New England Wind 2 Connector

Analysis to Support Petition Before the Energy Facilities Siting Board

Docket #EFSB 22-06

Volume II: Attachments

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Table of Contents

Volume II – Attachments

Attachment A Detailed Scoring Spreadsheets

Attachment B Preliminary Engineering Plans
- Attachment B1: Dowses Beach Landing HDD Landfall Drill Paths
- Attachment B2: Onshore 275-Kv Transmission Cable Duct Bank Route
- Attachment B3: Onshore 275-Kv Transmission Route 6 Crossing
- Attachment B4: 275/345 KV GIS Substation

Attachment C Offshore Export Cable Corridor Map Series
- Attachment C1: Benthic Habitat Map Set – Auster
- Attachment C2: Benthic Habitat Map Set – Coastal And Marine Ecological Classification Standard (CMECS) System

Attachment D Fisheries Communication Plan (FCP)

Attachment E Sediment Dispersion Modeling

Attachment F RMAT Climate Resilience Design Standards Tool Report

Attachment G Massachusetts Coastal Zone Management Act Consistency Certification

Attachment D

Fisheries Communication Plan (FCP)

Fisheries Communications Plan

Rev. 11

New England Wind

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New England Wind Fisheries Communication Plan

Revised June 2022

I. Introduction

New England Wind is the proposal to develop offshore renewable wind energy facilities in Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0534 along with associated offshore and onshore cabling, onshore substations, and onshore operations and maintenance (O&M) facilities. New England Wind will be developed in two Phases with a maximum of 130 wind turbine generator (WTG) and electrical service platform (ESP) positions. Phase 1, which includes the Park City Wind project, will be located in the northeastern portion of Lease Area OCS-A 0534. Phase 2, which includes Commonwealth Wind, will occupy the remainder of Lease Area OCS-A 0534. Four or five offshore export cables (two for Phase 1 and two or three for Phase 2) will transmit electricity generated by the WTGs to onshore transmission systems in the Town of Barnstable, Massachusetts unless technical, logistical, grid interconnection, or other unforeseen issues arise.

Park City Wind LLC (the Company), a wholly owned subsidiary of Avangrid Renewables, LLC, will be responsible for the construction, operation, and decommissioning of New England Wind. The Company is committed to successful communication and coordination with the commercial and recreational fishing communities, and this Fisheries Communications Plan (FCP) will inform and direct the Company's fisheries engagement and communications.

The New England Wind FCP is a living document and aligns with the Vineyard Wind 1 FCP, which was first drafted in 2011 to improve communication with fishermen potentially affected by the development of that offshore wind project. This document continues to evolve with each iteration, benefitting from lessons learned and incorporating feedback and guidance from fishermen, fishing organizations, and regulatory agencies. The Company strongly believes that increased participation from the fishing industry in the development, construction, and operation of offshore wind projects will help the offshore wind sector to reduce user conflict, improve project design, and result in a better understanding between the two industries.

Visit https://www.parkcitywind.com/fisheries or https://www.commonwealthwind.com/fisheries to sign-up for updates, Offshore Wind Mariner Updates, and information requests as well as to access charts, frequently asked questions (FAQs), and completed fisheries science reports.

II. New England Wind Lease Area

The Company holds Lease Area OCS-A 0534 (also known as the New England Wind Lease Area) for wind energy development on the Outer Continental Shelf (OCS). This Lease Area, which is shown in Figure 1, is located in the Massachusetts Wind Energy Area (MA WEA). The MA WEA was designated by BOEM, with significant stakeholder input, including the BOEM Massachusetts Renewable Energy Taskforce (made up of local and state elected officials in Massachusetts and Rhode Island), the Massachusetts Fisheries Working Group on Offshore Wind Energy (FWG),[1] and the Massachusetts Habitat Working Group on Offshore Wind

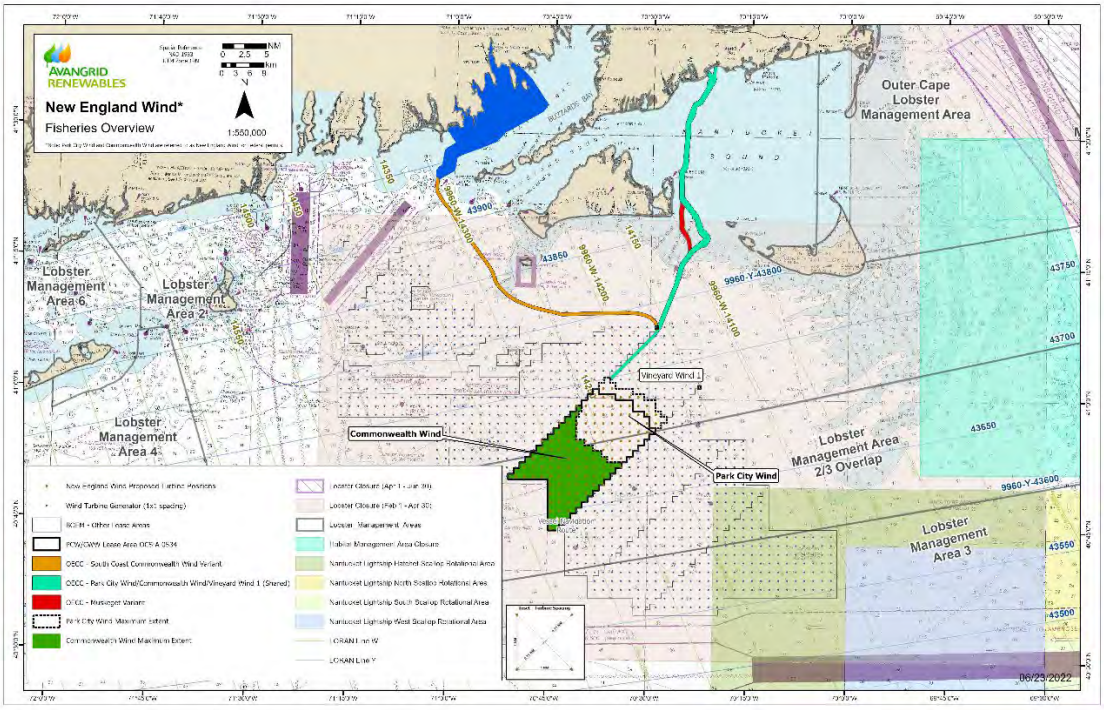
[1] The FWG is a voluntary, informal working group comprised of commercial fishermen and representatives from different ports and sectors, recreational fishermen, scientists, and state and federal agencies. The FWG, which was convened by the Commonwealth of Massachusetts, continues to meet and engage in offshore wind issues.

Energy (HWG),[2] to minimize and avoid impacts to the marine environment. For example, after considering stakeholder comments, BOEM modified the MA WEA to exclude an area of high fisheries value to reduce potential conflicts with commercial and recreational fishing activities. Siting choices such as these were considered to minimize and avoid potential impacts to fisheries and environmental resources from offshore wind development on the OCS.

Lease Area OCS-A 0534 is 159 square miles (sq. mi) in size and is located southwest of Lease Area OCS-A 0501, with the exception of two separate aliquots located along the northeastern boundary of Lease Area OCS-A 0501. At this time, the Company does not intend to develop the two positions in the separate aliquots. At its closest points (excluding the two separate aliquots), Lease Area OCS-A 0534 is just over 32 kilometers (km) (20 miles [mi]) from the southwest corner of Martha's Vineyard and approximately 38 km (24 mi) from Nantucket. Water depths in the Lease Area (excluding the two separate aliquots) generally range from about 146 – 202 feet (24 – 34 fathoms), with depths gradually increasing as distance from land increases. Water depths in the separate aliquots range from 125 – 131 feet (20 – 22 fathoms).

As shown in Figure 1, some New England Wind WTGs and ESPs may be located in the southwest portion of Lease Area OCS-A 0501. This is because Lease Area OCS-A 0501 contains 10 "spare" or extra wind turbine positions for Vineyard Wind 1. If some or all of those spare positions are not developed for Vineyard Wind 1, they will be assigned to Lease Area OCS-A 0534 and developed as part of New England Wind.

Figure 1. Lease Area and Offshore Export Cable Corridor for Park City Wind and Commonwealth Wind Projects

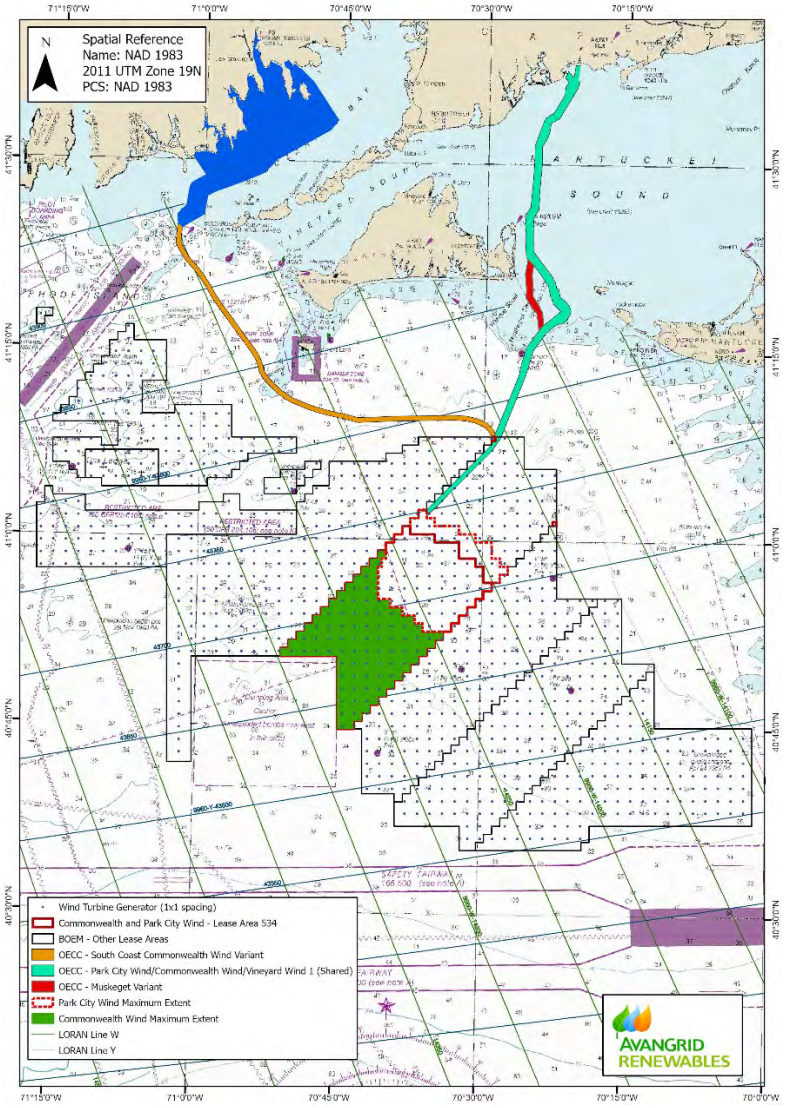


[2] The HWG is a voluntary, informal working group comprised of scientists and technical experts from environmental organizations, academia, and state and federal agencies. Early meetings addressed issues such as marine mammal and avian use of the potential offshore wind areas. The HWG, which was convened by the Commonwealth of Massachusetts, continues to meet and engage in offshore wind issues.

III. The Company's Offshore Wind Projects

The Company has been awarded long-term contracts for its Park City Wind and Commonwealth Wind offshore wind projects, both of which are located in the New England Wind Lease Area and are further described below. Park City Wind and Commonwealth Wind are collectively referred to as "the Projects." The Projects' export cables will be installed within a substantially similar Offshore Export Cable Corridor (OECC) and connect to the electric grid in West Barnstable, Massachusetts unless technical, logistical, grid interconnection, or other unforeseen issues arise. If needed for Phase 2, a variant cable corridor through Muskeget Channel and a variant cable corridor to the South Coast area of Massachusetts have been proposed (see Figure 2).[3]

Figure 2. OECC for Park City Wind (PCW) and Commonwealth Wind (CWW)



[3] *While the Company intends to install all New England Wind offshore export cables within the OECC that travels from the lease area northward through the eastern side of Muskeget Channel towards landfall sites in the Town of Barnstable, the Company is reserving the fallback option to install one or two Phase 2 cables along the western side of Muskeget Channel, referred to as the Phase 2 OECC Western Muskeget Variant. (see Section 4.1.3.2 of COP Volume I).*

a. Phase 1 (including Park City Wind)

Phase 1, which includes the Park City Wind 804-MW facility, will be located directly southwest of Vineyard Wind 1 in the northeastern portion of Lease Area OCS-A 0534 and potentially the southwestern portion of Lease Area OCS-A 0501 (if Vineyard Wind 1 does not develop some or all of its spare positions, as described above). The project site will be between 42 – 89 sq. mi in size with water depths ranging from 141 – 180 feet (approximately 24 – 30 fathoms). The Connecticut Department of Energy and Environmental Protection awarded Park City Wind long-term contracts with the Connecticut electric distribution companies in December 2019. The New England Wind Construction & Operations Plan (COP), which includes Park City Wind, was initially submitted in July 2020. Once operational, Park City Wind will deliver approximately 3.7 million megawatt hours of electricity per year, enough to power approximately 400,000 Connecticut households. Two offshore export cables will transmit electricity from the Phase 1 ESP(s) to one of two potential landfall sites in the Town of Barnstable, delivering power to the ISO-NE electric grid. The Phase 1 offshore export cables will be installed within the same OECC as Vineyard Wind 1's offshore export cables.

b. Phase 2 (including Commonwealth Wind)

Phase 2 includes Commonwealth Wind and will deliver power to one or more Northeastern states and/or to other offtake users, including but not limited to 1,232 MW of power to the ISO-NE electric grid to meet the Company's obligations under long-term contracts with Massachusetts electric distribution companies. When constructed, Commonwealth Wind will be located southwest of Park City Wind within Lease Area OCS-A 0534. The area developed for Commonwealth Wind will be between 86 – 117 sq. mi in size with water depths ranging from 154 – 203 feet (approximately 26 – 34 fathoms). Two or three offshore export cables will transmit electricity from the Phase 2 ESP(s) to one of two potential landfall site(s) in the Town of Barnstable, unless technical, logical, grid interconnection, or other unforeseen issues arise. While the Company intends to install all Phase 2 offshore export cables in the same OECC as Phase 1 and Vineyard Wind 1 cables, the Proponent has also identified two variations of the Phase 2 OECC (Figure 2).

IV. Fisheries Team

To support fisheries communication and engagement, the Company employs Fisheries Liaisons (FLs), Fisheries Representatives (FRs), and Onboard Fisheries Liaisons (OFLs) to support offshore operations. A fisheries team organization matrix is provided as Figure 3, and contact details are provided in Section IV.a.

The FLs are employed by the Company and report directly to the Company's Lead for Fisheries Outreach Coordination. The FLs are responsible for the overall implementation of this FCP and facilitating communication with the fishing industry. The FLs facilitate the work of the FRs by serving as a knowledgeable point of contact to which the FRs can efficiently and effectively communicate. The FLs also seek to:

- develop relationships and direct lines of communication with individuals that are representative of potentially impacted fishing regions, industries, and communities;
- understand and convey current fishing industry concerns and feedback to the fisheries team to identify and work towards solutions;
- maintain existing working relationships with FRs, and identify and engage new FRs;

- identify potentially affected fisheries and develop communication methods and tools to create two-way communication channels;
- work with scientists, agencies, and fisheries stakeholders to develop monitoring plans for fish species and habitats of concern; and
- ensure work opportunities for the fishing industry.

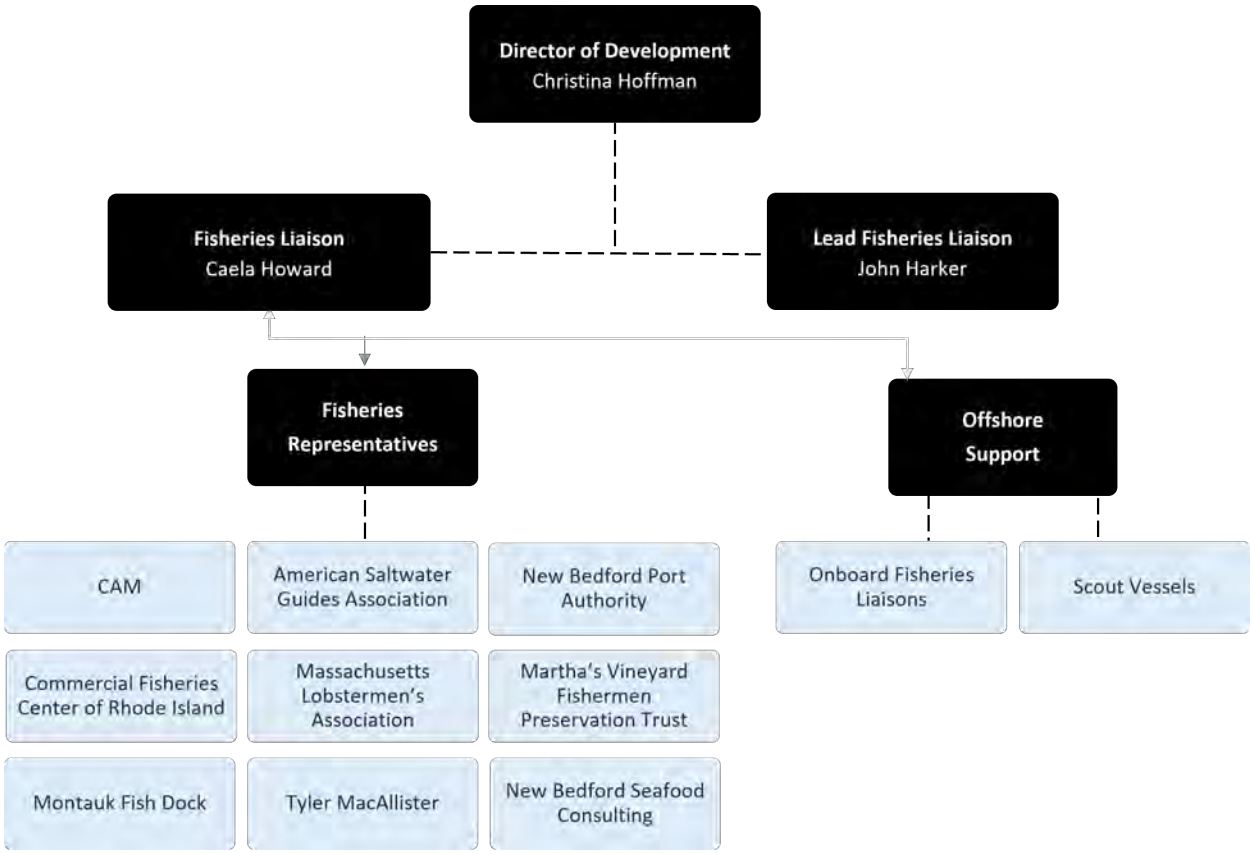
FRs do not work on behalf of the Company but represent a particular fishing community, organization, gear type, port, region, state, or sector(s). FRs are responsible for communicating fisheries concerns, issues, and other input to the Projects. Typically, the FR is an active recreational or commercial fisherman or group representing active fishermen within the region, fishery, state, or sector they represent. While FRs are compensated for their time and expenses by the Company, their duty is to the fishing region, industry, organization, gear-type, or sector they represent. FRs are solicited through a fair and equitable process by the Company to ensure these individuals or organizations adequately and appropriately represent their respective industry, gear type, port, or region and have the support of the fisheries stakeholders they represent.

The Projects' fisheries communications include engagement with FRs who represent a variety of gear types and homeports in Connecticut, Massachusetts, New York, and Rhode Island. Additional information about the FRs is provided in Appendix 1 and on our websites https://www.parkcitywind.com/fisheries and https://www.commonwealthwind.com/fisheries. The Company is committed to maintaining an effective network of FRs and is currently seeking additional FRs for the recreational community. If you are interested or have suggestions, please contact our FLs.

The FLs are further supported by offshore by fishing liaison consultants—referred to as Onboard Fisheries Liaisons (OFLs). OFLs are experienced fishermen employed to assist vessel captains with communication and document fishing gear encountered offshore to help avoid fishing vessel and gear interactions. OFLs serve an important function and are tasked with extending the role of the Projects' fisheries communications offshore so that there is effective communication onsite and in real-time. OFLs report to the FL and serve as their "eyes, ears, and voice" during offshore operations. The Projects contracted with fishermen who served as OFLs onboard survey vessels during the 2019, 2020, and 2021 survey seasons.

The Company also employs a Marine Operations Officer (MOO), also known as the Marine Operations Liaison Officer, who is responsible for safe marine operations and ensuring that the Company is a good neighbor while on the water. As such, there is frequent interaction, information exchange, and coordination between the MOO and the fisheries team.

Figure 3. Fisheries Team Organization Matrix



a. Contact Information

Contact information for the FLs and FRs is provided in Figure 4 below and posted on Park City Wind's and Commonwealth Wind's websites at https://www.parkcitywind.com/fisheries and https://www.commonwealthwind.com/fisheries, respectively. The FLs are available by phone, email, text, and through our website for ongoing communication. There is a specific form on our websites for fishermen to fill out their contact information and concerns. The form is sent directly to the FL's email, and a follow-up phone call and/or email is made shortly after receipt of the contact information.

Figure 4. FL and FR Contact Information

New England Wind Fisheries Liaisons and Fisheries Representatives Contact Information		
	John Harker, Lead Fisheries Liaison	Phone: 857-216-8611 Email: john.harker@avangrid.com
	Caela Howard, Fisheries Liaison	Phone: 508-386-9832 Email: caela.howard@avangrid.com
New Bedford Seafood Consulting	New Bedford Seafood Consulting	Contact: Jim Kendall Phone: 508-287-2010 - cell Email: nbsc@comcast.net
PORT OF NEW BEDFORD	New Bedford Port Authority	Contact: Justin Poulsen Email: justin.Poulsen@newbedford-ma.gov
	Massachusetts Lobster Association	Contact: Beth Casoni Phone: 781-545-6984 Email: beth.casoni@lobstermen.com
MARTHA'S VINEYARD FISHERMEN'S PRESERVATION TRUST	Martha's Vineyard Fisherman's Preservation Trust	Contact: Shelley Edmundson Phone: 508-687-0344 Email: mvfishermen@gmail.com
CAM	Coastal Asset Management LLC	Contact: Michael Theiler Phone: 860-235-5117 Email: mike@ss-na.com
COMMERCIAL FISHERIES CENTER OF RHODE ISLAND	Commercial Fisheries Center of Rhode Island (CFCRI)	Contact: Fred Mattera Phone: 401-741-4178 Email: fredmattera@cfcri.org
Montauk Fish Dock	Montauk Fish Dock	Contact: Paul Farnham Phone: 631 835 9355 Email: paulfarnham1@gmail.com
Tyler MacAllister	Tyler MacAllister	Phone: (508) 221-8991 Email: fvcynthiac@comcast.net
AMERICAN SALTWATER GUIDES ASSOCIATION	The American Saltwater Guides Association	Contact: Willy Goldsmith Phone: 617-763-3340 Email: willy@saltwaterguidesassociation.org

V. Fisheries Engagement

The Projects' fisheries team has met with hundreds of fisheries stakeholders in recent years, including fishermen from various gear types and sectors, fishing advocacy organizations, and local fisheries groups who are most likely to be affected by offshore wind development on the OCS. The Company employs a variety of outreach and engagement approaches to communicate and maintain relationships with fisheries stakeholders. These approaches include informal conversations with existing contacts, expanding the Company's network of FRs, attending fishing industry trade events and recreational fishing shows and tournaments, presenting at commercial and recreational fishing group meetings, and working with the various associations and organizations that represent fishing interests.

Various outreach methods and tools are used to disseminate relevant project information to commercial and recreational fishing stakeholders. These outreach methods and tools include, but are not limited to, the following:

- organizing bi-weekly meetings with FRs to share project information and discuss concerns and current issues facing the fishing industry;
- working with FRs to distribute flyers, charts, FAQs, and receive feedback from the fishing community and discuss other relevant information through their networks and communication channels;

- creating outreach materials for fishing communities to distribute at different events as well as local bait and tackle shops in the region;
- holding "port hours" with FLs from other offshore wind developers at ports including but not limited to New Bedford, Massachusetts, Narragansett, Rhode Island, Stonington, Connecticut, and Montauk, New York to provide information to fishing vessel crews who fish in or transit through the MA WEA;
- maintaining a website with information specifically for fishermen, including fisheries science information, charts, mariner updates of offshore vessel activity, and vessel Requests for Information (RFIs);
- maintaining a database of fishing vessels interested in offshore wind, survey vessel, and guard vessel work as identified through our vessel RFI;
- reaching out to local recreational fishing organizations and clubs;
- presenting project information and updates on fisheries science at recreational organization meetings;
- hosting tables at commercial marine expos and recreational fishing shows;
- engaging with recreational fishing tournaments and derby organizers, including sponsoring events;
- engaging with local recreational fishing experts and influencers with a high social media presence to increase project awareness;
- relying on word of mouth (i.e., reaching out to a fisherman at the request of another fisherman); and
- maintaining a two-way communication channel with an expanding network of fishermen through our open-door policy.

The Projects' fisheries team is also in regular contact with the relevant federal and state agencies on fisheries-related matters. We are a member of or active participant in the following technical working groups, advisory boards, councils, and commissions:

- Atlantic States Marine Fisheries Commission
- Connecticut Commission on Environmental Standards
- Massachusetts Fisheries Working Group on Offshore Wind Energy (FWG)
- Massachusetts Habitat Working Group on Offshore Wind Energy (HWG)
- Mid-Atlantic Fishery Management Council
- New England Fishery Management Council
- New York State Energy Research and Development's (NYSERDA's) Environmental Technical Working Group
- NYSERDA's Fisheries Technical Working Group (F-TWG)
- Project Advisory Committee for Automated Radio Telemetry at Offshore Wind Farms
- Regional Wildlife Science Entity (RWSE)
- Rhode Island Fisheries Advisory Board (FAB) meetings
- Responsible Offshore Science Alliance (ROSA)

The Company has used its membership and participation in these groups to provide project updates, better understand fisheries and fishermen concerns, build relationships, and collaborate on research and education.

Fisheries science is important to fisheries stakeholders, and our fisheries team is in regular contact with research institutions conducting fisheries research, such as UMass Dartmouth's School for Marine Science & Technology (SMAST) and the New England Aquarium, as well as fishermen supporting those research efforts. The FLs work with the FRs and scientists to identify fish species and habitats that have the potential to be impacted by offshore wind development. Research approaches have been developed to monitor species of concern and document potential changes in species abundance and distribution pre-/during/post-construction. The FLs are responsible for implementing and monitoring the effectiveness of this plan and updating it at least annually or as needed.

Finally, we understand that some fishermen do not feel adequately represented by fishing organizations, or FRs, and therefore prefer to share information and concerns individually and through different channels of communication. We recognize that individuals' concerns are just as important as group concerns and this FCP includes ongoing efforts to reach out to individual fishermen and respect requests for anonymity.

VI. Offshore Communication Protocols

a. Overview

Effective and efficient communication with fishermen is a high priority for the Company. It is important to ensure that fishermen are aware of our offshore activities and feel comfortable reaching out with questions and concerns. It is also important for vessel contractors to understand the fishing activities they may encounter and how to handle any interactions with the fishing fleet. The Company's communications protocols for offshore survey operations are outlined below and will be adjusted and adapted over time, as they continue to benefit from the Company's offshore experience and best practices. Similar protocols will be standardized and implemented for the Project's construction activities.

In the time leading up to offshore construction, the Projects will hold regular meetings with fishing groups that may be affected by offshore construction activities to review the construction timeline, what to expect during construction, and communication protocols. We will work with our FRs to help coordinate and invite fishermen to attend the meetings. Some of the small groups identified to date include squid vessels in Nantucket Sound, the conch fleet from Cape Cod and the Islands, state-permitted clam vessels, and the squid fleet from Point Judith.

Individuals and groups that want to stay updated on vessel activity and the Projects' offshore construction plans should visit our website and sign up for email and/or text alerts on the website.

b. Communication and Notification to Fishing Industry Prior to and During Offshore Survey Work

Our communication strategy, which incorporates recommendations from fishermen and adopts protocols used by the Massachusetts Division of Marine Fisheries (MA DMF) for their biannual inshore trawl survey, are as follows:

- Coordinate with the US Coast Guard (USCG) to issue Notices to Mariners.
- Send Offshore Wind Mariner Update Bulletins (OWMUs) with a survey vessel picture, survey vessel contact information, a chart showing the location and approximate duration of vessel activity, OFL contact information, a scout vessel picture, and scout vessel contact information to our fisheries email list and text alert system. Post OWMUs on our four main media channels—LinkedIn, Facebook, Twitter, and Instagram.

- Work with FRs to share information through their email lists and other media channels.
- Publicize activities through state agencies, fishing organization websites, fish houses, harbormasters, and newsletters (e.g., MA DMF, Rhode Island Department of Environmental Management, Massachusetts Lobstermen's Association [MLA], sector managers, National Oceanic and Atmospheric Association port agents, Fishing Support Services navigators, etc.).
- During offshore work, send out regular email/text updates detailing progress, both for work completed and upcoming work areas, to various parties (e.g., MA DMF, MLA, New Bedford Port Authority [NBPA], Martha's Vineyard Fishermen's Partnership Trust [MVFPT], etc.).
- Attend fisheries trade shows and outreach events to encourage fishermen to sign up for alerts that will inform them of the Projects' offshore activities.

c. Communication and Fisheries Protocols on Geological Survey Vessels

The Company contracts with local fishermen to serve as OFLs onboard survey vessels to assist vessel captains with communication and document fishing gear in the area to help avoid interactions. The OFL records observed fisheries activities, ensures vessel operations are compliant with this FCP and other fisheries-related policies, and seeks to avoid negative fisheries interactions by looking out for fixed gear and establishing communications (usually by very high frequency [VHF] radio) with fishing vessels when appropriate. If a negative fisheries interaction occurs, the OFL works with the FL and relevant FRs to quickly resolve the matter. Typically, OFLs with local fishing experience and knowledge are contracted for the duration of a vessel's operations.

Before the survey trip begins, the FL and OFL attend pre-trip meetings with the captain and crew to review the specifics of the fisheries active in the area. If the FL has known coordinates of fixed gear in the area, the information is shared with the vessel captain and OFL. The vessel captain and crew are instructed to communicate respectfully with fishermen and work around fishing gear to the greatest extent practicable.

The captain, crew chief, the Company's client representative, and OFL review and sign off on the communication and gear interaction protocols, which are outlined below, at the start of a survey campaign and whenever there is a new captain or party chief.

Communication Protocols for Survey Vessel Captains

- The OFL will have a VHF unit to monitor radio communications and will be able to communicate directly with fishermen if agreed upon with the vessel captain.
- If a fishing vessel is not responding to radio calls, the OFL will try to communicate with the fishing vessel. If the OFL is off watch, the crew will wake up the OFL if asleep to engage in communication if necessary.
- All communication between fishing vessels and the OFL, positive and negative, will be reported.
- The OFL will be alerted to all gear interactions at the time they occur, including waking up the OFL if necessary.
- The vessel captain will work around fishing gear to the greatest extent practicable.
- Fixed gear locations will be plotted while the OFL is off watch, and that information will be relayed to the OFL when back on watch.
- Agreed upon safety zones will be established and relayed to fishing vessels in the area.

- The OFL will have access to the wheelhouse to set up equipment if practicable.
- The OFL will be provided with a reliable internet connection.

Fixed Gear Interaction Protocols for Survey Vessels

The following outlines the Company's procedures in the event that an incident between a survey vessel and static fishing gear occurs. These procedures will be updated prior to the start of offshore construction activities for Park City Wind and Commonwealth Wind and will reflect any feedback and lessons learned during survey activities.

- For all incidents, the OFL will be immediately notified (wake up if off watch).
- For all incidents, the fishing gear interaction will be logged in both the daily vessel report spreadsheet and the Interaction Log. The time, location, photos, details of events, etc. will be recorded.
- If the fishing gear is entangled around survey equipment and is brought onboard, the OFL will determine if the fishing gear is actively engaged in fishing or if it is abandoned fishing gear (i.e., ghost gear).
- If the OFL determines that the fishing gear is actively engaged in fishing, and the line needs to be severed to release survey equipment, any severed gear will be kept on board.
- For active fishing gear where the line does not need to be severed, the gear will be returned to the water. Photos of the gear will be taken and the time and vessel position where the fishing gear is returned to the water will be recorded.
- If the OFL determines that the fishing gear is not actively engaged in fishing, the abandoned fishing gear will be kept on board the vessel and the position where it was retrieved will be recorded.
- All active severed fishing gear and ghost gear will be brought back to shore. If the owner can be identified, they will be notified, and the gear will be returned.
- For all incidents, vessel location and the time of any incident will be recorded.
- For all incidents, the buoy permit number and color will be logged as available.
- For all incidents, pictures of the gear will be taken.
- For all incidents, the FL on land will be notified of all gear interactions as soon as possible.

For the 2021 geological survey season, the Company hired local fishing vessels as scout vessels to plot where fixed gear is located and help survey vessels plan their survey operations so they avoid fixed gear. The scout vessels work in cooperation with OFLs to complete the communication cycle by working alongside and ahead of planned survey operations, reporting fishing activity back to the survey vessel, and helping to communicate with fishing vessels active in the area. This fishermen-based communication approach has resulted in successful coordination between the Projects' offshore survey efforts and local fishermen. We anticipate continuing this approach during the construction phase of the Project.

d. Safety Management System/Emergency Communication Protocols

An important objective of this FCP is to use fisheries communications to enhance the safety of all those who work on the ocean in a project area during development, construction, operations, and decommissioning. Our Safety Management System (SMS) will outline clear communication protocols and procedures for emergency events such as collision or allision of a vessel with a wind turbine structure, gear entanglement, damage to cables by fishing activity, catastrophic failure of a wind turbine, or another event.

Safety planning will be further elaborated in future updates of the FCP. The wind turbines, ESPs, and their foundations will be lit and marked in accordance with USCG, Federal Aviation Administration, and BOEM requirements, in order to promote navigational safety in and around Lease Area OCS-A 0534.

VII. Fishing Gear Interaction Reporting

The Company has adopted a standard gear loss/damage claims form that was developed through coordination with FRs, FLs, and other developers. This form, which has also been adopted by Equinor, Mayflower, and Vineyard Wind 1, is provided on our websites (https://www.parkcitywind.com/fisheries and https://www.commonwealthwind.com/fisheries) along with the contact information for other developers' FLs.

VIII. Fisheries Science Program

The Company recognizes the importance of and prioritizes collaborative science opportunities. Regionally focused collaborative research is the best approach to further understanding of the offshore environment and potential effects of offshore wind development. Collaboration and data sharing with environmental and fisheries stakeholders are also essential to build trust, identify priority research gaps, and address such gaps in a cost-effective manner. The Company is firmly committed to timely data sharing, transparent communication, and supporting independent and collaborative scientific research.

The Company currently maintains a robust fisheries science program to monitor fisheries and living marine resources within the Lease Area. As part of this program, the Company has worked with SMAST since 2017 to design and carry out fisheries monitoring plans that would capture potential fisheries impacts from offshore wind construction. Early on, we recognized the value of incorporating fishing community input into the planning stages of our research and data collection efforts. Towards that end, the Company tasked SMAST with hosting multiple interactive workshops with the fishing industry to identify priority areas for fisheries and ecological impact assessment.

Based on the input received from more than 75 commercial and recreational fishermen that attended these workshops as well as input from academics and government resource agencies, SMAST recommended a number of fisheries monitoring and research methods, which the Projects subsequently adopted to guide their fisheries monitoring plans. We have also worked with fishermen to ensure that we use fishing vessels to carry out our monitoring and research work.

The Projects also previously partnered with the New England Aquarium Anderson Cabot Center for Ocean Life to study highly migratory species presence across the MA WEA and Rhode Island/Massachusetts Wind Energy Area (RI/MA WEA), which was a direct request from recreational fishermen. The study involved a desktop compilation of conventional tagging data, large pelagic survey data, and input from the pelagic recreational fleet on fishing behavior in the WEAs through an online survey. The study determined that recreational effort for highly migratory species is widespread throughout southern New England, with the highest levels of recreational fishing activity occurring to the west of the MA WEA and RI/MA WEA. Results from that study are available at: https://www.parkcitywind.com/fisheries and https://www.commonwealthwind.com/fisheries.

a. Data Sharing

The survey and monitoring work that the Company has conducted or plans to conduct will continue to generate a substantial body of environmental, fisheries, and other data that will be made available in the public domain in a manner consistent with other academic research. Much of the data is publicly available through the federal and state permitting processes, as well as reports or academic publications that result from survey or monitoring work and is readily accessible to environmental and fisheries stakeholders.

We proactively publish our fisheries monitoring data and related research on our website. Several seasons of fisheries data collected from the project area are available at: https://www.parkcitywind.com/fisheries and https://www.commonwealthwind.com/fisheries. For all other environmental and fisheries data, including data collected during the construction and post-construction period, the Company will explore appropriate ways to store and make data publicly available and easy to access. Through ROSA and/or the RWSE, the Company will also work with fishermen, regulators, stakeholders, and other offshore wind developers to find ways to streamline and standardize available data across all lease areas to further support independent research and collaborative science.

X. Fishing Industry Initiatives

Aside from building relationships with the region's fishermen and fisheries stakeholders, one of the Company's key objectives is to support the fishing industry. This focus has resulted in the following recent efforts:

- COVID-19 testing and vaccinations: The Company participated in a consortium among the MA WEA and RI/MA WEA leaseholders to contribute funds to a Southcoast Health pilot program offering free COVID-19 testing directly at the Port of New Bedford.
- Seafood Distribution Program donations: The Company donated to the Commercial Fisheries Center of Rhode Island to support a program designed to provide benefits to households experiencing food insecurity and assist the fishing industry during the COVID-19 pandemic. The program purchases seafood directly from fishermen at or above market price and then donates the seafood to community organizations that provide it to families in need.
- Vessel Request for Information: The Company participated in an RFI in December 2020 to engage with vessel owners and fishing vessel crews who may be interested in offering services to the Projects. For additional information, please contact our FL (see Section IV).
- WATERFRONT App: The Company is working with Ithaca Clean Energy to help them develop a cellphone app that shows all of the Projects' offshore activities on an interactive map and provides a portal for fishing vessel crews and mariners to submit inquiries directly to the fisheries team. The goal is for the app to provide a single, consolidated location for fishing vessel crews and mariners to connect with and view information from all the MA WEA and RI/MA WEA leaseholders to help reduce email/text clutter and reduce uncertainty about which developer activities apply to that fishermen's operations.

Appendix 1 – Fisheries Representatives

Coastal Asset Management LLC

Coastal Asset Management LLC was founded by Connecticut-based fishermen to represent the interests and advocate on behalf of the Connecticut fishing community.

Commercial Fisheries Center of Rhode Island

The Commercial Fisheries Center of Rhode Island (CFCRI) is the home of the Ocean State's commercial fishing community. It was founded to preserve commercial fishing as a profession, culture, and way of life through promoting the sustainability of the resource. CFCRI believes in cultivating an environment of open communication and encouraging the sharing of knowledge about our ocean and its resources. In the pursuit of sustainable seas, CFCRI's approach is innovative, their lens is optimistic, and their goals are ambitious.

CFCRI's members believe in commercial fishing as a profession, a culture, and a way of life. CFCRI seeks to preserve the sanctity of the local fishing community, the solvency of small business, and the sustainability of the fishery resource. CFCRI serves as a headquarters to bring fishermen, scientists, managers, and elected officials together in a collaborative effort to improve local fisheries and understanding of the marine environment so that the proud heritage of our industry continues nobly through future generations.

Massachusetts Lobstermen's Association

The MLA is a member-driven organization that accepts and supports the interdependence of species conservation and the members' collective economic interests. It was established in 1963 by the fishermen, for the fishermen, and is presently one of the leading commercial fishing industry associations in New England. On behalf of the 1,800 members, the MLA works to maintain both the industry and the resource. It strives to be proactive on issues affecting the lobster industry and is active in the management process at both the state and federal levels. The MLA communicates with its members through a monthly newspaper, weekly email, Facebook, Twitter, and attendance at meetings. The MLA has become a trustworthy voice for the industry on important issues and is looked to by both the fishing industry and the management community.

The Martha's Vineyard Fishermen's Preservation Trust

The MVFPT is a Massachusetts 501(c)(3) non-profit corporation established in 2011 to: (i) preserve the historic fishing fleets, communities, and economies of Martha's Vineyard; (ii) protect the marine populations and fishing grounds off the coast of Martha's Vineyard and New England; and (iii) educate the community about its local fisheries.

The Montauk Fish Dock – Paul Farnham

The Montauk Fish Dock (Dock) is a commercial fish unloading packing and freight forwarding facility located in Montauk, New York. The Dock provides diesel fuel, ice, dockage, and fresh water. The Dock has been servicing the fishing fleet since 1988. Customer gear types are inshore and offshore draggers, inshore and offshore gillnetters, offshore bottom and surface longliners, inshore and offshore lobster, offshore sea scallop, and inshore and offshore rod and reel. The fleet consists of approximately 40 fishing vessels of which 20 vessels fish all year.

New Bedford Seafood Consulting – Jim Kendall

Mr. Kendall is the Executive Director of New Bedford Seafood Consulting. He is a former scallop fisherman with over 50 years of experience in the fishing industry and with fisheries issues. Mr. Kendall was a member of a research team for the Commercial Fisheries Research Foundation that focused on discard mortality rates of Southern New England flatfish. Mr. Kendall served as a New England Fishery Management Council member for numerous terms. He has also served on the Massachusetts Fisheries Recovery Commission, the New England Commercial Fishing Law Enforcement Working Group, and is a founding member of the Massachusetts Fishermen's Partnership. Mr. Kendall was featured in the book *A Doryman's Reflection: A Fisherman's Life*. Additionally, he has been interviewed on WBSM radio and by the New Bedford Standard Times, the Gloucester Times, and the Boston Globe on fisheries issues.

New Bedford Port Authority

The NBPA is the governing body for New Bedford's harbor and city-owned waterfront properties. It is chaired by the Mayor of New Bedford with six other members. The role of the NBPA is to support the Port of New Bedford by continually upgrading port resources, preserving its spot as the #1 U.S. fishing port, and expanding the New Bedford economy. The NBPA oversees all the commercial and recreational vessel activity within New Bedford city limits, incorporating the city's entire coastline and harbor.

The American Saltwater Guides Association – Tony Friedrich and Willy Goldsmith

The American Saltwater Guides Association (ASGA) is the organizing voice for members of the recreational fishing community who find greater value in having access to abundant fish stocks rather than simply maximizing harvest. Members include for-hire captains and guides, fishing-related small businesses, and private anglers from Maine to Florida who fish for a broad range of state- and federally-managed species.

Tyler MacAllister – Representing the commercial and recreational hand gear fishery for Highly Migratory Species

Tyler MacAllister currently participates in working groups for both commercially and recreationally targeted highly migratory species addressing current topics. These species include tunas, marlin, swordfish, and several species of sharks.

Attachment E

Sediment Dispersion Modeling

New England Wind

AVANGRID RENEWABLES

Construction and Operations Plan

Lease Area OCS-A 0534

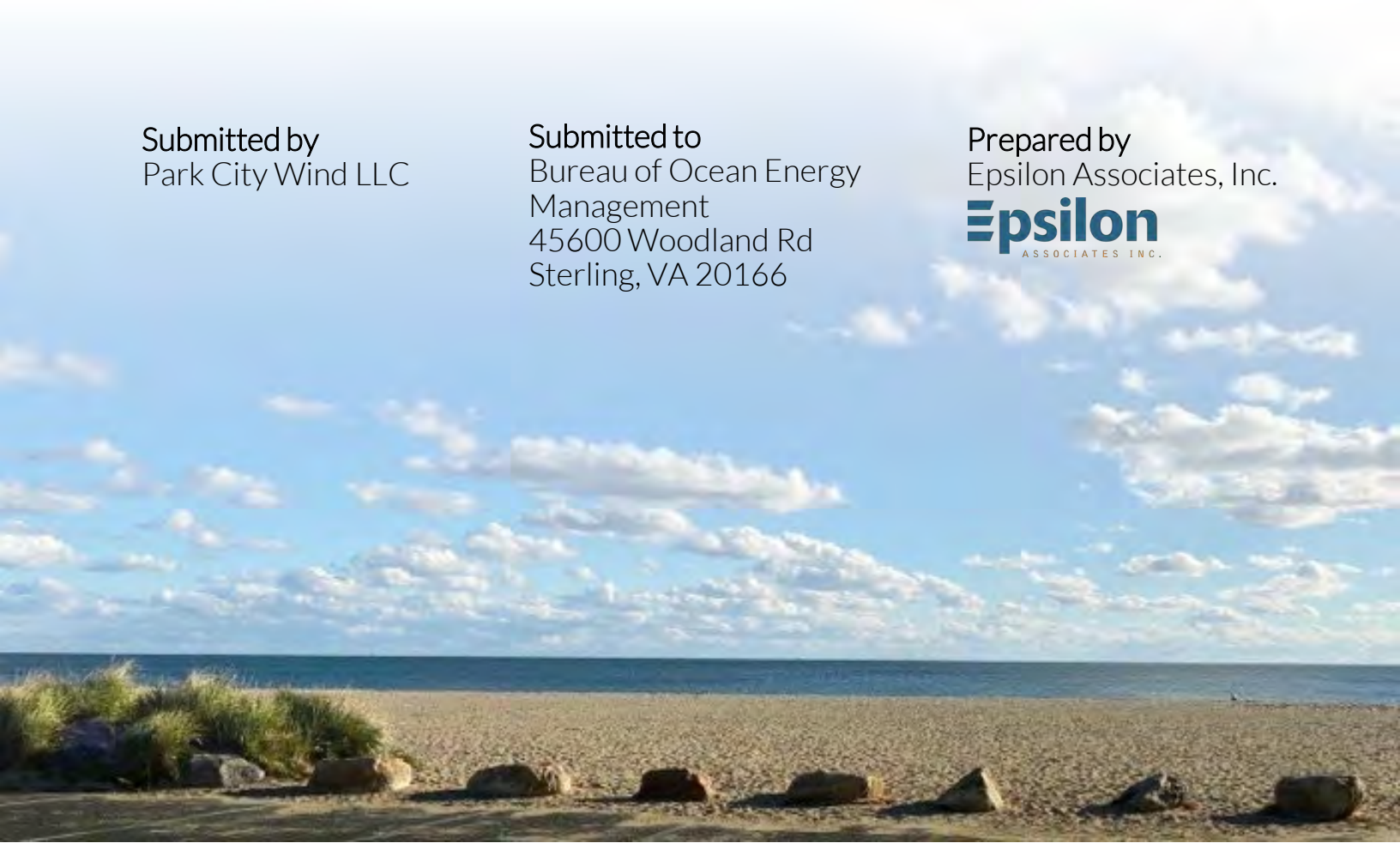
Volume III Appendices

June 2022

Submitted by
Park City Wind LLC

Submitted to
Bureau of Ocean Energy Management
45600 Woodland Rd
Sterling, VA 20166

Prepared by
Epsilon Associates, Inc.



New England Wind

AVANGRID RENEWABLES

New England Wind Construction and Operations Plan for Lease Area OCS-A 0534

Volume III Appendices

Submitted to:
BUREAU OF OCEAN ENERGY MANAGEMENT
45600 Woodland Rd
Sterling, VA 20166

Submitted by:
Park City Wind LLC

Prepared by:
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In Association with:

Baird & Associates
Biodiversity Research Institute
Capitol Air Space Group
Geo SubSea LLC
Geraldine Edens, P.A.
Gray & Pape
JASCO Applied Sciences
Public Archaeology Laboratory, Inc.
RPS
Saratoga Associates
SEARCH, Inc.
Wood Thilsted Partners Ltd

June 2022

On April 29, 2022, modifications were made to the Envelope that involved changing the maximum wind turbine generator (WTG) and electrical service platform (ESP) topside parameters for Phase 1 (Park City Wind) to match those of Phase 2 (Commonwealth Wind) (see Table 1). As a result of this change, the potential minimum footprint of Phase 1 decreased, and correspondingly the potential maximum footprint of Phase 2 increased (see Table 2). Additionally, the maximum capacity in megawatts for both phases was eliminated to accommodate the rapid advancement in commercially available wind turbine generator size and technology.

Table 1 Modifications to the Phase 1 WTG and ESP Parameters[1]

Maximum WTG Parameters	Previous Dimension	New Dimension[2]
Tip Height	319 m (1,047 ft)	357 (1,171 ft)
Top of the Nacelle Height	199 m (653 ft)	221 m (725 ft)
Hub Height	192 m (630 ft)	214 m (702 ft)
Rotor Diameter	255 m (837 ft)	285 m (935 ft)
Minimum Tip Clearance[3]	27 m (89 ft)	27 m (89 ft)
Blade Chord	8 m (26 ft)	9 m (30 ft)
Tower Diameter	9 m (30 ft)	10 m (33 ft)[4]
Maximum ESP Parameters	**Previous Dimension**	**New Dimension[2]**
Width	45 m (148 ft)	60 m (197 ft)
Length	70 m (230 ft)	100 m (328 ft)
Height	38 m (125 ft)	No change
Height of Topside (above MLLW[5])	70 m (230 ft)	No change

1. Maximum WTG dimensions are included in Table 3.2-1 and maximum ESP dimensions are included in Table 3.2-3 of COP Volume I
2. The new Phase 1 WTG and ESP maximum parameters were revised to match those of Phase 2
3. All parameters are maximum values except tip clearance, where the minimum tip clearance represents the maximum potential impact
4. To accommodate the slight increase in tower diameter, the maximum transition piece diameter/width for Phase 1 monopile foundations was also increased from 9 m (30 ft) to 10 m (33 ft) (see Table 3.2-2 of COP Volume I)
5. MLLW: Mean Lower Low Water

To accommodate the larger Phase 1 WTG dimensions and greater capacity range, the minimum footprint of Phase 1 decreased and the maximum footprint of Phase 2 increased, thus also adjusting the potential number of WTG/ESP positions within each Phase (see Table 2).

Table 2 Modifications to the Phase 1 and Phase 2 Layout and Size

		Previous Layout and Size	New Layout and Size
Phase 1	Number of WTGs	50-62	41-62
	Area	182-231 km^2 (44,973-57,081 acres)	150-231 km^2 (37,066-57,081 acres)
Phase 2	Number of WTGs	64-79	64-88
	Area	222-271 km^2 (54,857-66,966 acres)	222–303 km^2 (54,857–74,873 acres)

These revisions remain within the maximum design scenario considered for this report and the maximum potential impacts are still representative considering these modifications. Therefore, this report was not updated to reflect these minor modifications, as the findings are not affected.

The Proponent has also identified two variations of the Phase 2 Offshore Export Cable Corridor (OECC)— the Western Muskeget Variant and the South Coast Variant—in the event that technical, logistical, grid interconnection, or other unforeseen issues arise during the engineering and permitting processes that preclude one or more Phase 2 offshore export cables from being installed within all or a portion of the OECC (see Section 4.1.3 of COP Volume I). This Appendix considers the potential impacts associated with the Western Muskeget Variant; an assessment of the South Coast Variant in federal waters is provided separately in the COP Addendum.

FINAL TECHNICAL REPORT
SEDIMENT TRANSPORT MODELING

New England Wind Offshore Cable Installation

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Contents

EXECUTIVE SUMMARY ..... **vi**

1 INTRODUCTION **1**
1.1 Study Scope and Objectives 4

2 STUDY ENVIRONMENTAL DATA **1**
2.1 Shoreline Data 1
2.2 Bathymetry Data 2
2.3 Meteorological Observations 2
2.4 Sea Surface Height (Tides) Observations 3
2.5 Ocean Current Observations 2
2.6 Sediment Grain Size Distribution Data 2

3 HYDRODYNAMIC MODELING **3**
3.1 HYDROMAP Model Description 3
3.2 HYDROMAP Model Application 4
3.2.1 Model Grid 4
3.2.2 Model Boundary Conditions 3
3.2.3 Model Results 4

4 SEDIMENT MODELING **2**
4.1 SSFATE Model Description 2
4.1.1 Model Theory 2
4.1.2 General Description of SSFATE Model Set-Up 2
4.2 Study Model Application 2
4.2.1 Scenario Components: Routes 2
4.2.2 New England Wind Components: Construction Activities 8
4.2.3 Sediment Loading Vertical Initialization 2
4.2.4 Sediment Characteristics 2
4.3 Sediment Modeling Results 5
4.3.1 Inter-array Cable 6
4.3.2 OECC 11
4.3.3 Results Summary Tables 36
4.3.4 Results Discussion 43

5 REFERENCES **44**

List of Acronyms

BOEM	Bureau of Ocean Energy Management
COP	Construction and Operations Plan
ENC	Electronic Navigational Chart
ESP	Electrical Service Platform
GIS	Geographic Information System
NDBC	National Data Buoy Center
NOAA	National Oceanic and Atmospheric Administration
O&M	Operations and Maintenance
OECC	Offshore Export Cable Corridor
OSAMP	Ocean Special Area Management Plan
SSFATE	Suspended Sediment FATE
SWDA	Southern Wind Development Area
TSHD	Trailing Suction Hopper Dredge
TSS	Total Suspended Solids
WTG	Wind Turbine Generator

Tables

Table 1. Monthly Average Wind Speeds, 2006–2016 2
Table 2. Tidal Harmonic Constituents used as Hydrodynamic Model Boundary Forcing 3
Table 3. Amplitudes of Tidal Harmonic Constituents at Points in the Study Area....2
Table 4. Phases of Tidal Harmonic Constituents at Points in the Vicinity of the Study Area 2
Table 5. OSAMP Station Metrics and Current Observations 2
Table 6. Sediment Size Classes used in SSFATE 3
Table 7. Offshore Cable Routes Modeled and Assessed 3
Table 8. Route Length Modeled for Different Technologies and OECC Sections 2
Table 9. Approximate Dredging Lengths and Volumes for TSHD and Limited TSHD Pre-dredge 9
Table 10. Assumed Dredging Parameters 10
Table 11. Inter-array and Offshore Export Cable Installation Parameters 2
Table 12. Summary of Modeling Scenarios....2
Table 13. Vertical Distribution of Suspended Sediment Mass Associated with Dredging, Overflow, and Dredged Material Release 2
Table 14. Vertical Initial Distribution of Mass Associated with Cable Installation and Cable Installation Aided by Jetting and Vertical Injection 2
Table 15. Summary of Areas Over Above-Ambient TSS Threshold Concentrations for One Hour or Longer for Each Scenario[1,2] 37
Table 16. Summary of Areas Over Above-ambient TSS Threshold Concentrations for Two Hours or Longer for Each Scenario[1,2] 37
Table 17. Summary of Areas Over Above-ambient TSS Threshold Concentrations for Three Hours or Longer for Each Scenario[1,2] 38
Table 18. Summary of Areas Over Above-ambient TSS Threshold Concentrations for Four Hours or Longer for Each Scenario[1,2] 39
Table 19. Summary of Maximum Extent to the 10 mg/L TSS Contour from the Route Centerline for Each Scenario[1] 41

Table 20. Summary of Deposition Over Thresholds for Each Scenario[1] 42

Figures

Figure 1. Map of Study Area with Indicative Locations for New England Wind's Offshore Components 3
Figure 2. Locations of Environmental Data Sources 1
Figure 3. Wind Rose for 2006–2016 at NDBC BUZ3M Buzzards Bay Station 2
Figure 4. Hydrodynamic Model Grid 2
Figure 5. Model Grid Bathymetry Focused on the New England Wind Offshore Development Area 2
Figure 6. Tidal Boundary Forcing M2 Amplitude 3
Figure 7. Tidal Boundary Forcing M2 Phase[1] 4
Figure 8. Comparison of Model Predicted to Constructed Tidal Elevations from Station Harmonics at Stations within the Model Domain[1] 3
Figure 9. Comparison of observed (left) to modeled (right) currents at stations POS (top) and POF (bottom) presented as current roses from model verification period 4
Figure 10. Comparison of observed (left) to modeled (right) currents at stations MDF (top) and MDS (bottom) presented as current roses from model verification period 5
Figure 11. Qualitative comparison of observed (left) to modeled (right) currents at the metocean buoy location from a period within its deployment versus model predictions for the period used in the sediment transport modeling (detailed in Section 3.2.3.2) 6
Figure 12. Snapshot Showing Peak Flood Current[1] 1
Figure 13. Snapshot Showing Peak Ebb Current[1] 1
Figure 14. Representative Inter-array Cable Route 3
Figure 15. Representative OECC from the Northern Edge of Lease Area OCS-A 0501 to Phase 1 Landfall Sites 4
Figure 16. Representative Section of the OECC Located in Lease Area OCS-A 0501 5
Figure 17. Representative OECC Vertical Injector Route 6
Figure 18. Representative OECC Landfall Approach Route 7
Figure 19. Sediment Grain Size Distributions for the Upper 2 m (left) and Upper 3 m (right) of the Seabed in the SWDA 3
Figure 20. Sediment Grain size Distributions for OECC Scenarios[1] 4
Figure 21. Snapshot of Instantaneous TSS Concentrations[1] 7
Figure 22. Map of time-integrated maximum concentrations associated with a representative inter-array cable installation using typical (left) and maximum impact (right) cable burial parameters[1] 8
Figure 23. Map of duration of TSS ≥ 10 mg/L associated with a representative inter-array cable installation using typical (left) and maximum impact (right) cable burial parameters 9
Figure 24. Map of deposition thickness associated with a representative inter-array cable installation simulation using typical (left) and maximum impact (right) cable burial parameters 10
Figure 25. Snapshot of instantaneous TSS concentrations for a time step during simulation of TSHD dredging, overflow, and dredged material release operations for a representative cable route within the OECC[1] 13
Figure 26. Map of time-integrated maximum concentrations associated with TSHD dredging, overflow, and dredged material release operations for a representative cable route within the OECC[1] 14
Figure 27. Map of duration of TSS ≥ 10 mg/L associated with TSHD dredging, overflow, and dredged material release operations for a representative cable route within the OECC 15
Figure 28. Map of deposition thickness associated with TSHD dredging, overflow, and dredged material release operations for a representative cable route within the OECC 16
Figure 29. Map of time-integrated maximum concentrations associated with limited TSHD dredging, overflow, and dredged material release operations for a representative cable route within the OECC[1] 17

Figure 30. Map of duration of TSS ≥ 10 mg/L associated with limited TSHD dredging, overflow, and dredged material release operations for a representative cable route within the OECC.....18
Figure 31. Map of deposition thickness associated with limited TSHD dredging, overflow, and dredged material release operations for a representative cable route within the OECC.....19
Figure 32. Snapshot of instantaneous TSS concentrations for a time step during simulation of representative cable installation within the OECC[1].....20
Figure 33. Map of time-integrated maximum concentrations associated with representative cable installation within the OECC[1].....21
Figure 34. Map of duration of TSS ≥ 10 mg/L associated with representative cable installation within the OECC.....22
Figure 35. Map of deposition thickness associated with representative cable installation within the OECC.....23
Figure 36. Map of time-integrated maximum concentrations associated with cable installation aided by jetting for a representative cable route within the OECC[1].....24
Figure 37. Map of duration of TSS ≥ 10 mg/L associated with cable installation aided by jetting for a representative cable route within the OECC.....25
Figure 38. Map of deposition thickness associated with cable installation aided by jetting for a representative cable route within the OECC.....26
Figure 39. Map of time-integrated maximum concentrations associated with representative cable installation within the OECC in Lease Area OCS-A 0501[1].....27
Figure 40. Map of duration of TSS ≥ 10 mg/L associated with representative cable installation within the OECC in Lease Area OCS-A 0501.....28
Figure 41. Map of deposition thickness associated with representative cable installation within the OECC in Lease Area OCS-A 0501.....29
Figure 42. Map of time-integrated maximum concentrations associated with cable installation installed with a vertical injector for a representative section of the OECC[1].....30
Figure 43. Map of duration of TSS ≥ 10 mg/L associated with cable installation installed with a vertical injector for a representative section of the OECC.....31
Figure 44. Map of deposition thickness associated with cable installation installed with a vertical injector for a representative section of the OECC.....32
Figure 45. Map of time-integrated maximum concentrations associated with cable installation for a representative section of the OECC approaching the landfall site[1].....33
Figure 46. Map of duration of TSS ≥ 10 mg/L associated with cable installation for a representative section of the OECC approaching the landfall site.....34
Figure 47. Map of deposition thickness associated with cable installation for a representative section of the OECC approaching the landfall site.....35

Appendices

APPENDIX A

APPENDIX B

EXECUTIVE SUMMARY

New England Wind is the proposal to develop offshore renewable wind energy facilities in Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0534 along with associated offshore and onshore cabling, onshore substations, and onshore operations and maintenance (O&M) facilities. New England Wind will be developed in two Phases with a maximum of 130 wind turbine generator (WTG) and electrical service platform (ESP) positions. Four or five offshore export cables will transmit electricity from the Southern Wind Development Area (SWDA) to an onshore transmission system in the Town of Barnstable, Massachusetts. Park City Wind LLC, a wholly owned subsidiary of Avangrid Renewables, LLC, is the Proponent and will be responsible for the construction, operation, and decommissioning of New England Wind.

New England Wind's offshore renewable wind energy facilities are located immediately southwest of Vineyard Wind 1, which is located in Lease Area OCS-A 0501. New England Wind will occupy all of Lease Area OCS-A 0534 and potentially a portion of Lease Area OCS-A 0501 in the event that Vineyard Wind 1 does not develop "spare" or extra positions included in Lease Area OCS-A 0501 and Vineyard Wind 1 assigns those positions to Lease Area OCS-A 0534. For the purposes of the Construction and Operations Plan (COP), the SWDA is defined as all of Lease Area OCS-A 0534 and the southwest portion of Lease Area OCS-A 0501, as shown in Figure 1.1-1 of COP Volume I. The SWDA may be 411-453 square kilometers (km^2) (101,590-111,939 acres) in size depending upon the final footprint of Vineyard Wind 1. At this time, the Proponent does not intend to develop the two positions in the separate aliquots located along the northeastern boundary of Lease Area OCS-A 0501 as part of New England Wind. The SWDA (excluding the two separate aliquots that are closer to shore) is just over 32 kilometers (km) (20 miles [mi]) from the southwest corner of Martha's Vineyard and approximately 38 km (24 mi) from Nantucket.[1] The WTGs and ESPs in the SWDA will be oriented in an east-west, north-south grid pattern with one nautical mile (NM) (1.85 km) spacing between positions.

Each Phase of New England Wind will be developed and permitted using a Project Design Envelope (the "Envelope"). This allows the Proponent to properly define and bracket the characteristics of each Phase for the purposes of environmental review while maintaining a reasonable degree of flexibility with respect to the selection of key components, such as the WTGs, foundations, submarine cables, and ESPs. To assess potential impacts and benefits to various resources, a "maximum design scenario," or the design scenario with the maximum impacts anticipated for that resource, is established considering the Envelope parameters for each Phase that have the potential to cause the greatest effect. For some resources, the approach overestimates potential environmental impacts as the maximum design scenario is not the scenario the Proponent is likely to employ.

This appendix to the New England Wind COP documents the sediment dispersion modeling assessment of the sediment-disturbing offshore cable installation activities associated with the development of New England Wind. The cable installation methods may vary along the route depending on subsurface conditions; the installation methods are described in detail in the COP and the details of the assumed modeling parameters are documented within this report. Consistent with the Envelope, this study simulated multiple scenarios to capture the maximum design scenario and range of effects associated with the installation of inter-array cables in the SWDA and offshore export cables in the Offshore Export Cable Corridor (OECC), including dredging to clear sand waves and various cable installation methods.

Following is a brief overview of the terminology used to describe the methodologies modeled in this study:

- **Trailing Suction Hopper Dredge (TSHD):** Suction dredging through a drag arm near the seabed, overflow of sediment laden waters from a hopper and disposal of sediments from the hopper. In this report it refers to the methodology as applied to all sand wave sizes where dredging is needed.
- **Limited TSHD:** This method is the same as TSHD; the TSHD, however, is "Limited" in that it is only applied to larger (greater than 2 meters [m]) sand waves where dredging is needed.

[1] Within the SWDA, the closest WTG is approximately 34 km (21 mi) from Martha's Vineyard and 40 km (25 mi) from Nantucket.

- **Cable Installation:** Cable installation is accomplished by jetting techniques (e.g., jet plow, jet trenching, or similar) in areas where sand waves do not exist or have been cleared.
- **Cable Installation Aided by Jetting:** Cable installation is accomplished as described above; however, this method includes additional jetting by controlled flow excavation in areas of small sand waves.
- **Cable Installation using Vertical Injector:** Cable installation is achieved in areas with or without sand waves through the use of the vertical injector tool, which is a high-volume low-pressure water jetting tool that uses directed water jets to fluidize the seabed and lower the cable via the integral depressor to the bottom of the fluidized trench.

The scenarios that were modeled include a representative offshore export cable route for the full length of the OECC, a representative inter-array cable route within the SWDA, and representative sections of cable routes within the OECC. The scenarios include:

- Inter-array cable installation with typical burial installation parameters
- Inter-array cable installation with maximum impact burial installation parameters
- OECC sand wave clearing by TSHD
- OECC sand wave clearing by Limited TSHD
- OECC cable installation with typical burial installation parameters
- OECC cable installation aided by jetting with typical burial installation parameters
- OECC cable installation in the lease area with typical burial installation parameters
- OECC section of cable installation with vertical injector with typical burial installation parameters
- OECC section of cable installation along the landfall approach with typical burial installation parameters

The sediment dispersion modeling assessment was carried out through two interconnected modeling tasks:

1. Development of a three-dimensional hydrodynamic model application of a domain encompassing New England Wind activities using the HYDROMAP modeling system; and
2. Simulations of the suspended sediment fate and transport, including evaluation of seabed deposition and suspended sediment plumes, using the SSFATE (Suspended Sediment FATE) modeling system to simulate installation activities. Velocity fields developed using the HYDROMAP model are used as the primary forcing for SSFATE.

The modeling was performed to characterize the effects associated with the offshore cable installation activities. The effects were quantified in terms of the above-ambient total suspended solids (TSS) concentrations as well as seabed deposition of sediments suspended in the water column during cable installation activities, including sand wave dredging. Results are presented with respect to thresholds listed below.

- Water column concentrations thresholds: 10, 25, 50, 100, 200, and 650 milligrams per liter (mg/L)
- Water column exposure durations: 1, 2, 3, 4, 6, 12, and 24 hours
- Seabed deposition: 1, 5, 10, 20, 50, and 100 millimeters (mm)

Simulations of sand wave dredging using a TSHD and associated disposal activities along the OECC show that above-ambient TSS originating from the source is intermittent along the route, matching the intermittent need for dredging. Above-ambient TSS concentrations may be present throughout the entire water column since sediments are released at or near the water surface. Above-ambient TSS concentrations of 10 mg/L extend up to 16 and 8.5 km from the area of activity for the TSHD and limited TSHD model scenarios, respectively; however, these concentrations only persist for a matter of hours. Concentrations greater than 10 mg/L persist less than six hours for TSHD activities and less than four hours for limited TSHD activities.

Deposition greater than 1 mm associated with the TSHD drag arm is mainly constrained to within 150 m of the area of activity, whereas the same deposition thickness associated with overflow and dredged material release extends greater distances from the source, resulting in deposition mainly within 1 km but extending up to 2.3 km in isolated patches when subject to swift currents through Muskeget Channel. Due to the hopper disposal, which releases the entire hopper of sediment in one location, the TSHD scenarios result in areas with deposition of 100 mm or greater, which is substantially greater than the cable installation scenarios.

Simulations of several possible inter-array or offshore export cable installation methods using either typical installation parameters (for inter-array and offshore export cable installation) or maximum impact parameters (for inter-array cable installation only) predict a plume that is localized to the seabed. The plume may be located in the bottom approximate 6 m of the water column, which is typically a fraction of the water column; however, in shallow waters, the plume may occupy the entire water column. Simulations of cable installation found that above-ambient TSS greater than 10 mg/L and deposition over 1 mm stayed closer to the cable alignment as compared to the dredging footprints; this is due to the fact that sediments are introduced to the water column closer to the seabed. Above-ambient TSS concentrations greater than 10 mg/L typically stayed within 200 m of the alignment, though did extend up to a maximum distance of approximately 2.1 km for typical installation parameters and up to 2.2 km for maximum impact installation parameters (for inter-array cable installation only). The extent of above-ambient TSS concentrations decreases at higher concentration thresholds. Above-ambient TSS concentrations stemming from cable installation for the various model scenarios remain relatively close to the cable alignment, are constrained to the bottom of the water column, and are short-lived. Above-ambient TSS concentrations substantially dissipate within one to two hours and fully dissipate in less than four hours for most of the model scenarios. For the vertical injector model scenario, above-ambient TSS concentrations similarly substantially dissipated within one to two hours but required up to six hours to fully dissipate, likely due to the relatively slower installation rate and deeper trench (greater volume disturbed per unit length). Deposition greater than 1 mm was limited to within 100 m of the cable alignment for typical installation parameters and to within less than 150 m of the cable alignment for maximum impact installation parameters (for inter-array cable installation only). The maximum deposition associated with inter-array or offshore export cable installation was typically less than 5 mm, though there was a small isolated area associated with the vertical injector model scenario with deposition between 5-10 mm. The results of the extent and persistence of the plume and the extent and thickness of deposition for inter-array or offshore export cable installation scenarios are generally similar regardless of the route location (SWDA versus OECC).

1 INTRODUCTION

New England Wind is the proposal to develop offshore renewable wind energy facilities in Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0534 along with associated offshore and onshore cabling, onshore substations, and onshore operations and maintenance (O&M) facilities. New England Wind will be developed in two Phases with a maximum of 130 wind turbine generator (WTG) and electrical service platform (ESP) positions. Four or five offshore export cables will transmit electricity generated by WTGs to onshore transmission systems in the Town of Barnstable, Massachusetts. Park City Wind LLC, a wholly owned subsidiary of Avangrid Renewables, LLC, is the Proponent and will be responsible for the construction, operation, and decommissioning of New England Wind.

New England Wind's offshore renewable wind energy facilities are located immediately southwest of Vineyard Wind 1, which is located in Lease Area OCS-A 0501. New England Wind will occupy all of Lease Area OCS-A 0534 and potentially a portion of Lease Area OCS-A 0501 in the event that Vineyard Wind 1 does not develop "spare" or extra positions included in Lease Area OCS-A 0501 and Vineyard Wind 1 assigns those positions to Lease Area OCS-A 0534. For the purposes of the Construction and Operations Plan (COP), the SWDA is defined as all of Lease Area OCS-A 0534 and the southwest portion of Lease Area OCS-A 0501, as shown in Figure 1.1-1 of COP Volume I. The SWDA may be 411-453 square kilometers (km^2) (101,590-111,939 acres) in size depending upon the final footprint of Vineyard Wind 1. At this time, the Proponent does not intend to develop the two positions in the separate aliquots located along the northeastern boundary of Lease Area OCS-A 0501 as part of New England Wind. The SWDA (excluding the two separate aliquots that are closer to shore) is just over 32 kilometers (km) (20 miles [mi]) from the southwest corner of Martha's Vineyard and approximately 38 km (24 mi) from Nantucket.[2] The WTGs and ESPs in the SWDA will be oriented in an east-west, north-south grid pattern with one nautical mile (NM) (1.85 km) spacing between positions.

Each Phase of New England Wind will be developed and permitted using a Project Design Envelope (the "Envelope"). This allows the Proponent to properly define and bracket the characteristics of each Phase for the purposes of environmental review while maintaining a reasonable degree of flexibility with respect to the selection of key components, such as the WTGs, foundations, offshore cables, and ESPs. To assess potential impacts and benefits to various resources, a "maximum design scenario," or the design scenario with the maximum impacts anticipated for that resource, is established considering the Envelope parameters for each Phase that have the potential to cause the greatest effect. For some resources, the approach overestimates potential environmental impacts as the maximum design scenario is not the scenario the Proponent is likely to employ.

Four or five offshore export cables-two for Phase 1, also known as Park City Wind, and two or three for Phase 2, also known as Commonwealth Wind-will transmit electricity from the SWDA to shore (See Figure 1). Unless technical, logistical, grid interconnection, or other unforeseen issues arise, all New England Wind offshore export cables will be installed within a shared Offshore Export Cable Corridor (OECC) that will travel from the northwestern corner of the SWDA along the northwestern edge of Lease Area OCS-A 0501 (through Vineyard Wind 1) and then head northward along the eastern side of Muskeget Channel toward landfall sites in the Town of Barnstable. At approximately 2 - 3 km from shore, the OECC will diverge for each Phase towards their landfall sites. The OECC for New England Wind is largely the same OECC proposed in the approved Vineyard Wind 1 COP, but it has been widened to the west along the entire corridor and to the east in portions of Muskeget Channel.

While the Proponent intends to install all New England Wind offshore export cables within the OECC that travels from the SWDA northward through the eastern side of Muskeget Channel towards landfall sites in the Town of Barnstable, the Proponent is reserving the fallback option to install one or two Phase 2 cables along

[2] Within the SWDA, the closest WTG is approximately 34 km (21 mi) from Martha's Vineyard and 40 km (25 mi) from Nantucket.

the western side of Muskeget Channel, referred to as the Phase 2 OECC Western Muskeget Variant[3] (see Section 4.1.3.2 of COP Volume I). The sediment transport modeling results for the Western Muskeget Variant to the Covell's Beach Landfall Site are summarized in Appendix B of this document.

