning

Routine Discharges and Disposal

The greatest volume of vessel traffic and overall project-related activity will occur during the construction phase (of both the SFWF and SFEC). Routine discharges of wastewater (e.g., gray water or black water) or liquids (e.g., ballast, bilge, deck drainage, stormwater) outside of state waters may occur from vessels, WTGs, or the OSS during construction and decommissioning; however, those discharges and releases are anticipated to have negligible impacts because all vessel waste will be offloaded, stored, and disposed of in accordance with all applicable local, state, and federal regulations, such as the EPA and USCG requirements for discharges and releases to surface waters. In addition, compliance with applicable project-specific management practices and requirements will minimize the potential for adversely impacting water quality and marine life.

In accordance with the Oil Pollution Act of 1990 (OPA-90) and the MARPOL 73/78 international treaty, owners and operators of certain vessels are required to prepare Vessel Response Plans (VRP) approved by the USCG. In addition, the USCG regulates the at-sea discharges of vessel-generated waste under the authority of the Act to Prevent Pollution from Ships. All Project vessels will be required to comply with the applicable USCG pollution prevention requirements. Additionally, all vessels less than 79 feet (24.1 m) will comply with the Small Vessel General Permit issued by EPA on September 10, 2014 for compliance with National Pollutant Discharge Elimination System (NPDES) permitting.

Accidental or Non-Routine Spills or Releases

During construction and decommissioning, there is increased probability of spills and accidental releases of fuels, lubricants, and hydraulic fluids. BMPs for fueling and power equipment servicing greatly minimizes the potential for spills and accidental releases and will be incorporated into the SFWF and SFEC Oil Spill Response Plan (OSRP; Appendix D). Accidental releases are minimized by containment and clean-up measures detailed in the OSRP.

During all SFWF phases, certain hazardous materials necessary to support the installation of the WTGs will be transported to and from the SFWF and ports, including the SFWF O&M facility. The transport of this material may result in the accidental discharges of small volumes of hazardous materials, such as oil, solvents, or electrical fluids. The OSS will have transformers that contain large reservoirs of electrical insulating oil (such as mineral oil), as well as smaller amounts of additional fluids, such as diesel fuel and lubricating oil. Per the information requirements outlined in 30 CFR 585.626, a list of solid and liquid wastes generated, including

disposal methods and locations, as well as federally regulated chemical products, is found in Appendix F. SFWF and SFEC activities that could result in potential discharges and releases are presented in Table 4.0-1, and are further described below. Resources potentially impacted by discharges and releases are identified in Table 4.1-1, and further described in Sections 4.2 through 4.6.

Operations and Maintenance

The WTGs will be designed to contain any potential leakage of fluids, thereby preventing the discharge of fluids into the ocean. During WTG maintenance, small leaks could occur during servicing of hydraulic units or gearboxes. During WTG operation, small accidental leaks could occur because of broken hoses, pipes, or fasteners. Any accidental leaks within the WTGs are expected to be contained within the hub and main bed frame or tower. During O&M, the only discharges to the sea that are anticipated are those associated with vessels performing maintenance. BMPs for fueling and power equipment servicing greatly minimize the potential for spills and accidental releases. Accidental releases are minimized by containment and clean-up measures detailed in the OSRP (Appendix D).

4.1.5.2 South Fork Export Cable

Discharges and releases of liquids and solid waste to the ocean or land from SFEC construction, O&M, and decommissioning is similar to those described for the SFWF. The SFEC is a solid dielectric cable and is not liquid filled so there is no risk of cable rupture and release. Vessels used during SFEC construction or decommissioning will also comply with applicable local, state, and federal regulations and project-specific plans and procedures. The potential for discharges and releases from SFEC - Onshore construction will be governed by New York State regulations and the Project's Construction Plan. O&M of the SFEC – Interconnection Facility represents low potential for discharges and releases during routine O&M.

The sea-to-shore transition, which includes an HDD of the cable under the beach and intertidal water areas, will require the use of HDD drilling fluid, which typically consists of a water and bentonite mud mixture or another non-toxic drilling fluid. Bentonite is a natural clay that is mined from the earth, and similar to the clay minerals that are present in the drilling location. While the mixture is not considered toxic, if released, DWSF will implement BMPs during construction to minimize potential release for a frac-out of the drilling fluid associated with HDD activities.

4.1.6 Trash and Debris

Solid wastes and construction debris will be generated predominantly during construction and decommissioning of the SFWF and SFEC. Per the information requirements outlined in 30 CFR 585.626, a list of solid and liquid wastes generated, including disposal methods and locations is presented in Appendix F. The discharge or disposal of solid debris into offshore waters from OCS structures and vessels is prohibited by BOEM (30 CFR 250.300) and the USCG (MARPOL, Annex V, Pub. L. 100–220 [101 Stat. 1458]). The SFWF and SFEC activities that could result in the generation of trash and debris are presented in Table 4.0-1 and are further described below. Resources potentially affected by discharges and releases are identified in Table 4.1-1, and further described in Sections 4.2 through 4.6.

Construction and Decommissioning

It is anticipated that comprehensive measures, in accordance with applicable federal, state, and local laws, will be implemented prior to and during SFWF and SFEC construction to avoid,

minimize, and mitigate impacts related to trash and debris disposal. Offshore, trash and debris will be contained on vessels and offloaded at port/construction staging areas. Material that has been shredded and can pass through a 25-millimeter (mm) mesh screen may be disposed according to 33 CFR 151.51-77. All other trash and debris returned to shore will be disposed of or recycled at licensed waste management and/or recycling facilities. Disposal of any solid waste or debris in the water will be prohibited. Good housekeeping practices will be implemented to minimize trash and debris in the SFWF and SFEC work areas, offshore, and onshore.

Operations and Maintenance

During O&M of the SFWF and SFEC, the generation of trash and debris is likely to be limited. The overall quantity of trash and debris is likely to be small because most maintenance activities are unlikely to produce much of this type of material. The nominal amounts of trash and debris generated by maintenance activities will be managed in accordance with federal, state, and local laws and not disposed of at sea or on land.

4.1.7 Traffic (Vessels, Vehicles, and Aircraft)

Anticipated traffic related to the SFWF and SFEC will include water vessels, onshore vehicles, and helicopters. An overview of anticipated vessel usage is provided in Table 3.1-6. SFWF and SFEC activities that could result in potential impacts by traffic (vessels, vehicles, and aircraft) are presented in Table 4.0-1 and are further described below. Impacts to physical, biological, cultural, and socioeconomic resources from project-related traffic are evaluated in the sections identified in Table 4.1-1. The impacts of traffic on marine navigation are evaluated in Section 4.6.6, Commercial Shipping; Section 4.6.8, Other Marine Uses; and Appendix X, Navigational Safety Risk Assessment.

4.1.7.1 South Fork Wind Farm

Marine Vessel Traffic

A temporary increase in vessel traffic will occur during construction of the SFWF. Vessel traffic will occur at the SFWF and along routes between the SFWF and the ports used to support Project construction, O&M, and decommissioning. Timing of vessel traffic will be clarified once final construction schedules are issued and approved. The amount of time vessels will transit back and forth to the SFWF and how long they will remain on station is greatly dependent on final design factors, weather, sea conditions, and other natural factors. The larger installation vessels, like the floating/jack-up crane barge and DP cable-laying vessel, will generally travel to and out of the construction area at the beginning and end of the SFWF construction and not on a regular basis. Tugs and barges transporting construction equipment and materials will make more frequent trips while smaller support vessels carrying supplies and crew may travel to the SFWF daily. However, construction crews responsible for assembling the WTGs will hotel onboard installation vessels at sea thus, limiting the number of crew vessel transits expected during SFWF installation.

During SFWF O&M, vessel traffic will be limited to routine maintenance visits and nonroutine maintenance, as needed. Limited crew and supply runs using smaller support vessels will be required. Marine vessel traffic impacts during SFWF O&M will be based on the moderate size of the maintenance vessel and the number of vessel trips. Impacts are more fully evaluated in the navigation assessment in Section 4.6.6, Commercial Shipping, Section 4.6.8, Other Marine Uses, and Appendix X, Navigational Safety Risk Assessment.

Vehicular Traffic

Vehicular traffic during SFWF construction will include truck and automobile traffic over existing roads and highways to support various activities on land and at sea. The majority of vehicular traffic will be within and around the potential ports identified to support SFWF construction. It is expected that the greater proportion of SFWF components will be transported by sea; however, some components and equipment will arrive by land at varying frequencies throughout the construction period. Project-related deliveries will result in loading and unloading traffic as well as vehicle movements to complete assembly, fabrication, and staging of SFWF components and equipment. Vehicular traffic volumes and frequencies associated with the SFWF are not expected to have a measurable impact on traffic in and around the selected port facilities.

Aircraft Traffic

Anticipated aircraft traffic includes only helicopter trips to and from the SFWF during construction, O&M, and decommissioning for emergency transport or limited maintenance transport of crew and/or supplies. A winch deck for emergency evacuation is proposed as part of the OSS platform. Based on the very low anticipated frequency of aircraft traffic, the impact of air traffic is expected to be minimal for both the SFWF and SFEC during construction, O&M, and decommissioning.

4.1.7.2 South Fork Export Cable

Marine Vessel Traffic

Construction of the SFEC will require various vessel types including a DP cable-laying vessel, tugs, barges, and work and transport vessels. Cable installation will begin at the offshore site of the sea-to-shore transition point and proceed to the SFWF OSS. A comparable level of vessel activity is expected during decommissioning. During O&M, very limited vessel usage is expected for survey vessels and small maintenance vessels tasked with investigating any reported problems.

Vehicular Traffic

During SFEC installation, the transport of materials, personnel, and equipment in and out of the ports where staging, assembly, and fabrication take place will result in temporary increases in traffic along nearby roadways. During SFEC – Onshore installation, construction vehicles, including site worker vehicles, will result in temporary (mostly daytime) increases in traffic within the relatively dense, residential areas of East Hampton, New York. Vehicular traffic attributed to the SFEC will occur over a relatively short period and include heavy equipment (for example, excavators, dump trucks, and paving equipment) for onshore cable installation and interconnection facility construction.

Onshore construction activities will abide by local construction ordinances and occur primarily during normal daylight hours except for certain activities associated with cable installation at the landing sites. The increase in any construction traffic in East Hampton, New York would be comparable to typical roadway or utility construction work. New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures.

During O&M, vehicle traffic will be limited to the anticipated use of a pickup truck making routine visits to the SFEC - Interconnection Facility and occasional operational emergency visits. These limited additional trips are not expected to contribute to local traffic in any way.

Aircraft Traffic

Similar to anticipated aircraft traffic from the SFWF, helicopter usage associated with the SFEC would be primarily during the construction or decommissioning phase and during emergencies.

4.1.8 Air Emissions

Air emissions associated with construction, O&M, and decommissioning of the SFWF and SFEC depend on many factors, such as location, scope, type, and capacity of equipment; and schedule. Primary emission sources associated with the SFWF and SFEC will be from engine exhaust of marine vessel traffic, heavy equipment, and onshore vehicles during construction (Table 3.1-6). In general, most criteria pollutant emissions will be from internal combustion engines burning diesel fuel and will include primarily nitrogen oxides (NO_x) and carbon monoxide (CO), lesser amounts of volatile organic compounds (VOCs) and particulate matter less than 10 micrometers in aerodynamic diameter (PM₁₀) – mostly in the form of particulate matter less than 2.5 micrometers in aerodynamic diameter (PM_{2.5}), and negligible amounts of sulfur oxides (SO_x). Project air emissions are subject to the regulations summarized in Section 4.2.1.

SFWF and SFEC activities that could result in air emissions are presented in Table 4.0-1 and are further described below. Resources potentially impacted by air emissions are identified in Table 4.1-1, and further described in Section 4.2.1. In addition, an inventory of project-related air emissions is provided as Appendix L.

4.1.8.1 South Fork Wind Farm

SFWF construction, O&M, and decommissioning activities will rely on combustion engines to transport crew, equipment, and materials. These project-related emission sources will be located offshore and onshore during all Project phases. Primary SFWF emissions sources include the vessels and vehicles included in Table 3.1-6. In addition, general and specialized construction equipment, utilized offshore on vessels and work platforms and onshore at regional ports, have the potential to emit pollutants during SFWF construction. These emission sources are included in the emissions inventory found in Appendix L.

SFWF construction vessels will transit between onshore support/staging facilities at ports located in Connecticut, Massachusetts, New York, and Rhode Island and the SFWF work area. Most of these vessels and onboard construction equipment will utilize diesel engines burning low sulfur fuel while some larger construction vessels may use bunker fuel. SFWF O&M activities will likely consist of small vessels transiting to and from the SFWF to service the WTGs or the OSS over the 25 year operational life of the SFWF. The estimated duration of usage for vessels is also provided in Appendix L.

4.1.8.2 South Fork Export Cable

Primary SFEC emissions sources include the vessels and vehicles included in Table 3.1-6 and further assessed in Appendix L. The SFEC – OCS and SFEC – NYS will mainly involve the DP cable-laying vessel and support vessels. The remainder of the vessels will be similar to, but fewer than, the vessels used during SFWF construction. Also, like the SFWF, construction staging and laydown for offshore construction will occur at port facilities in Connecticut, Massachusetts, New York, Rhode Island, New Jersey, Maryland, and/or Virginia.

Construction of the SFEC - Onshore will include an increase in construction equipment and vehicles, that are expected to emit (or have the potential to emit) air pollutants. Construction activities that will utilize primarily diesel-powered equipment include HDD operations, trenching/duct bank construction, and cable pulling and termination. In addition, a localized

increase in fugitive dust may result during onshore construction activities. Any fugitive dust generated during construction of the SFEC - Onshore will be managed in accordance with the Project's Construction Plan.

4.1.9 Visible Structures

The SFWF and SFEC components that will be permanently visible and occupy space underwater, above water and on land have the potential to impact resources. Vessels, vehicles, and equipment used during SFWF and SFEC construction will be visible for a limited time and only from certain locations on the OCS, Long Island, and the ports to be used during construction. The temporary nature of these source during construction have such a negligible anticipated impact on resources that they are not considered further in this discussion. Once the Project is constructed, the visible structures will be the WTGs and the OSS.

SFWF and SFEC activities resulting in visible structures are presented in Table 4.0-1 and are further described below. Resources potentially impacted by visible structures are identified in Table 4.1-1, and further described in Sections 4.2 through 4.6. Impacts to visual resources and viewsheds are summarized in Section 4.5, Visual Resources and analyzed in Appendix U, Visual Resource Assessment, SFEC Onshore Substation, and Appendix V, Visual Impact Assessment - SFWF.

4.1.9.1 South Fork Wind Farm

During the O&M phase, the WTGs will occupy space in the ocean and above the water's surface. The WTG specifications, as they define the current SFWF design envelope, are discussed in Section 3.1.2.2.

The WTGs and OSS will be visible from points on land and water and the degree of visibility is dependent on a range of physical factors including elevation, weather conditions, sea state, and visual obstructions. Visual quality and significance of impact depends on the existing visual landscape and viewer groups, as discussed in Section 4.5 and associated appendices. Upon decommissioning, the WTGs and OSS will no longer be visible as they will be disassembled and removed from the area. The evaluation of potential impacts is the subject of Appendix V, Visual Impact Assessment, SFWF.

4.1.9.2 South Fork Export Cable

Visual infrastructure associated with the SFEC is limited to the SFEC - Interconnection Facility. 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. Following construction activities, temporarily disturbed areas around the periphery of the substation expansion will be seeded (and stabilized, if necessary) to reestablish vegetative cover in these areas. The potential visibility of the SFEC - Interconnection Facility is evaluated in Appendix U, Visual Resource Assessment Report, SFEC Onshore Substation.

Once constructed, the SFEC – Interconnection Facility may be viewed from a few areas within approximately 0.25 mile (450.6 m) of the proposed site. Much of the SFEC – Interconnection Facility will be screened from view from most nearby areas by dense, mature vegetation that ranges in height between approximately 50 and 70 feet (15 to 21 m). Where visible, it is expected that views of the SFEC – Interconnection Facility will be limited to the uppermost portions of the proposed lightning masts (the tallest structures in the proposed station). Where the SFEC – Interconnection Facility is visible from greater distances, the lightning masts, even if

visible, will be difficult to distinguish on the horizon because of their narrow profile and gray color.

4.1.10 Lighting

The impacts of lighting depend on the lighting source and factors that can affect light transmission, both in air and water. In air, the transmission of light can be affected by atmospheric moisture levels, cloud cover, and type and orientation of lights. In water, turbidity levels and waves can affect transmission distance and intensity. SFWF and SFEC activities that could result in potential impacts by lighting are presented in Table 4.0-1 and are further described below. Resources potentially impacted by lighting are identified in Table 4.1-1 and further described in Sections 4.2 through 4.6.

4.1.10.1 South Fork Wind Farm

In general, lights will be required on offshore platforms and structures, vessels, and construction equipment during construction, O&M, and decommissioning of the SFWF. There will be a temporary increase in the amount of lighting during construction and decommissioning due to the presence of work vessels. During operations, offshore structures will require lighting that conforms to BOEM guidelines and USCG requirements. Project construction lighting will meet USCG requirements, when required by federal regulations. BOEM has indicated that offshore lighting should meet standard specifications in Federal Aviation Administration (FAA) Advisory Circulars 70/7460-1L (FAA, 2015) and 150/5345-43H (FAA, 2016), and USCG standards for marine navigation lighting.

The FAA issued Advisory Circular outlines steps to clearly mark/light meteorological towers and their supporting guy wires; however, this federal guidance currently consists of recommendations for towers under 200 feet (61 m). Further, FAA navigation lighting and marking recommendations apply to structures that are up to 12 nm (22 km) offshore. Structures located in the SFWF are outside of 12 nm (22 km), and under the jurisdiction of BOEM. FAA regulations also require wind turbines be properly illuminated during construction, O&M, and decommissioning so that helicopter and airplane pilots can identify and avoid these structures (FAA, 2015).

Control, lighting, marking, and safety systems will be installed on each WTG; the specific systems will be reviewed by the selected Certified Verification Agent and provided in the FDR.

Offshore turbines must be visible not only to pilots in the air, but also mariners navigating on water. In daylight, offshore wind turbines do not require lighting if the tower and components are painted white. The FAA and USCG consider white-colored turbines to be the most effective early warning technique for both pilots and mariners (Patterson, 2005). Marine Navigation Lighting (MNL) is regulated by the USCG through Federal Regulation 33 CFR 67 [63]. Structures must be fitted with lights for nighttime periods. No daytime lighting is required. A conceptual lighting scheme developed in accordance with federal regulations is included in the Navigational Safety Risk Assessment presented as Appendix X. A summary of this conceptual scheme is provided as follows:

- Special Peripheral WTGs are considered Class A structures. As such, they will be equipped with a flashing white light visible to 5 nm.
- Intermediate Peripheral WTGs are considered Class B structures. These will be equipped with a flashing white light visible to 3 nm.

- Internal WTGs are Class C structures. These must be fitted with white or red lights visible to at least 1 nm.
- All WTGs must be fitted with low intensity short range lights (150 yards or 137.2 m) for proximity navigation.
- The Electric Service Platform must be equipped with one or more lights. The number and arrangement of the lights will depend on the horizontal length of the platform.
- In addition to MNL, foundations must be painted yellow from the maximum water level to 50 feet up the WTG tower. Corner WTGs must be equipped with sensor-operated foghorns which must be audible at 0.5 nm.

USCG-approved navigation lighting is required for all vessels during construction, O&M, and decommissioning. All vessels operating between dusk and dawn are required to turn on navigation lights. During night time construction, temporary work lighting will illuminate work areas on vessel decks or service platforms of adjacent WTGs or OSS platform. In addition, cable laying may occur 24 hours a day during certain periods, and these vessels will be illuminated at night for safe operation.

As discussed above, vessel and equipment lighting used during construction, O&M, and decommissioning will be temporary as vessels travel between the shore and SFWF and conduct maintenance activities at SFWF. Impacts of navigational and aviation lighting on WTGs during O&M are considered long-term but highly dependent on properties of the light. Upon decommissioning, all lighting will be removed.

4.1.10.2 South Fork Export Cable

During SFEC construction and decommissioning, lighting also will be necessary for illuminating the onshore work staging areas, at the ports, and on the vessels. Many of the onshore areas used for staging will be part of an industrial port where artificial lighting already exists. The SFEC – Interconnection Facility lighting will be designed to the minimum standard necessary for substation safety and security per utility operational requirements, as well as state and local regulations.

4.2 Physical Resources

4.2.1 Air Quality

Specific requirements for submittal of air emissions information within this COP are provided in 30 CFR 585.659, which directs COP submittals to follow the regulations in 40 CFR 55 – *Outer Continental Shelf Air Regulations*. BOEM’s COP guidelines mirror these regulations, requiring that a copy of the air emissions analysis prepared for the OCS air permit application be provided in the COP. DWSF completed a Project-specific emissions inventory by estimating Project-related air emissions as the basis for an air permit application to the EPA in accordance with 40 CFR 55.6. This emissions inventory includes both potential emissions regulated and not regulated by the *Outer Continental Shelf Air Regulations*, as explained in this section, and is provided as Appendix L.

Under the authority of the Clean Air Act (CAA), EPA regulates air quality on the OCS, including emissions from the construction, operation, and decommissioning of the SFWF and SFEC. Section 328 (a)(4)(c) of the CAA defines an OCS source to include any equipment, activity, or facility that emits, or has the potential to emit, any air pollutant; is regulated or authorized under the OCS Lands Act; and is located on the OCS or in or on waters above the OCS. This definition includes vessels when they are permanently or temporarily attached to the seabed (40 CFR 55.2). For the OCS air permit application, DWSF inventoried anticipated emissions from vessels associated with the Project while operating at the SFWF, along the SFEC route, or within 25 miles (40.2 km) of the activity. OCS activities located within 25 miles (40.2 km) of the seaward boundary of a state are subject to the same requirements as those applicable to the corresponding onshore area (COA) and to general conformity. Worst-case emission estimates were made for this analysis, which takes into the account the worst-case emissions for both OCS and conformity. It is anticipated that the actual emissions will be less than or equal to the worst-case emission estimates included herein.

In addition to the information specifically provided to support the OCS air permit, all estimated air emissions are included in the COP to allow for BOEM’s assessments to fulfill its NEPA and CAA obligations. Under NEPA, BOEM will assess Project-related impacts to air resources. Under the CAA, BOEM is obligated to make a general conformity determination based on 40 CFR 51, Subpart W and Part 93, Subpart B, entitled “Determining Conformity of General Federal Actions to State or Federal Implementation Plans.” The General Conformity Rule applies to all federal actions except highway and transit programs. Title I, Section 176(c)(1) of the CAA defines conformity as the upholding of “an implementation plan’s purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards (NAAQS) and achieving expeditious attainment of such standards.” Therefore, BOEM’s approval of the COP, and associated air pollutant emissions, should not cause or contribute to new violations of NAAQS; increase the frequency or severity of any existing violation of the NAAQS; or delay timely attainment of the NAAQS or interim emission reductions.

This section defines the affected environment as it relates to air resources and potential emissions from the SFWF and SFEC. It also summarizes the potential emissions from the three phases of the Project and presents them categorically according to the expected CAA review (OCS Air Permit versus [vs.] General Conformity). The methodology and detailed results of the Project’s air emissions inventory are found in Appendix L.

4.2.1.1 Affected Environment

Regional Overview

Air quality in the RI-MA WEA is described in the revised environmental assessment completed as part of BOEM’s NEPA review for the RI-MA WEA and summarized here (BOEM, 2013). Vessels are the predominant emission source in the region, as traffic transits to and from the many Northeastern commercial ports. Southerly winds through the region have the potential to transport these emissions onshore. Conversely, air quality in the SFWF and SFEC is also influenced by onshore sources, as pollutants may be carried to the SFWF and SFEC by westerly winds. In comparison to existing emission sources regularly transiting the region, an incremental increase in vessel traffic and related emissions will result from Project construction, O&M, and decommissioning but the volumes of these pollutants are expected to be low (BOEM, 2013).

The CAA requires the EPA to establish NAAQS to protect public health and welfare. The NAAQS are based on total concentrations of pollutants in the ambient air (i.e., outdoor air that is accessible to the public (40 CFR 50.1(e)). The EPA developed these ambient air quality standards for six common pollutants, known as criteria pollutants, for which ambient air quality standards exist: CO; lead; nitrogen dioxide (NO₂); ozone (O₃); particulate matter (PM); and sulfur dioxide (SO₂). PM is a mixture of solid particles and liquid droplets found in the air and includes particles of varying sizes and is categorized as PM₁₀ and PM_{2.5} (EPA, 2016a).

The NAAQS comprise both primary and secondary standards. The primary standards protect the health of particularly vulnerable populations, such as asthmatics, children, and the elderly. Secondary standards are based on protecting the welfare of the public against negative impacts, such as decreases in visibility and damage to crops, animals, vegetation, and buildings (EPA, 2016b). The NAAQS for each of the criteria pollutants are presented in Table 4.2-1.

Table 4.2-1. Criteria Pollutants and National Ambient Air Quality Standards

Pollutant	Primary/ Secondary	Averaging Time	Standard	
CO	Primary	8 hours	9 ppm	Not to be exceeded more than once per year
		1 hour	35 ppm	
Lead	Primary and Secondary	Rolling 3-month average	0.15 µg/m ³	Not to be exceeded
NO ₂	Primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Primary and Secondary	1 year	53 ppb	Annual mean
O ₃	Primary and Secondary	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
PM _{2.5}	Primary	1 year	12.0 µg/m ³	Annual mean, averaged over 3 years
	Secondary	1 year	15.0 µg/m ³	Annual mean, averaged over 3 years
PM ₁₀	Primary and Secondary	24 hours	35 µg/m ³	98th percentile, averaged over 3 years

Table 4.2-1. Criteria Pollutants and National Ambient Air Quality Standards

Pollutant	Primary/ Secondary	Averaging Time	Standard	
	Primary and Secondary	24 hours	150 µg/m ³	Not to be exceeded more than once per year on average over 3 years
SO ₂	Primary	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

Source: 40 CFR 50

Note:

Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air (µg/m³).

The CAA contains timeframes and milestones for states to meet and maintain NAAQS for criteria pollutants. Areas that do not meet the NAAQS based on an evaluation of available air quality data are designated as nonattainment areas (NAAs). The EPA reviews the NAAQS every 5 years and may update the standards based on new scientific information and establish new monitoring requirements. Each state is required to monitor the ambient air to determine whether it meets each standard. If monitoring shows that the air quality does not meet a standard, the state must develop and implement pollution control strategies to attain that standard. Once air quality meets a standard, a state must develop a plan to maintain that standard while accounting for future economic and emissions growth (MassDEP, 2016).

In addition to the criteria pollutants discussed, air pollutants can be categorized as toxic or hazardous air pollutants (HAPs) or greenhouse gasses (GHGs). There are no ambient air quality standards for HAPs or GHG; however, emissions are regulated through national manufacturing standards and permit requirements. HAPs, also known as toxic air pollutants or air toxics, are those pollutants known or suspected to cause cancer or other serious health impacts, such as reproductive impacts or birth defects, or adverse environmental impacts (EPA, 2017). Examples of HAPs include benzene (which is found in gasoline); dioxin; asbestos; toluene; and metals, such as cadmium, mercury, chromium, and lead compounds.

GHGs are gases that trap heat in the atmosphere and include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and fluorinated gasses. The largest source of GHG emissions from human activities in the United States is from burning fossil fuels (mostly coal and natural gas) for electricity, heat, and transportation (EPA, 2018a).

The scope of the affected environment for the assessment of potential Project-related emissions and impacts to ambient air quality encompass offshore areas and those states and counties where Project activities may occur. As described in Section 3.1.3.1, Project activities may use several regional, existing port facilities from Port of Montauk (Suffolk County, New York) to New Bedford Marine Commerce Terminal (Bristol County, Massachusetts), and several other ports in Connecticut, Rhode Island, New Jersey, Maryland and Virginia. Therefore, for the purposes of this discussion, it is assumed that Project-related air emissions could occur near or within one or more of the following counties, depending on the ports used by the SFWF and SFEC:

- New London, New Haven, Middlesex and Fairfield Counties, Connecticut
- Barnstable, Bristol, Dukes, and Nantucket Counties, Massachusetts

- Nassau and Suffolk Counties, New York
- Washington, Newport, Kent, Providence, and Bristol Counties, Rhode Island
- New Castle, Kent, and Sussex Counties, Delaware
- Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Mercer, Monmouth, Ocean, and Salem Counties New Jersey
- Berks, Bucks, Chester, Delaware, Lancaster, Lehigh, Montgomery, Northampton, Philadelphia, and York Counties, Pennsylvania
- Anne Arundel, Baltimore, Baltimore City, Calvert, Carroll, Caroline, Cecil, Charles, Dorchester, Frederick, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's, Somerset, St Mary's, Talbot, Wicomico, and Worcester Counties Maryland

Accomack, Charles City, Chesapeake, Essex, Franklin, Gloucester, Hampton, Isle of Wight, James City, King and Queen, King William, Lancaster, Middlesex, New Kent, Newport News, Norfolk, Northampton, Northumberland, Poquoson, Richmond, Suffolk, Sussex, Surry, Virginia Beach, Westmoreland, Williamsburg, and York Counties, Virginia

The CT DEEP, Bureau of Air Management, Ambient Air Monitoring Group monitors air quality to protect public health and the environment. CT DEEP's ambient air monitoring network monitors for ozone, PM_{2.5}, NO₂, SO₂, CO, and lead, as well as VOCs, aldehydes, polycyclic aromatic hydrocarbons (PAHs), mercury, and dioxin. According to EPA, the New York-Northern New Jersey-Long Island Area and the Greater Connecticut areas are currently designated as moderate nonattainment for the 2008 ozone (8-hour) NAAQS (EPA, 2018b). The current trend is improvement for ozone standard attainment designations for New York Metro and the Greater Connecticut Area areas (CT DEEP, 2017).

Massachusetts Department of Environmental Protection (MassDEP) is the responsible agency for monitoring air quality and assessing compliance with the NAAQS for each of the criteria pollutants. MassDEP's Air Assessment Branch operates a network of 24 air monitoring stations that measure ambient concentrations of criteria pollutants, noncriteria pollutants (HAPs and others), and meteorological data (MassDEP, 2017). The most recent MassDEP monitoring data report (for the year 2016) shows that Massachusetts is in attainment with all the NAAQS criteria pollutant standards.¹⁰ Trends for criteria pollutants and some HAPs have generally been downward in Massachusetts over the last several decades. MassDEP regulations establish a nonattainment new source review (NSR) preconstruction review program for new major sources or major modifications in an NAA. NO_x and VOCs are nonattainment pollutants in Massachusetts because the state is in an ozone transport region and as such designated as a serious ozone non-attainment area. Major source thresholds are 50 tons per year (tpy) NO_x or 50 tpy VOCs.