This appendix to the New England Wind COP documents the sediment dispersion modeling assessment of the sediment-disturbing offshore cable installation activities associated with the development of New England Wind. The cable installation methods may vary along the route depending on subsurface conditions; the installation methods are described in detail in the COP and the details of the assumed modeling parameters are documented within this report. Consistent with the Envelope, this study has been designed to simulate physical impacts from installation of a representative inter-array cable, a representative offshore export cable within the OECC from the northern edge of Lease Area OCS-A 0501 to the landfall site, and a representative offshore export cable within the portion of the OECC that occurs within Lease Area OCS-A 0501. In addition, the study included sensitivity simulations including installation of the representative inter-array cable, a representative section of the OECC with sand waves, and a representative section of the OECC local to the nearshore landfall site. An illustration of the location of New England Wind and relevant study components is presented in Figure 1.

[3] The Western Muskeget Variant is the same exact corridor as the western Muskeget option included in the Vineyard Wind 1 COP and has already been thoroughly reviewed and approved by BOEM as part of that COP.

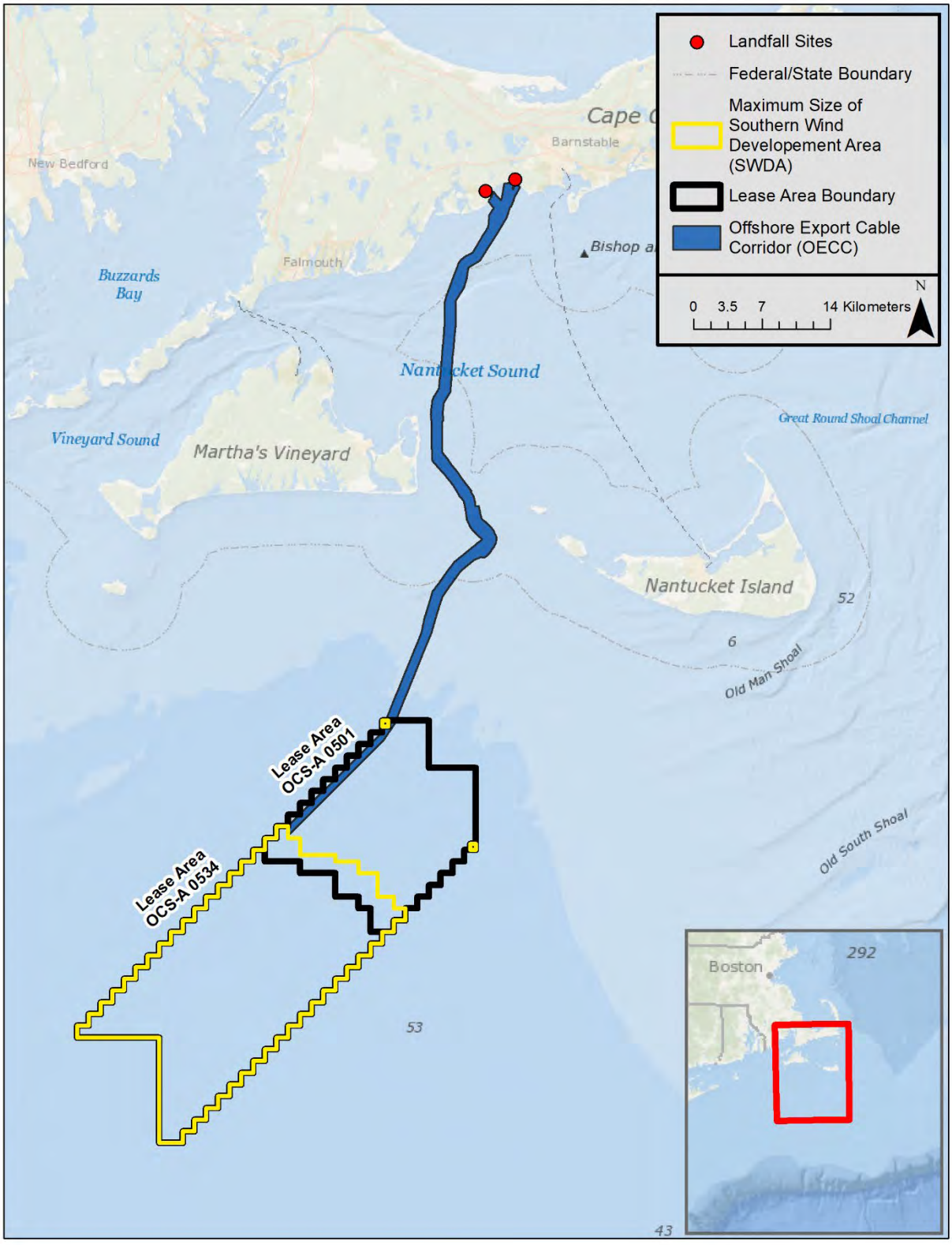

Figure 1. Map of Study Area with Indicative Locations for New England Wind's Offshore Components

1.1 Study Scope and Objectives

RPS applied customized hydrodynamic and sediment transport and dispersion models to assess potential effects from sediment suspension during cable installation activities. This approach is consistent to the modeling approach used for Vineyard Wind 1 and many similar studies that have been accepted by state and federal regulatory agencies for pipeline and cable installation (including the Block Island Wind Farm) as well as harbor dredging and land reclamation activities. Specifically, the analysis includes two interconnected modeling tasks:

1. Development of a three-dimensional hydrodynamic model application of a domain encompassing New England Wind activities using the HYDROMAP modeling system; and
2. Simulations of the suspended sediment fate and transport (including evaluation of seabed deposition and suspended sediment plumes) using the SSFATE modeling system to simulate installation activities. Velocity fields developed using the HYDROMAP model are used as the primary forcing for SSFATE.

This study assessed multiple scenarios representing the range of activities associated with New England Wind cable installation. While it is proposed that four or five cables will be installed within the OECC—two cables for Phase 1 and two or three cables for Phase 2—each cable will be installed in a separate trench; therefore, the simulations run were for a single representative cable. Also, since both Vineyard Wind 1 and New England Wind will share substantially the same OECC and will utilize similar cable installation technologies, the model results presented in this report are the same as those presented for the “Eastern Muskeget to Covell’s Beach” in the report for the Vineyard Wind 1 COP. This study provides new additional simulations including those associated with a representative portion of the OECC in the Lease Area, a representative New England Wind Phase 1 inter-array cable installation, a section of the OECC simulated with cable burial parameters associated with the use of a vertical injector, and a section of the OECC of the landfall approach that extends closer to shore.

This study was carried out to characterize the effects associated with the offshore cable installation activities. The effects were quantified in terms of the above-ambient TSS concentrations as well as seabed deposition of sediments suspended in the water column during cable installation activities (including sand wave dredging). Results are presented with respect to thresholds listed below, which were selected either because they are thresholds of biological significance or because they provide an effective means of demonstrating the physical effects. Thresholds associated with biological significance are documented in Sections 6.5 and 6.6 of the COP Volume III, which are the finfish and invertebrate and benthic sections, respectively.

- Water column concentrations thresholds: 10, 25, 50, 100, 200, and 650 mg/L
- Water column exposure durations: 1, 2, 3, 4, 6, 12, and 24 hours
- Seabed deposition: 1, 5, 10, 20, 50, and 100 mm

This report describes the models, modeling approach, inputs, and outputs used to assess cable installation activities. A description of environmental data sources used is provided in Section 2. The HYDROMAP hydrodynamic model and its application to the study area are presented in Section 3. Section 4 provides an overview of the SSFATE sediment dispersion model and results from the application of SSFATE for range of scenarios. References are provided in Section 5.

2 STUDY ENVIRONMENTAL DATA

This study for New England Wind used environmental data gathered from public sources or through the OECC survey work completed as part of Vineyard Wind 1. By the end of 2019, more than 4,272 km (2,307 NM) of geophysical trackline data, 123 vibracores, 83 cone penetrometer tests (CPTs), 82 benthic grab samples with still photographs, and 50 underwater video transects were gathered to support the characterization of the OECC. Gathered environmental data were used to develop modeling inputs or for hydrodynamic model validation. An overview of the data types and sources is provided below while more detailed discussions of the data are presented in the hydrodynamic and sediment transport modeling sections. A map illustrating the locations of the discrete data sources is presented in Figure 2.

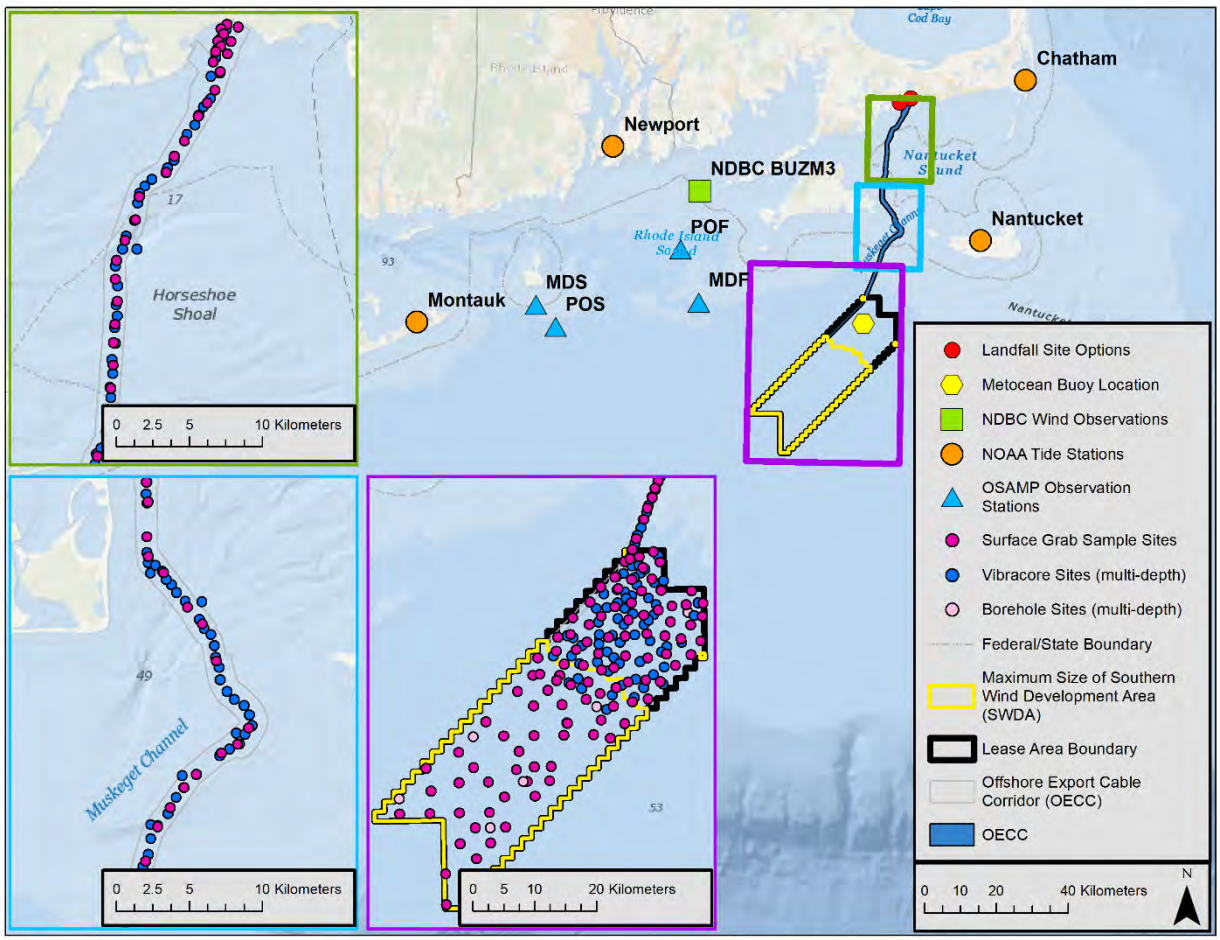

Figure 2. Locations of Environmental Data Sources

2.1 Shoreline Data

New England Wind footprint; the extent was chosen to best locate and define open boundary conditions. The shoreline for the domain was developed based on merging shoreline data from Massachusetts, Rhode Island, Connecticut, and New York, which was obtained from their respective Geographic Information System (GIS) clearinghouses per the links below. Each shoreline was projected from its native state plane

coordinate system to the geographic coordinate system GCS_WGS_1984, which is the coordinate system used in the hydrodynamic and sediment transport modeling systems.

- Massachusetts: https://www.mass.gov/get-massgis-data
- Rhode Island: http://www.rigis.org/
- Connecticut: http://www.ct.gov/deep/gisdata/ (superseded by https://portal.ct.gov/DEEP/GIS-and-Maps/)
- New York: http://gis.ny.gov/gisdata/inventories/details.cfm?DSID=927

The shoreline data were used as a guide for developing the hydrodynamic model grid and to develop the land/water boundaries in the concentration and deposition grid used in the sediment transport modeling.

2.2 Bathymetry Data

Bathymetric data were gathered both from National Oceanic and Atmospheric Administration (NOAA) datasets for coastal and offshore waters as well as from detailed marine surveys that were performed in the New England Wind area. NOAA soundings were downloaded from the NOAA ENC (Electronic Navigational Chart) Direct to GIS portal (https://encdirect.noaa.gov/), where data were obtained for the harbor, coastal, and approach Electronic Navigational Chart band levels. Soundings were available from their native positioning, which is irregular in spacing. In addition, detailed marine surveys of the OECC and SWDA were performed to provide high-resolution bathymetric data at a 0.5-m resolution. These data were interpolated to create a grid at a 50-m resolution from which grid centroids were then merged with the NOAA data for a complete dataset of the study area waters. The combined bathymetric dataset was used to develop depths for the hydrodynamic model grid as well as the depth grid used for sediment transport modeling.

2.3 Meteorological Observations

Meteorological (i.e., wind) data used as inputs to the hydrodynamic model were obtained from the National Data Buoy Center (NDBC) BUZ3M Buzzards Bay station, the location of which is shown on Figure 2. Wind speed and direction at this location were obtained from an anemometer located approximately 24.8 m above mean sea level, where measurements were recorded hourly. The currents are dominated by the tides which repeat periodically, and therefore wind speed does not have a major influence on the currents, particularly near the seabed. While any time period would capture the variability of tidal currents, the month of March was selected to run the model since construction in early spring may be possible and the average wind speeds in March are broadly representative of the wind conditions at the site.

Monthly average wind speeds from 2006 to 2016 are presented in Table 1 along with annual averages; a wind rose of the same period is provided in Figure 3. While the monthly average wind speed ranged from 3.83 to 10.29 meters per second (m/s), it stayed primarily between 5.78 and 9.38 m/s (5^{th} and 95^{th} percentile, respectively). The average annual speed was 7.6 m/s, and the average wind speed for the month of March was 8.10 m/s which is also close to the average annual windspeed. Reviewing the monthly averages throughout the record, March 2016 was identified as having a monthly average (8.14 m/s) close to the record March average monthly windspeed and close to the average annual wind speed.

Table 1. Monthly Average Wind Speeds, 2006–2016

Timeframe	Monthly Average Wind Speed (m/s)											Average
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Jan	9.13	7.19	8.86	8.68	8.63	7.84	9.15	8.61	9.40	10.05	9.59	8.83
Feb	9.84	7.30	8.50	8.87	8.80	8.93	7.88	9.11	8.30	9.33	9.37	8.75
Mar	7.94	7.25	8.67	7.68	8.72	8.32	7.77	8.54	8.23	7.87	8.14	8.10
Apr	7.62	8.02	6.78	8.19	6.56	8.02	7.29	7.59	7.63	7.64	7.89	7.57
May	7.75	6.83	7.83	6.87	6.89	6.84	5.99	6.81	7.03	6.73	7.01	6.96
Jun	7.35	7.29	5.92	5.95	6.27	5.84	6.79	7.24	5.96	6.66	6.20	6.50
Jul	6.94	5.90	5.79	6.22	5.65	5.97	3.83	6.50	6.78	5.78	6.15	5.96
Aug	5.80	5.78	5.04	5.72	6.54	6.24	5.27	5.84	5.40	5.82	6.14	5.78
Sep	6.81	6.63	6.53	6.79	7.65	6.54	6.58	6.55	6.34	6.34	7.13	6.72
Oct	9.36	7.62	8.14	8.64	9.59	8.16	7.82	6.99	8.66	9.09	8.00	8.37
Nov	7.46	9.09	8.24	8.67	9.04	8.45	8.79	9.21	9.30	8.10	8.43	8.62
Dec	8.78	8.90	10.07	10.29	10.17	7.96	8.65	8.35	8.63	8.12	9.13	9.00
Annual	7.90	7.32	7.53	7.71	7.88	7.43	7.15	7.61	7.64	7.63	7.76	**7.60**

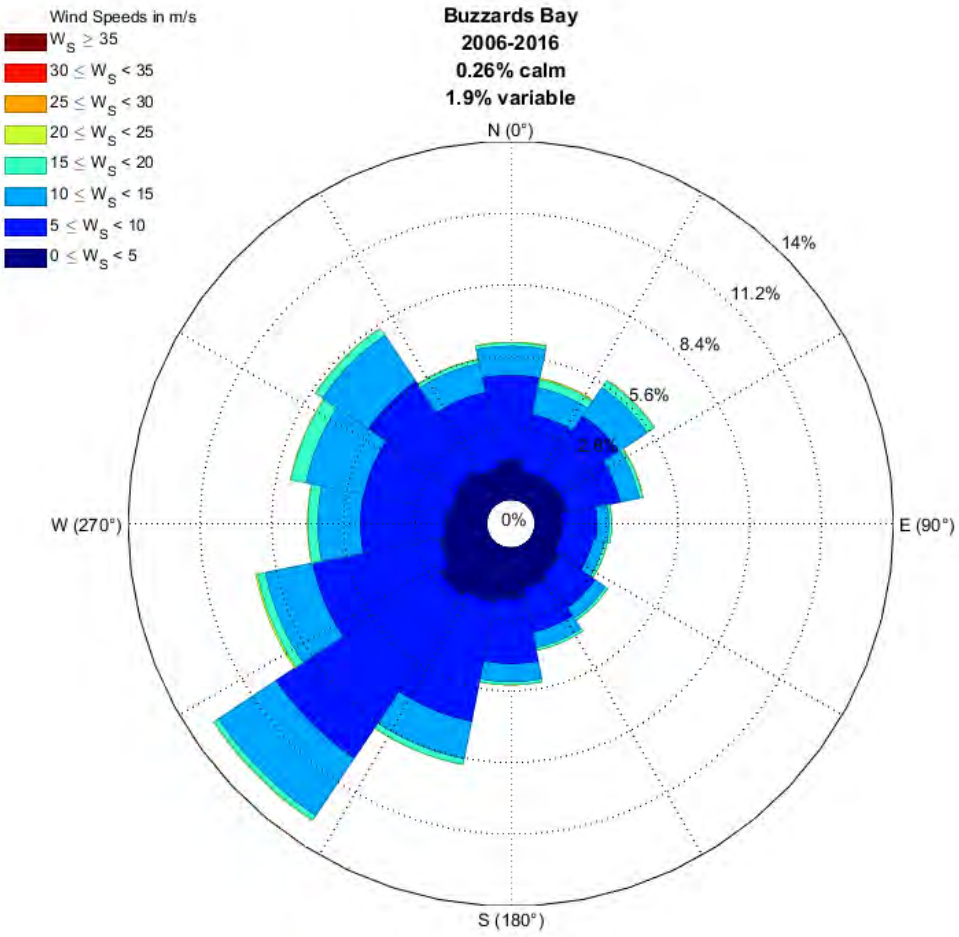

Figure 3. Wind Rose for 2006–2016 at NDBC BUZ3M Buzzards Bay Station

2.4 Sea Surface Height (Tides) Observations

Sea surface height characteristics were used to develop model forcing and verify hydrodynamic model predictions. Four data sources were used for this study, with data available either as time histories of observed water surface elevations or in the form of tidal harmonic constituents from a global model. Tidal harmonic constituents are the amplitude and phase of known periodic constituents of the tidal signal, where the tidal signal is the sum of all constituents added together by superposition. The amplitude describes the difference between a mean sea level datum and the peak water level for a constituent, and the phase describes the timing of the signal relative to a time datum. The constituent period determines the time for one full oscillation of the signal. The names of tidal harmonic constituents indicate the approximate period (e.g., M2 is twice daily and O1 is once daily).

The publicly available output from the TPXO7 global tidal model developed by Oregon State University was used to characterize the tides in the hydrodynamic model boundary forcing. This model output contains tidal harmonic constituent data on a one-quarter degree resolution across the globe. The model was based on data from the TOPEX/Poseidon and Jason satellites and the model methodology is documented in Egbert et al. (1994) and Egbert and Erofeeva (2002). The constituents obtained and their periods are provided in Table 2. Details on the spatially-varying amplitude and phase used to force the hydrodynamic model are provided in Section 3.2.2.

Table 2. Tidal Harmonic Constituents used as Hydrodynamic Model Boundary Forcing

Name	Constituent	Speed (degrees/hour)	Period (hours)
M2	Principal lunar semidiurnal constituent	28.98	12.42
S2	Principal solar semidiurnal constituent	30.00	12.00
N2	Larger lunar elliptic semidiurnal constituent	28.44	12.66
K1	Lunar diurnal constituent	15.04	23.93
O1	Lunar diurnal constituent	13.94	25.82

Observation-based tidal harmonic data were obtained from NOAA Tides and Currents for stations within the study area (see Figure 2). NOAA-published amplitudes and phases for M2, N2, S2, K1, and O1 constituents are provided in Table 3 and Table 4, respectively. These constituents were used to develop time histories of sea surface height at each location for different periods of time using the publicly available T_Tide Matlab Toolbox with methodologies of the toolbox described in Pawlowicsz et al. (2002). These time histories were used to validate model predictions.

Time histories of observational water column data (pressure) and published harmonic constituents from Grilli et al. (2010) characterizing the tides at two of the Rhode Island Ocean Special Area Management Plan (OSAMP) offshore buoys (POF and POS) were used in this study. Locations of the buoys are shown in Figure 2; note that the OSAMP had four buoys, but only two collected pressure which was converted to water depth to capture the tides. Data were available from October 2009 through June 2010 at a two-hour time step. Amplitudes and phases for the M2, N2, S2, K1, and O1 constituents at the OSAMP stations are provided in Table 3 and Table 4, respectively.

Table 3. Amplitudes of Tidal Harmonic Constituents at Points in the Study Area

Summary of Harmonic Constituent Amplitude (m)						
Location	**Source**	**M2**	**S2**	**N2**	**K1**	**O1**
Sandy Point	NOAA	0.688	0.134	0.158	0.103	0.054
Montauk	NOAA	0.302	0.065	0.079	0.074	0.054
Newport	NOAA	0.505	0.108	0.124	0.062	0.047
Nantucket	NOAA	0.439	0.047	0.113	0.092	0.084
Chatham	NOAA	0.713	0.089	0.139	0.103	0.088
POS	Grilli et al.	0.443	0.095	0.104	0.073	0.022
POF	Grilli et al.	0.452	0.098	0.111	0.068	0.034

Table 4. Phases of Tidal Harmonic Constituents at Points in the Vicinity of the Study Area

Summary of Harmonic Constituent Phase (degrees)						
Location	**Source**	**M2**	**S2**	**N2**	**K1**	**O1**
Sandy Point	NOAA	6.0	32.6	348.6	175.7	172.5
Montauk	NOAA	46.8	56.6	22.2	178.7	209.8
Newport	NOAA	2.3	25.0	345.8	166.1	202.0
Nantucket	NOAA	134.7	166.7	102.5	221.6	215.9
Chatham	NOAA	140.0	182.1	108.5	237.6	223.4
POS	Grilli et al.	3.9	18.7	350.5	166.8	16.3
POF	Grilli et al.	0.9	18.2	344.7	167.2	7.4

2.5 Ocean Current Observations

This study used observations of ocean currents from two different programs: the OSAMP and a field program carried out by the Proponent. Observations of currents were obtained from four OSAMP stations (MDF, MDS, POF, POS) (See Figure 2). At each station, currents were obtained at multiple depths through the water column through a number of different vertical bins. A summary of metrics for each station is provided in Table 5. The current observations were used to verify model predictions directly through comparison of the observed data to model predictions for times within the OSAMP deployment period.

Table 5. OSAMP Station Metrics and Current Observations

Source	Station Name	Time Step (hr)	Start Day Obtained	End Day Obtained	Bin Resolution (m)
OSAMP	POS	2	9/15/2009	1/15/2010	0.75
OSAMP	POF	2	9/15/2009	1/15/2010	0.75
OSAMP	MDF	1	10/9/2009	6/10/2010	1
OSAMP	MDS	1	10/9/2009	5/21/2010	1

Additionally, a metocean buoy was deployed within Lease Area OCS-A 0501 at the location shown in Figure 2. The buoy has been collecting metocean data, including observed current speeds and directions, since May 2018 at multiple ‘bins’ in the water column to provide observations of the currents as a function of depth. A

record of some of the observed data was provided to RPS to be used for a qualitative comparison of the model predications at the buoy location. The comparison was qualitative in the sense that it was not based on model predictions from the deployment period but rather a general comparison of the observed characteristics versus the model predicted characteristics.

2.6 Sediment Grain Size Distribution Data

This study utilized sediment data from multiple field campaigns focused on the SWDA and the OECC. Sample sites and detailed grain size results are documented in Volume II of the COP. These field campaigns produced a combination of grab samples, vibracores, and borehole samples. The samples underwent varying degrees of analysis including sieve analysis, hydrometer analysis, and moisture testing. The sample locations sites used in this study are shown in Figure 2. Detailed information about samples, as they were used to develop inputs to the sediment transport model, is provided in Section 4.

3 HYDRODYNAMIC MODELING

The first modeling task was the development, validation, and application of a three-dimensional hydrodynamic model application of a domain that included all New England Wind activities. RPS' HYDROMAP hydrodynamic model was used to model the circulation pattern and water volume flux through the study area and to provide hydrodynamic conditions (spatially and temporally varying currents) for input to the sediment dispersion model. The hydrodynamic modeling task included gathering and analyzing environmental data, developing a hydrodynamic model grid and boundary conditions, validating model performance for a period with observations, and developing currents for a timeframe characterized by typical wind conditions to be used in sediment transport simulations.

Circulation (currents) in the study area is tidally dominated (Spaulding & Gordon 1982), with wind and density variations playing a smaller role. Tidal currents in the study area are a combination of rectilinear reversing currents and rotary currents (Haight 1936) and are predominately semidiurnal (two nearly equal high tides and low tides every day) and diurnal (one high and one low tide every lunar day). Notably strong tidal currents (peaks greater than 1.5 m/s) exist in the area surrounding Muskeget Channel, which is located between the islands of Nantucket and Martha's Vineyard, with Nantucket Sound to the north and the Atlantic Ocean to the south (NOAA 2017).

Tidal currents are present throughout the water column, and their predominance is clear when evaluating observed current data, particularly near the seafloor. Depending on wind speed and water depth, wind can also influence surface currents and, at times, bottom currents, and therefore plays a minor role in sediment transport through most of the study area. Therefore, since tidal currents exhibit cyclical, repeating patterns and are not characterized by season, wind was chosen as the metric for identifying an environmental timeframe for use in sediment transport and dispersion modeling.

3.1 HYDROMAP Model Description

The RPS-developed HYDROMAP (Isaji et al. 2001) is a globally re-locatable hydrodynamic model capable of simulating complex circulation patterns due to tidal forcing, wind stress, and freshwater flows anywhere on the globe. HYDROMAP employs a novel step-wise-continuous-variable rectangular gridding strategy with up to six levels of resolution. The term "step-wise-continuous" implies that boundaries between successively smaller and larger grids are managed in a consistent integer step. The advantage of this approach is that large areas of widely differing spatial scales can be addressed within one consistent model application. Grids constructed by the step-wise-continuous-variable rectangular are still "structured" so arbitrary locations can be easily located to corresponding computational cells. This mapping facility is particularly advantageous when outputs of the hydrodynamic model are used in subsequent application programs (e.g., Lagrangian particle transport model) that use another grid or grid structure.

The hydrodynamic model solves three-dimensional conservation equations in spherical coordinates for water mass, density, and momentum with the Boussinesq and hydrostatic assumptions applied. These equations are solved subject to the following boundary conditions:

1. At land boundaries, the normal component of velocity is set to zero.
2. At the open boundaries, the sea surface elevation is specified by the dominant tidal constituents, each with its own amplitude and phase from a reference time zone, or as a time series of total surface elevation defined relative to the local surface elevation.
3. At the sea surface, the applied stress due to the wind is matched to the local stress in the water column and the kinematic boundary condition is satisfied.
4. At the seafloor, a quadratic stress law, based on the local bottom velocity, is used to represent frictional dissipation and a friction coefficient parameterizes the loss rate.

The numerical solution methodology follows that of Davies (1977) and Owen (1980). Vertical variations in horizontal velocity are described by an expansion of Legendre polynomials. Resulting equations are then

solved by a Galerkin-weighted residual method in the vertical and by an explicit finite difference algorithm in the horizontal. A space-staggered grid scheme in the horizontal plane is used to define the study area, and sea surface elevation and vertical velocity are specified in the center of each cell while the horizontal velocities are given on the cell face. To increase computational efficiency, a "split-mode" or "two mode" formulation is used (Gordon 1982; Owen 1980). In the split-mode, the free-surface elevation is treated separately from the internal, three-dimensional flow variables. The free-surface elevation and vertically integrated equations of motion (external mode), for which the Courant-Friedrichs-Lewis limit must be met, is solved first. The vertical structure of the horizontal components of the current may then be calculated such that effects of surface gravity waves are separated from the three-dimensional equations of motion (internal mode). Therefore, surface gravity waves no longer limit the internal mode calculations and much longer time steps are possible. The interested reader is directed to Isaji et al. (2001) and Isaji and Spaulding (1984) for a detailed description of the model physics and numerical implementation.

3.2 HYDROMAP Model Application

The model application was developed for simulations in the three-dimensional mode. First, an application was developed for a period with available in-situ current observations to verify model performance. Subsequent to model verification, an additional scenario application was developed for a period that reflected typical wind conditions, and the output was used in the sediment dispersion modeling. The main model application features are the model grid, bathymetry, and boundary forcing. These features are described in more detail below.

3.2.1 Model Grid

As described in Section 2.1, the shoreline for the model domain was developed based on merging shoreline data from each of the relevant states: Massachusetts, Rhode Island, Connecticut, and New York. The grid was mapped to the shoreline, with a coarse resolution at distances farther away from the immediate study area and fine resolution in areas closest to New England Wind components or where necessary to capture the physical characteristics of the study area.

Figure 4 shows the computational model grid cells for the entire domain, which consists of 24,313 active water cells. At the open eastern and southern boundaries and in the outer regions, a maximum cell size of approximately 1 km was assigned. Cell resolution was increased as needed to capture finer features and adequately resolve coastal features within the study area. The finest resolution of approximately 125 m was applied closer to shore to capture changes in shoreline and bathymetry. The model allows for three-dimensional simulations, which were utilized for this study. The vertical grid is represented by six Legendre polynomials to represent vertical variability in currents from tidal and wind forcing.

Model grid bathymetry was assigned by interpolating from a set of individual data points (developed as described in Section 2.2) onto the model grid. For grid cells with multiple soundings, values were averaged; for grid cells without soundings, the values were interpolated based on the closest soundings. The final gridded bathymetry in the study area is shown in Figure 5. Figure 5 is focused on the Offshore Development Area, which is the area where the Proponent’s offshore facilities are physically located and includes the SWDA and OECC.

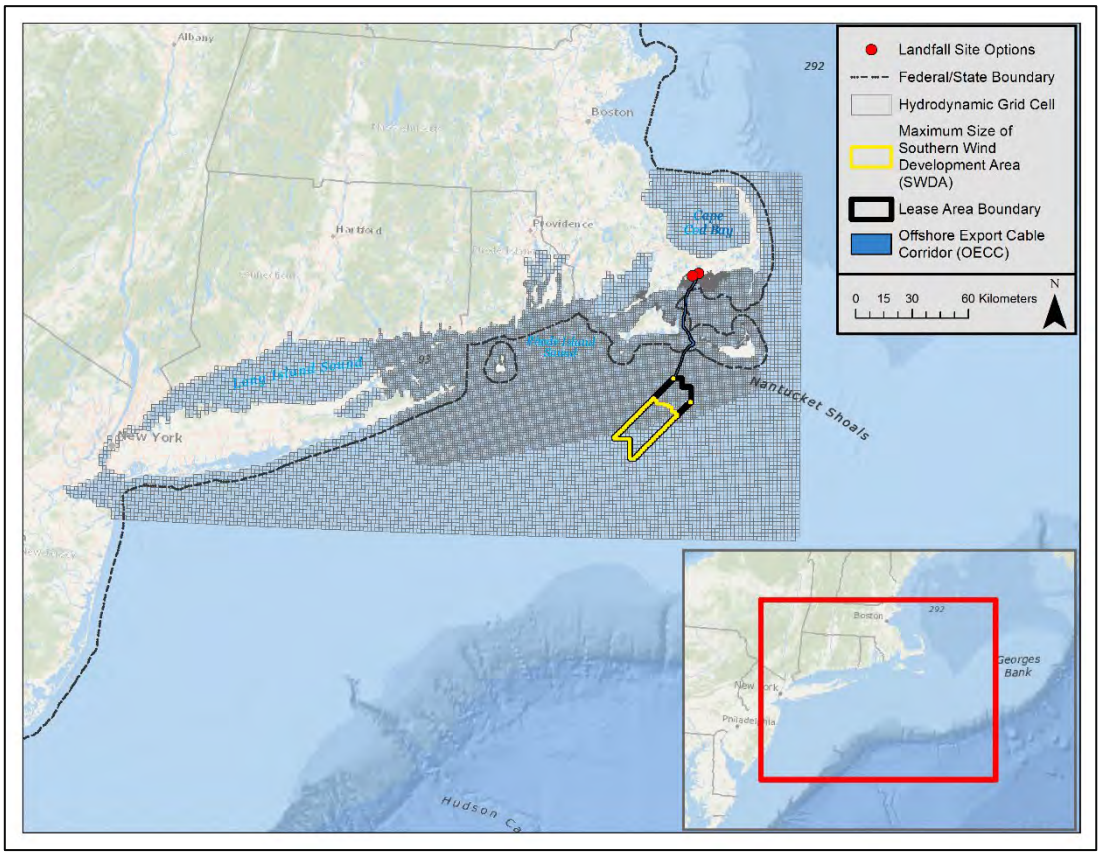

Figure 4. Hydrodynamic Model Grid

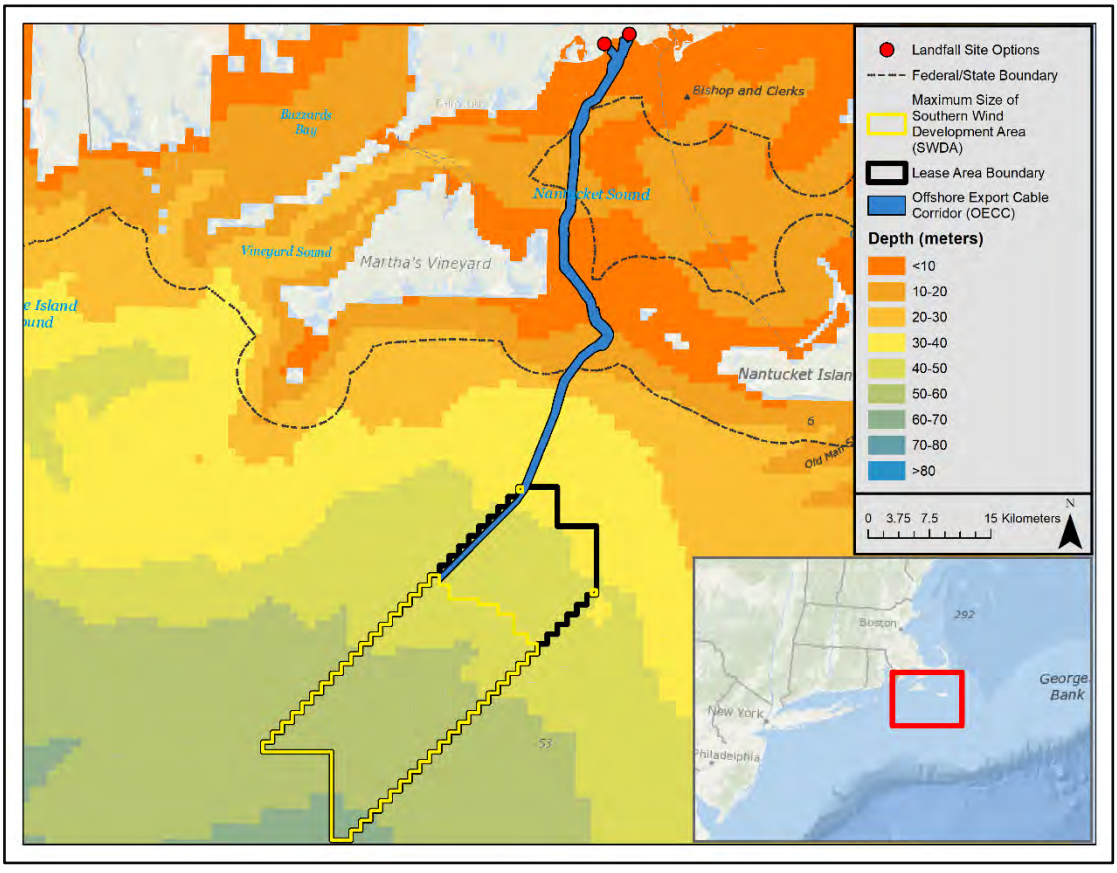

Figure 5. Model Grid Bathymetry Focused on the New England Wind Offshore Development Area

3.2.2 Model Boundary Conditions

Model boundary conditions included specification of tidal harmonic characteristics at open boundary water cells at the edge of the domain and surface winds that were applied to all cell surfaces.

Tidal Boundary Conditions

As previously noted, water circulation in the study area is tidally dominated (Spaulding and Gordon 1982) and is the key boundary forcing. Tidal harmonic constituent data extracted from the TPXO global tidal model were used at the model open boundaries. Each boundary cell was assigned a unique set of the tidal harmonic constituent amplitudes and phases. In total, the open boundary was specified for the predominant five tidal constituents in the area: three semidiurnal (M2, N2, and S2) and two diurnal (K1 and O1). HYDROMAP (Isaji et al. 2001) employs a strategy that uses the harmonic construction of astronomic tidal currents where each harmonic constituent is simulated individually and then the real-time tide is assembled using the harmonic summation of these simulated constituents. The dominant tidal constituent in this region is the M2-principal lunar semidiurnal (twice daily) constituent. The M2 causes the sea level to rise and fall approximately twice daily. This creates currents that peak and change direction approximately twice daily in the areas of reversing currents and rotary currents that complete their rotation approximately twice daily. Illustrations of amplitude and phase along the model grid open boundaries are shown in Figure 6 and Figure 7, respectively. Figure 6 illustrates that the M2 amplitude is greater than 0.4 m in most places with the exception of the southeast region of the domain. Figure 7 illustrates how the M2 phase is generally similar parallel to Long Island and Narragansett Bay, while a sharp change in phase is present southeast of Nantucket; north of this transition, the phase is again relatively similar. These notable features create the predominately semidiurnal surface elevation and current patterns; the sharp phase change southeast of Nantucket contributes to relatively fast-moving rotary currents within this domain.

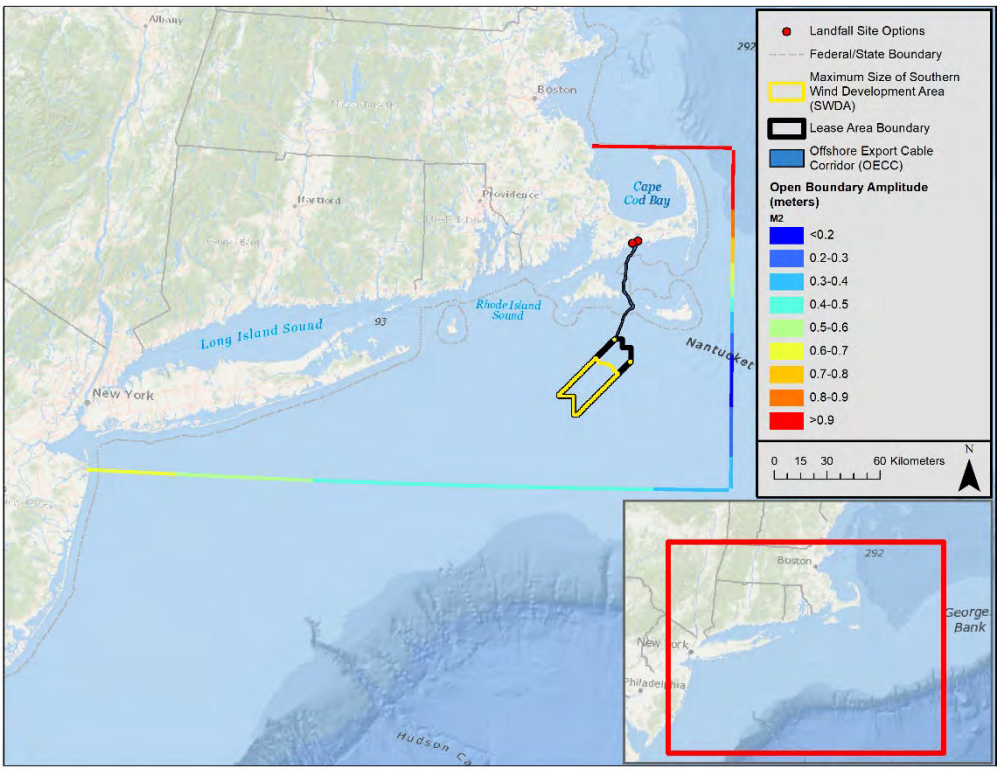

Figure 6. Tidal Boundary Forcing M2 Amplitude

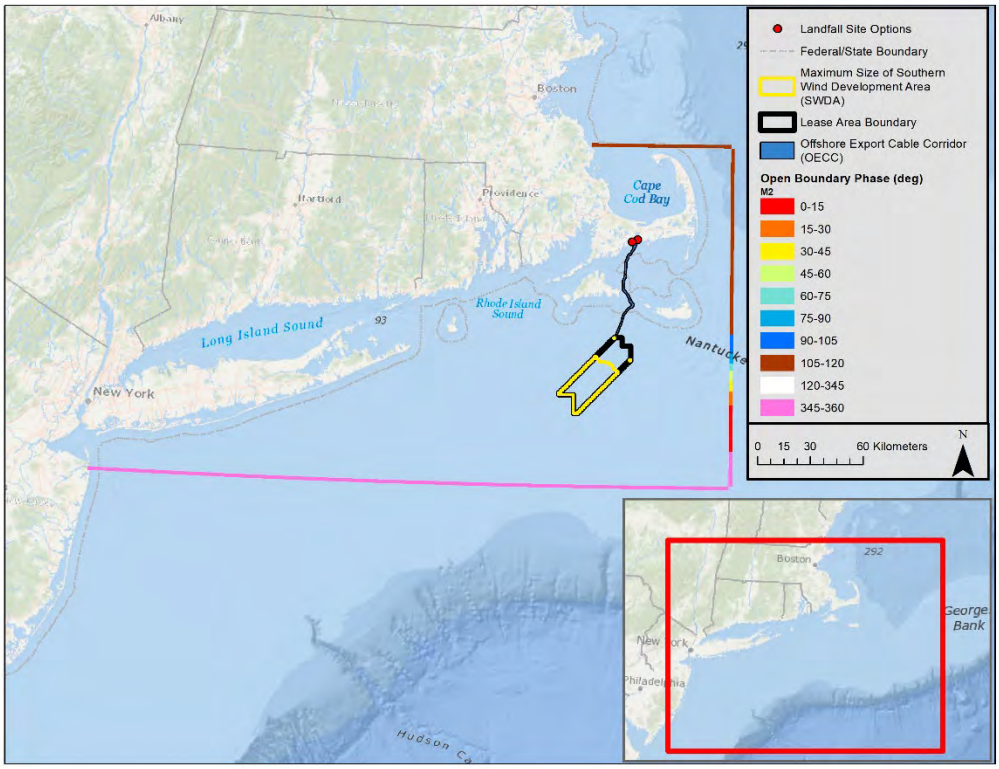

Figure 7. Tidal Boundary Forcing M2 Phase[1]

Notes:

1. Phase is defined between 0–360 degrees (and 360 degrees also equals 0 degrees) and there are no phases between 120–345 degrees which is why there are no white cells per the legend above.

Meteorological (Water Surface) Boundary Condition

The water surface boundary covers the entire gridded area and is influenced by wind speed and direction. Meteorological data were obtained from the NDBC Buzzards Bay Station, as described in Section 2.3, and was applied to the entire grid surface.

3.2.3 Model Results

The model was run for two different periods, the verification period and a scenario period. The verification period is a period with available observations such that the model predictions can be verified and the scenario period is the period of time simulated to produce a data set for the sediment transport modeling.

3.2.3.1 Model Application for Verification Period

Model-predicted surface elevations and current speeds at multiple water depths were compared to available observations to ensure the modeling was adequately reproducing tidal amplitude, current velocity, current direction, and vertical structure of the water column. The period used for model verification was October 15 to November 14, 2009. This date range was chosen because it had oceanographic (current) observations available from the OSAMP. Model predictions of water surface elevations at stations with tide data (pink) are compared with observed signals or with those reconstructed based on harmonics (blue) in Figure 8 (note the figure depicts a shorter period to facilitate viewing). This figure shows that the model was able to recreate the amplitude and phase throughout the domain.

A comparison of model predicted currents speeds and directions was also performed and presented as a comparison of current roses. Current roses show the frequency and intensity of current speed and direction. The rose petals reflect the direction the current flows towards and the color of the petals reflects the frequency of different speed intervals in each respective direction. A comparison of currents at the middle of the water column for the OSAMP locations are presented in Figure 9 (POS and POF) and Figure 10 (MDF and MDS) with observed roses shown on the left and modeled roses shown on the right. The model was able to recreate the range of speeds and general trends of directions. Both the observed and modeled show that speeds at the locations with observations are between approximately 0.15–0.25 m/s on average. The ability of the model to recreate the water surface elevations across the large domain and to recreate the predominate circulation features at these discrete points within the domain provides confidence that the model can be used to simulate actual conditions.

In addition to the comparison of model to observational data for a period of time with observations available, an additional qualitative comparison of current speeds at the location of a metocean buoy in the northern portion of Lease Area OCS-A 0501 was performed. The comparison was made based on observations for a period that was different from the model runs; however, it is expected that both records were long enough to capture the general trends of the currents at the buoy location. The observed and modeled current rose is presented in Figure 11. Figure 11 shows that both the observed data and model predictions result in the same trend of current directions and the same range of current speeds. It also shows that the speeds are typically less than 0.2 m/s and move in eastward or westward directions. The modeled record does have higher speeds; however, they are not frequent and may be due to anomalous wind forcing and not the predominate tidal circulation. Given that the model can capture the trends of the observed data, it is concluded that model predictions are representative of actual conditions.

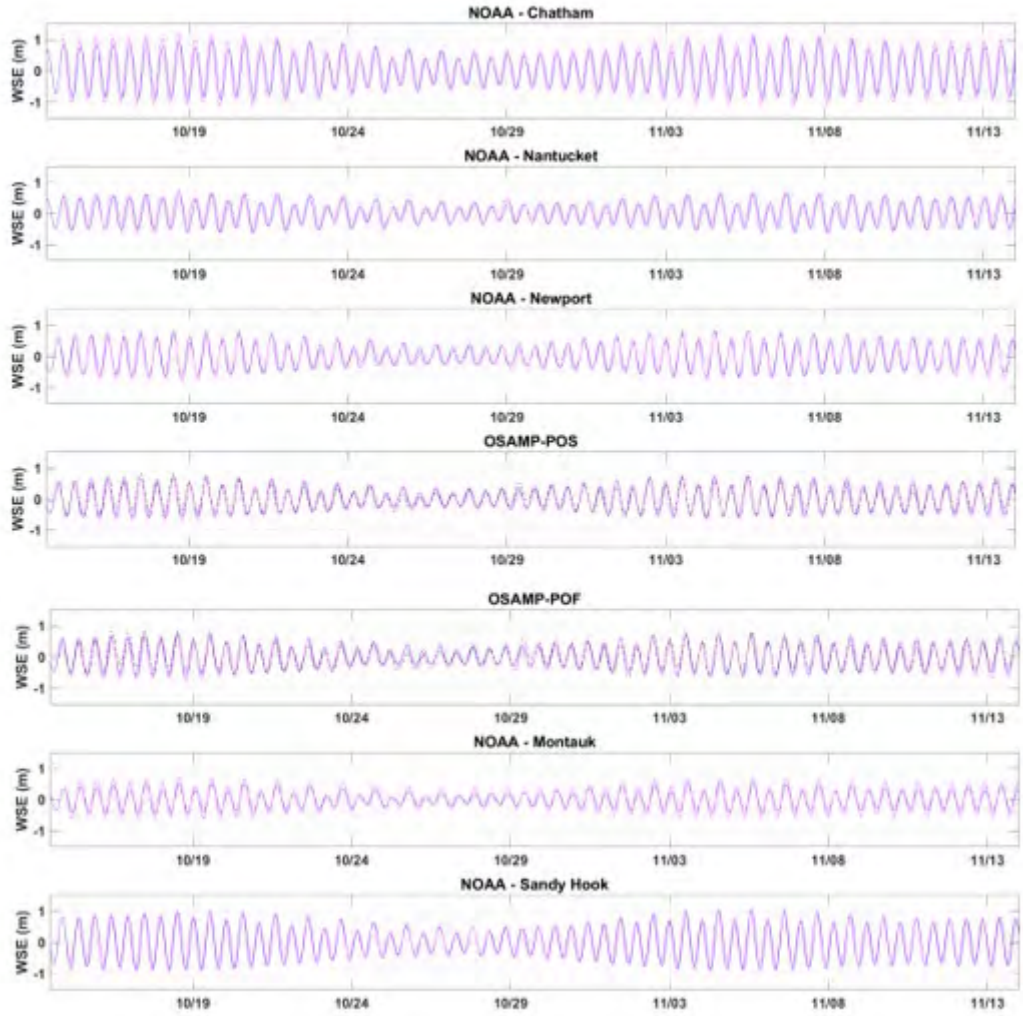

Figure 8. Comparison of Model Predicted to Constructed Tidal Elevations from Station Harmonics at Stations within the Model Domain[1]

Notes:

1. Modeled data is shown in pink and reconstructed data in blue. Y-axis for each sub plot ranges from -1.5 m to 1.5 m

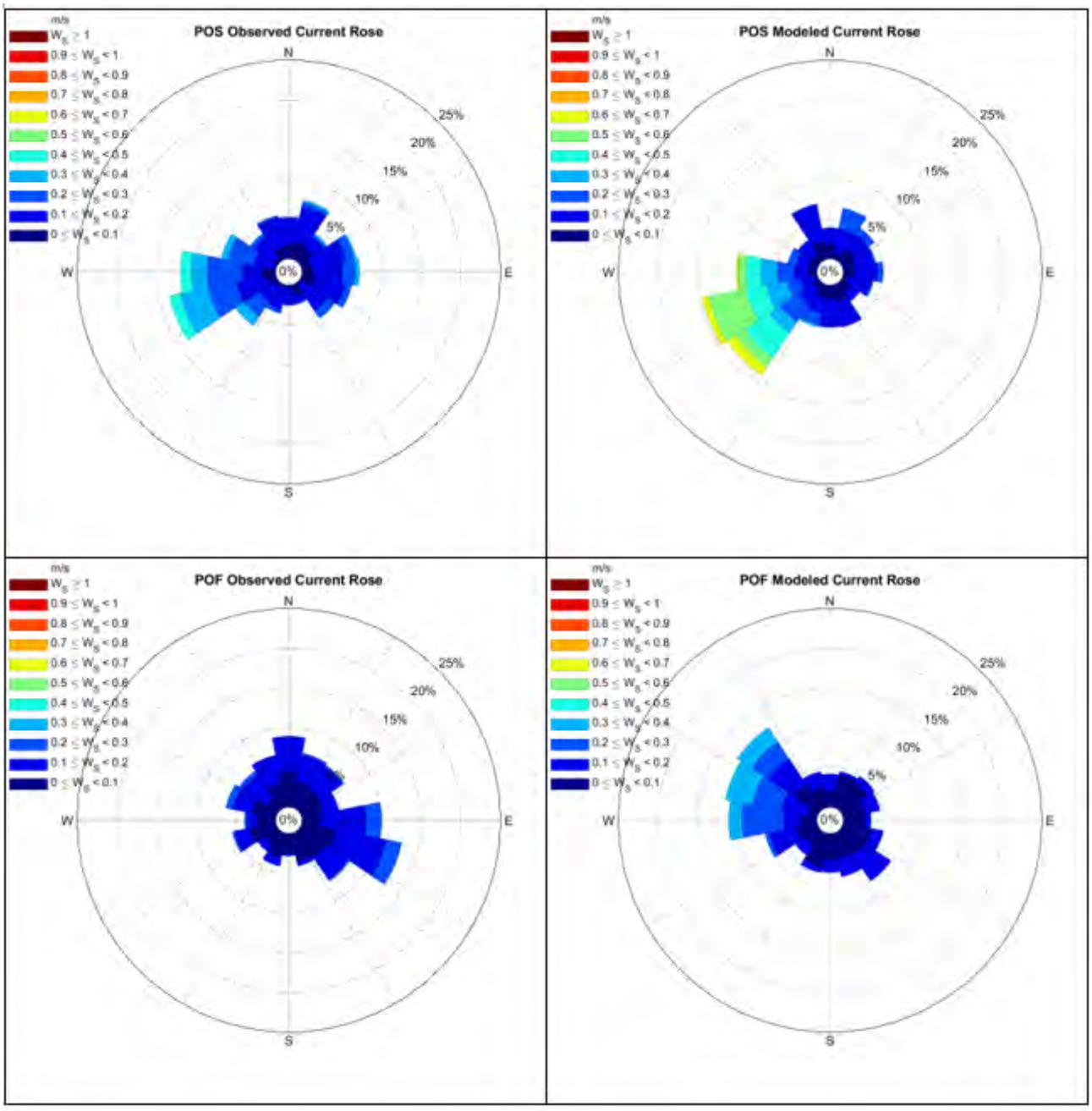

Figure 9. Comparison of observed (left) to modeled (right) currents at stations POS (top) and POF (bottom) presented as current roses from model verification period

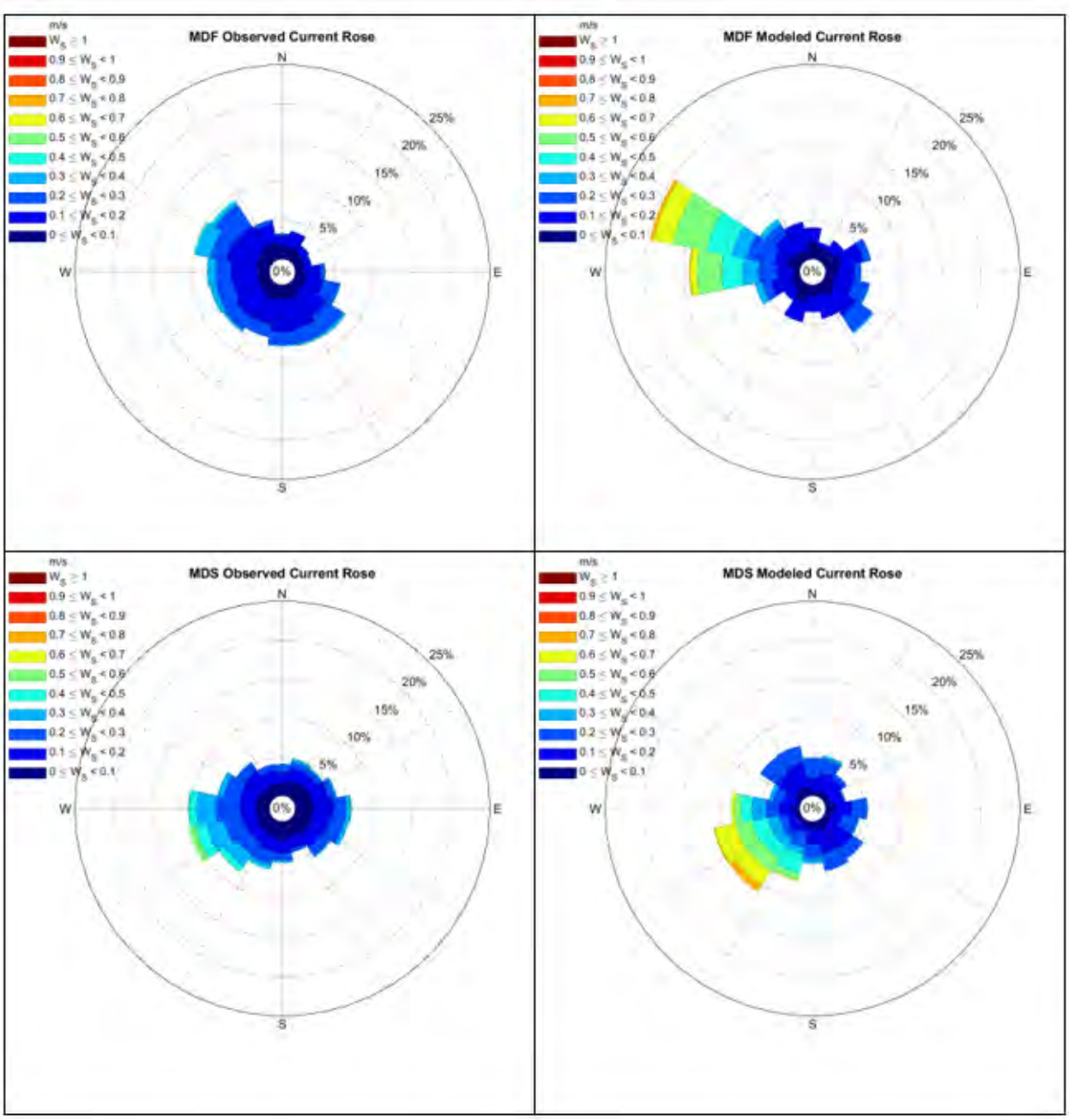

Figure 10. Comparison of observed (left) to modeled (right) currents at stations MDF (top) and MDS (bottom) presented as current roses from model verification period

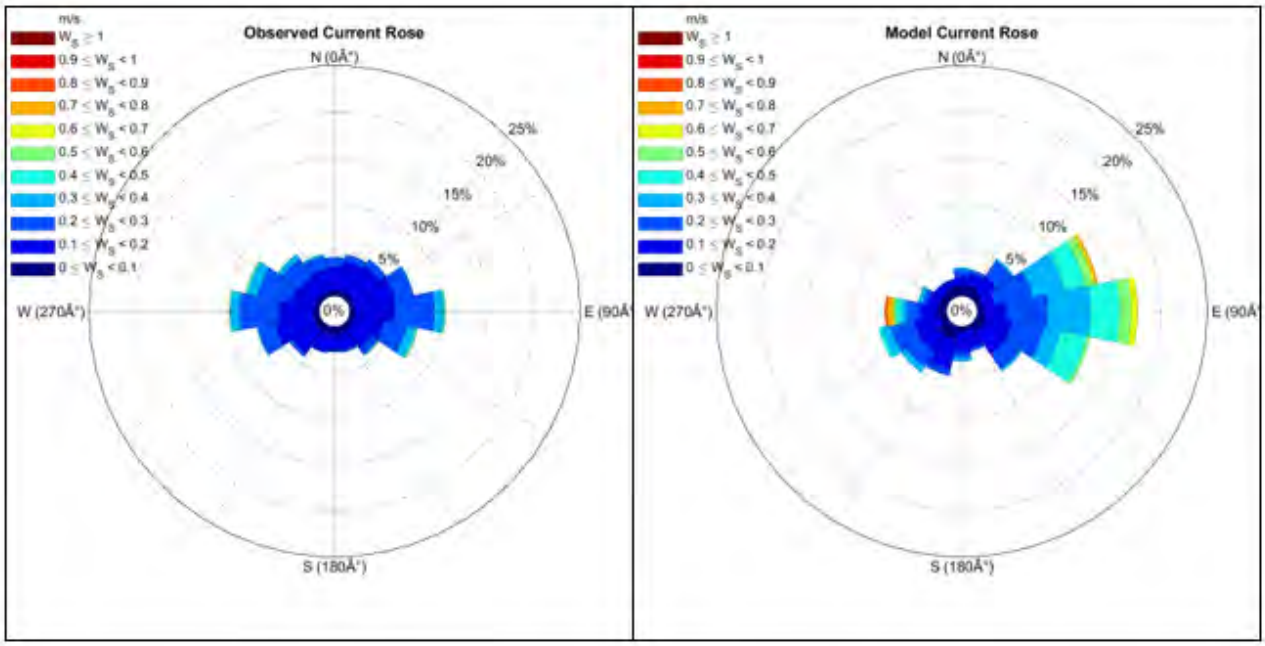

Figure 11. Qualitative comparison of observed (left) to modeled (right) currents at the metocean buoy location from a period within its deployment versus model predictions for the period used in the sediment transport modeling (detailed in Section 3.2.3.2)

3.2.3.2 Model Application for Scenario Period

Once the model performance was verified, a second application for a period with typical winds was modeled from March 1 to April 3, 2016. Snapshots of typical flood and ebb bottom current speeds and patterns are shown in Figure 12 and Figure 13, respectively; surface speeds are of a similar pattern but slightly stronger magnitude. Currents are variable throughout the New England Wind Offshore Development Area and relatively weak within the SWDA, though they increase sharply through Muskeget Channel. Within Vineyard Sound, currents are moderate, decreasing towards the coast.

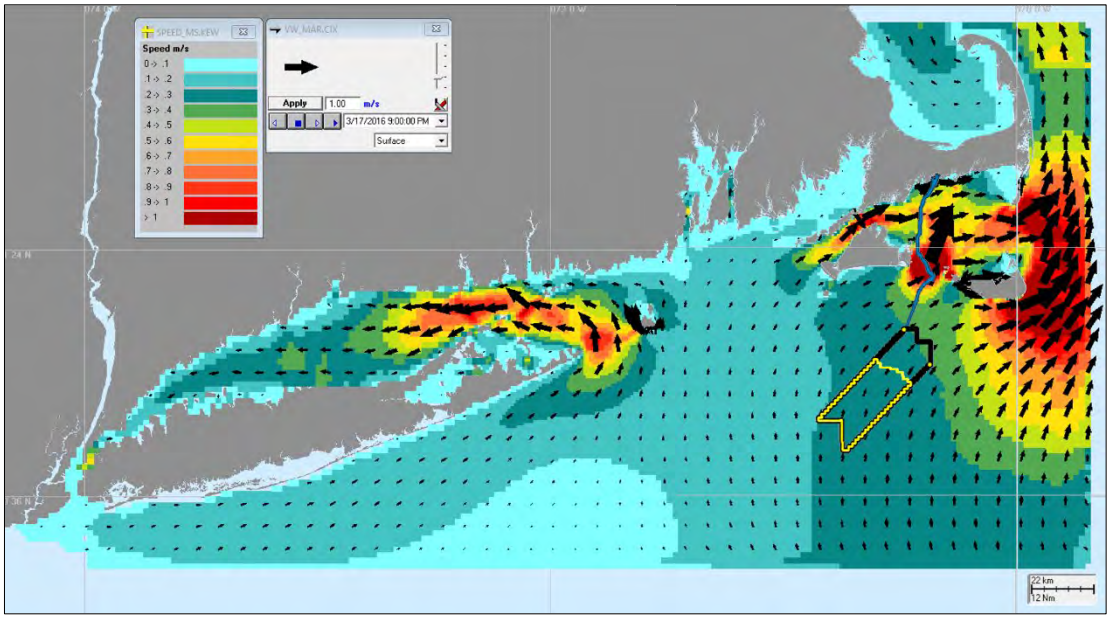

Figure 12. Snapshot Showing Peak Flood Current[1]

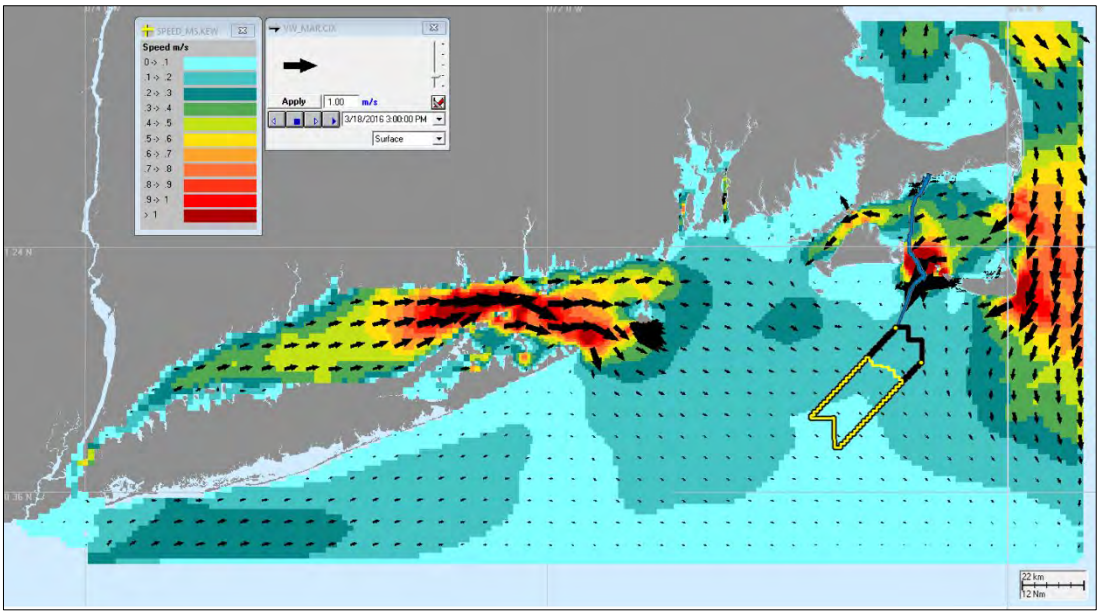

Figure 13. Snapshot Showing Peak Ebb Current[1]

Notes:

1. Cells are contoured by speed magnitude and vectors (sub-sampled for every 4th cell for clarity) show direction.

4 SEDIMENT MODELING

The sediment modeling was carried out using RPS in house model SSFATE. A description of the model, model application and the modeling results are presented in the following sections.

4.1 SSFATE Model Description

SSFATE is a three-dimensional Lagrangian (particle) model developed jointly by the United States (US) Army Corps of Engineers' Environmental Research and Development Center and Applied Science Associates (now part of RPS) to simulate sediment resuspension and deposition originally from marine dredging operations. Model development was documented in a series of US Army Corps of Engineers' Dredging Operations and Environmental Research Program technical notes (Johnson et al. 2000; Swanson et al. 2000), at previous World Dredging Conferences (Anderson et al. 2001), and at a series of Western Dredging Association Conferences (Swanson et al. 2006; Swanson and Isaji 2004). Following dozens of technical studies, which demonstrated successful application to dredging, SSFATE was further developed to include simulation of cable and pipeline burial operations using water jet trenchers (Swanson et al. 2006) and mechanical ploughs as well as sediment dumping and dewatering operations. The current modeling system includes a GIS-based interface for visualization and analysis of model output.

SSFATE computes TSS concentrations in the water column and sedimentation patterns on the seabed resulting from sediment-disturbing activities. The model requires a spatial and time-varying circulation field (typically from hydrodynamic model output), definition of the water body bathymetry, and parameterization of the sediment disturbance (source), which includes sediment grain size data and sediment flux description. The model predicts the transport, dispersion, and settling of suspended sediment released to the water column. The focus of the model is on the far-field processes (i.e., beyond the initial disturbance) affecting the dispersion of suspended sediment. The model uses specifications for the suspended sediment source strengths (i.e., mass flux), vertical distributions of sediments, and sediment grain-size distributions to represent loads to the water column from different types of mechanical or hydraulic dredges, sediment dumping practices, or other sediment-disturbing activities, such as jetting or ploughing for cable or pipeline burial. Multiple sediment types or fractions can be simulated simultaneously, as can discharges from moving sources.

SSFATE has been successfully applied to a number of recent modeling studies with these studies receiving acceptance from federal and state regulatory agencies.

4.1.1 Model Theory

SSFATE addresses the short-term movement of sediments that are disturbed during mechanical ploughing, hydraulic jetting, dredging, and other processes where sediment is suspended into the water column. The model predicts the three-dimensional path and fate of sediment particles based on sediment properties, sediment loading characteristics, and environmental conditions (e.g., bathymetry and currents). The computational model utilizes a Lagrangian or particle-based scheme to represent the total mass of sediments suspended over time, which provides a method to track suspended sediment without any loss of mass as compared to Eulerian (continuous) models due to the nature of the numerical approximation used for the conservation equations. Thus, the method is not subject to artificial diffusion near sharp concentration gradients and can easily simulate all types of sediment sources.

Sediment particles in SSFATE are divided into five size classes, each having unique behaviors for transport, dispersion, and settling (See Table 6.). For any given location (segment of the route), the sediment characterization is defined by this set of five classes, with each class representing a portion of the distribution and all five classes summing to 100%. The model determines the number of particles used per time step depending on the model time step and overall duration thereby ensuring an equal number of particles is used to define the source throughout the simulation. While a minimum of one particle per sediment size class per time step is enforced, typically multiple particles are used. The mass per particle varies depending on the total number of particles released, the grain size distribution, and the mass flux per time step.

Table 6. Sediment Size Classes used in SSFATE

Description	Class	Type	Size Range (microns)
Fine	1	Clay	0-7
	2	Fine silt	8-35
	3	Coarse silt	36-74
	4	Fine sand	75-130
Coarse	5	Coarse sand	>130

Horizontal transport, settling, and turbulence-induced suspension of each particle are computed independently by the model for each time step. Particle advection is based on the relationship that a particle moves linearly, in three-dimensions, with a local velocity obtained from the hydrodynamic field, for a specified model time step. Diffusion is assumed to follow a simple random walk process, with the diffusion distance defined as the square root of the product of an input diffusion coefficient, and at each time step is decomposed into X and Y displacements via a random direction function. The vertical Z diffusion distance is scaled by a random positive or negative direction.

Particle settling rates are calculated using Stokes equations and are based on the size and density of each particle class. Settling of mixtures of particles is a complex process due to interaction of the different size classes, some of which tend to be cohesive and thus clump together to form larger particles that have different settling rates than would be expected based on their individual sizes. Enhanced settlement rates due to flocculation and scavenging are particularly important for clay and fine-silt sized particles (Swanson 2004; Teeter 1998), and these processes have been implemented in SSFATE. These processes are bound by upper and lower concentration limits, defined through empirical studies, which contribute to flocculation for each size class of particles. Above and below these limits, particle collisions are either too infrequent to promote aggregation or so numerous that the interactions hinder settling.

Deposition is calculated as a probability function of the prevailing bottom stress and local sediment concentration and size class. The bottom shear stress is based on the combined velocity due to waves (if used) and currents using the parametric approximation by Soulsby (1998). Sediment particles that are deposited may be subsequently resuspended into the lower water column if critical levels of bottom stress are exceeded, and the model employs two different resuspension algorithms. The first applies to material deposited in the last tidal cycle (Lin et al. 2003). This accounts for the fact that newly-deposited material will not have had time to consolidate and will be resuspended with less effort (lower shear force) than consolidated bottom material. The second algorithm is the established Van Rijn (1989) method and applies to all other material that has been deposited prior to the start of the last tidal cycle. Swanson et al. (2007) summarize the justifications and tests for each of these resuspension schemes. Particles initially released by operations are continuously tracked for the length of the simulation, whether in suspension or deposited.

For each model time step, the suspended concentration of each sediment class as well as the total concentration is computed on a concentration grid. The concentration grid is a uniform rectangular grid in the horizontal dimension with user-specified cell size and a uniform thickness in the vertical dimension (z-grid). The concentration grid is independent of the resolution of the hydrodynamic data used to calculate transport, thus supporting finer spatial differentiation of plume concentrations and avoiding underestimation of concentrations caused by spatial averaging over larger volumes/areas. Model outputs include water-column concentrations in both horizontal and vertical dimensions, time-series plots of suspended sediment concentrations at points of interest, and thickness contours of sediment deposited on the seafloor. Deposition is calculated as the mass of sediment particles that accumulate over a unit area and is calculated on the same grid as concentration. Because the amount of water in the deposited sediment is unknown, by default, SSFATE converts deposition mass to thickness by assuming no water content.

For a detailed description of the SSFATE model equations governing sediment transport, settling, deposition, and resuspension, the interested reader is directed to Swanson et al. (2007).

4.1.2 General Description of SSFATE Model Set-Up

Setup of an SSFATE model scenario consists of defining how each sediment disturbance activity will be parameterized, establishing the sediment source terms, and defining environmental and numerical calculation parameters. For each scenario, the source definition includes:

- The geographic extent of the activity (point release versus line source [route]);
- Grain size distribution along the route;
- Timing and duration of the activity;
- Volumes, cross-sectional areas, and depths of the trench or excavation pit;
- The production rate for each sediment disturbance method;
- Loss (mobilization) rates for each sediment disturbance method; and
- The vertical distribution of sediments as they are initially released to the water column.