The NYSDEC Division of Air Resources is the responsible agency for monitoring air quality and assessing compliance with the NAAQS for each of the criteria pollutants. NYSDEC operates a network of 50 air monitoring stations that measure ambient concentrations of criteria pollutants, HAPs (at 12 monitoring stations), and meteorological data (NYSDEC, 2017a). Long Island is considered Region 1, which has four monitoring stations. The most recent NYSDEC monitoring

¹⁰ Massachusetts was previously designated as nonattainment for the 1979 1-hour ozone standard (0.12 ppm) and 1997 8-hour ozone standard (0.08 ppm). Through a combination of state and regional controls, Massachusetts' air quality attained the 1997 standards by the 2009 attainment deadline. In 2008, EPA lowered the 8-hour ozone standard to 0.075 ppm. In April 2012, EPA designated Dukes County as nonattainment (marginal classification) for the 2008 ozone standards and designated the remainder of Massachusetts as unclassifiable/attainment. Based on the most recent monitoring data, Dukes County attained the 2008 ozone standard by the 2015 attainment deadline (MassDEP, 2016).

data report (2015) shows that New York State is in attainment with all the NAAQS criteria pollutant standards, except for ozone, which is designated as moderate nonattainment (EPA, 2018c). Trends for HAPs have generally been downward in New York over the last 10 years (NYSDEC, 2017b). The New York City Metropolitan area, including Long Island is designated as a severe ozone non-attainment area.

The New York State Energy Research and Development Authority (NYSERDA) *New York State Greenhouse Gas Inventory: 1990 to 2014* is based on EPA protocols and methodologies and includes an estimate of current GHG emissions produced within New York State from 1990 to 2014. Emissions of GHGs gradually increased from 1990, peaked in 2005, and then began to decline since. In 2014, emissions were approximately 8 percent lower than in 1990. This reduction stands in contrast to the 7 percent national increase in total GHG emissions over the same period. Energy-related emissions were 13 percent lower in 2014 relative to 1990 levels (NYSERDA, 2017).

The RI DEM, in conjunction with the Rhode Island Department of Health, operates a network of eight air monitoring stations throughout the state that measure ambient concentrations of criteria pollutants; toxic air pollutants (or HAPs); and ozone precursors, which are substances that react in the atmosphere to form ground-level ozone (RI DEM, 2016). The most recent RI DEM monitoring data report shows that Rhode Island is in attainment with all the NAAQS criteria pollutant standards. Emissions of GHG in Rhode Island have been estimated at 11.3 million metric tons of carbon dioxide equivalent (CO₂e) in 2015 (EC4, 2016). This is on target to meet the 2020 limit of 11.23 million metric tons of CO₂e in accordance with the 2014 Resilient Rhode Island Act, which outlines programs and policies the state could undertake to meet its commitment to reduce annual GHG emissions to at least 10 percent less than 1990 levels by 2020, and up to 80 percent less than 1990 levels by 2050 (EC4, 2016).

Delaware Department of Natural Resources and Environmental Control, or DNREC, is the responsible agency for monitoring air quality and assessing compliance with the NAAQS for each of the criteria pollutants in Delaware. The Delaware air quality monitoring network includes permanent monitoring stations in all three counties and one mobile monitoring station used for special studies. Eight of the permanent monitoring stations measure multiple pollutants. Three measure only particulate matter. The Annual Air Quality Reports cover Delaware's air quality status and trends for criteria pollutants and some substances that do not have standard criteria, such as air toxics. They include information on sources of air pollution and inventory data related to the compounds responsible for forming ozone and PM_{2.5} pollution. And there is information on emission controls, air monitoring, air inventories, climate change, and more. According to EPA, the Philadelphia-Wilmington-Atlantic City Area and the Sussex County areas are currently designated as marginal nonattainment for the 2008 ozone (8-hour) NAAQS and the Philadelphia-Wilmington-Atlantic City Area is currently designated as marginal nonattainment for the 2015 ozone (8-hour) NAAQS (EPA, 2020).

New Jersey Department of Environmental Protection (NJDEP) operates 30 air quality monitoring states across the state. These stations monitor all six criteria air pollutants. NJDEP's data has shown downward trends in concentrations of criterial air pollutants over the past few decades. NJ is getting close to meeting the ozone NAAQS and is now in compliance with PM_{2.5} NAAQS and has been in compliance with the NO_x, SO₂, CO and lead NAAQS. According to EPA, the Philadelphia-Wilmington-Atlantic City Area is currently designated as marginal nonattainment for the 2008 ozone (8-hour) NAAQS, the New York-Northern New Jersey-Long Island, NY-NJ-CT area is currently designated as serious nonattainment for the 2008 ozone (8-hour) NAAQS and the New York-Northern New Jersey-Long Island, NY-NJ-CT

areas are currently designated as moderate nonattainment for the 2015 ozone (8-hour) NAAQS (EPA, 2020).

The Pennsylvania Department of Environmental Protection (DEP) Quality Assurance and Data Assessment Section collects and validates ambient air quality data and analyzes monitored data and conducts comparison studies for reporting results. According to EPA, the Allegheny, Indiana, Beaver, and Warren counties are currently designated as nonattainment for the 2010 sulfur dioxide, the Lower Beaver Valley, Lyons, and North Reading areas of PA are currently designated as nonattainment for 2008 lead (EPA, 2020).

Maryland Department of the Environment is the responsible agency for monitoring air quality and assessing compliance with the NAAQS for each of the criteria pollutants. In an effort to keep Maryland citizens informed about the region's air quality, the Ambient Air Monitoring Program publishes monthly air quality reports for the following forecast regions: Baltimore, Eastern Shore, Washington DC, and Western Maryland. These reports provide basic statistics regarding the two major pollutants in Maryland: ground-level ozone and fine particles. According to EPA, part of the Anne Arundel County and Baltimore County area is currently designated as nonattainment for the 2010 sulfur dioxide NAAQS, the Philadelphia-Wilmington-Atlantic City Area is currently designated as marginal nonattainment for the 2008 ozone (8-hour) NAAQS, the Baltimore areas are currently designated as moderate nonattainment for the 2008 ozone (8-hour) NAAQS and the Philadelphia-Wilmington-Atlantic City Area, Washington DC-MD, VA area, and Baltimore MD areas are currently designated as marginal nonattainment for the 2015 ozone (8-hour) NAAQS (EPA, 2020).

The Virginia Department of Environmental Quality (DEQ) air monitoring program is a combined effort of the Air Quality Monitoring Office (AQM), six regional offices, the Alexandria Transportation and Environmental Services, the National Park Service, and the US Department of Agriculture Forest Service. The air monitoring sites measure the ambient air for the criteria pollutants and other air pollutants of special interest. Some additional sampling is conducted for volatile organic compounds, also known as the 'ozone precursors.' According to EPA, Washington DC-MD-VA area is currently designated as marginal nonattainment for the 2015 ozone (8-hour) (EPA, 2020).

Permitting Applicability

DWSF will submit a notice of intent and then an OCS air permit application to EPA as required by the OCS Regulations in 40 CFR 55.6. For the OCS air permit application, annual construction and O&M air emissions will be compared with new source review (NSR) permitting thresholds to determine the type of permitting needed. Decommissioning emissions, likely to occur 25 years in the future, would be the subject of another permit application.

There are two types of major source permitting, depending upon the attainment status of the pollutant of concern with the NAAQS: Prevention of Significant Deterioration (PSD) program for attainment pollutants and NNSR for nonattainment pollutants. If the Project emissions are less than the major source thresholds, then only minor NSR applies to the project (EPA, 2018e). As stated, EPA sets NAAQS standards for six criteria air pollutants: O₃, CO, PM, SO₂, lead, and NO₂. Every area of the United States has been designated by EPA in one of three attainment classifications based on the status of the air quality in the area:

- Attainment – Air quality is equal to or better than the level of the NAAQS.
- Nonattainment – Air quality is worse than the level of the NAAQS.
- Unclassified – There are no air quality data for the area; the area is treated as attainment.

The PSD permitting program includes the following:

- Installation of the Best Available Control Technology – Emission limitation based on the maximum degree of emission control, considering environmental, energy, and economic impacts
- An air quality analysis consisting of an air dispersion model
- Additional impacts analysis to assess impacts on air, and ground and water pollution on soils, vegetation, and visibility
- Public involvement, including a required public review and comment period

The NNSR Program includes the following:

- Installation of the Lowest Achievable Emission Rate – Emission rate that represents the most stringent emission limit in a state implementation plan (SIP) or implemented in practice for a similar source, which is technically feasible for the project
- Purchasing of Emission Offsets – To avoid or offset increases in emissions, emissions from proposed projects are balanced by equivalent or greater reductions from existing sources
- Public involvement, including a required public review and comment period

A minor NSR program includes the following, which is implemented by the states:

- Sources must comply with emission controls or limits specified by the state.
- The program must not interfere with attainment of maintenance of the NAAQS or the control strategies of the SIP.

General Conformity

The General Conformity Rule per 40 CFR 93 Subpart B and 40 CFR 51 Subpart W prescribes that federal actions comply with the NAAQS. To meet this CAA requirement, a federal agency must demonstrate that every action it undertakes, approves, permits, or supports will conform to the appropriate SIP. That is, it will not interfere with the states’ plans to attain and maintain compliance with the NAAQS.

BOEM will conduct the conformity analysis for the SFWF and SFEC based on the construction, O&M, and decommissioning emissions provided in this COP. The General Conformity emissions will not include emissions that are already accounted for in the OCS air permit. General Conformity emissions will only include direct and indirect emissions outside the 25-mile (40.2-km) OCS air region. A Conformity Determination is only required for emissions that exceed the *de minimus* thresholds. A list of the codified *de minimus* thresholds are included in Table 4.2-2.

Table 4.2-2. Clean Air Act Conformity *de minimus* Emission Thresholds

Emission	tpy
<i>40 CFR 93.153(b)(1) – For purposes of paragraph (b) of this section the following rates apply in NAAs:</i>	
Ozone (VOCs or NOx):	
Serious NAAs	50
Severe NAAs	25

Table 4.2-2. Clean Air Act Conformity *de minimus* Emission Thresholds

Emission	tpy
Extreme NAAs	10
Other ozone NAAs outside an ozone transport region	100
Other ozone NAAs inside an ozone transport region:	
VOC	50
NO _x	100
CO: All maintenance areas	100
SO ₂ or NO ₂ : All NAAs	100
PM ₁₀ :	
Moderate NAAs	100
Serious NAAs	70
PM _{2.5} (direct emissions, SO ₂ , NO _x , VOC, and ammonia):	
Moderate NAAs	100
Serious NAAs	70
Lead: All NAAs	25
<i>40 CFR 93.153(b)(2) – For purposes of paragraph (b) of this section the following rates apply in maintenance areas:</i>	
Ozone (NO _x), SO ₂ , or NO ₂ : All maintenance areas	100
Ozone (VOCs):	
Maintenance areas inside an ozone transport region	50
Maintenance areas outside an ozone transport region	100
CO: All maintenance areas	100
PM ₁₀ : All maintenance areas	100
PM _{2.5} (direct emissions, SO ₂ , NO _x , VOC, and ammonia)	100
All maintenance areas	100
Lead: All maintenance areas	25

Source: EPA, 2018d.

South Fork Wind Farm

The discussion of air quality within the SFWF applies to the offshore area where the WTGs are located and the port areas that vessels will use in support of the Project. Ambient air quality data are not available for the offshore SFWF area because there are no air monitoring stations. However, the discussion of regional air quality, as previously presented, effectively characterizes the affected environment for air resources associated with the SFWF.

South Fork Export Cable

SFEC - OCS

The discussion of air quality along the SFEC – OCS applies to the offshore area where the SFEC will be installed in federal waters from the SFWF OSS to where the SFEC crosses into New York State jurisdictional waters. Air quality data are not available for the offshore OCS waters portion of the SFEC. However, the discussion of regional air quality, as previously presented, effectively characterizes the affected environment for air resources associated with the SFEC - OCS.

SFEC - NYS and SFEC - Onshore

The discussion of air quality along the SFEC – NYS applies to the nearshore area where the SFEC traverses New York State waters, including the offshore sea-to-shore transition. The SFEC - Onshore applies to the onshore area from the upland end of the sea-to-shore transition to the SFEC - Interconnection Facility. Air quality data are not available specifically for New York State waters; however, the NYSDEC Division of Air Resources is the responsible agency for monitoring air quality and assessing compliance with the NAAQS for each of the criteria pollutants in the state. Two NYSDEC air quality monitoring stations are in relatively proximity to the SFEC in Holtsville and Riverhead, New York. New York State is in attainment with all the NAAQS criteria pollutant standards, except for ozone (EPA, 2018c), which is designated as moderate nonattainment (EPA, 2017). Trends for HAPs have generally been downward in New York over the last 10 years (NYSDEC, 2017b).

4.2.1.2 Potential Impacts

A summary of the IPFs that could result in air quality impacts is illustrated on Figure 4.2-1. IPFs that will not impact air quality are depicted with slashes through the circle. For the IPFs that could impact air but were found to be negligible in the analyses in Section 4.1, the circle is gray without a slash. The IPFs with potential for minor to major impacts to air quality are evaluated in this section. The primary causes of potential air quality impacts from the SFWF and SFEC include emissions from vessels, vehicles, helicopters, and stationary engines. These sources were introduced in Table 3.1-6 and further categorized in the emissions inventory presented in Appendix L.

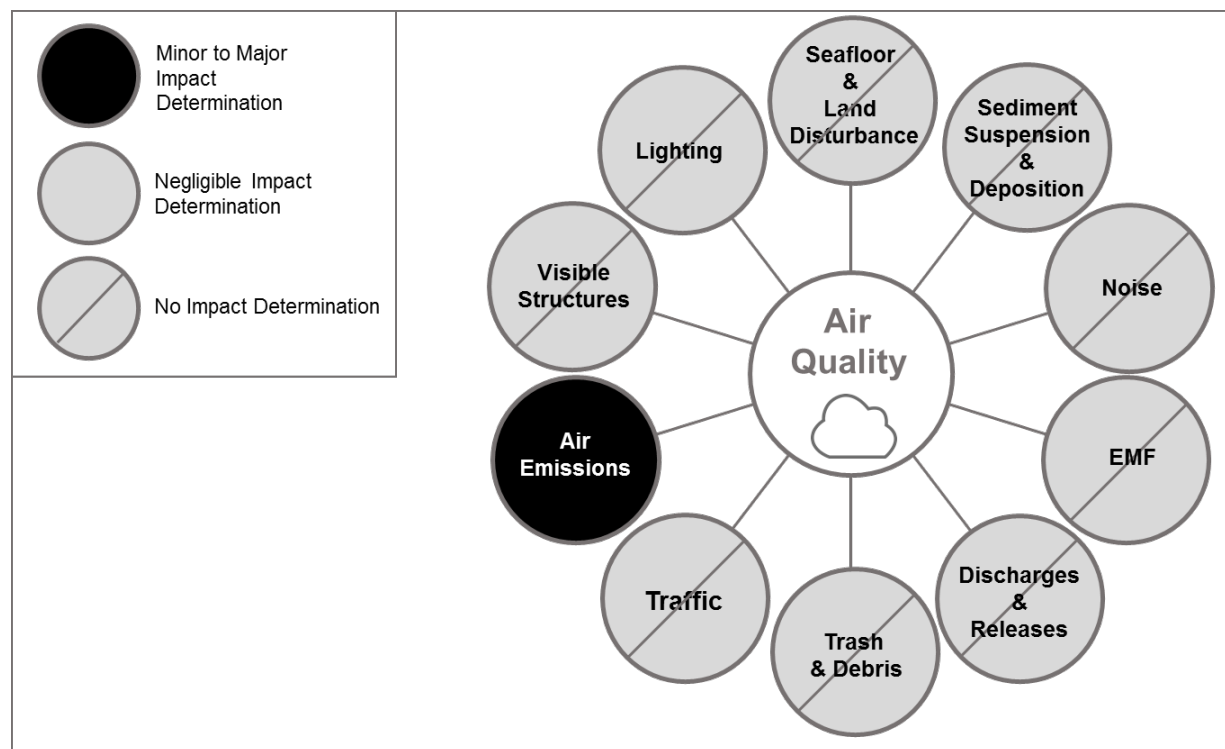


Figure 4.2-1. IPFs on Air Quality

Illustration of potential impacts to air quality resulting from SFWF and SFEC activities

Project-related aircraft, vessel, vehicle, and equipment usage will generate emissions offshore and onshore, predominantly during the anticipated one-to-two-year construction phase. However, a one-year construction period was used to estimate worst case emissions. During the 25-year estimated O&M phase, the SFWF and SFEC will generate few emissions from infrequent use of emergency generators, equipment engines, vessels, and vehicles. O&M activities will produce relatively little emissions compared to those produced during construction. Emissions from decommissioning are estimated to be an order of magnitude less than construction emissions – though similar construction activities will be conducted to decommission Project components; the activity will be of a much shorter duration. However, decommissioning activities would occur 25 years in the future when combustion energy and pollution control technologies will be different, so it is speculative to predict emissions.

Appendix L contains the complete emissions inventory, including underlying assumptions for engine type and rating, engine use (hours), number of trips, trip destinations, and emission factors. For this COP and its related environmental review, total estimated emissions are analyzed for the SFWF and SFEC and by the three phases of the Project. This analysis provides a comparison of potential emissions from the construction of SFWF, which will predominantly occur within the lease area during foundation installation, WTG assembly, and Inter-array Cable laying. Potential emissions from the SFEC will occur as the cable laying vessel and other support vessels follow the proposed corridor from the sea-to-shore transition at Long Island to the SFWF.

Estimated emissions also are presented as annual emissions, OCS permit emissions, and conformity emissions. Appendix L provides a detailed explanation and regulatory context for these categories, but they are also summarized as follows. Total emissions include all combustion sources anticipated for Project-related usage offshore and onshore. OCS permit

emissions include emissions from OCS sources, vessels meeting the definition of *OCS Source* (40 CFR 55.2), and vessels traveling to and from the SFWF when within 25 miles (40.2 km) of the SFWF’s center (the 25-mile [40.2-km] centroid or the OCS centroid). General Conformity air emissions include emissions outside the 25- mile (40.2-km) centroid and within 25 nautical miles (46.3 km) of a state’s seaward boundary. Conformity emissions are apportioned to the state where the emissions will occur based on the assumptions for project vessel trips between the SFWF and ports, as well as the SFEC landfall location. Emission estimates for construction and decommissioning phases are presented for a monopile WTG foundation. Emissions are presented by the pollutants identified in the BOEM *Wind Tool* and associated technical guidance (ERG, 2017).

Construction

For estimating worst case emissions, seven ports were chosen from the entire list of possible ports that may be used for the project, included in Table 3.1-5. Six ports were used for estimating worse case construction and decommissioning emissions and one port in New York was used for estimating worse case O&M emissions.

For estimating worst case total construction emissions, it was assumed that all construction and decommissioning activities could occur from one single port in each of the states (Massachusetts, Rhode Island, Connecticut, New Jersey, Maryland and Virginia), except New York. These ports, which were the likely port choices for each state are the New Bedford Marine Commerce Terminal in the City of New Bedford, MA, Port of Providence, Providence, RI, Port of New London, New London, CT, Paulsboro Marine Terminal, Paulsboro, NJ, Port of Baltimore, Sparrows Point, MD and Norfolk International Terminal, Norfolk, VA. Shinnecock Fish Dock Port in Hampton Bays, NY was chosen from among the New York ports for worst-case O&M emissions because that would result in greater emissions in New York than the other choices of Greenport and Montauk.

Using this approach provides a very conservative estimate of emissions in each state, as the total on-land, and emissions within 25 miles of the state’s seaward boundary (exclusive of OCS permit emissions) are attributed to each state in each stand-alone scenario. This methodology results in a maximum, or worse-case modeled impact for each of the potential ports and would also allow worst-case conformity assessment because a maximum emission total would be provided to BOEM for each of the onshore states. Thus, using those seven port locations, all potential impacts for both the OCS permit and conformity can be conservatively estimated.

Estimated air emissions from the proposed construction activities for the SFWF and SFEC are summarized in Table 4.2-3 by port location. As shown in the table, construction conformity emissions vary by port location, OCS air emissions do not vary by port location. In addition, SFEC installation results in estimated emissions within the same range of estimated emissions expected for SFWF installation.

Table 4.2-3. Estimated Emissions from Construction for the South Fork Wind Farm and South Fork Export Cable by Port

Project	CO ₂	CH ₄	N ₂ O	Black Carbon	CO	NOX	PM ₁₀	PM _{2.5}	SO ₂	Lead	VOC
<i>Port of New Bedford, MA</i>											
SFWF	18,453	0.1	0.9	6.8	46.2	286.3	9.5	9.1	3.2	0.0011	7.8
SFEC	25,359	0.1	0.7	5.1	90.0	302.1	10.3	10.0	21.9	0.0009	29.2

Table 4.2-3. Estimated Emissions from Construction for the South Fork Wind Farm and South Fork Export Cable by Port

Project	CO ₂	CH ₄	N ₂ O	Black Carbon	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	Lead	VOC
Port of Providence, RI											
SFWF	20,065	0.1	0.9	7.5	50.8	313.2	10.4	10.0	3.5	0.0012	8.5
SFEC	25,599	0.1	0.7	5.2	90.8	305.6	10.4	10.1	21.9	0.0009	29.3
Port of New London, CT											
SFWF	21,446	0.1	1.0	7.8	56.2	331.0	11.0	10.6	4.5	0.0013	9.8
SFEC	25,633	0.1	0.7	5.2	90.8	305.8	10.4	10.1	21.9	0.0009	29.3
Paulsboro Marine Terminal, NJ											
SFWF	53,690	0.3	2.6	21.4	145.3	875.4	29.3	28.1	9.6	0.0032	24.0
SFEC	30,614	0.1	0.9	7.1	107.2	379.4	12.9	12.6	22.2	0.0013	30.7
Sparrows Point, MD											
SFWF	76,821	0.5	3.7	30.8	211.9	1,256.8	42.2	40.4	14.5	0.0045	35.4
SFEC	33,893	0.1	1.1	8.3	118.0	427.6	14.6	14.2	22.3	0.0015	31.6
Port of Norfolk, VA											
SFWF	60,351	0.4	2.9	24.2	164.0	986.8	33.1	31.7	10.8	0.0036	27.1
SFEC	31,608	0.1	1.0	7.5	110.5	394.0	13.4	13.1	22.2	0.0014	31.0

Note: All units in tons. Black carbon is the sooty black material emitted from combustion sources and it is included because it comprises a significant portion of particulate matter or PM.

Total, annualized OCS, and annualized Conformity emissions for the entire Project (i.e., SFWF and SFEC combined) by port location are presented in Table 4.2-4, assuming the installation of a monopile foundation. Appendix L breaks down construction emissions on an annual basis for OCS permitting purposes.

Table 4.2-4. Estimated Total, OCS, and Conformity Emissions (tons) for the South Fork Wind Farm and South Fork Export Cable for Monopile Foundations

Emission Type	CO ₂	CH ₄	N ₂ O	Black Carbon	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	Lead	VOC
Port of New Bedford, MA											
Total Construction Emissions (tons)	43,811	0.2	1.5	11.9	136.2	588.3	19.7	19.1	25.1	0.0021	37.0
Worst-case OCS Emissions (SFWF)	28,959	0.2	1.4	10.9	66.9	442.3	14.8	14.3	2.8	0.0019	9.5

Table 4.2-4. Estimated Total, OCS, and Conformity Emissions (tons) for the South Fork Wind Farm and South Fork Export Cable for Monopile Foundations

Emission Type	CO ₂	CH ₄	N ₂ O	Black Carbon	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	Lead	VOC
Worst-case Conformity Emissions - Massachusetts	3,767	0.0	0.2	1.3	12.3	57.0	1.9	1.8	1.3	0.0002	2.4
Worst-case Conformity Emissions - New York	19,732	0.0	0.4	3.0	76.8	218.6	7.4	7.3	21.5	0.0005	27.6
<i>Port of Providence, RI</i>											
Total Construction Emissions (tons)	45,664	0.2	1.6	12.7	141.6	618.8	20.8	20.1	25.4	0.0022	37.8
Worst-case OCS Emissions (SFWF)	29,075	0.2	1.4	11.0	67.2	444.2	14.9	14.4	2.8	0.0019	9.6
Worst-case Conformity Emissions - Rhode Island	5,405	0.0	0.2	2.0	17.0	84.0	2.8	2.7	1.6	0.0003	3.1
Worst-case Conformity Emissions - New York	19,732	0.0	0.4	3.0	76.8	218.6	7.4	7.3	21.5	0.0005	27.6
<i>Port of New London, CT</i>											
Total Construction Emissions (tons)	47,079	0.2	1.6	13.0	147.1	636.8	21.4	20.7	26.4	0.0022	39.1
Worst-case OCS Emissions (SFWF)	31,385	0.2	1.5	11.8	72.8	477.6	16.0	15.4	3.2	0.0020	10.5
Worst-case Conformity Emissions - Rhode Island	4,036	0.0	0.2	1.4	13.1	61.4	2.1	2.0	1.4	0.0002	2.5
Worst-case Conformity Emissions - Connecticut	2,844	0.0	0.1	0.9	9.7	41.8	1.4	1.4	1.2	0.0001	2.0
Worst-case Conformity Emissions - New York	19,732	0.0	0.4	3.0	76.8	218.6	7.4	7.3	21.5	0.0005	27.6
<i>Paulsboro Marine Terminal, NJ</i>											
Total Construction Emissions (tons)	84,304	0.5	3.5	28.5	252.5	1,254.8	42.2	40.7	31.8	0.0045	54.7
Worst-case OCS Emissions (SFWF)	33,772	0.2	1.6	12.9	80.7	521.5	17.5	16.9	3.6	0.0022	11.7
Worst-case Conformity Emissions -New Jersey	26,358	0.2	1.3	10.6	77.2	428.8	14.5	13.9	5.1	0.0015	12.3
Worst-case Conformity Emissions - New York	27,192	0.1	0.7	6.0	98.2	341.4	11.6	11.2	22.8	0.0010	30.9
Emissions in Other Water beyond 25 NM	9,704	0.1	0.5	4.0	27.9	159.7	5.4	5.2	1.6	0.0006	4.3

Table 4.2-4. Estimated Total, OCS, and Conformity Emissions (tons) for the South Fork Wind Farm and South Fork Export Cable for Monopile Foundations

Emission Type	CO ₂	CH ₄	N ₂ O	Black Carbon	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	Lead	VOC
Sparrows Point, MD											
Total Construction Emissions (tons)	110,714	0.6	4.8	39.1	329.9	1,684.4	56.8	54.6	36.9	0.0060	67.0
Worst-case OCS Emissions (SFWF)	31,878	0.2	1.5	12.1	75.2	490.3	16.5	15.9	3.3	0.0021	10.8
Worst-case Conformity Emissions - Maryland	18,405	0.1	0.9	7.3	54.4	297.9	10.1	9.6	3.8	0.0011	8.8
Worst-case Conformity Emissions - Virginia	20,247	0.1	1.0	8.1	59.6	328.2	11.1	10.6	4.1	0.0012	9.6
Worst-case Conformity Emissions - New York	22,820	0.1	0.5	4.3	85.7	269.4	9.1	8.9	22.1	0.0007	29.0
Emissions in Other Water beyond 25 NM	28,191	0.2	1.4	11.5	81.0	464.0	15.7	15.0	4.7	0.0017	12.3
Port of Norfolk, VA											
Total Construction Emissions (tons)	91,958	0.5	3.9	31.6	274.5	1,380.7	46.5	44.7	33.1	0.0049	58.1
Worst-case OCS Emissions (SFWF)	31,852	0.2	1.5	12.1	75.2	489.9	16.4	15.8	3.3	0.0021	10.8
Worst-case Conformity Emissions - Virginia	15,266	0.1	0.7	6.0	45.3	246.3	8.3	8.0	3.2	0.0009	7.4
Worst-case Conformity Emissions - Maryland	4,502	0.0	0.2	1.8	12.9	74.1	2.5	2.4	0.7	0.0003	2.0
Worst-case Conformity Emissions - New York	22,781	0.1	0.5	4.2	85.5	268.8	9.1	8.9	22.1	0.0007	29.0
Emissions in Other Water beyond 25 NM	28,359	0.2	1.4	11.6	81.4	466.7	15.8	15.1	4.7	0.0017	12.4

Note: All units in tons. Black carbon is the sooty black material emitted from combustion sources and it is included because it comprises a significant portion of particulate matter or PM.

Over the assumed one-year construction period, Project-related air emissions could have **short-term, minor** impacts to air quality. The majority of Project emissions will occur over relatively short spans of time, and occur offshore, approximately 19 miles (30.6 km, 16.5 nm) or more from land, in the case of the SFWF, or along an approximately 26-mile (41.8-km) SFEC cable route. Impacts to air quality near populated areas is not anticipated, with the small exception of the SFEC - Onshore installation.

Operations and Maintenance

Annual total, OCS, and Conformity emissions from SFWF and SFEC O&M activities are summarized in Table 4.2-5 by port location. Similar to construction emissions, O&M conformity emissions vary slightly by port location, but OCS emissions do not vary by port location. O&M

activities for the SFWF and SFEC are described in Sections 3.1.5 and 3.2.5, respectively, and would occur over a 25- year period. Potential O&M emissions will result from the operation of crew and maintenance vessels, vehicles, and emergency generators, which are anticipated to be located on the OSS and possibly on each WTG. The submarine segments of the SFEC are not expected to require routine O&M activity resulting in air emissions. However, SFEC-related emissions estimates include routine O&M activities at the SFEC – Interconnection Facility consisting of regular usage of standard pickup trucks, which are all considered Conformity emissions.

Table 4.2-5. Estimated Annual Total, OCS, and Conformity Emissions during Operations and Maintenance Period of the South Fork Wind Farm and South Fork Export Cable

Emissions Type	CO ₂	CH ₄	N ₂ O	Black Carbon	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	Lead	VOC
<i>Shinnecock Fish Dock, NY - Crew Vessels; Port of New Bedford, MA - Working Vessels</i>											
Total O&M Emissions	5,421	0.0	0.3	2.1	16.6	87.3	2.8	2.7	0.6	0.0003	1.9
Worst-case OCS Emissions (SFWF)	5,160	0.0	0.3	2.0	15.7	83.3	2.7	2.6	0.5	0.0003	1.7
Worst-case Conformity Emissions - Massachusetts	303	0.0	0.0	0.1	0.9	5.2	0.2	0.2	0.0	0.0000	0.1
Worst-case Conformity Emissions - New York	1,154	0.0	0.1	0.4	4.0	16.0	0.5	0.5	0.1	0.0001	0.3
<i>Shinnecock Fish Dock, NY - Crew Vessels; Port of Providence, RI - Working Vessels</i>											
Total O&M Emissions	5,635	0.0	0.3	2.1	17.2	91.0	2.9	2.8	0.6	0.0004	1.9
Worst-case OCS Emissions (SFWF)	5,173	0.0	0.3	2.0	15.8	83.5	2.7	2.6	0.5	0.0003	1.7
Worst-case Conformity Emissions - Rhode Island	492	0.0	0.0	0.2	1.4	8.5	0.3	0.3	0.1	0.0000	0.2
Worst-case Conformity Emissions - New York	1,154	0.0	0.1	0.4	4.0	16.0	0.5	0.5	0.1	0.0001	0.3
<i>Shinnecock Fish Dock, NY - Crew Vessels; Port of New London CT - Working Vessels</i>											
Total O&M Emissions	5,666	0.0	0.3	2.2	17.3	91.5	2.9	2.8	0.6	0.0004	2.0
Worst-case OCS Emissions (SFWF)	5,440	0.0	0.3	2.1	16.5	88.1	2.8	2.7	0.5	0.0003	1.8
Worst-case Conformity Emissions - Rhode Island	334	0.0	0.0	0.1	1.0	5.7	0.2	0.2	0.0	0.0000	0.1
Worst-case Conformity Emissions - Connecticut	196	0.0	0.0	0.1	0.6	3.4	0.1	0.1	0.0	0.0000	0.1
Worst-case Conformity Emissions - New York	1,154	0.0	0.1	0.4	4.0	16.0	0.5	0.5	0.1	0.0001	0.3
<i>Paulsboro Marine Terminal, NJ</i>											
Total O&M Emissions (tons)	10,103	0.1	0.5	3.9	30.1	167.7	5.3	5.1	1.2	0.0006	3.6
Worst-case OCS Emissions (SFWF)	5,716	0.0	0.3	2.2	17.3	92.9	3.0	2.8	0.5	0.0004	1.9

Table 4.2-5. Estimated Annual Total, OCS, and Conformity Emissions during Operations and Maintenance Period of the South Fork Wind Farm and South Fork Export Cable

Emissions Type	CO ₂	CH ₄	N ₂ O	Black Carbon	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	Lead	VOC
Worst-case Conformity Emissions - New Jersey	2,915	0.0	0.1	1.1	8.4	50.1	1.5	1.5	0.4	0.0002	1.1
Worst-case Conformity Emissions - New York	2,017	0.0	0.1	0.7	6.5	30.8	1.0	1.0	0.2	0.0001	0.7
Emissions in Other Water beyond 25 NM	1,122	0.0	0.1	0.4	3.2	19.3	0.6	0.6	0.1	0.0001	0.4
<i>Sparrows Point, MD</i>											
Total O&M Emissions (tons)	13,023	0.1	0.6	5.0	38.5	217.9	6.8	6.6	1.5	0.0008	4.7
Worst-case OCS Emissions (SFWF)	5,497	0.0	0.3	2.1	16.7	89.1	2.8	2.7	0.5	0.0004	1.8
Worst-case Conformity Emissions - Maryland	1,995	0.0	0.1	0.8	5.7	34.3	1.1	1.0	0.3	0.0001	0.8
Worst-case Conformity Emissions - Virginia	2,208	0.0	0.1	0.9	6.4	37.9	1.2	1.1	0.3	0.0001	0.8
Worst-case Conformity Emissions - New York	1,511	0.0	0.1	0.5	5.1	22.1	0.7	0.7	0.1	0.0001	0.5
Emissions in Other Water beyond 25 NM	3,260	0.0	0.2	1.3	9.4	56.0	1.7	1.7	0.4	0.0002	1.2
<i>Port of Norfolk, VA</i>											
Total O&M Emissions (tons)	9,876	0.1	0.5	3.8	29.4	163.8	5.2	5.0	1.1	0.0006	3.5
Worst-case OCS Emissions (SFWF)	5,494	0.0	0.3	2.1	16.7	89.1	2.8	2.7	0.5	0.0004	1.8
Worst-case Conformity Emissions - Virginia	521	0.0	0.0	0.2	1.5	8.9	0.3	0.3	0.1	0.0000	0.2
Worst-case Conformity Emissions - Maryland	521	0.0	0.0	0.2	1.5	8.9	0.3	0.3	0.1	0.0000	0.2
Worst-case Conformity Emissions - New York	1,507	0.0	0.1	0.5	5.1	22.0	0.7	0.7	0.1	0.0001	0.5
Emissions in Other Water beyond 25 NM	3,279	0.0	0.2	1.3	9.5	56.3	1.7	1.7	0.4	0.0002	1.2

Notes: All units in tpy. Black carbon is the sooty black material emitted from combustion sources and it is included because it comprises a significant portion of particulate matter or PM.

Estimated air emissions from the proposed O&M activities are expected to have *negligible* impacts to regional air quality. The use of wind to generate electricity reduces the need for electricity generation from new traditional fossil fuel powered plants on the South Fork of Long Island that produce greenhouse gas emissions.

Potential impacts from O&M would be expected to be smaller compared to the impacts anticipated during construction activities. The only air emissions anticipated during O&M would result from maintenance vessels and crew transport vessels and would not be expected to cause an adverse impact on air quality within the surrounding area of the SFWF.

Decommissioning

Estimated air emissions from the conceptual decommissioning activities for the SFWF and SFEC are summarized in Table 4.2-6 by port location. Similar to construction and O&M emission estimates, the decommissioning conformity emissions vary based on port location, but the OCS air emissions do not vary by port location. These estimates are based on the conceptual approach for decommissioning the SFWF and SFEC, as explained in Sections 3.1.6 and 3.2.6, respectively. Decommissioning emissions would be an order of magnitude less than those for construction activities and would result largely from the operation of the construction equipment and vessels or aircraft. There would be no air emissions from the Project once decommissioning is complete.

Table 4.2-6. Estimated Emissions from Decommissioning for the South Fork Wind Farm and South Fork Export Cable by Port

Emissions Type	CO ₂	CH ₄	N ₂ O	Black Carbon	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	Lead	VOC
Port of New Bedford, MA											
SFWF	3,288	0.0	0.2	1.2	8.9	51.3	1.7	1.6	0.6	0.0002	1.5
SFEC	4,844	0.0	0.1	1.0	16.9	58.0	2.0	1.9	4.0	0.0002	5.4
Port of Providence, RI											
SFWF	3,654	0.0	0.2	1.4	9.9	57.5	1.9	1.8	0.7	0.0002	1.6
SFEC	4,896	0.0	0.1	1.0	17.1	58.7	2.0	2.0	4.0	0.0002	5.4
Port of New London, CT											
SFWF	3,958	0.0	0.2	1.4	11.1	61.4	2.0	1.9	0.9	0.0002	1.9
SFEC	4,904	0.0	0.1	1.0	17.1	58.8	2.0	2.0	4.0	0.0002	5.4
Paulsboro Marine Terminal, NJ											
SFWF	11,280	0.1	0.5	4.6	31.4	186.8	6.3	6.0	2.3	0.0006	5.4
SFEC	5,994	0.0	0.2	1.4	20.6	74.9	2.6	2.5	4.1	0.0003	5.7
Sparrows Point, MD											
SFWF	16,515	0.1	0.8	6.7	46.4	274.4	9.2	8.8	3.5	0.0009	8.1
SFEC	6,711	0.0	0.2	1.7	22.9	85.5	2.9	2.8	4.1	0.0003	5.9
Port of Norfolk, VA											
SFWF	12,791	0.1	0.6	5.2	35.6	212.5	7.1	6.8	2.6	0.0007	6.1
SFEC	6,211	0.0	0.2	1.5	21.3	78.1	2.7	2.6	4.1	0.0003	5.8

Note: All units in tons. Black carbon is the sooty black material emitted from combustion sources and it is included because it comprises a significant portion of particulate matter or PM.

Estimated total, OCS, and Conformity emissions were also calculated for the decommissioning phase and are presented in Table 4.2-7. Appendix L breaks down decommissioning emissions on an annual basis for OCS permitting purposes.

Table 4.2-7. Estimated Total, OCS, and Conformity Emissions during Decommissioning for the South Fork Wind Farm and South Fork Export Cable for Monopile Foundations

	CO ₂	CH ₄	N ₂ O	Black Carbon	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	Lead	VOC
<i>Port of New Bedford, MA</i>											
Total Decommissioning Emissions	8,132	0.0	0.3	2.2	25.8	109.2	3.7	3.6	4.7	0.0004	6.9
Worst-case OCS Emissions (SFWF)	5,296	0.0	0.3	2.0	12.7	81.0	2.7	2.6	0.5	0.0004	1.8
Worst-case Conformity Emissions - Massachusetts	841	0.0	0.0	0.3	2.7	12.9	0.4	0.4	0.3	0.0000	0.5
Worst-case Conformity Emissions - New York	3,720	0.0	0.1	0.6	14.3	41.3	1.4	1.4	3.9	0.0001	5.1
<i>Port of Providence, RI</i>											
Total Decommissioning Emissions	8,550	0.0	0.3	2.4	27.0	116.2	3.9	3.8	4.7	0.0004	7.1
Worst-case OCS Emissions (SFWF)	5,322	0.0	0.3	2.0	12.8	81.4	2.7	2.6	0.5	0.0004	1.8
Worst-case Conformity Emissions - Rhode Island	1,210	0.0	0.1	0.4	3.8	19.0	0.6	0.6	0.4	0.0001	0.7
Worst-case Conformity Emissions - New York	3,720	0.0	0.1	0.6	14.3	41.3	1.4	1.4	3.9	0.0001	5.1
<i>Port of New London, CT</i>											
Total Decommissioning Emissions	8,862	0.0	0.3	2.5	28.2	120.2	4.0	3.9	4.9	0.0004	7.4
Worst-case OCS Emissions (SFWF)	5,843	0.0	0.3	2.2	14.0	89.1	3.0	2.9	0.6	0.0004	2.0
Worst-case Conformity Emissions - Rhode Island	901	0.0	0.0	0.3	2.9	13.9	0.5	0.4	0.3	0.0000	0.6
Worst-case Conformity Emissions - Connecticut	635	0.0	0.0	0.2	2.2	9.4	0.3	0.3	0.3	0.0000	0.5
Worst-case Conformity Emissions - New York	3,720	0.0	0.1	0.6	14.3	41.3	1.4	1.4	3.9	0.0001	5.1
<i>Paulsboro Marine Terminal, NJ</i>											
Total Decommissioning Emissions (tons)	17,274	0.1	0.7	6.0	52.0	261.8	8.8	8.5	6.3	0.0009	11.1
Worst-case OCS Emissions (SFWF)	6,382	0.0	0.3	2.4	15.8	99.1	3.3	3.2	0.7	0.0004	2.3
Worst-case Conformity Emissions -New Jersey	5,941	0.0	0.3	2.4	17.3	98.0	3.3	3.2	1.3	0.0003	2.9
Worst-case Conformity Emissions - New York	5,405	0.0	0.2	1.3	19.1	69.4	2.4	2.3	4.3	0.0002	5.9
Emissions in Other Water beyond 25 NM	2,191	0.0	0.1	0.9	6.3	36.6	1.2	1.2	0.4	0.0001	1.0

Table 4.2-7. Estimated Total, OCS, and Conformity Emissions during Decommissioning for the South Fork Wind Farm and South Fork Export Cable for Monopile Foundations

	CO ₂	CH ₄	N ₂ O	Black Carbon	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	Lead	VOC
<i>Sparrows Point, MD</i>											
Total Decommissioning Emissions (tons)	23,226	0.1	1.0	8.4	69.3	359.9	12.1	11.6	7.6	0.0012	14.0
Worst-case OCS Emissions (SFWF)	5,955	0.0	0.3	2.3	14.6	92.0	3.1	3.0	0.6	0.0004	2.1
Worst-case Conformity Emissions - Maryland	4,145	0.0	0.2	1.7	12.2	68.0	2.3	2.2	0.9	0.0002	2.1
Worst-case Conformity Emissions - Virginia	4,561	0.0	0.2	1.8	13.4	74.9	2.5	2.4	1.0	0.0003	2.3
Worst-case Conformity Emissions - New York	4,418	0.0	0.1	0.9	16.3	52.9	1.8	1.8	4.1	0.0001	5.4
Emissions in Other Water beyond 25 NM	6,364	0.0	0.3	2.6	18.2	106.2	3.6	3.4	1.2	0.0004	3.0
<i>Port of Norfolk, VA</i>											
Total Decommissioning Emissions (tons)	19,002	0.1	0.8	6.7	56.9	290.6	9.8	9.4	6.7	0.0010	11.9
Worst-case OCS Emissions (SFWF)	5,949	0.0	0.3	2.3	14.6	91.9	3.1	3.0	0.6	0.0004	2.1
Worst-case Conformity Emissions - Virginia	3,437	0.0	0.2	1.4	10.2	56.2	1.9	1.8	0.8	0.0002	1.8
Worst-case Conformity Emissions - Maryland	1,016	0.0	0.0	0.4	2.9	17.0	0.6	0.5	0.2	0.0001	0.5
Worst-case Conformity Emissions - New York	4,409	0.0	0.1	0.9	16.3	52.8	1.8	1.8	4.1	0.0001	5.4
Emissions in Other Water beyond 25 NM	6,403	0.0	0.3	2.7	18.3	106.8	3.6	3.4	1.2	0.0004	3.0

Note: All units in tons. Black carbon is the sooty black material emitted from combustion sources and it is included because it comprises a significant portion of particulate matter or PM.

Estimated emissions anticipated during decommissioning would result largely from the operation of the construction equipment and vessels or aircraft and would not be expected to [cause an adverse impact on](#) air quality within the surrounding area of the SFWF. There would be no further air emissions from the SFWF once decommissioning is complete. Overall, air quality impacts from decommissioning would be considered *negligible*.

4.2.1.3 Proposed Environmental Protection Measures

The construction activities for the SFWF and SFEC are planned and designed in a manner that will avoid, minimize, and mitigate the potential impacts to air quality.

- Vessels providing construction or maintenance services for the SFWF will use low sulfur fuel where possible.

- Vessel engines will meet the appropriate EPA air emission standards for NO_x emissions when operating within Emission Controls Areas.
- Equipment and fuel suppliers will provide equipment and fuels that comply with the applicable EPA or equivalent emission standards.
- Marine engines with a model year of 2007 or later and non-road engines complying with the Tier 3 standards (in 40 CFR 89 or 1039) or better will be used to satisfy best available control technology (BACT).

In addition, the use of wind to generate electricity reduces the need for electricity generation from new traditional fossil fuel powered plants on the South Fork of Long Island that produce greenhouse gas emissions. Table 4.2-8 presents the estimated annual avoided emissions from the operation of the SFWF. Avoided emissions were based on New York’s annual nonbaseload outputs and rates. The estimated annual and lifetime (25 years) emissions were calculated based on 392,500 MW hours. The Project is expected to annually displace CO₂, NO_x, and SO₂ produced by the New York electric grid and decrease the creation of GHG in the atmosphere from these sources.

Table 4.2-8. Estimated Annual and Lifetime Avoided Emissions for the Operation of the South Fork Wind Farm over a 25-year Period

Pollutant (metric tons)	CO ₂	NO _x	SO ₂	N ₂ O	CH ₄	CO _{2e}
Annual Avoided Emissions	217,653	234	164	1,454	6	798,125
Lifetime Avoided Emissions	5,441,325	5,855	4,091	36,355	147	19,535,130

Note: All units in metric tons.

4.2.2 Water Quality and Water Resources

This section provides a description of water quality and water resource conditions in the SFWF and SFEC, as defined by several parameters including: dissolved oxygen; chlorophyll; nutrient content; seasonal variations in algae or bacterial content; upwelling conditions; contaminants in water or sediment; and turbidity or water visibility. This section also briefly discusses relevant anthropogenic activities that have in the past or currently may impact water quality, including point and nonpoint source pollution discharges, deposition and spills, and pollutants in the water or in sediment.

The description of the affected environment and assessment of potential impacts for water quality and water resources was evaluated by reviewing the revised Environmental Assessment completed as part of the BOEM NEPA review for the RI-MA WEA (BOEM, 2013) and the OSAMP (RI CRMC, 2010). In addition, current public data sources related to water quality and water resources in Suffolk County and on Long Island, including local, regional, state, and federal agency-published papers and reports and published journal articles were reviewed.

4.2.2.1 Affected Environment

The SFWF and SFEC will occur in federal and state marine waters, and the SFEC - Onshore will occur near surface water (tidal waters and freshwater wetlands) and groundwater resources. This section describes the water resources in the SFWF and SFEC and the metrics used to describe their condition according to available data.

Regional Overview

The SFWF and SFEC - OCS are located in offshore marine waters where available water quality data are limited. However, the threat to marine water quality is reduced at greater distances from shore and with exposure to the movement of high-water volume through oceanic circulation, causing pollutants to be dispersed, diluted, and biodegraded (BOEM, 2013).

The SFEC - NYS is located in coastal marine waters of New York State where there is also limited water quality data available. The EPA rated the quality of the nation's coastal waters as "poor," "fair," and "good" for the 2010 National Coastal Condition Assessment (NCCA) (EPA, 2015) from data collected at 238 Northeast Coast sampling locations from Maine through Virginia. The NCCA used physical and chemical indicators to rate water quality, including phosphorous, nitrogen, dissolved oxygen, salinity, water clarity, pH, and chlorophyll a. The National Coastal Condition Report (NCCR) presents a summary of data collected for assessing the ecological and environmental conditions of U.S. coastal waters. Data have been collected since 1997 and summarized in four different reports. This NCCR IV presents an assessment of data collected from 2003 to 2006. The water quality of the coastal waters ranging from Maine to North Carolina, which is inclusive of the SFWF and SFEC, was rated as "good" to "fair" (EPA, 2012). This survey only included four sites located near the SFWF and SFEC: four sampling locations within Block Island Sound.

Dissolved Oxygen

Dissolved oxygen (DO) is the amount of oxygen present in water received from the atmosphere and from aquatic plants. Low levels of oxygen (hypoxia) or no oxygen levels (anoxia) can occur when excess organic material, such as large algal blooms, are decomposed by microorganisms (LICAP, 2016). Water sampling conducted at four stations in Rhode Island Sound in 2002 by the USACE found that DO concentrations both at the surface and in bottom waters remained above

established levels for the “highest quality marine waters” and suggests that hypoxic and anoxic conditions do not typically occur in those areas (RI CRMC, 2010).

The NCCR IV (EPA, 2012) points out that the overall condition of DO in the Northeast Coast region is fair. However, a summary of data in the NCCA shows the stations within Block Island Sound area to have good water quality conditions (EPA, 2015).

Chlorophyll a

Chlorophyll *a* is the main photosynthetic pigment in green algae. The concentration of chlorophyll gives an indication of the volume of aquatic plants present in the water column. For this reason, chlorophyll *a* is used as a metric of plant production, called “primary production” because of the ability of plants to capture energy from sunlight and is described in units of grams of carbon per meter square per day ($g\ C\ m^{-2}\ day^{-1}$). The RI CRMC adapted a table (Table 4.2-9) from Hyde (2009) to compare the range of primary production throughout the year for OSAMP waters and nearby ecosystems. Primary production in the OSAMP area is comparable to other coastal systems, just slightly lower than the value ranges presented for Narragansett Bay and New York Bight.

Table 4.2-9. Comparison of the Range of Primary Production ($g\ C\ m^{-2}\ day^{-1}$).

Ecosystem	Production	Reference
OSAMP	143-204	Hyde, 2009
Narragansett Bay	160-619	Oviatt et al., 2002
Massachusetts Bay	160-570	Keller et al., 2001; Oviatt et al., 2007; Hyde et al., 2008
New York Bight	370-480	Malone and Chervin, 1979

Table adapted from RI CRMC, 2010

Limited data are available on nutrient levels (e.g., silica, nitrogen, and phosphorus) in the waters south of Rhode Island and Massachusetts. Dissolved nutrients are discharged from Narragansett Bay, Long Island Sound, and Buzzards Bay; research on Block Island Sound water quality also suggests that nutrient concentrations had seasonal variation, with peaks in the autumn, and nearly undetectable levels in the late spring and early summer months (Staker and Bruno, 1977).

Water quality data collected in Northeast coastal waters indicates that concentrations of chlorophyll *a* continue to be elevated when compared to thresholds used to evaluate water quality in coastal waters; therefore, the waters are considered to represent fair water quality conditions (EPA, 2012; EPA, 2015).

Algae and Bacterial Content

Nutrients are chemical elements that all living organisms need for growth. Problems arise when too much of a nutrient is introduced into the environment through human activities. In surface waters, excess nutrients fuel algal blooms which can lead to water quality degradation. Severe or harmful algal blooms can result in the depletion of oxygen in the water that aquatic life needs for survival. Algal blooms also reduce water clarity preventing desirable plant growth, such as seagrasses, reduce the ability of aquatic life to find food, and clog fish gills. In groundwater, excess nitrogen can cause nitrate concentrations to rise to levels unsafe for drinking water (LICAP, 2016). Freshwaters are primarily affected by excess phosphorus, while in coastal

waters, nitrogen is the nutrient of highest concern. In some cases, both nutrients may interact and contribute to the water pollution problem (RI DEM, 2010).

Waterborne pathogens include bacteria, viruses, and other organisms that may cause disease or health problems in native species and in humans. When pathogens are present in water at elevated concentrations, the beneficial uses of waters are adversely affected prompting restrictions (closures) at public beaches and on the harvest of shellfish.

The SFWF and SFEC is located in waters that are considered temperate and therefore, subject to highly seasonal variation in temperature, stratification, and productivity. There is little information on the algal and bacteria dynamics in either Block Island or Rhode Island Sounds. According to RI CRMC (2010), there were no documented reports of harmful algal blooms or waterborne pathogen outbreaks in the waters of either Block Island or Rhode Island Sounds as of 2010.

Upwelling/Currents

The physical oceanographic and meteorological conditions of the SFWF and SFEC are described in Section 4.2.4.

Contaminants in Water or Sediment

Data on water-column contaminant levels in Rhode Island Sound are limited. Organic contaminants (polychlorinated biphenyls [PCBs] and pesticides) measured in 2001 and 2002 were generally below method detection limits (USACE, 2004). For example, total PCB concentrations were less than 46 parts per trillion, and total dichlorodiphenyltrichloroethanes (DDTs) were less than 4 parts per trillion. Water-column dissolved metals concentrations in Rhode Island Sound were also low, with concentrations generally less than 1 part per billion. Dissolved metal concentrations appeared similar throughout the year and throughout Rhode Island Sound. Metals, PCBs, and pesticide concentrations measured in the water column within the OSAMP area in 2002 were well below ambient RI DEM water quality criteria for toxic pollutants (RI CRMC, 2010).

DWSF completed chemical analyses of geotechnical sediment samples from the SFEC - NYS and completed testing for the following contaminants: arsenic; cadmium; copper; lead; mercury; benzene; total benzene, toluene, ethylbenzene, and xylenes (BTEX); total PAH; Sum of DDT + dichlorodiphenyldichloroethene (DDE)+ dichlorodiphenyldichloroethane (DDD); mirex; chlordane; dieldrin; PCBs (sum of aroclors); dioxin (Toxic Equivalency Total); grain size; and total organic carbon. The methods used for this sampling procedure and the results are described in the following section on water quality in the SFEC - NYS, and in greater detail in Appendix H.

Toxicity testing at dredged materials disposal sites in Rhode Island Sound indicates that the constituents do not appear to pose a significant threat to water quality in the Rhode Island Sound area (RI CRMC, 2010).

Turbidity

Turbidity is the measure of cloudiness or haziness in water caused by suspended solids (e.g., sediments or algae). Ocean waters beyond 3 miles (4.8 km, 2.6 nm) offshore typically have very low concentrations of suspended particles and low turbidity. Turbidity in Rhode Island Sound from five studies cited in USACE (2004) ranged from 0.1 to 7.4 mg/L TSS. Bottom currents may re-suspend silt and fine-grained sands, causing higher suspended particle levels in benthic

waters. Storm events, particularly frequent intense wintertime storms, may also cause a short-term increase in suspended sediment loads. (BOEM, 2013)

Additional information on turbidity impacts (TSS and deposition) resulting from construction activities in the SFWF and SFEC are described further in the Hydrodynamic and Sediment Transport Modeling Results in Appendix I.

Anthropogenic Activities

Current anthropogenic activities that are sources of water quality degradation include point source pollution and nonpoint source pollution. Point source pollutants, which enter waterways at well-defined locations, such as pipe or sewer outflows are the most common sources of water pollution. There are no direct municipal wastewater or industrial point sources for pollution into or within the SFWF and SFEC.

Nonpoint source pollutants, however, are considered the largest contributors to water pollution and water quality degradation. Various human land-use practices, such as agriculture, construction activities, urban runoff, and deposition of airborne pollutants, can introduce nutrients, bacterial and chemical contaminants, and sediments, which all can impact coastal water quality and water resources (NYSDEC, 2018).

There is a 1.3 square mile (3.24 km²) site in east-central Rhode Island Sound (the Rhode Island Sound Disposal Site) that was designated in December 2004 for the disposal of dredge material, including approximately 120 million cubic feet (Mft³; 3.4 million cubic meters [Mm³]) of sediment from Providence River. The disposal site is located approximately 13 miles (21 km) south of Narragansett Bay and is approximately 6 miles (9 km) northwest from the nearest part of the SFWF and SFEC (RI CRMC, 2010). There are no other active open water disposal sites in federal waters near the SFWF, SFEC – OCS, and SFEC - NYS (USACE, 2018).

South Fork Wind Farm

As described previously, there is minimal available information related to offshore water quality specific to the SFWF. The movement of water and currents through the SFWF are described in Section 4.2.4. In addition, DWSF completed the geophysical and geotechnical (G&G) survey reports of the seafloor within the SFWF to categorize the geophysical and chemical properties of the sediment for the purposes of improved micro-siting of the WTGs, as well as to understand the risks associated with seafloor disturbance and contaminants in the sediment at the SFWF (Appendix H).

South Fork Export Cable

This section discusses water quality and water resources that could be impacted by the SFEC - OCS, SFEC - NYS, and SFEC - Onshore.

SFEC - OCS

The SFEC - OCS extends from the SFWF passing through the OSAMP area, to the boundary of New York State waters, south of the two potential landing sites (Figure 1.1-2). As noted for the SFWF, DWSF completed testing of the seafloor along a proposed SFEC - OCS route corridor to categorize the geophysical and chemical properties of the sediment for the purposes of improved micro-siting of the cable route, as well as to understand the risks associated with seafloor disturbance and contaminants in the sediment along the path of the SFEC - OCS (Appendix H).

SFEC - NYS

The SFEC - NYS extends from where the SFEC - OCS crosses into New York State waters and connects on shore at one of the potential landing sites on the south shore of Long Island in East Hampton. These waters are categorized by the NYSDEC as a Class SA saline surface waterbody and are described as “suitable for fish, shellfish, and wildlife propagation, and survival.” The best uses of Class SA waters are “shellfishing for market purposes, primary, and secondary contact recreation and fishing” (NYSDEC, 2018a).

DWSF completed a geotechnical analysis of 12 vibracores collected in New York State waters using techniques described in Appendix H3, Geotechnical Data Report. Samples were analyzed along the two proposed SFEC - NYS routes and landing sites at Beach Lane and Hither Hills, with six cores collected from each approach. Sediment contaminant concentration results from these cores correspond to Class A (No Appreciable Contamination) as defined in the Sediment Quality Thresholds described in the Technical Guidance for Screening Contaminated Sediments (NYSDEC, 1999) for in-water/riparian placement.

SFEC - Onshore

Onshore surface waters found along the SFEC - Onshore route options include marine subtidal and intertidal waters, mudflats, as well as a variety of freshwater water resource types including bogs, marshes, ponds, streams, swamps, and various groundwater-influenced ditches and swales. These tidal and freshwater wetlands and waterbody features are regulated by the USACE, NYSDEC, and the town and/or the village of East Hampton. Descriptions of the tidal and freshwater wetlands and water bodies are provided in the Onshore Biological Resources Report (Appendix M) and in Section 4.3.1.

Surface Waters

The fresh and marine water resources of eastern Suffolk County are diverse and abundant with coastal waters forming the county’s boundaries to the north, east, and south. Most of the bays along Suffolk County’s southern coast are designated as impaired; that is, they are in violation of state water quality standards. A variety of algae blooms proliferates in warmer weather. In addition to regular algae blooms, there are “harmful” algae blooms, “red tides,” “rust tides” and “brown tides” comprising different types of problematic microscopic organisms, all linked to excess nitrogen pollution from wastewater-derived effluent (primarily cesspools and septic systems) and atmospheric deposition (Suffolk County Department of Health Services, 2017). These algal blooms could have adverse impacts on swimming, fishing, shellfishing, and boating.

Suffolk County’s fresh surface water resources are also considered abundant and generally of sufficient quality to support multiple uses. Within the county, New York State has classified more than 200 freshwater streams and ponds and regulates over 1,050 freshwater wetlands covering nearly 24,000 acres (9,712 ha) (Suffolk County, 2015). Suffolk County surface waters are regularly monitored, and their quality is assessed as part of other ongoing programs, including New York State’s identification of impaired waters under Section 303(d) (NYSDEC, 2017c).

However, coastal waters throughout eastern Suffolk County are impacted to varying degrees by contaminants introduced by nonpoint sources. Nonpoint sources are considered to be the major contributors of nutrients and pathogens. Nitrogen and pathogens were identified as the parameters with the greatest impacts in terms of limiting uses and stressing the living marine resources. As of 2014, almost 30,000 acres (12,140 ha) are closed to shellfishing year-round, and approximately 9,000 acres (3,642 ha) are closed on a seasonal basis (NYSDEC, 2014; Suffolk

County, 2015). Toxic contaminants along with emerging contaminants such as pharmaceuticals and personal care products also play a role in imparting stress on the living resources of Suffolk County's coastal waters.

Most of the marine surface waters in the East Hampton area are classified by the NYSDEC as Class SA saline waters (NYSDEC, 2017c; Suffolk County, 2015). The NYSDEC classifies the best usages of Class SA waters as shellfishing for market purposes, primary and secondary contact recreation, and fishing. These waters would be considered suitable for fish propagation and survival. Freshwater classifications for waterbodies in the SFEC - Onshore are classified by the NYSDEC as Class C or Class D waters. Class C waters are for fishing. These waters are also suitable for fish propagation and survival. The water quality of Class C waters is suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes. The best usage of Class D waters is fishing. The NYSDEC states that natural water conditions, such as intermittency of flow, are not conducive to propagation of game fishery, or stream bed conditions; therefore, these waters generally would not support fish propagation. The Class D waters would be suitable for fish survival. The water quality also would be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes (NYSDEC, 2017c).