The sediment source for cable installation simulations is defined through a load source file, which defines the location of the sources, mass flux of sediment disturbed through operations, loss rate of the disturbed flux resuspended into the water column, vertical position of the mass introduced to the water column, and grain size distribution of the mass introduced to the water column along the route of installation. A component of the sediment grain size distribution is a definition of the percent solids, which is used in the mass flux calculation. Bed sediments contain some water within interstitial pore spaces, and therefore the trench volume consists of both sediment and interstitial water. Therefore, the percent solid of the sediment sample, as based on laboratory measure of moisture content, is used in the calculation of total mass flux. The sediment source can vary spatially, and therefore the line source file is broken into multiple discrete entries, each representing a segment of the route with uniform characteristics. The segments are defined to capture curved route geometry and provide a continuous route aligned with the installation plan.

A model scenario also requires characterization of the environment, including a definition of the study area's spatially and time-varying currents (HYDROMAP output) and water body bathymetry. Model setup also requires specification of the concentration and deposition grid, which is the grid at which concentration and deposition calculations are made. The concentration and deposition grid in SSFATE is independent of the resolution of the hydrodynamic or bathymetric data used as inputs; this allows finer resolution which better captures water column concentrations without being biased by numerical diffusion. The concentration and deposition gridding is based on a prescribed square grid resolution in the horizontal plan view and a constant thickness in the vertical. The extent of the concentration is determined dynamically, fit to the extent the sediments travel.

4.2 Study Model Application

A number of SSFATE model scenarios were run to encompass the potential cable routes and construction approaches included in the New England Wind Envelope. The following sections describe the routes and associated sediment-suspending activities as they pertain to defining modeling inputs.

4.2.1 Scenario Components: Routes

The model scenarios have been separated into two components: (1) the inter-array cables located within the SWDA; and (2) the offshore export cables located within the OECC.

The modeled inter-array cable route was selected from a representative layout of the New England Wind Phase 1 and Phase 2 inter-array cables. Grain size characteristics were reviewed for the entire SWDA. The individual inter-array cable route that passed through relatively larger regions of finer sediment was selected

to model a conservative assessment of potential impacts from cable installation within the SWDA for either Phase 1 or Phase 2. Fine sediments (e.g., clays, silts) tend to last longer in the water column, whereas coarse sediment (e.g., fine sand, coarse sand) will settle at a faster rate. The route selected for modeling was a Phase 1 inter-array cable route, but it provides representative results for either Phase 1 or Phase 2. Similarly, short lengths of offshore export cable will need to be installed within the SWDA to reach the Phase 1 and Phase 2 ESPs, and inter-link cables may be used to connect ESPs. Due to the similarities in installation methods, the modeled results for inter-array cable installation are representative of potential impacts of inter-link and offshore export cable installation within the SWDA. Both the potential layout and the individual component modeled are shown in Figure 14. No sand wave dredging is proposed for either phase of inter-array cable installation.

The modeled offshore export cable route was selected along an approximate centerline within the OECC. As described in Section 1.1, the OECC is the same for both Phases of New England Wind until approximately 2–3 km from shore, at which point the OECC will diverge for each Phase to reach separate landfall sites in Barnstable. For Phase 1, the OECC includes two possible landfall sites located nearby to one another along the same stretch of shoreline in Barnstable: Craigville Public Beach Landfall Site and Covell's Beach Landfall Site. Due to the proximity and similar sediment grain size results of the two landfall sites, the Craigville Public Beach Landfall Site route was modeled and serves as a proxy of results for the Covell's Beach Landfall Site. The Phase 2 Landfall Site will be located to the west of Craigville Public Beach at the Dowses Beach Landfall Site and/or Wianno Avenue Landfall Site. Additionally, modeling of the Phase 1 Landfall Site was considered as a conservative representation of a worst-case plume for the Phase 2 Landfall Site because this location has a relatively high fraction of fine sediments compared with those of Phase 2.

The offshore export cable scenarios that were modeled include a representative offshore export cable route for a section of the OECC from the northern edge of Lease Area OCS-A 0501 to the Craigville Public Beach Landfall Site. A representative shorter offshore export cable route within Lease Area OCS-A 0501 (referred to as "Representative OECC in Lease Area OCS-A 0501") was also modeled. The model scenarios also include several representative sections of the OECC, including a representative section of the OECC with sand waves, where cable installation is accomplished using a vertical injector, and a representative section of the OECC local to the nearshore Craigville Public Beach Landfall Site.

The representative cable installation within the OECC and detailed views of the various sections that were simulated are shown in Figure 15 through Figure 18.

A key component of the modeling is the delineated geographical extent of the source. The New England Wind cable routes assessed as part of this study are presented in Table 7. A further breakdown of the route length modeled for various installation methodologies simulated is presented in Table 8.

Table 7. Offshore Cable Routes Modeled and Assessed

New England Wind Functional Component	Total Route Length (km)
SWDA Representative Inter-array	19.9
OECC Lease Area OCS-A 0501 to Nearshore	61.2

Table 8. Route Length Modeled for Different Technologies and OECC Sections

OECC Methodology	Total Possible Route Length
Offshore Cable Installation	
TSHD	Intermittent along 61.2 km of route (Approximately 10% of route)
Limited TSHD	Intermittent along 61.2 km of route (Approximately 1 % of route)
Cable Installation	61.2 km (Representative OECC)
Cable Installation Aided by Jetting	61.2 km (Representative OECC)
Cable Installation along OECC in Lease Area OCS-A 0501	11.9 km (Representative Section of OECC)
Vertical Injector Section	1.7 km (Representative Section of OECC)
Landfall Approach Section	2.5 km (Representative Section of OECC)

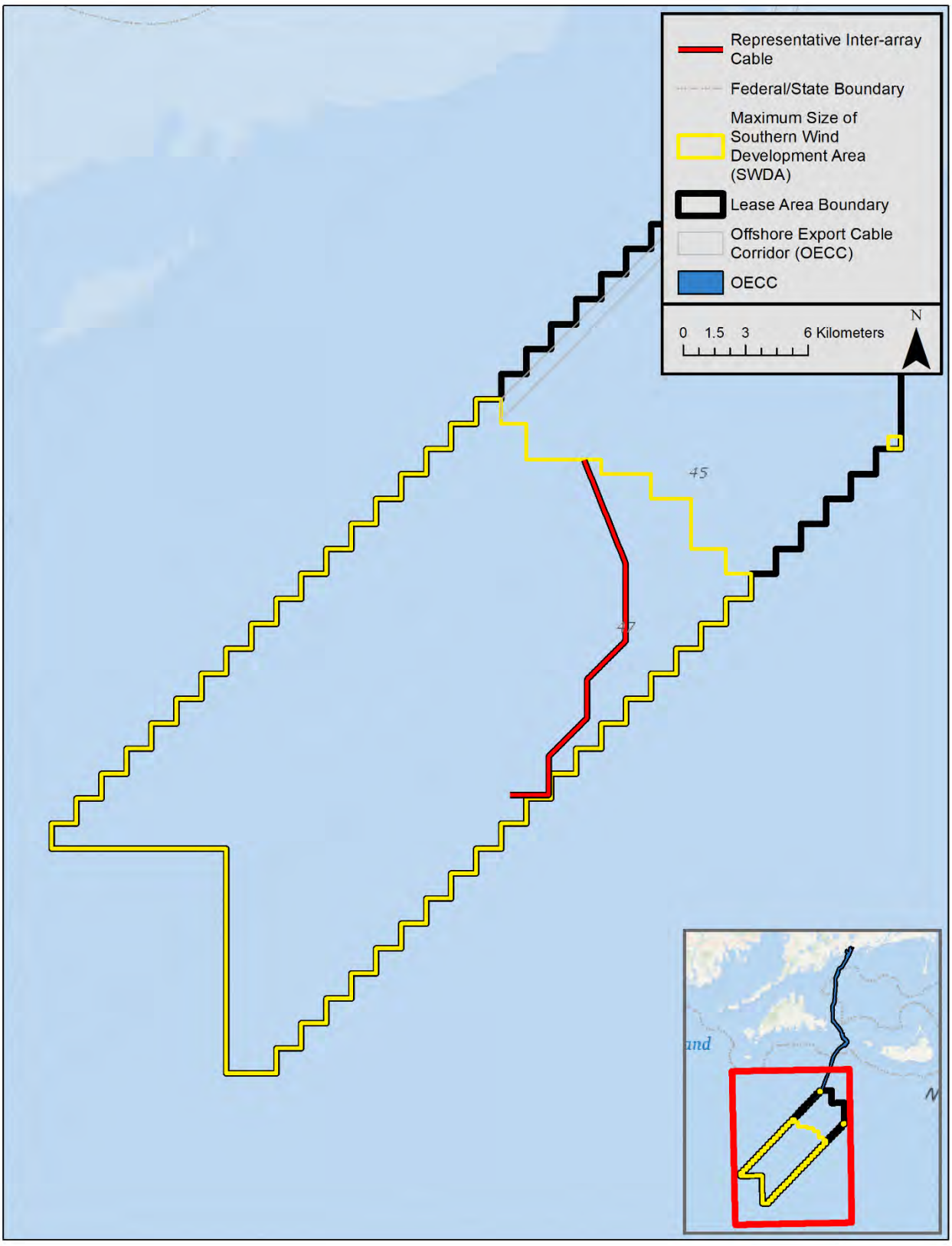

Figure 14. Representative Inter-array Cable Route

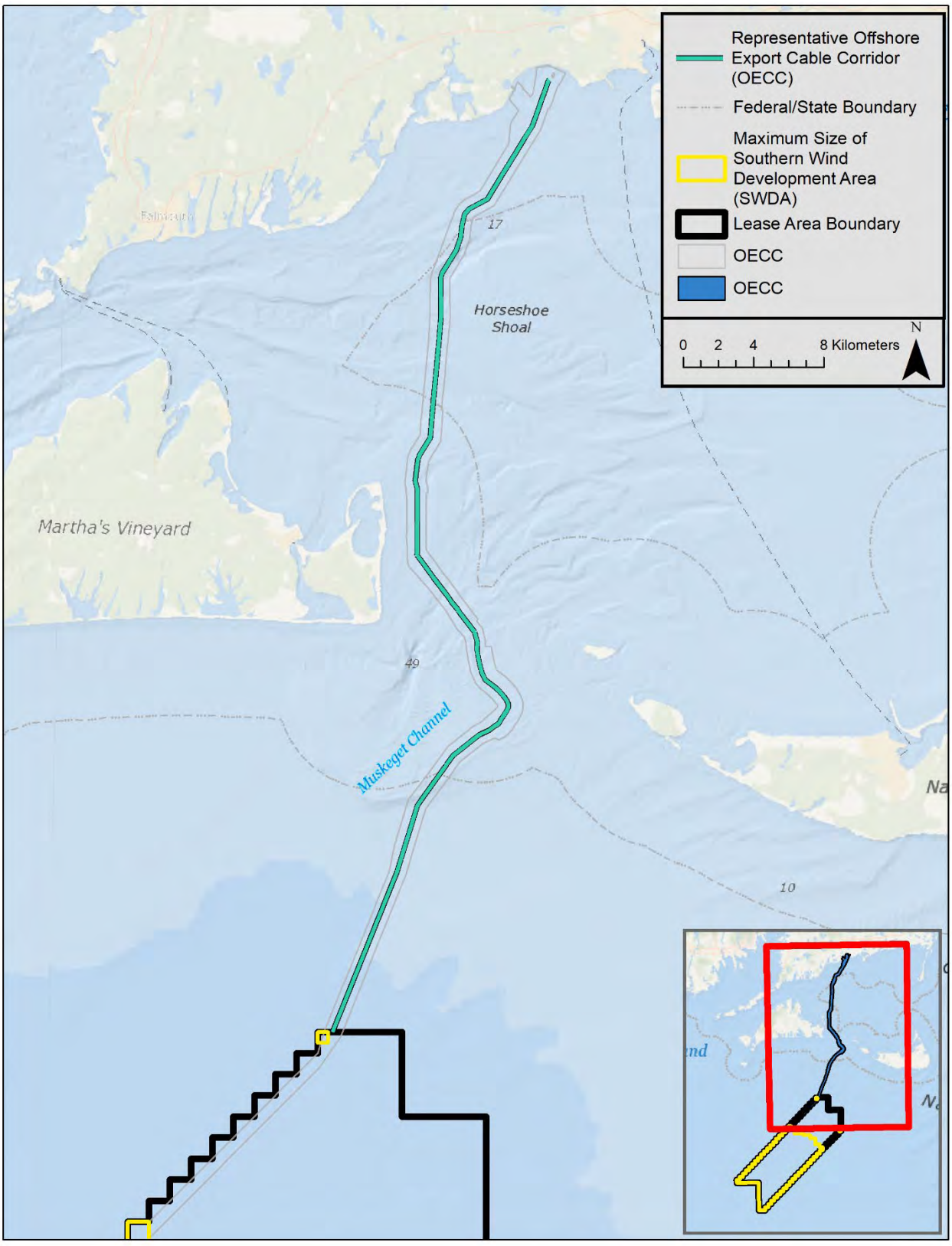

Figure 15. Representative OECC from the Northern Edge of Lease Area OCS-A 0501 to Phase 1 Landfall Sites

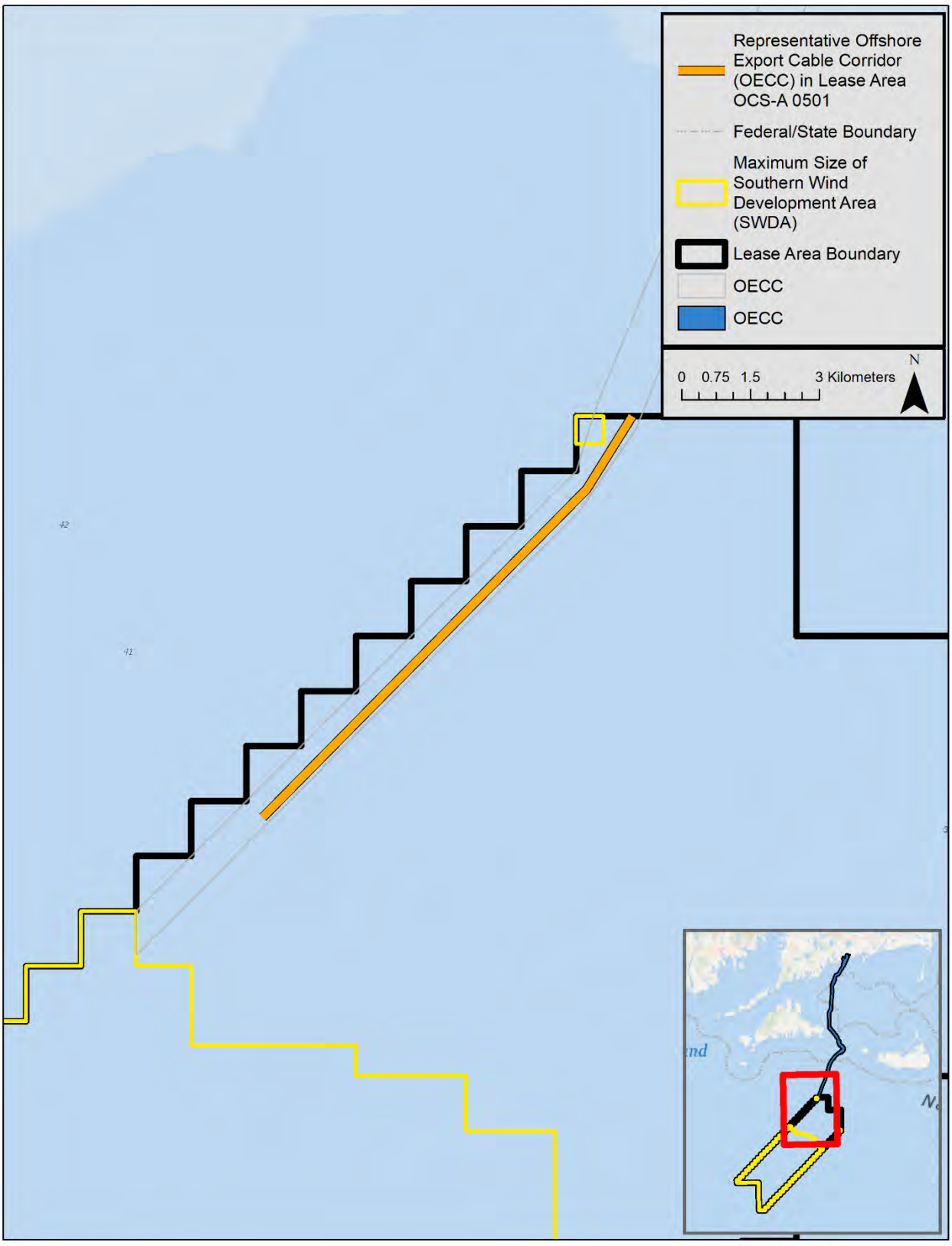

Figure 16. Representative Section of the OECC Located in Lease Area OCS-A 0501

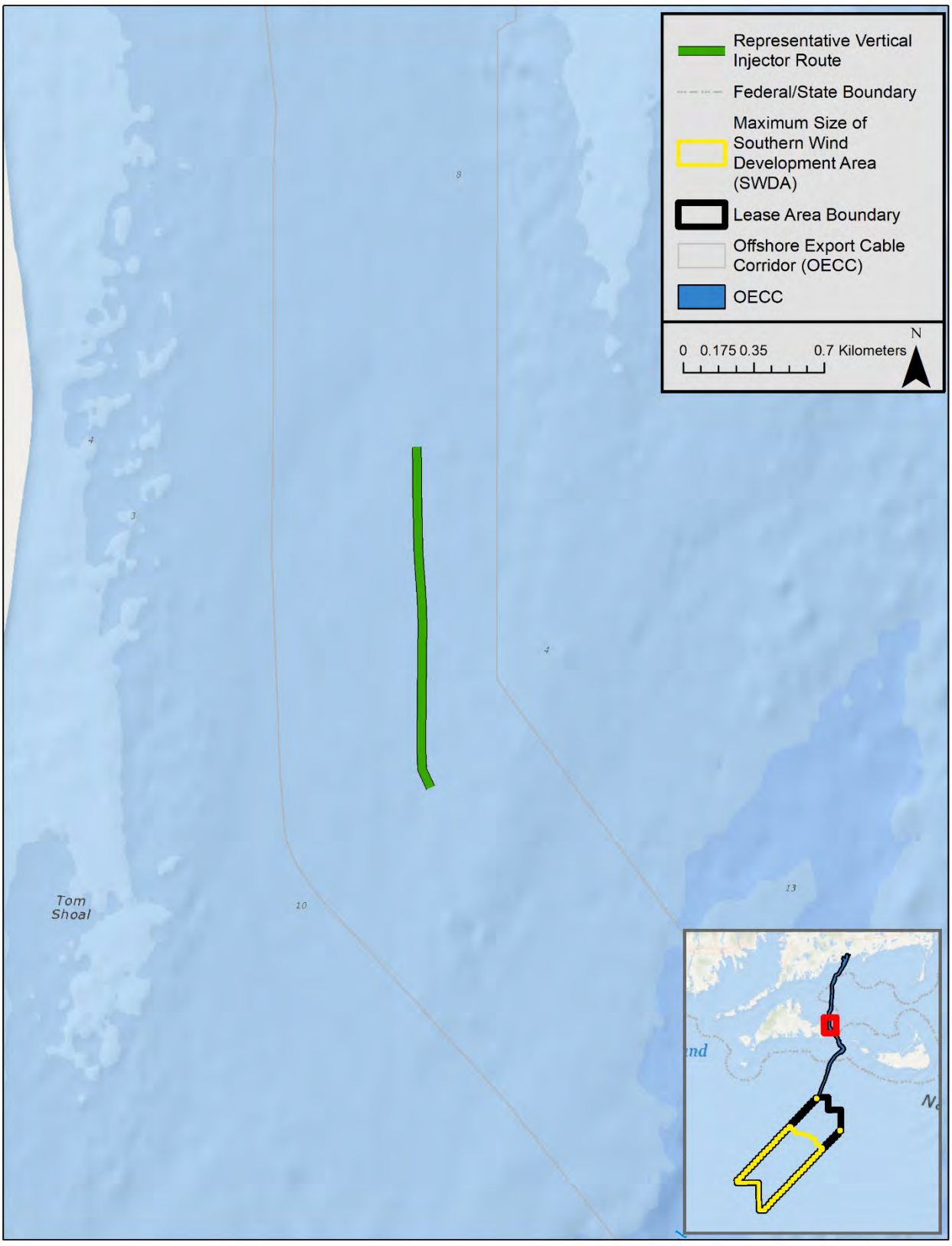

Figure 17. Representative OECC Vertical Injector Route

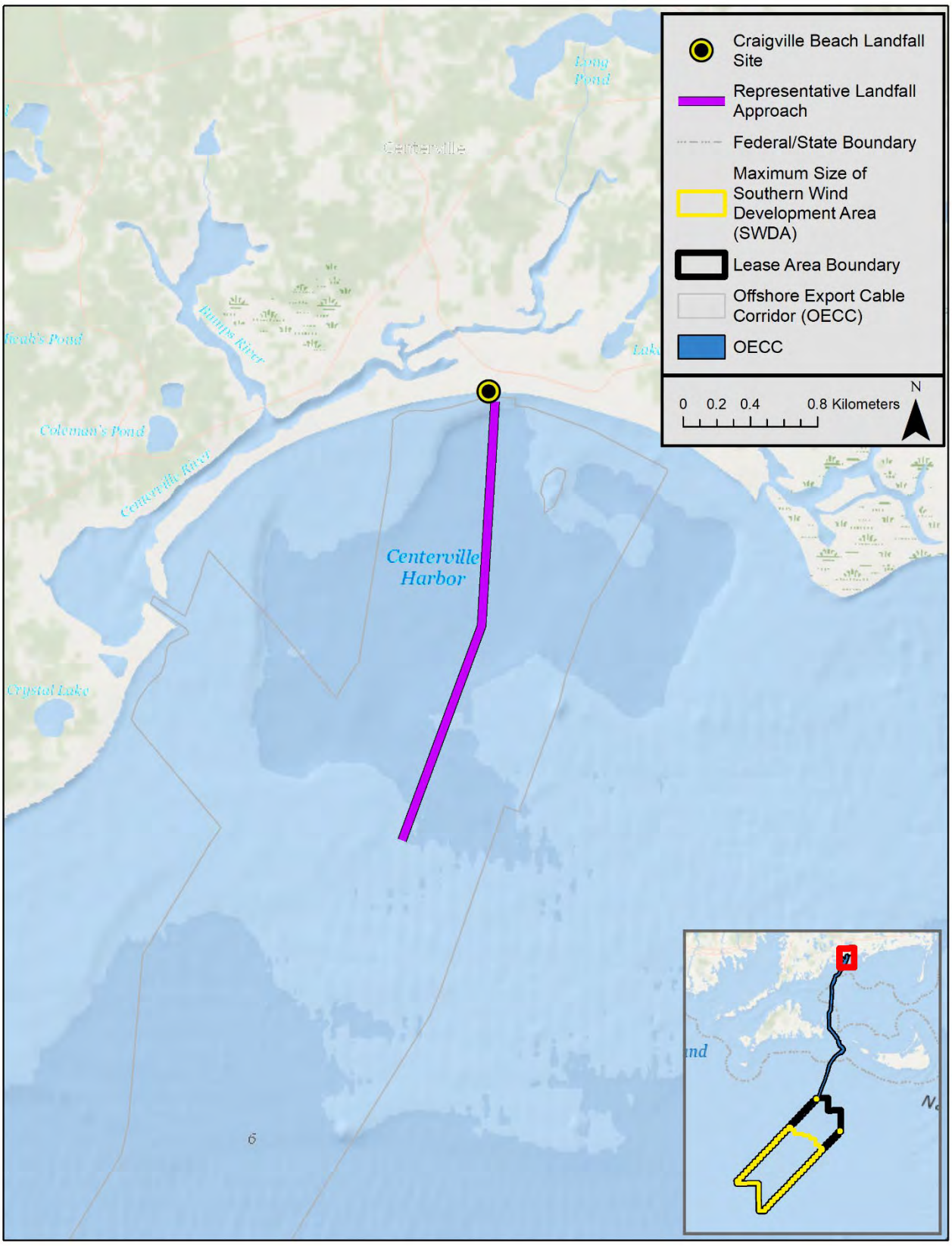

Figure 18. Representative OECC Landfall Approach Route

4.2.2 New England Wind Components: Construction Activities

Cable installation activities that will suspend sediments in the water column include cable burial within the SWDA (inter-array cables) and along the OECC (offshore export cables) and, for cable installation along the OECC, could also include either pre-cable installation sand wave dredging or installation within sand waves using a vertical injector. No sand wave dredging will be required within the SWDA for inter-array or inter-link cable installation.

Along the OECC, sand waves are mobile features. Removing the upper portions of the sand waves will facilitate cable installation within the stable seabed beneath thereby ensuring that sand wave migration will not leave a cable exposed on the seafloor. The amount of required sand wave dredging will vary based on the size of the sand waves and the achievable burial depth of the cable installation equipment employed. Once any needed sand wave removal occurs, installation and burial of the cable will occur.

Various approaches are being considered to remove the upper portions of the sand waves above the stable seabed where necessary along the OECC. The first technique is TSHD. Dredgers of this type are typically used for European offshore wind projects and are also commonly used in the US for channel maintenance, beach nourishment projects, and other uses. A TSHD would be used to remove an approximately 15 to 20 m wide[4] section of a sand wave (for each of the offshore export cables) that is deep enough to allow subsequent installation of the cable within the stable seabed.

The second approach involves jetting by controlled flow excavation (referred to as “jetting” herein), which uses a pressurized stream of water to push sand to the side. Jetting is a post-lay burial technique that removes the tops of sand waves while burying a section of cable that was previously laid on the surface of the seafloor. Accordingly, jetting both removes the tops of sand waves where required and buries the cable. Jetting is a viable technique where excavation less than approximately 2 m is required; if excavation greater than approximately 2 m is required, use of the TSHD or vertical injector would be required.

The third approach is to use a vertical injector. The vertical injector is a high-volume low-pressure water jetting tool that uses directed water jets to fluidize the seabed and lower the cable via the integral depressor to the bottom of the fluidized trench. The vertical injector is capable of directly installing the cable in areas with sand waves without the need for any separate sand wave clearing.

Inter-array and offshore export cable installation may be achieved through various methods, which may be combined interchangeably. The methods captured through modeling are listed below along with a description of relevant operational parameters. The cable installation method was simulated using typical installation parameters that reflect a conservative estimate of typical installation speed and trench depth. For the inter-array cables, two scenarios were modeled: one with typical parameters and one with “maximum impact” parameters involving deeper penetration and faster installation.

Inter-array Cable Installation

- **Cable Installation:** Cable installation is accomplished by jetting techniques (e.g. jet plow, jet trenching, or similar).
    - **Typical Installation:** 1-m-wide x 2-m-deep trench, production rate (i.e., installation rate) of 200 meters per hour (m/hr), and sediment mobilization fraction of 0.25 (25% of total trench volume).
    - **Maximum Impact Installation:** 1-m-wide x 3-m-deep trench, production rate of 300 m/hr, and sediment mobilization fraction of 0.35 (35% of total trench volume).

[4] To be conservative, the model uses a 20-m wide section.

Offshore Export Cable Installation

- **TSHD:** For all sand wave sizes where dredging is needed, dredging is accomplished by TSHD to prepare the OECC for cable installation.
    - **Typical Operation:** Used for variable cross-section depending on sand wave height, production rate of 1,875 cubic meters per hour (m^3/hr). Assumes a drag arm sediment mobilization fraction of 0.01 (1%) and overflow sedimentation mobilization of 0.05 (5%) coarse sediments and 0.30 (30%) fine sediments from hopper. Once the hopper fills, it moves to dump. Upon dumping, the entire hopper load of sediment is mobilized.
- **Limited TSHD:** For larger (greater than 2 m) sand waves only where dredging is needed. Dredging is accomplished by TSHD to prepare the OECC for cable installation.
    - **Typical Operation:** Used for variable cross-section depending on sand wave height, production rate of 1,875 m^3/hr. Assumes a drag arm sediment mobilization fraction of 0.01 (1%) and overflow sedimentation mobilization of 0.05 (5%) coarse sediments and 0.30 (30%) fine sediments from hopper. Once the hopper fills, it moves to dump. Upon dumping, the entire hopper load of sediment is mobilized.

A summary of the intermittent length and modeled volume for TSHD and limited TSHD are summarized in Table 9 and assumptions relative to hopper size and operations are provided in Table 10.

Table 9. Approximate Dredging Lengths and Volumes for TSHD and Limited TSHD Pre-dredge

New England Wind Component with Sand Waves	TSHD		Limited TSHD	
	Length where TSHD may Occur	Per-Cable Volume of TSHD dredging[1]	Length with Sand Waves > 2m where TSHD may Occur	Per-Cable Volume of Sand Waves > 2m where Limited TSHD may Occur
	km	m^3	km	m^3
OECC	6.64	44,569	0.34	10,595

Notes:

1. These volumes are a conservative estimate based on the assumption that cable installation equipment would have an achievable burial depth of 1.5 m. In reality, cable installation equipment may be able to reach a greater burial depth of 2.5 m, which would require less sand wave removal to ensure burial within the stable seabed.

Table 10. Assumed Dredging Parameters

Sediment Characteristics		Depth weighted to 2 m[1] Average percent solid ~73%
Total Dredging Production (sediment + water)	**m^3/hr**	9,175
Sediment Production	**m^3/hr**	1,835
Hopper Volume	**m^3**	2,294
Sediment Suspended at Drag Head (as % of total dredged, both fines and coarse)	**%**	1
Target Fines in Overflow	**%**	29.7
Target Coarse in Overflow	**%**	4.95
Target Fines in Hopper Release	**%**	70.3
Target Coarse in Hopper Release	**%**	94.05
Operations	**hrs/day**	24
Time to Fill Hopper	**hrs**	1
Time to Transit, Release, Transit Back	**hrs**	0.5

Notes:

1. See Section 4.2.4. for details of the procedure to develop depth weighted grain size distributions.

- **Cable Installation:** Cable installation is accomplished by jetting techniques (e.g., jet plow, jet trenching, similar).
    - **Typical Installation:** 1-m-wide by 2-m-deep trench, production rate (i.e., installation rate) of 200 m/hr, and sediment mobilization fraction of 0.25 (25% of total trench volume).
- **Cable Installation Aided by Jetting:** Cable installation is accomplished by jetting in areas of small sand waves and by jetting techniques (e.g., jet plow, jet trenching, or similar) where sand wave dredging is not necessary.
    - **Typical Installation:** 2-m-wide by 2-m-deep trench, production rate (i.e., installation rate) of 100 m/hr, and sediment mobilization fraction of 0.25 (25% of total trench volume).
- **Cable Installation Using Vertical Injector:** Cable installation is achieved to the necessary target depth through use of a vertical injector. The vertical injector is a high-volume low-pressure water jetting tool that uses directed water jets to fluidize the seabed and lower the cable via the integral depressor to the bottom of the fluidized trench. The tool is lowered to a depth such that seabed sediment fluidization is achieved and the cable ends is installed at the desired depth.
    - **Typical Installation:** 1-m-wide by up to 7.5-m-deep trench, production rate (i.e., installation rate) of 120 m/hr, and sediment mobilization fraction of 1.0 (25%) of the upper 3 m of the trench.

A summary of the inter-array and offshore export cable installation parameters is provided in Table 11. The individual SSFATE modeling scenarios is presented in Table 12 along with the method simulated and the total duration of the active loading.

Table 11. Inter-array and Offshore Export Cable Installation Parameters

Scenario Description	Inter-array or Offshore Export Cable	Sediment Characteristics[1]	Trench Width (m)	Trench Depth (m)	Trench Volume per meter (m^3)	Advance Rate (m/hr)	Percent Mobilized (%)
Typical cable burial	Inter-array, Offshore Export Cable	Depth weighted to 2m	1	2	2	200	25
Typical cable burial aided by jetting	Offshore Export Cable	Depth weighted to 2m	2	2	4	100	25
Maximum impact cable burial	Inter-array	Depth weighted to 3m	1	3	3	300	35
Vertical injector	Offshore Export Cable	Depth weighted upper 3m	1	3	3	120	25

Notes:

1. Details of the procedure to develop depth weighted grain size distributions are provided in Section 4.2.4.

Table 12. Summary of Modeling Scenarios

Location	Method	TYP or MAX	Duration of Sediment Loading for Scenario (days)
Inter-array Cable Installation			
SWDA Inter-array	Cable Installation	TYP	3.83
SWDA Inter-array	Cable Installation	MAX	2.87
Offshore Cable Installation[1] – Representative Sections			
OECC	TSHD	TYP	2.31
OECC	Limited TSHD	TYP	0.77
OECC	Cable Installation	TYP	12.80
OECC	Cable Installation Aided by Jetting	TYP	12.82
OECC in Lease Area OCS-A 0501	Cable Installation	TYP	2.31
OECC Vertical Injector Section	Vertical Injector Cable Installation	TYP	0.66
OECC Landfall Approach Section	Cable Installation	TYP	0.47

Notes:

1. Within this section of the table, the term “OECC” refers to the portion of the OECC from the northern edge of Lease Area OCS-A 0501 to the landfall site.

4.2.3 Sediment Loading Vertical Initialization

In addition to the sediment loading rate, the model requires specification of the vertical location of the sediment resuspension. The vertical initialization from the TSHD and limited TSHD operations of dredging, overflow, and dumping is summarized in Table 13 and the vertical initialization from the different cable installation methods is presented in Table 14.

Table 13. Vertical Distribution of Suspended Sediment Mass Associated with Dredging, Overflow, and Dredged Material Release

Dredging		
Individual Bin Percent	Cumulative Percent	Meters Above Bottom
5	100	3
10	95	2
28	85	1
28	57	0.66
29	29	0.33

Overflow		
Individual Bin Percent	Cumulative Percent	Meters Below Surface
100	100	0

Dredged Material Release		
Individual Bin Percent	Cumulative Percent	Meters Below Surface
100	100	6.1

Table 14. Vertical Initial Distribution of Mass Associated with Cable Installation and Cable Installation Aided by Jetting and Vertical Injection

Individual Bin Percent	Cumulative Percent	Meters Above Bottom
5	100	3
10	95	2
28	85	1
28	57	0.66
29	29	0.33

4.2.4 Sediment Characteristics

The sediment characteristics are a key factor of the sediment load definition input to the SSFATE model. The spatially varying sediment characteristics were developed based on analysis of samples from multiple surveys. The details of the sediment sampling and laboratory analysis is documented in Volume II of the COP though an overview of the RPS analysis of the sediment data follows since it pertains to the sediment characterization used in the modeling. The objective of the RPS analysis of the sediment data was to develop the sediment characteristics that represent either the upper two or three meters of the seabed, since those are the target depths of cable installation and represent the depth of sediments that may get resuspended during installation activities. Specifically, the objective was to determine the distribution within the five delineated classes used in SSFATE (Table 6) and the percentage of the upper seabed that is solid based on the measure of sediment water content, which is a measure of the interstitial pore waters in the sediments.

The sampling included a combination of grab samples that sample the upper few centimeters of the seabed, as well as vibracores and boreholes, which both provide a vertical profile of sediments that are then analyzed at multiple depths from the profile. All samples were analyzed by a sieve, which is similar to a filter and screens out sediments smaller than the specific sieve size. Sieve analysis is performed on multiple sizes in order to build a curve of the percent finer than various grain sizes, though it can only resolve the fraction of sands relative to the classes in SSFATE. Some samples also included hydrometer analysis which is a laboratory test that can further resolve the fractions in the finer grain size classes. For all stations without hydrometer data, the remaining fraction (percent finer than fine sand) was split evenly between the three classes of coarse silt, fine silt, and clay. Additionally, the majority of samples had a measure of the water content.

The grab samples were typically staggered relative to the locations of vibracore or boreholes. Therefore, to develop a vertical profile of sediment characteristics, the samples taken at depth from a vibracore or borehole

were paired with the nearest grab sample to develop a composite depth weighted average sediment distribution at each sample location.

The resulting sediment grain size distributions and percent solids are shown in Figure 19 and Figure 20. Figure 19 shows the two and three meter sediment characteristics in the SWDA and Figure 20 shows the two and three meter sediment characteristics in the OECC.

Most of the sediments are primarily coarse sand however there are isolated samples with noticeable fractions of fine sediments (clay, fine silt, and coarse silt). The SWDA has more fine material in the sediments relative to the OECC and the OECC is primarily coarse except near the landfall where most sediments have a larger amount of fine sediments. Comparing the two- to three-meter sediments in the SWDA, the three-meter sediments have relatively more fine material along the modeled route.

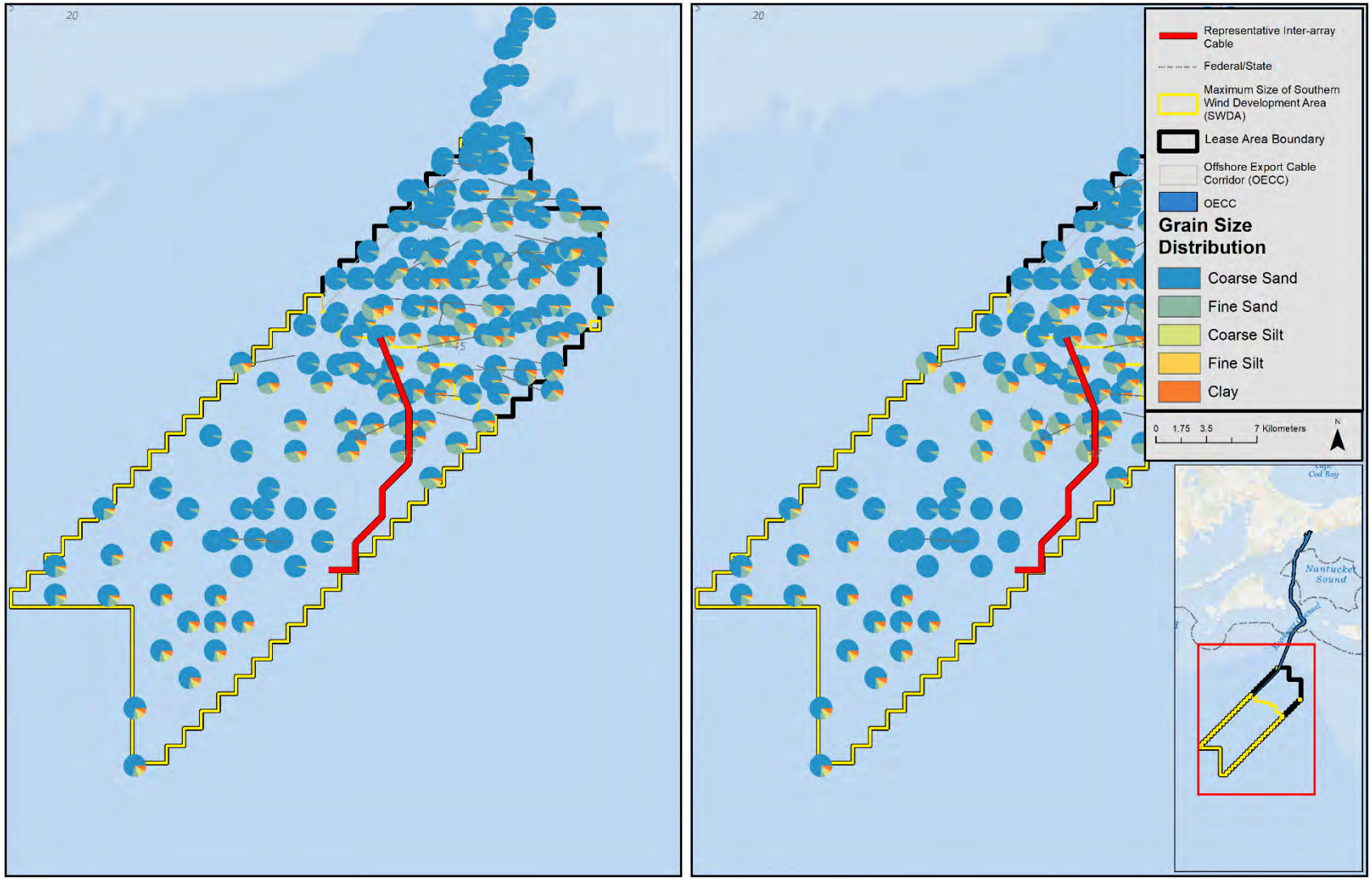

Figure 19. Sediment Grain Size Distributions for the Upper 2 m (left) and Upper 3 m (right) of the Seabed in the SWDA

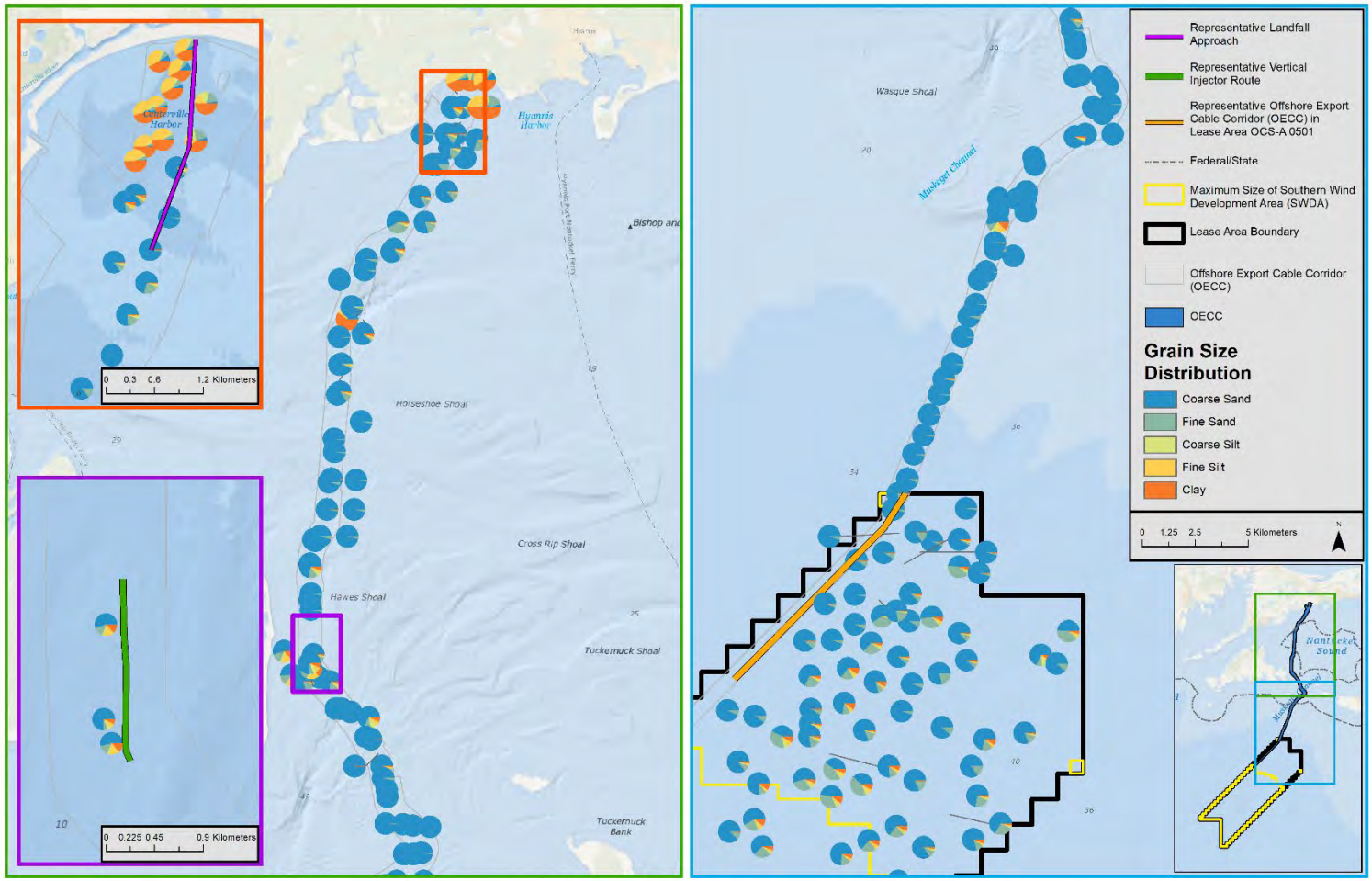

Figure 20. Sediment Grain size Distributions for OECC Scenarios[1]

Notes:

1. Left and right large panels show the northern and southern halves of the OECC, respectively. The insets on the left panel provide zoomed in views of the landfall (red outline) and the vertical injector section (purple outline); note that all views reflect characteristics depth weighted to two meters with the exception of the vertical injector which is showing the three meter depth weighted characteristics.

4.3 Sediment Modeling Results

SSFATE simulations were performed for each sediment disturbance activity. Sediment concentrations were computed on a grid with resolution of 50 m x 50 m in the horizontal dimension and 0.5 m in the vertical dimension. The model time step and output results-saving interval was five minutes for the cable installation scenarios and two minutes for the dredging/overflow/disposal simulations; a smaller time step was necessary for the dredging due to the faster production rate of those operations. Model-predicted concentrations are "excess" concentrations above background (i.e., a concentration of 0 mg/L is assumed for the ambient concentration).

Results from the model runs are presented through a set of figures and tables. Maps of maximum above-ambient TSS concentrations, duration of above-ambient TSS of 10 mg/L or greater, and seabed deposition are provided for each modeled scenario. Tables quantifying the area exceeding TSS thresholds for specific durations as well as areas of seabed deposition exceeding thickness thresholds are presented for the representative inter-array and offshore export cables. Further, examples of instantaneous concentration snapshots are presented to provide further detail.

Additional information about standard graphical outputs for each scenario are provided below:

- **Maps of Instantaneous TSS Concentrations:** These figures show the instantaneous TSS concentrations at a moment in time. The plan view shows the maximum concentration throughout the water column and the vertical cross-section shows the cross-sectional variability of concentrations along a transect. An example of instantaneous concentrations is shown for an example time step from the SWDA inter-array simulation of typical burial parameters, the OECC TSHD simulation, and the OECC cable installation simulation. Additionally, hourly snapshots of instantaneous TSS concentrations over six consecutive hours for each scenario are presented in Appendix A.
- **Maps of Time-integrated Maximum TSS Concentrations:** These figures show the maximum time-integrated water column concentration from the entire water column in scaled plan view. Most figures also include a non-scaled inset showing a cross-sectional view of maximum TSS concentrations in the water column. The concentrations are shown as contours using mg/L. The entire area within the contour is at or above the concentration defined by the contour itself. Most importantly, it should be noted that these maps show the maximum TSS concentration that occurred throughout the entire simulation and that: (1) these concentrations do not persist throughout the entire simulation and may be just one time step (30 minutes); and (2) these concentrations do not occur concurrently throughout the entire modeled area but are the time-integrated spatial views of maximum predicted concentrations.
- **Maps of Duration of TSS Concentrations Greater than 10 mg/L:** These figures show the number of hours that the TSS concentrations are expected to be equal to or greater than 10 mg/L.
- **Maps of Seabed Deposition:** These figures show the deposition on the seabed that would occur once the activity has been completed. The thickness levels are shown as contours (in mm) and the entire area within the contour is at or above the thickness defined by the contour itself. The contours have been delineated at levels either tied to biological significance (1 mm and 20 mm) or to facilitate viewing the results.

4.3.1 Inter-array Cable

SSFATE modeling and results associated with TSS generation as well as sediment deposition from the installation of a representative inter-array cable are described below. A snapshot of the instantaneous concentrations from the cable installation using typical parameters is presented in Figure 21. This figure shows the plan view concentrations as well as the vertical cross-section. This figure illustrates that higher concentrations are contained around the centerline, with lower concentrations biased towards the west due to bottom currents. The vertical cross-section shows that all concentrations are constrained to the bottom of the water column, with the highest concentrations closest to the bottom (i.e., localized to the source).

Side-by-side comparisons of the results of the inter-array cable installation from typical and maximum impact cable burial parameters are presented in Figure 22 through Figure 24. The map of time-integrated maximum concentrations is presented in Figure 22. In this figure, the cross-sectional view, presented as an inset, runs along the route centerline and shows that the plume is localized to the bottom of the water column. For both cases, the overall footprint shows how the plume oscillates with the tides, which is reflective in the oscillatory pattern of the 10–25 mg/L (yellow) concentrations relative to the route centerline. Concentrations greater than 10 mg/L contour have a maximum excursion of approximately 1 km and 2.2 km from the centerline for typical and maximum cable burial parameters, respectively.

A map of hours with TSS concentrations greater than 10 mg/L is presented in Figure 23. The results for both the typical and maximum impact parameters show that in any given location, the total exposure is typically one to two hours or two to three hours with some small isolated patches of exposure between three to four hours for the maximum impact scenario.

The map of deposition thickness for the inter-array scenarios is presented in Figure 24. This figure shows that deposition is mainly centered around the installation alignment with deposition of 1 mm or greater limited to within approximately 100 - 150 m for typical and maximum impact, respectively. Deposition does not reach 5 mm in the simulation of typical parameters and has small isolated patches greater than 5 mm in the simulation of maximum impact parameters.

Figure 22 through Figure 24 indicate that most of the sediments settle out quickly and not transported for long by the currents. Relative to one another the maximum impact simulation has a larger footprint for each threshold and has more area of longer exposures to concentrations greater than 10 mg/L. Elevated TSS is confined to the bottom few meters of the water column, which is only a small fraction of the water column in the SWDA. Deposition greater than 1 mm is confined within 100 - 150 m of the installation alignment for the typical and maximum parameter simulations, respectively, and maximum deposition in both simulations is usually less than 5 mm. Water quality impacts from inter-array cable installation are therefore short-term and localized.

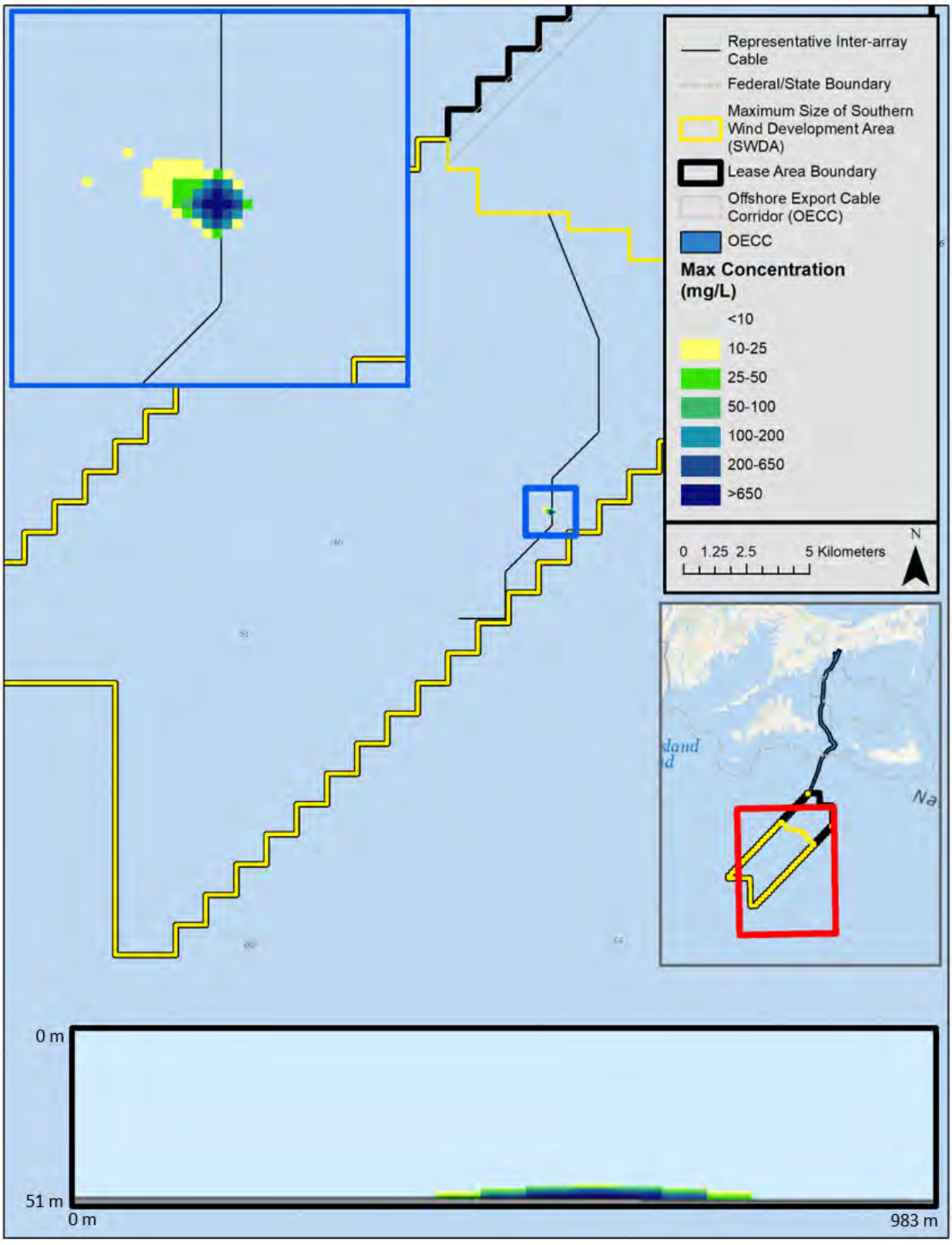

Figure 21. Snapshot of Instantaneous TSS Concentrations[1]

Notes:

1. The above depicts a time step from the simulation of inter-array cable installation using typical cable burial parameters. Inset at bottom shows the vertical cross-section across the plume.

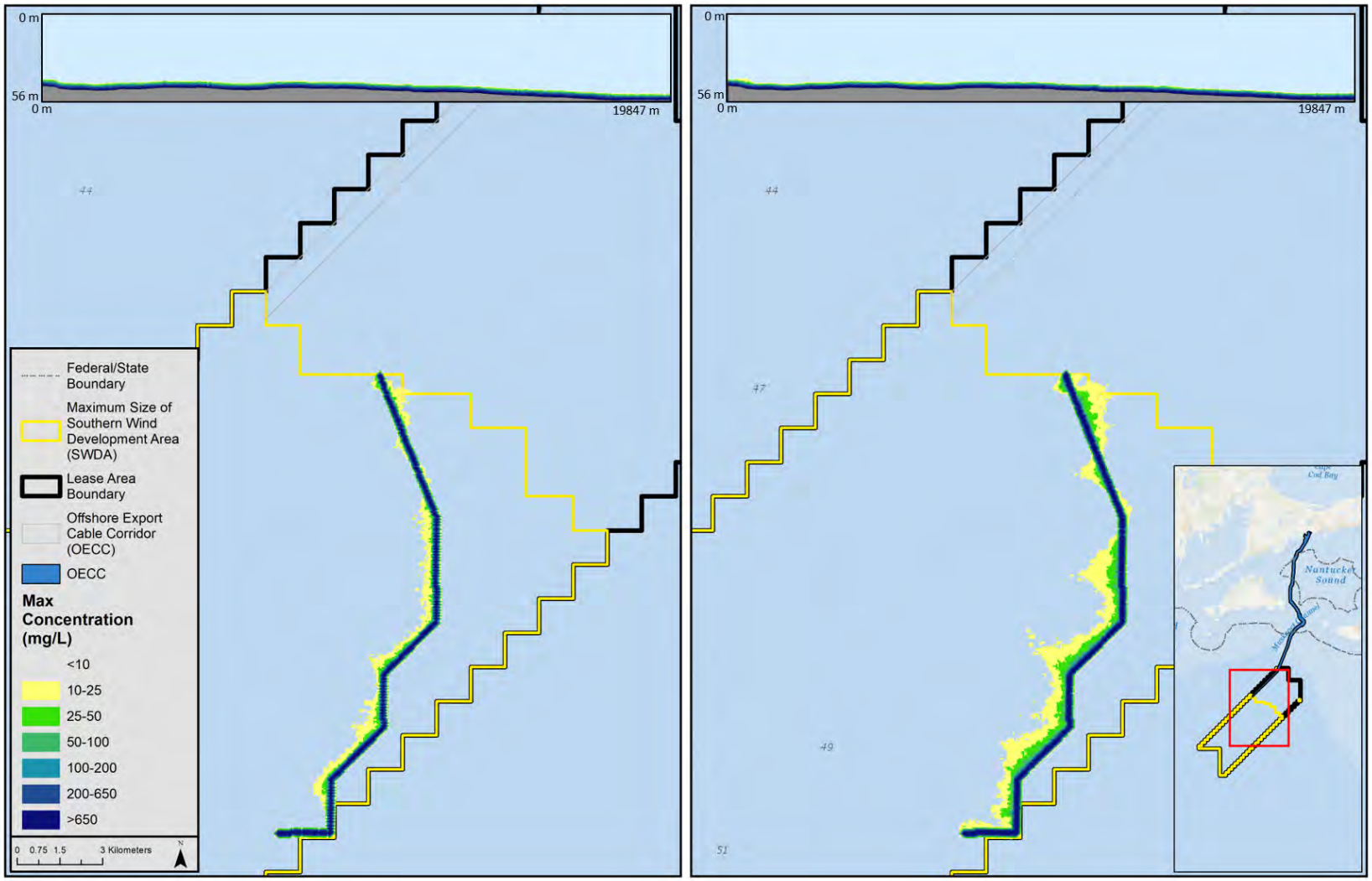

Figure 22. Map of time-integrated maximum concentrations associated with a representative inter-array cable installation using typical (left) and maximum impact (right) cable burial parameters[1]

Notes:

1. Inset shows a vertical cross-section along the route centerline.

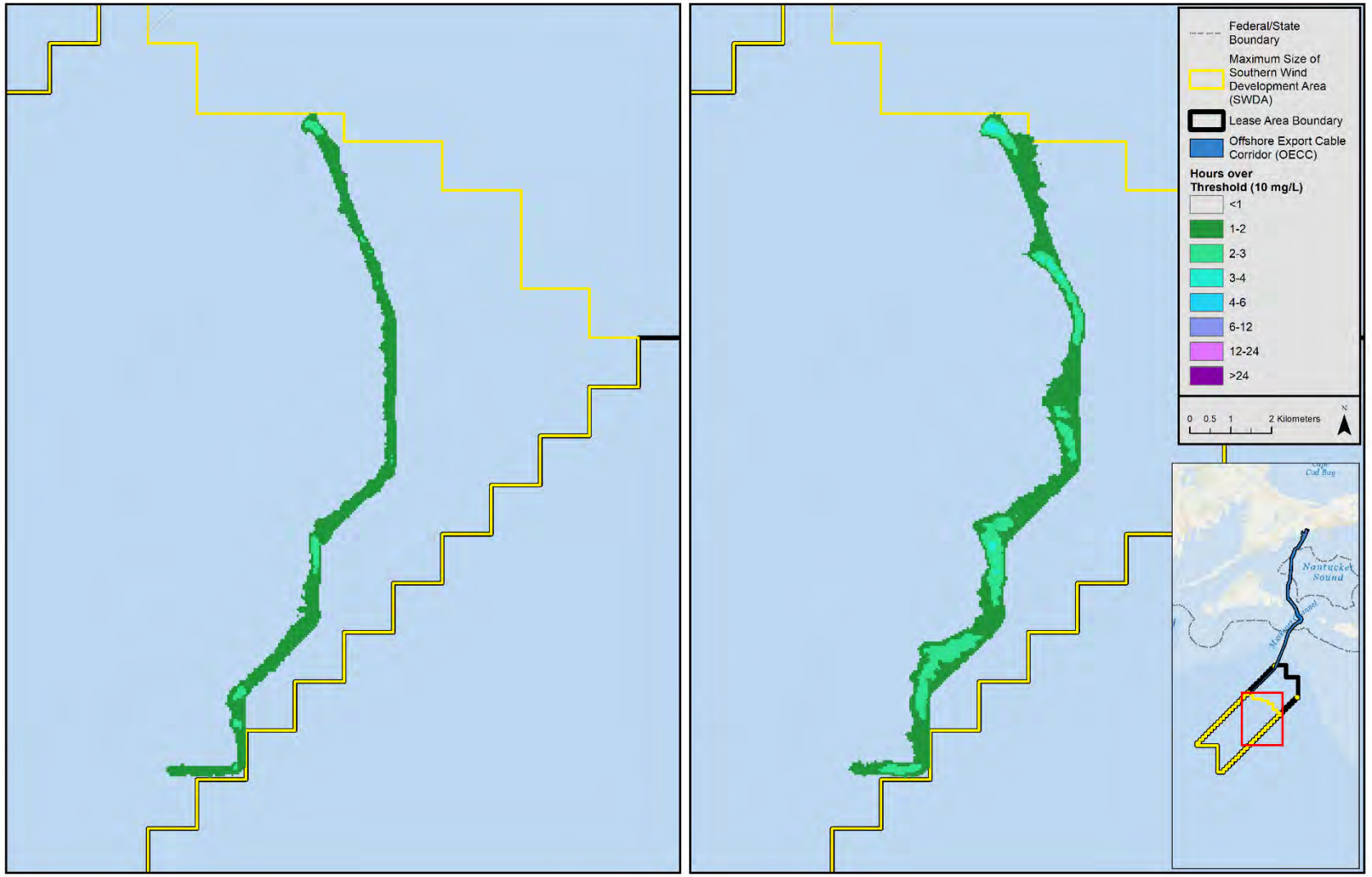

Figure 23. Map of duration of TSS ≥ 10 mg/L associated with a representative inter-array cable installation using typical (left) and maximum impact (right) cable burial parameters

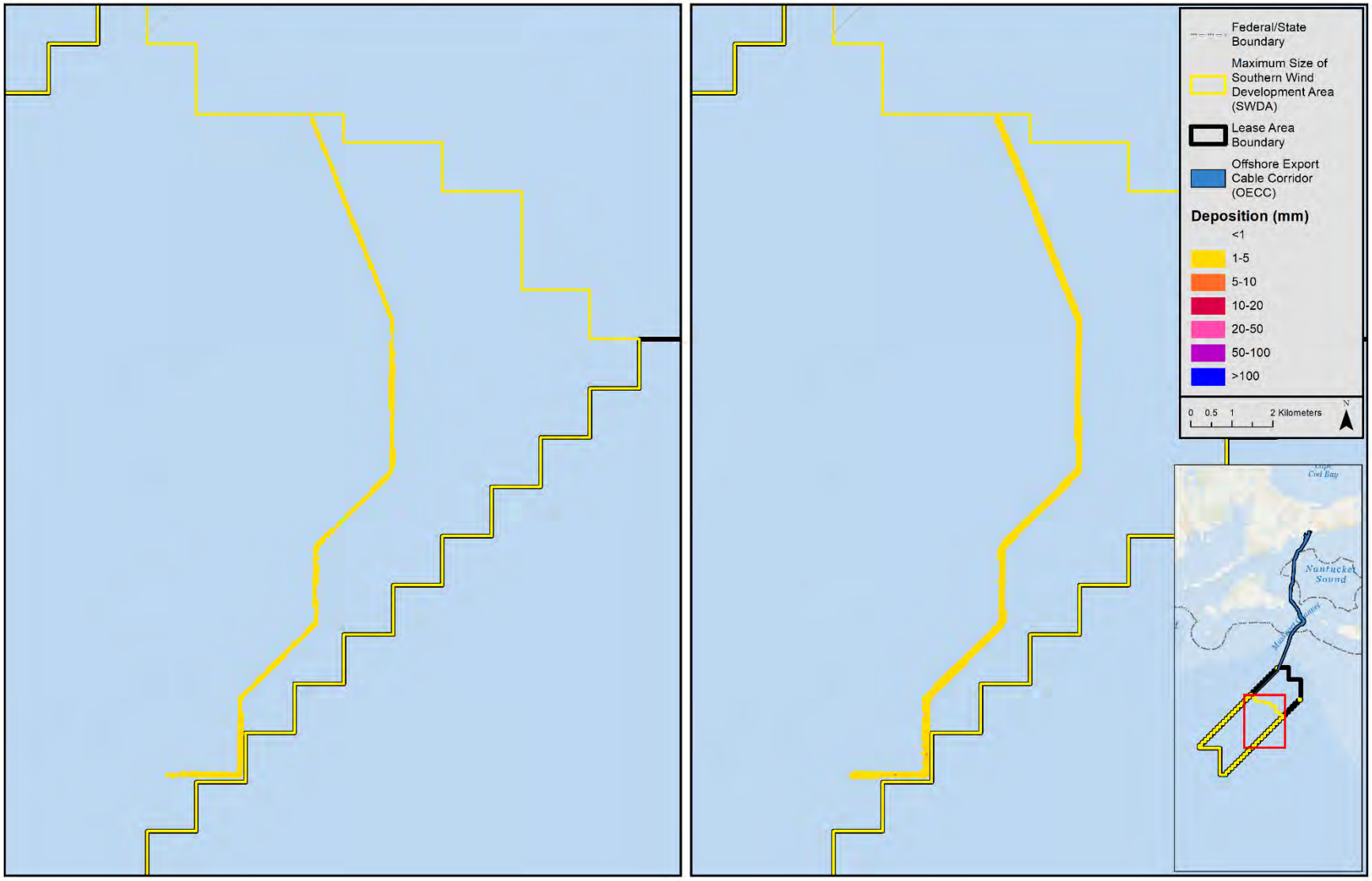

Figure 24. Map of deposition thickness associated with a representative inter-array cable installation simulation using typical (left) and maximum impact (right) cable burial parameters

4.3.2 OECC

This section presents results from the simulations of cable installation activities in the OECC. These activities include sand wave dredging and cable installation methods. Results are presented separately for each of the seven model scenarios:

- TSHD
- Limited TSHD
- OECC cable installation
- OECC cable installation aided by jetting
- OECC cable installation in the lease area
- OECC section of cable installation with vertical injector
- OECC section of cable installation along the landfall approach

Since both Vineyard Wind 1 and New England Wind occupy the same OECC and will utilize similar cable installation technologies, the model results presented in this report for TSHD, limited TSHD, OECC cable installation and OECC cable installation by jetting are the same as those presented for the "Eastern Muskeget to Covell's Beach" in the report for the Vineyard Wind 1 project.

TSHD Model Scenario

A snapshot of the instantaneous concentrations from the TSHD scenario is presented in Figure 25, the inset contains the vertical cross-section across the plume. This figure shows that at this instance, TSS concentrations above ambient are occurring throughout most of the vertical extent of the water column due to disposal activity releasing sediments in the upper water column.

For the TSHD scenario, the map of maximum time-integrated concentrations is presented in Figure 26, the duration of exposure to TSS above ambient greater than 10 mg/L above ambient is presented in Figure 27, and the seabed deposition is shown in Figure 28. Figure 26 illustrates that the simulation predicted that the affected areas are discontinuous in response to the intermittent nature of dredging. The 10 mg/L footprint extends up to 16 km from the activity and may be present throughout the majority of the water column. The map of exposure of the water column to TSS concentrations greater than 10 mg/L shows a much smaller footprint as compared to the map of maximum concentrations, indicating that at 10 mg/L the plume is very transient (i.e., present for less than one hour) in most locations. Most locations have exposures of less than one hour, though there are some areas with exposure of up to six hours. The deposition greater than 1 mm is discontinuous and tends to stay central to the route centerline.

Limited TSHD Model Scenario

For the limited TSHD scenario, the map of maximum time-integrated concentrations is presented in Figure 29, the duration of exposure to TSS above ambient greater than 10 mg/L is presented in Figure 30, and the seabed deposition is shown in Figure 31. The results for the limited TSHD scenario are similar in trend to those of the TSHD, but are reduced in size and intensity due to the fact that this scenario is dredging less sediments.

OECC Cable Installation

A snapshot of the instantaneous concentrations from the representative OECC cable installation scenario is presented in Figure 32, the inset contains the vertical cross-section across the plume. This figure shows that at this instance, TSS concentrations are local to the bottom of the water column. The results of the representative cable installation scenario for the OECC is provided in Figure 33 through Figure 35. The map of maximum time-integrated concentrations is presented in Figure 33, the duration of exposure to TSS above ambient greater than 10 mg/L is presented in Figure 34, and the seabed deposition is shown in Figure 35. TSS greater than 10 mg/L typically remains within less than 200 m from the route alignment; however, may extend up to 1.9 km in the region of Muskeget Channel, which is expected due to the relatively higher current speeds.

Concentrations greater than 10 mg/L persist for less than two hours in most locations with small isolated areas that persist between two to three hours. Seabed deposition for this scenario between 1–5 mm is predicted to remain within 100 m from the route alignment and the footprint is uniform along the route.

OECC Cable Installation Aided by Jetting

The results of the OECC cable installation aided by jetting scenario for the OECC are provided in Figure 36 through Figure 38. The map of maximum time-integrated concentrations is presented in Figure 36, the duration of exposure to TSS above ambient greater than 10 mg/L is presented in Figure 37, and the seabed deposition is shown in Figure 38. These results are nearly identical to those from the cable installation scenario with small localized differences.

OECC Section of Cable Installation within the Lease Area

The results of the representative cable installation for the OECC in the Lease Area are provided in Figure 39 through Figure 41. The map of maximum time-integrated concentrations is presented in Figure 39, the duration of exposure to TSS above ambient greater than 10 mg/L is presented in Figure 40, and the seabed deposition is shown in Figure 41. The concentrations greater than 10 mg/L primarily stay within a few hundred meters from the route alignment with a few localized areas with greater excursion (up to 600 m). The map of duration shows that the plume typically persists between one to two hours in most locations with a few localized patches where it persists between two to three hours. The seabed deposition associated with this scenario shows that deposition between 1–5 mm remains within approximate 100 m from the route alignment and is a uniform footprint along the route.

OECC Section of Cable Installation with Vertical Injector

The results of the cable installation for the section of OECC with installation by vertical injector are provided in Figure 42 through Figure 44. The map of maximum time-integrated concentrations is presented in Figure 42, the duration of exposure to TSS above ambient greater than 10 mg/L is presented in Figure 43, and the seabed deposition is shown in Figure 44. TSS concentrations greater than 10 mg/L extend approximately 1.2 km from the route alignment in response to the fast currents in this area. The concentrations are localized to the bottom of the water column. Concentrations greater than 10 mg/L persist primarily for three to four hours or less though there are a couple of isolated patches that are exposed between four to six hours. Seabed deposition is between 1–5 mm extends up to 627 m from the route alignment with a small isolated patch close to the route alignment with thickness between 5–10 mm.

OECC Section of Cable Installation along Landfall Approach

The results of the cable installation for the section of OECC representing the landfall approach are provided in Figure 45 through Figure 47. The map of maximum time-integrated concentrations is presented in Figure 45, the duration of exposure to TSS above ambient greater than 10 mg/L is presented in Figure 46, and the seabed deposition is shown in Figure 47. Concentrations of TSS greater than 10 mg/L mainly stay within approximately 200 m from the route alignment; however, may extend up to 764 m. Concentrations occupy less than the bottom 6 m of the water column; however, since the water depths are shallower in this area, it may occupy nearly the entire water column. Concentrations of TSS greater than 10 mg/L persist typically less than one to two hours; however, there are two isolated patches with exposure between two to three hours and there is one small patch (~100 m x 50 m) that the concentrations persist between four to six hours. The seabed deposition is limited to 1–5 mm within approximately 100 m from the route alignment.

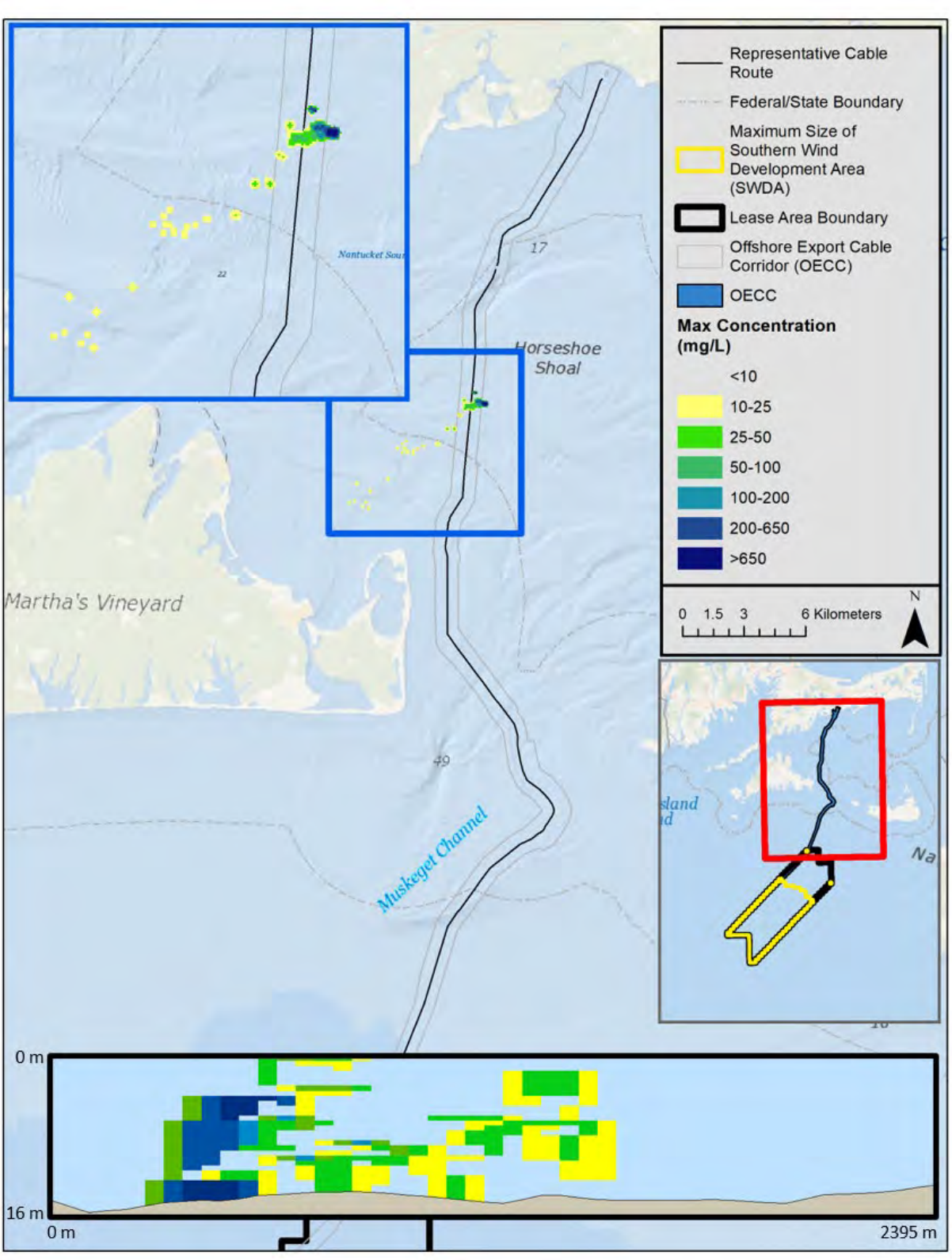

Figure 25. Snapshot of instantaneous TSS concentrations for a time step during simulation of TSHD dredging, overflow, and dredged material release operations for a representative cable route within the OECC[1]

Notes:

1. Inset at bottom shows the vertical cross-section across the plume east (left) to west (right).

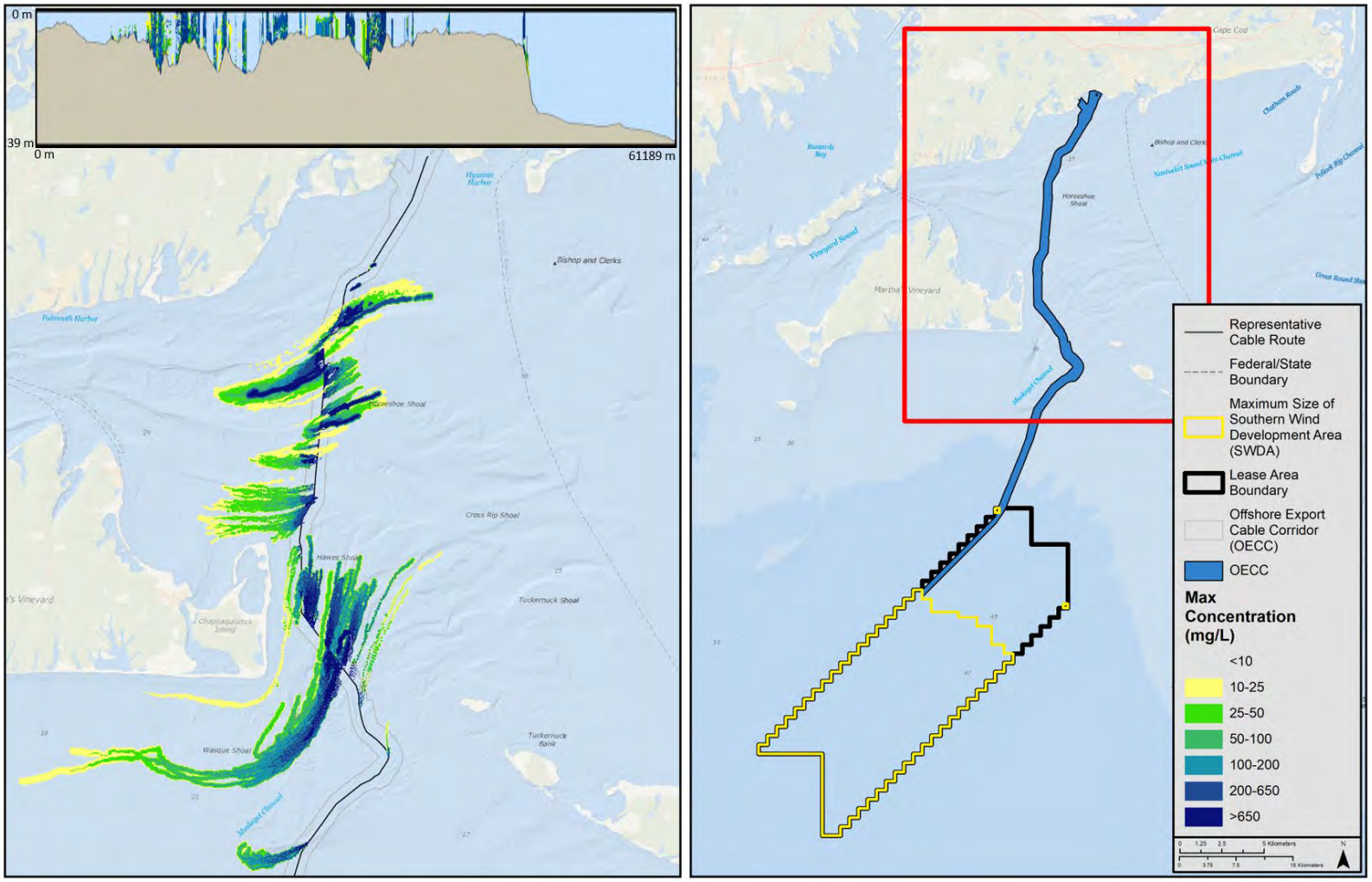

Figure 26. Map of time-integrated maximum concentrations associated with TSHD dredging, overflow, and dredged material release operations for a representative cable route within the OECC[1]

Notes:

1. Inset shows a vertical cross-section.

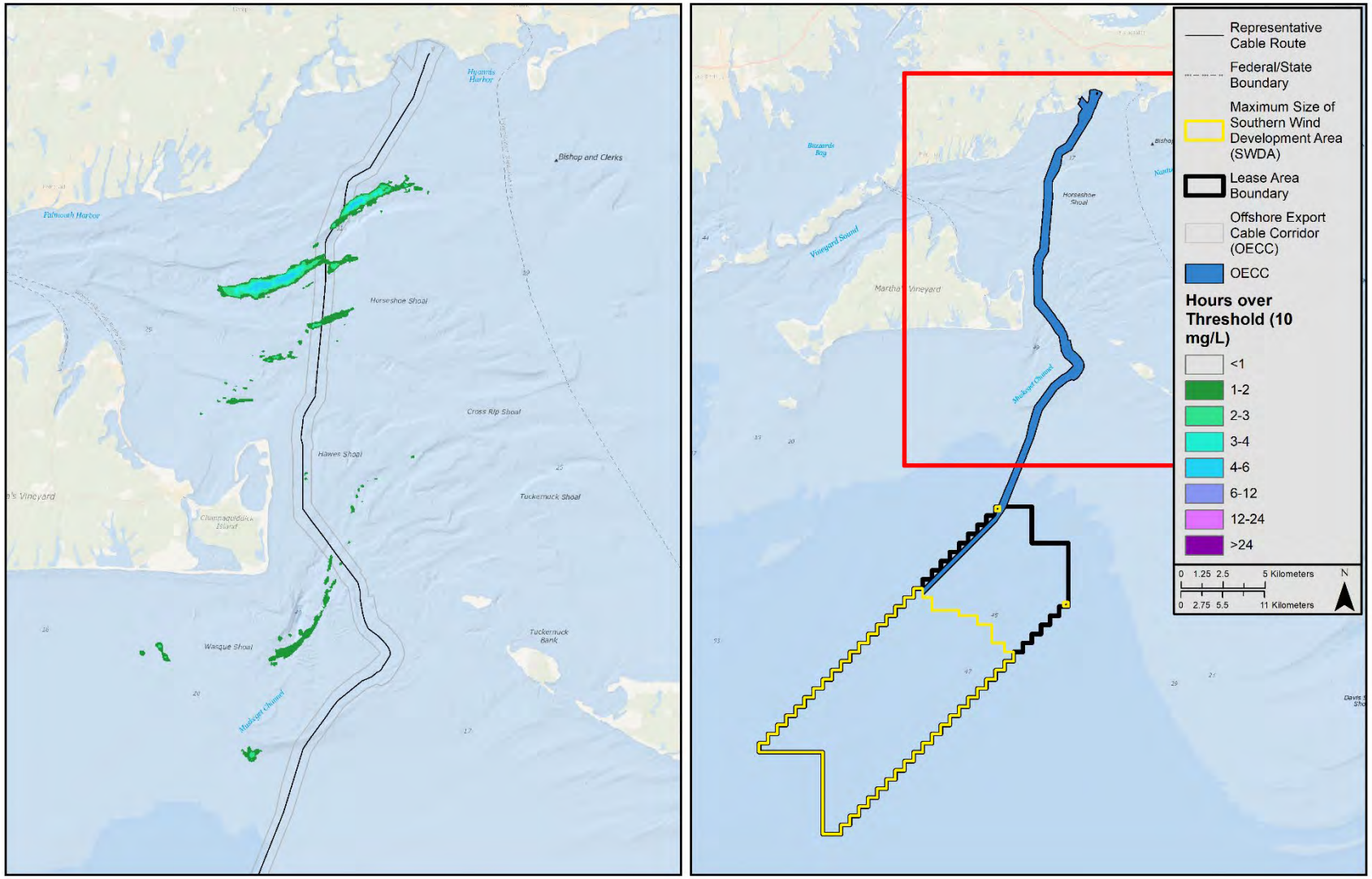

Figure 27. Map of duration of TSS ≥ 10 mg/L associated with TSHD dredging, overflow, and dredged material release operations for a representative cable route within the OECC

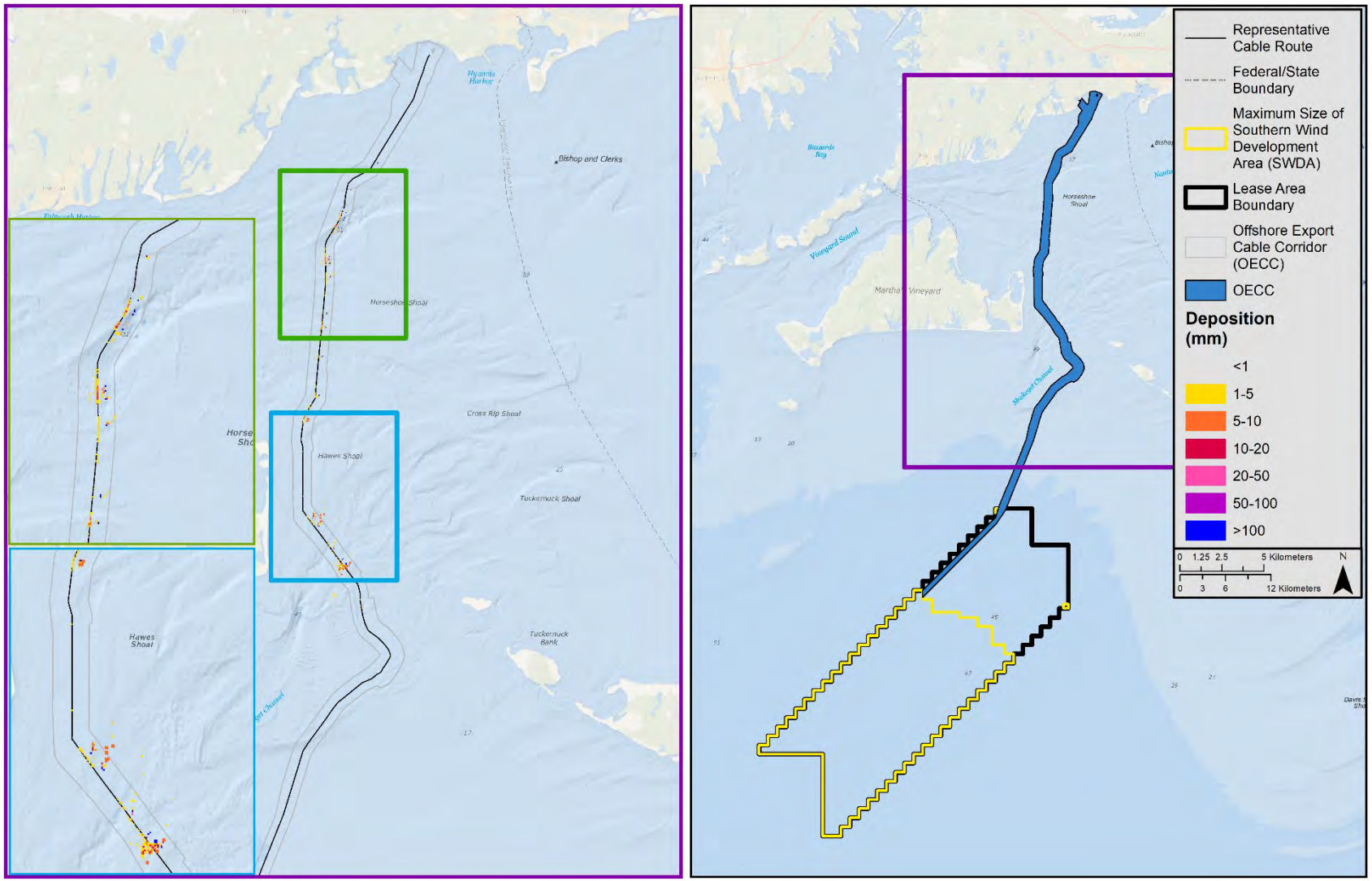

Figure 28. Map of deposition thickness associated with TSHD dredging, overflow, and dredged material release operations for a representative cable route within the OECC

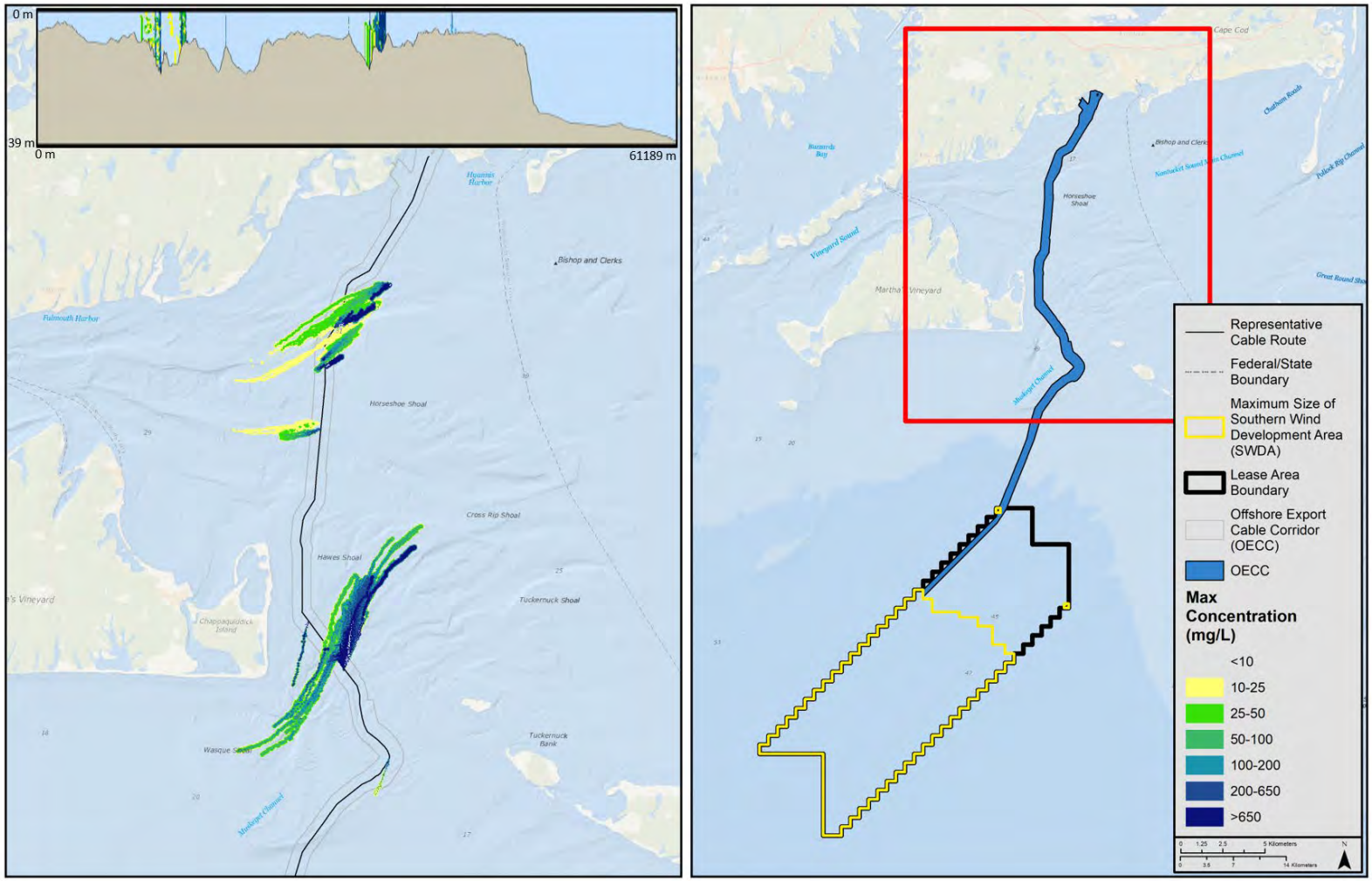

Figure 29. Map of time-integrated maximum concentrations associated with limited TSHD dredging, overflow, and dredged material release operations for a representative cable route within the OECC[1]

Notes:

1. Inset shows a vertical cross-section along the route centerline.

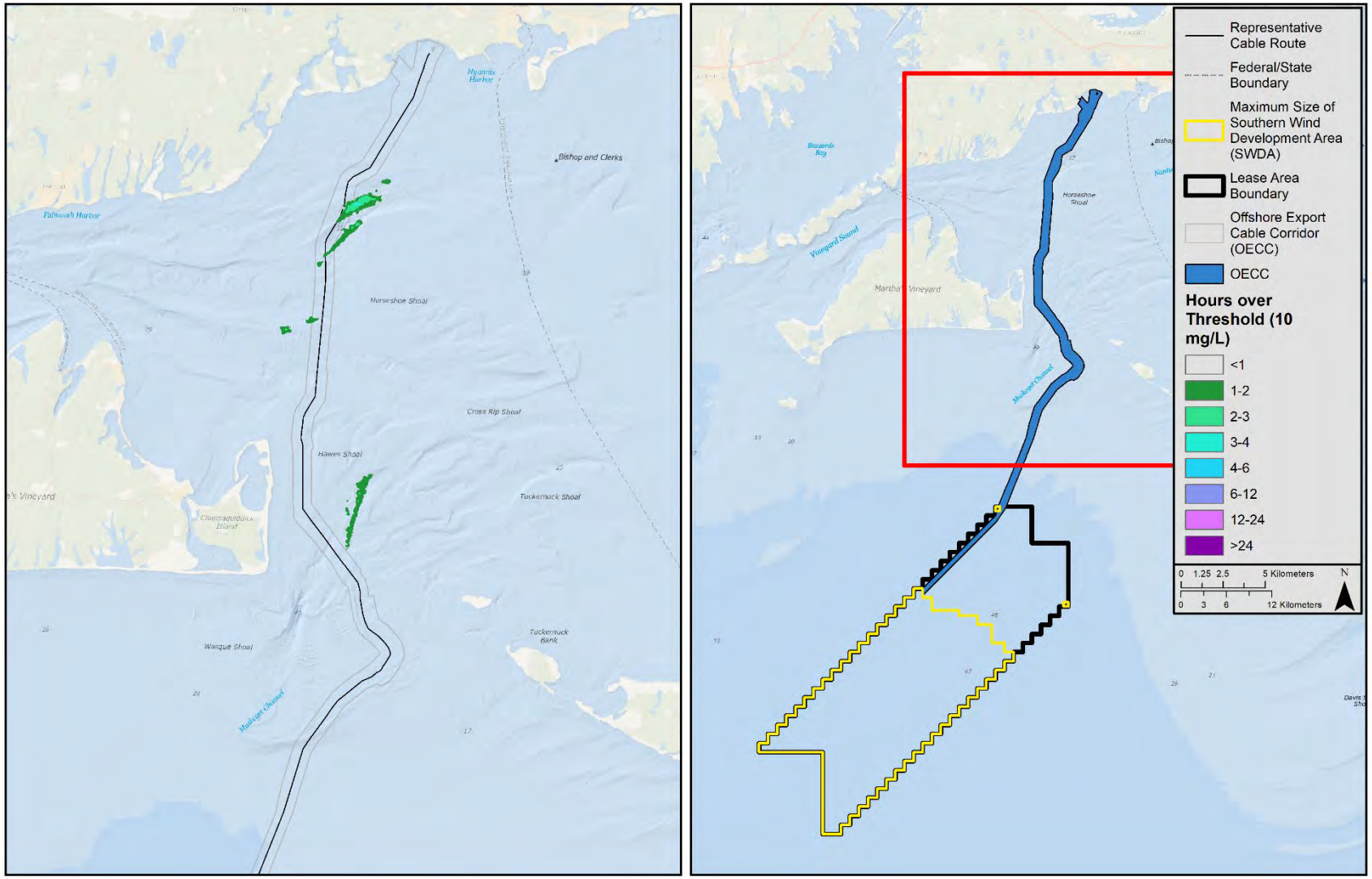

Figure 30. Map of duration of TSS ≥ 10 mg/L associated with limited TSHD dredging, overflow, and dredged material release operations for a representative cable route within the OECC

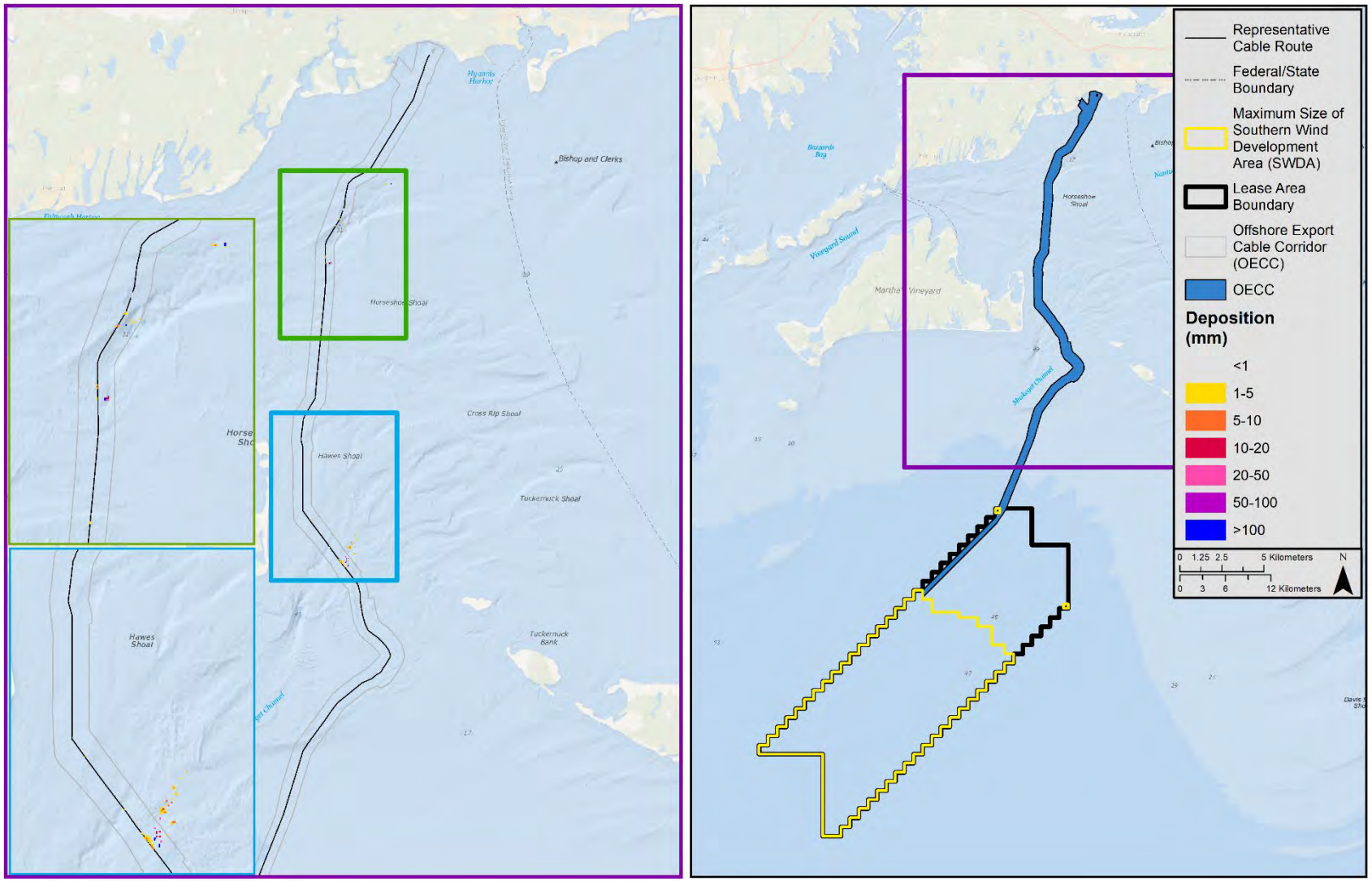

Figure 31. Map of deposition thickness associated with limited TSHD dredging, overflow, and dredged material release operations for a representative cable route within the OECC

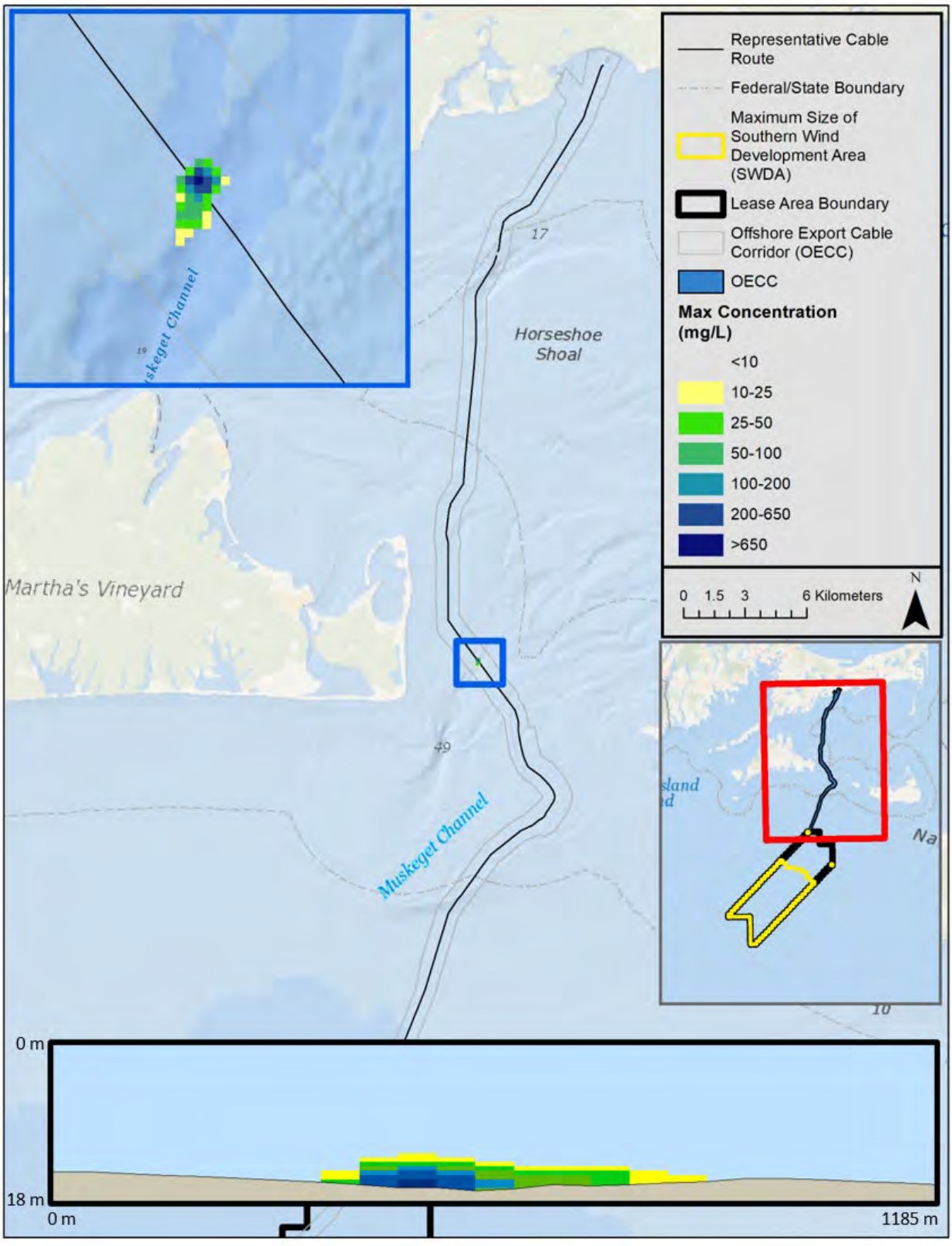

Figure 32. Snapshot of instantaneous TSS concentrations for a time step during simulation of representative cable installation within the OECC[1]

Notes:

1. Inset at bottom shows the vertical cross-section across the plume.

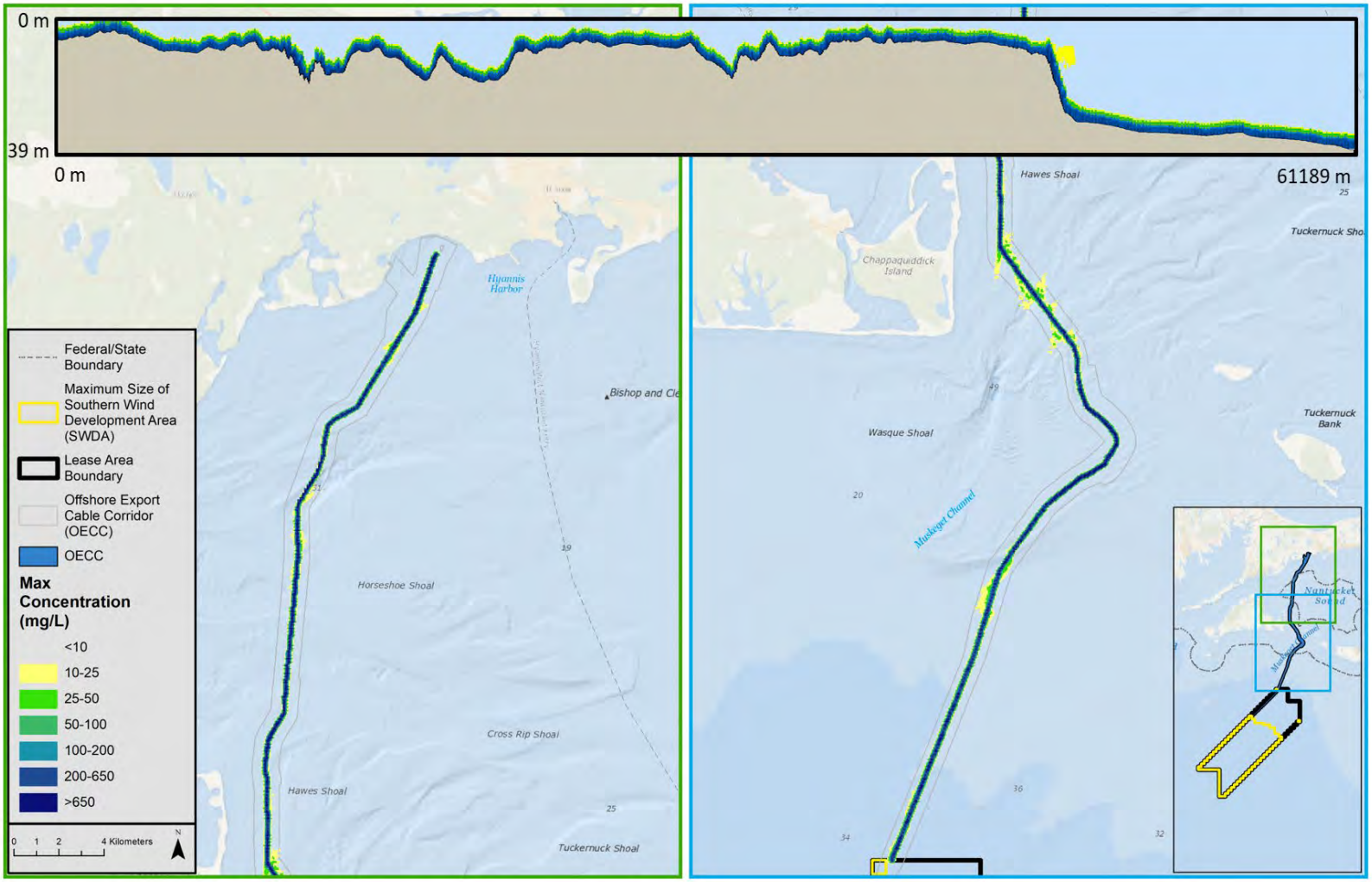

Figure 33. Map of time-integrated maximum concentrations associated with representative cable installation within the OECC[1]

Notes:

1. Inset shows a vertical cross-section along entire representative centerline.

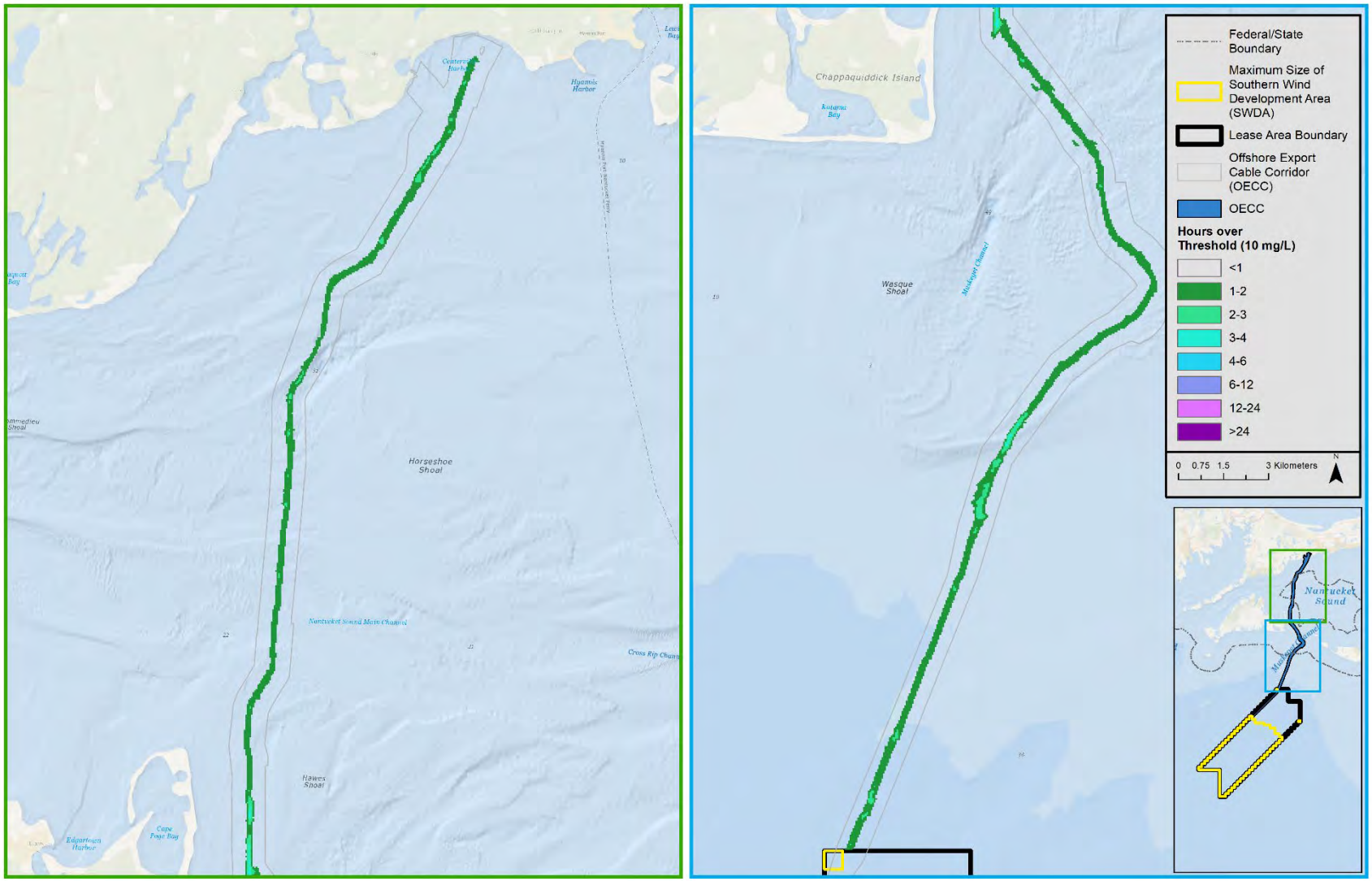

Figure 34. Map of duration of TSS ≥ 10 mg/L associated with representative cable installation within the OECC

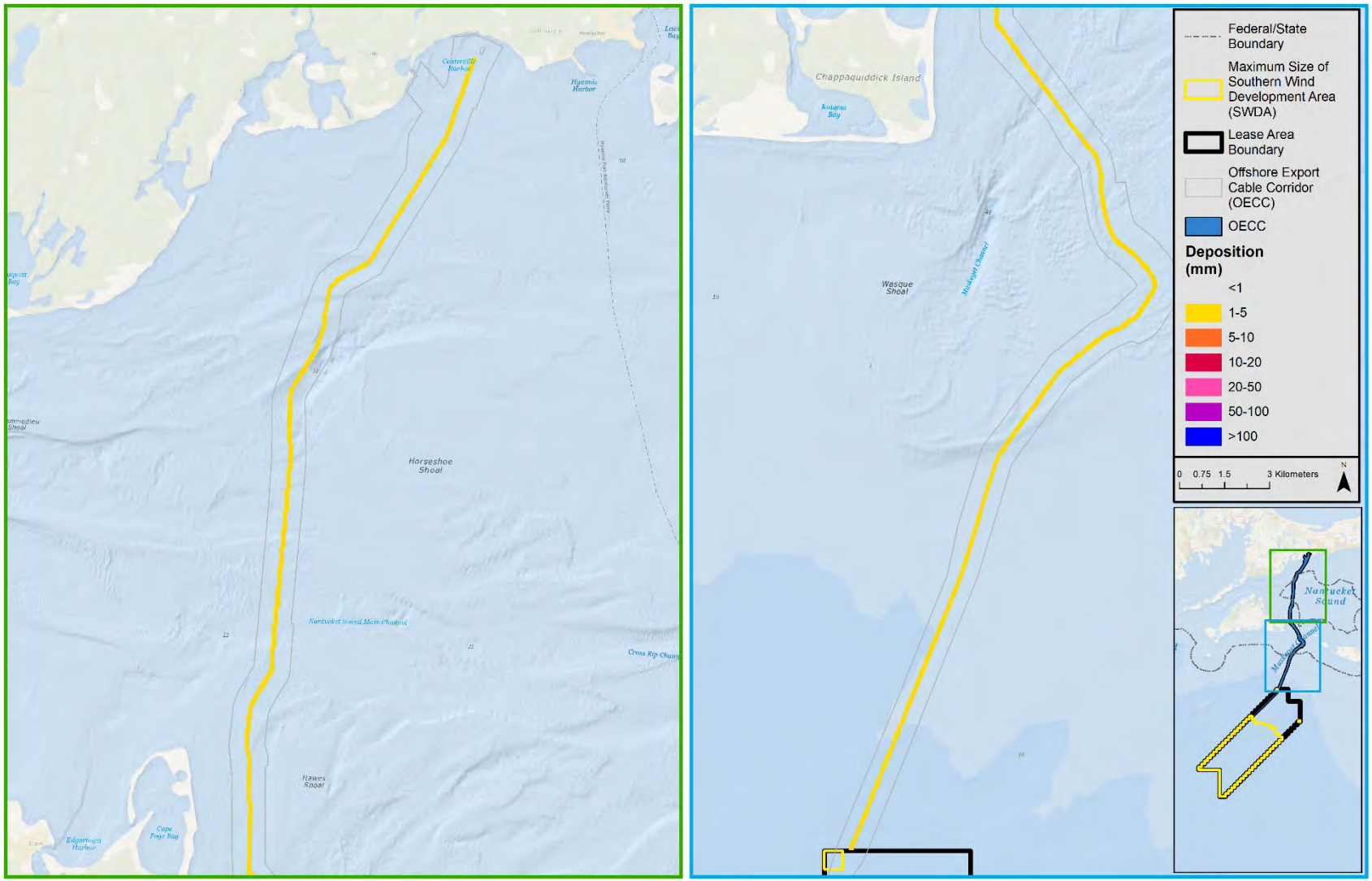

Figure 35. Map of deposition thickness associated with representative cable installation within the OECC

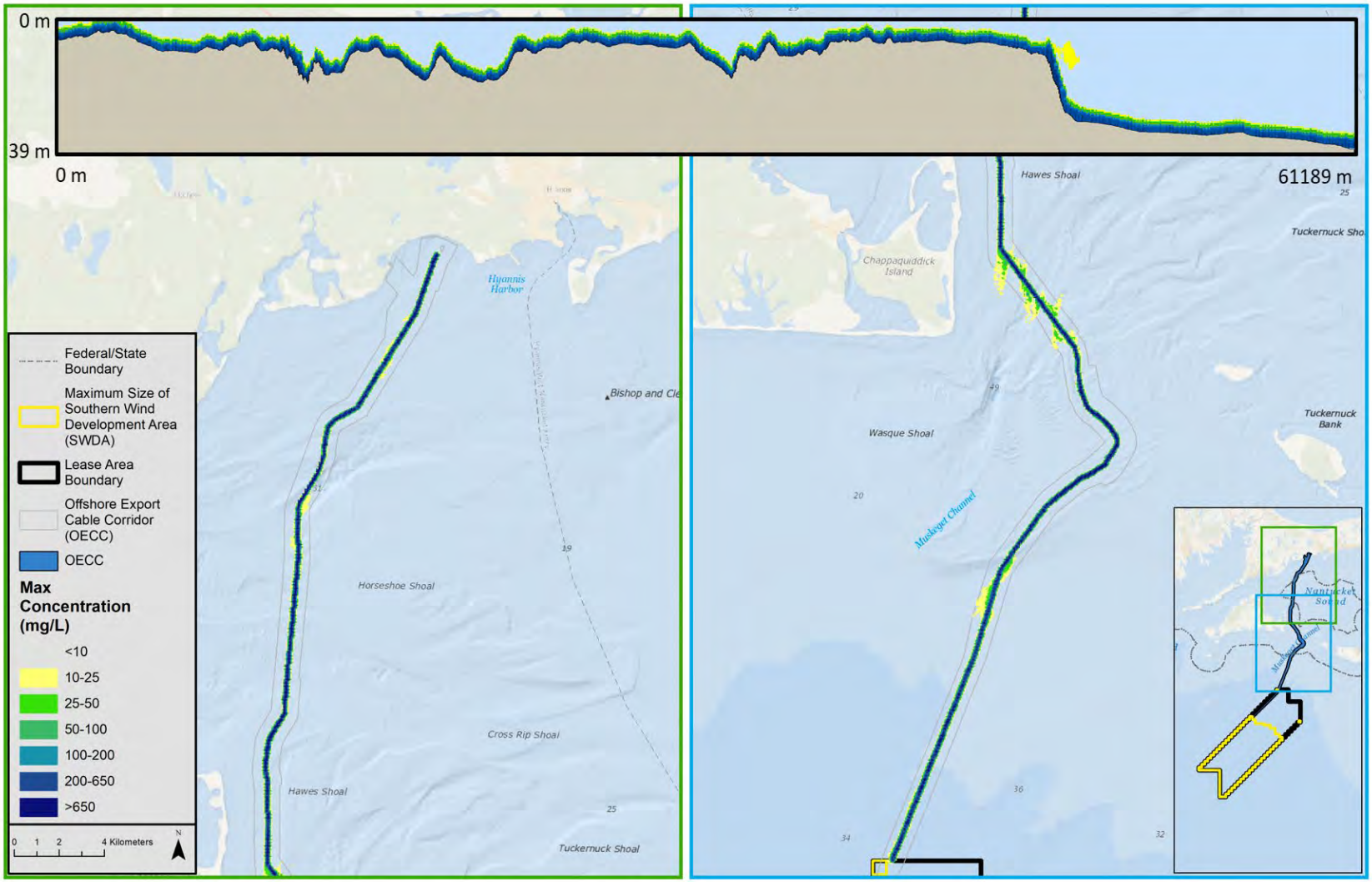

Figure 36. Map of time-integrated maximum concentrations associated with cable installation aided by jetting for a representative cable route within the OECC[1]

Notes:

1. Inset shows a vertical cross-section of entire representative route centerline.

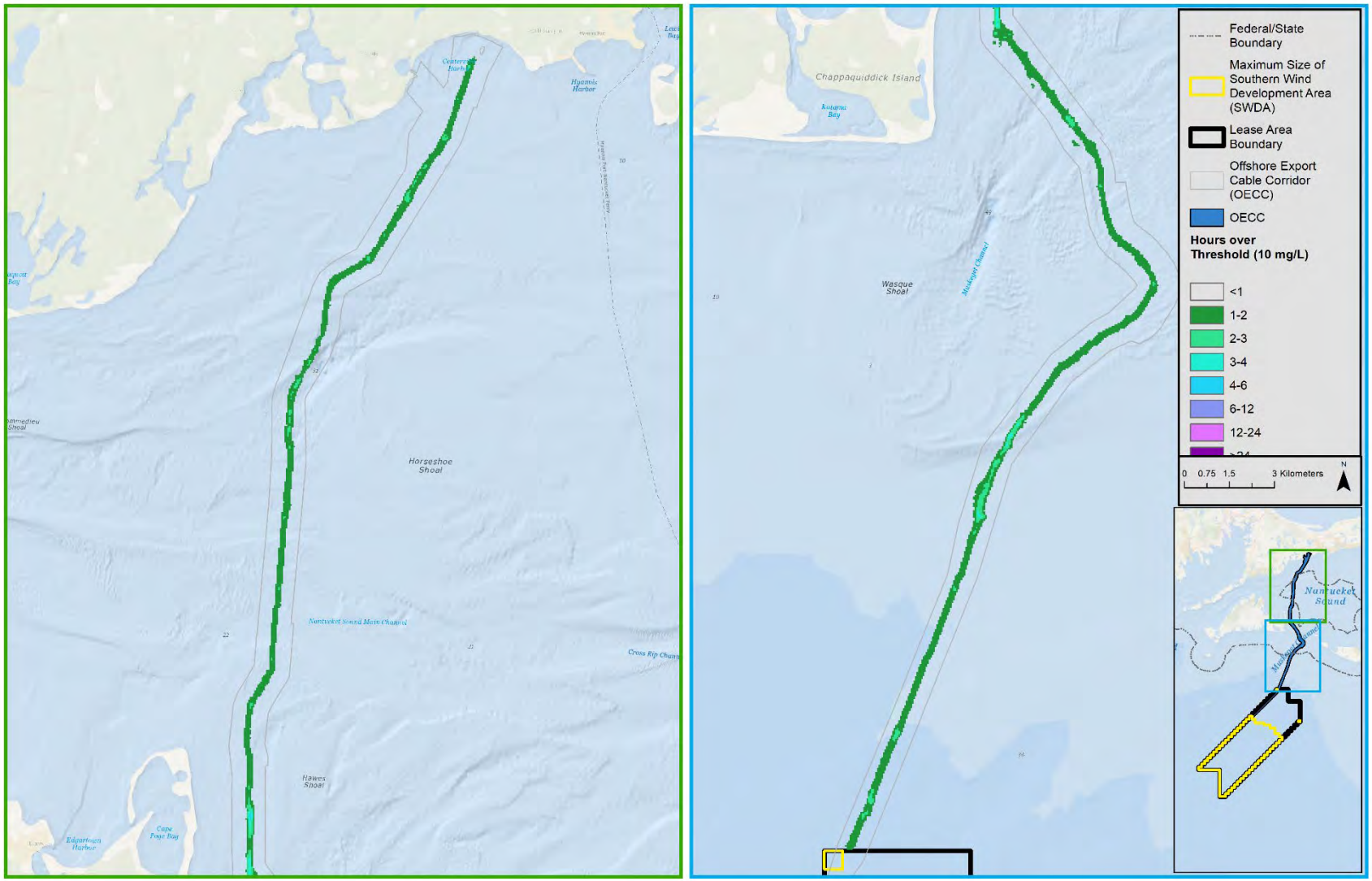

Figure 37. Map of duration of TSS ≥ 10 mg/L associated with cable installation aided by jetting for a representative cable route within the OECC

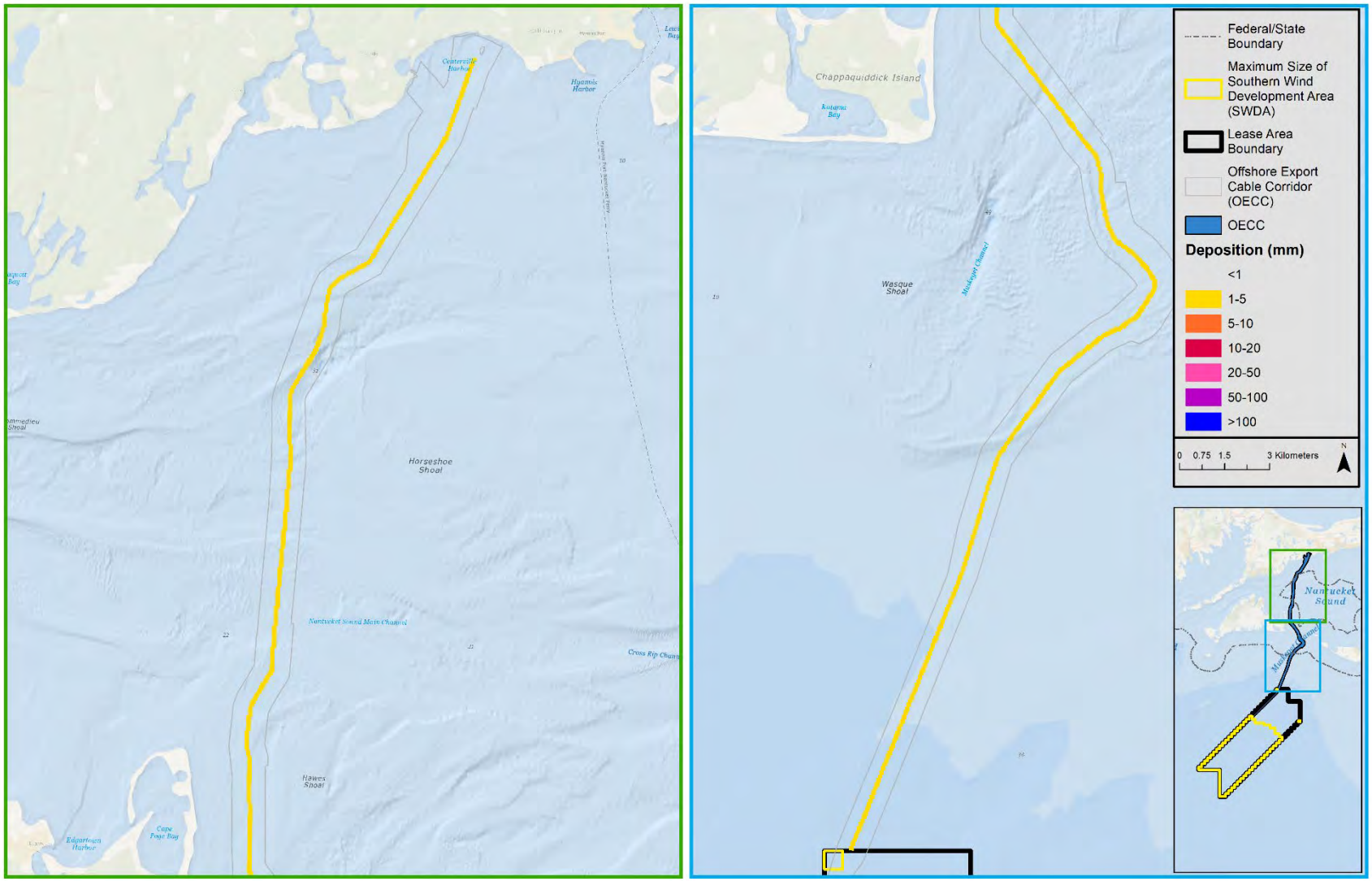

Figure 38. Map of deposition thickness associated with cable installation aided by jetting for a representative cable route within the OECC

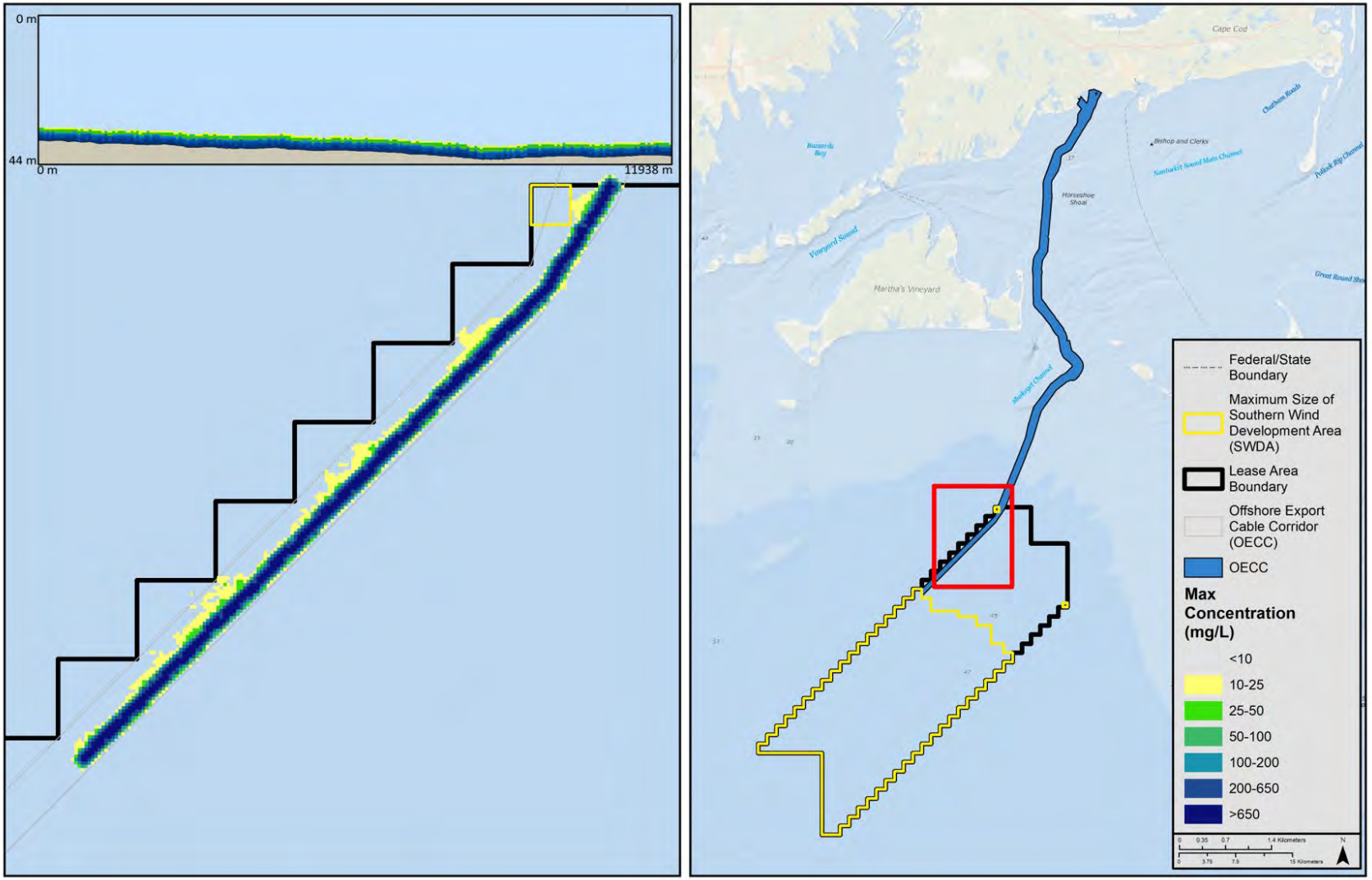

Figure 39. Map of time-integrated maximum concentrations associated with representative cable installation within the OECC in Lease Area OCS-A 0501[1]

Notes:

1. Inset shows a vertical cross-section.

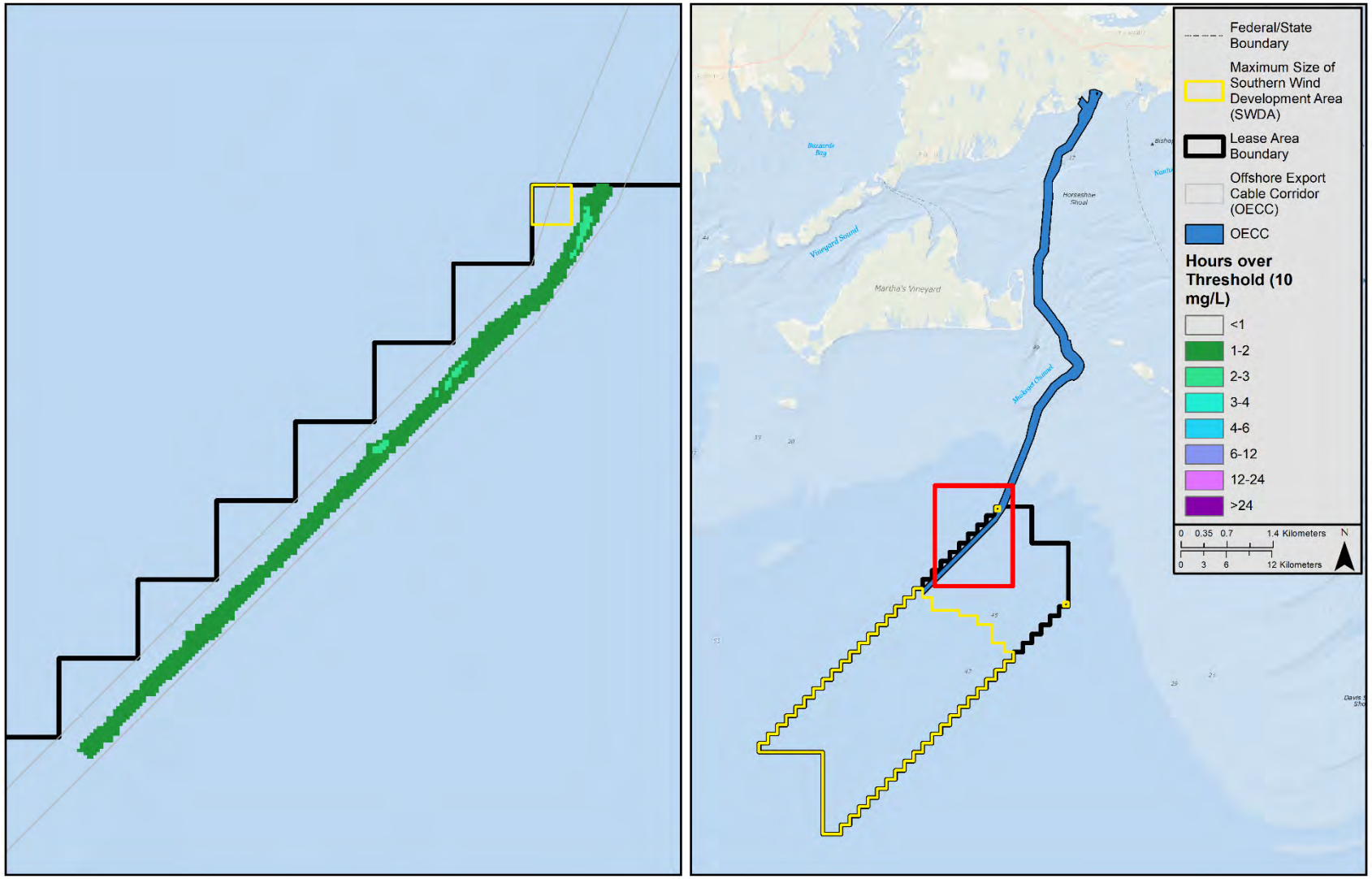

Figure 40. Map of duration of TSS ≥ 10 mg/L associated with representative cable installation within the OECC in Lease Area OCS-A 0501

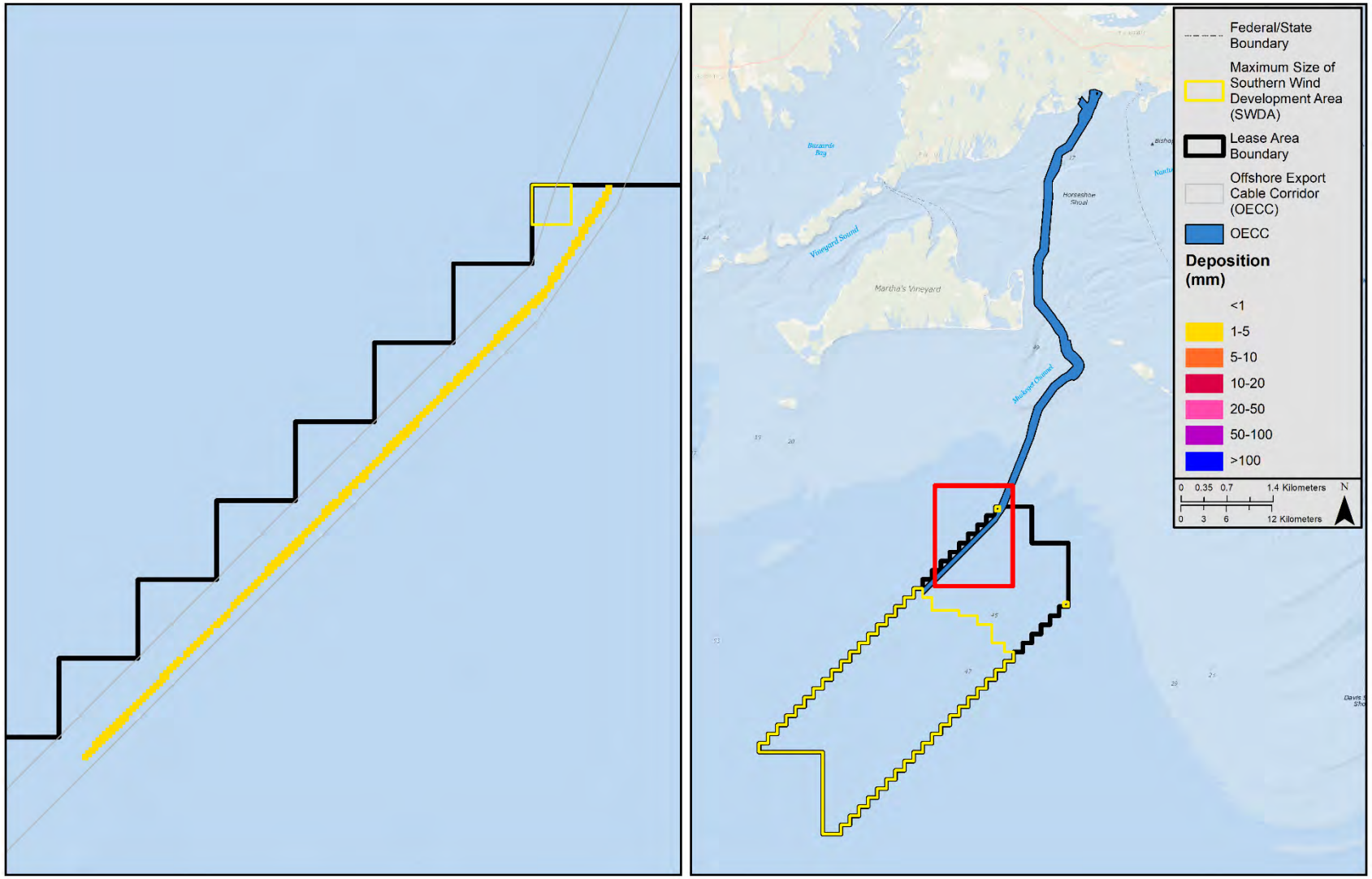

Figure 41. Map of deposition thickness associated with representative cable installation within the OECC in Lease Area OCS-A 0501

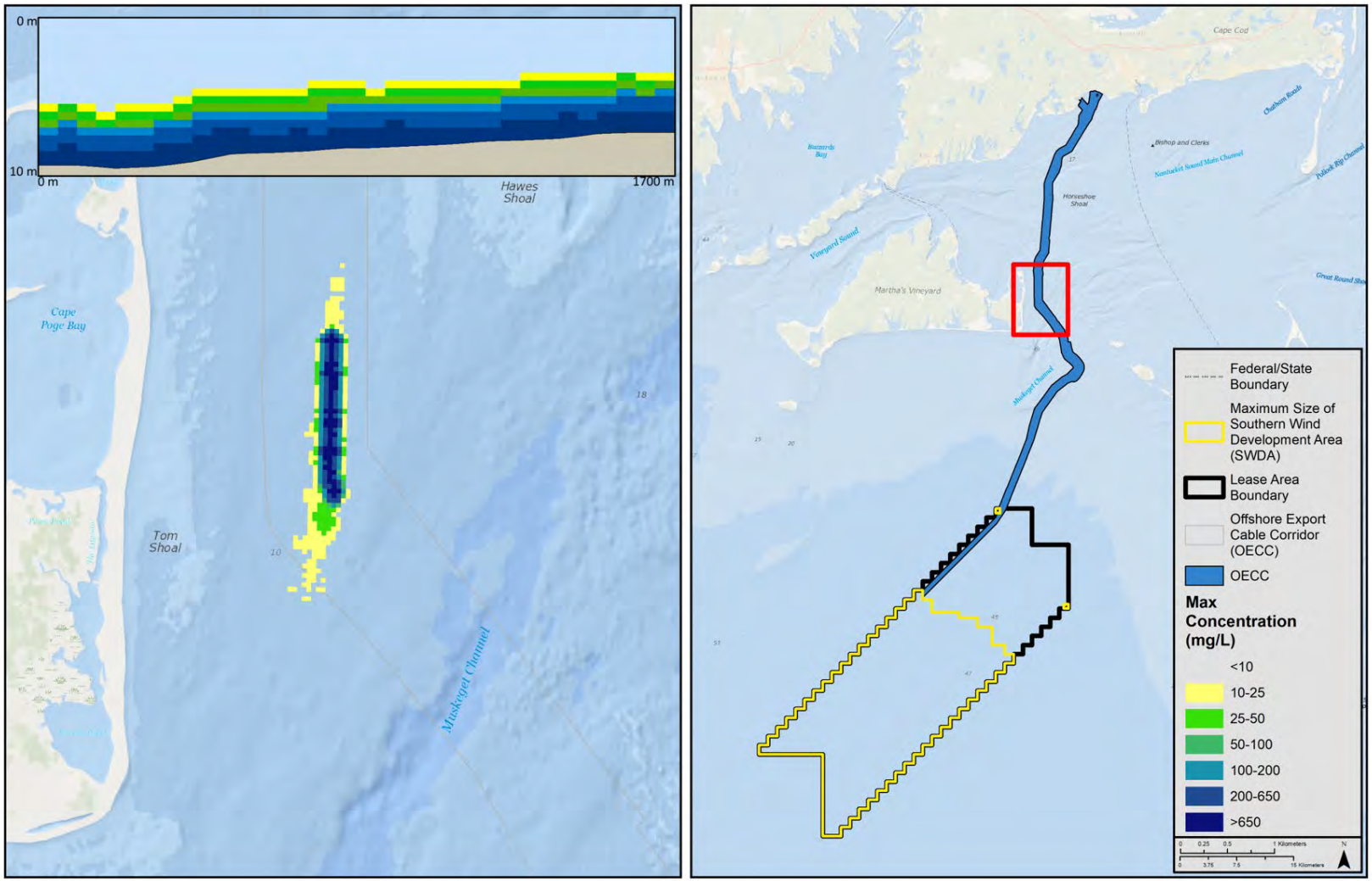

Figure 42. Map of time-integrated maximum concentrations associated with cable installation installed with a vertical injector for a representative section of the OECC[1]

Notes:

1. Inset shows a vertical cross-section.

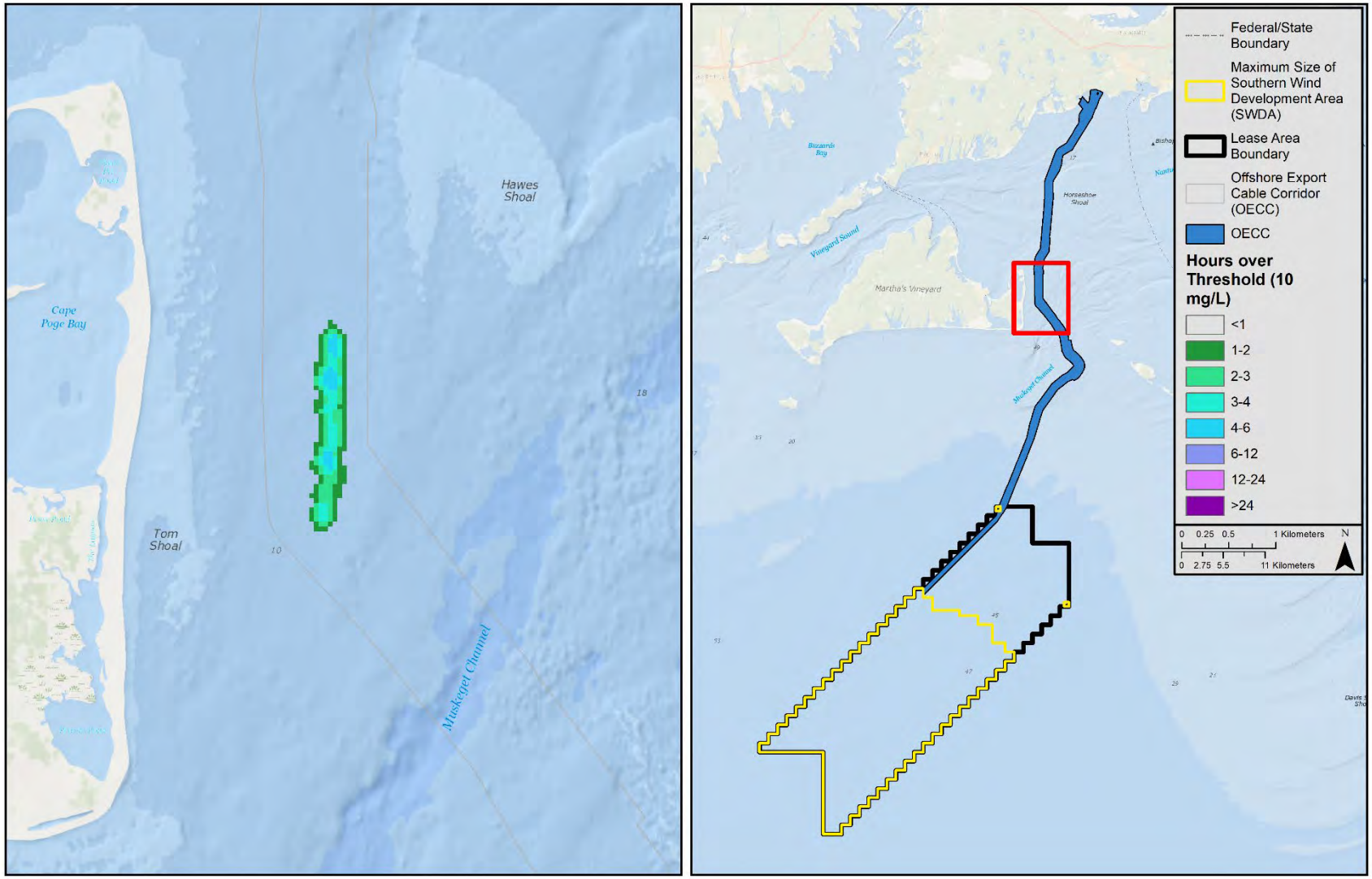

Figure 43. Map of duration of TSS ≥ 10 mg/L associated with cable installation installed with a vertical injector for a representative section of the OECC