Groundwaters

Long Island is considered a sole source aquifer region, which means that groundwater is the single water supply source. Most of Long Island's drinking water is from groundwater with surface water an insignificant contributor. There are four primary formations, which are layered and make up the Long Island aquifer system: Upper Glacial Aquifer, Magothy Aquifer, Raritan Clay, and Lloyd Aquifer. The three most important Long Island aquifers are the Upper Glacial Aquifer, the Magothy Aquifer, and the Lloyd Aquifer (USGS, 2017; NYSDEC, 2017d). Most of the private groundwater wells and the wells that provide water to farms, golf courses, and industry tap the Upper Glacial Aquifer. Because the population is less dense and the threat of contamination in the aquifer is reduced, public supply wells in eastern Suffolk County also take water from the Upper Glacial Aquifer (LICAP, 2016).

Groundwater throughout most of eastern Suffolk County is of generally high quality (NYSDOH, 2003). All freshwater groundwater in New York State is Class GA, a source for potable water supply (NYSDOS, 2018b) With rare exceptions, potable water supplied by community water systems in Suffolk County meet all drinking water quality standards.

However, according to Suffolk County, median groundwater nitrogen levels in the Upper Glacial Aquifer have risen 40 percent to 3.58 mg/L, and the Magothy Aquifer has seen a 93 percent increase in nitrogen levels to 1.76 mg/L since 1987. While nitrogen levels are generally below the drinking water standard, there are some areas that now exceed the 10 mg/L limit. These aquifers, of course, are recharged through surface water and subsurface wastewater infiltration.

Groundwater along the SFEC – Onshore corridor and at the SFEC – Interconnection Facility generally flows both downward and horizontally to the south, toward the Atlantic Ocean, and ranges from a depth of zero feet below ground surface (bgs) at the Beach Lane and Hither Hills landing sites to approximately 40 feet (12 m) bgs at the proposed SFEC – Interconnection Facility.

The Beach Lane and Hither Hill landing sites are underlain by the Upper Glacial and Magothy aquifers. The area is vulnerable to saltwater intrusion from over-pumping of groundwater (Nemickas and Koszalka, 1982). Groundwater depths to the Upper Glacial Aquifer at the potential landing sites are estimated to be less than 11 feet (3.4 m) from the ground surface

(USGS, 2017), but typical groundwater depths along the south coastline of eastern Suffolk County have been shown to be depths ranging from approximately 4 to 5 feet (1.2 to 1.5 m) bgs (GZA, 2018).

4.2.2.2 Potential Impacts

Construction, O&M, and decommissioning activities associated with the SFWF and SFEC have the potential to impact water quality and water resources, as discussed in the following sections. All impacts are anticipated to be short-term and not result in permanent or long-term impacts to water quality or water resources. An overview of the potential IPFs and their potential impacts to water quality and water resources associated with the SFWF and SFEC is presented on Figure 4.2-2.

The IPFs that may impact water quality and water resources include seafloor and land disturbance, sediment suspension and deposition, discharges and releases, and trash and debris. Supporting information on the negligible level of impact from the trash and debris IPF is provided in Section 4.1. An evaluation of the remaining IPFs that may impact water quality are presented in the following sections.

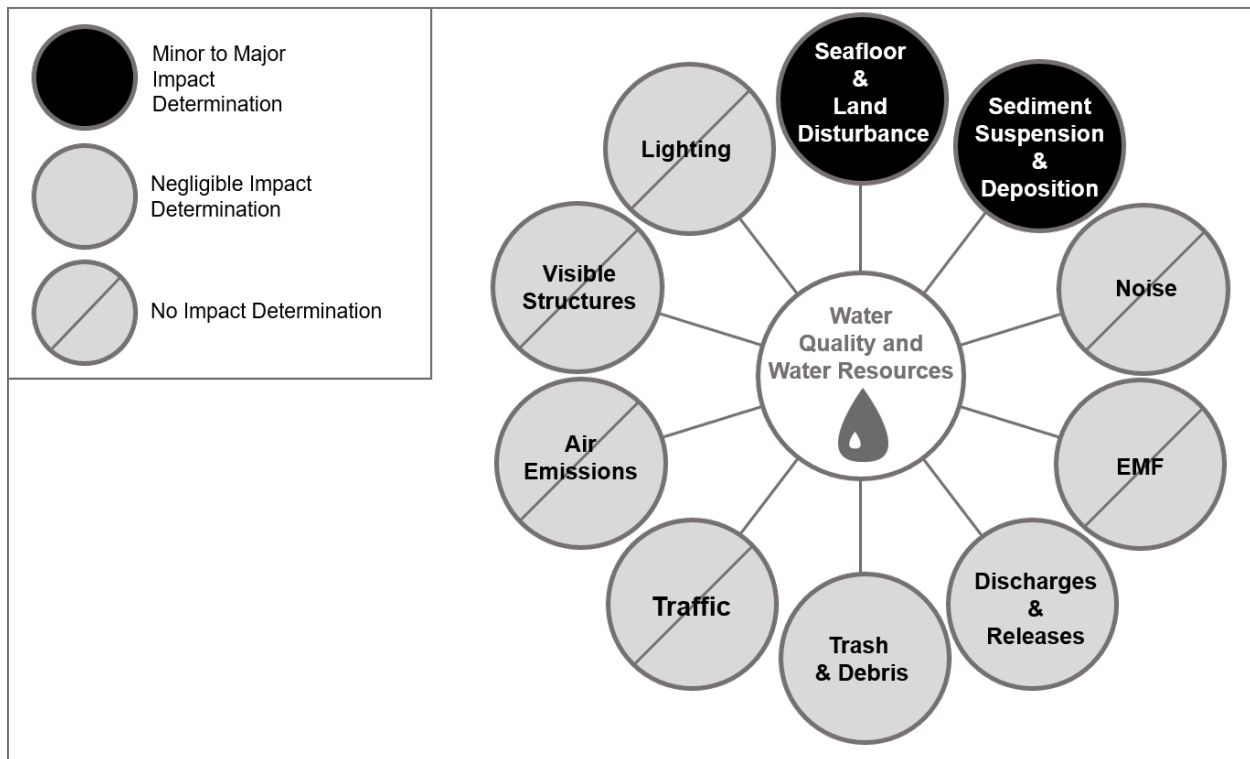


Figure 4.2-2. IPFs on Water Quality and Water Resources
Illustration of potential impacts to water quality resulting from SFWF and SFEC activities

South Fork Wind Farm

Construction

Seafloor Disturbance

Impacts to marine water quality resulting from seafloor disturbance activities during the construction of the SFWF are expected to be *minor* and *short-term*. Sediment disturbance from pile-driving, foundation placement, cable-laying, and the positioning of jack-up barges and

vessel anchors would result in a **short-term** and **localized** increase in suspended sediment concentrations at the seafloor, as addressed below.

Sediment Suspension and Deposition

All seafloor-disturbing construction activities including foundation work, installation of the Inter-array Cable using cable installation equipment that could include either a mechanical cutter, mechanical plow (which may include a jetting system), and/or jet plow, positioning of jack-up barges, boulder relocation, and positioning of vessel anchors will result in **short-term** and **localized** suspension of sediment in the water column. The magnitude of these impacts depends on the sediment grain size, the volume and rate of sediment suspended, and the currents transporting the sediment. Vessel mooring or anchoring activity resulting in sediment suspension is expected to be limited to areas of seafloor immediately adjacent to the spuds or anchors. For jet plow activity, a sediment transport study was completed that estimated the suspended sediment concentrations, sediment transport, and resulting sediment deposition that may result from jet plow installation of the Inter-Array Cable (Appendix I).

A modeling simulation was conducted on a representative section of the Inter-Array Cable which estimated that the maximum modeled TSS concentration from SFWF Inter-Array Cable installation is 100 mg/L. Water column concentrations of 100 mg/L are predicted to extend up to 131 feet (40 m) horizontally from the jet plow and TSS concentrations are predicted to return to ambient levels (less than 10 mg/L) within 18 minutes (0.3 hour) from the conclusion of jet plow trenching. Modeling also indicates that elevated TSS concentrations are expected to remain very close to the seabed and that plumes are not predicted to extend vertically beyond 3 to 9 feet (1 to 3 m) of the jet plow at any time during the simulation. These localized impacts to marine water quality would be **short-term** and **minor** and should not impact DO, chlorophyll *a*, or nutrient balance in the region. In addition, the sediment in the SFWF is not expected to contain contaminants; therefore, water quality will be affected primarily by the short-term physical suspension of sediments.

Discharges and Releases

Multiple vessels will be used during the construction of the SFWF, as addressed in Section 3.1.3.1. Vessels will comply with regulatory requirements for management of onboard fluids and fuels, including prevention and control of discharges and accidental spills. Vessels will be navigated by trained, licensed vessel operators who will adhere to navigational rules and regulations, and vessels will be equipped with spill handling materials. Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D). The likelihood of discharges and releases is expected to be low and impacts to water quality are unlikely and considered **negligible**.

Some liquid wastes are allowed to be discharged to marine waters during the construction phase of the SFWF. These discharges include domestic water, deck drainage, treated sump drainage, uncontaminated ballast water, and uncontaminated bilge water, as described in Appendix F. These discharges are not expected to pose a water quality impact to marine water, because these releases would quickly disperse, dilute, and biodegrade (BOEM, 2013). All project vessels will comply with USCG standards in U.S. territorial waters to legally discharge uncontaminated ballast and bilge water, and standards regarding ballast water management.

Other liquid wastes such as sewage, chemicals, solvents, and oils and greases from equipment, vessels, or facilities will be stored and properly disposed on land. A list of chemicals to be utilized during the project is provided as required by 30 CFR 585.626 in Appendix F.

Operations and Maintenance

Seafloor Disturbance

Seafloor disturbance during O&M is expected to only occur if the Inter-array Cable or scour protection around the WTGs require maintenance that exposes the Inter-array Cable or disturbs the area around the scour protection. These maintenance activities are considered nonroutine events and are not expected to occur with any regularity. Impacts associated with exposing the Inter-array Cable or disturbing the scour protection may be similar to, but less frequent than, those described for the construction phase for the SFWF.

In addition, vessels are not expected to anchor during O&M activities unless the Inter-array Cable or WTGs require maintenance. Impacts associated with potential vessel anchoring during operation are expected to be similar to those discussed in the construction phase for the SFWF.

Sediment Suspension and Deposition

Increases in sediment suspension and deposition during O&M would primarily result from vessel anchoring and any maintenance activities associated with a repair of the Inter-array Cable. These activities are expected to be nonroutine events and not expected to occur with any regularity. If maintenance or an emergency repair of the Inter-array Cable is required, impacts on water quality would only include local increases in turbidity and resuspension of sediments. Sediment suspension and deposition impacts resulting from vessel activity or maintenance and repair during SFWF O&M are expected to be similar, or less than sediment suspension and deposition impacts described for the construction phase.

Discharges and Releases

There may be a small, temporary diesel generator at each WTG location on the work deck of the foundation. If present, the generator will have a 50-gallon diesel tank with secondary containment. The OSS may also include a small permanent diesel generator with a 500-gallon diesel tank with secondary containment.

The operation of the SFWF is not anticipated to generate any sources of pollutants to the marine environment. To make sure that no discharges of fluids (oil, hydraulic, cooling, etc.) occur even under abnormal circumstances, the WTG and the OSS will be designed for secondary levels of containment as described in more detail in Section 3.1 and in Appendix F. Most maintenance would occur inside the WTGs, thereby reducing the risk of a spill, and no oils or other waste is expected to be discharged during service events. Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D). The original coating system on the towers is designed to last the lifetime of the structure; therefore, no painting is anticipated during the life of the turbines other than to repair minor surface damage. As a result, impacts to surface water quality during O&M is expected to be ***negligible***.

As with vessels associated with construction, any vessels used for O&M activities will comply with USCG regulations and applicable spill prevention, control, and countermeasure (SPCC) plans; therefore, potential impacts from spills are considered unlikely resulting in ***negligible impacts*** to water quality.

The proposed Inter-array Cable and SFEC do not contain any fluid. There will be no risk to the environment if they are disturbed by anchors or keels because no fluids or materials will be released.

Decommissioning

Decommissioning of the SFWF is expected to have similar impacts to water quality as construction of the WTGs, OSS, and Inter-array Cable.

SFEC – OCS

Construction

Seafloor Disturbance

Impacts to marine water quality resulting from seafloor disturbance activities during the installation of the SFEC - OCS are expected to be *minor* and *short-term*, consisting of sediment disturbance from cable-laying and the positioning of vessel anchors. These seafloor disturbance activities will result in a *short-term* and *localized* increase in suspended sediment concentrations, which is described in more detail in the next subsection.

Sediment Suspension and Deposition

Installation of the SFEC - OCS using cable installation equipment that could include either a mechanical cutter, mechanical plow (which may include a jetting system), and/or jet plow, and positioning of vessel anchors will result in *short-term* and *localized* suspension of sediment in the water column. The magnitude of these impacts depends on the sediment grain size, the volume and rate of sediment suspended, and the currents transporting the sediment. Vessel mooring or anchoring activity resulting in sediment suspension is expected to be limited to areas of seafloor immediately adjacent to the spuds or anchors. For jet plow activity, a sediment transport study was completed that estimated the suspended sediment concentrations, sediment transport, and resulting sediment deposition that may result from jet plow installation of the SFEC - OCS (Appendix I).

A modeling simulation was conducted for one of three types of equipment that could be used for cable installation along the SFEC - OCS which indicated that the maximum modeled TSS concentration from SFEC - OCS installation is 1,347 mg/L. The highest TSS concentrations are predicted to occur in locations where the jet plow passes over pockets of finer sediments (e.g., between VC-217 and VC-220, and again between VC-235 and the end of the route – see Appendix H), but concentrations above 30 mg/L otherwise remain within approximately 328 feet (100 m) of the source during the simulation. For the maximum predicted TSS concentrations, water column concentrations of 100 mg/L or greater are predicted to extend up to 1,115 feet (340 m) horizontally from the jet plow and TSS concentrations are predicted to return to ambient levels (less than 10 mg/L) in 1.4 hours after the conclusion of jet plow trenching. Modeling also indicates that elevated TSS concentrations are expected to remain very close to the seabed and that plumes are not predicted to extend vertically beyond 3 to 9 feet (1 to 3 m) of the jet plow at any time during the simulation. These localized impacts to marine water quality would be *short-term* and *minor* and are not anticipated to affect DO, chlorophyll *a*, or nutrient balance in the region. In addition, the sediment in the SFEC - OCS is not expected to contain contaminants; therefore, water quality will be affected primarily by the short-term physical suspension of sediments.

Discharges and Releases

Impacts associated with discharges and releases during construction of the SFEC - OCS are expected to be similar to those described for the SFWF Inter-array Cable.

Operations and Maintenance

Seafloor Disturbance

Seafloor disturbance during O&M would only occur if the SFEC - OCS requires maintenance or repair. Maintenance or repair of the SFEC - OCS is considered a nonroutine event and is not expected to occur with any regularity. Impacts associated with exposing the SFEC - OCS are expected to be similar to but less frequent than those described for the construction phase.

In addition, vessels are not expected to anchor during O&M activities unless the SFEC - OCS requires maintenance. Impacts associated with potential vessel anchoring during operation are expected to be similar to those discussed in the construction phase for the SFWF.

Sediment Suspension and Deposition

Impacts associated with sediment suspension and deposition during O&M of the SFEC - OCS are expected to be similar to those described for O&M of the SFWF Inter-array Cable.

Discharges and Releases

Impacts associated with discharges and releases during O&M of the SFEC - OCS are expected to be similar to those described for O&M of the SFWF Inter-array Cable.

Decommissioning

Decommissioning of the SFEC - OCS would have similar impacts as construction.

SFEC - NYS

Construction

Seafloor Disturbance

Impacts to marine water quality resulting from seafloor disturbance activities during the installation of the SFEC - NYS would be *minor* and *short-term*, consisting of sediment disturbance from cable-laying, the temporary cofferdam, and the positioning of vessel anchors. Sediments disturbed during these activities are not expected to introduce contaminants into the water column based on results of vibracores collected along the SFEC - NYS as presented in Appendix G of the Fugro Geotechnical Data Report (Appendix H3). These seafloor disturbance activities will result in a *short-term* and *localized* increase in suspended sediment concentrations which is described in more detail in the next subsection.

HDD will avoid disturbance to inter-tidal zone, beach, and dunes. For the HDD landing, spoils from the trench excavation will be stored and returned to the trench after the SFEC is installed. Based on the composition of the surficial materials surrounding the boreholes, it is unlikely the drilling mud will penetrate more than 3 feet (0.9 m) of the aquifer (GZA, 2018).

The slurry used for the drilling process is comprised of bentonite clay and water; bentonite is a natural clay that is mined from the earth, and similar to the clay minerals that are present in the drilling location. No impacts to chemistry or hydrogeology are anticipated at any depths.

HDD operations are not expected to threaten private, residential wells because they will occur at safe distances. For example, at areas near the Beach Lane landing site, water pumped from residential wells draw from approximately 5 feet (1.5 m) away from the intake around the well site.

Sediment Suspension and Deposition

Installation of the SFEC - NYS using a mechanical cutter, mechanical plow (which may include a jetting system), and/or jet plow, positioning of vessel anchors, and sediment disturbance during installation of the temporary cofferdam will result in short-term and localized suspension of sediment in the water column. The magnitude of these impacts depends on the sediment grain size, the volume and rate of sediment suspended, and the currents transporting the sediment. For jet plow activity and excavation in the temporary cofferdam, a sediment transport study was completed that estimated the suspended solids concentrations, sediment transport, and resulting sediment deposition that may result from jet plow installation of the SFEC - NYS and temporary cofferdam construction (Appendix I).

The results of the project-specific sediment sampling of vibracores collected along the SFEC - NYS were compared against the sediment quality thresholds for in-water/riparian placement in the Technical Guidance for Screening Contaminated Sediments (NYSDEC-DFWMR, 1999) and determined to correspond to Class A – No Appreciable Contamination. The results of the sediment sampling and chemical analysis are summarized in Appendix G of the Geotechnical Data Report included in Appendix H3.

As previously stated, a modeling simulation was conducted for one of three types of equipment that could be used for cable installation along the SFEC - NYS which indicated that the maximum modeled TSS concentration from SFEC - NYS installation is 578 mg/L. Water column concentrations of 100 mg/L or greater are predicted to extend up to 394 feet (120 m) horizontally from the jet plow and TSS concentrations are predicted to return to ambient levels (less than 10 mg/L) in 1.3 hours after the conclusion of jet plow trenching. Modeling also indicates that elevated TSS concentrations are expected to remain very close to the seabed and that plumes are not predicted to extend vertically beyond 3 to 9 feet (1 to 3 m) of the jet plow at any time during the simulation.

A modeling simulation of suction dredging and side-casting at the HDD exit point for the sea-to-shore was also conducted. The maximum predicted TSS concentration from suction dredging at the HDD site is 562 mg/L. Water column concentrations of 100 mg/L are predicted to extend up to 476 feet (145 m) horizontally from the source and TSS concentrations are predicted to return to ambient levels (less than 10 mg/L) in 1.1 hours after the conclusion of suction dredging.

These localized impacts to marine water quality would be *short-term* and *minor* and are not anticipated to affect DO, chlorophyll *a*, or nutrient balance in the region. In addition, based on project-specific vibracore sampling results (Appendix H), the sediment in the SFEC - NYS is not expected to contain contaminants; therefore, water quality will be affected primarily by the short-term physical suspension of sediments.

Discharges and Releases

Impacts associated with discharges and releases during construction of the SFEC - NYS are expected to be similar to those described for the SFWF. However, additional water quality impacts could occur during HDD operations, described as follows.

Both HDD landing site alternatives will require the use of HDD drilling fluid, which typically consists of a water and bentonite mud mixture or another nontoxic drilling fluid. Bentonite is a natural clay that is mined from the earth, and similar to the clay minerals that are present in the drilling location. While the mixture is not anticipated to significantly impact water quality if released, DWSF will implement BMPs during construction to minimize potential release for a frac-out of the drilling fluid associated with HDD 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 impact marine and coastal habitats. Because DWSF has avoided sensitive habitats in selection of the cable landing sites, a potential frac-out will result in only *negligible* and *localized* impacts to water quality in the shallow marine and freshwater environments along the SFEC route. In addition, DWSF will develop an HDD frac-out contingency plan for the inadvertent releases of drilling fluid before construction to further minimize the potential risks associated with a frac-out.

Operations and Maintenance

Seafloor Disturbance

Impacts associated with seafloor disturbance during O&M of the SFEC - NYS are expected to be similar to those described for the SFEC - OCS.

Sediment Suspension and Deposition

Impacts associated with sediment suspension and deposition during O&M of the SFEC - NYS are expected to be similar to those described for O&M of the SFEC - OCS.

Discharges and Releases

Impacts associated with discharges and releases during O&M of the SFEC - NYS are expected to be similar to those described for O&M of the SFEC - OCS.

Decommissioning

Decommissioning of the SFEC - NYS will have similar impacts as construction.

SFEC – Onshore

Construction

The activities that could impact water quality and water resources in the SFEC – Onshore include the installation of the underground transition vault at the Beach Lane or Hither Hills landing sites, installation of the underground SFEC – Onshore route, and construction of the SFEC – Interconnection Facility. However, the SFEC – Onshore would be located underground within public roadways and MTA-owned LIRR ROW, or along roadway corridors that are characterized as impervious road surfaces or railroad beds.

Land Disturbance

The underground transition vault will be installed above mean high water, several hundred feet landward of the MHWL within a paved roadway or a parking lot and will have a manhole cover at the ground surface. The onshore transition vault will be located outside wetlands and other waterbodies. **No impacts** in the intertidal areas from construction at the landing sites are anticipated due to subsurface installation techniques proposed (i.e., HDD) to connect the SFEC – NYS to the SFEC - Onshore transition vault. The transition vault is located within an area identified as an “adjacent area” to a NYSDEC-regulated tidal wetland. However, as discussed in Section 4.3.1, the transition vault and HDD work area will be located within paved surfaces, and erosion and sedimentation controls will be utilized. Therefore, impacts, if they occur, to surface water quality or to surface water resources from construction activities would be **short-term** and **negligible**.

Wetland resources located in the vicinity of the potential routes for the SFEC – Onshore include both freshwater and tidal wetlands. Potential impacts to wetland resources are discussed further in Section 4.3.1, Coastal and Terrestrial Habitat.

The SFEC – Interconnection Facility will be located adjacent to and on the same parcel as the existing LIPA East Hampton substation on Cove Hollow Road. **Negligible, short-term impacts** to water quality and water resources are expected from increased erosion and sedimentation during land clearing and construction for the SFEC – Interconnection Facility. Similarly, impacts to water quality and water resources from erosion of disturbed soils and transport by stormwater during construction of the onshore cable duct bank and the SFEC – Interconnection Facility would be expected to be **negligible** and **short-term**. All earth disturbances from onshore construction activities will be conducted in compliance with the SPDES General Permit and an approved SWPPP.

Discharges and Releases

Although *no impacts* from discharges and releases are anticipated during routine construction activities, some spills and accidental releases of fuels, lubricants, and hydraulic fluids may occur. These non-routine spills or accidental releases may result in *negligible* and *short-term impacts* to stormwater quality. However, pollution of local wetlands and waterbodies will be avoided and minimized through the implementation of an SPCC.

Operations and Maintenance

The SFEC – Onshore has no maintenance needs unless a fault or failure occurs. Therefore, O&M of the SFEC - Onshore is not expected to generate sources of pollutants that would impact water quality and water resources.

Land Disturbance

Given that no maintenance needs are anticipated for the SFEC – Onshore, *no impacts* to water quality or water resources are expected from land disturbance activities. In the event of a fault or failure, impacts are expected to be similar to those described for the SFEC - Onshore construction phase.

Discharges and Releases

No impacts associated with discharges and releases during O&M of the SFEC – Onshore are expected; however, in the event there is a fault or failure, the impacts are expected to be similar to those described for construction of the SFEC – Onshore construction.

Decommissioning

Decommissioning of the SFEC – Onshore would have similar impacts as construction.

4.2.2.3 Proposed Environmental Protection Measures

The protection of water quality in marine and onshore environments is incorporated into many facets of the SFWF and SFEC design and construction. Site selection and routing, installation techniques and equipment technologies have been selected to avoid and minimize potential impacts to the environment, including water quality.

Several environmental protection measures will reduce potential impacts to water quality.

- Installation of the SFWF Inter-Array Cable and SFEC - Offshore will occur using equipment such as mechanical cutter, mechanical plow, and/or jet plow. Compared to open cut dredging, this method will minimize turbidity and total suspended solids.
- Vessels will comply with regulatory requirements related to the prevention and control of discharges and accidental spills.
- Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D).
- At the onshore HDD work area for the SFEC, drilling fluids will be managed within a contained system to be collected for reuse as necessary
- An HDD Inadvertent Release Plan will minimize the potential risks associated with release of drilling fluids or a frac-out.
- A SWPPP, including erosion and sedimentation control measures, and a Spill Prevention, Control, and Countermeasures Plan, will minimize potential impacts to water quality during construction of the SFEC - Onshore.

4.2.3 Geological Resources

An overview of the regional geological setting and characterization of the potentially affected environment is provided in this section. These descriptions provide the basis for an evaluation of potential Project-related impacts to geological resources. In accordance with 30 CFR 585.626, a G&G survey was conducted for the SFWF and SFEC route, including the two potential landing sites. These surveys collected data for characterizing shallow hazards, geological conditions, geotechnical characteristics, and to provide data for marine archaeological resource assessment and benthic studies. The results of the G&G survey work are summarized below and discussed in detail in a series of G&G reports included in Appendix H. In addition, geological hazards that could affect SFWF and SFEC siting and development are discussed. Related assessments, such as the characterization of the benthic and shellfish resources anticipated within the SFWF and along the SFEC as well as an assessment of the potential Project-related impacts are found in Section 4.3.2 and Appendix N1.

4.2.3.1 Affected Environment

Regional Overview

Regional geology and geomorphology are a product of glacial action and post-glacial coastal processes. The continental ice sheet advanced and retreated several times over the area, leaving behind a wide range of glacial deposits and outwash, depending on the location of the edge of the ice sheet at any given time. The geomorphology of the ocean bottom, shorelines, and island masses in this area are all products of glacial processes. In general, deposits range from fine-grained clays to sand, gravel, and interlaying boulders as evidenced on the exposed erosional cliffs of the offshore islands, such as Block Island (RI CRMC, 2010).

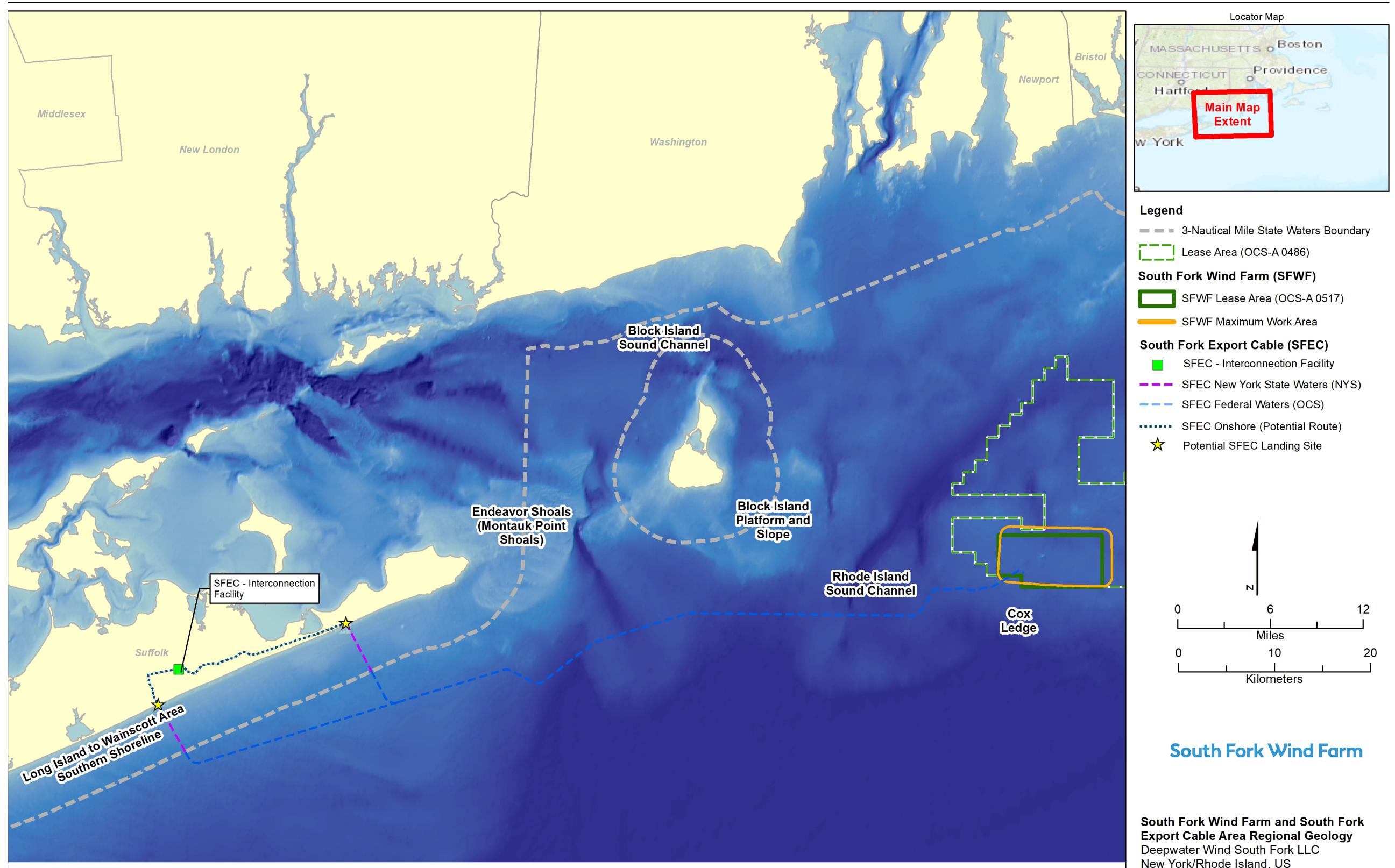
The surficial expression of Rhode Island Sound was formed during the advance and retreat of the last continental ice sheet in the northeastern United States, part of the Laurentide glaciation, and the subsequent erosion and reworking of the glacial deposits during the Holocene (10,000 years ago to the present) sea-level rise. Characteristic glacial deposits are moraine and outwash. Glacial moraines are formed at the leading edge of an ice sheet when it is no longer advancing, and melting has begun. Typically, moraine includes poorly sorted, fine-grained to gravel sediments with boulders, which can be called glacial till deposits. Glacial outwash (also referred to as glacial drift) is well-sorted material, formed from meltwater within glaciers or from drainage off the front of a glacier across an outwash plain. These can be thick deposits of primarily sandy material and may include incised channels where meltwater drained. Following the glacial period, the shoreline transgressed across the area to its current location, leaving behind fine-grained to sandy fluvial-estuarine deposits (RI CRMC, 2010).