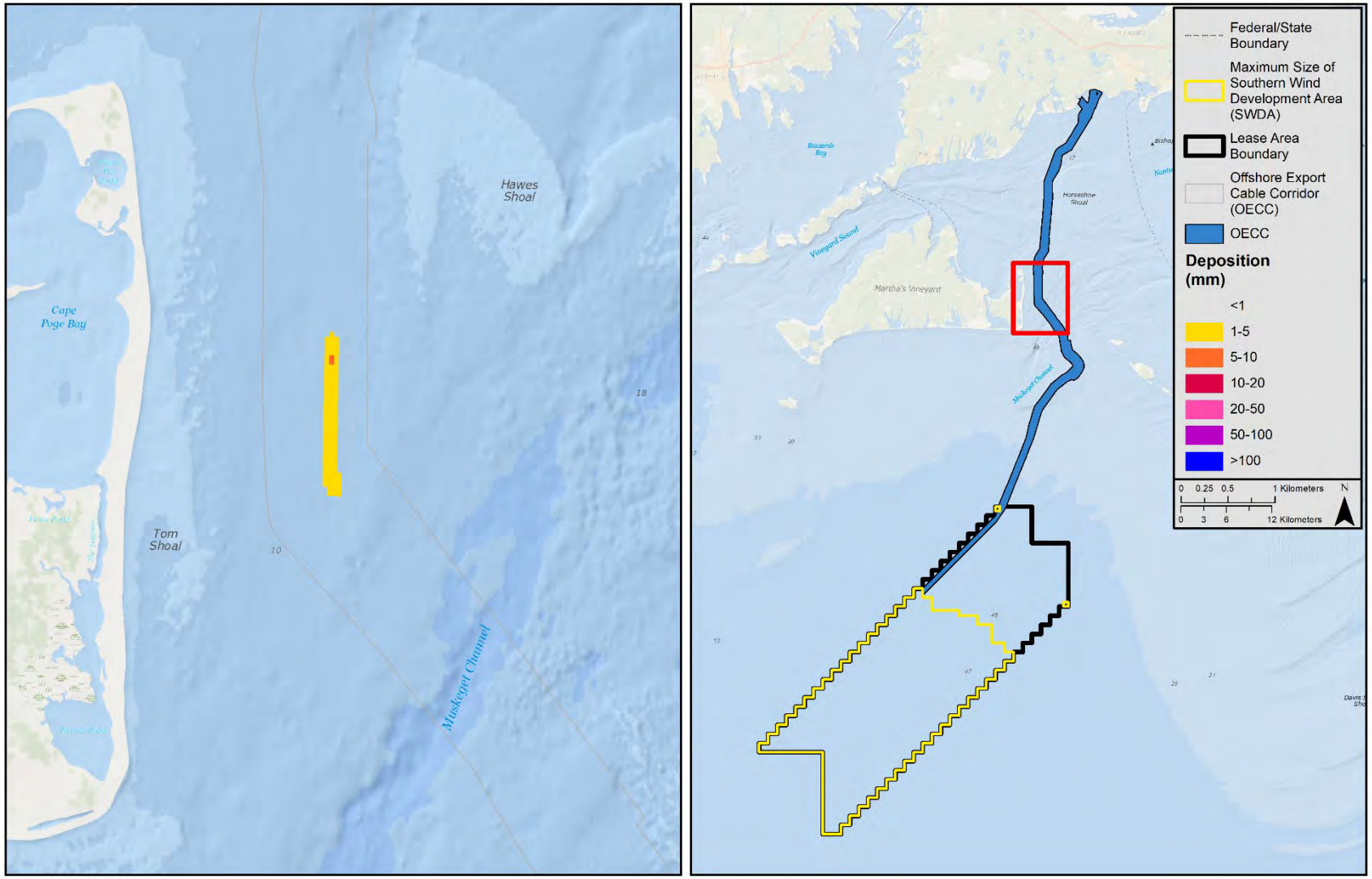

Figure 44. Map of deposition thickness associated with cable installation installed with a vertical injector for a representative section of the OECC

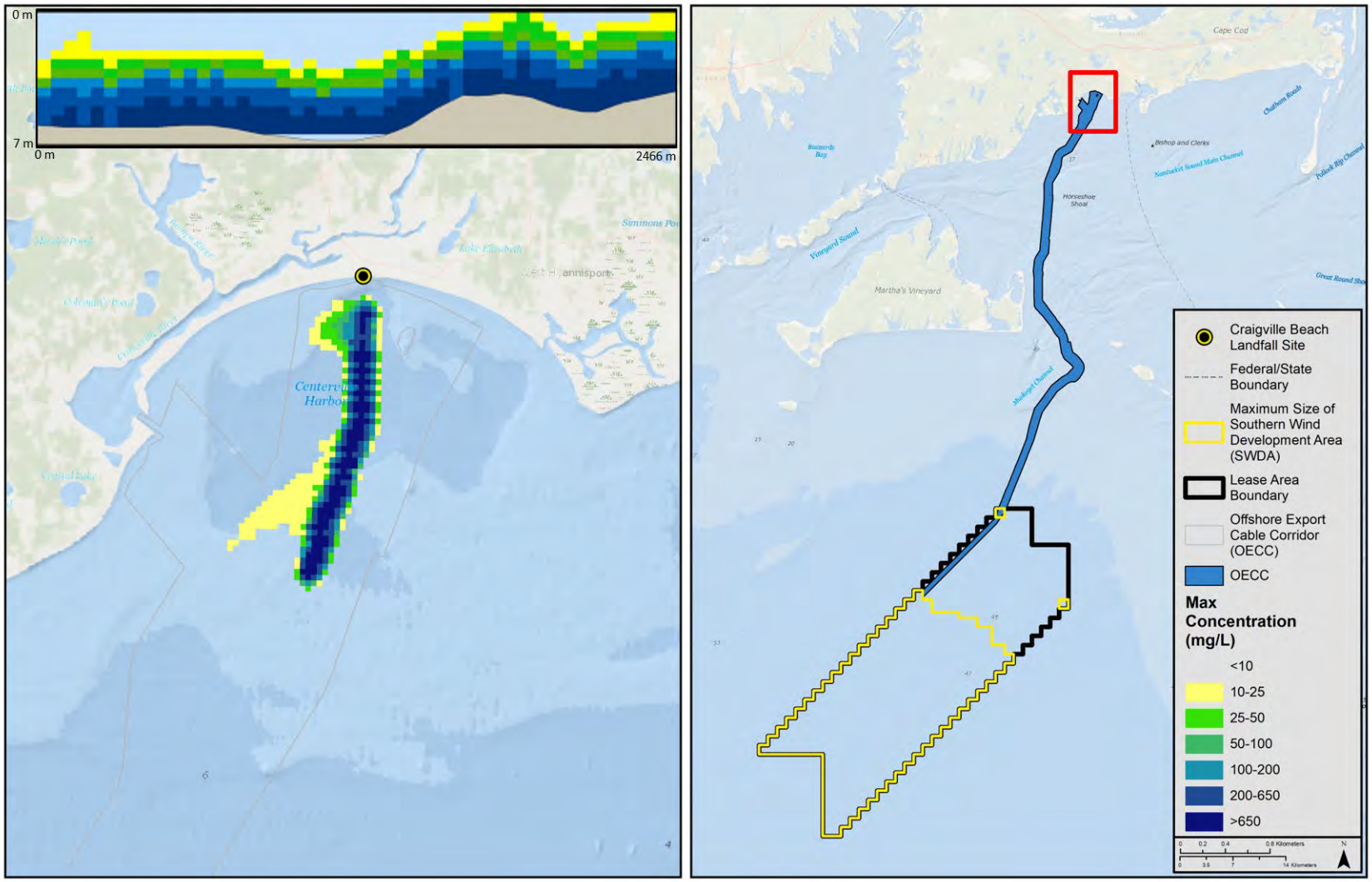

Figure 45. Map of time-integrated maximum concentrations associated with cable installation for a representative section of the OECC approaching the landfall site[1]

Notes:

1. Inset shows a vertical cross-section.

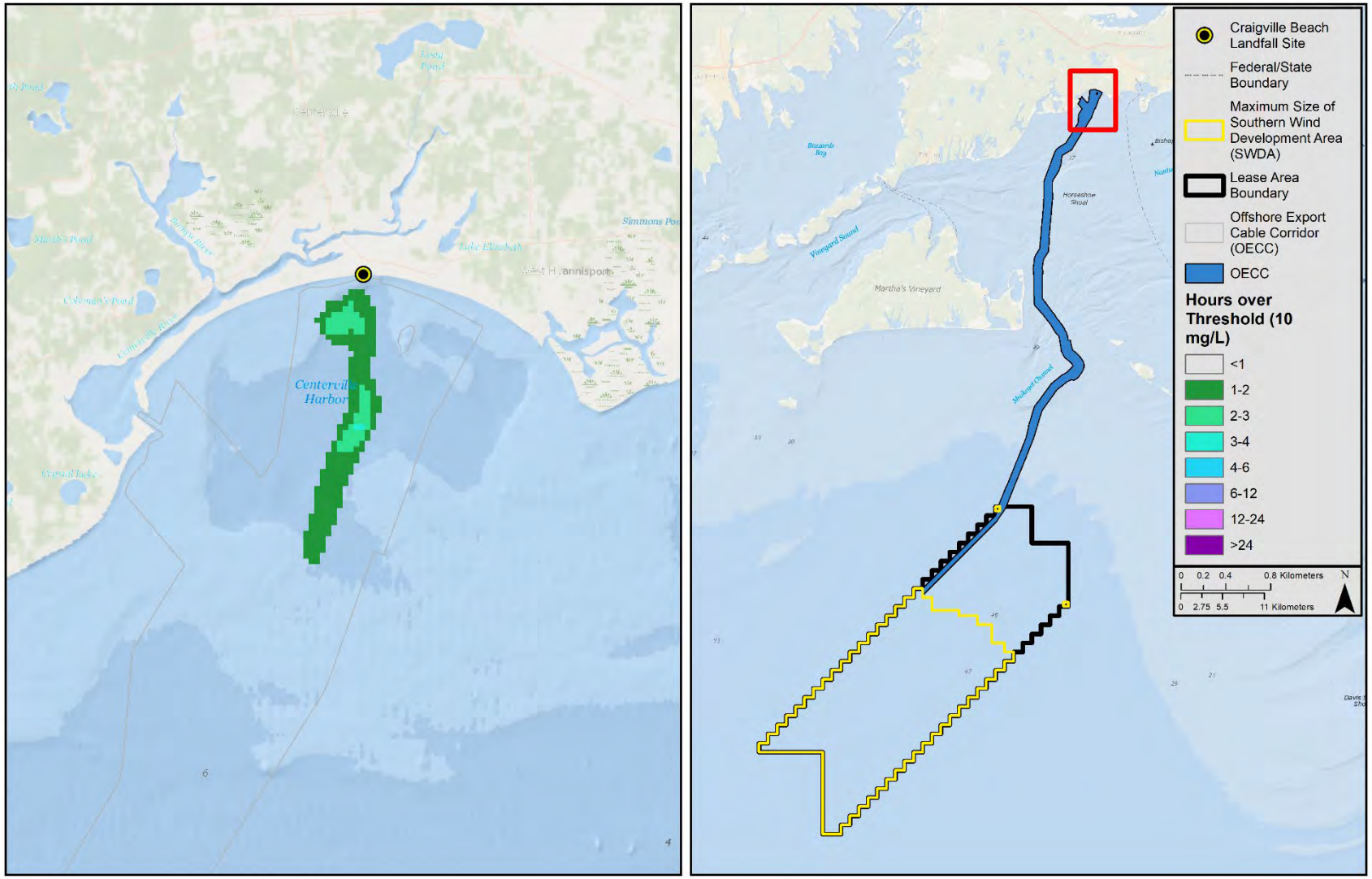

Figure 46. Map of duration of TSS ≥ 10 mg/L associated with cable installation for a representative section of the OECC approaching the landfall site

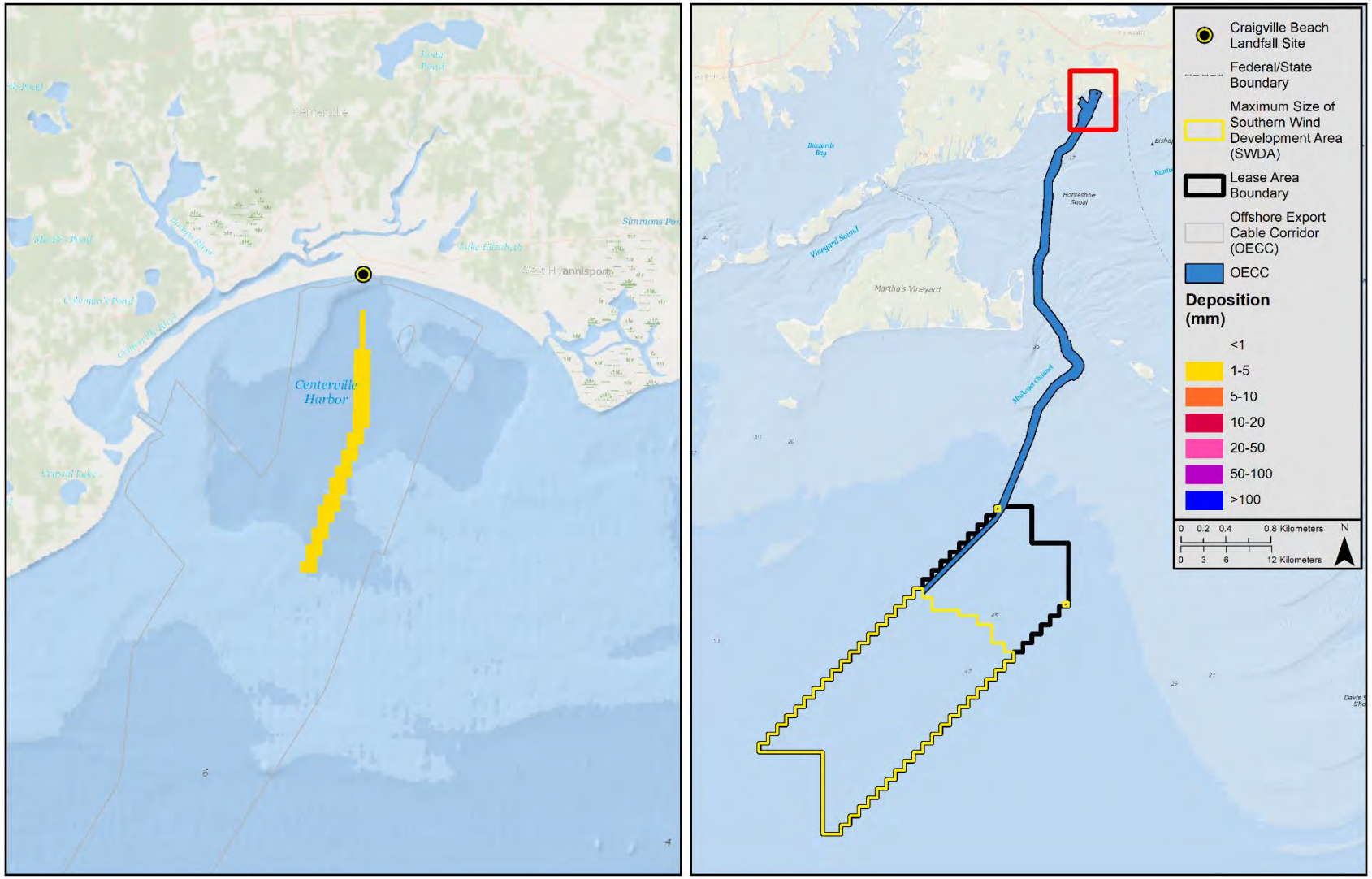

Figure 47. Map of deposition thickness associated with cable installation for a representative section of the OECC approaching the landfall site

4.3.3 Results Summary Tables

Results from all modeled scenarios were analyzed to determine the spatial area exposed to above-ambient TSS concentrations exceeding specific thresholds for various durations. These areas are not always contiguous, but the results provide a sum of all individual concentration grid cells that exceeded a threshold anywhere in the water column for the duration of interest. Post-processing included calculations with respect to duration threshold of one, two, three, four, six, 12, 24, and 48 hours; however, there were no areas over thresholds for the six-, 12-, 24-, or 48-hour durations. Table 15 through Table 18 show the results for durations of one, two, three, and four hours, respectively. In reviewing these tables, it is helpful to keep in mind that the concentration grid resolution is 50 m in the horizontal plane. For a route 60 km long, the area covered by the grid cells along the route is therefore 3 km^2 (60,000 m x 50 m = 3 km^2). The dredge source is introduced in a smaller footprint since dredging is intermittent and does not occur along the entire cable alignment. Similarly, the representative OECC in the Lease Area and the representative OECC sections (vertical injector and landfall approach) have a smaller direct footprint because their linear extent is smaller.

Table 15 through Table 18 illustrate that areas exposed to above-ambient TSS concentrations are largest when assessing concentrations above 10 mg/L, and that the areas rapidly decrease in size with increasing concentration threshold and increasing duration. For example, as shown in Table 15, the cable installation aided by jetting model scenario has a total area throughout the entire OECC of 13.3 km^2 over 10 mg/L for more than 60 minutes, but only 0.01 km^2 of this area is over 200 mg/L for more than 60 minutes. (Note the listed areas are a summation of impacts throughout the entire OECC, such that all the listed areas are not impacted simultaneously). Above-ambient TSS concentrations similarly decrease quickly with time: for the same example scenario (OECC cable installation aided by jetting) concentrations over 10 mg/L decrease from 13.3 km^2 for one hour (Table 15) to 0.7 km^2 for two hours (Table 16), to 0.1 km^2 for three hours (Table 17) to zero for four hours (Table 18). In addition, for this route TSS concentrations greater than 50 mg/L do not endure for periods of two hours or greater. Similar trends of rapid decrease of area with increasing time and/or increasing threshold are noted for all other routes presented.

Table 19 summarizes the maximum extent of the 10 mg/L concentration as measured perpendicular to the route centerline for each scenario. This table shows how the TSHD activities will have a 10 mg/L plume that reaches a farther extent as compared to the cable installation activities. This is because the TSHD activities have sediments introduced much higher in the water column during disposal, which means they take longer to settle so the 10 mg/L contour therefore extends farther from the activity. The plume is not expected to be of that size contiguously from the release, but the extent reflects the trajectory that sediments may follow away from source activities. As described in the preceding paragraphs, the plume is temporary and dissipates rapidly.

Table 20 summarizes the areas affected by sediment deposition over various thickness thresholds. The inter-array cable installation had deposition of up to 1–5 mm for the typical installation and a small patch of deposition of 5–10 mm for the maximum impact simulation. Comparing the two scenarios, the max distance to the 1 mm thickness contour is greater for the maximum impact simulation (150 m versus 100 m, approximately one additional grid cell) and thickness thresholds are greater for the maximum impact burial parameters as compared to the simulation with typical parameters. The OECC cable installation scenarios primarily result in a maximum thickness less than 5 mm with a small exception of the OECC section installed with vertical injector which has a small area (0.01 km^2) of thickness between 5–10 mm. The TSHD scenarios result in deposition thicknesses greater than the cable installation scenarios, with some areas of 100 mm or greater. These areas are associated with the hopper disposal which disposes of the entire hopper of sediment in one location.

Table 15. Summary of Areas Over Above-Ambient TSS Threshold Concentrations for One Hour or Longer for Each Scenario[1,2]

Location	Method	TYP or MAX	Concentration Thresholds in mg/L					
			10	25	50	100	200	650
			Areas Above Concentration Threshold (km^2)					
Inter-array Cable Installation – Representative Section								
SWDA Inter-array	Cable Installation	TYP	6.7	4.4	3.6	2.5	1.3	N/A
SWDA Inter-array	Cable Installation	MAX	9.5	4.4	2.3	0.9	0.1	N/A
Offshore Cable Installation – Representative Sections								
OECC	TSHD	TYP	17.2	7.9	3.6	1.0	0.2	N/A
OECC	Limited TSHD	TYP	5.3	2.0	0.8	0.2	0.1	N/A
OECC	Cable Installation	TYP	13.3	10.8	6.2	2.4	0.1	N/A
OECC	Cable Installation Aided by Jetting	TYP	13.3	10.9	6.4	2.5	0.1	N/A
OECC in Lease Area OCS-A 0501	Cable Installation	TYP	3.4	2.7	2.2	1.7	0.6	N/A
OECC Vertical Injector Section	Cable Installation	TYP	0.6	0.5	0.4	0.3	0.3	N/A
OECC Landfall Approach Section	Cable Installation	TYP	0.7	0.5	0.4	0.3	0.1	N/A

Notes:

1. Typical ("Typ") and maximum impact ("Max") parameters are presented where applicable.
2. The areas in this table are the total areas from the entire simulation, and therefore reflect the sum of different instances of smaller areas and do not occur simultaneously.

Table 16. Summary of Areas Over Above-ambient TSS Threshold Concentrations for Two Hours or Longer for Each Scenario[1,2]

Location	Method	TYP or MAX	Concentration Thresholds in mg/L					
			10	25	50	100	200	650
			Areas Above Concentration Threshold (km^2)					
Inter-array Cable Installation – Representative Section								
SWDA Inter-array	Cable Installation	TYP	0.7	N/A	N/A	N/A	N/A	N/A
SWDA Inter-array	Cable Installation	MAX	1.5	N/A	N/A	N/A	N/A	N/A
Offshore Cable Installation – Representative Sections								
OECC	TSHD	TYP	5.7	2.4	0.7	N/A	N/A	N/A
OECC	Limited TSHD	TYP	0.9	N/A	N/A	N/A	N/A	N/A
OECC	Cable Installation	TYP	0.7	N/A	N/A	N/A	N/A	N/A
OECC	Cable Installation Aided by Jetting	TYP	0.7	0.1	N/A	N/A	N/A	N/A
OECC in Lease Area OCS-A 0501	Cable Installation	TYP	0.3	N/A	N/A	N/A	N/A	N/A
OECC Vertical Injector Section	Cable Installation	TYP	0.5	0.3	0.2	0.1	N/A	N/A
OECC Landfall Approach Section	Cable Installation	TYP	0.2	N/A	N/A	N/A	N/A	N/A

Notes:

1. Typical ("Typ") and maximum impact ("Max") parameters are presented where applicable.
2. The areas in this table are the total areas from the entire simulation, and therefore reflect the sum of different instances of smaller areas and do not occur simultaneously.

Table 17. Summary of Areas Over Above-ambient TSS Threshold Concentrations for Three Hours or Longer for Each Scenario[1,2]

Location	Method	TYP or MAX	Concentration Thresholds in mg/L					
			10	25	50	100	200	650
			Areas Above Concentration Threshold (km^2)					
Inter-array Cable Installation – Representative Section								
SWDA Inter-array	Cable Installation	TYP	N/A	N/A	N/A	N/A	N/A	N/A
SWDA Inter-array	Cable Installation	MAX	0.1	N/A	N/A	N/A	N/A	N/A
Offshore Cable Installation – Representative Sections								
OECC	TSHD	TYP	2.8	0.8	N/A	N/A	N/A	N/A
OECC	Limited TSHD	TYP	0.1	N/A	N/A	N/A	N/A	N/A
OECC	Cable Installation	TYP	0.1	N/A	N/A	N/A	N/A	N/A
OECC	Cable Installation Aided by Jetting	TYP	0.1	N/A	N/A	N/A	N/A	N/A
OECC in Lease Area OCS-A 0501	Cable Installation	TYP	N/A	N/A	N/A	N/A	N/A	N/A
OECC Vertical Injector Section	Cable Installation	TYP	0.2	0.1	N/A	N/A	N/A	N/A
OECC Landfall Approach Section	Cable Installation	TYP	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

1. Typical ("Typ") and maximum impact ("Max") parameters are presented where applicable.
2. The areas in this table are the total areas from the entire simulation, and therefore reflect the sum of different instances of smaller areas and do not occur simultaneously.

Table 18. Summary of Areas Over Above-ambient TSS Threshold Concentrations for Four Hours or Longer for Each Scenario[1,2]

Location	Method	TYP or MAX	Concentration Thresholds in mg/L					
			10	25	50	100	200	650
			Areas Above Concentration Threshold (km^2)					
Inter-array Cable Installation – Representative Section								
SWDA Inter-array	Cable Installation	TYP	N/A	N/A	N/A	N/A	N/A	N/A
SWDA Inter-array	Cable Installation	MAX	N/A	N/A	N/A	N/A	N/A	N/A
Offshore Cable Installation – Representative Sections								
OECC	TSHD	TYP	1.2	0.1	N/A	N/A	N/A	N/A
OECC	Limited TSHD	TYP	N/A	N/A	N/A	N/A	N/A	N/A
OECC	Cable Installation	TYP	N/A	N/A	N/A	N/A	N/A	N/A
OECC	Cable Installation Aided by Jetting	TYP	N/A	N/A	N/A	N/A	N/A	N/A
OECC in Lease Area OCS-A 0501	Cable Installation	TYP	N/A	N/A	N/A	N/A	N/A	N/A
OECC Vertical Injector Section	Cable Installation	TYP	0.1	N/A	N/A	N/A	N/A	N/A
OECC Landfall Approach Section	Cable Installation	TYP	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

1. Typical ("Typ") and maximum impact ("Max") parameters are presented where applicable.
2. The areas in this table are the total areas from the entire simulation, and therefore reflect the sum of different instances of smaller areas and do not occur simultaneously.

Table 19. Summary of Maximum Extent to the 10 mg/L TSS Contour from the Route Centerline for Each Scenario[1]

Location	Method	TYP or MAX	Maximum (Max) Distance (km) to 10 mg/L Contour
Inter-array Cable Installation – Representative Section			
SWDA Inter-array	Cable Installation	TYP	1.0
SWDA Inter-array	Cable Installation	MAX	2.2
Offshore Cable Installation – Representative Sections			
OECC	TSHD	TYP	16.0
OECC	Limited TSHD	TYP	8.5
OECC	Cable Installation	TYP	1.9
OECC	Cable Installation Aided by Jetting	TYP	2.1
OECC in Lease Area OCS-A 0501	Cable Installation	TYP	0.6
OECC Vertical Injector Section	Cable Installation	TYP	1.2
OECC Landfall Approach Section	Cable Installation	TYP	0.8

Notes:

1. Typical ("Typ") and maximum impact ("Max") parameters are presented where applicable.

Table 20. Summary of Deposition Over Thresholds for Each Scenario[1]

Location	Method	TYP or MAX	Max Extent (km) of Deposition > 1 mm	Max Extent (km) of Deposition > 20 mm	Area (km^2) over Deposition threshold in mm					
					1 mm	5 mm	10 mm	20 mm	50 mm	100 mm
Inter-array Cable Installation – Representative Section										
SWDA Inter-array	Cable Installation	TYP	0.10	N/A	2.41	N/A	N/A	N/A	N/A	N/A
SWDA Inter-array	Cable Installation	MAX	0.15	N/A	3.48	0.01	N/A	N/A	N/A	N/A
Offshore Cable Installation – Representative Sections										
OECC	TSHD	TYP	2.3	0.4	1.06	0.37	0.14	0.10	0.08	0.08
OECC	Limited TSHD	TYP	2.3	0.9	0.26	0.10	0.06	0.03	0.02	0.02
OECC	Cable Installation	TYP	0.12	N/A	9.08	N/A	N/A	N/A	N/A	N/A
OECC	Cable Installation Aided by Jetting	TYP	0.10	N/A	9.08	N/A	N/A	N/A	N/A	N/A
OECC in Lease Area OCS-A 0501	Cable Installation	TYP	0.10	N/A	1.44	N/A	N/A	N/A	N/A	N/A
OECC Vertical Injector Section	Cable Installation	TYP	0.10	N/A	0.27	0.01	N/A	N/A	N/A	N/A
OECC Landfall Approach Section	Cable Installation	TYP	0.10	N/A	0.30	N/A	N/A	N/A	N/A	N/A

Notes:

1. Typical ("Typ") and maximum impact ("Max") parameters are presented where applicable.

4.3.4 Results Discussion

Simulations of sand wave dredging and associated disposal activities using a TSHD along the OECC show that above-ambient TSS originating from the source is intermittent along the route, matching the intermittent need for dredging. Above-ambient TSS concentrations may be present throughout the entire water column since sediments are released at or near the water surface. Above-ambient TSS concentrations of 10 mg/L extend up to 16 km and 8.5 km from the area of activity for the TSHD and limited TSHD model scenarios, respectively; however, these concentrations only persist for a matter of hours. Concentrations greater than 10 mg/L persist less than six hours for TSHD activities and less than four hours for limited TSHD activities. Deposition greater than 1 mm associated with the TSHD drag arm is mainly constrained to within 150 m of the area of activity, whereas the same deposition thickness associated with overflow and dredged material release extends greater distances from the source, resulting in deposition mainly within 1 km but extending up to 2.3 km in isolated patches when subject to swift currents through Muskeget Channel. Due to the hopper disposal, which releases the entire hopper of sediment in one location, the TSHD scenarios result in limited areas with deposition of 100 mm or greater, which is substantially greater than the cable installation scenarios.

Simulations of several possible inter-array or offshore export cable installation methods using either typical installation parameters (for inter-array and offshore export cable installation) or maximum impact parameters (for inter-array cable installation only) predict a plume that is localized to the seabed. The plume may be located in the bottom approximate 6 m of the water column, which is typically a fraction of the water column; however, in shallow waters, the plume may occupy the entire water column; these represent only a small fraction of the cable routes. Simulations of cable installation found that above-ambient TSS greater than 10 mg/L and deposition over 1 mm stayed closer to the cable alignment as compared to the dredging footprints; this is due to the fact that sediments are introduced to the water column closer to the seabed. TSS concentrations greater than 10 mg/L typically stayed within 200 m of the alignment, though travelled a maximum distance of approximately 2.1 km for typical installation parameters and up to 2.2 km for maximum impact installation parameters (for inter-array cable installation only).

Above-ambient TSS concentrations stemming from cable installation for the various model scenarios remain relatively close to the cable alignment, are constrained to the bottom of the water column, and are short-lived. Above-ambient TSS concentrations substantially dissipate within one to two hours and fully dissipate in less than four hours for most of the model scenarios. For the vertical injector model scenario, above-ambient TSS concentrations similarly substantially dissipated within one to two hours but required up to six hours to fully dissipate, likely due to the relatively slower installation rate and deeper trench (greater volume disturbed per unit length). Deposition greater than 1 mm was limited to within 100 m of the cable alignment for typical installation parameters and to within less than 150 m of the cable alignment for maximum impact installation parameters (for inter-array cable installation only). The maximum deposition associated with inter-array or offshore export cable installation was typically less than 5 mm, though there was a small isolated area associated with the vertical injector model scenario with deposition between 5–10 mm.

The results of the extent and persistence of the plume and the extent and thickness of deposition for inter-array or offshore export cable installation scenarios are generally similar regardless of the route location (SWDA versus OECC).

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FINAL TECHNICAL REPORT
SEDIMENT TRANSPORT MODELING: APPENDIX A

New England Wind Offshore Cable Installation

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Contents

1 INTRODUCTION 1

Figures

Figure 1. Representative inter-array cable installation, extent of hourly snapshots 1
Figure 2. Representative inter-array cable installation (typical) hourly snapshots 2
Figure 3. Representative inter-array cable installation (maximum) hourly snapshots 3
Figure 4. Representative TSHD and limited TSHD installation, extent of hourly snapshots 4
Figure 5. Representative TSHD installation hourly snapshots 5
Figure 6. Representative limited TSHD installation hourly snapshots 6
Figure 7. Representative cable installation with and without jetting aid, extent of hourly snapshots 7
Figure 8. Representative cable installation without jetting aid hourly snapshots 8
Figure 9. Representative cable installation aided by jetting hourly snapshots 9
Figure 10. Representative OECC in Lease Area OCS-A 0501 installation, extent of hourly snapshots 10
Figure 11. Representative OECC in Lease Area OCS-A 0501 installation hourly snapshots 11
Figure 12. Representative OECC vertical injector installation, extent of hourly snapshots 12
Figure 13. Representative OECC vertical injector installation hourly snapshots 13
Figure 14. Representative OECC landfall approach installation, extent of hourly snapshots 14
Figure 15. Representative OECC landfall approach installation hourly snapshots 15

1 INTRODUCTION

This appendix serves to supplement sediment modeling results presented in the technical report, “Sediment Transport Modeling: New England Wind Offshore Cable Installation”. The purpose of this appendix is to provide hourly snapshots to represent a ‘typical’ day of each installation technology. A general figure is presented first for each scenario which shows the extent of the snapshots and then hourly snapshots for a day for each scenario are presented in a grid of the zoomed in extent.

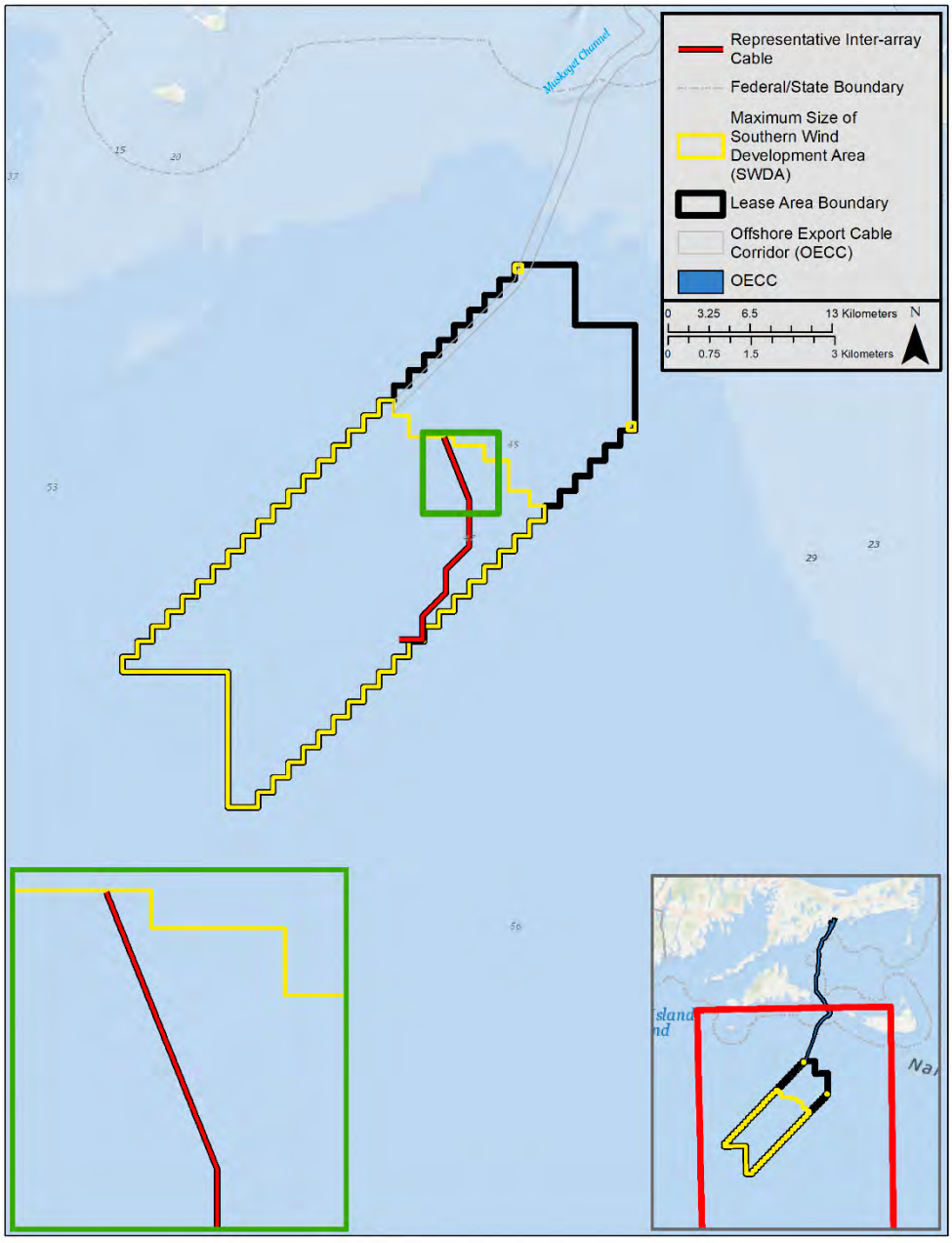

Figure 1. Representative inter-array cable installation, extent of hourly snapshots

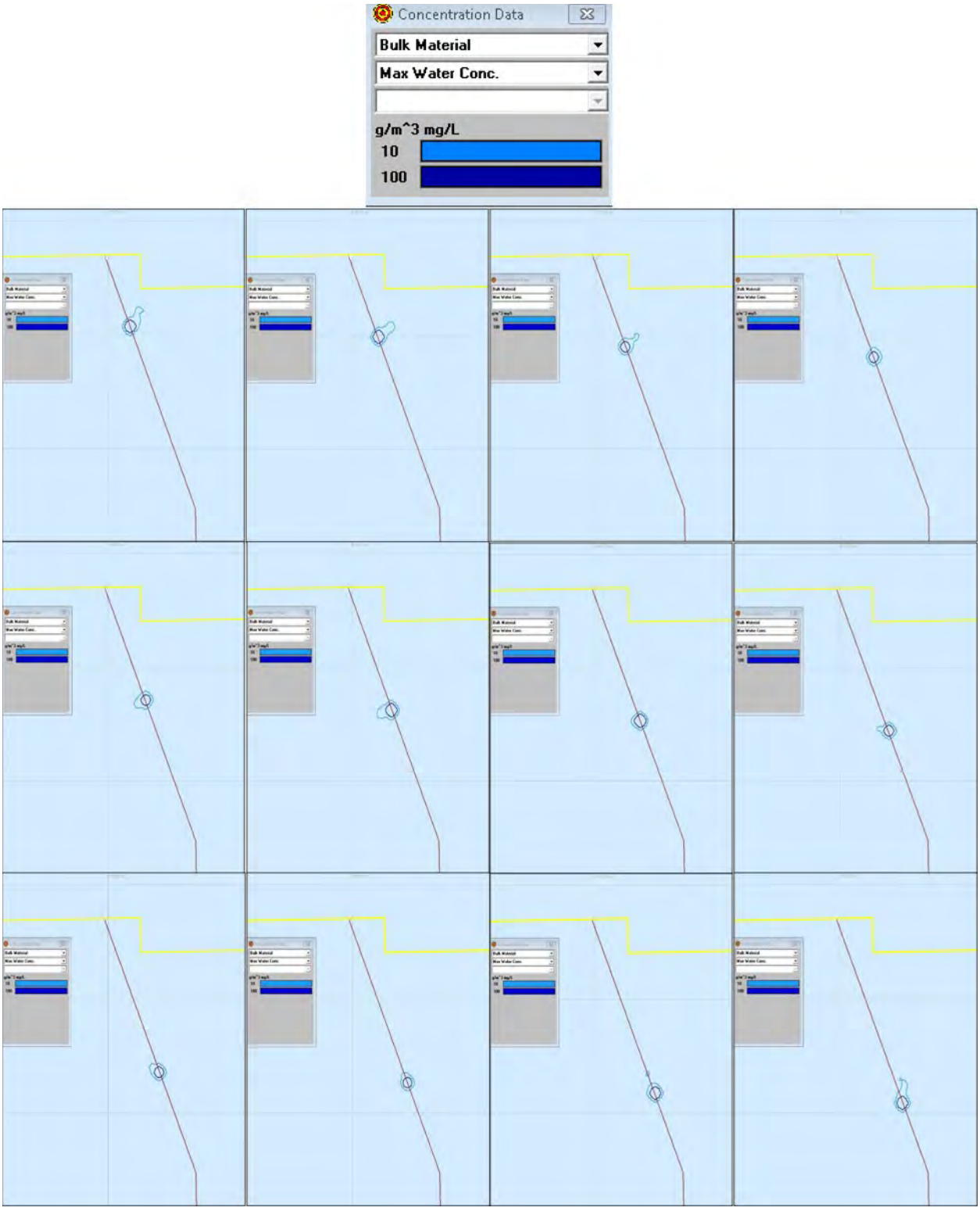

Figure 2. Representative inter-array cable installation (typical) hourly snapshots

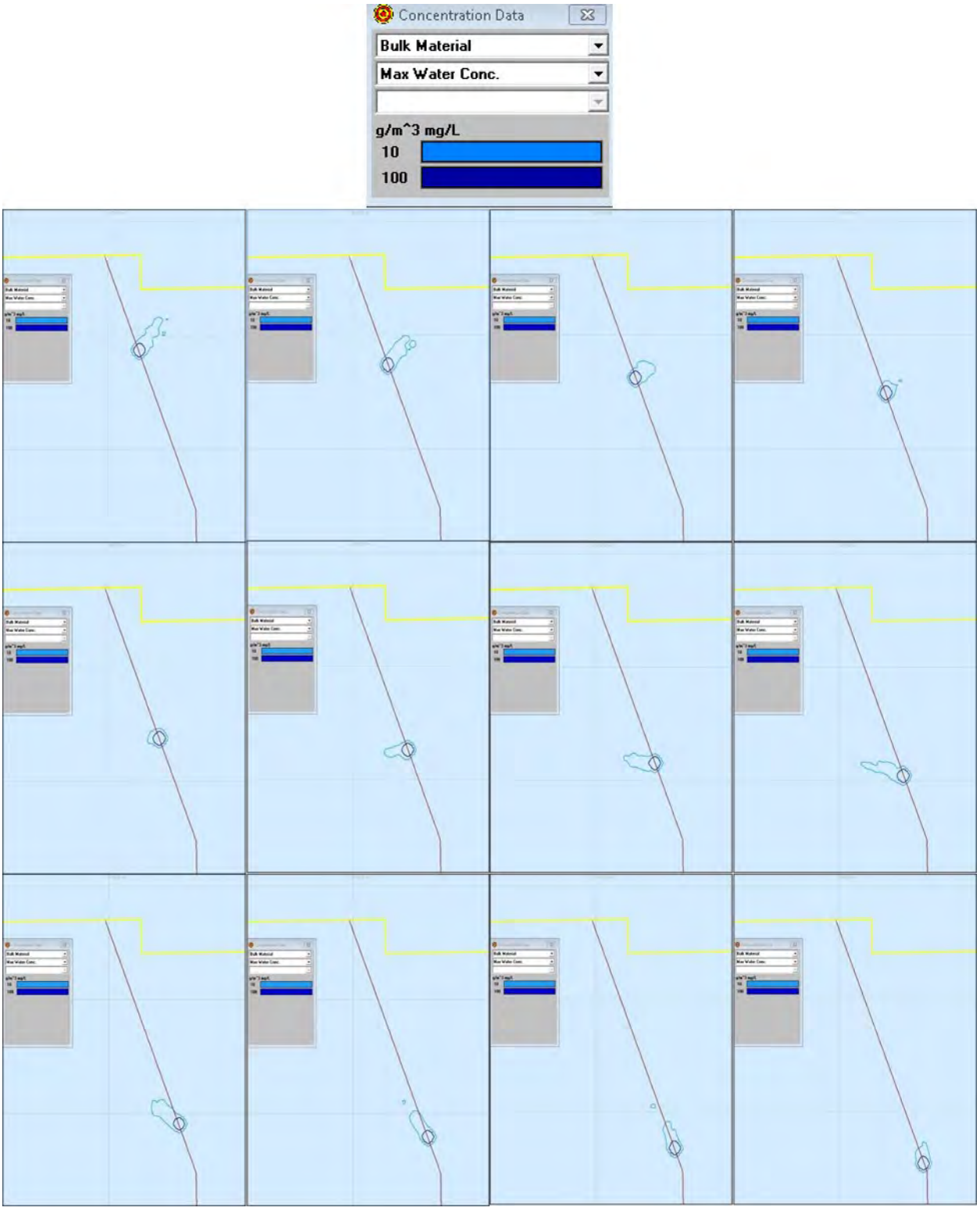

Figure 3. Representative inter-array cable installation (maximum) hourly snapshots

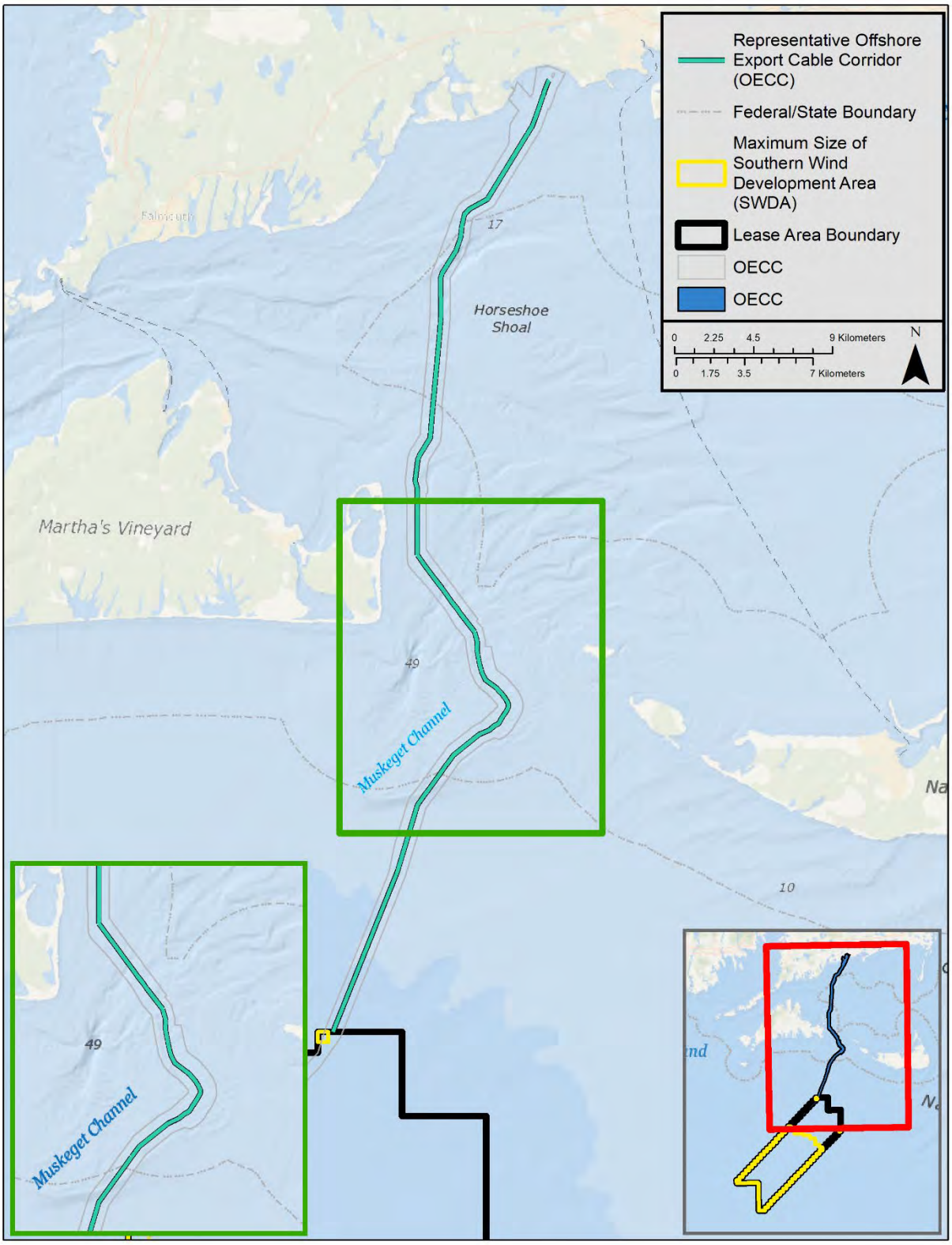

Figure 4. Representative TSHD and limited TSHD installation, extent of hourly snapshots

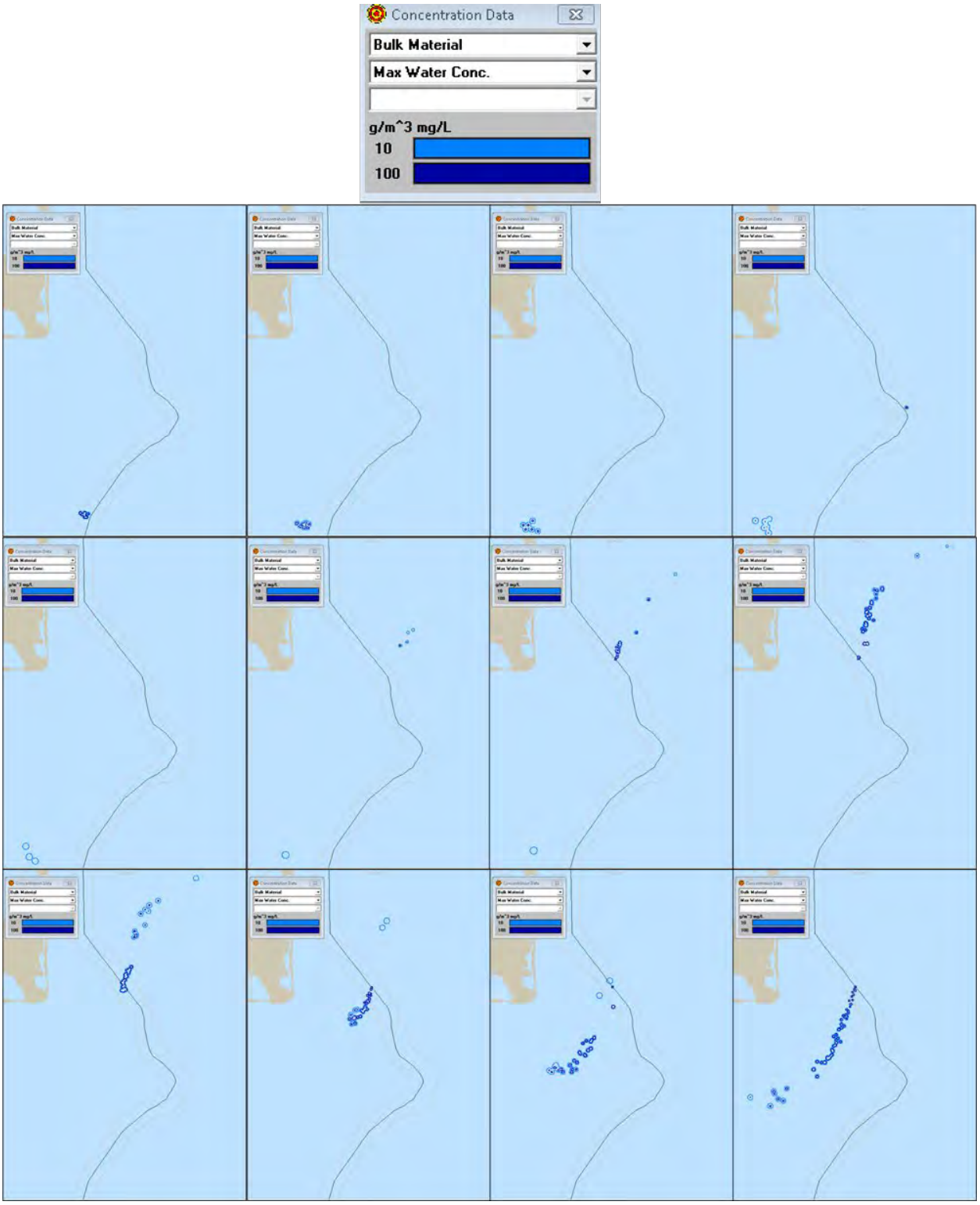

Figure 5. Representative TSHD installation hourly snapshots

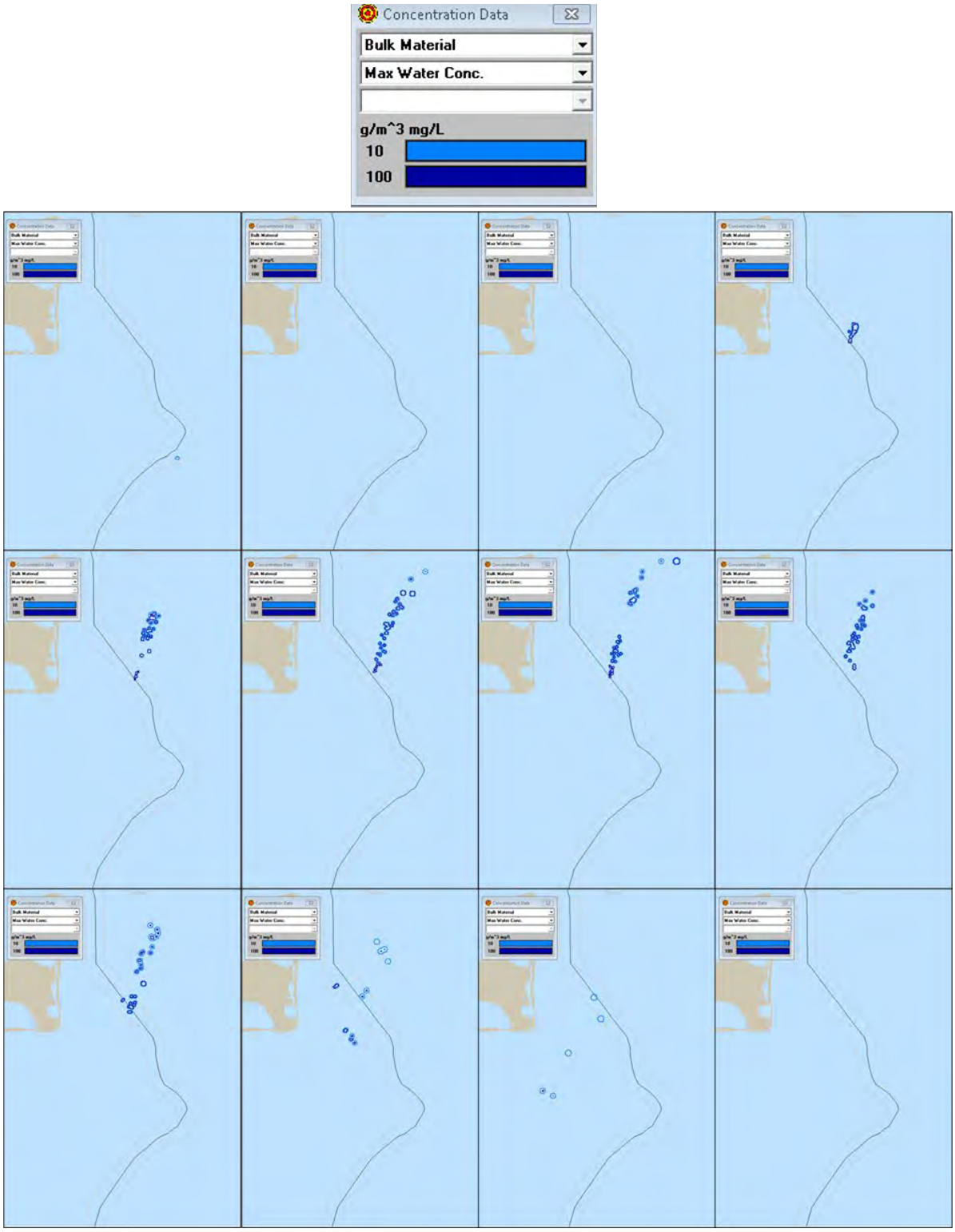

Figure 6. Representative limited TSHD installation hourly snapshots

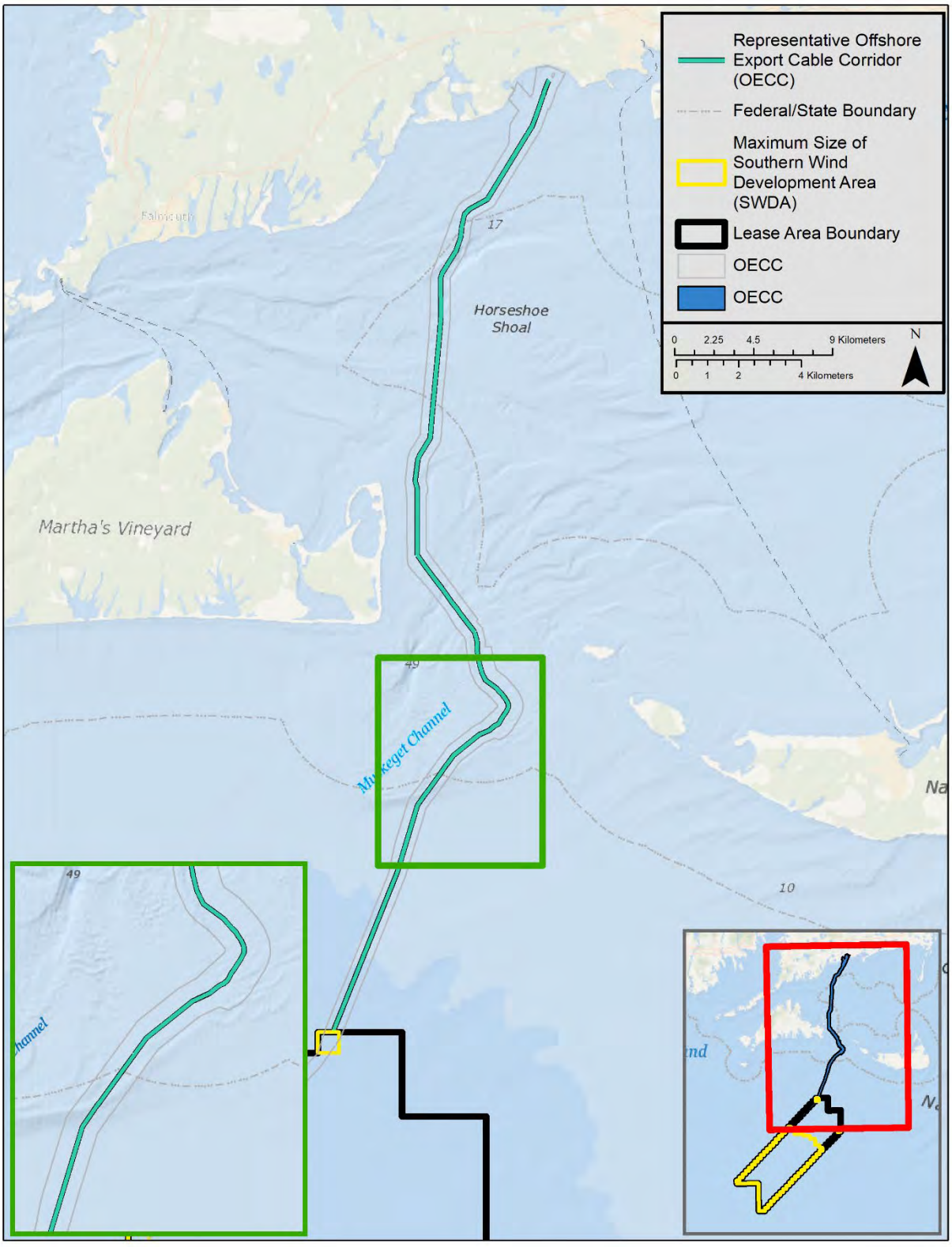

Figure 7. Representative cable installation with and without jetting aid, extent of hourly snapshots

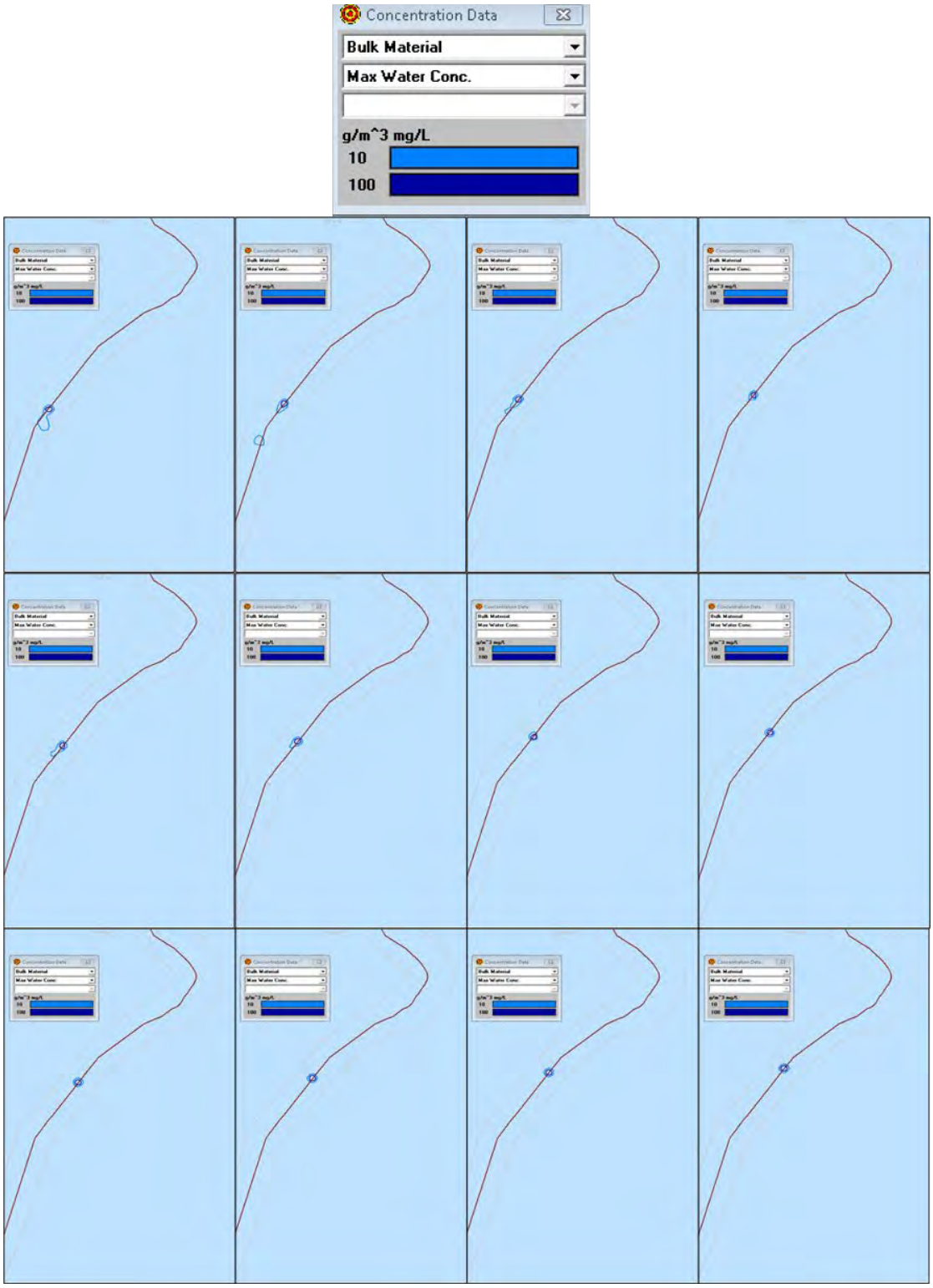

Figure 8. Representative cable installation without jetting aid hourly snapshots

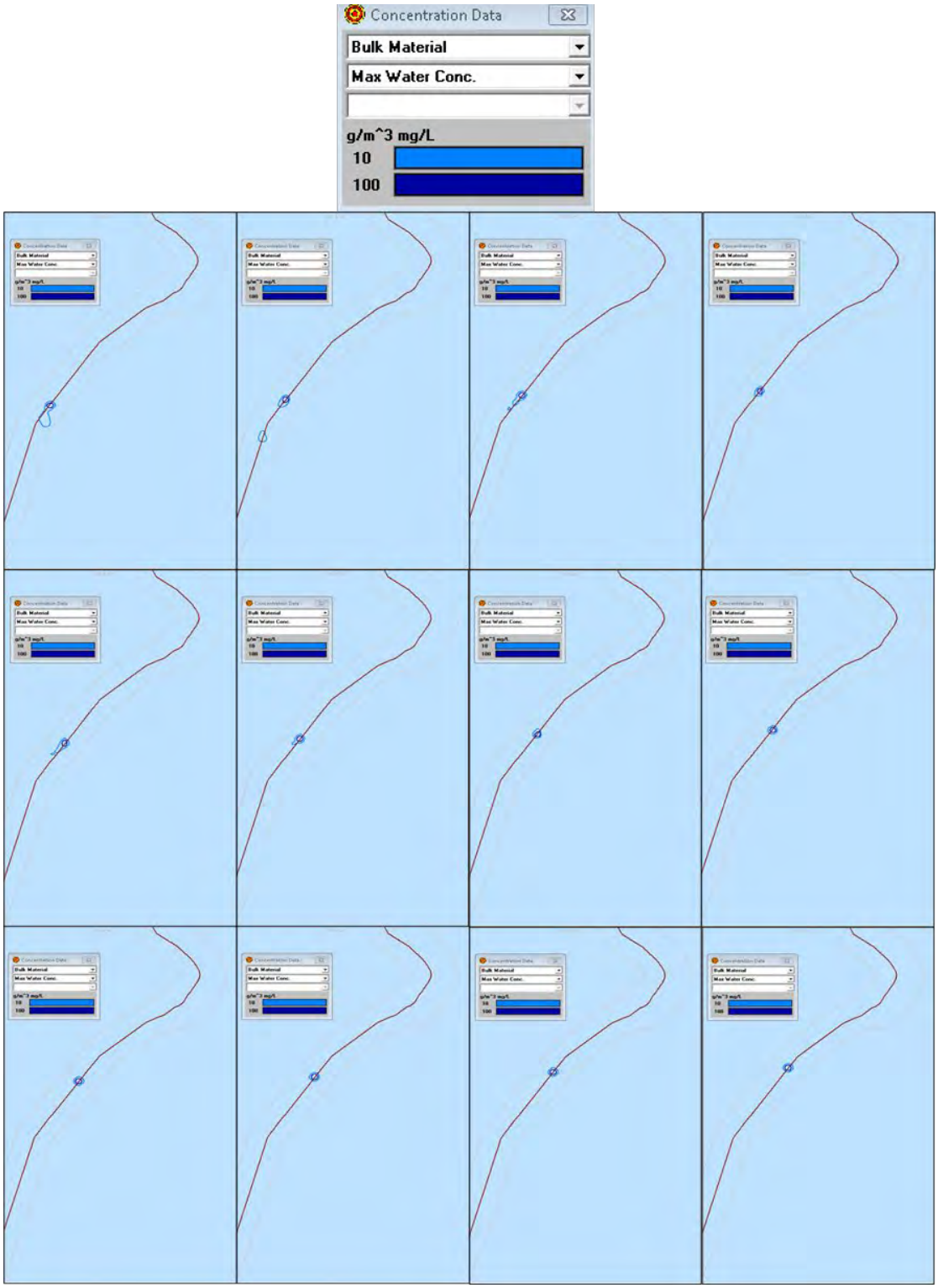

Figure 9. Representative cable installation aided by jetting hourly snapshots

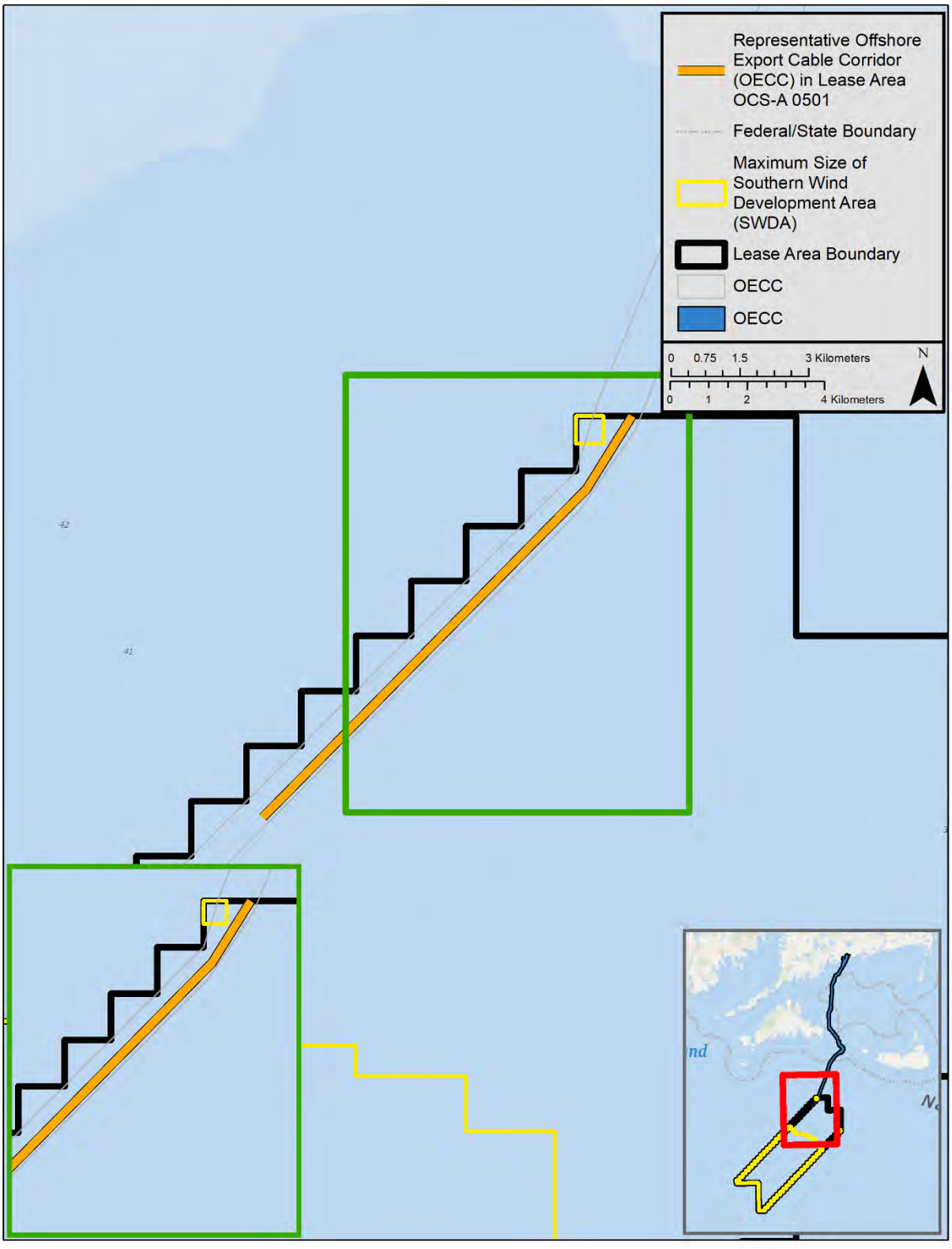

Figure 10. Representative OECC in Lease Area OCS-A 0501 installation, extent of hourly snapshots

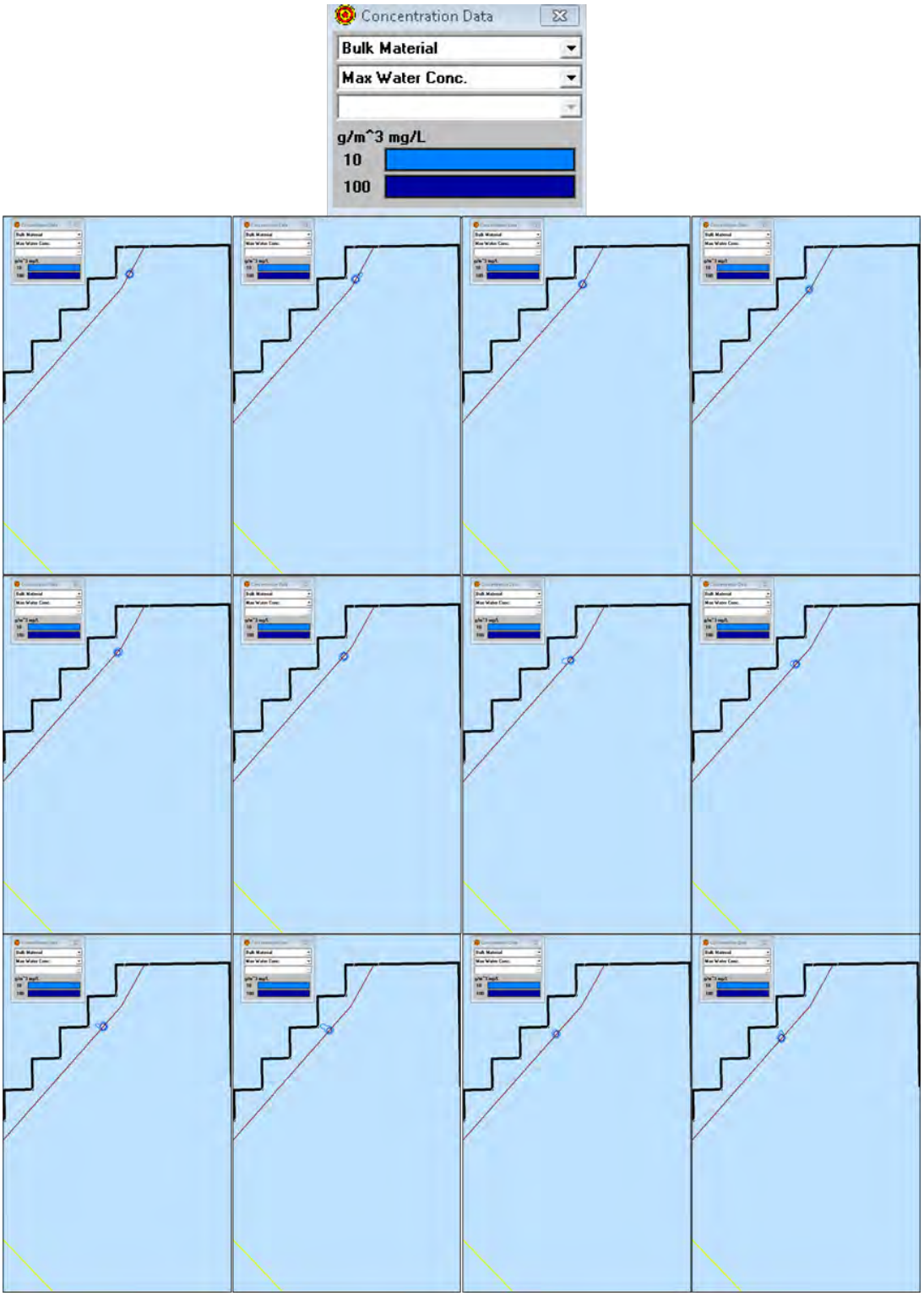

Figure 11. Representative OECC in Lease Area OCS-A 0501 installation hourly snapshots