In the Atlantic OCS, glacial deposits on top of shallower shelves resulted in the formation of Block Island, Martha's Vineyard, and Long Island. The shelves surrounding the island masses, received post-glacial sediments from erosion of the islands.

The sounds in this area – Block Island Sound and Rhode Island Sound – were formed by the presence of the glacial features Block Island, Martha's Vineyard and Long Island, and the Rhode Island and Massachusetts shorelines.

Other major geologic characteristics of the area from the SFWF, along the proposed SFEC route to the southern shore of Long Island, are illustrated on Figure 4.2-3 and listed as follows:

- **Cox Ledge.** The SFWF is in an area identified as Cox Ledge on the southern side of Rhode Island Sound. Bottom geology is expected to be sandy with varying amounts of coarser material, including boulders.
- **Rhode Island Sound Channel.** Cox Ledge is bound to the west by a glacial/post glacial drainage channel incised into the ledge. The channel may contain soft fine or sandy sediments, depending on the water current velocities within the channel feature.
- **Block Island Platform and Slope** is located west of the Rhode Island Sound channel and contains glacial deposits which could include boulder zones.
- **Block Island Sound Channel** is located between Block Island and the coast of mainland Rhode Island and appears to have steep side slopes and may contain sandy to soft deposits.
- **Endeavor Shoals (Montauk Point Shoals)** is a shallow platform of glacial deposits extending off Montauk Point. Bottom deposits include sand and gravel, with possible boulders. Actively migrating sand waves up to 16 feet (5 m) tall have been mapped here.
- **Nearshore along Southern Shoreline of Long Island to Wainscott Area** is a medium- to high-energy wave environment, resulting in sandy deposits along the beach front and near shore. Varying amounts of gravel and larger material up to boulders may also be present.



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Figure 4.2-3. South Fork Wind Farm and South Fork Export Cable Area Regional Geology
 Depiction of the major geologic characteristics in the SFWF and along the SFEC route.

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A site characterization report was developed from the Project-specific survey work completed in 2017 and 2018. This report is incorporated into this section by reference as Appendix H. The regional stratigraphy of the area consists of Cenozoic-aged geologic units that were generally deposited in marine or fluvial environments that formed in response to the cyclic rise and fall of the sea level. Cenozoic aged deposits generally thicken and dip gently seaward. As mentioned earlier, glacial and post-glacial processes during the Quaternary period dramatically shaped the geology of the region encompassing the SFWF and SFEC. In descending order, the site is inferred to be underlain by Quaternary, Tertiary, Cretaceous, and Paleozoic age strata with the youngest marine deposits comprising the uppermost strata as described:

- **Recent – Marine Deposits:** Marine deposits cover much of the seafloor and are comprised of sand to silty sand where moderate to strong currents are present and silt to clay in deeper, quiet water areas.
- **Holocene age – Transgressive Deposits:** As the Laurentide ice sheet melted, sea level rose, and the shoreline transgressed across the continental shelf. As the area transitioned into a submerged environment, Holocene age sediments were deposited over the Late Pleistocene surface. The transgressive deposits typically exhibit a fining-upward sequence that commonly consist of gravel and basal sand deposits that transition into silt and clay. The materials may be interbedded or predominantly sand or fine-grained. These deposits are presumed to be thicker where they have filled glacial drainages cut into old surface strata (Appendix H).
- **Pleistocene age – Glacial Drift and Post-Glacial Deposits:** During the Pleistocene, glaciers advanced into region and then retreated as they melted. This depositional environment resulted in a wide variety of materials that were deposited. Glacial deposits underlying the site most likely include tills, moraine (stratified and unstratified), and/or outwash deposits (Veeger et al., 1996). The glacial outwash or ice-contact stratified drift can be characterized as acoustically well-layered sequences although some glacial moraine deposits may result in a more chaotic seismic character (signal) and with numerous indicators of glacial erratics (boulders) (O’Hara and Oldale, 1980).
- **Late Cretaceous/Tertiary age – Coastal Plain Deposits:** The seaward extension of the Atlantic Coastal Plain is likely made up of late Cretaceous to possibly Tertiary age deposits overlying basement bedrock. These deposits are inferred to be primarily of marine origin with generally parallel strata that dip gently seaward. Limited information is available about the physical properties of the Coastal Plain deposits that underlie the survey area. However, they are inferred to be comprised of semi-consolidated to unconsolidated sand, silt, clay, and gravel deposits (Appendix H).
- **Bedrock:** Consolidated sediments and crystalline bedrock in the region is thought to be comprised of Paleozoic and Proterozoic rock units. Metasedimentary, metavolcanics and plutonic rocks of Proterozoic and early Paleozoic age outcrop along the southern Massachusetts coast and southeastern Rhode Island (Quinn, 1971).

The site characterization report provides a categorization of the area’s soil/geomorphic provinces. These regional soil provinces include moraine zones, moraine flank, glacial outwash plain and proximal fan, Pleistocene tunnel valley channel complex, and Holocene channel complex. Characteristics of these provinces are summarized as follows and further explained in Appendix H.

- **Moraine:** Moraine zone sediments are comprised predominantly of dense to very dense sand and gravel. Abundant boulders and cobbles are observed across the seafloor in the side scan sonar and multibeam echo sounder (MBES) bathymetry data (Appendix H). Boulders are the dominant features on within the moraine zone and are generally most exposed between buried paleo-channels in the central and western margin of the SFWF. Diffractions in the seismic data within the glacial unit suggest abundant buried boulders may also be present. Boulders may extend from the seafloor up to approximately 98 feet (30 m) depth. Overall, moraine sediments vary from coarse sands to gravel, cobbles, and boulders – some of which could be greater than 32 feet (10 m) in diameter. Overlying marine and transgressive deposits can range from 0 (missing) to greater than 9.8 feet (3 m) in these areas. The thicker overlying sediment may mask the presence of boulders on the seafloor (Appendix H).
- **Moraine Flank:** The moraine flank zone marks a transition between the boulder-dominant moraine to the glacial outwash plain, where surficial boulders become less prevalent. In general, thicknesses of marine and transgressive sediments are similar to those found in the moraine zone; however, dense glacial outwash sands begin to accumulate in this zone. The thickness of the glacial outwash sands ranges from less than 3.3 feet (1 m) to approximately 8 feet (2.5 m) depth. Exposed and buried boulders are still considered a significant hazard with respect to cable route and burial in this area (Appendix H).
- **Glacial Outwash Plain and Proximal Fan:** The glacial outwash plain extends from the moraine flank near the SFWF to the shore of Long Island, New York. The USGS mapped a proximal outwash fan along the Long Island coast in 1999 extending from the shore landing of the SFEC route (Appendix H). The glacial outwash plain and proximal fan zones are distinguished from other glacial units by a paucity of boulders detected in side scan sonar and bathymetric data. Despite a decrease in the density of surficial boulders in this zone, boulders are likely still present in the subsurface (Appendix H).
- **Pleistocene Tunnel Valley Channel Complex:** It is interpreted that tunnel valley channels formed beneath the terminal glacier lobes across the SFWF and SFEC. These channels partly split the ice and eroded underlying strata to drain subglacial water (Hanson, 2000). A channel complex was identified in the SFWF buried approximately 19.6 to 65.6 feet (6 to 20 m) below the seafloor (Appendix H).
- **Holocene Channel Complex:** A second generation of channels formed post-glaciation as sea-level began to rise. These fluvial channels are filled with re-worked glacial sands and capped by younger marine sediments. Generally, these channels formed in the same location as the older Pleistocene channels; however, the drainage direction reversed as glaciers retreated, with a gradient indicating southward flow. Holocene channel zones are identified in the SFWF and SFEC route (Appendix H).

Seismic activity and other potential hazards are summarized as follows and further detailed in Appendix H. Seismic activity was documented from a review of the Northeast States Emergency Consortium (NESEC) data. NESEC states that approximately 40 to 50 earthquakes are detected annually in the Northeast, which includes Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont (NESEC, 2017a). Regionally, there has been one occurrence of seismic activity of a magnitude or intensity 4 or greater since 1965, recorded in East Hampton, New York, in March 1992 (NESEC, 2017b).

Potential geological hazards within the region were identified per 30 CFR 585.626. Geologic hazards are considered any significant geological features that can pose a significant hazard with respect to cable route and burial in the SFWF and SFEC. Boulders are the predominant

geohazard in the region and may occur anywhere throughout the area based on the glacial history of the region. Sharp topographic features may also pose a hazard. Sand waves up to 16 feet (5 m) tall, have been identified mainly between Block Island and the Montauk Shelf (RI CRMC, 2010). Although, sand waves more commonly encountered in the region can be up to 1.6 feet (0.5 m) high and display a wavelength (peak-to-peak) ranging from approximately 65.6 to 164 feet (20 to 50 m) (Appendix H). Geological hazards within the SFWF and along the SFEC are discussed further in the sections below and in the G&G reports included in Appendix H.

South Fork Wind Farm

The SFWF is located approximately 19 miles (30.6 km, 16.6 nm) southeast of Block Island, Rhode Island near Cox Ledge, in Rhode Island Sound on the Atlantic OCS. The SFWF is located on a terminal glacial moraine which is defined as a high boulder hazard area (Appendix H). The G&G survey in Appendix H confirmed a high-density of boulders mainly located in the western and central portion of the SFWF. Sources for boulders typically include moraine deposits, glacial outwash, and glacial erratics transported by ice rafts in front of the glaciers and were deposited when the ice rafts melted.

Seafloor and shallowly buried boulders with seafloor expression are observed throughout the SFWF area. Corridors were identified where surface boulders appear to be infrequent to absent. Those zones correlate to buried paleochannel systems. The boulders are inferred to be related to a terminal moraine deposit which has been mapped across the footprint of the SFWF site. Seismic data were used to interpret the thickness of the moraine unit. The moraine unit is interpreted to be approximately 66 to 98 feet (20 to 30 m) thick and up to approximately 295 to 328 feet (90 to 100 m) thick in the deeper paleochannel of the SFWF where folding has increased the thickness of this unit. This report presents the interpreted top and bottom elevation of the boulder unit and the inferred thickness based on the seismic data. Buried boulders present a significant potential hazard to piled foundations at this site (Appendix H).

Seafloor boulders mapped from MBES bathymetry data estimated the diameter of boulders based on the assumption that the most common expression of a surface boulder is circular. After correcting for this assumption, boulder size generally measures 1.5 to 32 feet (0.5 to 10 m) across (Lundblad et al., 2006; Appendix H). The highest density area of seafloor boulders is in the western and central portions of the SFWF and interpreted to represent Ronkonkoma and Harbor Hill moraine deposits observed onshore. Generally, within the SFWF, the areas of fewer seafloor boulders correspond to the extents of mapped buried paleo-channels. It is inferred that these south-southeast to north-northwest trending paleo-channels eroded and downcut into the glacial moraine deposit and removed boulders in that area. Surficial boulders rise less than 3.5 feet (1 m) to approximately 11.5 feet (3.5 m) above the seafloor, with an unknown number of boulders remaining buried. Slope angles along the flanks of seafloor boulders range from about 3 to over 30 degrees, and some flanks show clear signs of scouring. Unidentified shallowly buried boulders may be present below the widespread seafloor sand waves (Appendix H).

Sand waves occur across the SFWF. Sand waves are migrating depositional features, generally understood to form from sediments that are transported and redeposited by bottom currents (Wynn and Stow, 2002). Sand wave crests generally trend north – south to northeast – southwest. The sand waves can be up to 1 to 2 feet (0.3 to 0.5 m) high and display a wavelength (peak-to-peak) ranging from approximately 65.6 to 164 feet (20 to 50 m). Mobility assessments (e.g., migration rate and direction) of sand waves across the SFWF area could not be determined based on the available datasets. Lower MBES backscatter intensity (blues and greens) indicate that the sand

waves are most likely fine-grained sands to sandy-silts overlain on denser reworked glacial till and/or glacial moraine (yellow and reds) (Appendix H).

Ripples were identified in relative lows between sand wave bodies. The ripples are approximately 0.4 to 1.9 inches (1 to 5 cm) high (trough-to-peak) and display a wavelength (peak-to-peak) ranging from approximately 3.2 to 6.5 feet (1 to 2 m). The crests of the ripples display highly variable trends. The mobility of the ripples could not be estimated with the current data (Appendix H).

Soil provinces delineated within the SFWF include Moraine zone sediments, moraine flank, glacial outwash plain, Pleistocene tunnel valley channel complex, and Holocene channel complex (Appendix H).

A Pleistocene Tunnel Valley Channel Complex was identified in high resolution geophysical seismic data in the SFWF area as large valleys buried approximately 65.6 feet (6 to 20 m) below the sea floor. The base of this complex is characterized by high-amplitude reflector that corresponds to harder material composing the valley beds. The walls and base of these channels likely contain reworked glacial material, including boulders, cobbles, and gravel pavement (i.e., dense material that would cause high positive impedance contrast with overlying outwash sand infill). Channel floor elevation may vary greatly within tunnel valleys, preserving drumlins, eskers, and transverse ridges. This undulating base is generally attributed to the water flowing under hydrostatic pressure in enclosed conduits. (Appendix H)

Three channels transect the SFWF survey area – the Western Channel, Central Channel, and Eastern Channel. Despite elevation variation of the channel base, overall each channel deepens to the north, suggesting glacial drainage to the north. The Western Channel trends north-south and generally underlies the planned locations for the western-most column of WTGs. This is the smallest tunnel valley channel in the complex, measuring approximately 2,624 feet (800 m) across. Thickness of infilled sediment varies from approximately 13 to 65.6 feet (4 to 20 m). The southern extent of the Central Channel is divided into thin fingers approximately 328 to 984 feet (100 to 300 m) wide. These fingers are shallow and only cut approximately 16.4 feet (5 m) into the underlying strata. They join to create a single channel (approximately 5,905 feet [1,800 m] across) that incises to the underlying moraine approximately 49 to 65.6 feet (15 to 20 m). Channel geomorphology changes again to the north of the SFWF as the Central Channel splits into two fingers.

The Eastern Channel exhibits a dramatically different morphology than the other two. This tunnel valley formed over deformation within the underlying unit, which is inferred to have been caused by glacial loading (Hanson, 2000). Compressional deformation thickened and folded the underlying strata, while also creating a preferential pathway for subglacial water to drain to the north. This preferential drainage pattern formed the deepest and widest of the three channels. This channel cuts at an oblique angle to the other two Pleistocene channels. Like the other two channels, channel bed morphology varies significantly in the Eastern Channel, ranging from about 19 to 82 feet (6 to 25 m) of sediment infill. However, the Eastern Channel is generally straighter than the other two channels, likely because of a flow constraint caused by deformation. It is the widest channel in the tunnel valley channel complex, measuring approximately 7,545 feet (2,300 m) wide and contains a southward branching segment composed primarily of fine-grained sediment (Appendix H).

Compared to the Pleistocene-aged complex, Holocene-aged channels are narrower and generally contain less than 3.2 feet (1 m) of sediment. Presence of Holocene Western and Central Channels in the SFWF span approximately 1,312 to 1,640 feet (400 to 500 m) and 1,640 to 2,624 feet (500 to

800 m), respectively. The branches of the two channels join in the southern extent of the survey area. Morphology of the Holocene Eastern Channel is drastically different than the underlying Pleistocene-aged channel. The channel branches from a single segment approximately 3,280 feet (1,000 m) wide into two smaller segments to the southeast. Each branch measures about 984 feet (300 m) (Appendix H).

The seafloor also includes fine-grained to coarse-grained sediments. Underneath the seafloor surface, a layer of sand with gravels was encountered, with a nominal thickness between approximately 3.2 to 6.6 feet (1 to 2 m) with some interbedded fine soil content, and below a layer of low plastic clays with sand and gravel. Other geological resource characteristics at the SFWF are summarized further in the Geotechnical Data Report and the Sediment Profile Imaging and Benthic Survey Report included as Appendix H.

South Fork Export Cable

The eastern end of the SFEC – OCS route starting at the SFWF until the bend in the route as represented between mile marker 3 to mile marker 13, shown on Figure 4.2-4, had a high proportion of gravel, cobbles, and boulders on the upper surface. Underneath fine-grained sands and clay were present. Westward between mile markers 6 and 31 along the SFEC – OCS route the surface was generally fine sand overlaying layers of either clayey sand or silty sand. Further west along the SFEC corridor, the gradation increases and generally includes various percentages of fine, medium, and coarse sand and gravel.

The highest density areas of observed seafloor boulders are located from mile marker 0 to mile marker 13 and mile marker 47 to mile marker 58. Glacial deposits encountered in the SFEC route were outwash plain/proximal fan. The outwash plain consists of dense to very dense sands of varying particle size with seams and lenses of fine gravels. Mean tip resistance calculated from cone penetration testing (CPT) in the outwash plain is 17.7 megaPascals (MPa) with a standard deviation of 7.9 MPa. Outwash sand thickness is estimated to be greater than the penetration of the longest geotechnical exploration in this zone: CPT C-300 at 35.37 feet (10.78 m). All vibracores and CPTs in the outwash plain terminated in this unit. (Appendix H)

A proximal outwash fan exists along the Long Island Coast from the shore landing of the SFEC at Beach Lane and terminates near Hither Hills (Foster et al., 1999). Mapping conducted as part of the Site Characterization Report (Appendix H), indicates that the glacial outwash extends beyond this initial mapped outwash fan, approximately 12.4 miles (20 km) further to the northeast along the proposed SFEC route. The general thickness of marine deposits, transgressive sediments, and glacial outwash sand increase with distance from the east, except for a rocky outcrop area long the proposed cable route between mile marker 47 and mile marker 58. The proposed SFEC route was deviated around this area to avoid the surficial boulders and rocky outcrops and to improve cable burial feasibility.

Pleistocene channel complexes are identified along the SFEC route between mile markers 13 and 39, mile markers 43 and 54, and mile markers 77 and 80 (Appendix H).

Holocene channel zones are identified along the SFEC route between mile markers 14 and 23, mile markers 27 and 30, mile markers 33 and 47, and mile markers 71 and 79 (Appendix H).

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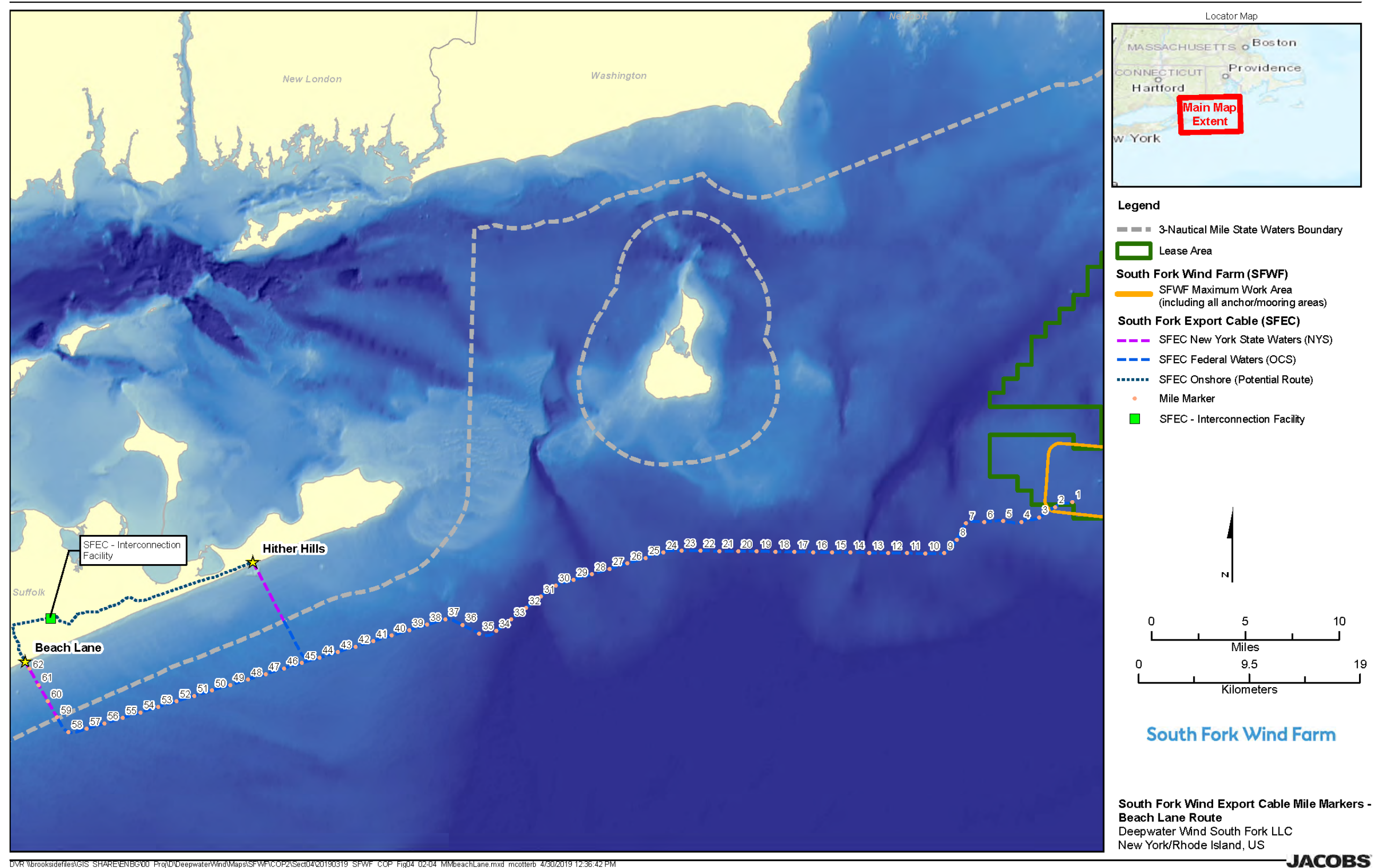


Figure 4.2-4. South Fork Wind Export Cable Mile Markers and SFEC - Onshore Routes
 Depiction of Mile Markers from SFWF and along the SFEC route, including landing site options, and interconnection point at SFEC - Interconnection Facility.

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SFEC – OCS and SFEC – NYS

Geology along the SFEC route on the OCS is characterized by recent fine marine surficial sediments, with underlying glacial drift, and the possibility of boulders and other coarser materials occurring in the subsurface and at the surface. As shown on Figure 4.2-4, the SFEC route crosses the southern ends of the Rhode Island Sound and Block Island Sound paleochannels and may encounter shallow representations of these features.

As the SFEC route enters shallower New York State waters, the surface layer of re-worked glacial deposits may become increasingly coarser sands, with the continuing possibility of boulders. The SFEC landing site approach at either potential Beach Lane or Hither Hills locations consists of similar glacial outwash deposits.

SFEC – Onshore

The land mass of Long Island is also a product of glacial and post-glacial processes. The Wisconsin epoch is predominantly responsible for the surficial geology of the modern Long Island region. During the Wisconsin glacial stage, an ice sheet moved to approximately the center of Suffolk County, New York and stopped, leaving before it two terminal moraines, which are now known as the Ronkonkoma moraine and the Harbor Hills moraine. After the ice sheet reached its southern limits in Suffolk County, it began to melt. The melted water flowed into streams and carried a large volume of sand and gravel farther south. This sand and gravel were deposited in two relatively flat outwash plains; one between the Ronkonkoma moraine and the Atlantic Ocean, where the South Fork of Long Island and the town of East Hampton are located, and the other between the Harbor Hill moraine, which extends from the western edge of Nassau County, along the north shore of Long Island, to its easternmost point at Fisher’s Island, and the Ronkonkoma moraine. (USDA, 1975)

The Ronkonkoma moraine and the Harbor Hills moraine are parallel in the western half of Long Island but diverge near Peconic Bay. The Harbor Hill moraine and the Ronkonkoma moraine are comprised primarily of poorly sorted till, including sand, pebbles, rocks, and boulders, while the outwash plains located between the moraines, and south of the Ronkonkoma moraine, include varying amounts of well sorted sand and gravel. The Ronkonkoma moraine was deposited as a terminal moraine at the end of a glacial lobe and forms the spine of Long Island (Sanders and Merguerian, 1994). Streams draining southward at the edge of the glacier deposited an outwash plain of sandy material that is now the southern Long Island coastal zone and shore. In general, at low ground elevations near the shore, the groundwater table is encountered at shallow depths (Como et al., 2015). At higher ground elevations along the SFEC onshore route, the groundwater table may occur at deeper depths.

The bedrock under Suffolk County varies in depth from approximately 400 feet (121 m) bgs along the northern coastline of the town of Southold, to approximately 2,000 feet (609 m) bgs along the central part of the southern coastline of Fire Island (i.e., an outer barrier island parallel to the south shore of Long Island). Depth to bedrock, proximate to the SFEC – Onshore, ranges from approximately 1,400 feet (426 m) bgs at the Beach Lane landing site to approximately 1,300 feet (396 m) bgs at the point of the SFEC – Onshore intersection with the LIRR ROW (USGS, 1995).

The soils along the SFEC – Onshore and at the SFEC – Interconnection Facility were characterized in accordance to the Soil Survey of Suffolk County, New York (USDA, 1975) (the “Soil Survey”), in which soils were classified according to distinct characteristics and placed accordingly into series and mapping units. A series is a group of mapping units formed from

partly disintegrated and partly weathered rocks that lie approximately parallel to the surface and that are similar in arrangement and differentiating characteristics, such as color, structure, reaction, consistency, mineralogical composition, and chemical composition. Mapping units differ from each other according to slope and may differ according to characteristics, such as texture (USDA, 1975). The predominant soil series found along the SFEC – Onshore and at the SFEC – Interconnection Facility include Bridgehampton, Carver, and Plymouth series (USDA, 1975).

The landing sites and surrounding areas are underlain by beach deposits, consisting of beach sand and gravel, and dune sand, that range from less than 5 feet (1.5 m) to approximately 20 feet (6 m) in thickness (USDA, 1975). The beach deposits are underlain by glacial deposits consisting of clay, silt, clayey and silty sand, sand, and gravel, that comprise the upper glacial aquifer, which ranges up to approximately 200 feet (60.9) in thickness below the landing sites and is one of the principal water sources of Suffolk County. According to data from the USGS, depth to groundwater around the landing sites typically ranges from approximately 4 to 5 feet (1.2 to 1.5 m) bgs (GZA, 2017).

4.2.3.2 Potential Impacts

Construction, O&M, and decommissioning activities associated with the SFWF and SFEC have the potential to cause both direct and indirect impacts on geological resources, as discussed in the following sections. IPFs associated with the construction, O&M, and decommissioning phases for the SFWF and SFEC are described in Section 4.1.

An overview of the IPFs for geological resources associated with the SFWF and SFEC is presented on Figure 4.2-5. IPFs not expected to impact geological resources are depicted with slashes through the circle. For the IPFs that could impact geological resources but were found to be negligible in the analyses in Section 4.1, the circle is gray without a slash. The IPFs with potential to impact geological resources are indicated by gray shading.

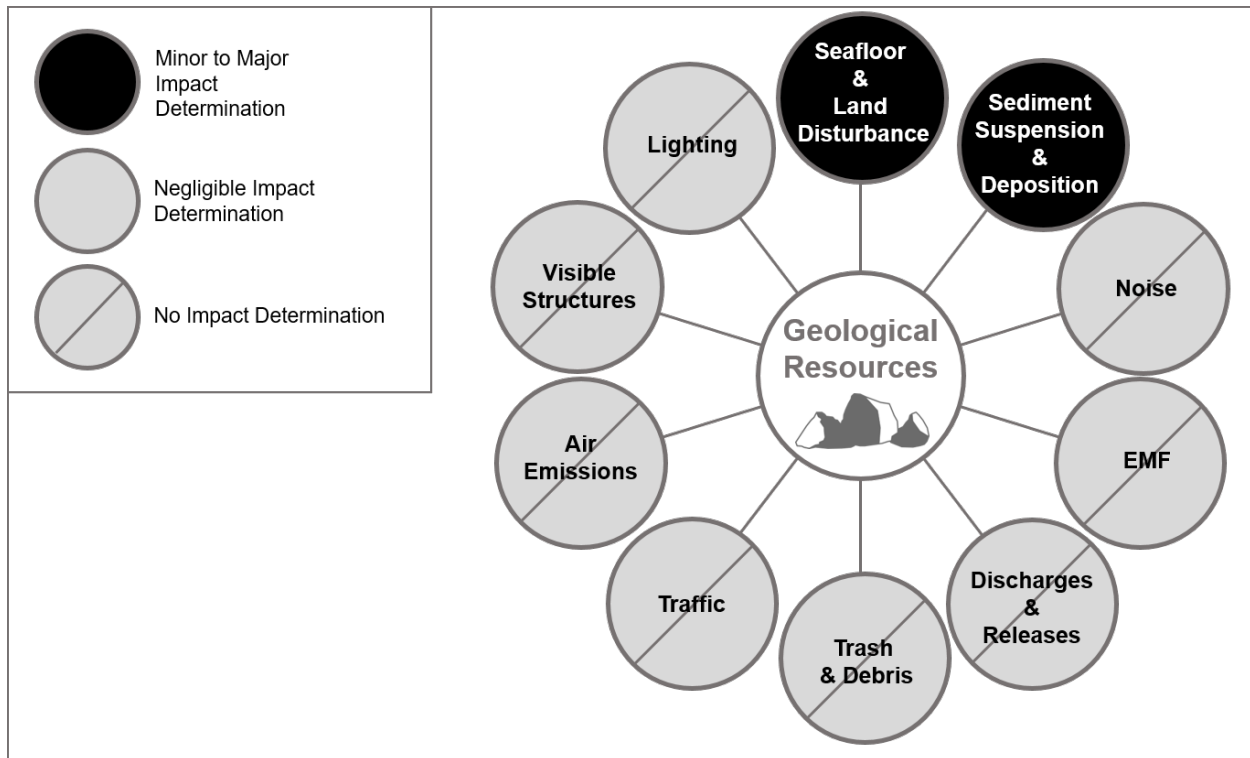


Figure 4.2-5. IPFs on Geological Resources

Illustration of potential impacts to geological resources resulting from SFWF and SFEC activities

South Fork Wind Farm

Construction

Seafloor Disturbance

Seafloor disturbance from foundation installation, Inter-array Cable installation, and anchoring would impact geologic resources. Mainly surficial and subsurface geological resources at specific installation locations would be impacted from penetration (i.e., pile driving), cable installation, and anchoring. Monopile foundation installation will result in subsurface impacts extending up to approximately 164 feet (50 m) into the seabed. Alteration of the strata by the installation of the foundations will occur at each pile point but would not result in a broader scale impact to the geologic setting of the area. Impacts from seafloor disturbances during construction described above would be **short-term localized** and **minor**. The presence of boulders on the seafloor within the SFWF are the primary geologic hazards identified by pre-construction assessments, as described in the Site Characterization Report included in Appendix H. The siting of the SFWF areas avoided shallow hazards to the extent practicable. However, where construction activities result in the movement of boulders or depositional features (e.g., ripples, sand waves) impacts would be **short-term, localized, and minor**.

Sediment Suspension and Deposition

Surficial geological resources, mostly comprised of (recent) Holocene pre-transgressive and transgressive marine sediments, would be impacted mainly because of sediment suspension/deposition from Inter-array Cable installation resulting in localized changes to surficial geology and bottom topography. Installation of the Inter-array Cable using the mechanical cutter, mechanical plow (which may include a jetting system), and/or jet plow is

expected to result in the disturbance and temporary suspension and re-deposition of these deposits, as described in the Hydrodynamic and Sediment Transport Modeling Results Report included in Appendix I. Recent marine deposits would also be disturbed during foundation installation. Sedimentation resulting from the installation of the Inter-array Cable would be limited to the area immediately adjacent to the burial route. These impacts are considered to be **short-term, localized**, and **minor** because of the limited extent of sedimentation predicted by the model and highly dynamic nature of the marine sediments in the SFWF.

As explained above in the discussion of seafloor disturbance, the presence of boulders and topographic features (channels and sand waves) on the seafloor within the SFWF are the primary geologic hazards identified by pre-construction assessments, as described in the Site Characterization Report included in Appendix H. The siting of the SFWF Inter-array Cable avoids these hazard areas to the extent practicable. However, where construction activities result in the movement of boulders or depositional features (e.g., ripples, sand waves) impacts would be **short-term, localized** and **minor**.

Operations and Maintenance

Seafloor Disturbance

Once the SFWF is constructed and operational, **no impacts** to geologic resources are anticipated except for vessel anchoring during planned and unplanned maintenance, and the very low likelihood that the Inter-array Cable requires replacement, relocation, or additional armoring. In the very rare circumstances that seafloor disturbances occur during the O&M phase, impacts would be similar to those discussed for construction of the SFWF.

Sediment Suspension and Deposition

Scour at the base of the WTG foundations will locally impact surficial geology during the O&M phase. Scour protection will be placed at the base of each WTG foundation and on top of the segments of the Inter-array Cables where they emerge from the trench and connect into the WTG. **Negligible impacts** to Holocene marine deposits from sediment suspension and deposition around the artificial structures are expected during O&M, but broad-scale geologic resources impacts are unlikely.

Decommissioning

Impacts to geologic resources from seafloor disturbance and sediment suspension and deposition would be similar to those impacts described for construction if removal of the SFWF components takes place using similar equipment and methods.

SFEC – OCS and SFEC – NYS

Construction

Seafloor Disturbance

Impacts to geologic resources during construction of the SFEC in OCS waters would be limited to the mechanical cutter, mechanical plow (which may include a jetting system), and/or jet plowing of the seafloor during cable installation, vibratory pile driving for sheet pile cofferdam, or gravity cell installation for the sea-to-shore transition. Similar to the seafloor disturbance described above for the SFWF foundations and Inter-array Cable, trenching and sheet pile installation would result in **short-term** and **minor impacts** to localized geologic resources such as marine deposits (sediments) and near-surface stratigraphy. Broad-scale geologic features would not be measurably impacted.

In New York State waters, SFEC installation impacts to Holocene deposits consisting of medium to coarse sand with some gravel resources would be from the SFEC sea-to-shore transition (e.g., HDD); impacts to the Holocene sediment layers at this depth would be *minor* because the cable will be installed within the conduit. This technique will minimize impacts, compared to an open trench installation. Also, measurable impacts to geologic resources from the SFEC cable installation, including the HDD process, would be *negligible* to the overall geologic resources and processes in the area. The temporary cofferdam installed nearshore would result in *short-term, localized, and minor impacts* to Holocene sediments but *no permanent or long-term impact* to geologic resources are expected.

Sediment Suspension and Deposition

According to the modeling simulation of SFEC installation with a jet plow, one of three potential types of equipment to be used for cable installation (Appendix I), sediment will be disturbed and temporarily suspended during installation of the SFEC and during suction dredging of the cofferdam for the offshore sea-to-shore transition between the SFEC – NYS and SFEC - Onshore. The model predicted that sediment suspension and deposition resulting from installation of the SFEC – OCS and SFEC – NYS will be limited to the area immediately adjacent to the burial route. Localized impacts to marine deposits would be *short-term* and *minor*.

Sediment suspension and deposition from suction dredging at the sea-to-shore transition were predicted to occur within a very small radius of the activity without the confinement of the steel sheetpile or gravity cell cofferdam. Any localized impacts to marine deposits would be *short-term* and *minor*.

Operations and Maintenance

Seafloor Disturbance

No impacts to geological resources from SFEC operations are anticipated. If mechanical damage to the SFEC – OCS and/or SFEC - NYS should occur, repair of the cable may result in disturbance to the seafloor from maintenance vessels and activities. Localized impacts to marine deposits would be *short-term* and *minor*.

Sediment Suspension and Deposition

No impacts to geological resources from SFEC operations are anticipated. If mechanical damage to the SFEC – OCS and/or SFEC - NYS should occur, repair of the cable may result in sediment suspension and deposition from maintenance vessels and activities. Localized impacts to marine deposits would be *short-term* and *minor*.

Decommissioning

Impacts to geologic resources from seafloor disturbance and sediment suspension and deposition would be similar to those impacts described for construction if removal of the SFEC takes place using similar equipment and methods.

SFEC – Onshore

Construction

Land Disturbance

HDD will be used to connect the SFEC – NYS with the SFEC – Onshore in the sea-to-shore transition area resulting in *long-term minor impacts* to the subsurface geology along the cable alignment. *No impacts* to the geomorphology of the beach and adjacent coastal area will occur because of the subsurface installation technique.

Previously disturbed areas within and along roadways and railways will be excavated and trenched for burial of the SFEC – Onshore. The upper layers of soil in these areas will be reconfigured. Following installation all trenches will be back-filled and surface grades will be returned to pre-construction conditions where practicable. Overall, impacts to geological resources would be *short-term* and *negligible*.

Sediment Suspension and Deposition

Sediment suspension and deposition along the SFEC – Onshore would have *negligible impacts* to surficial geology because all earth disturbances from onshore construction activities will be conducted in compliance with the SPDES General Permit and an approved SWPPP.

Operations and Maintenance

Land Disturbance

Negligible impacts to geological resources could occur during the O&M phase in the unlikely event that SFEC - Onshore requires repair or replacement.

Decommissioning

Decommissioning impacts to geological resources would be similar to impacts described for construction.

4.2.3.3 Proposed Environmental Protection Measures

Several environmental protection measures will reduce potential impacts to geological resources.

- The SFWF and SFEC - Offshore will avoid, to the extent practicable, identified shallow hazards.
- Installation of the SFWF Inter-array Cable and SFEC - Offshore will occur using equipment such as mechanical cutter, mechanical plow, and/or jet plow. Compared to open cut dredging this method will minimize impacts to surficial geology.
- Use of monopiles with associated scour protection will minimize impacts to surficial geology, compared to other foundation types.
- Use of DPV for cable installation for the SFWF Inter-array Cable and SFEC - Offshore will minimize impacts to surficial geology, as compared to use of a vessel relying on multiple-anchors.
- A plan for vessels will be developed prior to construction to identify no-anchor areas inside the MWA to protect sensitive areas or other areas to be avoided.
- The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone. SFEC - Onshore is sited within previously disturbed existing ROWs.

4.2.4 Physical Oceanography and Meteorology

The physical oceanographic and meteorological conditions within the SFWF and SFEC are described in this section. Physical oceanographic conditions include circulation, currents, and water column stratification by temperature and salinity. Meteorological conditions include wind speed and direction, and occurrence of storms. This section is intended to provide an overview of conditions to form the basis of evaluating potential impacts of the Project construction, operation, and decommissioning on physical processes. These topics will be assessed in greater detail during the FDR and Fabrication and Installation Report (FIR) phases in accordance with 30 CFR 585.700-702.

4.2.4.1 Affected Environment

The following are key sources of oceanographic and meteorological information on the SFWF and SFEC reviewed in the support of the development of this COP section:

- *Rhode Island Ocean Special Area Management Plan (OSAMP)* (RI CRMC, 2010).
- Environmental Assessment prepared by BOEM for the RI-MA WEA, Appendix C: *Additional Resource Information: Geology and Physical Oceanography* (BOEM, 2013).
- Wind speed and directional data obtained from the National Centers for Environmental Prediction (NCEP) Climate Forecast System Reanalysis (CFSR) product for 2001-2010 (Saha et al., 2010) and from Environmental Assessment prepared by BOEM for the RI-MA WEA (BOEM, 2013).
- Data on regional current and circulation data for the area was obtained from the HYbrid Coordinate Ocean Model (HYCOM) hindcast reanalysis performed by the U.S. Naval Research Laboratory (Chassignet et al., 2007).
- The National Aeronautics and Space Administration (NASA) Global Modeling and Assimilation Office project, the Modern-Era Retrospective analysis for Research and Applications, Version 2 (MERRA-2) provides wind data from 1980 to the present (Gelaro et al., 2017).
- The Integrated Ocean Waves for Geophysical and Other Applications (IOWAGA), funded by the European Commission, provides wave-related information through a model that simulates sea state conditions from 1996 to 2016.
- NOAA's National Data Buoy Center (NDBC) manages a U.S. data buoy network to collect meteorological and environmental data and includes buoys and a Coastal-Marine Automated Network (C-MAN) (NOAA, 2018; Appendix X).
- Current and water level data were also extracted from a Global Tide Model included in a model package created by IOWAGA called MIKE 21 (Appendix X).
- A time series of sea-level data were obtained from Oregon State University's (OSU) Tidal Inversion Software model that assimilated tide gauges along the East coast.
- Tidal elevations information was obtained from the Admiralty Total Tide (ATT) software (Appendix X).
- Tropical cyclone track data were obtained from the International Best Tracks for Climate Stewardship (IBTrACS) database (version IBTrACS v03r09), which is a historical global dataset of tropical cyclones.

Regional Overview

The SFWF is located at the southern end of Rhode Island Sound, which is bounded by Block Island to the west, mainland Rhode Island to the north, Martha's Vineyard to the east, and is open to the Atlantic Ocean to the south. The SFWF and a portion of the SFEC are at the southern end of the OSAMP study area. Block Island Sound lies to the west of Block Island and extends to Long Island Sound, as depicted on Figure 1.1-2 in Section 1. The SFEC - OCS and SFEC - NYS occupy waters south of Block Island and Montauk until the cable makes landfall.

Circulation

Circulation patterns are influenced by winds, tides, differences in water density (dependent on temperature and salinity), and geomorphology (bathymetry and land masses). Overall, net transport of water from Rhode Island Sound moves toward the southwest and west. However, bottom water may flow toward the north, particularly during the winter. Circulation patterns are influenced by water moving in from Block Island Sound and the colder water coming in from the Gulf of Maine. Also, "warm core rings" split off from the northward flowing Gulf Stream could move into Rhode Island Sound, bringing entrained warm water biota (RI CRMC, 2010).

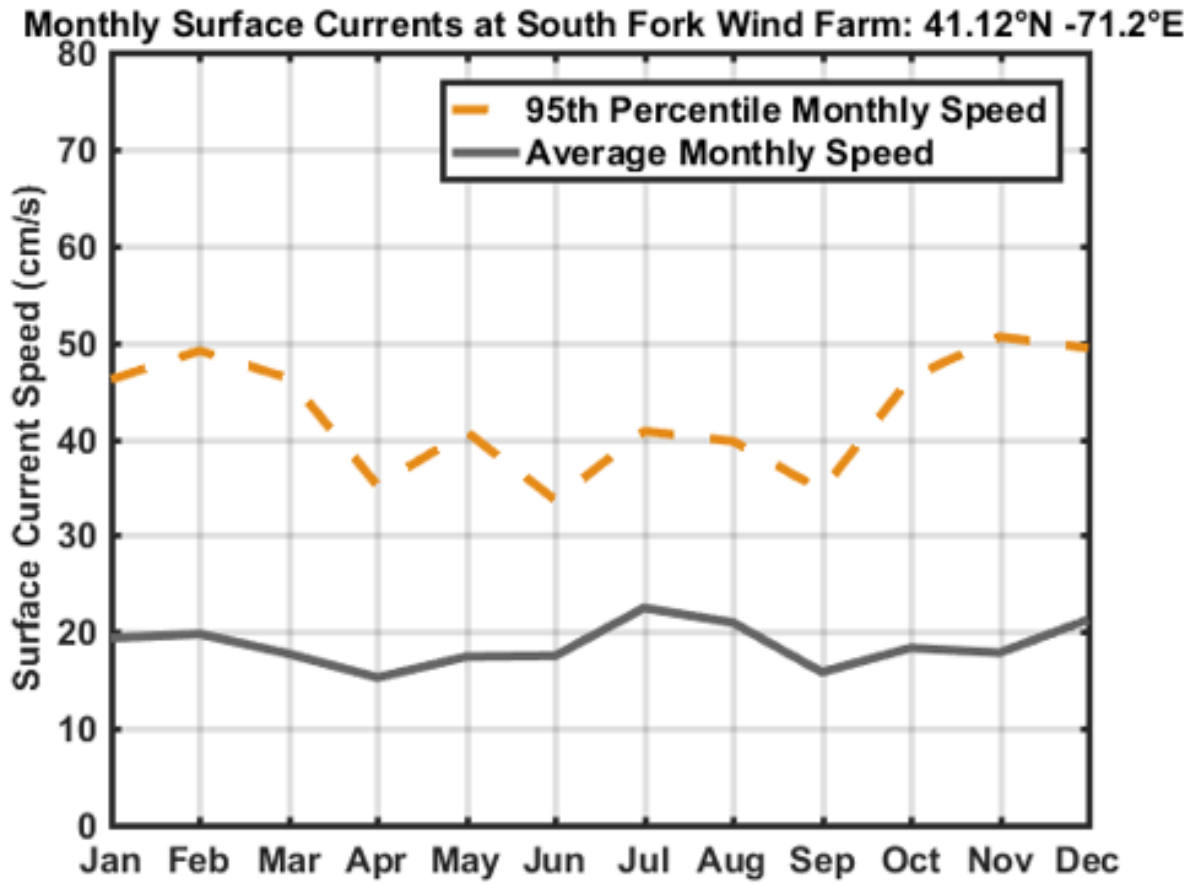
Regionally, currents from Rhode Island Sound meet outflow from Block Island Sound off Montauk Point and flow towards the southwest below Long Island. Although current flow south of Long Island follows the overall southwestern movement, nearshore currents flow towards the east (RI CRMC, 2010).

Waves generally move across the area from the south and are on average between 3.3 and 9.8 feet (1 and 3 m). Highest storm waves are up to 30 feet (9 m). Under normal conditions, wave action results in little disturbance to bottom waters or sediments. Semi-diurnal (i.e., twice daily) tides come in from the southeast, with an average tidal range of 3.2 feet (1.0 m) across Block Island and Rhode Island Sounds (RI CRMC, 2010).

Evaluation of Available Data Sets for Circulation

As a preliminary assessment of ocean currents within the SFWF and SFEC, statistics were generated based on modeled hindcast reanalysis of inputs for the years 2001 to 2010, from the HYCOM 1/12-degree global simulation assimilated with Navy Coupled Ocean Data Assimilation (NCODA) from the U.S. Naval Research Laboratory (Halliwell, 2004). The 2001 to 2010 data period was chosen as the most recent 10 years of re-analysis data for HYCOM currents and its matching wind CFSR that is available.

The study area for this assessment was centered on the SFWF, but spatial coverage extended to the SFEC route. At the SFWF, average surface current speeds were consistently about 8 inches per second (in./s; 20 centimeters per second [cm/s]) throughout the year, with the strongest currents of 20 in./s (50 cm/s; as the 95th percentile) in late fall and early spring, as depicted on Figure 4.2-6. Estimated average currents at depth of 98.4 feet (30 meters) range between approximately 2.8 in./s (7 cm/s) as the mean, to 6.7 in./s (17 cm/s) as the 95th percentile. Currents show directional variability from the surface to the bottom depth, changing from easterly in the surface to north-easterly/west-south-westerly at depth. Differences between surface currents and seabed currents can be attributed partly to the influence of wind effect on the surface layer and bathymetric features around the study area on the bottom layer, as depicted on Figure 4.2-7.



Sources: Halliwell, 2004; Chassignet et al., 2007

Figure 4.2-6. HYCOM Monthly Current Speed Statistics Near the SFWF and SFEC Study Area from January 2001 to December 2010

Graphical representation of estimated average surface current and 95th percentile monthly speed at the SFWF and SFEC.

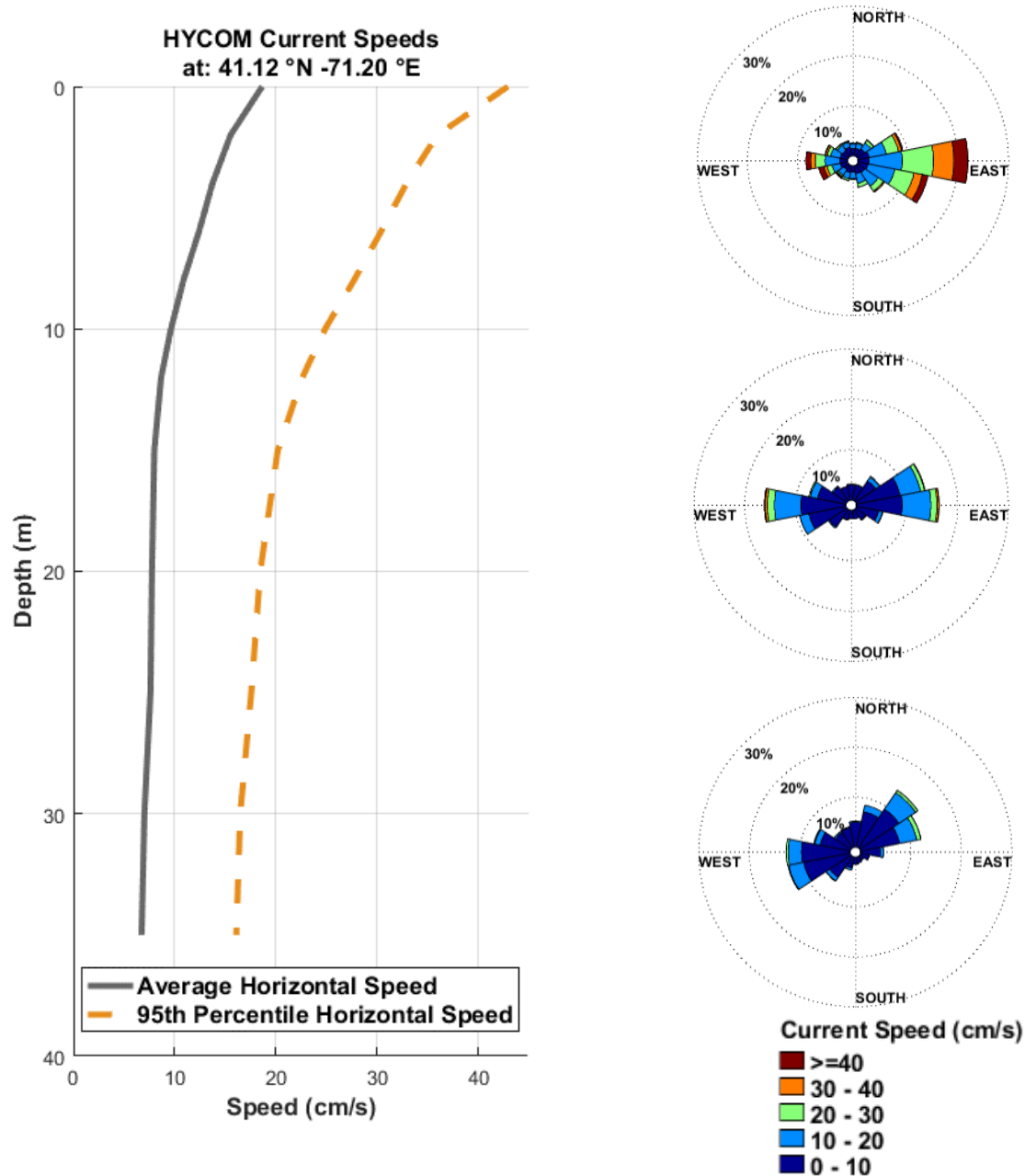
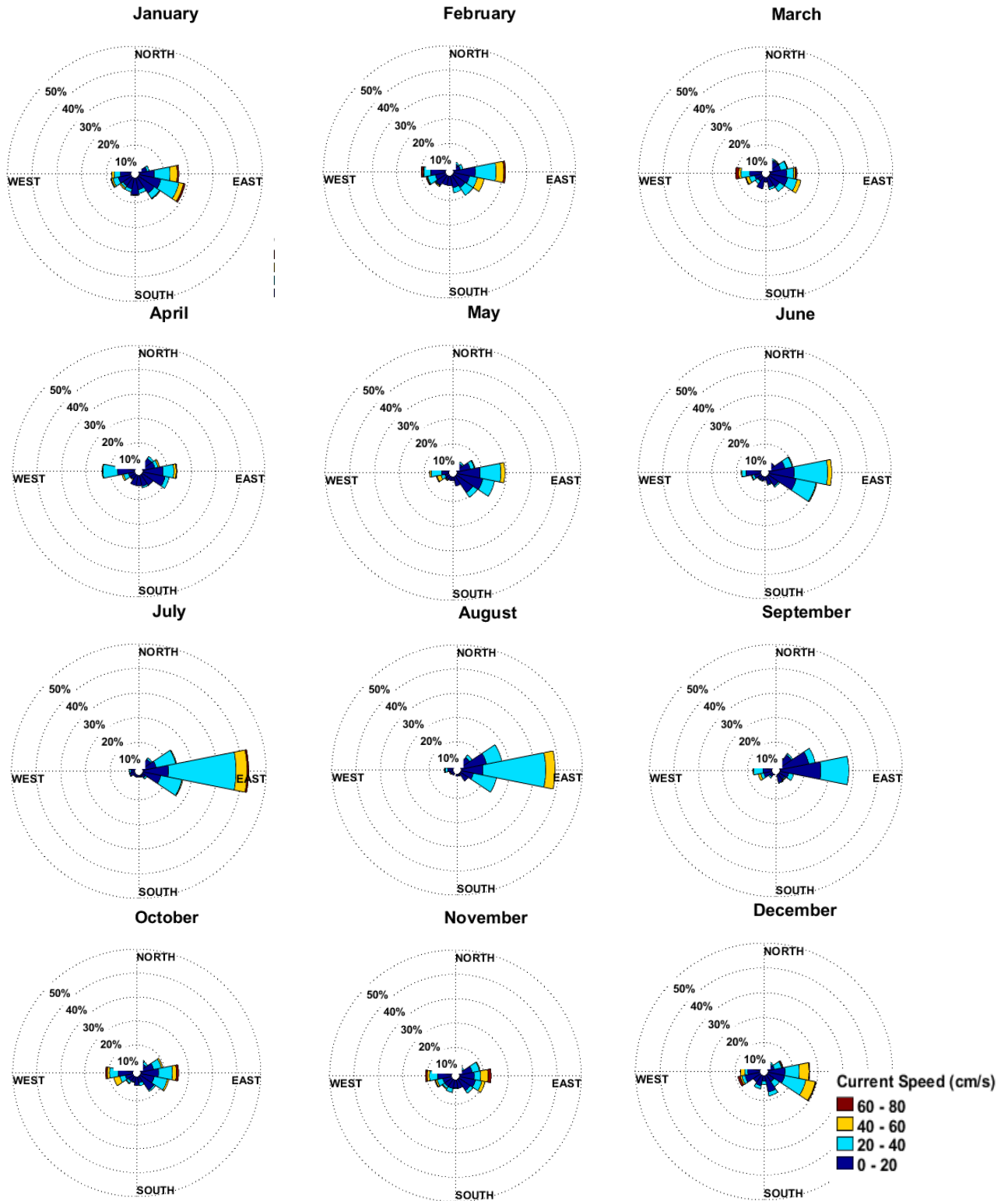


Figure 4.2-7. Vertical Profile of the HYCOM 2001-2010 Horizontal Current Speed (cm/S) Dataset

Depiction of average and 95th percentile speed and variation with depth near the study area. Current roses of annual current are from the surface, 15 m and 30 m water depths. Current roses show the direction to which the current is flowing.

Figure 4.2-8 illustrates that surface currents consistently move toward the east. The direction of flow shifts westerly as depth increases. Currents moving along the southern Long Island shoreline near the SFEC – NYS had higher average velocities, up to 9.8 in./s (25 cm/s). A map of surface currents on Figure 4.2-9 indicates flow direction at peak flood and peak ebb. Based on this preliminary assessment of currents at the SFWF, it appears that the SFWF may be located outside the zone of regional southwestward surface current flow from Block Island and Rhode Island Sounds.

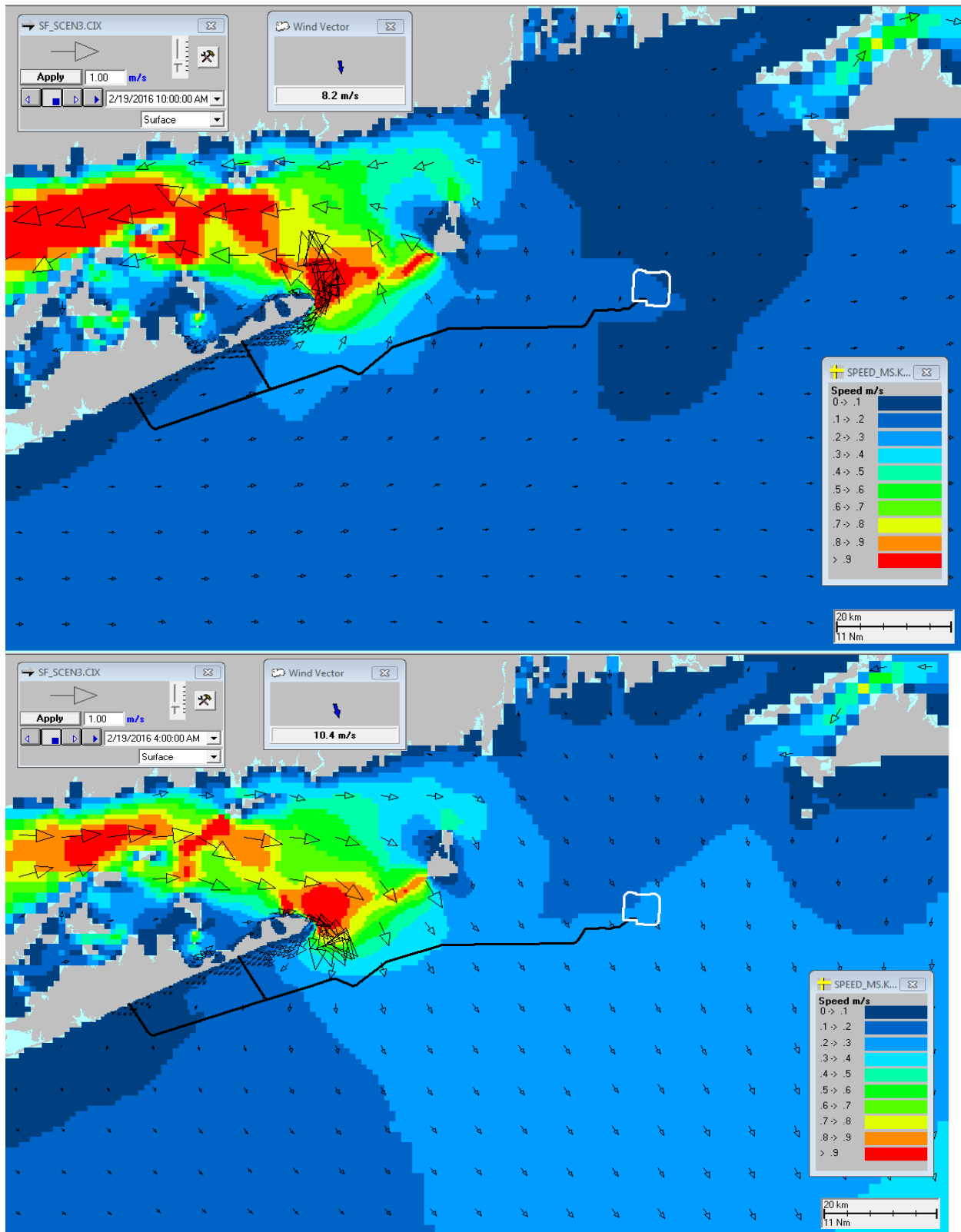


Note: Direction convention is standard (i.e., direction currents are headed).

Source: Saha et al., 2010

Figure 4.2-8. Monthly Averaged HYCOM Surface Currents near the Study Area from January 2001 to December 2010

Depiction of current roses showing monthly averaged surface current direction and speeds.