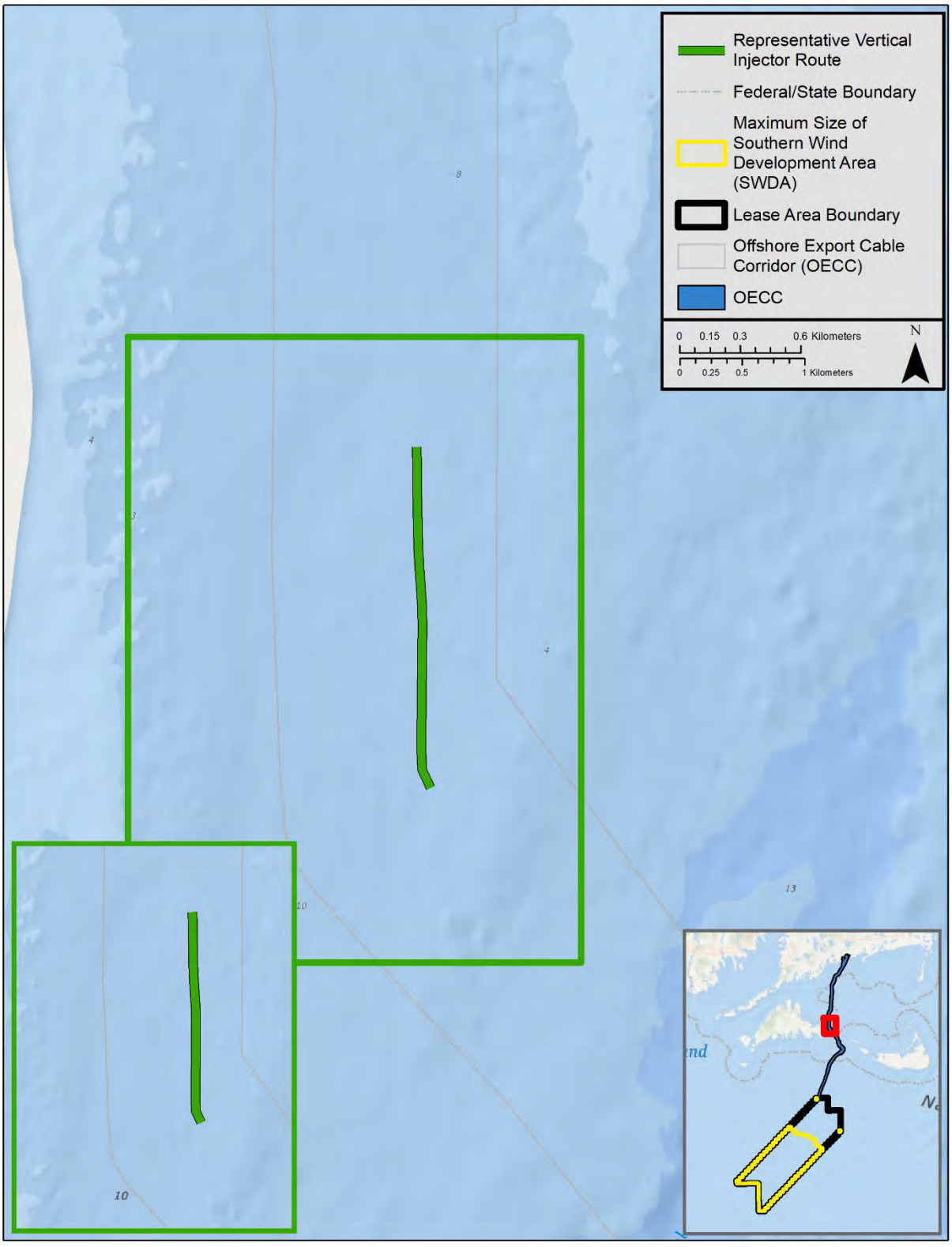

Figure 12. Representative OECC vertical injector installation, extent of hourly snapshots

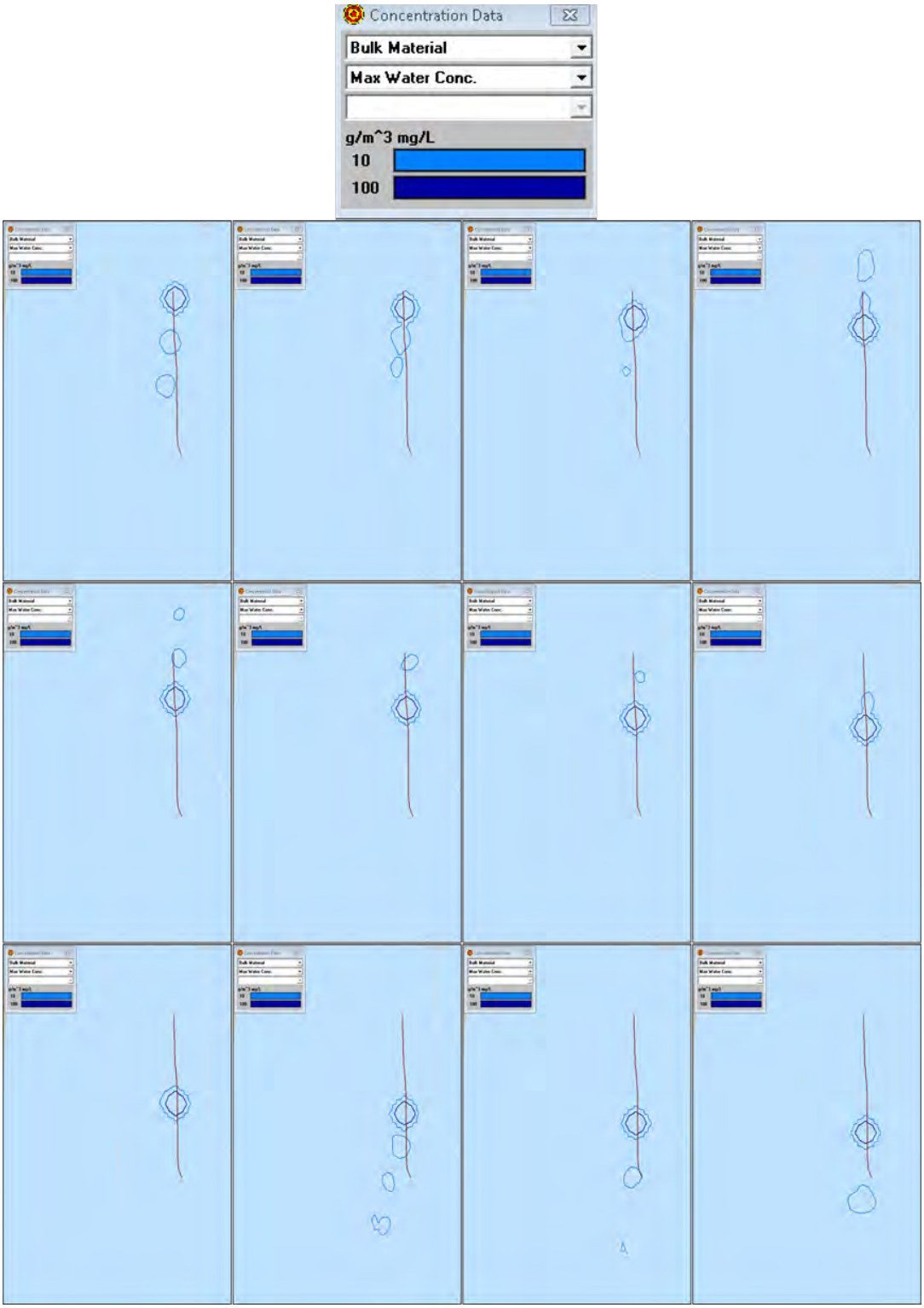

Figure 13. Representative OECC vertical injector installation hourly snapshots

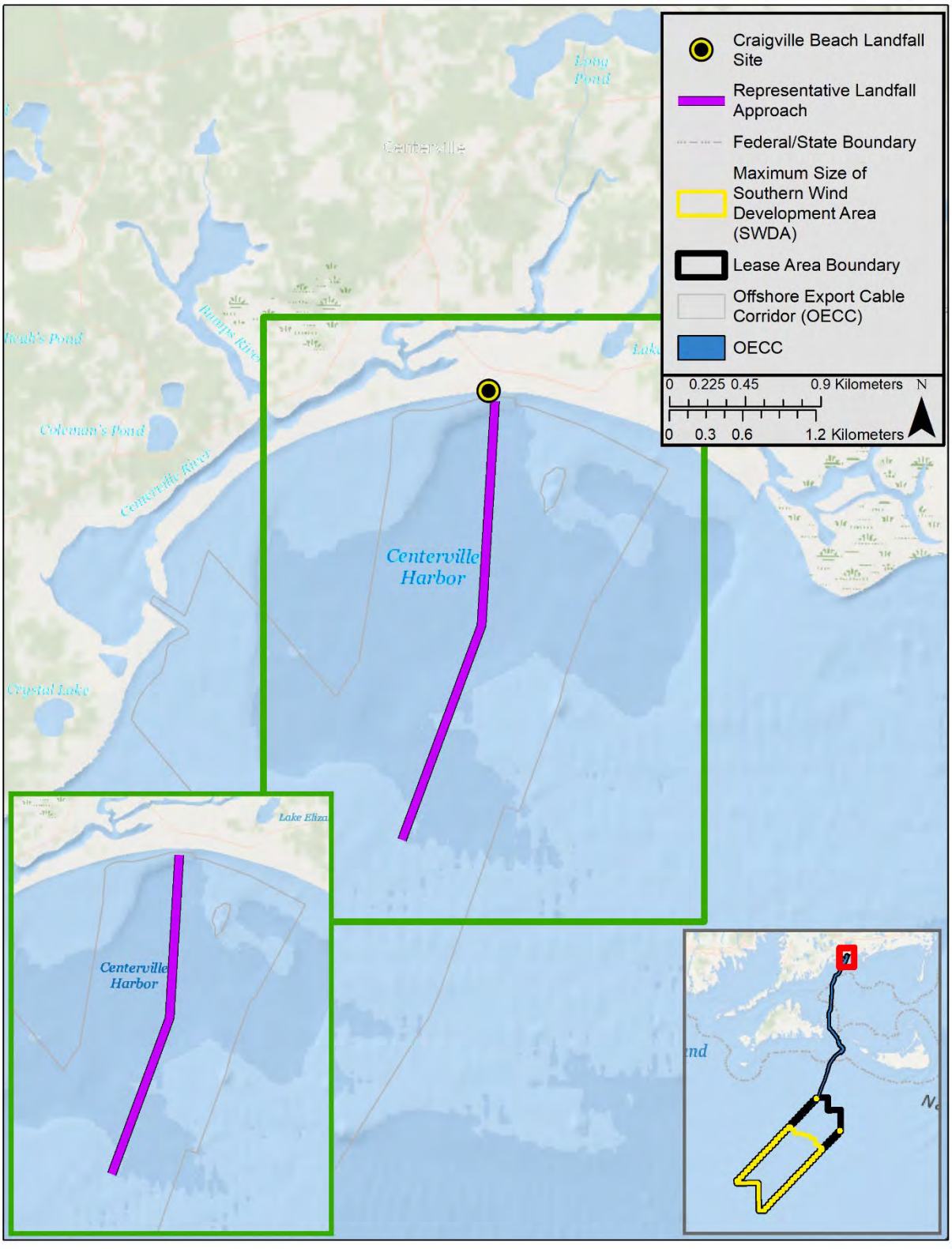

Figure 14. Representative OECC landfall approach installation, extent of hourly snapshots

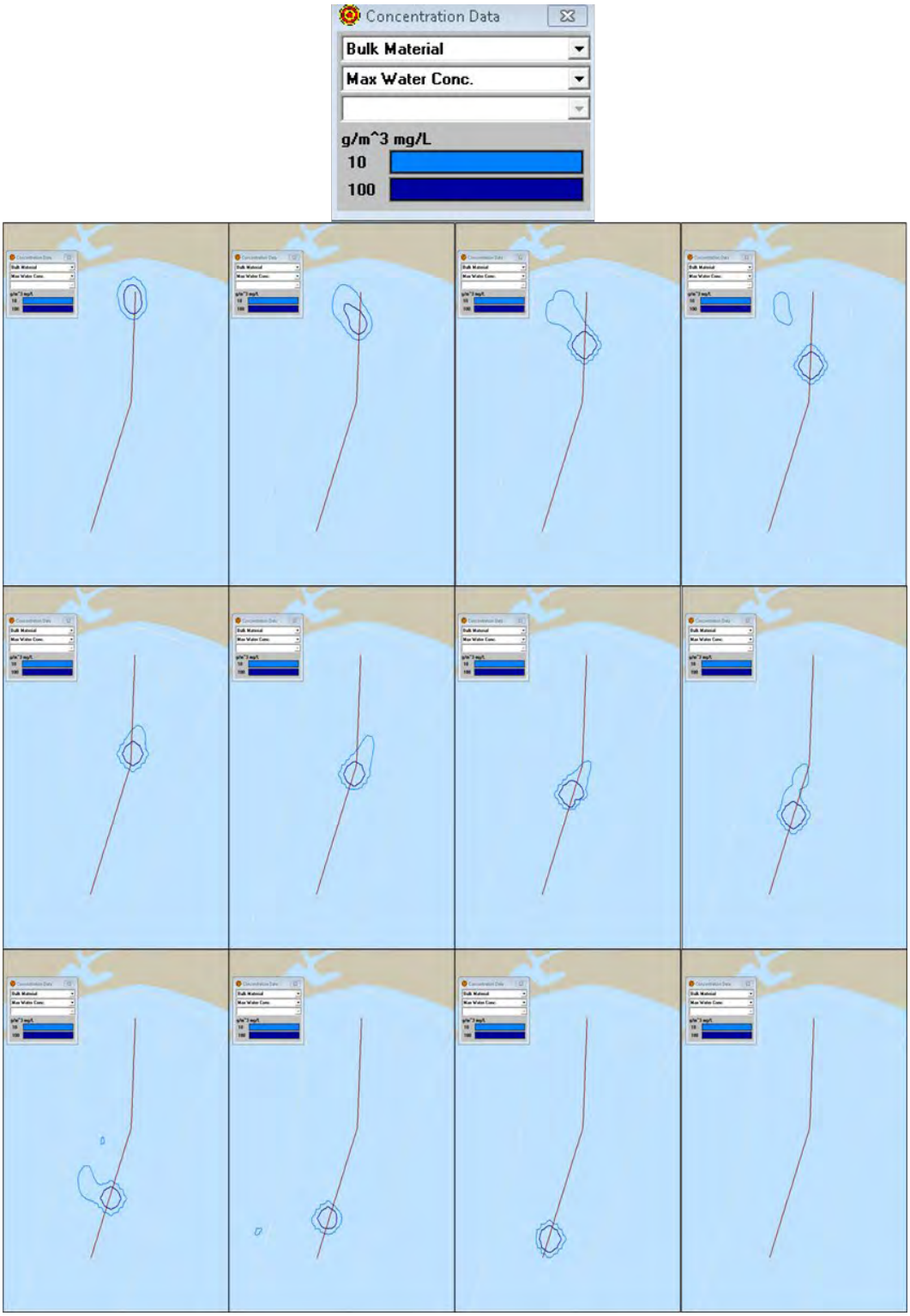

Figure 15. Representative OECC landfall approach installation hourly snapshots

FINAL TECHNICAL REPORT

APPENDIX B: WESTERN MUSKEGET VARIANT SEDIMENT TRANSPORT MODELING

New England Wind Offshore Cable Installation

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Contents

EXECUTIVE SUMMARY ..... **v**

1 INTRODUCTION **1**
1.1 Study Scope and Objectives 1
1.2 Scenario Components: Routes and Approaches 2

2 SEDIMENT MODELING **5**
2.1 Input Parameters: Construction Activities 5
2.2 Sediment Characteristics 2
2.3 Sediment Modeling Results 3
2.3.1 TSHD Pre-Dredge 4
2.3.2 Cable Installation 9
2.3.3 Limited TSHD Pre-Dredge 14
2.3.4 Cable Installation aided by Jetting 19
2.3.5 Results Summary Tables 24
2.3.6 Results Discussion 27

3 REFERENCES **28**

List of Acronyms

BOEM	Bureau of Ocean Energy Management
COP	Construction and Operations Plan
ESP	Electrical Service Platform
NOAA	National Oceanic and Atmospheric Administration
O&M	Operations and Maintenance
OECC	Offshore Export Cable Corridor
SSFATE	Suspended Sediment FATE
SWDA	Southern Wind Development Area
TSHD	Trailing Suction Hopper Dredge
TSS	Total Suspended Solids
WTG	Wind Turbine Generator
TSHD	Trailing Suction Hopper Dredge

Tables

Table 1. Approximate Dredging Lengths and Volumes for TSHD and Limited TSHD Pre-Dredge 6
Table 2. Assumed Dredging Parameters 6
Table 3. Summary of vertical initial distribution of mass associated with dredging, overflow and dumping.....6
Table 4. Summary of typical and maximum cable installation impact parameters.....2
Table 5. Summary of vertical initial distribution of mass associated with cable installation and jetting. 2
Table 6. Sediment Size Classes used in SSFATE 2
Table 7. Summary of area over threshold concentrations for 1 hour or longer for all scenarios. 25
Table 8. Summary of area over threshold concentrations for 2 hours or longer for all scenarios.....25
Table 9. Summary of area over threshold concentrations for 3 hours or longer for all scenarios.....25
Table 10. Summary of area over threshold concentrations for 4 hours or longer for all scenarios.....25
Table 11. Summary of area over threshold concentrations for 6 hours or longer for all scenarios.....26
Table 12. Summary of deposition area over threshold concentrations for all complete routes in federal and state waters. 26
Table 13. Summary of deposition area over threshold concentrations in MA state waters for all complete routes. 26

Figures

Figure 1. Map of Study Area with Indicative Locations for New England Wind's Offshore Components 1
Figure 2. Map of the Western Muskeget Variant's modeled route. 3
Figure 3. Sediment Grain Size Distributions along the Western Muskeget Variant route.....2
Figure 4. Snapshot of instantaneous TSS concentrations for a time step during simulation of TSHD dredging, overflow, and dredged material release operations for a representative cable route within the Western Muskeget Variant.[1] 5
Figure 5. Map of time-integrated maximum concentrations associated with TSHD dredging, overflow, and dredged material release operations for a representative cable route within the Western Muskeget Variant. [1] 6

Figure 6. Map of duration of TSS ≥ 10 mg/L associated with TSHD dredging, overflow, and dredged material release operations for a representative cable route within the Western Muskeget Variant. 7
Figure 7. Map of deposition thickness associated with TSHD dredging, overflow, and dredged material release operations for a representative cable route within the Western Muskeget Variant. 8
Figure 8. Snapshot of instantaneous TSS concentrations for a time step during simulation of representative cable installation within the Western Muskeget Variant.[1] 10
Figure 9. Map of time-integrated maximum concentrations associated with representative cable installation within the Western Muskeget Variant.[1] 11
Figure 10. Map of duration of TSS ≥ 10 mg/L associated with representative cable installation within the Western Muskeget Variant. 12
Figure 11. Map of deposition thickness associated with representative cable installation within the Western Muskeget Variant. 13
Figure 12: Snapshot of instantaneous TSS concentrations for a time step during simulation of limited TSHD dredging, overflow, and dredged material release operations for a representative cable route within the Western Muskeget Variant.[1] 15
Figure 13. Map of time-integrated maximum concentrations associated with limited TSHD dredging, overflow, and dredged material release operations for a representative cable route within the Western Muskeget Variant.[1] 16
Figure 14. Map of duration of TSS ≥ 10 mg/L associated with limited TSHD dredging, overflow, and dredged material release operations for a representative cable route within the Western Muskeget Variant. 17
Figure 15. Map of deposition thickness associated with limited TSHD dredging, overflow, and dredged material release operations for a representative cable route within the Western Muskeget Variant. 18
Figure 16. Snapshot of instantaneous TSS concentrations for a time step during simulation of representative cable installation aided by jetting within the Western Muskeget Variant.[1] 20
Figure 17. Map of time-integrated maximum concentrations associated with cable installation aided by jetting for a representative cable route within the Western Muskeget Variant.[1] 21
Figure 18. Map of duration of TSS ≥ 10 mg/L associated with cable installation aided by jetting for a representative cable route within the Western Muskeget Variant. 22
Figure 19. Map of deposition thickness associated with cable installation aided by jetting for a representative cable route within the Western Muskeget Variant. 23

EXECUTIVE SUMMARY

New England Wind is the proposal to develop offshore renewable wind energy facilities in Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0534 along with associated offshore and onshore cabling, onshore substations, and onshore operations and maintenance (O&M) facilities. New England Wind will be developed in two phases with a maximum of 130 wind turbine generator (WTG) and electrical service platform (ESP) positions. Four or five offshore export cables will transmit electricity generated by WTGs to onshore transmission systems in the Town of Barnstable, Massachusetts. Park City Wind LLC, a wholly owned subsidiary of Avangrid Renewables, LLC, is the Proponent and will be responsible for the construction, operation, and decommissioning of New England Wind.

New England Wind's offshore renewable wind energy facilities are located immediately southwest of Vineyard Wind 1, which is located in Lease Area OCS-A 0501. New England Wind will occupy all of Lease Area OCS-A 0534 and potentially a portion of Lease Area OCS-A 0501 in the event that Vineyard Wind 1 does not develop "spare" or extra positions included in Lease Area OCS-A 0501 and Vineyard Wind 1 assigns those positions to Lease Area OCS-A 0534. For the purposes of the Construction and Operations Plan (COP), the Southern Wind Development Area (SWDA) is defined as all of Lease Area OCS-A 0534 and the southwest portion of Lease Area OCS-A 0501, as shown in Figure 1.1-1 of COP Volume I. The SWDA may be 411-453 square kilometers (km^2) (101,590-111,939 acres) in size depending upon the final footprint of Vineyard Wind 1. At this time, the Proponent does not intend to develop the two positions in the separate aliquots located along the northeastern boundary of Lease Area OCS-A 0501 as part of New England Wind. The SWDA (excluding the two separate aliquots that are closer to shore) is just over 32 kilometers (km) (20 miles [mi]) from the southwest corner of Martha's Vineyard and approximately 38 km (24 mi) from Nantucket.[1] The WTGs and ESPs in the SWDA will be oriented in an east-west, north-south grid pattern with one nautical mile (NM) (1.85 km) spacing between positions.

Each Phase of New England Wind will be developed and permitted using a Project Design Envelope (the "Envelope"). This allows the Proponent to properly define and bracket the characteristics of each Phase for the purposes of environmental review while maintaining a reasonable degree of flexibility with respect to the selection of key components, such as the WTGs, foundations, offshore cables, and ESPs. To assess potential impacts and benefits to various resources, a "maximum design scenario," or the design scenario with the maximum impacts anticipated for that resource, is established considering the Envelope parameters for each Phase that have the potential to cause the greatest effect. For some resources, the approach overestimates potential environmental impacts as the maximum design scenario is not the scenario the Proponent is likely to employ.

While the Proponent intends to install all New England Wind offshore export cables within the OECC that travels from the SWDA northward through the eastern side of Muskeget Channel towards landfall sites in the Town of Barnstable, the Proponent is reserving the fallback option to install one or two Phase 2 cables along the western side of Muskeget Channel, referred to as the Phase 2 OECC Western Muskeget Variant[2] (see Section 4.1.3.2 of COP Volume I and Figure 1). This attachment describes the modeling approach, inputs, and results used to assess cable installation activities for four model scenarios along the Western Muskeget Variant. These representative sediment dispersion model scenarios were conducted to simulate the construction and installation of an approximately 58.3 km (36.2 mi) offshore export cable along the Western Muskeget Variant, spanning from the Covell's Beach Landfall Site to the northern edge of Lease Area OCS-A 0501.

[1] Within the SWDA, the closest WTG is approximately 34 km (21 mi) from Martha's Vineyard and 40 km (25 mi) from Nantucket.

[2] The Western Muskeget Variant is the same exact corridor as the western Muskeget option included in the Vineyard Wind 1 COP and has already been thoroughly reviewed and approved by BOEM as part of that COP.

The following is a brief overview of the terminology used to describe the methodologies modeled in this study:

- **Trailing Suction Hopper Dredge (TSHD):** Suction dredging through a drag arm near the seabed, overflow of sediment laden waters from a hopper and disposal of sediments from the hopper. In this report it refers to the methodology as applied to all sand wave sizes where dredging is needed.
- **Cable Installation:** Cable installation is accomplished by jetting techniques (e.g., jet plow, jet trenching, or similar) in areas where sand waves do not exist or have been cleared.
- **Limited TSHD:** This method is the same as TSHD; the TSHD, however, is "Limited" in that it is only applied to larger (greater than 2 meters [m]) sand waves where dredging is needed.
- **Cable Installation aided by Jetting:** Cable installation is accomplished as described above; however, this method includes additional jetting by controlled flow excavation in areas of small sand waves.

The scenarios that were modeled include a representative offshore export cable route along the Western Muskeget Variant from the northern edge of Lease Area OCS-A 0501 to the Covell's Beach Landfall Site. The scenarios include:

- TSHD Pre-Dredge
- Cable Installation
- Limited TSHD Pre-Dredge
- Cable Installation aided by Jetting

The sediment dispersion modeling assessment was carried out through two interconnected modeling tasks:

1. Development of a three-dimensional hydrodynamic model application of a domain encompassing New England Wind activities using the HYDROMAP modeling system; and
2. Simulations of the suspended sediment fate and transport, including evaluation of seabed deposition and suspended sediment plumes, using the SSFATE (Suspended Sediment FATE) modeling system to simulate installation activities. Velocity fields developed using the HYDROMAP model are used as the primary forcing for SSFATE.

The modeling was performed to characterize the effects associated with the offshore cable installation activities. The effects were quantified in terms of the above-ambient total suspended solids (TSS) concentrations as well as seabed deposition of sediments suspended in the water column during cable installation activities, including sand wave dredging. Maps of instantaneous TSS concentrations, time-integrated maximum TSS concentrations, duration of TSS ≥ 10 mg/L, and seabed deposition are provided for each modeled scenario. Tables quantifying the area exceeding TSS thresholds for specific durations as well as areas of seabed deposition exceeding thickness thresholds are presented for each modeled scenario. Results are presented with respect to thresholds listed below.

- Water column concentrations thresholds: 10, 50, 100, 150, 200, 300, 650, 750, and 1,000 mg/L
- Water column exposure durations: 1, 2, 3, 4, 6, 12, 24, and 48 hours
- Seabed deposition thresholds: 1, 5, 10, 20, 50, and 100 mm

Simulations of sand wave dredging using a TSHD along the Western Muskeget Variant show that plumes originating from the source are intermittent along the route because of the intermittent need for dredging. Above ambient TSS concentrations may be present throughout the entire water column as sediments were released at or near the water surface. Above ambient TSS ≥10 mg/L extend up to 16 km from the area of activity for both TSHD scenarios, with the plume's maximum extent occurring in different locations, due to the timing of the currents, as these simulations were modeled at slightly different times. Concentrations ≥10 mg/L persist less than six hours for TSHD Pre-Dredge activities and less than three hours for the Limited TSHD Pre-Dredge activities. For both TSHD scenarios, the deposition ≥1 mm was discontinuous and tended to stay close to the route centerline with small areas reaching thicknesses >100 mm. The deposition ≥1.0 mm associated with the TSHD drag arm is mainly constrained to within 80 m from the route centerline whereas the deposition

greater than 1.0 mm associated with overflow and disposal extends to greater distances from the source, mainly within 1 km though such deposition can extend up to 2.3 km in isolated patches when subject to swift currents through Muskeget Channel (located within MA state waters).

The simulations of the cable installation showed that both the footprint of the 10 mg/L excess concentration plume and the footprint of deposition over 1.0 mm stayed close to the route centerline. The maximum excursion of the 10 mg/L excess plume extended up to ~2 km, though typically less than 200 m from the route centerline. The excess concentrations stemming from cable installation, both with and without jetting for sand wave clearance, remain relatively close to the route centerline, are constrained to the bottom of the water column, and are also short-lived (typically dissipating within four to six hours). Deposition greater than 1.0 mm was limited to within 100 m from the route centerline for typical installation parameters; this trend holds true in both federal and state waters.

These results illustrate that areas impacted by the plume follow similar trends regardless of the scenario. In general, trends of rapid decrease of area with increasing time and/or increasing concentration threshold are noted for all scenarios. While the plume patterns for the Cable Installation and Cable Installation aided by Jetting were similar, and TSHD Pre-Dredge and Limited TSHD Pre-dredge were similar, differences in the extent and persistence of the plumes and the extent and thickness of deposition may be attributed to route orientation relative to currents, timing of currents, installation parameters, volume suspended, and sediment grain size distribution.

1 INTRODUCTION

New England Wind is the proposal to develop offshore renewable wind energy facilities in Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0534 along with associated offshore and onshore cabling, onshore substations, and onshore operations and maintenance (O&M) facilities. New England Wind will be developed in two Phases with a maximum of 130 wind turbine generator (WTG) and electrical service platform (ESP) positions. Four or five offshore export cables will transmit electricity generated by WTGs to onshore transmission systems in the Town of Barnstable, Massachusetts. Park City Wind LLC, a wholly owned subsidiary of Avangrid Renewables, LLC, is the Proponent and will be responsible for the construction, operation, and decommissioning of New England Wind.

New England Wind's offshore renewable wind energy facilities are located immediately southwest of Vineyard Wind 1, which is located in Lease Area OCS-A 0501. New England Wind will occupy all of Lease Area OCS-A 0534 and potentially a portion of Lease Area OCS-A 0501 in the event that Vineyard Wind 1 does not develop "spare" or extra positions included in Lease Area OCS-A 0501 and Vineyard Wind 1 assigns those positions to Lease Area OCS-A 0534. For the purposes of the Construction and Operations Plan (COP), the SWDA is defined as all of Lease Area OCS-A 0534 and the southwest portion of Lease Area OCS-A 0501, as shown in Figure 1.1-1 of COP Volume I. The SWDA may be 411-453 square kilometers (km^2) (101,590-111,939 acres) in size depending upon the final footprint of Vineyard Wind 1. At this time, the Proponent does not intend to develop the two positions in the separate aliquots located along the northeastern boundary of Lease Area OCS-A 0501 as part of New England Wind. The SWDA (excluding the two separate aliquots that are closer to shore) is just over 32 kilometers (km) (20 miles [mi]) from the southwest corner of Martha's Vineyard and approximately 38 km (24 mi) from Nantucket.[3] The WTGs and ESPs in the SWDA will be oriented in an east-west, north-south grid pattern with one nautical mile (NM) (1.85 km) spacing between positions.

Each Phase of New England Wind will be developed and permitted using a Project Design Envelope (the "Envelope"). This allows the Proponent to properly define and bracket the characteristics of each Phase for the purposes of environmental review while maintaining a reasonable degree of flexibility with respect to the selection of key components, such as the WTGs, foundations, submarine cables, and ESPs. To assess potential impacts and benefits to various resources, a "maximum design scenario," or the design scenario with the maximum impacts anticipated for that resource, is established considering the Envelope parameters for each Phase that have the potential to cause the greatest effect. For some resources, the approach overestimates potential environmental impacts as the maximum design scenario is not the scenario the Proponent is likely to employ.

While the Proponent intends to install all New England Wind offshore export cables within the OECC that travels from the SWDA northward through the eastern side of Muskeget Channel towards landfall sites in the Town of Barnstable, the Proponent is reserving the fallback option to install one or two Phase 2 cables along the western side of Muskeget Channel, referred to as the Phase 2 OECC Western Muskeget Variant[2] (see Section 4.1.3.2 of COP Volume I and Figure 1). This appendix describes the modeling approach, inputs, and results used to assess cable installation activities for four model scenarios along the Western Muskeget Variant. These representative sediment dispersion model scenarios were conducted to simulate the construction and installation of an approximately 58.3 km (36.2 mi) offshore export cable along the Western Muskeget Variant, spanning from the Covell's Beach Landfall Site to the northern edge of the Lease Area OCS-A 0501.

The sediment modeling was carried out using an RPS in house model Suspended Sediment FATE (SSFATE). SSFATE computes TSS concentrations in the water column and sedimentation patterns on the seabed resulting from sediment-disturbing activities. The model requires a spatial and time-varying circulation field (created using RPS' hydrodynamic model output from HYDROMAP), definition of the water body bathymetry, and parameterization of the sediment disturbance (source), which includes sediment grain size data and

[3] Within the SWDA, the closest WTG is approximately 34 km (21 mi) from Martha's Vineyard and 40 km (25 mi) from Nantucket.

sediment flux description. A description of the environmental data used in the modeling (e.g., bathymetry, meteorological observations), the descriptions and theory behind the models (HYDROMAP and SSFATE), and validation of the hydrodynamic forcing used in the sediment dispersion modeling is presented in the main sediment transport modeling report entitled “Sediment Transport Modeling for New England Wind COP.”

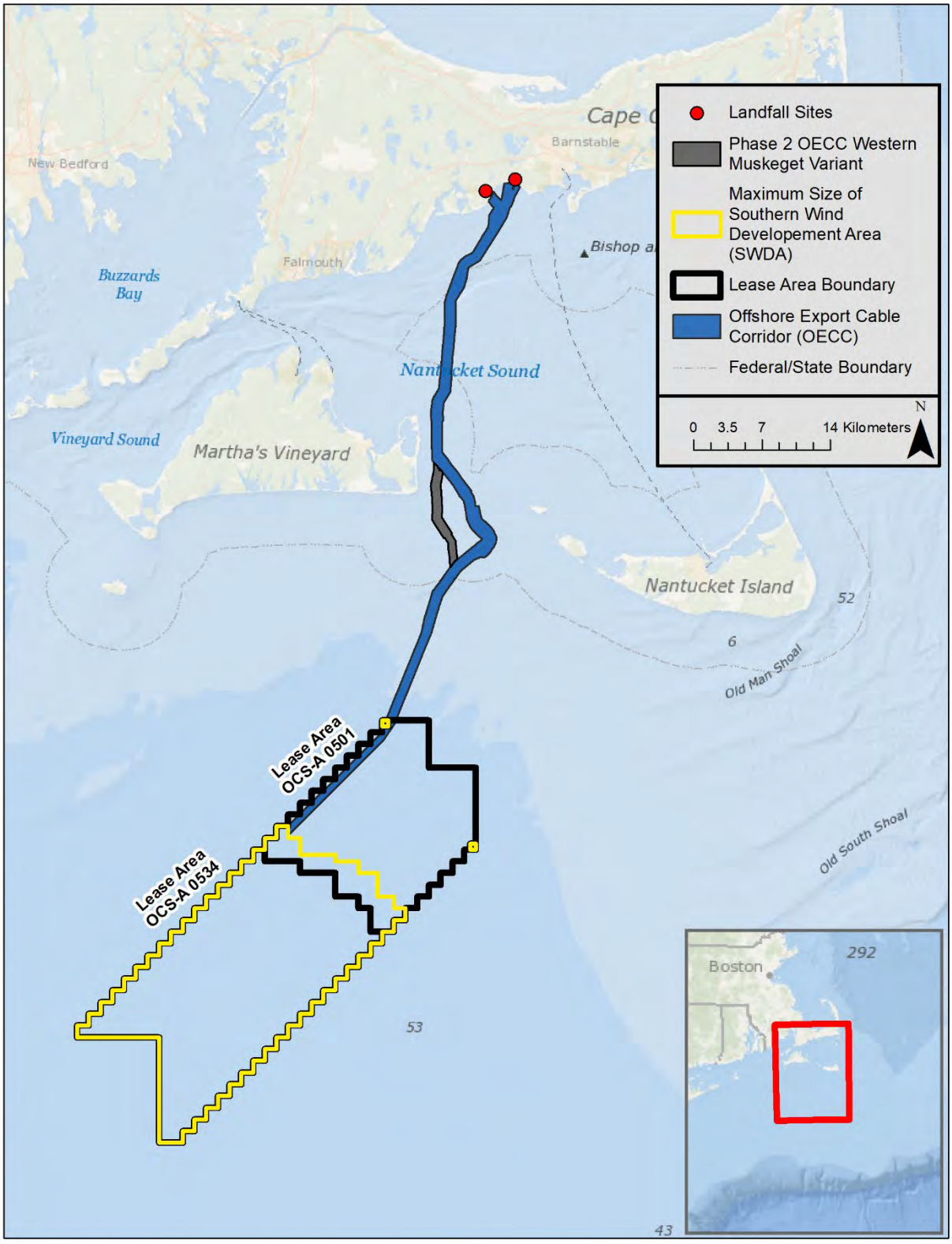


Figure 1. Map of Study Area with Indicative Locations for New England Wind's Offshore Components

1.1 Study Scope and Objectives

RPS applied customized hydrodynamic and sediment transport and dispersion models to assess potential effects from sediment suspension during cable installation activities. This approach has been accepted by

state and federal regulatory agencies for pipeline and cable installation (including the Block Island Wind Farm) as well as harbor dredging and land reclamation activities. Specifically, the analysis includes two interconnected modeling tasks:

1. Development of a three-dimensional hydrodynamic model application of a domain encompassing New England Wind activities using the HYDROMAP modeling system; and
2. Simulations of the suspended sediment fate and transport (including evaluation of seabed deposition and suspended sediment plumes) using the SSFATE modeling system to simulate installation activities. Velocity fields developed using the HYDROMAP model are used as the primary forcing for SSFATE.

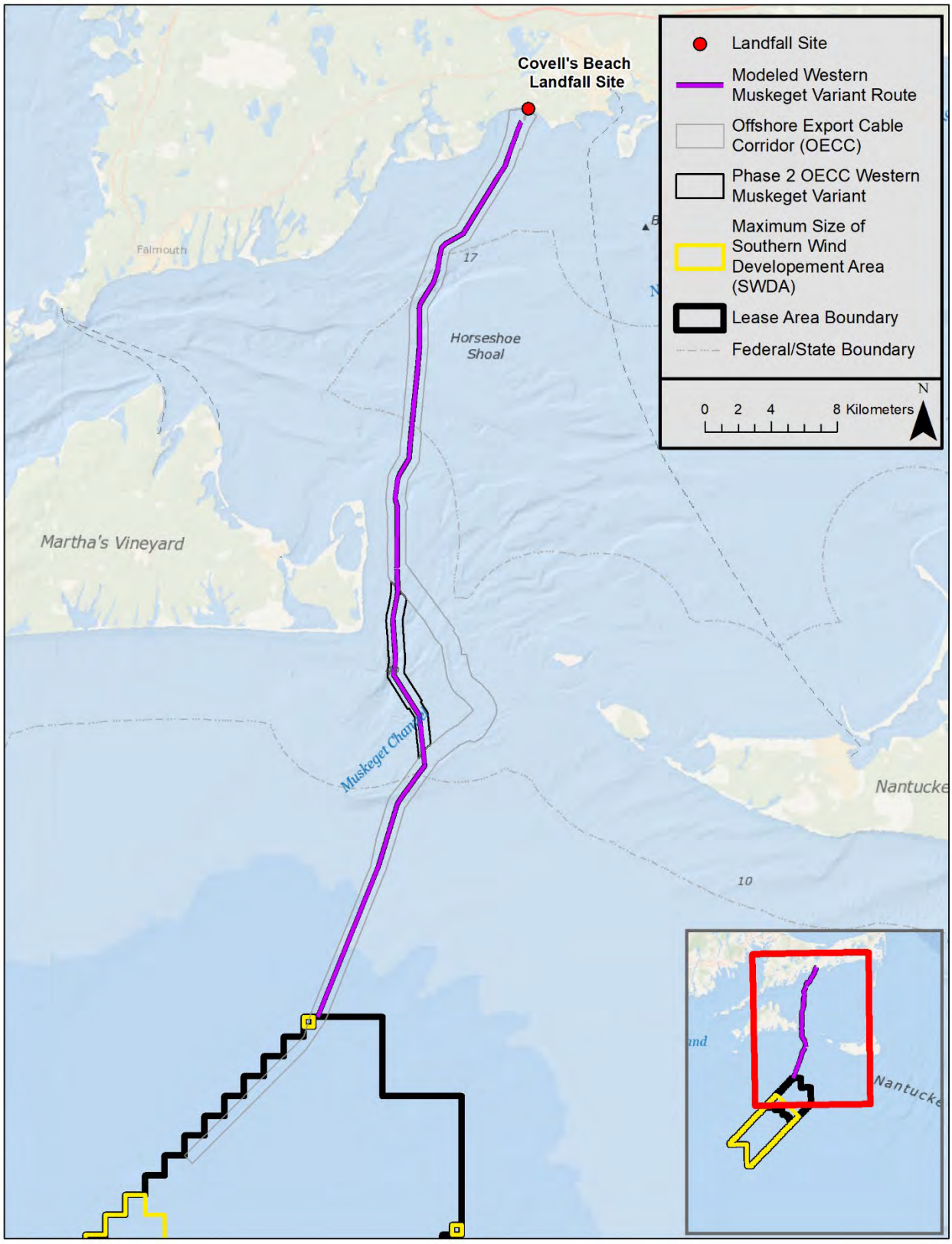
SSFATE predicts the transport, dispersion, and settling of suspended sediment released to the water column. The focus of the model is on the far-field processes (i.e., beyond the initial disturbance) affecting the dispersion of suspended sediment. The model uses specifications for the suspended sediment source strengths (i.e., mass flux), vertical distributions of sediments, and sediment grain-size distributions to represent loads to the water column from different types of mechanical or hydraulic dredges, sediment dumping practices, or other sediment-disturbing activities, such as jetting or ploughing for cable or pipeline burial. For a detailed description of the SSFATE model equations governing sediment transport, settling, deposition, and resuspension, the interested reader is directed to Swanson et al. (2007).

The effects were quantified in terms of the above-ambient TSS concentrations as well as seabed deposition of sediments suspended in the water column during seabed preparation and cable installation activities. Results are presented with respect to the thresholds listed below, which were selected either because they are thresholds of biological significance or because they provide an effective means of demonstrating the physical effects. Thresholds associated with biological significance are documented in Sections 6.5 and 6.6 of the COP Volume III, which are the finfish and invertebrate and benthic sections, respectively.

- Water column concentrations thresholds: 10, 50, 100, 150, 200, 300, 650, 750, and 1,000 mg/L
- Water column exposure durations: 1, 2, 3, 4, 6, 12, 24, and 48 hours
- Seabed deposition thresholds: 1, 5, 10, 20, 50, and 100 mm

1.2 Scenario Components: Routes and Approaches

This study assessed multiple scenarios representing a range of activities associated with cable installation along the Western Muskeget Variant (Figure 2). This appendix was developed to summarize results from the COP Vol I Section 2.3.1 and Appendix I-G which was carried out to characterize the effects associated with the offshore cable installation activities. The construction activities that will resuspend sediments in the water column include cable burial along the offshore export cables and dredging along some of the offshore export cables prior to cable installation to remove sand waves. Portions of the sand waves may be mobile over time; therefore, the upper portions of the sand waves may need to be removed by dredging so that the cable laying equipment can achieve the proper burial depth below the sand waves and into the stable sea bottom. The sand waves are not uniform in presence or size (volume) and therefore the required dredging varies depending on the specific route and techniques used.


Covell's Beach
Landfall Site
Landfall Site
Modeled Western Muskeget Variant Route
Offshore Export Cable Corridor (OECC)
Phase 2 OECC Western Muskeget Variant
Maximum Size of Southern Wind Developement Area (SWDA)
Lease Area Boundary
Federal/State Boundary
N
0 2 4 8 Kilometers
Falmouth
17
Horseshoe Shoal
Martha's Vineyard
Muskeget Channel
Nantucke
10

Two distinct approaches were considered to remove the upper portions of the sand waves above the stable seabed along the offshore export cables:

1. The first technique is a trailing suction hopper dredge ("TSHD"). Dredgers of this type are typically used for European offshore wind projects and are also commonly used in the US for channel maintenance, beach nourishment projects, and other uses. For this study, a TSHD would be used to remove a 20 m (65.6 ft) wide section of a sand wave (for each of the up to two cables) that is deep enough to allow subsequent installation of the cable within the stable seabed (referred to as "TSHD Pre-Dredge"). After the dredging was complete, cable installation would occur using one of the methods (e.g., jet plow) described in Sections 3.3.1.3.6 and 4.3.1.3.6 of Volume I of the COP. For the "TSHD Pre-Dredge" approach, cable installation is a separate activity that occurs after dredging is complete (referred to as "Cable Installation"). Therefore, the model first simulates the TSHD dredging, then separately simulates the cable installation. This combined approach of TSHD dredging followed by cable installation is referred to as "**TSHD Pre-Dredge + Cable Installation**".
2. The second approach involves jetting (also known as mass flow excavation), which uses a pressurized stream of water to push sand to the side. Jetting is a post-lay burial technique that removes the tops of sand waves while burying a section of cable that has previously been placed on the sand waves. Jetting removes the tops of sand waves where required and subsequently buries the cable. Jetting is a viable technique for excavation less than approximately 2 m through sand waves and into the stable seabed. If excavation greater than approximately 2 m is required, additional dredging by the TSHD would be required. Accordingly, the dredging could be accomplished entirely by the TSHD on its own (the "TSHD Pre-Dredge" described above) or the dredging could be accomplished by a combination of jetting and TSHD. In this scenario, jetting would be used in smaller sand waves and the TSHD would be used to remove the larger sand waves.
3. The jetting activity both removes the tops of sand waves where required and buries the cable (such jetting occurs only for very limited portions of the cable corridor). Therefore, the model accounts for cable installation both through jetting (in smaller sand waves) and through one of the other potential cable burial methods listed in the COP (such as a jet plow) in areas where sand wave removal is not required. This approach is referred to as "Cable Installation aided by Jetting". Accordingly, the model first simulates the limited TSHD dredging, then separately simulates the cable installation (which consists of jetting in limited segments for sand wave clearance and cable burial, plus jet plow or one of the other cable installation techniques listed in the COP for the remainder of the route). This combined approach of limited TSHD dredging (in larger sand waves) followed by cable installation via either jetting (in smaller sand waves) or one of the other potential cable burial methods (such as a jet plow) is referred to as "**Limited TSHD Pre-Dredge + Cable Installation aided by Jetting**."

The four independently modeled scenarios include: 1) TSHD Pre-Dredge, 2) Cable Installation, 3) Limited TSHD Pre-Dredge, and 4) Cable Installation aided by Jetting. The four scenarios can be grouped based on two distinct approaches defined in the text above: 1) TSHD Pre-Dredge + Cable Installation, and 2) Limited TSHD Pre-Dredge + Cable Installation aided by Jetting. However, the results are presented independently for each scenario because it is expected that there will be sufficient time between pre-dredging activities and cable installation such that the effects from sand wave clearance do not compound or influence effects from cable installation activities.

2 SEDIMENT MODELING

The following sections describe the construction methods and associated sediment-suspending activities as they pertain to defining modeling inputs.

2.1 Input Parameters: Construction Activities

In both options where the TSHD is used, a 20 m wide swath is required to be dredged for each cable (up to two cables are possible). The TSHD method includes a vessel with a drag arm that extends below the vessel to the seabed. The drag arm has an opening through which vessel-housed pumps suction the sediments (and water) from the seabed to the vessel hopper. The drag arm will induce some suspended sediments in the water column. It is assumed that it will resuspend 1% of the target sediments; this loss rate was based on a study (Anchor QEA, 2003) which established the average loss rate to be 0.77%, therefore the 1% is slightly conservative rounded up to the nearest integer. The suction process typically results in acquisition of 80% water and 20% sediment and therefore the vessel allows for overflow. The overflow will occur at the water surface and the overflow waters will contain some of the dredge sediments, preferentially the fine material. It is assumed that the overflow waters will contain 5% of the coarse material (fine sand and coarse sand as defined by the modeled binning of sediments) and 30% of the fine material (clay, fine silt and coarse silt as defined by the model binning of sediments); these values are based on a review of quantification of dredge related resuspension source terms. Given that the hopper will contain 99% of the target volume (since 1% is lost near the drag arm) this means that the overflow of coarse and fine sediments is equivalent to 4.95% and 29.7 % of the target volumes, respectively. Further it is assumed that the hopper will retain some of the water and the hopper will have a ratio of 20% water to 80% sediments on average.

Based on the parameters of this project it is anticipated that a 2,294 m^3 (3,000 cy) hopper will be employed and that the total (sediment plus water with a higher water content in the drag arm than in the hopper) production rate is 9,175 m^3/hr (12,000 cy/hr). Using the assumptions presented above, after 1 hour the hopper will contain approximately 1,835 m^3 (2,400 cy) of sediment and therefore the sediment production rate is 1,835 m^3/hour. This is approximate since, for the ease of discussion, it neglects the losses at the seabed or from overflow. Note that while ~30% of fines will overflow, fine material typically represents less than 5% of the sediment grain size distribution. Once the hopper is filled, the drag arm will stop suctioning and the vessel will sail offsite (but within the OECC) to dump the hopper contents (sediments and water). The hopper was assumed to open 6.09 m (20 ft) below the water surface. For the purposes of defining modeling inputs, it was assumed that the suction dredging would occur for approximately an hour, then the TSHD would sail to a location approximately 250 m east of the route and dump the hopper load and then sail back to the position along the route. The entire cycle of stopping the dredge, sailing to dump and sailing back is estimated to take approximately a half hour. Further, since the sand waves and associated dredging are intermittent, there are intermittent stoppages along the route and an average sail speed of 5.6 km/hr (3 knots) was assumed.

The actual volume of dredging is dependent on the cable installation method and achievable burial depth (Table 1). The volumes associated with dredged material were conservatively estimated, specifically for the jetting scenario, as jetting may be limited to even smaller sand waves than 2 m to ensure appropriate cable burial. In this case, less jetting will occur and more sand wave removal will occur by TSHD. As noted above, the Project Envelope includes both the “TSHD Pre-Dredge + Cable Installation” and the “Limited TSHD Pre-Dredge + Cable Installation aided by Jetting” approaches or various combinations of the jetting and TSHD amounts listed in these approaches.

The actual installation parameters could be one of these approaches on its own or some combination of these approaches. Components that are considered part of the Project Envelope were modeled based on established “typical” installation parameters which are described in more detail below. The dredging parameters (Table 2) and the vertical initialization of sediment mass associated with each of these activities (Table 3) were used as model input parameters.

Table 1. Approximate Dredging Lengths and Volumes for TSHD and Limited TSHD Pre-Dredge

OECC Route	TSHD Pre-Dredge Option		Limited TSHD Pre-Dredge + Jetting Option		Average Percent Solid
	Approx. Length with Sand Waves > 0 m where TSHD may Occur	Per Cable Volume of Sand Waves > 0 m where TSHD may Occur[1]	Approx. Length with Sand Waves >2 m where Limited TSHD may Occur[1]	Per Cable Volume of Sand Waves > 2 m where Limited TSHD may Occur	
	km	m^3	km	m^3	%
OECC – Western Muskeget Variant	7.65	60,080	0.63	19,634	72.85

Notes:

1. These volumes are a conservative estimate based on the assumption that cable installation equipment would have an achievable burial depth of 1.5 m. In reality, cable installation equipment may be able to reach a greater burial depth of 2.5 m, which would require less sand wave removal to ensure burial within the stable seabed

Table 2. Assumed Dredging Parameters

Sediment Characteristics		Depth weighted to 2 m[1]
Total Dredging Production (sediment + water)	m^3/hr	9,175
Sediment Production	m^3/hr	1,835
Hopper Volume	m^3	2,294
Sediment Suspended at Drag Head (as % of total dredged, both fines and coarse)	%	1
Target Fines in Overflow	%	29.7
Target Coarse in Overflow	%	4.95
Target Fines in Hopper Release	%	70.3
Target Coarse in Hopper Release	%	94.05
Operations	hrs/day	24
Time to Fill Hopper	hrs	1
Time to Transit, Release, Transit Back	hrs	0.5

Notes:

1. See COP Vol I Section 2.3.1 and Appendix I-G for details of the procedure to develop depth weighted grain size distributions.

Table 3. Summary of vertical initial distribution of mass associated with dredging, overflow and dumping.

Dredging			Overflow			Dumping		
Individual Bin Percent	Cumulative Percent	Meters Above Bottom	Individual Bin Percent	Cumulative Percent	Meters Below Surface	Individual Bin Percent	Cumulative Percent	Meters Below Surface
5	100	3	100	100	0	100	100	6.1
10	95	2	-	-	-	-	-	-
28	85	1	-	-	-	-	-	-
28	57	0.66	-	-	-	-	-	-
29	29	0.33	-	-	-	-	-	-

The impact cable installation parameters (Table 4) were developed based on typical modeling assumptions and discussions with the Proponent. The typical installation will have a one-meter-wide trench that is two meters deep, and the installation will advance at a rate of 200 m/hr. These parameters are considered applicable for a jet plow and are conservative for a mechanical plow.

For cable installation aided by jetting, sections requiring jetting will have a trench that is two meters wide and two meters deep and the excavation along those portions will advance at a rate of 100 m/hr. Mobilization fraction or percentage (often referred to as the loss rate or resuspension rate) during installation for the envelope of installation methods typically range from 10-35% (Foreman, 2002).

The typical sediment mobilization fraction for cable burial including sections where jetting was used was assumed to be 25%. The mass was assumed to be initialized in the bottom three meters (or less when depths are shallower than three meters) of the water column (Table 5). Additionally, operations were assumed to be continuous (i.e., 24 hrs/ day).

Table 4. Summary of typical and maximum cable installation impact parameters

Scenario Description	Grain Size Distribution	Trench Width (m)	Trench Depth (m)	Trench Volume per Meter (m^3)	Advance Rate (m/hr)	Percent Mobilized (%)
Typical – Cable Installation	Depth weighted to 2 m*	1	2	2	200	25
Typical – Cable Installation aided by Jetting	Depth weighted to 2 m*	2	2	4	100	25

Table 5. Summary of vertical initial distribution of mass associated with cable installation and jetting.

Individual Percent Mass (%)	Cumulative Percent Mass (%)	Height Above Bottom (m)
29	29	0.33
28	57	0.66
28	85	1
10	95	2
5	100	3

2.2 Sediment Characteristics

The sediment characteristics are a key factor of the sediment load definition input to the SSFATE model. The spatially varying sediment characteristics were developed based on analysis of samples from multiple surveys. A combination of surface grab samples and sediment cores were available at locations along the Western Muskeget Variant offshore export cable. The grab samples, obtained from the upper half meter of the seabed, contained both sieve and hydrometer analysis as well as moisture content. The vibracore stations all yielded sieve data and a few stations also contained hydrometer analysis. Sediment analysis at multiple depths (typically two) within the upper three meters of the seabed were available at most vibracore stations, however they did not include analysis of the surface sediments; therefore, this information was obtained from the grab samples. Measurement of the moisture content was provided for all vibracore stations. The distributions at each location at each depth were discretized to determine the fraction in each of the five bin categories used in SSFATE (Table 6).

Table 6. Sediment Size Classes used in SSFATE

Description	Class	Type	Size Range (microns)
Fine ↓ Coarse	1	Clay	0-7
	2	Fine silt	8-35
	3	Coarse silt	36-74
	4	Fine sand	75-130
	5	Coarse sand	>130

For all stations without hydrometer data, the remaining fraction (percent finer than fine sand) was split evenly in the three bins of clay, fine silt, and coarse silt. The depth-weighted sediment distribution used in the modeling (Figure 3) was produced at each of the vibracore station locations. The distribution was developed by assuming the nearest grab sample characterization represented the upper half meter, then that number was combined with all remaining samples to determine the depth weighted characterization for the target depth. For this analysis, the resulting sediment characterizations for the typical scenario (two-meter target depth) were used.

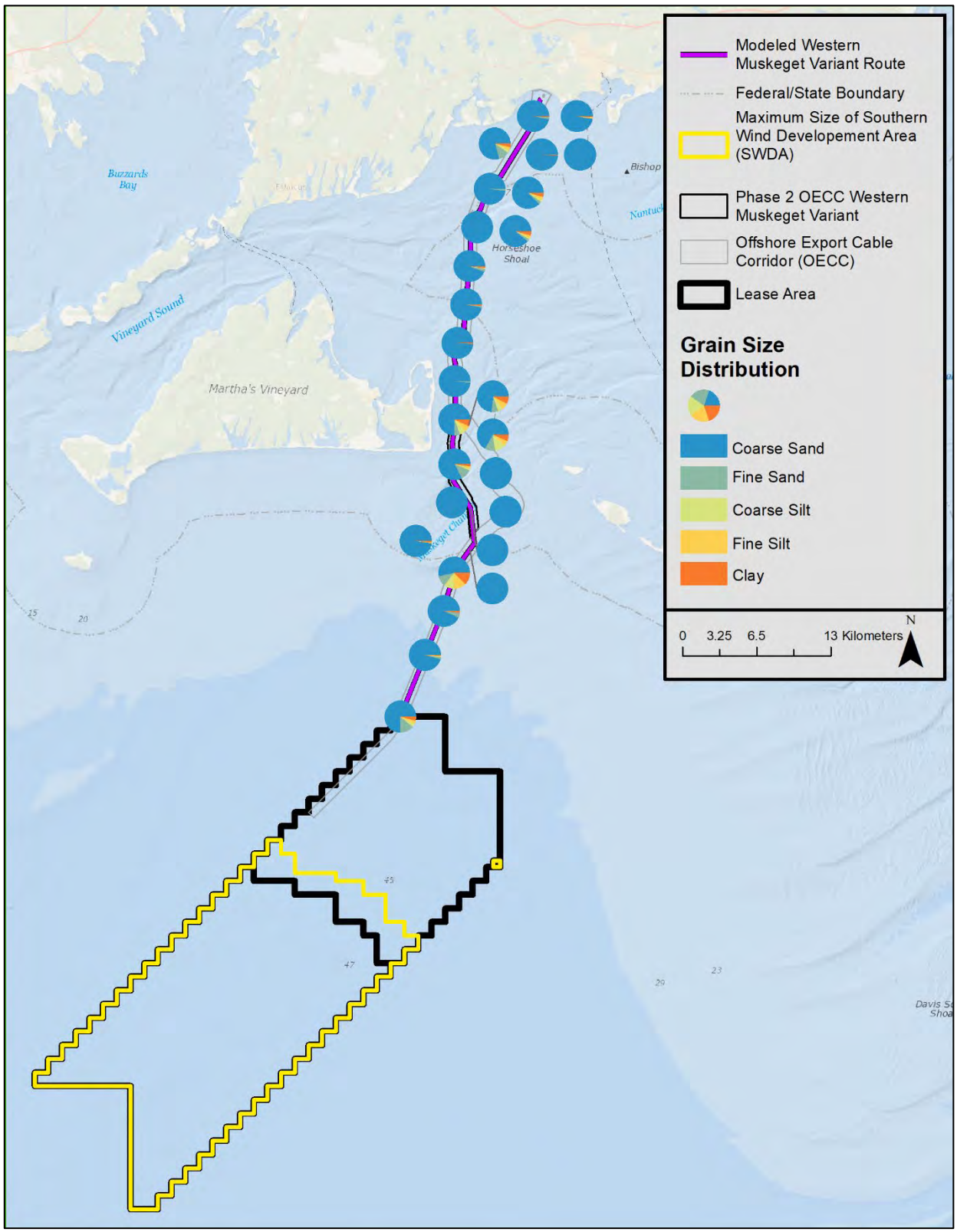


Figure 3. Sediment Grain Size Distributions along the Western Muskeget Variant route.

2.3 Sediment Modeling Results

SSFATE simulations were performed for each sediment disturbance activity. Sediment concentrations were computed on a grid with resolution of 50 m x 50 m in the horizontal dimension and 0.5 m in the vertical dimension. The model time step and output results saving interval was 5 minutes for the cable installation scenarios and 2 minutes for the dredging/overflow/disposal simulations. A smaller timestep was necessary for the dredging due to the faster production rate of the dredging operations. Model predicted concentrations are "excess" concentrations above the background concentration (i.e., a concentration of 0 mg/L is assumed for background, ambient conditions).

Results from the model runs are presented through a set of figures and tables. Maps of instantaneous TSS concentrations, time-integrated maximum TSS concentrations, duration of TSS ≥ 10 mg/L, and seabed deposition are provided for each modeled scenario. Tables quantifying the area exceeding TSS thresholds for specific durations as well as areas of seabed deposition exceeding thickness thresholds are presented for the representative offshore export cables. Mapped results are presented separately for each of the four model scenarios (Section 2.3.1 to 2.3.4), and tabular results are presented together in Section 2.3.5.

Additional information about standard graphical outputs for each scenario are provided below:

- **Maps of Instantaneous TSS Concentrations**: These figures show the instantaneous TSS concentrations at a moment in time. The plan view shows the maximum concentration throughout the water column and the vertical cross-section shows the cross-sectional variability of concentrations along a transect.
- **Maps of Time-integrated Maximum TSS Concentrations**: These figures show the maximum time-integrated water column concentration from the entire water column in scaled plan view. Most figures also include a non-scaled inset showing a cross-sectional view of maximum TSS concentrations in the water column. The concentrations are shown as contours using mg/L. The entire area within the contour is at or above the concentration defined by the contour itself. Most importantly, it should be noted that these maps show the maximum TSS concentration that occurred throughout the entire simulation and that: (1) these concentrations do not persist throughout the entire simulation and may be just one time step; and (2) these concentrations do not occur concurrently throughout the entire modeled area but are the time-integrated spatial views of maximum predicted concentrations.
- **Maps of Duration of TSS Concentrations ≥10 mg/L:** These figures show the number of hours that the TSS concentrations are expected to be equal to or greater than 10 mg/L.
- **Maps of Seabed Deposition**: These figures show the deposition on the seabed that would occur once the activity has been completed. The thickness levels are shown as contours (in mm) and the entire area within the contour is at or above the thickness defined by the contour itself. The contours have been delineated at levels either tied to biological significance (1 mm and 20 mm) or to facilitate viewing the results.

2.3.1 TSHD Pre-Dredge

A snapshot of the instantaneous concentrations from the TSHD Pre-Dredge scenario is presented in Figure 4, the inset contains the vertical cross-section across the plume. This figure shows that at this instance, TSS concentrations above ambient are occurring throughout most of the vertical extent of the water column due to disposal activity releasing sediments in the upper water column.

In viewing the map of the time-integrated maximum concentrations footprint (Figure 5) the plume is present adjacent to the areas where sand wave dredging will occur, which is intermittent along the route. Further it can be seen that the plume may be present at varying orientations relative to the route centerline in response to the prevailing direction of the oscillating current synchronous with the simulated activity. In that sense it is noted that this footprint corresponds to the modeled time period and multiple perturbations of the footprint are possible, though the general trends are expected to be the same. The footprint and contours for the dredging, overflow and disposal activity show that excess concentrations are expected throughout the water column. This is due to the overflow release located at the surface and therefore a plume is noted throughout the water column as the sediments settle. Similarly, the dumping will initiate sediments approximately 6 m below the surface and therefore the resulting plume occupies waters throughout the majority of the water column. The plume of excess TSS at 10 mg/L and 750 mg/L extends up to 16 km and 5 km from the route centerline, though may be less extensive at varying locations along the route. Relatively high concentrations (>1,000 mg/L) are predicted at distances up to 5 km in response to the relatively high loading of dumping and swift transport of the dumped sediments.

The duration of exposure to TSS ≥10 mg/L above ambient is presented in Figure 6, and the seabed deposition is shown in Figure 7. Figure 5 illustrates that the simulation predicted that the affected areas are discontinuous in response to the intermittent nature of dredging. The map of exposure of the water column to TSS concentrations greater than 10 mg/L shows a much smaller footprint as compared to the map of maximum concentrations, indicating that at 10 mg/L the plume is very transient (i.e., present for less than one hour) in most locations. Most locations have exposures of less than one hour, though there are some areas with exposure of up to six hours. The deposition ≥1 mm was discontinuous and tended to stay near route.

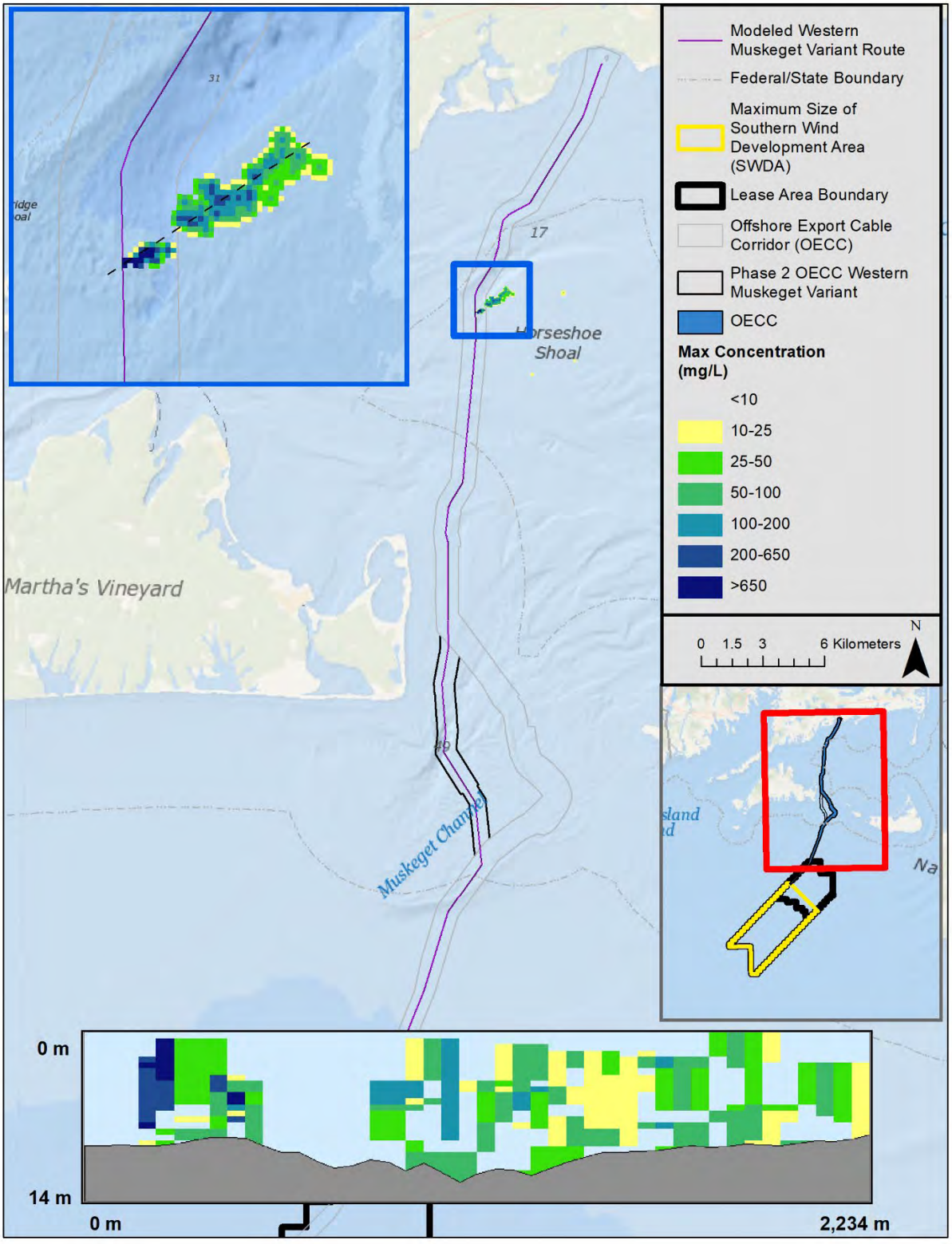


Figure 4. Snapshot of instantaneous TSS concentrations for a time step during simulation of TSHD dredging, overflow, and dredged material release operations for a representative cable route within the Western Muskeget Variant.[1]

Notes:

1. Inset at bottom shows the vertical cross-section across the plume from southwest (bottom left) to northeast (top right).

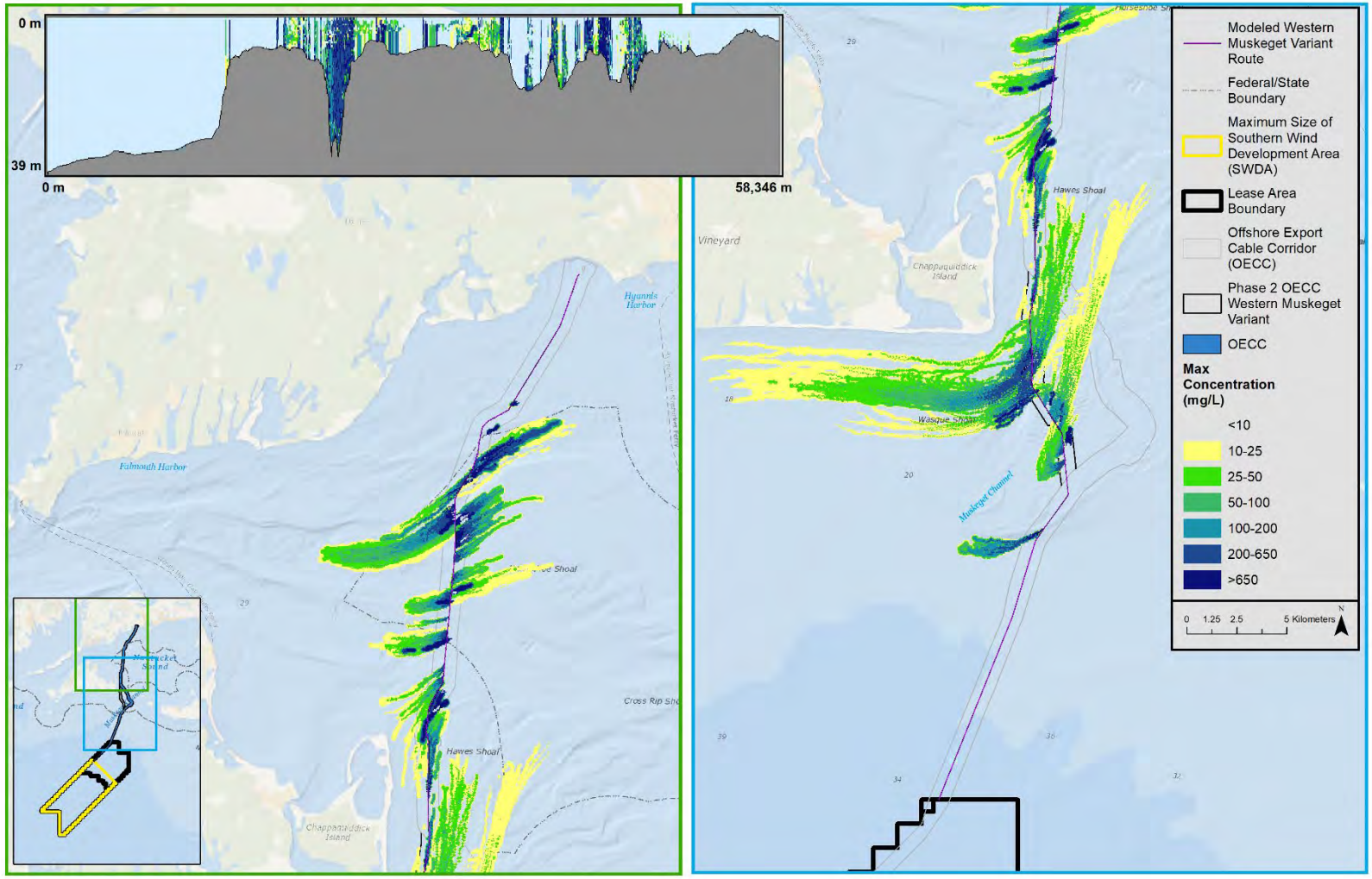


Figure 5. Map of time-integrated maximum concentrations associated with TSHD dredging, overflow, and dredged material release operations for a representative cable route within the Western Muskeget Variant. [1]

Notes:

1. Inset shows a vertical cross-section.

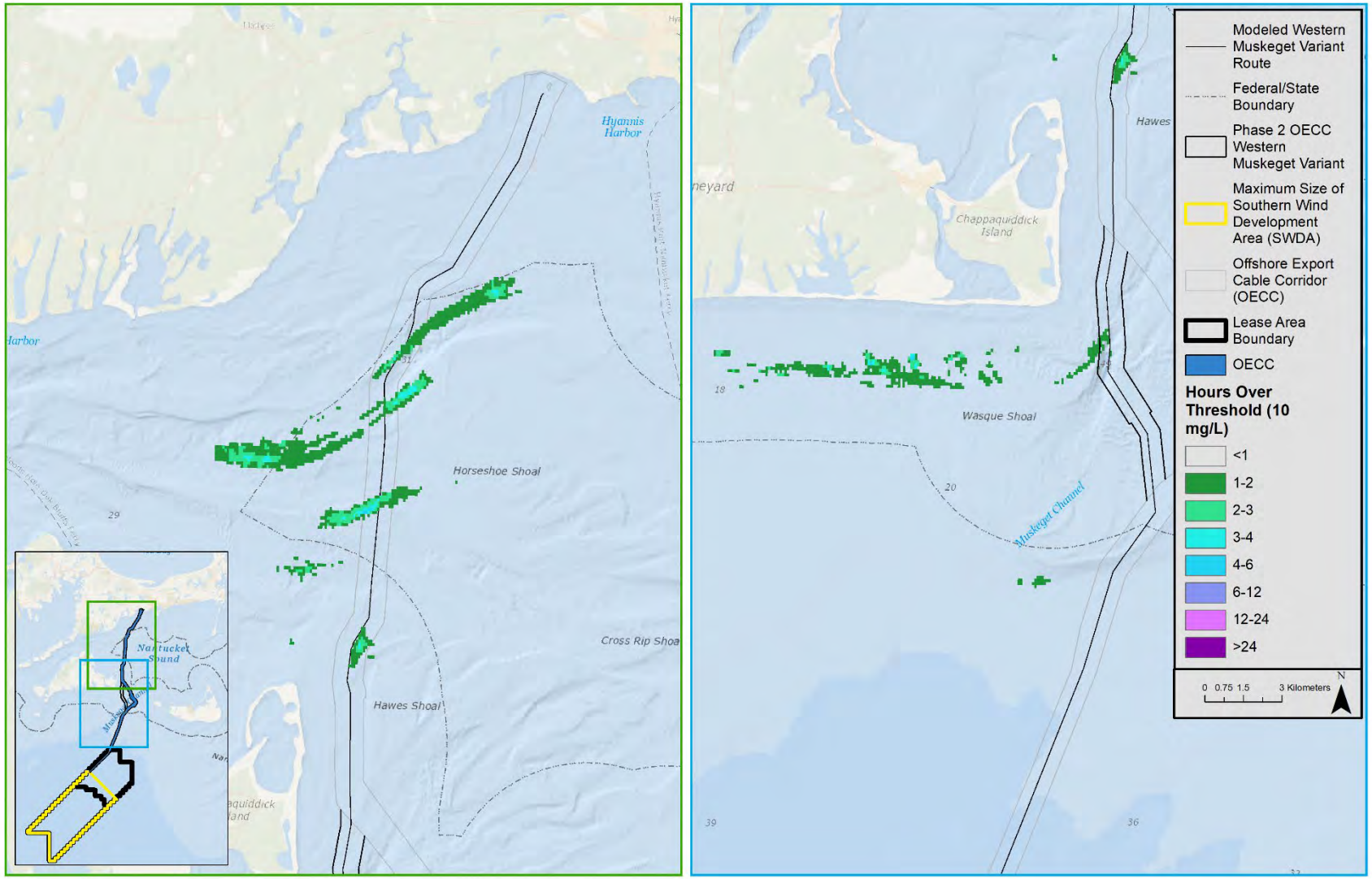


Figure 6. Map of duration of TSS ≥ 10 mg/L associated with TSHD dredging, overflow, and dredged material release operations for a representative cable route within the Western Muskeget Variant.

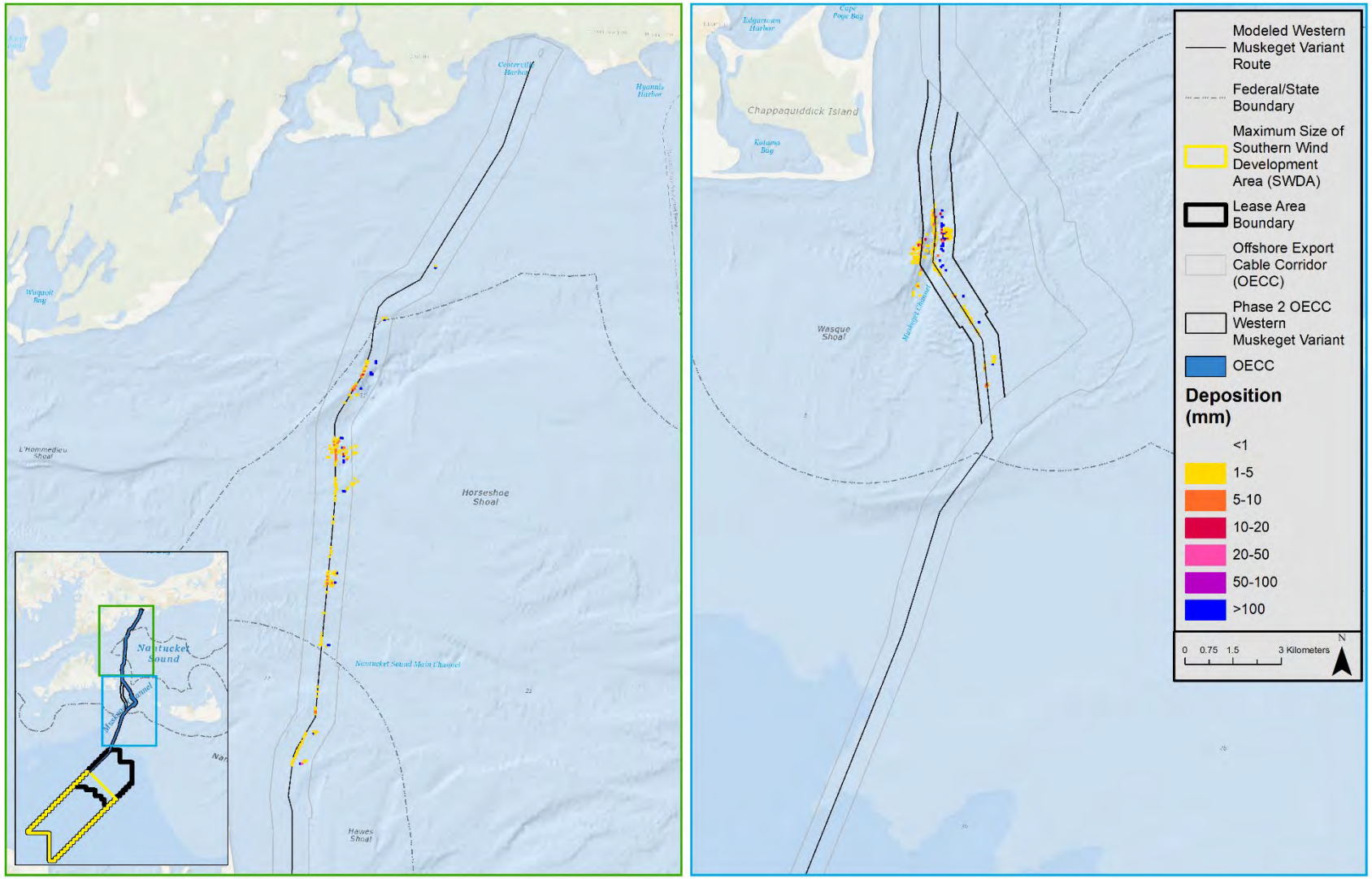


Figure 7. Map of deposition thickness associated with TSHD dredging, overflow, and dredged material release operations for a representative cable route within the Western Muskeget Variant.

2.3.2 Cable Installation

Subsequent to the pre-installation dredging via TSHD, cable installation will take place. A snapshot of the instantaneous concentrations from the representative cable installation scenario is presented in Figure 8, the inset contains the vertical cross-section across the plume. This figure shows that at this instance, TSS concentrations are local to the bottom of the water column.

The map of maximum time-integrated concentrations is presented in Figure 9, the duration of exposure to TSS above ambient ≥10 mg/L is presented in Figure 10, and the seabed deposition is shown in Figure 11. The overall footprint shows that the plume, as delineated by excess concentrations of 10 mg/L and greater, remains relatively close to the route centerline for the majority of the route. Some areas of the plume, as delineated by the 10 mg/L contour, were transported away from the centerline in response to the currents or due to the relatively higher volume of finer material present. Water column concentrations above 10 mg/L generally remain along the route centerline, with the 10 mg/L contour extended ~1.85 km from the centerline, though typically remaining within ~200 m or less from the centerline. The cross-sectional view of the maximum concentration (Figure 9) runs along the centerline and shows that the plume is contained within the bottom of the water column close to the disturbance.

Deposition was mainly centered around the route centerline with deposition ≥1.0 mm limited to within ~100 m from the centerline (Figure 11). Deposition was not predicted to reach 5 mm. The results indicate that most of the mass settles out quickly and is not transported for long by the currents.

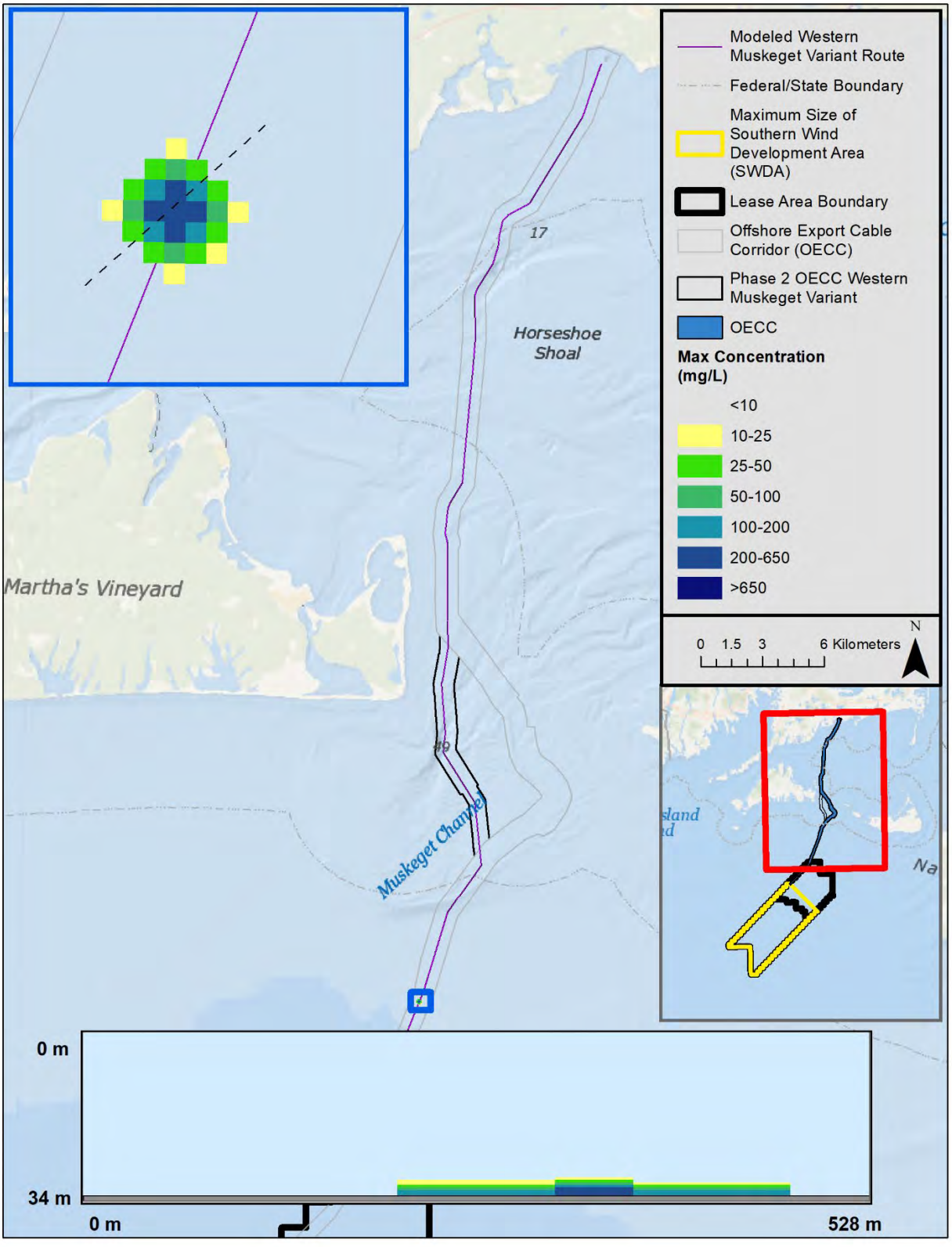


Figure 8. Snapshot of instantaneous TSS concentrations for a time step during simulation of representative cable installation within the Western Muskeget Variant.[1]

Notes:

1. Inset at bottom shows the vertical cross-section across the plume from northeast (top right) to southwest (bottom left).

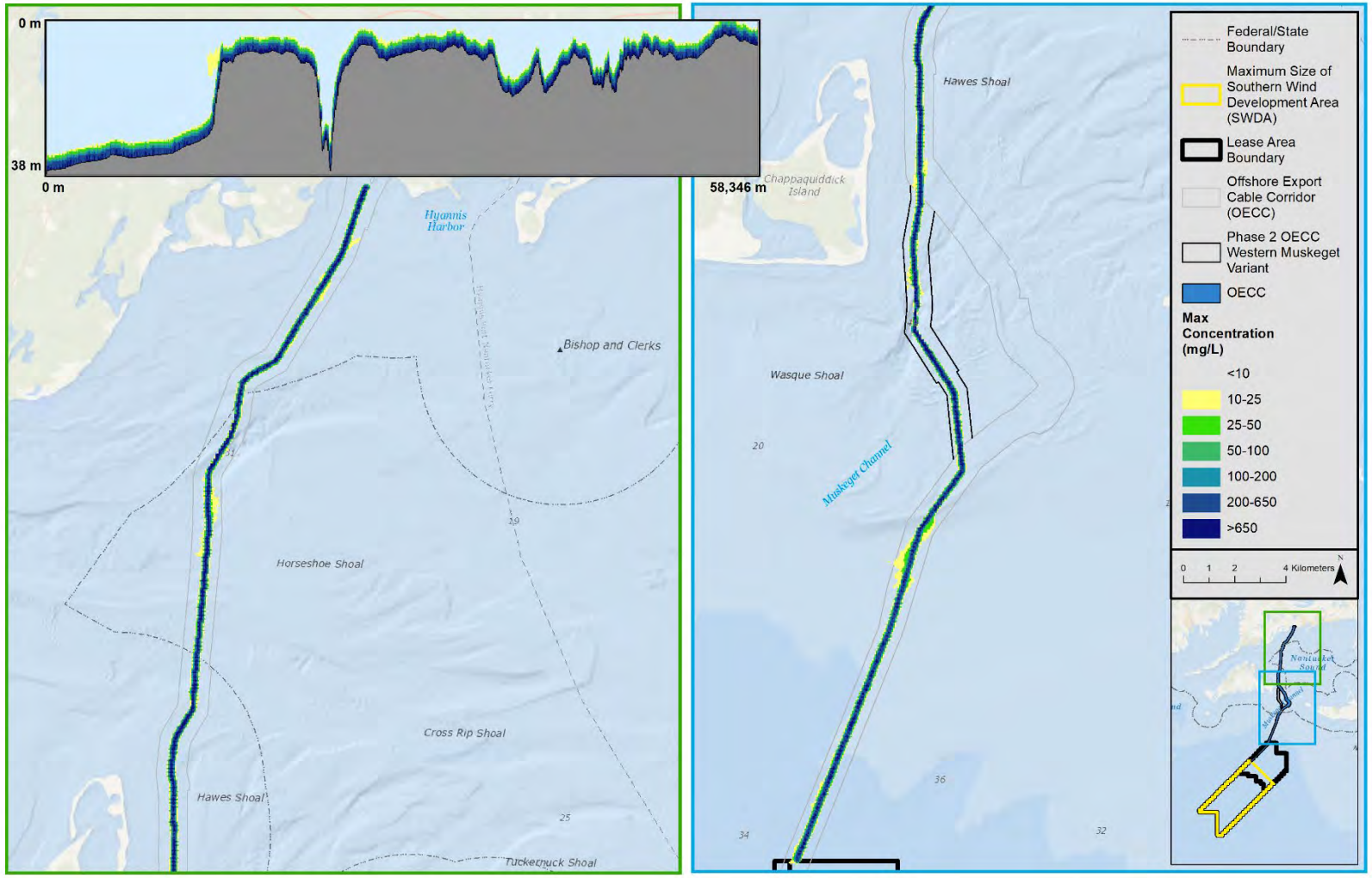


Figure 9. Map of time-integrated maximum concentrations associated with representative cable installation within the Western Muskeget Variant.[1]

Notes:

1. Inset shows a vertical cross-section along entire representative centerline.

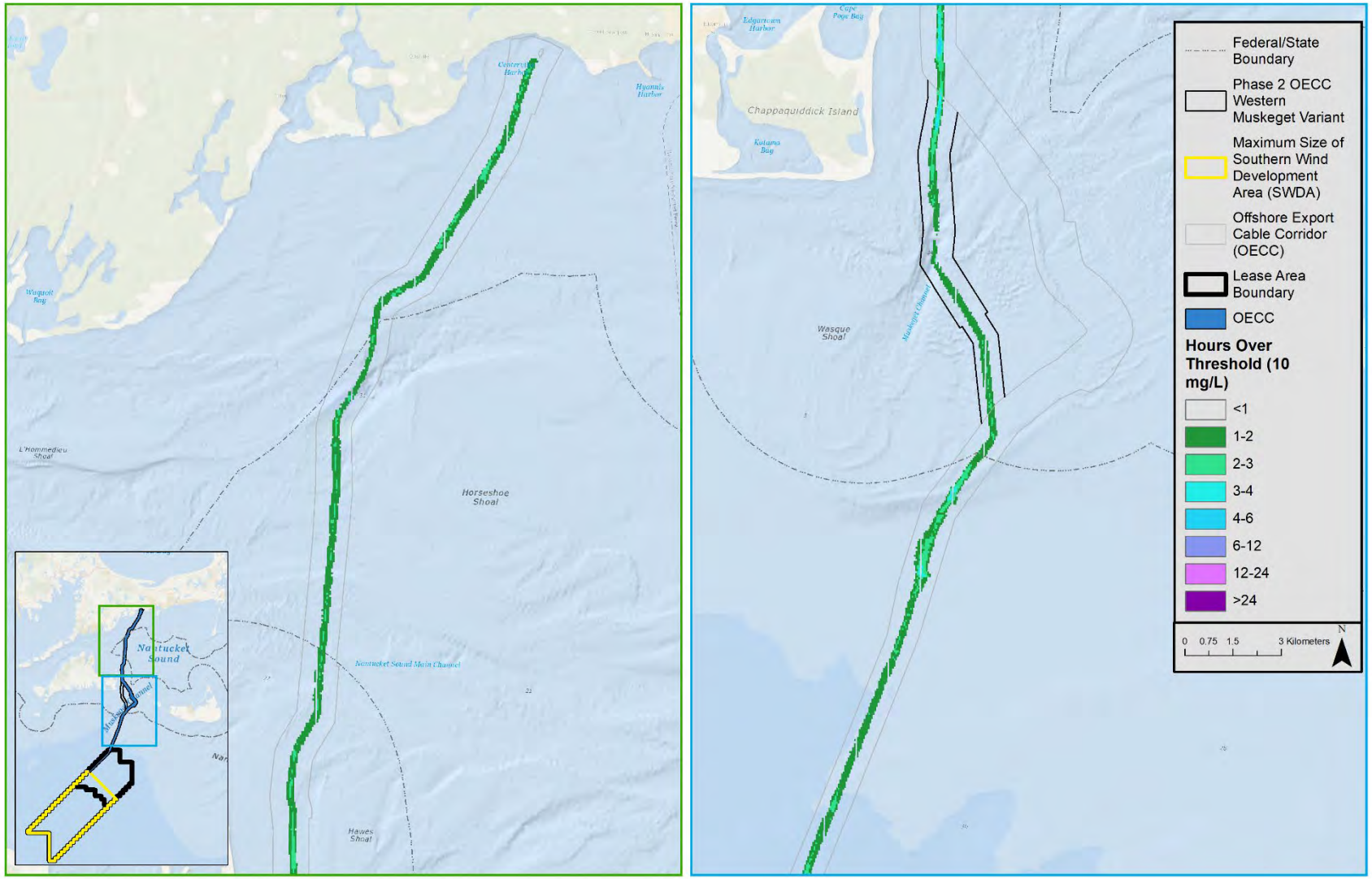


Figure 10. Map of duration of TSS ≥ 10 mg/L associated with representative cable installation within the Western Muskeget Variant.

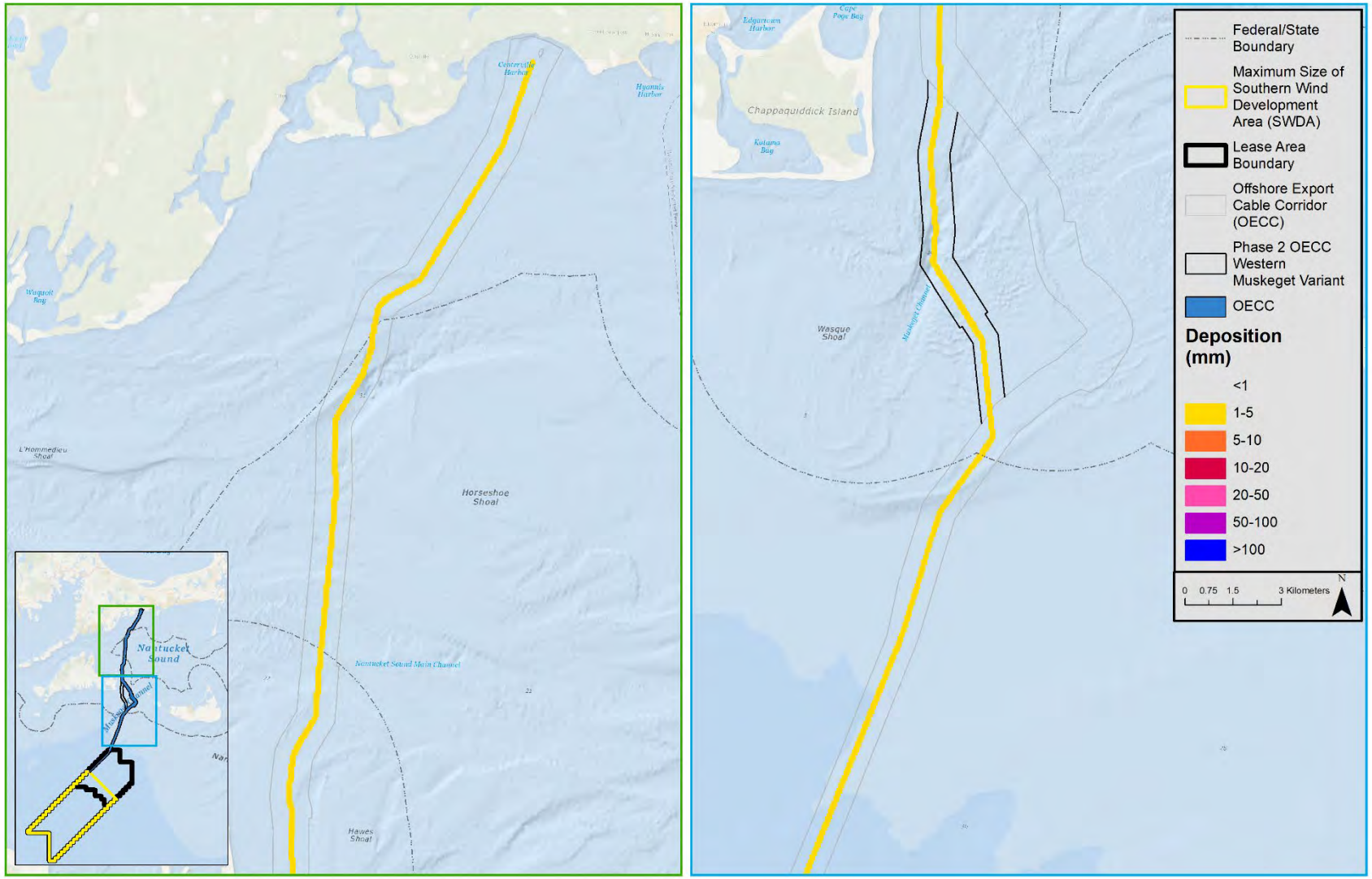


Figure 11. Map of deposition thickness associated with representative cable installation within the Western Muskeget Variant.

2.3.3 Limited TSHD Pre-Dredge

A snapshot of the instantaneous concentrations from the Limited TSHD Pre-Dredge scenario is presented in Figure 12 with an inset that contains the vertical cross-section across the plume. This figure shows that at this instance, TSS concentrations above ambient are occurring throughout most of the vertical extent of the water column due to disposal activity releasing sediments in the upper water column.

The maps of the time-integrated maximum concentration for the limited TSHD scenario (Figure 13), the duration of exposure to TSS ≥10 mg/L (Figure 14), and the seabed deposition (Figure 15) show that results for the limited TSHD scenario are similar in trend to those of the TSHD, but are reduced in size and intensity due to the fact that this scenario is dredging less sediments. The plume was transported by the prevailing direction of the oscillating currents synchronous with the simulated activity. The plume extent was similar to the TSHD Pre-Dredge scenario (~16 km), but occurred in a different location (i.e., Vineyard Sound) due to the timing of the currents. Due to sediment introduction at the surface and approximately 6 m below the surface, the plume extends throughout the water column as the sediments settle. Relatively high TSS concentrations (1,000 mg/L) subside within the first hour and concentrations ≥10 mg/L diminish within three hours. The exposure to above-ambient TSS ≥10 mg/L occur for a relatively short time period and generally remains near the route centerline.

As expected, the areas of deposition associated with the Limited TSDH Pre-Dredge were smaller for all thresholds than the TSHD Pre-Dredge. The deposition ≥1 mm was discontinuous and tended to stay close to the route centerline.

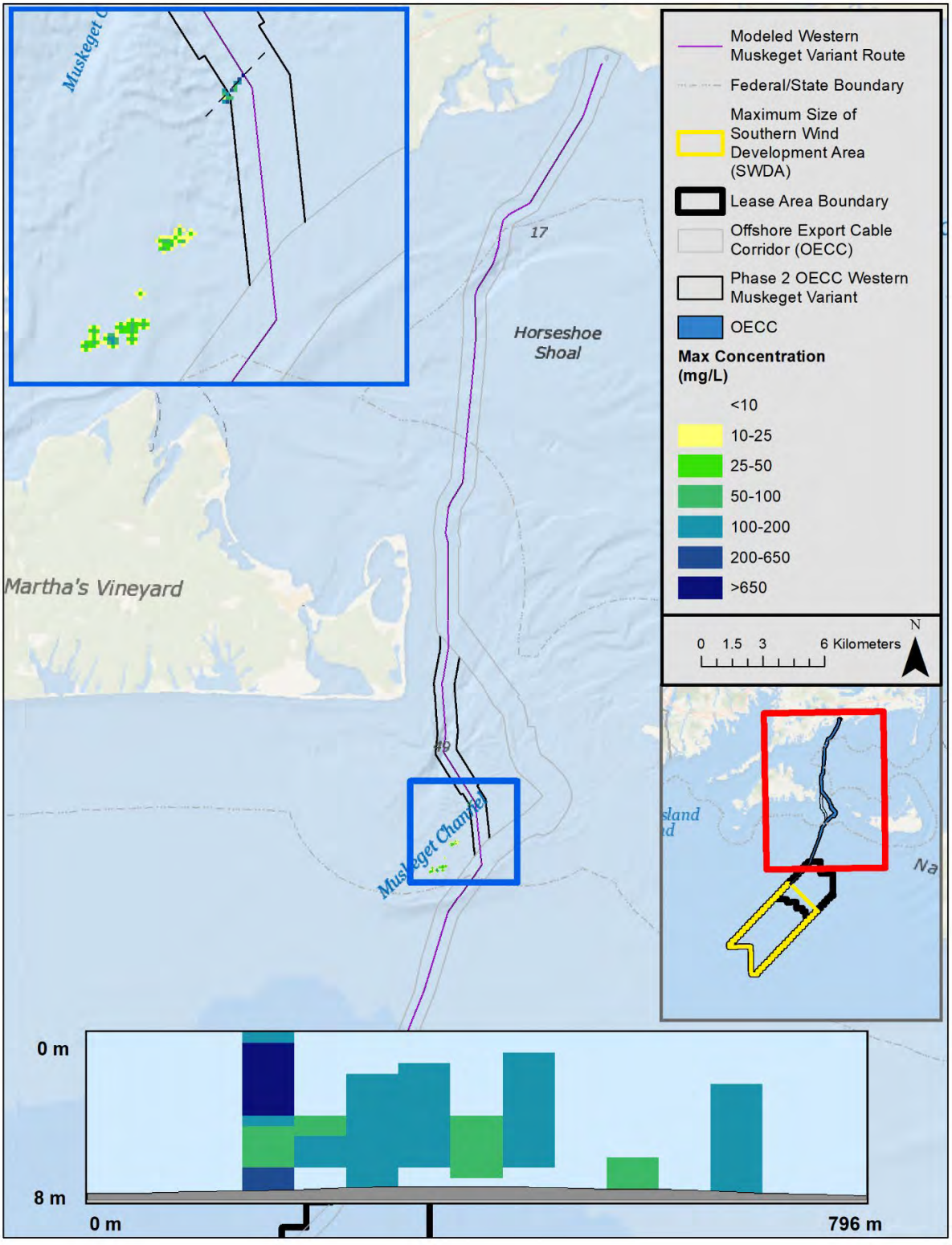


Figure 12: Snapshot of instantaneous TSS concentrations for a time step during simulation of limited TSHD dredging, overflow, and dredged material release operations for a representative cable route within the Western Muskeget Variant.[1]

Notes:

1. Inset at bottom shows the vertical cross-section across the plume from northeast (top right) to southwest (bottom left).

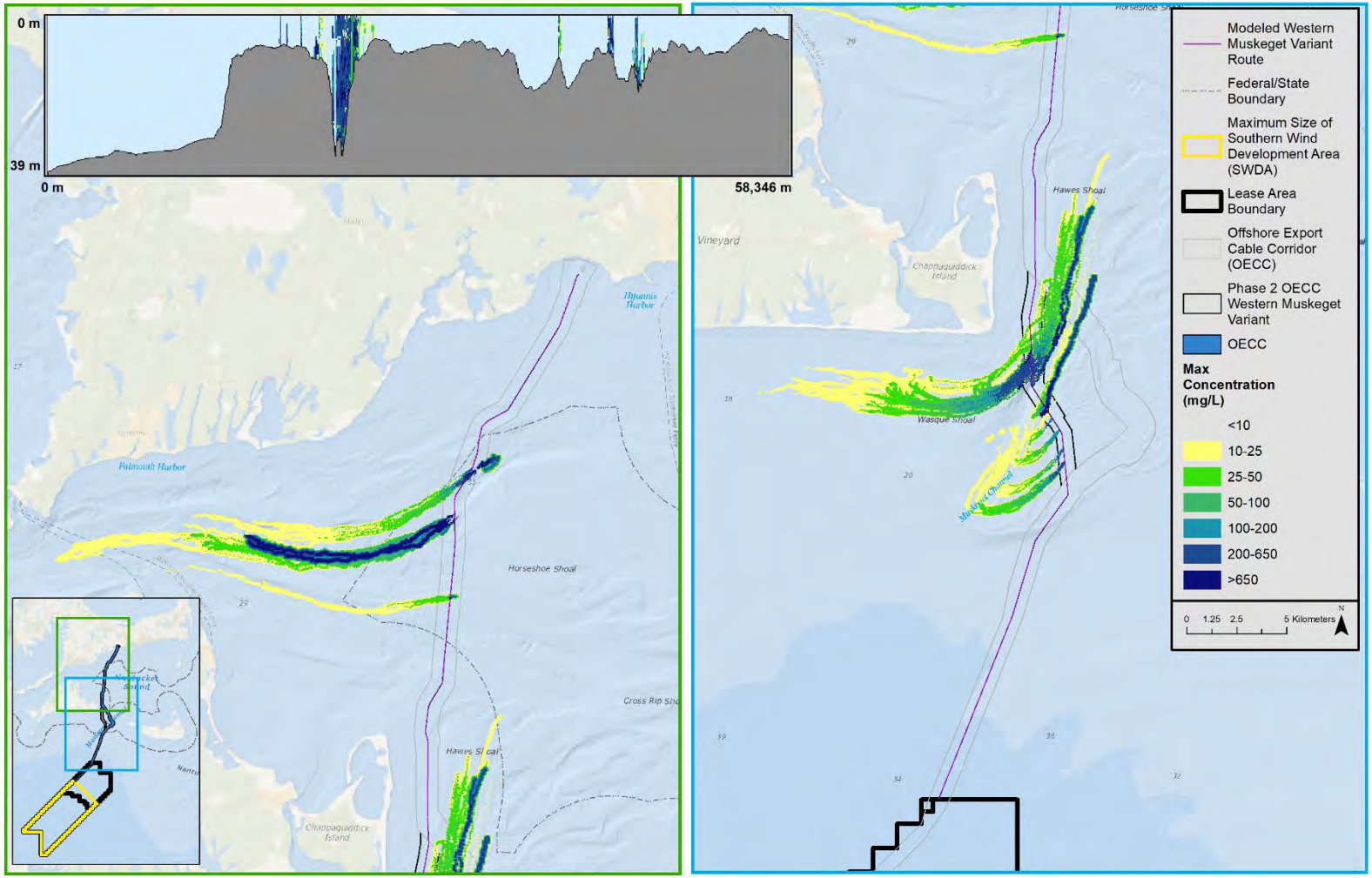


Figure 13. Map of time-integrated maximum concentrations associated with limited TSHD dredging, overflow, and dredged material release operations for a representative cable route within the Western Muskeget Variant.[1]

Notes:

1. Inset shows a vertical cross-section along the route centerline.

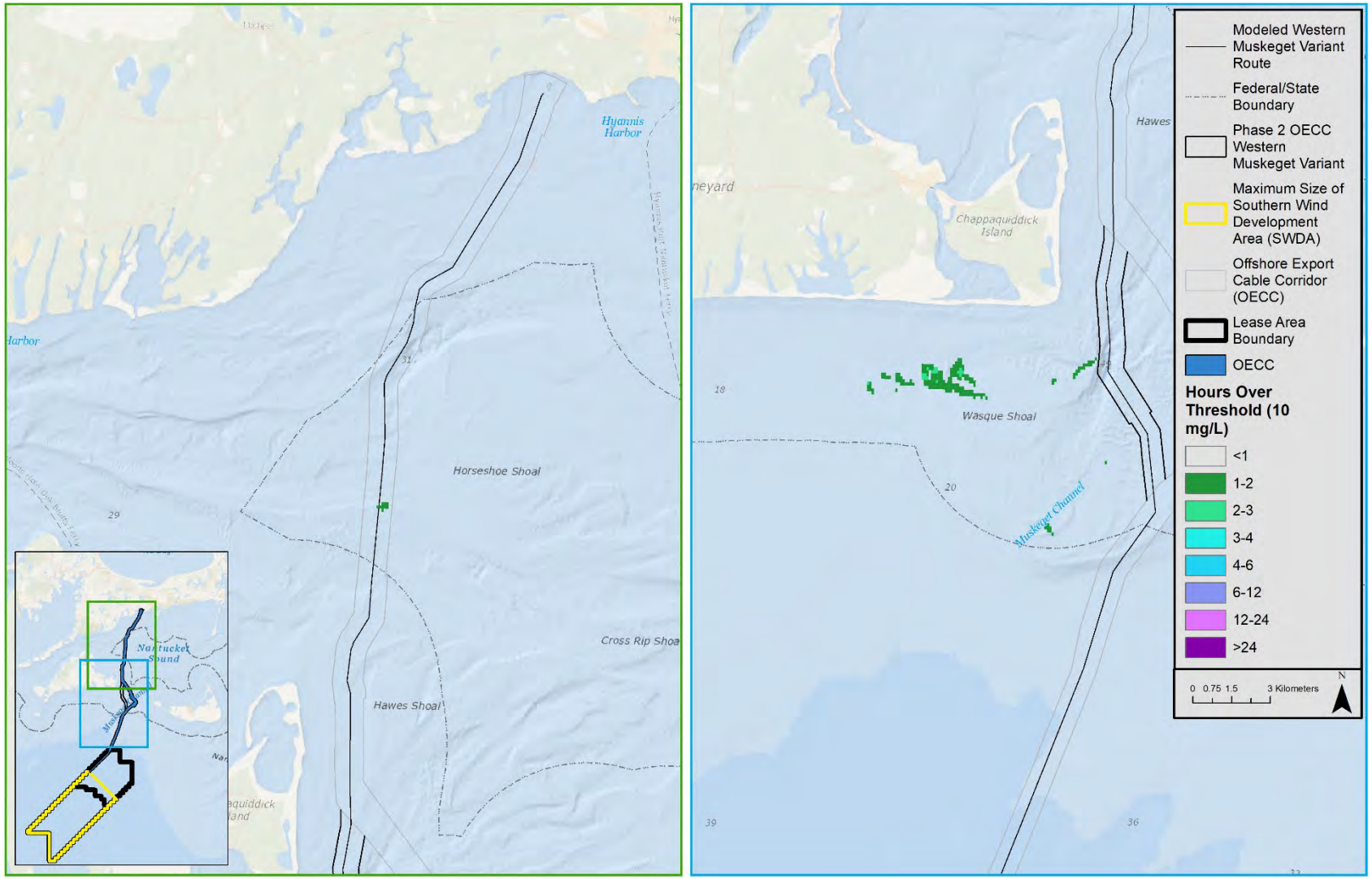


Figure 14. Map of duration of TSS ≥ 10 mg/L associated with limited TSHD dredging, overflow, and dredged material release operations for a representative cable route within the Western Muskeget Variant.

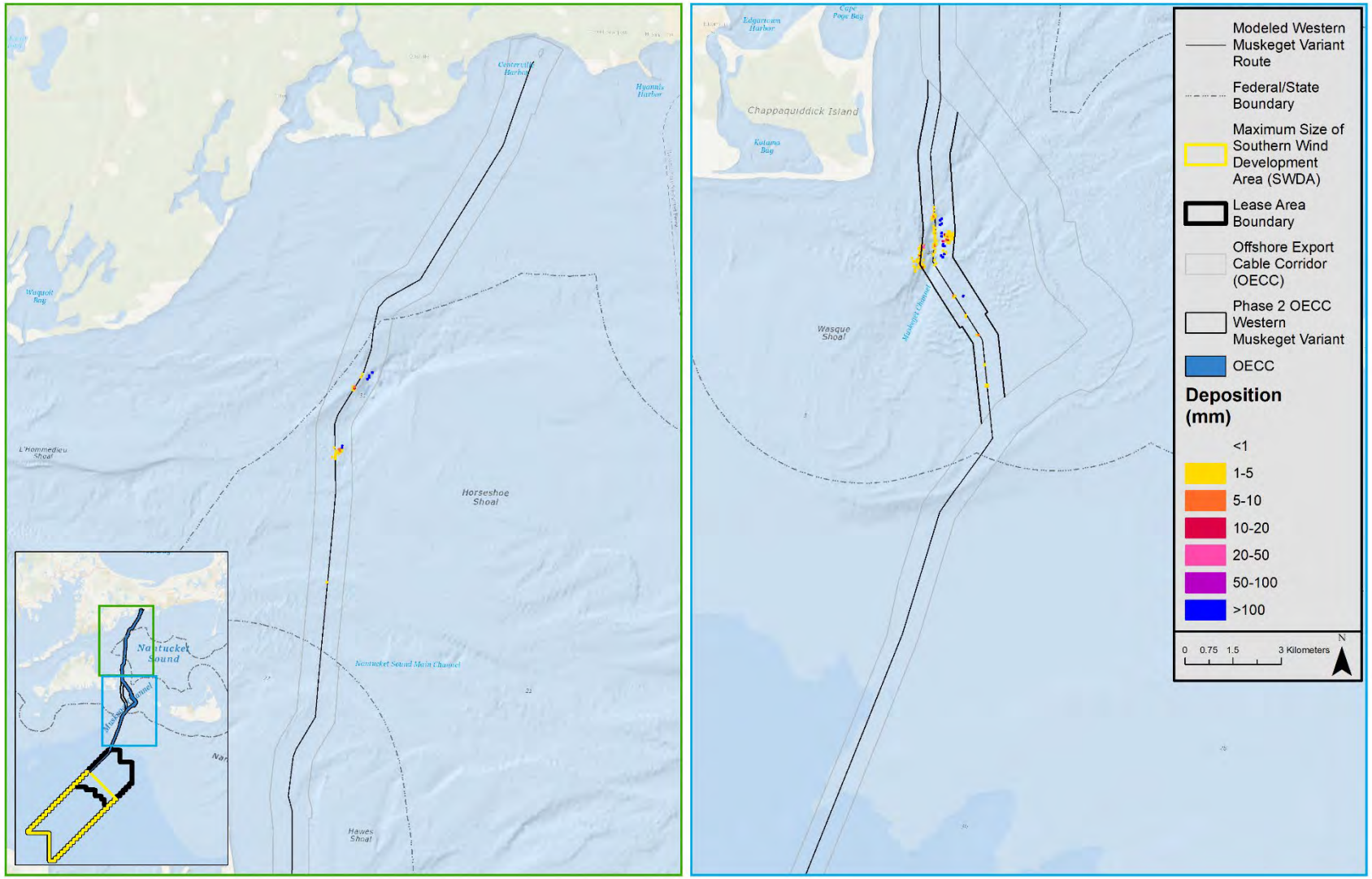


Figure 15. Map of deposition thickness associated with limited TSHD dredging, overflow, and dredged material release operations for a representative cable route within the Western Muskeget Variant.

2.3.4 Cable Installation aided by Jetting

A snapshot of the instantaneous concentrations from the Cable Installation aided by Jetting scenario is presented in with an inset that contains the vertical cross-section across the plume (Figure 16). This figure shows at that instance, TSS concentrations are local to the bottom of the water column.

For the Cable Installation aided by Jetting scenario, the maps of the time-integrated maximum concentration (Figure 17), the duration of exposure to TSS ≥10 mg/L (Figure 18), and the seabed deposition (Figure 19) show that results are similar to those from the Cable Installation simulation. The areas associated with the TSS concentrations were slightly larger for the one-hour duration of exposure for Cable Installation aided by Jetting, with maximum concentrations reaching 650 mg/L. Exposure to TSS concentrations ≥10 mg/L were predicted to subside within four hours.

Deposition ≥1 mm was mainly centered around the route centerline and deposition was not predicted to reach 5 mm. The results indicate that most of the mass settles out quickly and is not transported for long by the currents.

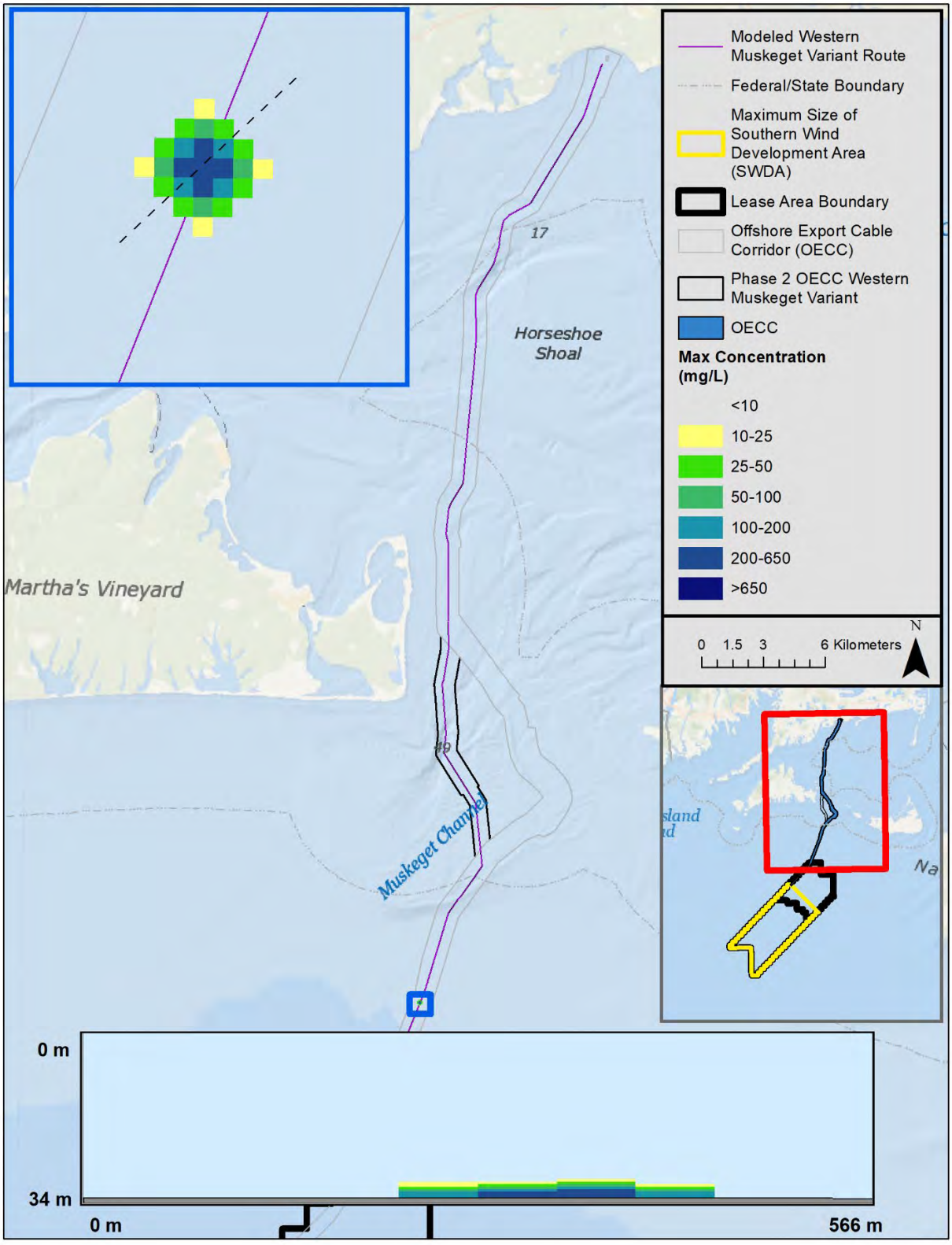


Figure 16. Snapshot of instantaneous TSS concentrations for a time step during simulation of representative cable installation aided by jetting within the Western Muskeget Variant.[1]

Notes:

1. Inset at bottom shows the vertical cross-section across the plume from northeast (top right) to southwest (bottom left).

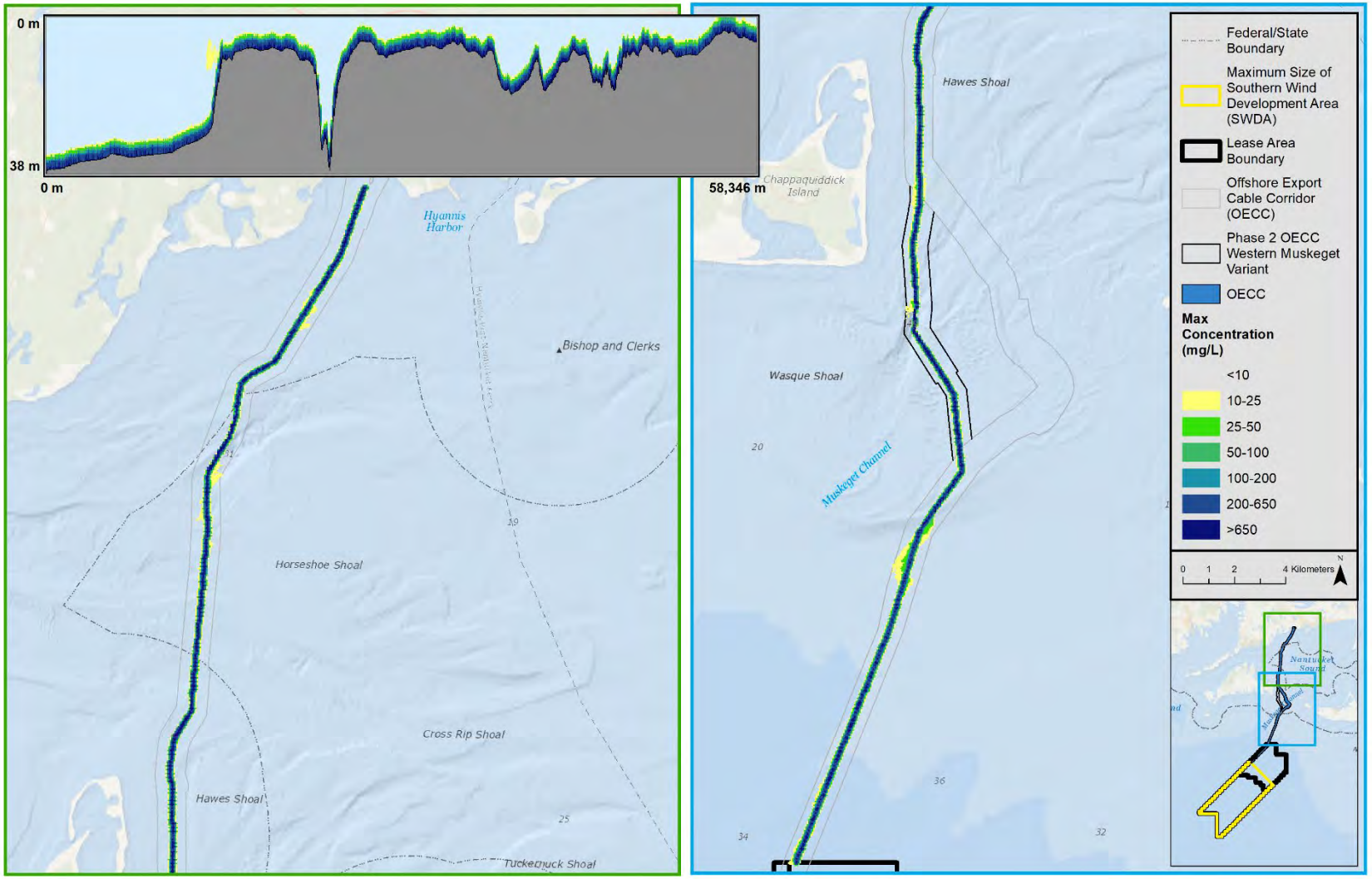


Figure 17. Map of time-integrated maximum concentrations associated with cable installation aided by jetting for a representative cable route within the Western Muskeget Variant.[1]

Notes:

1. Inset shows a vertical cross-section of entire representative route centerline.

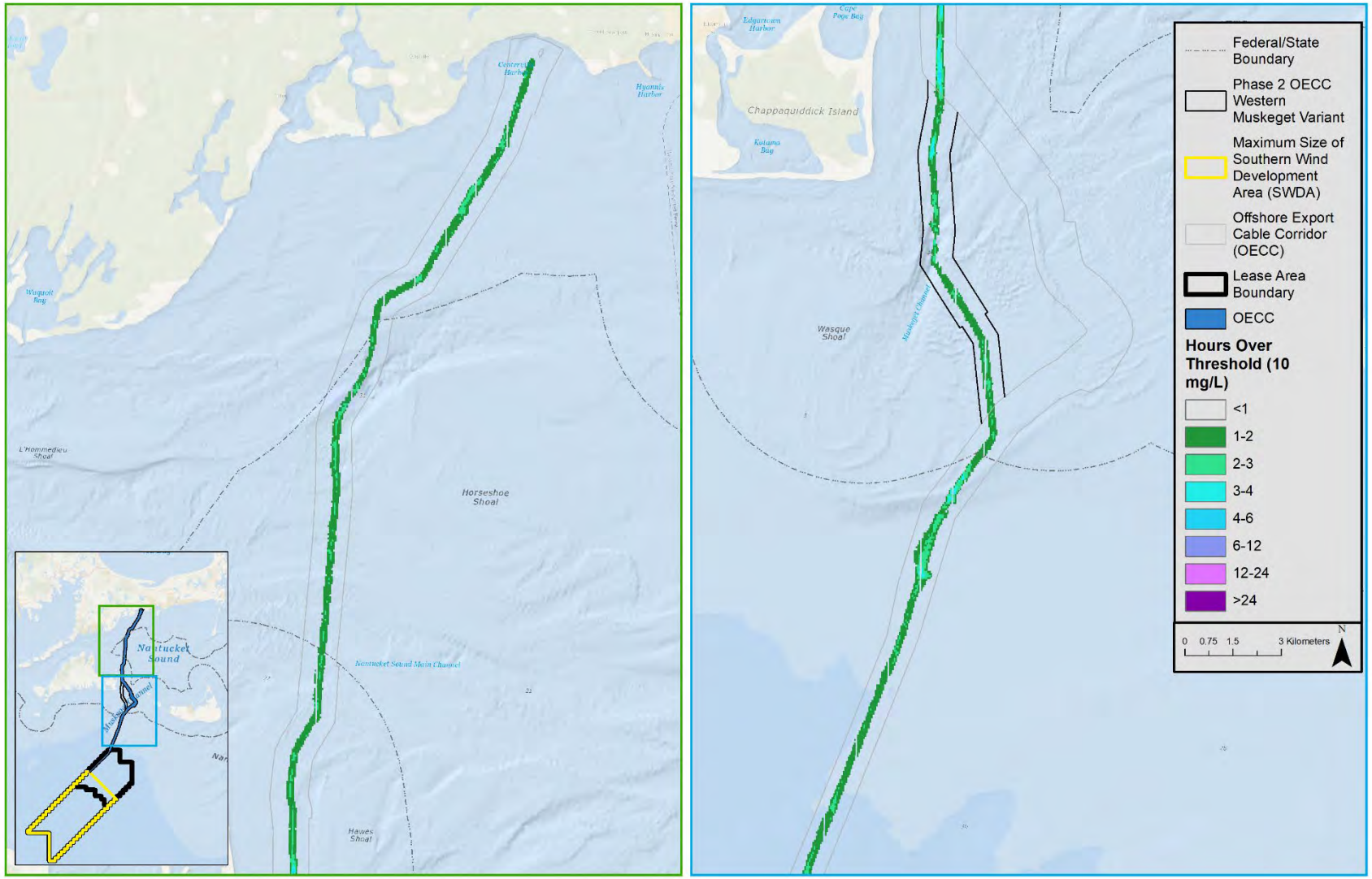


Figure 18. Map of duration of TSS ≥ 10 mg/L associated with cable installation aided by jetting for a representative cable route within the Western Muskeget Variant.

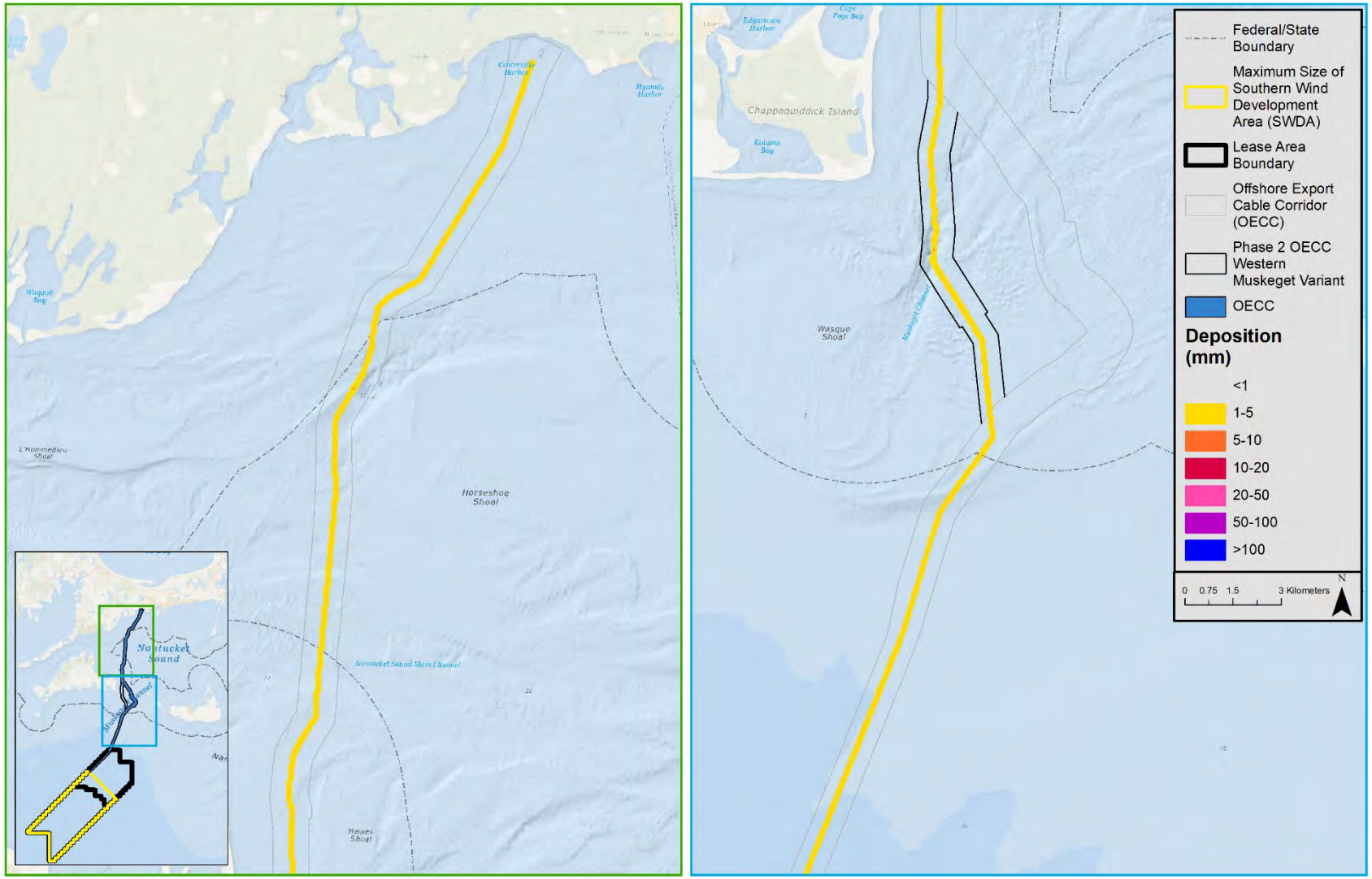


Figure 19. Map of deposition thickness associated with cable installation aided by jetting for a representative cable route within the Western Muskeget Variant.

2.3.5 Results Summary Tables

In reviewing the mapped modeling results for all scenarios, the largest difference between the figures is due to the extent TSHD was used. As expected, the dredging footprint for the “Limited TSHD Pre-Dredge + Cable Installation aided by Jetting” approach is smaller than the dredging footprint for the “TSHD Pre-Dredge + Cable Installation” approach. Note for all results tables, these scenarios were modeled along the Western Muskeget Variant route using “typical” parameters.

The model results of simulations of the Western Muskeget Variant show that the use of the TSHD for pre-cable installation dredging has the potential to generate temporary plumes that impact the entire water column and may extend several km from the route centerline. The cable installation activities may generate temporary plumes that are constrained to the bottom of the water column and do not extend far from the route centerline.

Results from all modeled scenarios were analyzed to determine the spatial area exposed to above-ambient TSS concentrations exceeding specific thresholds for various durations. These areas are not always contiguous, but the results provide a sum of all individual concentration grid cells that exceeded a threshold anywhere in the water column for the duration of interest. Post-processing included calculations with respect to duration threshold of one, two, three, four, six, 12, 24, and 48 hours; however, there were no areas over thresholds for the 12-, 24-, or 48-hour durations. Table 7 through Table 11 show the results for durations of one, two, three, four, and six hours, respectively. In reviewing these tables, it is helpful to keep in mind that the concentration grid resolution is 50 m in the horizontal plane. For a route 60 km long, the area covered by the grid cells along the route is therefore 3 km^2 (60,000 m x 50 m = 3 km^2). Further when the source is introduced to the concentration grid, the mass is spread out across a central cell and four neighboring cells and therefore the cell footprint of initial loading is close to 5 x 3 km^2 or 15 km^2. The dredge source is introduced in a smaller footprint since the dredging is intermittent and does not take place along the entire route.

These results tables illustrate that areas exposed to above-ambient TSS concentrations are largest when assessing concentrations above 10 mg/L, and that the areas rapidly decrease in size with increasing concentration threshold and increasing duration. For example, the Cable Installation aided by Jetting has 12.3 km^2 over 10 mg/L for 1 hour, which reduces to 0.01 km^2 over 650 mg/L for 1 hour (Table 7). Above-ambient TSS concentrations similarly decrease quickly with time: the concentrations over 10 mg/L reduce from 12.3 km^2 for 1 hour (Table 7) to 1.06 km^2 for 2 hours (Table 8), to 0.15 km^2 for 3 hours (Table 9) to zero for 4 hours (Table 10). Also, for this route, concentrations above 100 mg/L do not endure for 2 hours. Similar trends of rapid decrease of area with increasing time and/or increasing threshold are noted for all scenarios presented.

Table 12 summarizes the areas affected by sediment deposition over various thickness thresholds for the entire simulation route, and Table 13 summarizes areas affected by sediment deposition in Massachusetts (MA) state waters. The Cable Installation scenario resulted in a maximum thickness less than 5 mm, while the Cable Installation aided by Jetting was predicted to have a small area (0.01 km^2) of thickness at 5 mm. The TSHD scenarios result in deposition thicknesses greater than the cable installation scenarios, with some areas of 100 mm or greater. These areas are associated with the hopper disposal which disposes of the entire hopper of sediment in one location.

Table 7. Summary of area over threshold concentrations for 1 hour or longer for all scenarios.

Method	Concentration Thresholds in mg/L								
	10	50	100	150	200	300	650	750	1000
	Areas above Concentration Threshold (km^2)								
TSHD Pre-Dredge	17.40	1.67	0.75	0.33	0.17	0.11	0.04	0.03	0.02
Cable Installation	12.10	5.62	2.14	0.47	0.04	-	-	-	-
Limited TSHD Pre-Dredge	2.26	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cable Installation aided by Jetting	12.30	5.82	2.38	0.62	0.13	0.04	0.01	-	-

Table 8. Summary of area over threshold concentrations for 2 hours or longer for all scenarios.

Method	Concentration Thresholds in mg/L								
	10	50	100	150	200	300	650	750	1000
	Areas above Concentration Threshold (km^2)								
TSHD Pre-Dredge	3.85	0.37	0.07	0.01	0.01	-	-	-	-
Cable Installation	1.06	-	-	-	-	-	-	-	-
Limited TSHD Pre-Dredge	0.18	-	-	-	-	-	-	-	-
Cable Installation aided by Jetting	1.06	-	-	-	-	-	-	-	-

Table 9. Summary of area over threshold concentrations for 3 hours or longer for all scenarios.

Method	Concentration Thresholds in mg/L								
	10	50	100	150	200	300	650	750	1000
	Areas above Concentration Threshold (km^2)								
TSHD Pre-Dredge	0.83	0.01	-	-	-	-	-	-	-
Cable Installation	0.15	-	-	-	-	-	-	-	-
Limited TSHD Pre-Dredge	-	-	-	-	-	-	-	-	-
Cable Installation aided by Jetting	0.15	-	-	-	-	-	-	-	-

Table 10. Summary of area over threshold concentrations for 4 hours or longer for all scenarios.

Method	Concentration Thresholds in mg/L								
	10	50	100	150	200	300	650	750	1000
	Areas above Concentration Threshold (km^2)								
TSHD Pre-Dredge	0.09	0.01	-	-	-	-	-	-	-
Cable Installation	0.02	-	-	-	-	-	-	-	-
Limited TSHD Pre-Dredge	-	-	-	-	-	-	-	-	-
Cable Installation aided by Jetting	-	-	-	-	-	-	-	-	-

Table 11. Summary of area over threshold concentrations for 6 hours or longer for all scenarios.

Method	Concentration Thresholds in mg/L								
	10	50	100	150	200	300	650	750	1000
	Areas above Concentration Threshold (km^2)								
TSHD Pre-Dredge	-	-	-	-	-	-	-	-	-
Cable Installation	-	-	-	-	-	-	-	-	-
Limited TSHD Pre-Dredge	-	-	-	-	-	-	-	-	-
Cable Installation aided by Jetting	-	-	-	-	-	-	-	-	-

Table 12. Summary of deposition area over threshold concentrations for all complete routes in federal and state waters.

Method	Deposition Thresholds					
	1 mm	5 mm	10 mm	20 mm	50 mm	100 mm
	Areas of Deposition above Threshold (km^2)					
TSHD Pre-Dredge	1.23	0.29	0.17	0.13	0.12	0.12
Cable Installation	8.64	-	-	-	-	-
Limited TSHD Pre-Dredge	0.42	0.11	0.08	0.06	0.05	0.05
Cable Installation aided by Jetting	8.68	0.01	-	-	-	-

Table 13. Summary of deposition area over threshold concentrations in MA state waters for all complete routes.

Method	Deposition Thresholds					
	1 mm	5 mm	10 mm	20 mm	50 mm	100 mm
	Areas of Deposition above Threshold (km^2)					
TSHD Pre-Dredge	0.77	0.17	0.12	0.09	0.07	0.07
Cable Installation	4.82	-	-	-	-	-
Limited TSHD Pre-Dredge	0.38	0.08	0.07	0.04	0.04	0.04
Cable Installation aided by Jetting	4.85	-	-	-	-	-

2.3.6 Results Discussion

Simulations of sand wave dredging using a TSHD along the Western Muskeget Variant show that plumes originating from the source are intermittent along the route because of the intermittent need for dredging. For the TSHD Pre-Dredge scenario, the plume of excess TSS at 10 mg/L and 750 mg/L extends up to 16 km and 5 km from the route centerline, though may be less extensive at varying locations along the route. Relatively high concentrations (>1,000 mg/L) are predicted at distances up to 5 km from the route centerline in response to the relatively high loading of dumping and swift transport of the dumped sediments, but this high concentration only persists for less than two hours. In general, the excess concentrations over 10 mg/L from dredging can extend several km from the route centerline and may be present throughout the entire water column but are temporary and typically dissipate within six hours. The deposition greater than 1.0 mm associated with the TSHD drag arm is mainly constrained to within 80 m from the route centerline whereas the deposition greater than 1.0 mm associated with overflow and disposal extends to greater distances from the source, mainly within 1 km though such deposition can extend up to 2.3 km in isolated patches when subject to swift currents through Muskeget Channel (located within MA state waters). For the TSHD scenarios, releasing fine-grained material near the surface resulted in a more persistent plume that extended away from the route centerline. This was due to the fine grain material taking longer to settle as opposed to coarse sediments which tend to settle out faster and remain in proximity of the release location.

The simulations of the cable installation showed that both the footprint of the 10 mg/L excess concentration plume and the footprint of deposition over 1.0 mm stayed close to the route centerline. The maximum excursion of the 10 mg/L excess plume extended up to ~2 km, though typically less than 200 m from the route centerline. The excess concentrations stemming from cable installation, both with and without jetting for sand wave clearance, remain relatively close to the route centerline, are constrained to the bottom of the water column, and are also short-lived (typically dissipating within four to six hours). Deposition greater than 1.0 mm was limited to within 100 m from the route centerline for typical installation parameters; this trend holds true in both federal and state waters. For the cable installation scenarios, the resulting plume was predicted to remain near the release location and the sediment ultimately deposited along the route due to the combination of a relatively high fraction of coarse-grain material present along the Western Muskeget Variant and the introduction of sediment near the seabed.

These results illustrate that areas impacted by the plume follow similar trends regardless of the scenario. In general, trends of rapid decrease of area with increasing time and/or increasing concentration threshold are noted for all scenarios. While the plume patterns for the Cable Installation and Cable Installation aided by Jetting were similar, and TSHD Pre-Dredge and Limited TSHD Pre-dredge were similar, differences in the extent and persistence of the plumes and the extent and thickness of deposition may be attributed to route orientation relative to currents, timing of currents, installation parameters, volume suspended, the location in the water column where sediments are introduced, and sediment grain size distribution.

3 REFERENCES

Anchor QEA. 2003. Literature Review of Effects of Resuspended Sediments Due to Dredging Operations. Prepared for the Los Angeles Contaminated Sediments Task Force.

Foreman, J. 2002. Resuspension of sediment by the jet plow during submarine cable installation. Submitted to GenPower, LLC, Needham, MA. Submitted by Engineering Technology Applications, Ltd, Romsey, Great Britain.

Swanson, J. C., Isaji, T., & Galagan, C. 2007. Modeling the ultimate transport and fate of dredge-induced suspended sediment transport and deposition. Proceedings of the WODCON XVIII, 27.

Attachment F

RMAT Climate Resilience Design Standards Tool Report

RMAT Climate Resilience Design Standards Tool Project Report

NE Wind Connector 2
Date Created: 7/12/2022 8:46:30 AM Created By: EpsilonTricia Download

Project Summary

Link to Project

Estimated Construction Cost: $200000000.00
End of Life Year: 2055
Project within mapped Environmental Justice neighborhood: No

Ecosystem Benefits	Scores
Project Score	Low
Exposure	**Scores**
Sea Level Rise/Storm Surge	High Exposure
Extreme Precipitation - Urban Flooding	High Exposure
Extreme Precipitation - Riverine Flooding	Moderate Exposure
Extreme Heat	High Exposure

Asset Summary

Number of Assets: 2

Asset Risk	Sea Level Rise/Storm Surge	Extreme Precipitation - Urban Flooding	Extreme Precipitation - Riverine Flooding	Extreme Heat
Substation including Equipment and Building and Control Room	High Risk	High Risk	High Risk	High Risk
Onshore Cable Package including Joint Bays, Transmission Cables, and Grid Interconnection Cables	High Risk	High Risk	Moderate Risk	High Risk

Project Outputs

	Target Planning Horizon	Intermediate Planning Horizon	Percentile	Return Period	Tier
Sea Level Rise/Storm Surge					
Substation including Equipment and Building and Control Room	2050			200-yr (0.5%)	Tier 3
Onshore Cable Package including Joint Bays, Transmission Cables, and Grid Interconnection Cables	2050			100-yr (1%)	Tier 2
Extreme Precipitation					
Substation including Equipment and Building and Control Room	2050			50-yr (2%)	Tier 3
Onshore Cable Package including Joint Bays, Transmission Cables, and Grid Interconnection Cables	2050			25-yr (4%)	Tier 2
Extreme Heat					
Substation including Equipment and Building and Control Room	2050		90th		Tier 3
Onshore Cable Package including Joint Bays, Transmission Cables, and Grid Interconnection Cables	2050		90th		Tier 2

Scoring Rationale - Exposure

Sea Level Rise/Storm Surge

This project received a "High Exposure" because of the following:

- Located within the predicted mean high water shoreline by 2030
- Exposed to the 1% annual coastal flood event as early as 2030
- Historic coastal flooding at project site

Extreme Precipitation - Urban Flooding

This project received a "High Exposure" because of the following:

- Increased impervious area
- Maximum annual daily rainfall exceeds 10 inches within the overall project's useful life
- No historic flooding at project site
- Existing impervious area of the project site is between 10% and 50%

Extreme Precipitation - Riverine Flooding

This project received a "Moderate Exposure" because of the following:

- Part of the project is within 100ft of a waterbody
- No historic riverine flooding at project site
- The project is not within a mapped FEMA floodplain [outside of the Massachusetts Coast Flood Risk Model (MC-FRM)]
- Project is not likely susceptible to riverine erosion

Extreme Heat

This project received a "High Exposure" because of the following:

- Increased impervious area
- Existing trees are being removed as part of the proposed project
- Existing impervious area of the project site is between 10% and 50%
- Located within 100 ft of existing water body
- < 10 day increase in days over 90 deg. F within project's useful life

Scoring Rationale - Asset Risk Scoring

Asset - Substation including Equipment and Building and Control Room
Primary asset criticality factors influencing risk ratings for this asset:

- Asset must be operable at all times, even during natural hazard event
- Loss/inoperability of the asset would have state-wide or greater impacts
- The building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
- Some alternative programs and/or services are available to support the community
- Cost to replace is greater than $100 million
- Spills and/or releases of hazardous materials would be relatively easy to clean up

Asset - Onshore Cable Package including Joint Bays, Transmission Cables, and Grid Interconnection Cables
Primary asset criticality factors influencing risk ratings for this asset:

- Asset may inaccessible/inoperable for more than a day but less than a week after natural hazard event
- Loss/inoperability of the asset would have state-wide or greater impacts
- The infrastructure provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
- Inoperability of the asset would not be expected to result in injuries
- Cost to replace is between $30 million and $100 million
- There are no hazardous materials in the asset

Project Design Standards Output

Asset: Substation including Equipment and Building and Control Room	Building/Facility
Sea Level Rise/Storm Surge	High Risk

Target Planning Horizon: 2050
Intermediate Planning Horizon: Not Applicable
Return Period: 200-yr (0.5%)

Applicable Design Criteria

Tiered Methodology: Tier 3

Projected Tidal Datums: Yes

Planning Horizon	MHHW	MHW	MTL	MLW	MLLW
	(ft-NAVD88)				
2050	4.6	4.3	2.6	1	0.8

Limitations: Tidal datums are recommended based on the user drawn polygon, user responses to the useful life of the selected asset, and intersection of the project polygon with the mean high water (MHW) polygon for 2030. Tidal datum values provided are based on the MC-FRM, developed by Woods Hole Group in coordination with UMass Boston. For additional information on how these values were generated, review the link here. The values provided within should be used to inform design, but they do not provide guarantees for resilience. The guidance provided within is general and people are encouraged to do their own due diligence as part of planning and design.