Source: Appendix I

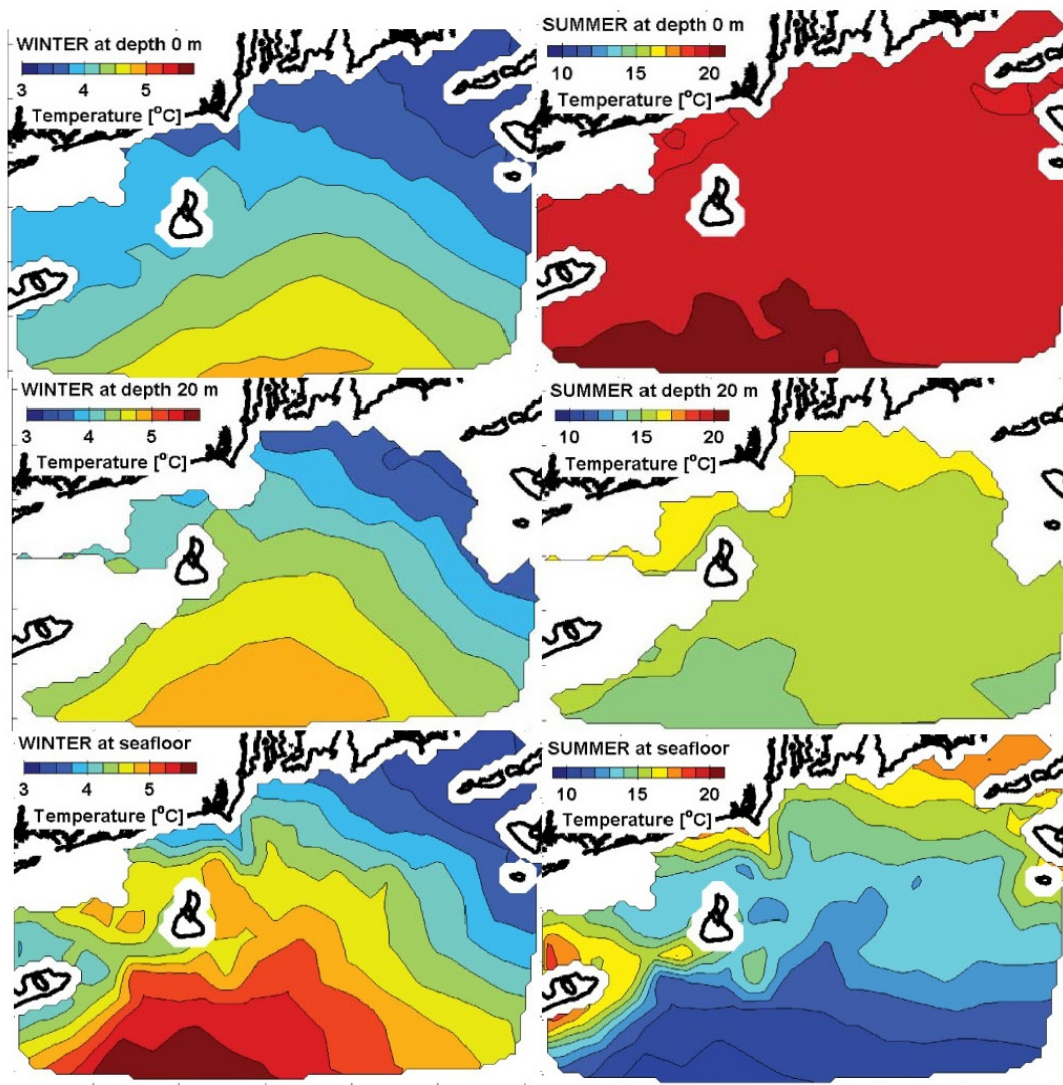
Figure 4.2-9. Surface Currents with Flow Direction Indicated at Peak Flood and Peak Ebb Tides

Depiction of the surface current flow directions at peak flood and peak ebb tides throughout the Project Area.

Water Column Stratification

In general, the heating of water and increased salinity during the late summer and early fall results in a stratified water column that is subjected to mixing in the fall from upwelling bottom waters and storm action. The temperature and salinity trends described below contribute to this seasonal stratification.

Averages of seasonal water temperature data collected by the RI CRMC between 1980 and 2007 are depicted on Figure 4.2-10 (RI CRMC, 2010). Surface water temperatures fluctuate up to 59 degrees Fahrenheit (°F) (15 degrees Celsius [°C]) seasonally, and as expected, bottom waters have smaller seasonal temperature fluctuation of approximately 41°F (5°C). Water temperatures are highest in July/August when the water column becomes stratified; surface water temperatures are close to 68°F (20°C), with bottom waters in the SFWF area of about 50°F (10°C). During the winter, average surface water temperatures range from approximately 39 to 41°F (4 to 5°C), with bottom waters staying slightly warmer at the southern edge of Rhode Island Sound in the SFWF.

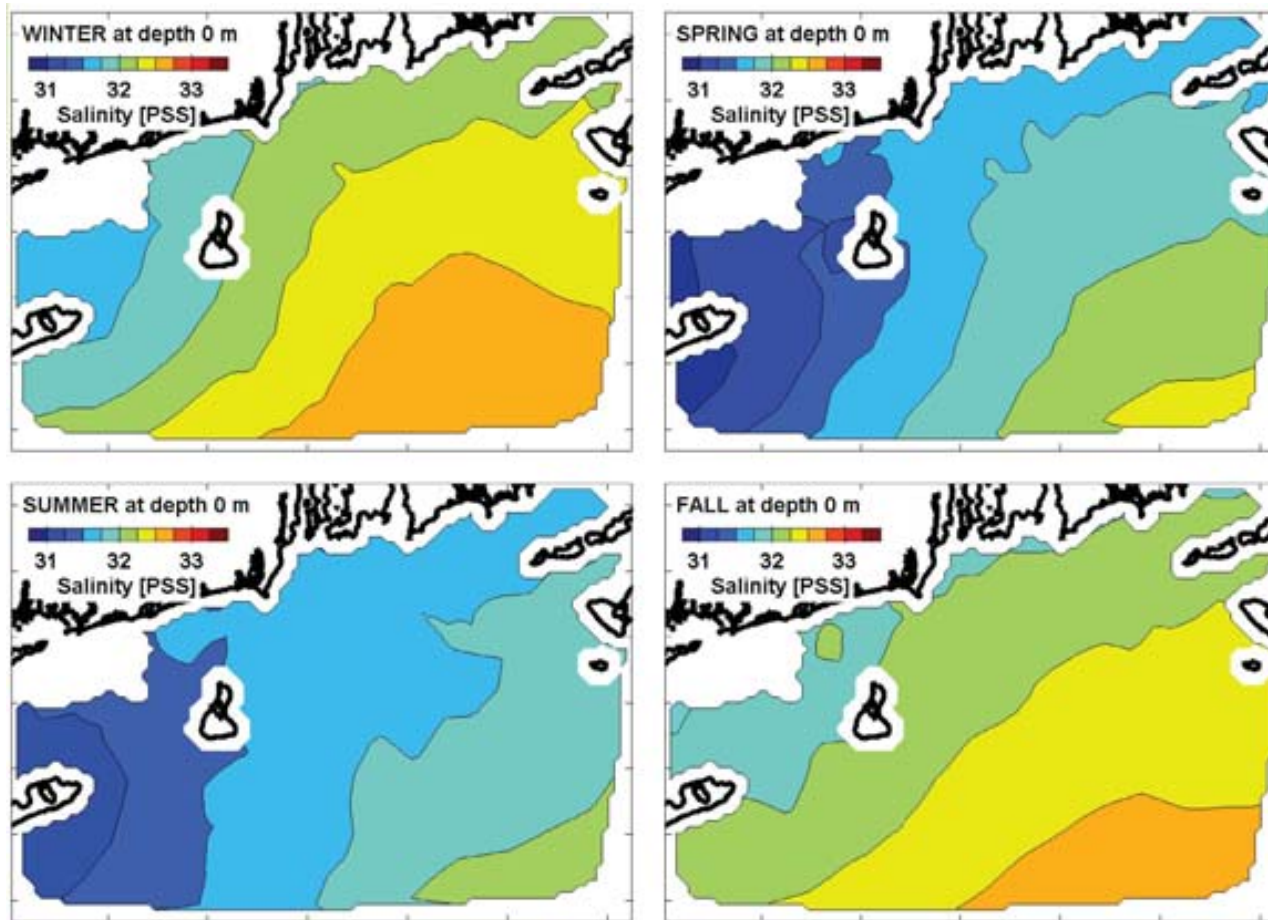


Source: RI CRMC, 2010

Figure 4.2-10. Seasonal Water Temperature Based on Data Collected Between 1980 and 2007

Depiction of seasonal water temperature data in Rhode Island Sound.

Surface water salinity decreases in the spring with fresh water inflows from ice melts and spring rains, and increases with temperature in the summer, with highest surface water salinities in the fall and winter. Bottom water salinities are higher than surface water salinities throughout the year, setting up for the stratification described above. Highest salinities within Rhode Island Sound (approximately 33 Practical Salinity Scale [PSS]) are bottom waters at the southern end of the Sound, near the SFWF. Seasonal water salinities at the sea surface in Rhode Island Sound are shown on Figure 4.2-11.

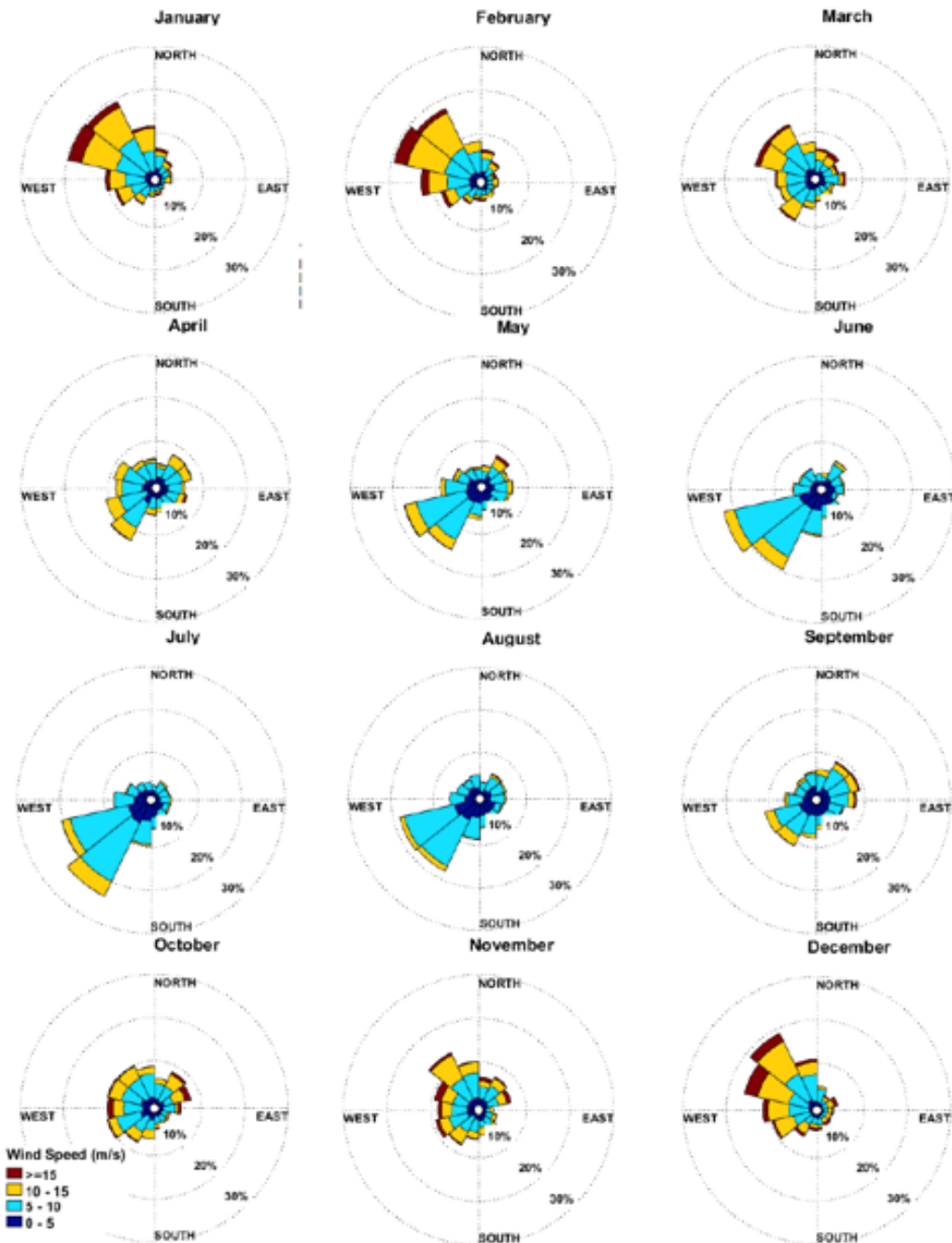


Source: RI CRMC, 2010

Figure 4.2-11. Seasonal Water Salinities at Sea Surface (Depth 0 m), Based on Archived Conductivity, Temperature, and Depth Data Collected Between 1980 and 2007
Illustration of the seasonal water salinities at sea surface in Rhode Island Sound.

Wind

Wind data were obtained from the NCEP CFSR product for 2001 through 2010 to provide a preliminary evaluation of wind direction and speed. Predominant wind direction is from the southwest during the summer months, and from the northwest during the winter when wind speeds are higher. Monthly wind direction and speed at a representative point within the Rhode Island Sound are depicted on Figure 4.2-12.

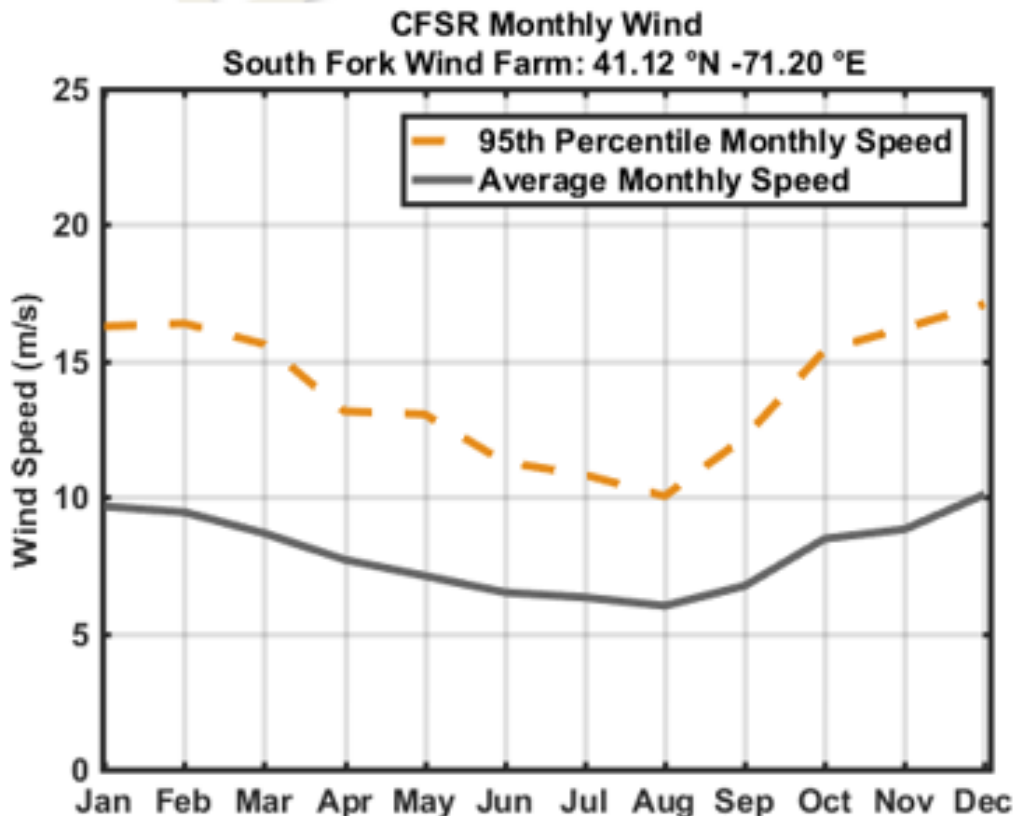


Note: Wind speeds are in m/s, using meteorological convention (i.e., direction from which wind is coming).
 Source: Saha et al., 2010

Figure 4.2-12. Monthly Wind Roses for the CFSR Grid Point Nearest to the SFWF
Depiction of the monthly wind direction and speed at a representative point within the Rhode Island Sound.

Average monthly wind speeds and strongest winds (represented by the 95th percentile) are depicted on Figure 4.2-13 for the years 2001 through 2010. Average wind speeds are between 16 and 32 feet per second (ft/s) (5 and 10 meters per second [m/s]), with stronger wind in the winter. The occurrence of stronger winds from the northwest during winter is seen by the 95th percentile curve that reaches over 49 ft/s (15 m/s). According to wind measurements from meteorological measurement sites in Massachusetts and Rhode Island, the wind rose figures show the

predominant winds for Block Island, Martha’s Vineyard, and Nantucket during the years 2003 through 2012 are from the southwest through northerly directions and the average speeds are between 12.5 and 20.3 ft/s (3.8 and 6.2 m/s).



Source: Halliwell, 2004; Chassignet et al. 2007

Figure 4.2-13. Monthly Wind Speed Statistics for the CFSR Grid Point Nearest to the SFWF
Graphical representation of the average monthly wind speeds and strongest winds (represented by the 95th percentile) at the SFWF and SFEC.

Storms

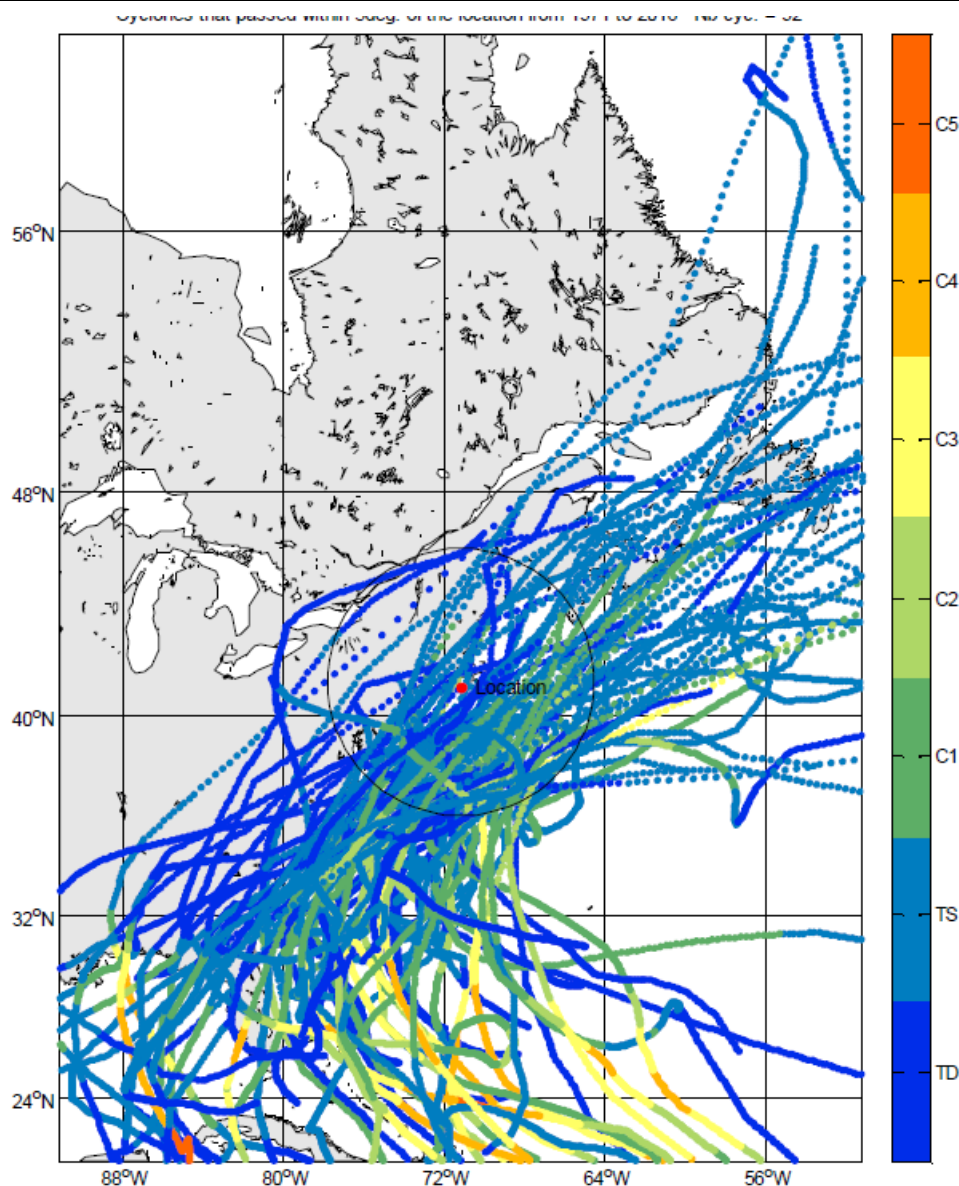
Regional data reports indicating the magnitude of wind events within the NOAA National Centers for Environmental Information Storm Events Database, provides a characterization of recently recorded wind events in the general vicinity of the project. Table 4.2-10 includes the high wind events for Barnstable and Nantucket Counties in Massachusetts between January 2017 and March 2018. Few hurricanes pass through New England, but the area is subjected to frequent Nor’easters that form offshore between Georgia and New Jersey, and typically reach maximum intensity in New England. These storms are usually characterized by winds from the northeast, and can bring heavy precipitation, wind, storm surges, and rough seas. They primarily occur between September and April but can form any time of the year. Although hurricanes are relatively infrequent in New England, wave heights up to 30 feet (9 m) were recorded south of Block Island (Scripps Buoy 44097) during Hurricane Sandy in 2012 (NOAA, 2012).

Table 4.2-10. Recorded High Wind Speeds for Barnstable and Nantucket Counties, Massachusetts for January 2017 to March 2018

Date of Measurement	Magnitude (knots)	Magnitude (m/s)	Measured (MG) or Estimated (EG)
23-Jan-17	51	26.2	MG
13-Feb-17	50	25.7	EG
2-Mar-17	50	25.7	MG
14-Mar-17	69	35.5	MG
14-Mar-17	51	26.2	MG
19-Mar-17	52	26.8	MG
1-Apr-17	54	27.8	MG
1-Apr-17	56	28.8	MG
25-Oct-17	50	25.7	MG
29-Oct-17	81	41.7	MG
30-Oct-17	61	31.4	MG
25-Dec-17	57	29.3	MG
25-Dec-17	66	34.0	EG
4-Jan-18	65	33.4	EG
4-Jan-18	53	27.3	MG
12-Jan-18	57	29.3	EG
30-Jan-18	36	18.5	MS
2-Mar-18	84	43.2	EG
2-Mar-18	78	40.1	EG
5-Mar-18	35	18.0	MS
13-Mar-18	67	34.5	EG

Cyclones

The IBTrACS project contains the most complete global set of historical tropical cyclones available. It combines information from numerous tropical cyclone datasets, simplifying interagency comparisons by providing storm data from multiple sources in one place. As part of the IBTrACS project, the quality of storm inventories, positions, pressures, and wind speeds are checked and information about the quality of the data are passed on to the user. The version of the database that has been used is IBTrACS v03r09, which contains cyclone data from 1848 up to 2015 and was released in September 2016. Figure 4.2-14 illustrates the track of cyclones having passed within 5 degrees of the SFWF project area between 1971 and 2015.



Source: NOAA IBTrACS, 2010

Figure 4.2-14. Cyclone Tracks Having Passed within 5 degrees of the SFWF between 1971 and 2015

Overview of the cyclone tracks near the SFWF Project Area over the past 44-year time period

Available data for all cyclones passing within a certain radius (e.g., 270 NM) of the SFWF were examined using the IBTrACS data. For each of those cyclones, the DWSF team employed a parametric wind model to identify the maximum wind speed caused at the location due to the passing of the cyclone. An extreme value analysis was then undertaken on the distribution of maximum wind speeds caused by all cyclones within the 270-NM radius in order to determine the extreme wind speeds with a given return period. A number of different locations along the cyclone tracks were included and the analysis was applied to those locations with the highest cyclone risk. Appendix Z includes the technical report for a meteorological and oceanographic study of the SFWF area (SFWF MetOcean Conditions Report). Table 4.2-11 is excerpted from Appendix Z and provides predicted cyclonic conditions near the SFWF based on previously

recorded events. The results presented are omni-directional so that predominant wind or wave directions are not indicated.

Table 4.2-11 Possible Cyclone Conditions, including Omni-directional Extremes, within the SFWF Area for 10, 50, 100, 500- and 1,000-Year Model Return Periods

Season - CYCLONE	All-year	All-year	All-year	All-year	All-year
Return Period	10	50	100	500	1,000
WIND SPEED					
1-minute mean wind speed at 10m [m/s]	27	39	44	56	61
3-second gust wind speed at 10m [m/s]	30	44	50	65	71
SEA STATE (3-HOUR)					
Maximum individual wave height [m]	9.8	13.7	15.2	18.9	20.5
Associated period [s]	9.4	11.0	11.7	13.0	13.5
Associated wave length [m]	138	183	201	239	255
Significant wave height [m]	5.6	7.8	8.7	10.8	11.7
Zero crossing period [s]	7.7	9.0	9.5	10.6	11.1
Peak energy period [s]	10.2	12.0	12.7	14.1	14.7
WATER LEVELS					
Wave crest elevation [m]	5.6	8.1	9.3	12.2	13.5
Tidal rise [m]	1.4	1.4	1.4	1.4	1.4
Storm surge [m]	0.4	0.9	1.1	1.7	1.9
Safety margin [m]		1.5	1.5	1.5	1.5
Minimum airgap [m]		11.9	13.3	16.7	18.3
CURRENT					
Total surface current [m/s]	1.1	1.4	1.5	1.8	1.9
Current at 25% of water depth [m/s]	0.9	1.2	1.3	1.6	1.7
Current at mid-depth [m/s]	0.8	1.0	1.1	1.3	1.4
Current at 75% of water depth [m/s]	0.7	0.8	0.9	1.1	1.1
Current at 1m above seabed [m/s]	0.4	0.5	0.6	0.7	0.7

Icing and Fog

Given the cold air temperatures experienced during many New England winters, there is potential for icing of equipment and vessels above the water line in the SFWF and SFEC. To evaluate the potential for icing and fog conditions within the OSAMP, Merrill (2010) assessed data from two locations: the Buzzard's Bay Tower (west of the Elizabeth Islands) and the Martha's Vineyard Coastal Observatory (1.9 miles [3 km] offshore). Results of the data analysis indicate the highest potential for fog development during the summer, with 10 potential days in June, compared to 1 to 4 potential days during each of the winter months. As expected, days with potential for icing conditions were limited to November through March, with the highest number of days (9) in January.

4.2.4.2 Potential Impacts

An overview of the IPFs for physical oceanography and meteorology are depicted on Figure 4.2-15. IPFs which would not impact physical oceanography and meteorology are shown as circles with a slash. IPFs that could impact physical oceanography and meteorology but were found to be negligible in the analyses in Section 4.1, are shown as gray circles without a slash.

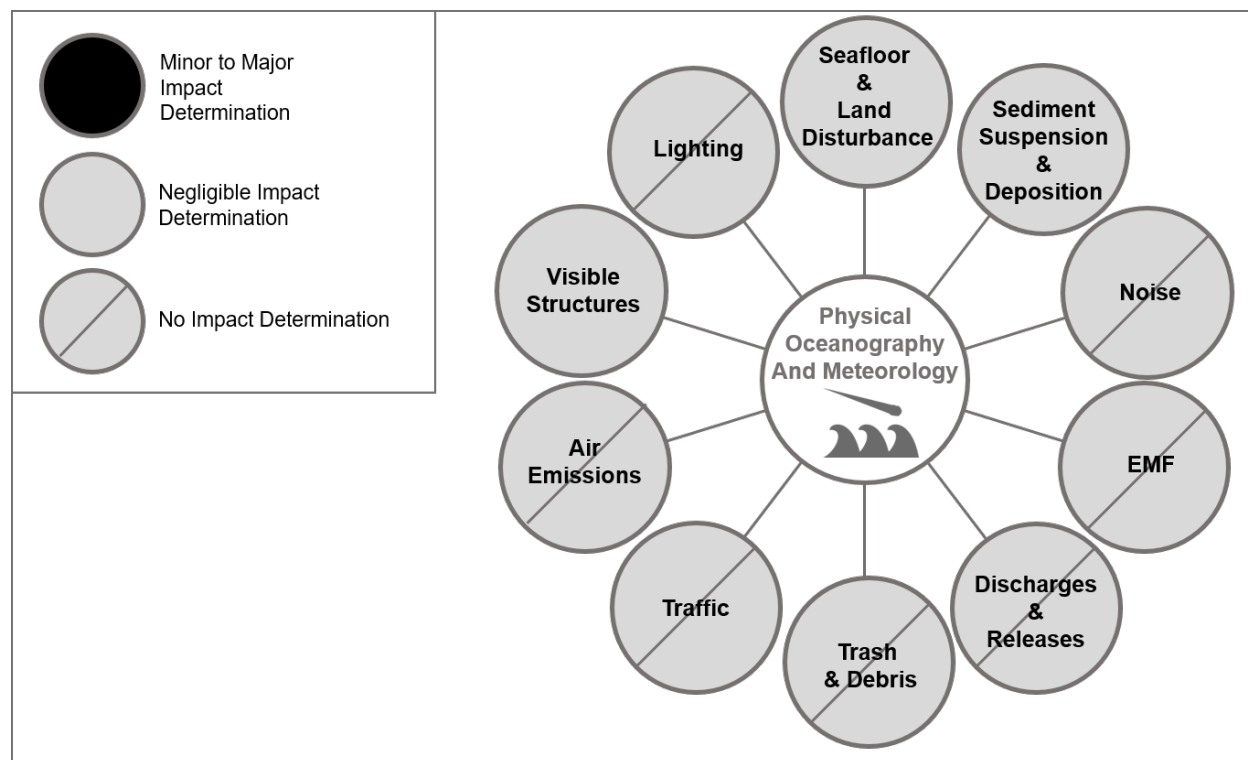


Figure 4.2-15. IPFs on Physical Oceanography and Meteorology

Illustration of potential impacts to physical oceanography and meteorology resulting from SFWF and SFEC activities

Three, inter-related IPFs were identified that will result in **negligible impacts** to physical oceanographic processes and conditions or meteorological conditions. Seafloor and Land Disturbance, Sediment Suspension and Deposition, and Visible Structures from the construction activity and physical presence of the SFWF and SFEC will affect water and wind currents as well as seafloor topography that, on a small scale, impact oceanographic and meteorological conditions but not to a degree to alter these conditions or processes. Because of the inter-related nature of these IPFs and consequent impacts, they are addressed together below.

Meteorological and oceanographic conditions could potentially affect all phases of the SFWF and SFEC, including construction, operations, and decommissioning. The SFWF and SFEC will be designed to address risks that the identified oceanographic and meteorological factors pose. The design will be reviewed by BOEM during the FDR in accordance with 30 CFR 585.700-702.

South Fork Wind Farm

Construction

Seafloor and Land Disturbance/Sediment Suspension and Deposition

Disturbance of the seafloor and increases in sediment suspension and deposition during construction of the SFWF may result in **short-term, localized, and negligible impacts** to physical oceanographic conditions because of relatively small and isolated changes to currents and seafloor topography.

Operations and Maintenance

Seafloor and Land Disturbance/Sediment Suspension and Deposition/Visible Structures

Over the operational period, the presence of the SFWF foundations will result in relatively small and isolated changes to bottom current patterns, sediment scour, suspension, and transport. However, only appreciable changes in sediment distribution patterns are expected and would result in *localized, negligible impacts* to oceanographic conditions. However, because the foundations would be spaced widely apart (e.g., approximately 1.15 mile (1.8 km, 1 nm) and given the small footprint of the SFWF relative to the oceanic current systems, currents would likely not be affected by the presence of the foundations, and impacts are considered *negligible*.

Similarly, the presence and operation of the WTGs has the potential to create turbulence in the immediate vicinity of the tower, nacelle, and blades. However, impacts to air flow would be *localized* and are considered *negligible*.

Decommissioning

Impacts to physical oceanographic and meteorological conditions would be similar to those described above, *short-term, localized, and negligible*.

SFEC – OCS

Construction

Seafloor and Land Disturbance/Sediment Suspension and Deposition

Disturbance of the seafloor resulting in increases in sediment suspension and deposition during construction of the SFEC - OCS would result in *short-term, localized, and negligible impacts* to physical oceanographic conditions in the installation because of effects on currents and seafloor topography.

Operations and Maintenance

Seafloor Disturbance

No disturbance to physical oceanographic conditions is expected during routine operations because there is no routine maintenance of the SFEC – OCS requiring work on the seafloor. Should there be a need for construction-related maintenance of the SFEC - OCS, vessels similar in size to the cable lay barge spread or smaller would likely be used for the repair. Therefore, routine operations of the SFEC - OCS are expected to result in *no impact* to physical oceanographic conditions with the potential for *localized, negligible impacts* if a repair is needed.

Sediment Suspension and Deposition

The physical presence of the SFEC - OCS would have *no impacts* to currents because the cables will be buried beneath the seabed except in some areas of the SFEC - OCS that require protective armoring which could have the potential to affect currents. However, because of the small acreage associated with this protective armoring relative to the greater oceanic current systems in the region, this potential SFEC – OCS O&M impact is expected to be *localized and negligible*.

Decommissioning

Impacts to physical oceanographic and meteorological conditions would be similar to those described above, *short-term, localized, and negligible*.

SFEC – NYS

Construction

Seafloor Disturbance/Sediment Suspension and Deposition

Similar to the SFEC - OCS, construction of the SFEC - NYS has the potential to result in *short-term, localized, and negligible impacts* to physical oceanographic conditions from seafloor disturbance and related sediment suspension and deposition because of small, isolated changes to currents and seafloor topography. The onshore segments of the SFEC - NYS will not impact physical oceanographic and meteorological conditions.

Operations and Maintenance

Seafloor and Land Disturbance/Sediment Suspension and Deposition

Impacts associated with seafloor disturbance during O&M of the SFEC - NYS are expected to be similar to those described for the SFEC - OCS.

Decommissioning

Impacts to physical oceanographic and meteorological conditions would be similar to those described above, *short-term, localized, and negligible*.

4.2.4.3 Proposed Environmental Protection Measures

DWSF has designed the Project to account for site-specific oceanographic and meteorological conditions within the Project Area; therefore, no additional measures are necessary.

4.3 Biological Resources

4.3.1 Coastal and Terrestrial Habitat

This section describes the affected environment and provides an assessment and discussion of potential impacts for existing coastal and terrestrial habitats, including sensitive habitats, during construction, O&M, and decommissioning of the SFWF and SFEC. The coastal and terrestrial habitats considered are along the Long Island south coastline in the vicinity of the two potential landing sites and inland along the SFEC – Onshore cable routes. Other habitats, such as benthic and shellfish habitats and essential fish habitat (EFH) are discussed separately in Sections 4.3.2 and 4.3.3, respectively.

To characterize existing coastal and terrestrial habitats within the vicinity of the various SFEC – Onshore components, information in this section was assembled from desktop research, agency consultations, and field surveys of biological resources. The following resources informed the description of the affected environment:

- Current public data sources related to coastal and terrestrial habitats in the town of East Hampton, village of East Hampton East Hampton, Suffolk County, and in Montauk Peninsula area on eastern Long Island including the town of East Hampton Local Waterfront Revitalization Program (Town of East Hampton, 2008).
- State and federal agency published reports including BOEM (2013), USFWS (1997), U.S. Department of Interior, Minerals Management Service (DOI-MMS; 2007), and NYSDEC.
- Project-specific studies included field surveys of onshore biological resources to aid in the characterization of the affected environment for coastal and terrestrial habitats (Appendix M). The field surveys included classification of observed habitats, delineations of freshwater and tidal wetlands, identification of plant and wildlife species, observations of rare and protected species and communities, and delineation of invasive species occurrences within the locations of the potential landing sites and routes for the SFEC – Onshore.

4.3.1.1 Affected Environment

Regional Overview

The SFWF and much of the SFEC will be located on the southern New England OCS and on the northern end of the Mid-Atlantic Bight. A portion of the SFEC will be located within New York State (SFEC – NYS) waters and onshore in the town or village of East Hampton on Long Island, New York.

Eastern Long Island's coastal and terrestrial environment varies widely and consists of a diversity of habitats. These range from exposed rocky shores and exposed bedrock, sandy coastal beaches, dunes, freshwater and brackish bays and ponds, and salt marshes fringing the shore of sheltered embayments to intertidal mud- and sandflats (BOEM, 2013). The sandy, coastal beaches along the southeastern coastline of Long Island are characterized by four zones: nearshore bottom (submerged areas below mean low water to 29.5 feet [9 m]); foreshore (intertidal areas between mean low water to the high tide zone); backshore (exposed sandflats above high tide line to dunes, but occasionally submerged during storms or exceptionally high tides); and dunes (areas of wind-blown sand ridges or mounds above the highest tide line and exposed to wind action) (USFWS, 1997).

These coastal and terrestrial habitats are constantly changing because of wave action and tidal currents that cause sediment transport (DOI-MMS, 2007). Eroding beaches and sand shoals on the inner continental shelf are the primary sources of sand that are deposited on and maintain the sand beaches (BOEM, 2013). In addition, small, sheltered beaches between rocky headlands are the predominant shoreline type for Long Island Sound, Rhode Island, and Massachusetts coastlines (DOI-MMS, 2007).

The vegetated habitat areas along the coastal beaches of eastern Long Island are generally found from the high tide line inland to the mainland. The backshore of the beach (high tide line to dunes) is usually sparsely vegetated. Just inland, at the toe of the dune, American beachgrass (*Ammophila breviligulata*) occurs along with dusty miller (*Artemisia stelleriana*), beach pea (*Lathyrus japonica*), and saltwort (*Salsola kali*). On the primary dunes, beachgrass is dominant along with seaside goldenrod (*Solidago sempervirens*); on the backside of the dunes, beach heather (*Hudsonia tomentosa*), bearberry (*Arctostaphylos uva-ursi*), and bayberry (*Myrica pensylvanica*) occur. Interdunal swales are wetlands that are formed where blowouts in the dunes intersect the water table and typical wetland plants such as sedges, rushes, herbs, and low shrubs become established. Characteristic species of these swale wetlands include purple gerardia (*Agalinis purpurea*), sundews (*Drosera* spp.), cranberry (*Vaccinium macrocarpon*), highbush blueberry (*Vaccinium corymbosum*), and bayberry. The upland transition zone along the south coastline of eastern Long Island has stands of shrublands/woodlands dominated by bayberry, arrowwoods (*Viburnum* spp.), and pitch pine (*Pinus rigida*) (USFWS, 1997).

South Fork Wind Farm

The SFWF is located offshore and therefore does not include coastal or terrestrial habitat. Marine habitats in the SFWF are discussed in Section 4.3.2 and finfish habitat and EFH are discussed in Section 4.3.3. Water quality in the SFWF is described in Section 4.2.2.

South Fork Export Cable

SFEC - OCS and SFEC - NYS

Much of the SFEC –OCS, including off the coast of Long Island and the SFEC – NYS approaching the coastline of Long Island, supports coastal subtidal marine habitats, not coastal and terrestrial habitats. Subtidal coastal marine habitats, such as submerged aquatic vegetation (SAV), macroalgal assemblages, hard bottom habitat, microbenthic and macrobenthic communities, soft bottom habitat, and shellfish resources are discussed in Sections 4.3.2 and 4.3.3.

SFEC – Onshore

The coastal and terrestrial habitats associated with the SFEC – Onshore would include those habitats in the vicinity of the landing sites, along the SFEC – Onshore cable routes, and at the SFEC – Interconnection Facility.

The coastal habitats in the SFEC – Onshore include the area from the ocean inland to the mainland, including the foreshore, backshore, dunes, and interdunal areas. Habitats could include nesting and feeding areas for beach-nesting birds, rare beach and interdunal swale communities and plants, and wintering waterfowl habitat.

Wetland habitats in the region are shown on Figures 4.3-1 and 4.3-2 and consist of fresh, brackish, and salt marshes and mudflats. Salt marshes and mudflats occur in the intertidal zones. Estuaries, which are shallow semi-enclosed areas where stream or river inflows mix with marine waters, include a range of intertidal and subtidal habitats from fresh to brackish and saline. Coastal wetlands and estuaries are highly productive, yet fragile, environments that support a

great diversity of fish and wildlife species (DOI-MMS, 2007). The Peconic Bay Estuary, Narragansett Bay Estuary, and Long Island Sound are major estuaries in the region. Subtidal habitats such as seagrass beds occur offshore in shallow water and are addressed in Section 4.3.2.

New York State Significant Coastal Fish and Wildlife Habitats (SCFWH) are shown on Figure 4.3-2 (NYSDOS, 2018). New York State SCFWH are NYSDOS-designated special coastal and terrestrial habitat areas that are mapped along with a technical narrative providing site-specific information. The habitat narrative constitutes a record of the basis for the SCFWH's designation and provides specific information regarding the fish and wildlife resources that depend on this area.

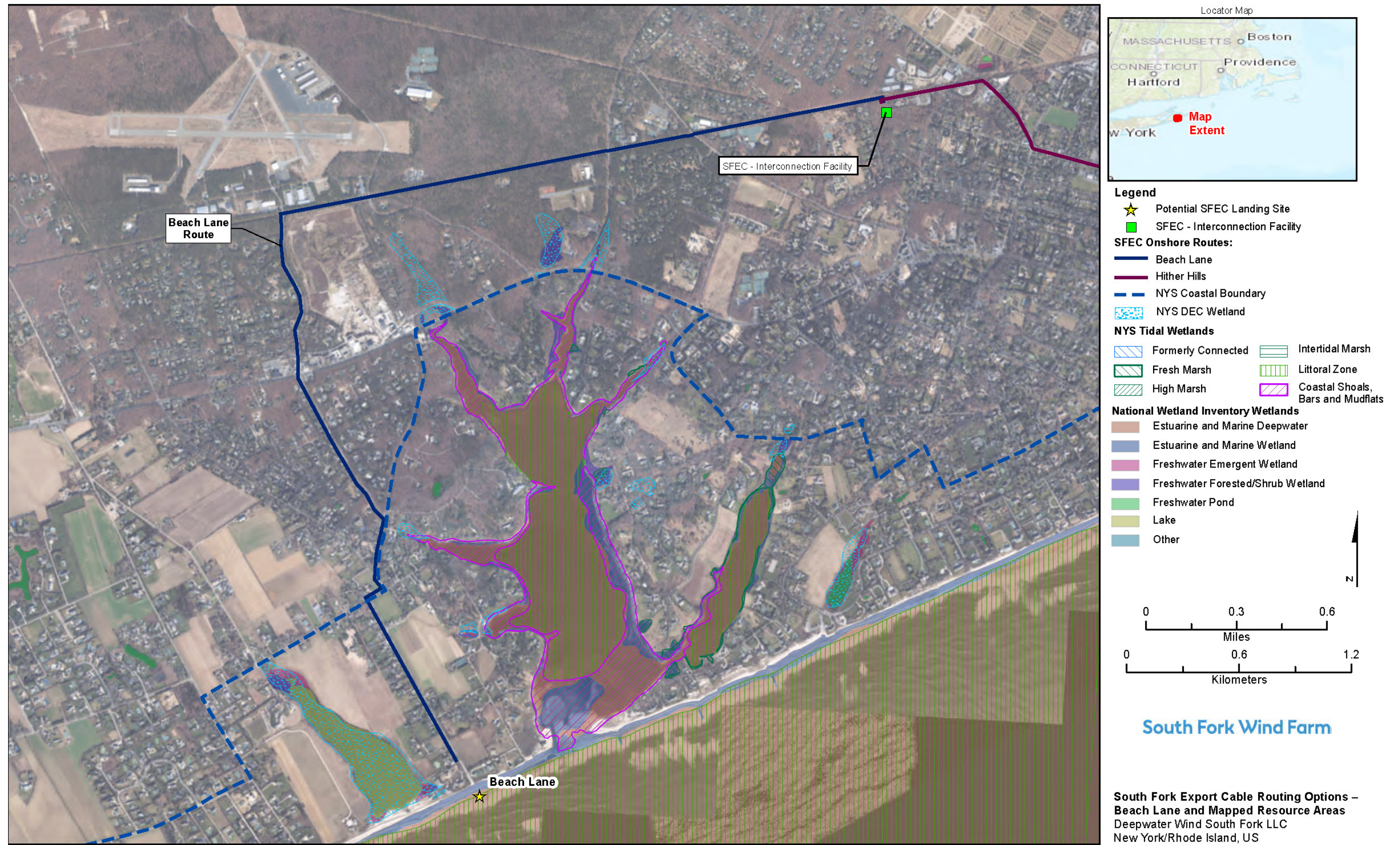
The coastal and terrestrial habitats along the SFEC – Onshore cable routes are described below and summarized in Table 4.3-1. The habitats along the routes generally include a successional shrubland community located adjacent to the various roadway ROWs and the LIRR ROW. The vegetated cover types observed adjacent to the SFEC – Onshore cable routes include various upland and wetland plant communities (Appendix M).

- The landing sites consist of the marine intertidal gravel/sand beach and maritime beach communities as classified by the New York Natural Heritage Program (NYNHP) Ecological Communities of New York State (ECNYS) publication (Edinger et al., 2014; Town of East Hampton, 2008).
- The SFEC – Onshore cable routes traverse the following NYNHP-identified Significant Natural Communities: marine intertidal gravel/sand beach, maritime dunes, maritime heathland, maritime pitch pine dune woodland, maritime freshwater interdunal swales, high salt marsh, low salt marsh, salt shrub, brackish meadow, highbush blueberry bog thicket, coastal oak-heath forest, coastal oak-hickory forest, and pitch pine-oak forest (Edinger et al., 2014; Town of East Hampton, 2008). Neither of the proposed SFEC – Onshore route landing sites (Beach Lane and Hither Hills) is within a NYSDOS-designated SCFWH. However, the SFEC – Onshore cable route from the Hither Hills landing site would traverse three (Hither Hills Uplands, Napeague Beach, and Napeague Harbor) of the NYSDEC-designated SCFWH.
- The SFEC – Interconnection Facility consists of some ECNYS communities, including paved road path, unpaved road/path, and urban structure exterior, as well as a disturbed example of the coastal oak hickory forest community and a successional shrubland community (Edinger et al., 2014; Town of East Hampton, 2008).

Field surveys and desktop research for areas along the SFEC – Onshore cable routes identified habitat for a variety of birds, terrestrial mammals, and reptiles and amphibians, including species commonly associated with tidal, intertidal, and freshwater wetlands, freshwater surface waters, forests, successional habitats, agricultural fields, and developed areas. Observed avian, terrestrial mammal, and reptiles and amphibians documented near the SFEC – Onshore routes are described in Appendix M.

Wetland resources located in the vicinity of the SFEC – Onshore are illustrated on Figures 4.3-1 (Beach Lane) and 4.3-2 (Hither Hills). These include National Wetlands Inventory (NWI) and NYSDEC freshwater and tidal wetlands and adjacent areas. Figure 4.3-2 also shows the NYSDEC-designated SCFWH areas that would be traversed along the Hither Hills SFEC - Onshore route. Wetland delineation and results are presented in Appendix M, including a summary in Table 2 and maps in Appendix A (of Appendix M), Figure 4 (Sheets – 1-127).

The locations of rare and protected species and species habitats were observed during the field surveys of the SFEC – Onshore routes. Observed species documented near the SFEC – Onshore routes are described further in Appendix M.

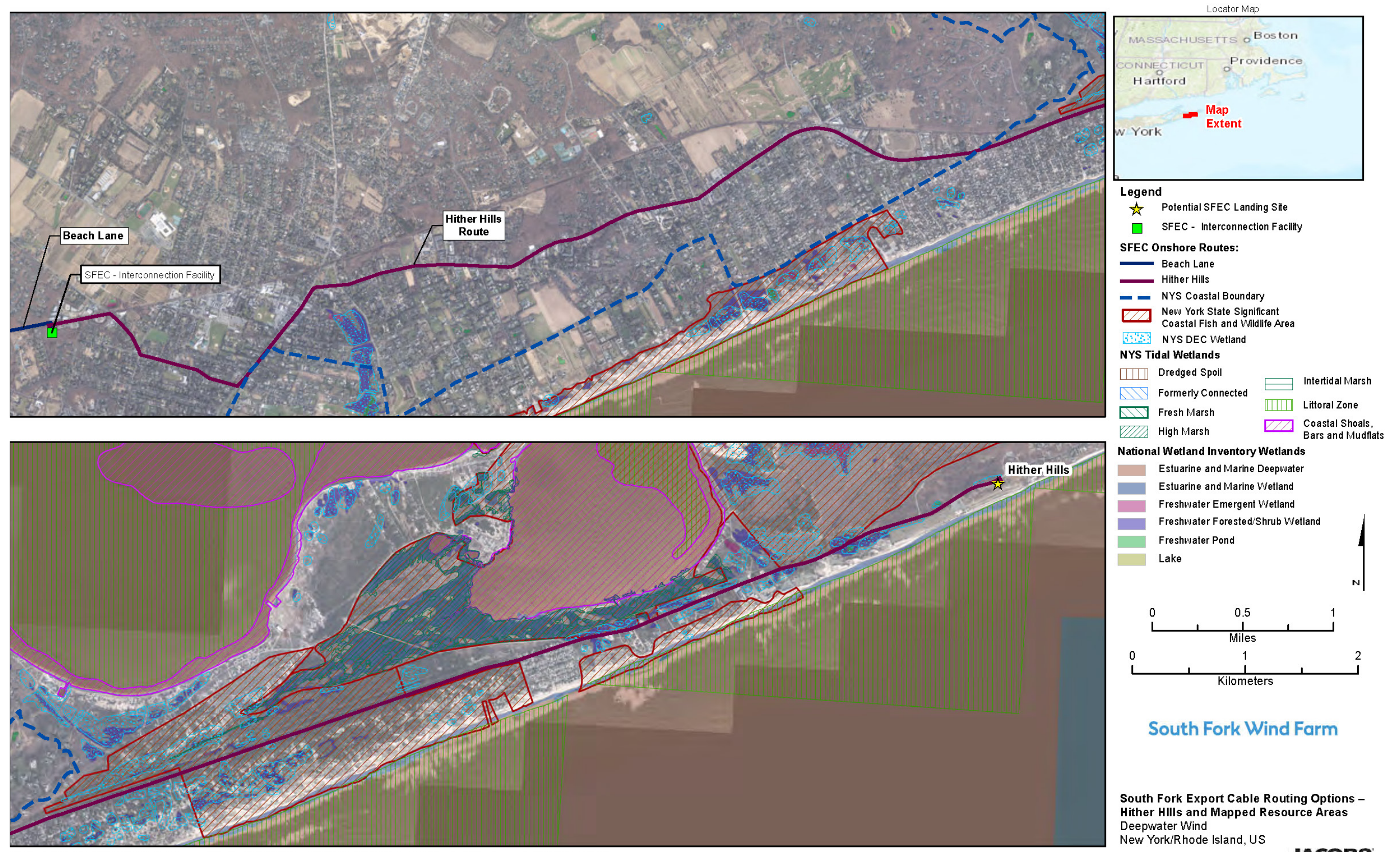


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Figure 4.3-1. South Fork Export Cable Routing Options – Beach Lane and Mapped Resource Areas
Depiction of the wetland habitats and wetland resources in proximity of the Beach Lane landing and cable routing option.

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Figure 4.3-2. South Fork Export Cable Routing Options – Hither Hills and Mapped Resource Areas
 Depiction of the wetland habitats and wetland resources in proximity of the Hither Hills landing and cable routing option.

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Table 4.3-1. Summary of Coastal and Terrestrial Habitats Observed for the SFEC - Onshore

Environmental Considerations and Onshore Habitats

Project Component	NLCD Developed Land Cover Types (percent)	Delineated Wetlands and Wetland Adjacent Areas (number/ acres [ha])	Rare/Protected Species Observation (Number)	Invasive Species Occurrences (number)
<i>SFEC – ONSHORE (BEACH LANE)</i>				
Beach Lane Landing Site	91	0 / 0	2	2
Beach Lane – Route A	68.85	0 / 0	0	26
<i>SFEC – ONSHORE (HITHER HILLS)</i>				
Hither Hills Landing Site	42.47	0	0	3
Hither Hills Route B	99.45	34 / 19.96	49	89
Hither Hills – Route A	86.14	57 / 10.85 (4.39)	17	123
Hither Hills – Route C	97.18	50 / 13.34 (5.39)	49	83
<i>SFEC – Interconnection facility</i>				
SFEC – Interconnection Facility Site	0	0/0	0	1

NLCD = National Land Cover Database

4.3.1.2 Potential Impacts

Project-related IPFs that could potentially result in impacts to coastal and terrestrial habitats during the construction, O&M, and decommissioning phases of the SFWF and SFEC are described in this section. Impacts to benthic habitats are discussed in Section 4.3.2 and finfish habitat and EFH are discussed in Section 4.3.3. The IPFs that are discussed in this section that may impact coastal and terrestrial habitats are seafloor and land disturbance and sediment suspension and deposition IPFs. IPFs like discharges and releases and trash and debris could have indirect impacts on some of the coastal and terrestrial habitats included in this chapter but given the lack of direct impact with project activities (Section 4.1), these IPFs are dismissed as no impact for the remainder of this discussion. A summary of IPFs and the potential impacts to coastal and terrestrial habitats associated with the SFWF and SFEC is presented on Figure 4.3-3.

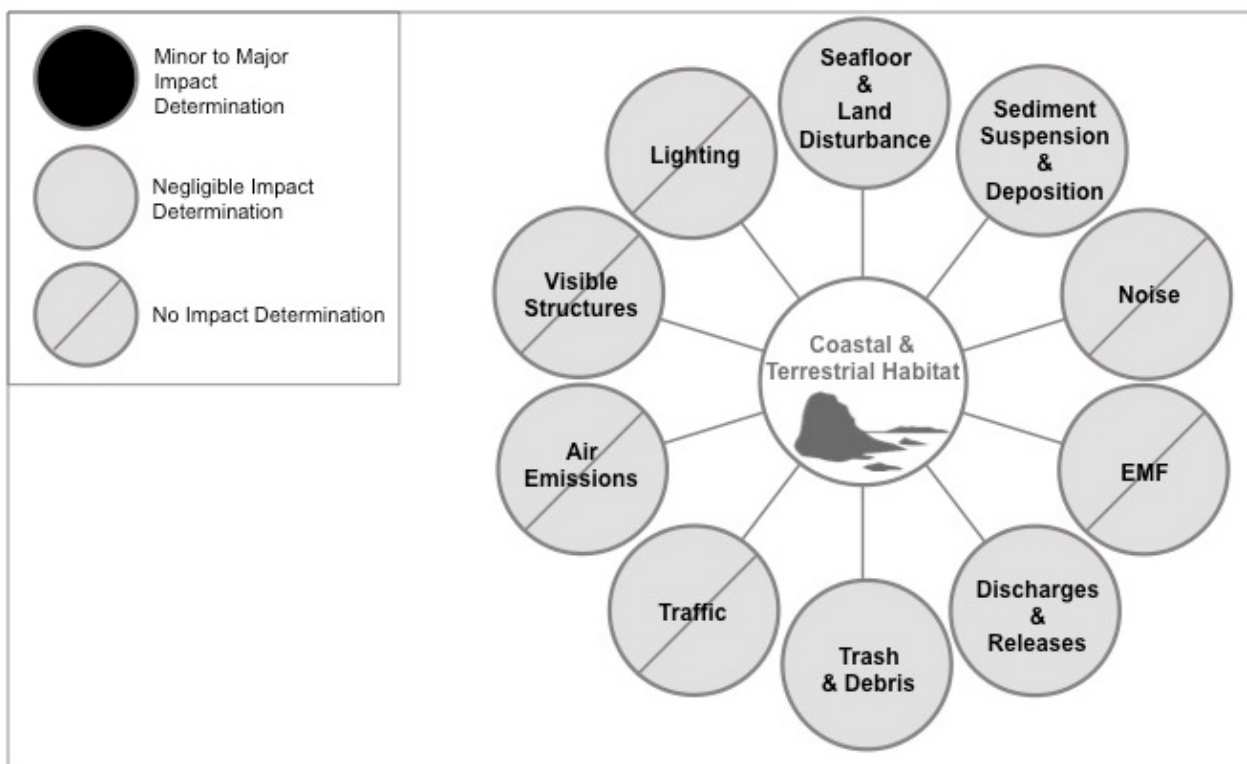


Figure 4.3-3. IPFs on Coastal and Terrestrial Habitat

Illustration of potential impacts to coastal and terrestrial habitats resulting from SFWF and SFEC activities.

South Fork Wind Farm

The focus of the coastal and terrestrial habitat section is on evaluating the presence of sensitive habitats that may be present along the Long Island coast and marginally inland where the SFEC route is being considered; therefore, the SFWF is not expected to have an impact on coastal and terrestrial habitats during construction, O&M, or decommissioning. Offshore benthic habitats, finfish habitat, and EFH are the marine habitats that could be impacted during construction, O&M, or decommissioning of the SFWF. Benthic habitats are discussed in Section 4.3.2 and finfish habitat and EFH is discussed in Section 4.3.3.

South Fork Export Cable

Impacts to coastal and terrestrial habitats that are anticipated to occur from activities associated with the SFEC – OCS and SFEC - NYS are discussed in Section 4.3.1. Activities associated with the SFEC – Onshore could impact onshore coastal and terrestrial habitats during construction, O&M, and decommissioning. Onshore coastal and terrestrial habitats may experience *short-term* and *negligible impacts* from construction activities, including HDD operations, trenching, equipment, and supplies laydown, and SFEC – Interconnection Facility construction.

Table 4.3-2 summarizes the level of impacts expected to occur to coastal and terrestrial habitat during the construction, O&M, and decommissioning phases of the SFEC. Additional details on potential impacts to coastal and terrestrial habitat from the various IPFs of the SFEC during construction are described in the following sections.

Table 4.3-2. IPFs and Potential Levels of Impact on Coastal and Terrestrial Habitat at the SFEC

IPF	Potential Impact	Maximum Level of Impact
Seafloor/Land Disturbance	Land Disturbance	Negligible direct short-term localized
Sediment Suspension and Deposition		Negligible direct short-term localized
Discharges and Releases		Negligible indirect
Trash and Debris		Negligible indirect

SFEC-OCS and SFEC-NYS***Construction, Operations, and Decommissioning*****Seafloor and Land Disturbance**

Offshore, benthic habitats, finfish habitat, and EFH are the coastal and terrestrial habitats that could be impacted during construction, O&M, or decommissioning in the SFEC – OCS and SFEC – NYS. Benthic habitats are discussed in Section 4.3.2 and finfish habitat and EFH is discussed in Section 4.3.3.

SFEC-Onshore***Construction*****Land Disturbance**

Coastal and terrestrial habitat between the landing sites and SFEC – Interconnection Facility may experience ***direct, negligible, and short-term impacts*** from land disturbance during onshore construction activities.

Impacts to intertidal wetlands within the sea-to-shore transition area would be avoided by using HDD technology. Impacts to the marine intertidal gravel/sand beach and maritime beach communities near the landing sites and sea-to-shore transition area would be avoided by locating the sea-to-shore transition vault within the roadway by using HDD technology to bury the cable beneath the beach and dune.

No wetlands were delineated within the site proposed for the SFEC – Interconnection Facility.

During construction, there may be ***short-term, localized, and negligible impacts*** to coastal and terrestrial habitats along the SFEC – Onshore routes, including wetlands, from land disturbance, as described in Table 4.3-1. HDD technology may be used in locations along the cable routes, as needed, to avoid or minimize impacts to sensitive areas, such as wetlands, surface water crossings, or parklands. No long-term impacts resulting in habitat loss or alteration are anticipated. ***Long-term*** and ***negligible*** impacts are expected to result from the clearing at the SFEC – Interconnection Facility site.

In addition, depending on the route selected, construction of the SFEC – Onshore cable routes may result in ***short-term, negligible impacts*** to NYSDEC-regulated Freshwater Wetlands and 100-foot (30-m) Adjacent Area, NYSDEC-regulated Tidal Wetlands and 300-foot (91-m) Adjacent Area, and USFWS NWI Wetland coastal and terrestrial habitats, as described in Appendix M. Very limited sections of the SFEC – Onshore will be located in existing roads that intersect with FEMA-mapped 100-year or 500-year floodplains. Impacts to coastal and terrestrial habitats would be minimized along the alignment of and in the vicinity of the SFEC – Onshore

cable routes because the cable will be located underground in previously disturbed areas, such as roadways and LIRR ROW.

Sediment Suspension and Deposition

Construction-related impacts to water quality from suspended sediment are discussed in Section 4.2.2, Water Quality and Water Resources. Indirect impacts to coastal and terrestrial habitat from *short-term, localized* decreases in water quality during SFEC – Onshore construction or decommissioning activities may occur, but they are considered *negligible*. The risk of erosion and sedimentation will be managed according to federal, state, and local regulations through the implementation of the SWPPP.

Operations and Maintenance

Regular O&M activities would not be expected to cause further habitat alteration or involve activities that have potential to cause impacts. However, when cable inspection or repairs require excavation, resulting in land disturbance, there may be *negligible, short-term, and localized impacts* to coastal and terrestrial habitats from these O&M activities.

Decommissioning

Impacts to coastal and terrestrial habitats would be expected to be similar to the construction impacts, and the area is expected to return to pre-project conditions.

4.3.1.3 Proposed Environmental Protection Measures

Several environmental protection measures will reduce potential impacts to coastal and terrestrial habitat.

- SFEC - Onshore is sited within previously disturbed existing ROWs.
- The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone. Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D).
- A SWPPP, including erosion and sedimentation control measures, and a SPCC Plan, will minimize potential impacts to water quality during construction of the SFEC - Onshore.