Projected Water Surface Elevation: Yes

Asset Name	Recommmended Planning Horizon	Recommmended Return Period	Max	Min	Area Weighted Average
			(ft - NAVD88)		
Substation including Equipment and Building and Control Room	2050	0.5% (200-Year)	16.3	14.9	15.3

Limitations: Projected water surface elevations are recommended based on the user drawn polygon, and user responses to the useful life of the selected asset. The projected water surface elevation values provided are based on the MC-FRM, developed by Woods Hole Group in coordination with UMass Boston. For additional information on how these values were generated, review the link here. The values provided within should be used to inform design, but they do not provide guarantees for resilience. The guidance provided within is general and people are encouraged to do their own due diligence as part of planning and design.

Projected Wave Action Water Elevation: Yes

Asset Name	Recommmended Planning Horizon	Recommmended Return Period	Max	Min	Area Weighted Average
			(ft - NAVD88)		
Substation including Equipment and Building and Control Room	2050	0.5% (200-Year)	20.8	15.4	18

Limitations: Projected dynamic flood elevations are recommended based on the user drawn polygon, and user responses to the useful life of the selected asset. The projected dynamic flood elevation values provided are based on the MC-FRM, developed by Woods Hole Group in coordination with UMass Boston. For additional information on how these values were generated, review the link here. The values provided within should be used to inform design, but they do not provide guarantees for resilience. The guidance provided within is general and people are encouraged to do their own due diligence as part of planning and design.

Projected Wave Heights: Yes

Asset Name	Recommmended Planning Horizon	Recommmended Return Period	Max	Min	Area Weighted Average
			(Feet)		
Substation including Equipment and Building and Control Room	2050	0.5% (200-Year)	8	0	4.3

Limitations: Projected wave heights are recommended based on the user drawn polygon, and user responses to the useful life of the selected asset. The projected wave height values provided are based on the MC-FRM, developed by Woods Hole Group in coordination with UMass Boston. For additional information on how these values were generated, review the link here. The values provided within should be used to inform design, but they do not provide guarantees for resilience. The guidance provided within is general and people are encouraged to do their own due diligence as part of planning and design.

Projected Duration of Flooding: Yes
Projected Design Flood Velocity: Yes
Projected Scour & Erosion: No

Extreme Precipitation High Risk

Target Planning Horizon: 2050
Return Period: 50-yr (2%)

Applicable Design Criteria

Tiered Methodology: Tier 3

Projected Total Precipitation Depth & Peak Intensity for 24-hr Design Storms: Yes

Asset Name	Recommended Planning Horizon	Recommended Return Period (Design Storm)	Projected 24-hr Total Precipitation Depth (inches)	Step-by-Step Methodology for Peak Intensity
Substation including Equipment and Building and Control Room	2050	50-Year (2%)	8.2	Downloadable Methodology PDF

Limitations: While precipitation depth is useful for project planning and design, rainfall distribution and peak intensity of the design storm is recommended to also be considered. Lower-intensity, longer-duration storms allow time for infiltration and reduce the load on the infrastructure system over the duration of the storm. Higher-intensity, shorter-duration storms often have higher runoff volumes because the water does not have enough time to infiltrate and infrastructure systems (e.g., catch basins) and may overflow or back up during such storms. In the Northeast, short -duration high intensity rain events are becoming more frequent, and there is often little early warning for these events, making it difficult to plan operationally. These events can result in the rapid inundation of the asset project location. Design should consider both short- and long-duration precipitation events and how they may impact the asset.

The precipitation values provided by this Tool (version 1) are recommended to inform planning and design, but they do not guarantee that the asset will be protected from or be able to withstand an extreme precipitation event. The planning, design, and review guidance accompanying these values is general and projects are encouraged to do their own due diligence to understand the vulnerability of their asset.

Projected Riverine Peak Discharge & Peak Flood Elevation: Yes

Extreme Heat High Risk

Target Planning Horizon: 2050
Percentile: 90th Percentile

Applicable Design Criteria

Tiered Methodology: Tier 3

Projected Annual/Summer/Winter Average Temperatures: Yes
Projected Heat Index: Yes
Projected Growing Degree Days: No
Projected Days Per Year With Max Temp > 95°F, >90°F, <32°F: Yes
Projected Number of Heat Waves Per Year & Average Heat Wave Duration: Yes
Projected Cooling Degree Days & Heating Degree Days (base = 65°F): Yes

Asset: Onshore Cable Package including Joint Bays, Transmission Cables, and Grid Interconnection Cables — Infrastructure

Sea Level Rise/Storm Surge High Risk

Target Planning Horizon: 2050
Intermediate Planning Horizon: Not Applicable
Return Period: 100-yr (1%)

Applicable Design Criteria

Tiered Methodology: Tier 2

Projected Tidal Datums: Yes

Planning Horizon	MHHW	MHW	MTL	MLW	MLLW
	(ft-NAVD88)				
2050	4.6	4.3	2.6	1	0.8

Limitations: Tidal datums are recommended based on the user drawn polygon, user responses to the useful life of the selected asset, and intersection of the project polygon with the mean high water (MHW) polygon for 2030. Tidal datum values provided are based on the MC-FRM, developed by Woods Hole Group in coordination with UMass Boston. For additional information on how these values were generated, review the link here. The values provided within should be used to inform design, but they do not provide guarantees for resilience. The guidance provided within is general and people are encouraged to do their own due diligence as part of planning and design.

Projected Water Surface Elevation: Yes

Asset Name	Recommmended Planning Horizon	Recommmended Return Period	Max	Min	Area Weighted Average
			(ft - NAVD88)		
Onshore Cable Package including Joint Bays, Transmission Cables, and Grid Interconnection Cables	2050	1% (100-Year)	14.7	13.9	14.1

Limitations: Projected water surface elevations are recommended based on the user drawn polygon, and user responses to the useful life of the selected asset. The projected water surface elevation values provided are based on the MC-FRM, developed by Woods Hole Group in coordination with UMass Boston. For additional information on how these values were generated, review the link here. The values provided within should be used to inform design, but they do not provide guarantees for resilience. The guidance provided within is general and people are encouraged to do their own due diligence as part of planning and design.

Projected Wave Action Water Elevation: Yes

Asset Name	Recommmended Planning Horizon	Recommmended Return Period	Max	Min	Area Weighted Average (ft - NAVD88)
Onshore Cable Package including Joint Bays, Transmission Cables, and Grid Interconnection Cables	2050	1% (100-Year)	19.3	14.3	16.8

Limitations: Projected dynamic flood elevations are recommended based on the user drawn polygon, and user responses to the useful life of the selected asset. The projected dynamic flood elevation values provided are based on the MC-FRM, developed by Woods Hole Group in coordination with UMass Boston. For additional information on how these values were generated, review the link here. The values provided within should be used to inform design, but they do not provide guarantees for resilience. The guidance provided within is general and people are encouraged to do their own due diligence as part of planning and design.

Projected Wave Heights: Yes

Asset Name	Recommmended Planning Horizon	Recommmended Return Period	Max	Min	Area Weighted Average (Feet)
Onshore Cable Package including Joint Bays, Transmission Cables, and Grid Interconnection Cables	2050	1% (100-Year)	7.5	0	4.1

Limitations: Projected wave heights are recommended based on the user drawn polygon, and user responses to the useful life of the selected asset. The projected wave height values provided are based on the MC-FRM, developed by Woods Hole Group in coordination with UMass Boston. For additional information on how these values were generated, review the link here. The values provided within should be used to inform design, but they do not provide guarantees for resilience. The guidance provided within is general and people are encouraged to do their own due diligence as part of planning and design.

Projected Duration of Flooding: Yes
Projected Design Flood Velocity: Yes
Projected Scour & Erosion: Yes

Extreme Precipitation High Risk

Target Planning Horizon: 2050
Return Period: 25-yr (4%)

Applicable Design Criteria

Tiered Methodology: Tier 2

Projected Total Precipitation Depth & Peak Intensity for 24-hr Design Storms: Yes

Asset Name	Recommended Planning Horizon	Recommended Return Period (Design Storm)	Projected 24-hr Total Precipitation Depth (inches)	Step-by-Step Methodology for Peak Intensity
Onshore Cable Package including Joint Bays, Transmission Cables, and Grid Interconnection Cables	2050	25-Year (4%)	7.3	Downloadable Methodology PDF

Limitations: While precipitation depth is useful for project planning and design, rainfall distribution and peak intensity of the design storm is recommended to also be considered. Lower-intensity, longer-duration storms allow time for infiltration and reduce the load on the infrastructure system over the duration of the storm. Higher-intensity, shorter-duration storms often have higher runoff volumes because the water does not have enough time to infiltrate and infrastructure systems (e.g., catch basins) and may overflow or back up during such storms. In the Northeast, short -duration high intensity rain events are becoming more frequent, and there is often little early warning for these events, making it difficult to plan operationally. These events can result in the rapid inundation of the asset project location. Design should consider both short- and long-duration precipitation events and how they may impact the asset.

The precipitation values provided by this Tool (version 1) are recommended to inform planning and design, but they do not guarantee that the asset will be protected from or be able to withstand an extreme precipitation event. The planning, design, and review guidance accompanying these values is general and projects are encouraged to do their own due diligence to understand the vulnerability of their asset.

Projected Riverine Peak Discharge & Peak Flood Elevation: Yes

Extreme Heat High Risk

Target Planning Horizon: 2050
Percentile: 90th Percentile

Applicable Design Criteria

Tiered Methodology: Tier 2

Projected Annual/Summer/Winter Average Temperatures: Yes
Projected Heat Index: Yes
Projected Growing Degree Days: No
Projected Days Per Year With Max Temp > 95°F, >90°F, <32°F: Yes
Projected Number of Heat Waves Per Year & Average Heat Wave Duration: Yes

Projected Cooling Degree Days & Heating Degree Days (base = 65°F): No

Project Inputs

Core Project Information

Name:	NE Wind Connector 2
Given the expected useful life of the project, through what year do you estimate the project to last (i.e. before a major reconstruction/renovation)?	2055
Location of Project:	Barnstable
Estimated Capital Cost:	$200,000,000
Who is the Submitting Entity?	Private Other Park City Wind LLC Marc Bergeron (mbergeron@epsilonassociates.com)
Is this project being submitted as part of a state grant application?	No
Which grant program?	
What stage are you in your project lifecycle?	Design
Is climate resiliency a core objective of this project?	No
Is this project being submitted as part of the state capital planning process?	No
Is this project being submitted as part of a regulatory review process or permitting?	Yes
Brief Project Description:	New England Wind proposes to develop offshore renewable wind energy facilities in BOEM Lease Area OCS-A 0534 along with associated offshore and onshore cabling and a new onshore substation. The proposed offshore export cables will be installed beneath the seafloor via jet plow and will transition to shore via horizontal directional drilling (HDD) at the Dowse's Beach Landfall Site. The onshore export cables will be installed entirely underground in a concrete duct bank primarily within existing roadway rights-of-way. The Project will also provide an opportunity for the installation of a municipal sewer system in advance of the current planned scheduled which will reduce nitrogen loading from backyard septic systems. The Project is subject to numerous federal, state, regional, and local reviews. In addition to MEPA, the Project will require review by the following state, regional, and local entities: EFSB; DPU; MassDEP; MassDOT; MBUAR; NHESP; MHC; DMF; CCC; MVC, and the Towns of Barnstable, Edgartown, Mashpee, and Nantucket (Conservation Commissions and Town of Barnstable DPW, Town Council, Planning/Zoning, and Tree Warden). Federal agency reviews and approvals include BOEM, EPA, USACE, NMFS, USCG, FAA, and CZM. Attachment D to the ENF includes a list of permits, reviews, and approvals required for the Project and their status.
Project Submission Comments:	

Project Ecosystem Benefits

Factors Influencing Output

- ✓ Project promotes decarbonization
- ✓ Project filters stormwater using green infrastructure
- ✓ Project improves water quality
- ✓ Project improves air quality

Factors to Improve Output

- ✓ Incorporate nature-based solutions that may provide flood protection
- ✓ Incorporate nature-based solutions that may reduce storm damage
- ✓ Protect public water supply by reducing the risk of contamination, pollution, and/or runoff of surface and groundwater sources used for human consumption
- ✓ Incorporate green infrastructure or nature-based solutions that recharge groundwater
- ✓ Incorporate nature-based solutions that sequester carbon carbon
- ✓ Increase biodiversity, protect critical habitat for species, manage invasive populations, and/or provide connectivity to other habitats
- ✓ Preserve, enhance, and/or restore coastal shellfish habitats
- ✓ Incorporate vegetation that provides pollinator habitat
- ✓ Identify opportunities to remediate existing sources of pollution
- ✓ Provide opportunities for passive and/or active recreation through open space
- ✓ Increase plants, trees, and/or other vegetation to provide oxygen production
- ✓ Identify opportunities to prevent pollutants from impacting ecosystems
- ✓ Incorporate education and/or protect cultural resources as part of your project

Is the primary purpose of this project ecological restoration?

No

Project Benefits

Provides flood protection through nature-based solutions	No
Reduces storm damage	No

Recharges groundwater	No
Protects public water supply	No
Filters stormwater using green infrastructure	Yes
Improves water quality	Yes
Promotes decarbonization	Yes
Enables carbon sequestration	No
Provides oxygen production	No
Improves air quality	Yes
Prevents pollution	No
Remediates existing sources of pollution	No
Protects fisheries, wildlife, and plant habitat	No
Protects land containing shellfish	No
Provides pollinator habitat	No
Provides recreation	No
Provides cultural resources/education	No

Project Climate Exposure

Is the primary purpose of this project ecological restoration?	No
Does the project site have a history of coastal flooding?	Yes
Does the project site have a history of flooding during extreme precipitation events (unrelated to water/sewer damages)?	Unsure
Does the project site have a history of riverine flooding?	No
Does the project result in a net increase in impervious area of the site?	Yes
Are existing trees being removed as part of the proposed project?	Yes

Project Assets

Asset: Substation including Equipment and Building and Control Room
Asset Type: Typically Unoccupied
Asset Sub-Type: Generator
Construction Type: New Construction
Construction Year: 2024
Useful Life: 30
Identify the length of time the asset can be inaccessible/inoperable without significant consequences.
Building must be accessible/operable at all times, even during natural hazard event
Identify the geographic area directly affected by permanent loss or significant inoperability of the building/facility.
State-wide or greater impacts
Identify the population directly served that would be affected by the permanent loss of use or inoperability of the building/facility.
Greater than 10,000 people
Identify if the building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
The building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
If the building/facility became inoperable for longer than acceptable in Question 1, how, if at all, would it be expected to impact people's health and safety?
Inoperability of the building/facility would not be expected to result in injuries
If there are hazardous materials in your building/facility, what are the extent of impacts related to spills/releases of these materials?
Spills and/or releases of hazardous materials would be relatively easy to clean up
If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts on other facilities, assets, and/or infrastructure?
Moderate – Inoperability may impact other facilities, assets, or buildings, but is not expected to affect their ability to operate
If this building/facility was damaged beyond repair, how much would it approximately cost to replace?
Greater than or equal to $100 million
Is this a recreational facility which can be vacated during a natural hazard event?
No
If the building/facility became inoperable for longer than acceptable in Question 1, what are the public and/or social services impacts?
Some alternative programs and/or services are available to support the community
If the building/facility became inoperable for longer than acceptable in Question 1, what are the environmental impacts related to natural resources?
No impact on surrounding natural resources is expected
If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to government services (i.e. the building is not able to serve or operate its intended users or function)?
Loss of building is not expected to reduce the ability to maintain government services.
If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to loss of confidence in government (i.e. the building is not able to serve or operate its intended users or function)?
No Impact
Asset: Onshore Cable Package including Joint Bays, Transmission Cables, and Grid Interconnection Cables
Asset Type: Utility Infrastructure
Asset Sub-Type: Energy (electric, gas, petroleum, renewable)
Construction Type: New Construction
Construction Year: 2025
Useful Life: 30
Identify the length of time the asset can be inaccessible/inoperable without significant consequences.
Infrastructure may be inaccessible/inoperable for more than a day, but less than a week after natural hazard without consequences.
Identify the geographic area directly affected by permanent loss or significant inoperability of the infrastructure.
State-wide or greater impacts

Identify the population directly served that would be affected by the permanent loss or significant inoperability of the infrastructure.
Greater than 100,000 people
Identify if the infrastructure provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
The infrastructure provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
Will the infrastructure reduce the risk of flooding?
No
If the infrastructure became inoperable for longer than acceptable in Question 1, how, if at all, would it be expected to impact people's health and safety?
Inoperability of the infrastructure would not be expected to result in injuries
If there are hazardous materials in your infrastructure, what are the extents of impacts related to spills/releases of these materials?
There are no hazardous materials in the infrastructure
If the infrastructure became inoperable for longer than acceptable in Question 1, what are the impacts on other facilities, assets, and/or infrastructure?
Minor – Inoperability will not likely affect other facilities, assets, or buildings
If the infrastructure was damaged beyond repair, how much would it approximately cost to replace?
Between $30 million and $100 million
Does the infrastructure function as an evacuation route during emergencies? This question only applies to roadway projects.
No
If the infrastructure became inoperable for longer than acceptable in Question 1, what are the environmental impacts related to natural resources?
No impact on surrounding natural resources is expected
If the infrastructure became inoperable for longer than acceptable in Question 1, what are the impacts to government services (i.e. the infrastructure is not able to serve or operate its intended users or function)?
Loss of infrastructure is not expected to reduce the ability to maintain government services
What are the impacts to loss of confidence in government resulting from loss of infrastructure functionality (i.e. the infrastructure asset is not able to serve or operate its intended users or function)?
No Impact

Report Comments

N/A

Attachment G

Massachusetts Coastal Zone Management Act Consistency Certification

New England Wind

Lease Area OCS-A 0534

Massachusetts Coastal Zone Management Act Consistency Certification

September 2022

Submitted by
Park City Wind LLC

Submitted to
Massachusetts Office of
Coastal Zone Management
251 Causeway Street
Suite 800
Boston, MA 02114-2138

Prepared by
Epsilon Associates, Inc.

New England Wind
Massachusetts Coastal Zone Management Act Consistency Certification

Submitted to:

BUREAU OF OCEAN ENERGY MANAGEMENT
45600 Woodland Rd
Sterling, VA 20166

MASSACHUSETTS OFFICE OF COASTAL ZONE MANAGEMENT
251 Causeway Street, Suite 800
Boston, MA 02114-2138

Prepared for:

Park City Wind LLC

Prepared by:

Epsilon Associates, Inc.

June 2022

TABLE OF CONTENTS

NEW ENGLAND WIND MASSACHUSETTS COASTAL ZONE MANAGEMENT ACT CONSISTENCY CERTIFICATION

1.0 INTRODUCTION 1-1

2.0 SUMMARY OF NEW ENGLAND WIND FACILITIES AND ACTIVITIES 2-1

2.1 Overview 2-1

2.2 Organization of the COP 2-3

2.3 Phase 1 of New England Wind 2-3

2.3.1 Phase 1 Construction and Installation 2-4

2.3.1.1 Wind Turbine Generators 2-4

2.3.1.2 Wind Turbine Generator Foundations 2-6

2.3.1.3 Electrical Service Platforms 2-6

2.3.1.4 Offshore Export Cables 2-6

2.3.1.5 Inter-Array and Inter-Link Cables 2-7

2.3.1.6 Landfall Site and Onshore Export Cables 2-7

2.3.1.7 Onshore Substation and Grid Interconnection 2-8

2.3.1.8 Port Facilities 2-8

2.3.2 Phase 1 Operations and Maintenance 2-8

2.3.3 Phase 1 Decommissioning 2-9

2.4 Phase 2 of New England Wind 2-9

2.4.1 Phase 2 Construction and Installation 2-10

2.4.1.1 Wind Turbine Generators 2-10

2.4.1.2 Wind Turbine Generator Foundations 2-12

2.4.1.3 Electrical Service Platforms 2-13

2.4.1.4 Offshore Export Cables 2-13

2.4.1.5 Inter-Array and Inter-Link Cables 2-14

2.4.1.6 Landfall Site(s), Onshore Cable Route(s), Onshore Substation(s), and Grid Interconnection 2-16

2.4.1.7 Port Facilities 2-16

2.4.2 Phase 2 Operations and Maintenance 2-17

2.4.3 Phase 2 Decommissioning 2-17

3.0 NEW ENGLAND WIND CONSISTENCY WITH MASSACHUSETTS ENFORCEABLE POLICIES 3-1

3.1 Jurisdiction for Federal Consistency Certification 3-1

3.2 Consistency with MA CZM Enforceable Policies 3-2

Coastal Hazards 3-2

Coastal Hazard Policy #1 3-2

Coastal Hazard Policy #2 3-4

Coastal Hazard Policy #3 3-4

Coastal Hazard Policy #4 3-4

TABLE OF CONTENTS (CONTINUED)

Energy 3-5
Energy Policy #1 3-5
Energy Policy #2 3-5
Growth Management 3-5
Growth Management Policy #1 3-5
Growth Management Policy #2 3-6
Growth Management Policy #3 3-6
Habitat 3-7
Habitat Policy #1 3-7
Coastal, Estuarine, and Marine Habitats 3-7
Coastal Freshwater Streams, Ponds, and Wetlands 3-9
Habitat Policy #2 3-10
Ocean Resources 3-10
Ocean Resources Policy #1 3-10
Ocean Resources Policy #2 3-10
Ocean Resources Policy #3 3-11
Port and Harbors 3-11
Ports and Harbors Policy #1 3-11
Ports and Harbors Policy #2 3-12
Ports and Harbors Policy #3 3-13
Ports and Harbors Policy #4 3-13
Ports and Harbors Policy #5 3-13
Protected Areas 3-13
Protected Areas Policy #1 3-13
Protected Areas Policy #2 3-14
Protected Areas Policy #3 3-14
Public Access 3-14
Public Access Policy #1 3-14
Public Access Policy #2 3-15
Public Access Policy #3 3-16
Water Quality 3-16
Water Quality Policy #1 3-16
Water Quality Policy #2 3-17
Water Quality Policy #3 3-17
3.3 Supplemental Information Related to the Massachusetts Ocean Management Plan 3-18
3.3.1 Commercial Fishing 3-18
3.3.1.1 WTG and ESP Siting 3-19
3.3.1.2 WTG and ESP Layout 3-19
3.3.1.3 Scour Protection and Cable Protection 3-21
3.3.1.4 Access to the SWDA and OECC 3-22

TABLE OF CONTENTS (CONTINUED)

3.3.1.5 Economic Exposure and Impacts to Massachusetts Commercial Fisheries 3-22
3.3.1.6 Avoidance, Minimization, and Mitigation Measures 3-23
3.3.2 Recreational Fishing 3-24
3.2.2.1 Potential Impacts 3-24
3.2.2.2 Avoidance, Minimization, and Mitigation Measures 3-25
3.3.3 Fisheries Studies and Monitoring Plans 3-26
3.3.4 Cable Installation and Monitoring 3-28
3.3.4.1 Co-Location of New England Wind and Vineyard Wind 1 Offshore Export Cables 3-28
3.3.4.2 Offshore Export Cable Installation 3-31
3.3.4.3 Cable Monitoring 3-36
3.3.5 Coastal and Marine Birds 3-37
3.3.5.1 Potential Impacts 3-37
3.3.5.2 Avoidance, Minimization and Mitigation Measures 3-39

4.0 CONCLUSION 4-1

5.0 REFERENCES AND INCORPORATION BY REFERENCE 5-1

LIST OF FIGURES

Figure 1.0-1 New England Wind Overview 1-3
Figure 2.4-1 Phase 2 Offshore Export Cable Corridor Variants 2-15

LIST OF TABLES

Table 2.3-1 Phase 1 of New England Wind Design Envelope Summary 2-5
Table 2.4-1 Phase 2 of New England Wind Design Envelope Summary 2-11

1.0 INTRODUCTION

New England Wind is the proposal to develop offshore renewable wind energy facilities in Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0534 along with associated offshore and onshore cabling, onshore substations, and onshore O&M facilities. Park City Wind LLC, a wholly owned subsidiary of Avangrid Renewables, LLC, is the Proponent and will be responsible for the construction, operation, and decommissioning of New England Wind. Figure 1.0-1 provides an overview of New England Wind. The Proponent has prepared this federal Consistency Certification to demonstrate that New England Wind will comply with and will be conducted in a manner consistent with the enforceable policies of the approved Massachusetts Coastal Management Programs (MA CMPs).

The Proponent filed its New England Wind Construction and Operations Plan (COP) with BOEM on July 2, 2020. New England Wind's offshore wind facilities within all of Lease Area OCS-A 0534 and the southwest portion of Lease Area OCS-A 0501, referred to as the Southern Wind Development Area (SWDA), will be developed in two Phases. Phase 1 will be developed immediately south of the Vineyard Wind 1 project, followed by Phase 2, which will be developed immediately south of Phase 1. New England Wind's wind turbine generators (WTGs), electrical service platforms (ESPs), inter-array cables, inter-link cables, and portions of the offshore export cables are in federal waters. The remaining portions of the offshore export cables (approximately 19.5 nautical miles [36.1 kilometers] of each offshore export cable) are in Massachusetts waters. All onshore facilities are located in the Town of Barnstable, Massachusetts.

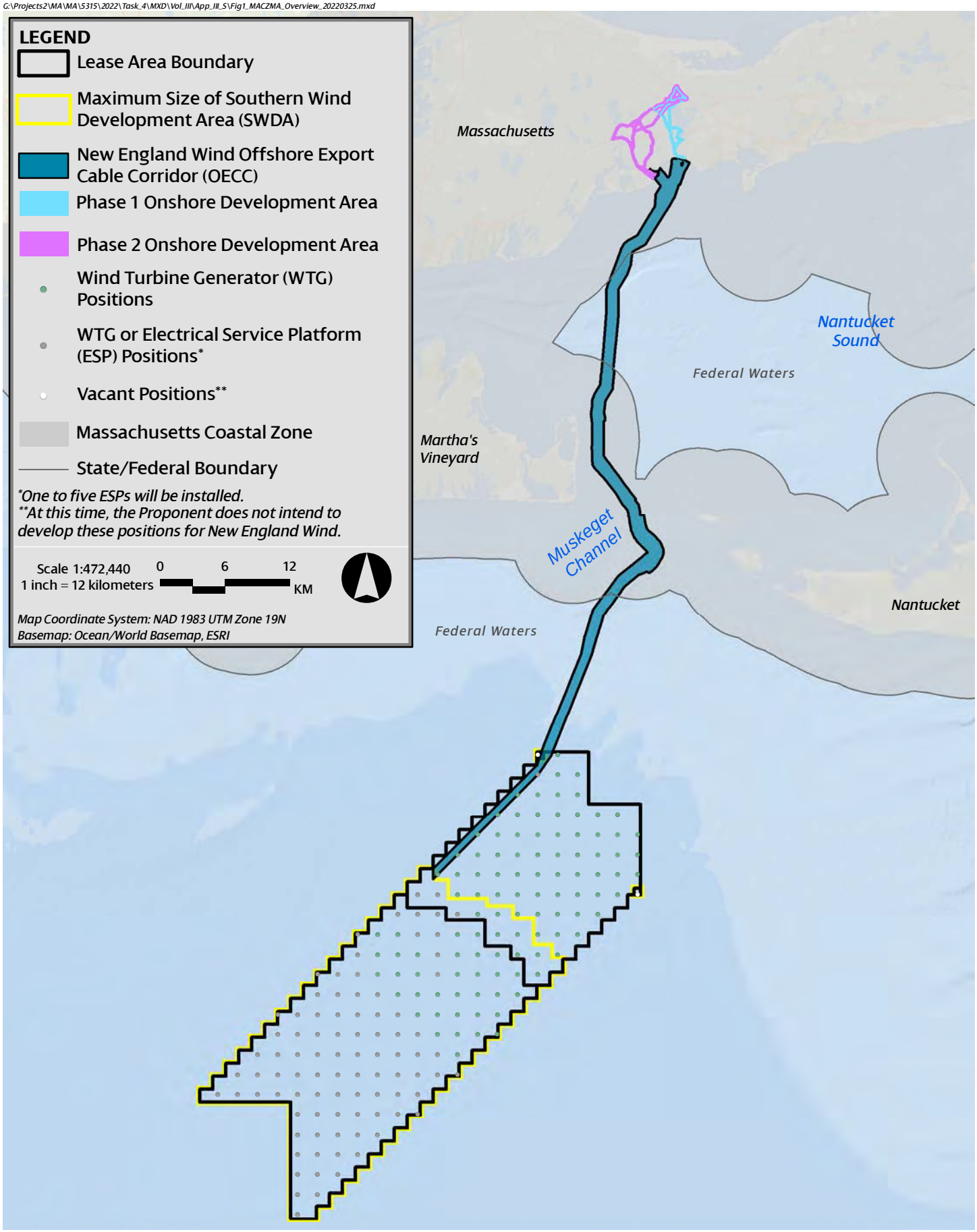
In June 2020, the Proponent submitted a statement of consistency with the Massachusetts Coastal Zone Management's (MA CZM) enforceable program policies to the Massachusetts Executive Office of Energy and Environmental Affairs (EEA #16231) and MA CZM as Attachment E of the New England Wind 1 Connector Environmental Notification Form (ENF)[1]. The consistency statement was prepared for the portions of Phase 1 in state jurisdiction (referred to as New England Wind 1 Connector). The following federal consistency review builds upon the previous consistency statement and also addresses both Phases 1 and 2 of New England Wind in state jurisdiction, as well as New England Wind activities in federal waters "with reasonably foreseeable effects on any land or water uses or natural resources of the Massachusetts coastal zone," in accordance with 301 CMR Part 20.04(1).

A summary of New England Wind's facilities and activities is provided in Section 2. Section 3 demonstrates how New England Wind, as described in Section 2 and more completely in the New England Wind COP, complies with each of the MA CMPs applicable enforceable policies. Based upon the analyses presented herein and, in the COP, the Proponent certifies to the MA CZM that:

> *The proposed activities described in detail in the New England Wind COP comply with Massachusetts' approved coastal management program and will be conducted in a manner consistent with such program.*

[1] At the time the ENF was filed, the proposed development was referred to by its previous name "Vineyard Wind Connector 2."

This certification is made in accordance with the requirements of the Federal Coastal Zone Management Act (16 U.S.C. 1451 et seq.) and implementing regulations at 15 CFR Part 930, Subparts D and E; 301 CMR 20.00; and the relevant statutory and regulatory authorities for the Commonwealth of Massachusetts' Coastal Zone Management Plan and Program Policies.



New England Wind

AVANGRID RENEWABLES

Figure 1.0-1

New England Wind Overview

2.0 SUMMARY OF NEW ENGLAND WIND FACILITIES AND ACTIVITIES

2.1 Overview

New England Wind is the proposal to develop offshore renewable wind energy facilities in Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0534 along with associated offshore and onshore cabling, onshore substations, and onshore O&M facilities. ("Lease Area OCS-A 0534 is within the Massachusetts Wind Energy Area (MA WEA) identified by BOEM, following a public process and environmental review, as suitable for wind energy development. Park City Wind LLC, a wholly owned subsidiary of Avangrid Renewables, LLC, is the Proponent of this Construction and Operations Plan (COP) and will be responsible for the construction, operation, and decommissioning of New England Wind.

New England Wind's offshore renewable wind energy facilities are located immediately southwest of Vineyard Wind 1, which is located in Lease Area OCS-A 0501. New England Wind will occupy all of Lease Area OCS-A 0534 and potentially a portion of Lease Area OCS-A 0501 in the event that Vineyard Wind 1 does not develop "spare" or extra positions included in Lease Area OCS-A 0501 and Vineyard Wind 1 assigns those positions to Lease Area OCS-A 0534. For the purposes of the COP, the Southern Wind Development Area (SWDA) is defined as all of Lease Area OCS-A 0534 and the southwest portion of Lease Area OCS-A 0501, as shown in Figure 1.0-1.

New England Wind will be developed in two Phases with a maximum of 130 wind turbine generator (WTG) and electrical service platform (ESP) positions. Phase 1, also known as Park City Wind, will be developed immediately southwest of Vineyard Wind 1. Phase 2, also known as Commonwealth Wind, will be located southwest of Phase 1 and will occupy the remainder of the SWDA. Each Phase of New England Wind will be developed and permitted using a Project Design Envelope (the "Envelope"). This allows the Proponent to properly define and bracket the characteristics of each Phase for the purposes of environmental review while maintaining a reasonable degree of flexibility with respect to the selection of key components (e.g. WTGs, foundations, submarine cables, and ESPs). To assess potential impacts and benefits to various resources, a "maximum design scenario," or the design scenario with the maximum impacts anticipated for that resource, is established (see Section 3 of COP Volume III).

The SWDA may be 411–453 square kilometers (km^2) (101,590–111,939 acres) in size depending upon the final footprint of the Vineyard Wind 1 project. At this time, the Proponent does not intend to develop the two positions in the separate aliquots located along the northeastern boundary of Lease Area OCS-A 0501 as part of New England Wind. The SWDA (excluding the two separate aliquots that are closer to shore) is just over 32 kilometers (km) (20 miles [mi]) from the southwest corner of Martha's Vineyard and approximately 38 km (24 mi) from Nantucket.[2] In accordance with US Coast Guard (USCG) recommendations, the WTGs and ESP(s) in the SWDA

[2] Within the SWDA, the closest WTG is approximately 34 km (21 mi) from Martha's Vineyard and 40 km (25 mi) from Nantucket.

will be oriented in fixed east-to-west rows and north-to-south columns with one nautical mile (1.85 km) spacing between positions. This uniform grid layout provides 1 NM wide corridors in the east-west and north-south directions as well as 0.7 NM (1.3 km) wide corridors in the northwest-southeast and northeast-southwest directions.

Four or five offshore export cables—two cables for Phase 1 and two or three cables for Phase 2—will transmit electricity from the SWDA to shore. Unless technical, logistical, grid interconnection, or other unforeseen issues arise, all New England Wind offshore export cables will be installed within a shared Offshore Export Cable Corridor (OECC) that will travel from the northwestern corner of the SWDA along the northwestern edge of Lease Area OCS-A 0501 (through Vineyard Wind 1) and then head northward along the eastern side of Muskeget Channel toward landfall sites in the Town of Barnstable (see Figure 2.3-1 of COP Volume I).[3] The OECC for New England Wind is largely the same OECC proposed in the approved Vineyard Wind 1 COP, but it has been widened to the west along the entire corridor and to the east in portions of Muskeget Channel. The two Vineyard Wind 1 offshore export cables will also be installed within the New England Wind OECC. To avoid cable crossings, the Phase 1 cables are expected to be located to the west of the Vineyard Wind 1 cables and, subsequently, the Phase 2 cables are expected to be installed to the west of the Phase 1 cables.

Each Phase of New England Wind will have a separate onshore transmission system located in the Town of Barnstable.[4] The Phase 1 onshore facilities will ultimately include one of two potential landfall sites, one of two potential Onshore Export Cable Routes, one new onshore substation, and one of two potential Grid Interconnection Routes, which are identified in Figure 2.4-1 of COP Volume I. Phase 2 will include one or two landfall sites, one or two Onshore Export Cable Routes, one or two onshore substation sites, and one or two Grid Interconnection Routes. The potential landfall sites, Onshore Export Cable Routes, and Grid Interconnection Routes are illustrated on Figure 2.4-1 of COP Volume I. The Phase 2 onshore substation site(s) will be located generally along the Phase 2 onshore routes identified in Figure 2.4-1 of COP Volume I.

New England Wind has significant environmental benefits. The electricity generated by the WTGs, which do not emit air pollutants, will displace electricity generated by fossil fuel power plants and significantly reduce emissions from the ISO New England (ISO-NE) electric grid over the lifespan of New England Wind. New England Wind is expected to reduce carbon dioxide equivalent (CO_2e) emissions from the ISO-NE electric grid by approximately 3.93 million tons per year (tpy), or the

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[3] As described further in Section 4.1.3 of COP Volume I, the Proponent has identified two variations of the Phase 2 OECC in the event that technical, logistical, grid interconnection, or other unforeseen issues arise during the COP review and engineering processes that preclude one or more Phase 2 offshore export cables from being installed within all or a portion of the OECC.

[4] One or more Phase 2 offshore export cables may deliver power to a second grid interconnection point if technical, logistical, grid interconnection, or other unforeseen issues arise. Under this scenario, Phase 2 could include one onshore transmission system in Barnstable and/or an onshore transmission system(s) in proximity to the second grid interconnection point (see Section 4.1.4 of COP Volume I).

equivalent of taking 775,000 cars off the road.[5] New England Wind will significantly decrease the region's reliance on fossil fuels and enhance the reliability and diversity of regional energy supply. In addition to these important environmental and energy reliability benefits, New England Wind is expected to result in significant long-term economic benefits and high-quality jobs.

2.2 Organization of the COP

The New England Wind COP, upon which this Federal Consistency Certification relies, describes all planned activities and facilities associated with the construction and operation of each Phase of New England Wind. The COP is comprised of three volumes:

- Volume I provides a detailed description of New England Wind's location, offshore and onshore facilities, and construction, O&M, and decommissioning activities. Phase 1 is described in Section 3 of COP Volume I and Phase 2 is described separately in Section 4.

- Volume II provides a comprehensive analysis of the data collected during geophysical and geotechnical surveys conducted for New England Wind.

- Volume III details the benefits and potential impacts of both Phases to physical, atmospheric, biological, economic, cultural, and historic resources based on the "maximum design scenario" for each resource.

The remainder of this section summarizes the facilities and activities for each Phase as described in COP Volume I. Potential environmental impacts and avoidance, minimization, and mitigation measures are summarized in Section 4 of COP Volume III.

2.3 Phase 1 of New England Wind

Phase 1 of New England Wind, also known as Park City Wind, will deliver power to one or more Northeastern states and/or other offtake users, including but not limited to 804 MW of power to the ISO-NE electric grid to meet the Proponent's obligations under long-term contracts with Connecticut electric distribution companies. Assuming the necessary permits are issued and financial close is achieved, construction of Phase 1 would likely begin in late 2023 onshore and 2025 offshore. The Envelope for Phase 1 is summarized in Table 2.3-1 below.

[5] The avoided emissions analysis conservatively assumes a minimum total capacity for both Phases of New England Wind of approximately 2,000 MW; however, it is likely that benefits will be greater than those reported. The analysis is based on Northeast Power Coordinating Council (NPCC) New England 2018 emission rates from EPA's Emissions & Generation Resource Integrated Database eGRID2018(v2) released in March 2020. See Section 5.1.2.2 of COP Volume III for additional details.

2.3.1 Phase 1 Construction and Installation

2.3.1.1 Wind Turbine Generators

Phase 1 will consist of 42–62 WTGs oriented in a 1 x 1 NM layout. The potential footprint of Phase 1 within the SWDA includes a portion of Lease Area OCS-A 0501 (see Figure 3.1-4 of COP Volume I), in the event that Vineyard Wind 1 does not develop some or all of its 10 spare positions and Vineyard Wind 1 assigns those positions to Lease Area OCS-A 0534. Similarly, the potential footprint of Phase 1 overlaps with the potential footprint of Phase 2 to account for the range in the number of WTGs that may be developed for Phase 1 (see Figure 3.1-4 of COP Volume I).

The WTG parameters for Phase 1 are provided in Table 2.3-1 and shown on Figure 3.2-1 of COP Volume I. The WTGs will be no lighter than RAL 9010 Pure White and no darker than RAL 7035 Light Grey in color; the Proponent anticipates that the WTGs will be painted off-white/light grey to reduce their visibility against the horizon. The WTGs will include one or two levels of red flashing aviation obstruction lights in accordance with Federal Aviation Administration (FAA) and/or BOEM requirements. The Proponent expects to use an Aircraft Detection Lighting System (ADLS) that automatically activates all aviation obstruction lights when aircraft approach the Phase 1 WTGs, subject to BOEM approval. Each WTG will be maintained as a Private Aid to Navigation (PATON) and will contain marine navigation lighting and marking in accordance with the USCG's PATON marking guidance for offshore wind facilities in First District-area waters.

The WTGs will be installed using jack-up vessels, anchored vessels, or dynamic positioning (DP) vessels along with necessary support vessels and supply vessels. The tower will first be erected followed by the nacelle and finally the hub, inclusive of the blades. Alternatively, the nacelle and hub could be installed in a single operation followed by installation of individual blades.

Table 2.3-1 Phase 1 of New England Wind Design Envelope Summary

Layout and Size of Phase 1	WTGs	WTG Foundations
• 41–62 wind turbine generators (WTGs) installed • One or two electrical service platforms (ESPs) installed • Windfarm layout in E-W & N-S grid pattern with 1 NM (1.85 km) spacing between WTG/ESP positions • Area of Phase 1 SWDA: 150–231 km^2 (37,066–57,081 acres)	• 41–62 WTGs • Maximum rotor diameter of 285 m (935 ft) • Maximum tip height of 357 m (1,171 ft) • Minimum tip clearance of 27 m (89 ft) • Installation with a jack-up vessel, anchored vessel, or dynamic positioning (DP) vessel and components likely supplied by feeder vessels	• Each WTG installed on a monopile or piled jacket foundation • Scour protection may be used around all foundations • Maximum pile driving energy of 6,000 kJ for monopiles and 3,500 kJ for jackets • Installation with a jack-up vessel, anchored vessel, or DP vessel and components potentially supplied by feeder vessels
ESPs (Topside and Foundation)	**Inter-Array & Inter-Link Cables**	**Offshore Export Cables**
• One or two ESP(s) • Each ESP installed on a monopile or jacket foundation (ESPs installed on monopiles may be co-located) • Maximum pile driving energy of 6,000 kJ for monopiles and 3,500 kJ for jackets • Scour protection may be installed around the foundations • Installation with a jack-up vessel, anchored vessel, or DP vessel	• 66–132 kV inter-array cables buried beneath the seafloor at a target depth of 1.5–2.5 m (5–8 ft) • Maximum total inter-array cable length of ~225 km (~121 NM) • Up to one 66–275 kV inter-link cable buried at a target depth of 1.5–2.5 m (5–8 ft) • Maximum total inter-link cable length of ~20 km (~11 NM) • Example layout identified, not finalized • Pre-lay grapnel run and pre-lay survey • Typical installation techniques include jetting (e.g. jet plow or jet trenching) and mechanical plow • Use of cable protection (rock, gabion rock bags, concrete mattresses, half-shell pipes [or similar]) on areas of minimal cable burial	• Two 220–275 kV offshore export cables buried beneath the seafloor at a target depth of 1.5–2.5 m (5–8 ft) • Maximum total offshore export cable length of ~202 km (~109 NM) • Cables installed in one Offshore Export Cable Corridor • Pre-lay grapnel run, pre-lay survey, and possibly boulder clearance • Typical installation techniques include jetting (e.g. jet plow or jet trenching) and mechanical plow, possibly with dredging in some locations to achieve burial depth • Use of cable protection (rock, gabion rock bags, concrete mattresses, half-shell pipes [or similar]) on areas of minimal cable burial

Note: Elevations are relative to Mean Lower Low Water (MLLW).

2.3.1.2 Wind Turbine Generator Foundations

At this time, the Proponent expects to use all monopiles for the Phase 1 WTG foundations. However, a combination of monopiles and/or piled jackets may be used, pending the outcome of a foundation feasibility analysis. The monopiles will have a maximum diameter of 12 m (39 ft) and will be driven into the seabed to a maximum penetration depth of 55 m (180 ft). The Envelope of dimensions for each Phase 1 WTG foundation type are shown on Figures 3.2-2 and 3.2-3 of COP Volume I. Scour protection consisting of rock material will be used for the larger diameter monopiles but may or may not be needed for the smaller diameter piles used for jacket foundations.

The foundations are expected to be installed by one or two DP, anchored, or jack-up vessels, along with necessary support vessels and supply vessels. Pile driving would begin with a "soft-start" (i.e., the hammer energy level will be gradually increased) to ensure the pile remains vertical and allow any motile marine life to leave the area before pile driving intensity is increased. It is anticipated that a maximum of two monopiles or one complete piled jacket (3–4 piles) can be driven into the seabed per day.

2.3.1.3 Electrical Service Platforms

One or two ESP(s) will serve as the common interconnection point(s) for the Phase 1 WTGs. The ESP(s) will be supported by either a monopile or piled jacket foundation (with 3–12 piles) that may be surrounded by scour protection, if needed. If two ESPs are used, they may be located at two separate positions or co-located at one of the potential ESP positions shown on Figure 3.1-4 of COP Volume I (co-located ESPs would be smaller structures installed on monopile foundations). The approximate size and design of the ESP topside and foundation are depicted in Figures 3.2-6 and 3.2-7 of COP Volume I. If necessary, the ESP(s) will include an aviation obstruction lighting system in compliance with FAA and/or BOEM requirements, which would be activated by ADLS, subject to BOEM approval. The ESP(s) will include marine navigation lighting and marking similar to the lighting and marking described for the WTGs. ESP foundation and topside installation may be performed by a DP, anchored, or jack-up vessel. ESP foundation installation is similar to WTG foundation installation described above. Following topside installation, the ESP(s) will be commissioned.

2.3.1.4 Offshore Export Cables

Phase 1 includes two offshore export cables, which will transmit electricity from the Phase 1 ESP(s) to the selected landfall site. Each offshore export cable is expected to be comprised of a three-core 220–275 kV high voltage alternating current (HVAC) cable and one or more fiber optic cables. Between the Phase 1 ESP(s) and the northwestern corner of the SWDA, the offshore export cables may be installed in any area of the SWDA. From the northwestern corner of the SWDA, the Phase 1 offshore export cables will be installed within the OECC to reach either the Craigville Public Beach Landfall Site or the Covell's Beach Landfall Site (see Figure 3.1-6 of COP Volume I). The maximum length of offshore export cables (assuming two cables) is ~202 km (~109 NM).

Prior to cable laying, a pre-lay grapnel run, and pre-lay survey will be performed to clear obstructions and inspect the route. Large boulders along the route may need to be relocated and some dredging of the upper portions of sand waves may be required prior to cable laying to achieve sufficient burial depth below the stable sea bottom. Each offshore export cable will be installed beneath the seafloor at a target depth of 1.5–2.5 m (5–8 ft). Offshore export cable laying is expected to be performed primarily via simultaneous lay and bury using jetting techniques or mechanical plow. However, other specialty techniques may be used in certain areas to ensure sufficient burial depth (see Section 3.3.1.3.6 of COP Volume I). To facilitate cable installation, anchored vessels may be used along the entire length of the offshore export cables. While the Proponent intends to avoid or minimize the need for cable protection to the greatest extent feasible, the Proponent conservatively estimates that approximately 6% of the offshore export cables within the OECC could require cable protection (or up to 7% of the offshore export cables within the OECC for both Phases if the Western Muskeget Variant is used for one or two Phase 2 export cables).

2.3.1.5 Inter-Array and Inter-Link Cables

Strings of multiple WTGs will be connected to the Phase 1 ESP(s) via 66–132 kV inter-array cables. The maximum anticipated length of the Phase 1 inter-array cables is approximately 225 km (121 NM). In addition, if two ESPs are used, the ESPs may be connected together by an up to ~20 km (~11 NM) long 66–275 kV inter-link cable. The Phase 1 inter-array and inter-link cable layout will be designed and optimized during the final design of Phase 1.

The inter-array and inter-link cables will be buried beneath the seafloor at a target depth of 1.5–2.5 m (5–8 ft), likely using jetting techniques. However, in some cases, a mechanical plow may be better suited to certain site-specific conditions and other specialty techniques may be used more rarely. The Proponent conservatively estimates that up to 2% of the total length of the inter-array and inter-link cables could require cable protection.

2.3.1.6 Landfall Site and Onshore Export Cables

The offshore export cables will make landfall within paved parking areas at either the Craigville Public Beach Landfall Site or the Covell's Beach Landfall Site in the Town of Barnstable. The ocean to land transition at either landfall sites will be made using horizontal directional drilling (HDD), which will avoid or minimize impacts to the beach, intertidal zone, and nearshore areas and achieve a burial significantly deeper than any expected erosion. From the landfall site, the onshore export cables would follow one of two approximately 6.5-10.5 km (4.0-6.5 mi) potential Onshore Export Cable Routes (with variants) in the Town of Barnstable to the new onshore substation (see Figure 3.2-11 of COP Volume I).

The onshore export cables will be primarily installed in an underground duct bank (i.e., an array of plastic conduits encased in concrete) along the selected Onshore Export Cable Route; the duct bank will typically be within public roadway layouts although portions of the duct bank may be within existing utility rights-of-way (ROWs).

2.3.1.7 Onshore Substation and Grid Interconnection

Phase 1 will require the construction of a new onshore substation on a 0.027 km^2 (6.7 acre) privately-owned parcel located at 8 Shootflying Hill Road. From the onshore substation, grid interconnection cables will be installed within an underground duct bank along one of two potential Grid Interconnection Routes (with variants) to the grid interconnection point at Eversource's existing West Barnstable Substation. The Proponent may construct an access road to the onshore substation site on 6 Shootflying Hill Road, which is adjacent the onshore substation site. The Proponent may also use an approximately 0.011 km^2 (2.8 acre) parcel of land, assessor map parcel #214-001 ("Parcel #214-001"), located immediately southeast of the West Barnstable Substation for a segment of the grid interconnection cables and/or to house some onshore substation equipment (see Figure 3.1-2 of COP Volume I).

2.3.1.8 Port Facilities

The Proponent has identified several port facilities in Massachusetts, Rhode Island, Connecticut, New York, and New Jersey that may be used for frequent crew transfer, offloading/loading shipments of components, storage, preparing components for installation, and potentially some component fabrication and assembly. In addition, some components, materials, and vessels could come from Canadian and European ports. See Section 3.2.2.5 of COP Volume I for a complete list of possible ports that may be used for major construction staging. It is not expected that all the ports identified would be used; it is more likely that only some ports would be used during construction depending upon final construction logistics planning.

2.3.2 Phase 1 Operations and Maintenance

The Phase 1 WTGs will be designed to operate without attendance by any operators. Continuous monitoring will be conducted remotely using a supervisory control and data acquisition (SCADA) system. Routine preventive maintenance and proactive inspections (e.g. multi-beam echosounder inspections, side scan sonar inspections, magnetometer inspections, depth of burial inspections, etc.) will be performed for all offshore facilities.

To execute daily O&M activities offshore, the Proponent expects to use a service operation vessel (SOV) to provide offshore accommodations and workspace for O&M workers. Daughter craft and/or crew transfer vessels (CTVs) would be used to transfer crew to and from shore. Although less likely, if an SOV is not used, several CTVs and helicopters would be used to frequently transport crew to and from the offshore facilities. In addition to the SOV, CTVs, and/or daughter craft, other larger support vessels (e.g. jack-up vessels) may be used infrequently to perform some routine maintenance and repairs (if needed).

The Proponent expects to use one or more facilities in support of Phase 1 O&M activities. For Phase 1, the Proponent will likely establish a long-term SOV O&M base in Bridgeport, Connecticut. Current plans anticipate that CTVs and/or the SOV's daughter craft would operate out of Vineyard

Haven and/or New Bedford Harbor. Although the Proponent plans to locate the Phase 1 O&M facilities in Bridgeport, New Bedford Harbor, and/or Vineyard Haven, the Proponent may use other ports listed in Table 3.2-8 of COP Volume I to support O&M activities.

2.3.3 Phase 1 Decommissioning

As currently envisioned, the decommissioning process for Phase 1 is essentially the reverse of the installation process. Decommissioning of the offshore facilities is broken down into several steps:

- Retirement in place (if authorized by BOEM) or removal of the offshore cable system (i.e., inter-array, inter-link, and offshore export cables) and any associated cable protection.
- Dismantling and removal of WTGs. Prior to dismantling the WTGs, they would be properly drained of all lubricating fluids and chemicals, which would be brought to port for proper disposal and/or recycling.
- Cutting and removal of foundations and removal of scour protection. In accordance with BOEM's removal standards (30 CFR § 585.910(a)), the foundations would likely be cut at least 4.5 m (15 ft) below the mudline; the portion below the cut will likely remain in place.
- Removal of ESP(s). The ESP(s) and their foundations will be disassembled in a similar manner as the WTGs. Before removing the ESP(s), the offshore export cables, inter-array cables, and inter-link cables would be disconnected.

The onshore facilities could be retired in place or retained for future use. The extent of onshore decommissioning is subject to discussions with the Town of Barnstable on the approach that best meets the Town's needs and has the fewest environmental impacts.

2.4 Phase 2 of New England Wind

Phase 2 of New England Wind, also known as Commonwealth Wind, will deliver power to one or more Northeastern states and/or to other offtake users, including 1,232 MW of power to the ISO-NE electric grid to meet the Proponent's obligations under long-term contracts with Massachusetts electric distribution companies. Phase 2 may be developed as one or more projects. The full build-out of Phase 2 development is largely dependent on market conditions and the advancement of WTG technology. It is likely that a portion of Phase 2 construction could begin immediately following Phase 1[6] with the remainder following by a number of years. The Envelope for Phase 2 of New England Wind is summarized in Table 2.4-1.

[6] In this scenario, each major construction activity would be sequential for the two Phases (e.g. Phase 2 foundation installation would immediately follow Phase 1 foundation installation). However, there could be some overlap of different offshore activities between Phase 1 and Phase 2 (e.g. Phase 2 foundation installation could occur at the same time as Phase 1 WTG installation). There will be no concurrent/simultaneous pile driving of foundations.

2.4.1 Phase 2 Construction and Installation

2.4.1.1 Wind Turbine Generators

Phase 2 will occupy the remainder of the SWDA that is not developed for Phase 1. As described in Section 2.3.1.1, the potential footprint of Phase 2 within the SWDA overlaps with the potential footprint of Phase 1 to account for the range in the number of WTGs that may be developed for Phase 1 (see Figure 4.1-4 of COP Volume I). Depending on the final footprint of Phase 1, the total number of WTG/ESP positions expected to be available for Phase 2 ranges from 64 to 88. Up to 88 of those positions may be used for WTGs. The Phase 2 WTGs will be oriented in a 1 x 1 NM layout. The WTG parameters for Phase 2 are provided in Table 2.4-1 and shown on Figure 4.2-1 of COP Volume I.

Table 2.4-1 Phase 2 of New England Wind Design Envelope Summary

Layout and Size of Phase 2	WTGs	WTG Foundations

• 64–88 total wind turbine generator (WTG) and electrical service platform (ESP) positions expected to be available
  o Up to 79 WTGs installed
  o Up to 3 ESPs installed
• Windfarm layout in E-W & N-S grid pattern with 1 NM (1.85 km) spacing between positions
• Area of Phase 2 SWDA: 222–303 km^2 (54,857–74,873 acres)
	• Up to 88 WTGs
	• Maximum rotor diameter of 285 m (935 ft)
	• Maximum tip height of 357 m (1,171 ft)
	• Minimum tip clearance of 27 m (89 ft)
	• Installation likely with a jack-up vessel, anchored vessel, or dynamic positioning (DP) vessel and components potentially supplied by feeder vessels
		• Each WTG installed on a monopile, jacket, or bottom-frame foundation
		• Scour protection may be used around all foundations
		• Maximum pile driving energy of 6,000 kJ for monopiles and 3,500 kJ for jackets and bottom-frames
		• Installation likely with a jack-up vessel, anchored vessel, or DP vessel and components potentially supplied by feeder vessels

ESP(s) (Topside and Foundation)	**Inter-Array & Inter-Link Cables**	**Offshore Export Cables**
• Up to 3 ESPs • Each ESP installed on a monopile or jacket foundation (ESPs installed on monopiles may be co-located) • Maximum pile driving energy of 6,000 kJ for monopiles and 3,500 kJ for jackets • Scour protection may be installed around the foundations • Installation likely with a jack-up vessel, anchored vessel, or DP vessel	• 66–132 kV inter-array cables buried beneath the seafloor at a target depth of 1.5–2.5 m (5–8 ft) • Maximum total inter-array cable length of ~325 km (~175 NM) • 66–345 kV inter-link cables buried at a target depth of 1.5–2.5 m (5–8 ft) • Maximum total inter-link cable length of ~60 km (~32 NM) • Example layout identified, not finalized • Pre-lay grapnel run and pre-lay survey • Typical installation techniques include jetting (e.g. jet plow or jet trenching) and mechanical plow • Use of cable protection (rock, gabion rock bags, concrete mattresses, half-shell pipes [or similar]) on areas of minimal cable burial	• Two or three 220–345 kV high voltage alternating current (HVAC) cables buried beneath the seafloor at a target depth of 1.5–2.5 m (5–8 ft) • Cables installed in an Offshore Export Cable Corridor (OECC) with potential variations • Maximum total offshore export cable length of ~356 km (~192 NM) • Pre-lay grapnel run, pre-lay survey, and possibly boulder clearance • Typical installation techniques include jetting (e.g. jet plow or jet trenching) and mechanical plow, possibly with dredging in some locations to achieve burial depth • Use of cable protection (rock, gabion rock bags, concrete mattresses, half-shell pipes [or similar]) on areas of minimal cable burial

Note: Elevations are relative to Mean Lower Low Water (MLLW).

Unless BOEM and FAA guidance is modified before Phase 2 proceeds, the WTGs will be no lighter than RAL 9010 Pure White and no darker than RAL 7035 Light Grey in color; the Proponent anticipates that the WTGs will be painted off-white/light grey to reduce their visibility against the horizon. Unless current guidance is modified by the FAA and BOEM, the WTGs will include one or two levels of red flashing aviation obstruction lights. The Proponent expects to use the same or similar approaches used for Vineyard Wind 1 and/or Phase 1, including the use of an ADLS that is activated automatically by approaching aircraft. Each WTG will be maintained as a PATON and will contain marine navigation lighting and marking in accordance with the USCG's PATON marking guidance for offshore wind facilities in First District-area waters.

The WTGs are expected to be installed using jack-up vessels, anchored vessels, or DP vessels along with necessary support vessels and supply vessels. The tower will first be erected followed by the nacelle and finally the hub, inclusive of the blades. Alternatively, the nacelle and hub could be installed in a single operation followed by installation of individual blades.

2.4.1.2 Wind Turbine Generator Foundations

Commercial and technical considerations at the time Phase 2 is ready to proceed will determine the types of WTG foundations used for Phase 2. Monopiles, jackets (with piles or suction buckets), bottom-frame foundations (with piles or suction buckets), or a combination of those foundation types may be used for Phase 2 pending the outcome of a foundation feasibility analysis.

If used, monopiles would have a maximum diameter of 13 m (43 ft) and would be driven into the seabed to a maximum depth of 55 m (180 ft). The dimensions for each Phase 2 WTG foundation type are shown on Figures 4.2-2 through 4.2-6 of COP Volume I. Scour protection consisting of rock material may be placed around the foundations; it is anticipated that scour protection will be needed for the larger diameter monopiles and suction buckets but may or may not be needed for the smaller diameter piles used for jacket and bottom-frame foundations.

The foundations are expected to be installed by one or two DP, anchored, or jack-up vessels, along with necessary support vessels and supply vessels. Pile driving will begin with a "soft-start" to ensure the pile remains vertical and allow any motile marine life to leave the area before pile driving intensity is increased. It is anticipated that a maximum of two monopiles, one complete piled jacket (3–4 piles), or one complete piled bottom-frame (3 piles) can be driven into the seabed per day. If suction buckets are used, pumps attached to the top of each bucket would pump water and air out of the space between the suction buckets and seafloor, pushing the buckets down into the seafloor.

2.4.1.3 Electrical Service Platforms

Up to three ESP(s) will serve as the common interconnection point(s) for the Phase 2 WTGs. The ESP(s) would be supported by a monopile, piled jacket (with 3–12 piles), or suction bucket jacket foundation, which may be surrounded by scour protection, if needed. If two or three ESPs are used, they may be located at separate positions or two of the ESPs may be co-located at one of the potential ESP positions shown on Figure 4.1-4 of COP Volume I (co-located ESPs would be smaller structures installed on monopile foundations). The approximate size and design of the ESP(s) are depicted in Figures 4.2-10 through 4.2-12 of COP Volume I. The ESP(s) will include an aviation obstruction lighting system in compliance with FAA and/or BOEM requirements in effect at the time Phase 2 proceeds, if necessary. The aviation obstruction lights would be activated by ADLS (or similar), subject to BOEM approval. Marine navigation lighting and marking on each ESP will follow USCG and BOEM regulations and guidance in effect at the time Phase 2 proceeds.

ESP foundation and topside installation may be performed by a DP, anchored, or jack-up vessel. ESP foundation installation is similar to WTG foundation installation described above. Following topside installation, the ESP(s) will be commissioned. As an alternative to installing separate ESP(s) situated on their own foundation(s), the ESP(s) could potentially be integrated onto a WTG foundation, which entails placing ESP equipment on one or more expanded WTG foundation platforms (see Figure 4.2-9 of COP Volume I).

2.4.1.4 Offshore Export Cables

Two or three 220-345 kV HVAC offshore export cable(s) will transmit electricity from the Phase 2 ESP(s) to the selected landfall site(s). Between the Phase 2 ESP(s) and the northwestern corner of the SWDA, the offshore export cables may be installed in any area of the SWDA. The Proponent intends to install all Phase 2 offshore export cables within the OECC that travels from the northwestern corner of the SWDA to the Dowses Beach Landfall Site and/or Wianno Avenue Landfall Site in the Town of Barnstable (see Figure 4.1-6 of COP Volume I). Under this scenario, the maximum length of Phase 2 offshore export cables (assuming three cables) is ~356 km (~192 NM). However, as described further in Section 4.1.3 of COP Volume I, the Proponent has also identified two variations of the Phase 2 OECC in the event that technical, logistical, grid interconnection, or other unforeseen issues arise during the COP review and engineering processes that preclude one or more Phase 2 offshore export cables from being installed within all or a portion of the OECC. As described in Section 4.1.3 of COP Volume I, these variants include the Western Muskeget Variant (located along the western side of Muskeget Channel) and the South Coast Variant (which travels west-northwest from Lease Area OCS-A 0501 to the Massachusetts state waters boundary near Buzzards Bay). The Proponent is reserving the option

to install one or two Phase 2 export cables within the Western Muskeget Variant[7] and one or more Phase 2 export cables within the South Coast Variant (see Figure 2.4-1 and Section 4.1.3 of COP Volume I). The Proponent intends to provide additional information on the South Coast Variant in its February 2022 COP Addendum.

Prior to cable laying, a pre-lay grapnel run and pre-lay survey are expected to be performed to clear obstructions and inspect the route. Large boulders along the route may need to be relocated and some dredging of the upper portions of sand waves may be required prior to cable laying to achieve sufficient burial depth below the stable sea bottom. Each offshore export cable will be installed beneath the seafloor at a target depth of 1.5–2.5 m (5–8 ft). Offshore export cable laying is expected to be performed primarily via simultaneous lay and bury using jetting techniques (e.g. jet plow or jet trenching) or mechanical plow. However, other specialty techniques may be used in certain areas to ensure sufficient burial depth (see Section 4.3.1.3.6 of COP Volume I). To facilitate cable installation, anchored vessels may be used along the entire length of the offshore export cables. While the Proponent intends to avoid or minimize the need for cable protection to the greatest extent feasible, the Proponent conservatively estimates that approximately 6% of the Phase 2 offshore export cables within the OECC could require cable protection (or 7-8% of the offshore export cables within the OECC for Phase 2 if the Western Muskeget Variant is used for one or two Phase 2 export cables).

2.4.1.5 Inter-Array and Inter-Link Cables

Strings of multiple WTGs will be connected to the Phase 2 ESP(s) via 66–132 kV inter-array cables. The maximum anticipated length of the Phase 2 inter-array cables is approximately 325 km (175 NM). In addition, the Phase 2 ESPs may be connected to each other (if two or three ESPs are used) or to a Phase 1 ESP by up to two 66–345 kV inter-link cables. The maximum total length of inter-link cables for Phase 2 is ~60 km (~32 NM). The Phase 2 inter-array and inter-link cable layout is highly dependent upon the final number of Phase 2 WTGs and the location and number of ESPs. The design and optimization of the inter-array and inter-link cable system will occur during the final design of Phase 2.

The inter-array and inter-link cables will be buried beneath the seafloor at a target depth of 1.5–2.5 m (5–8 ft). Based on currently available technologies, the inter-array and inter-link cables will likely be installed using jetting techniques. However, in some cases, a mechanical plow may be better suited to certain site-specific conditions and other specialty techniques may be used more rarely. The Proponent conservatively estimates that up to 2% of the total length of the inter-array and inter-link cables could require cable protection.

[7] The Western Muskeget Variant is the same exact corridor as the western Muskeget option included in the Vineyard Wind 1 COP and has already been thoroughly reviewed and approved by BOEM as part of that COP.

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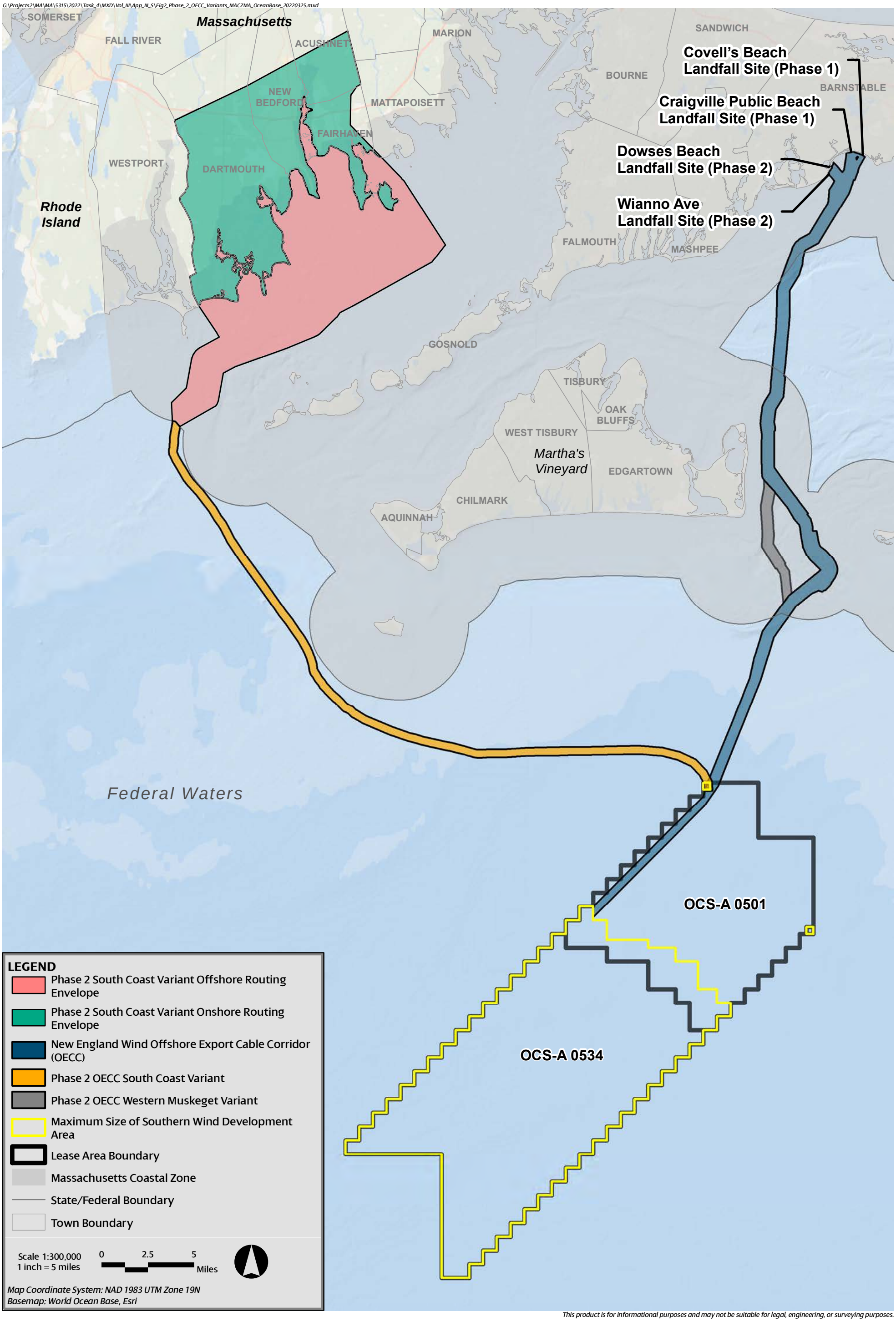

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New England Wind
AVANGRID RENEWABLES

Figure 2.4-1
Phase 2 Offshore Export Cable Corridor Variants

2.4.1.6 Landfall Site(s), Onshore Cable Route(s), Onshore Substation(s), and Grid Interconnection

The Phase 2 offshore export cables will come ashore within paved parking areas at the Dowses Beach Landfall Site and/or Wianno Avenue Landfall Site in Barnstable, unless unforeseen technical, logistical, or grid interconnection issues arise that preclude the Proponent from installing one or more Phase 2 offshore export cables within the OECC and a second grid interconnection point is needed (see Section 4.1.3.3 of COP Volume I). The ocean to land transition at the Dowses Beach Landfall Site will be made using HDD, which will avoid or minimize impacts to the beach, intertidal zone, and nearshore areas and achieve a burial significantly deeper than any expected erosion. HDD or open trenching may be used at the Wianno Avenue Landfall Site.

Upon making landfall, the onshore export cables would follow one or two Onshore Export Cable Routes to one or two new onshore substations. Grid interconnection cables installed along one or two Grid Interconnection Routes would connect the Phase 2 onshore substations to the grid interconnection point at Eversource's existing 345 kV West Barnstable Substation. The onshore export and grid interconnection cables are expected to be installed underground within public roadway layouts and utility ROWs. From each landfall site to the grid interconnection point, the maximum combined length of the Phase 2 Onshore Export Cable Route and Grid Interconnection Route is up to 17 km (10.6 mi). The properties needed for the Phase 2 onshore substation site(s) have not yet been secured, but the site(s) will be located generally along the potential onshore routes illustrated on Figure 4.1-2 of COP Volume I.

In the event that one or more Phase 2 HVAC offshore export cables deliver power to a second grid interconnection point, Phase 2 could include one onshore transmission system in Barnstable (using either the Dowses Beach Landfall Site or Wianno Avenue Landfall Site) and/or an onshore transmission system(s) in proximity to the alternative grid interconnection point. See Section 4.1.1 of COP Volume I for additional details.

2.4.1.7 Port Facilities

The Proponent has identified several port facilities in Massachusetts, Rhode Island, Connecticut, New York, and New Jersey that may be used for frequent crew transfer, offloading/loading shipments of components, storage, preparing components for installation, and potentially some component fabrication and assembly. In addition, some components, materials, and vessels could come from Canadian and European ports. See Section 4.2.2.5 of COP Volume I for a complete list of possible ports that may be used for major Phase 2 construction staging activities. It is not expected that all the ports identified would be used; it is more likely that only some ports would be used during construction depending upon final construction logistics planning.

2.4.2 Phase 2 Operations and Maintenance

The Phase 2 WTGs will be designed to operate without attendance by any operators. Continuous monitoring is typically conducted remotely using a SCADA system. Routine preventive maintenance and proactive inspections (e.g. multi-beam echosounder inspections, side scan sonar inspections, magnetometer inspections, depth of burial inspections, etc.) will be performed for all offshore facilities.

Once Phase 2 becomes operational, the Proponent expects to use a SOV to provide offshore accommodations and workspace for O&M workers. Under this scenario, daughter craft and/or CTVs would be used to transfer crew to and from shore. If an SOV or similar accommodation vessel is not used, several CTVs and helicopters could be used to frequently transport crew to and from the offshore facilities. In addition to the SOV, CTVs, and/or daughter craft, other larger support vessels (e.g. jack-up vessels) may be used infrequently to perform some routine maintenance and repairs (if needed).

In support of O&M activities for Phase 2, the Proponent will likely use O&M facilities in Bridgeport, Vineyard Haven, and/or New Bedford Harbor. The O&M facilities may include management and administrative team offices, a control room, office and training space for technicians and engineers, warehouse space for parts and tools, and/or pier space for vessels used during O&M. The Proponent may use any of the ports listed in Table 4.2-8 of COP Volume I to support O&M activities.

2.4.3 Phase 2 Decommissioning

As currently envisioned, the decommissioning process for Phase 2 is essentially the reverse of the installation process. Decommissioning of the offshore facilities is broken down into several steps:

- Retirement in place (if authorized by BOEM) or removal of the offshore cable system (i.e., inter-array, inter-link, and offshore export cables) and any associated cable protection.

- Dismantling and removal of WTGs. Prior to dismantling the WTGs, they would be properly drained of all lubricating fluids and chemicals, which would be brought to port for proper disposal and/or recycling.

- Cutting and removal of foundations and removal of scour protection. In accordance with BOEM's removal standards (30 CFR § 585.910(a)), the foundations would likely be cut at least 4.5 m (15 ft) below the mudline; the portion below the cut will likely remain in place. Suction buckets (if used) are anticipated to be removed by injecting water into the space between the suction bucket and seafloor to reduce the suction pressure that holds the foundation in place.

- Removal of ESP(s). The ESP(s), and their foundations are expected to be disassembled in a similar manner as the WTGs. Before removing the ESP(s), the offshore export cables, inter-array cables, and inter-link cables would be disconnected.

The onshore facilities could be retired in place or retained for future use. The extent of onshore decommissioning is subject to discussions with the Town of Barnstable on the approach that best meets the Town's needs and has the fewest environmental impacts.

3.0 NEW ENGLAND WIND CONSISTENCY WITH MASSACHUSETTS ENFORCEABLE POLICIES

3.1 Jurisdiction for Federal Consistency Certification

Section 307(c)(3)(B) of the federal Coastal Zone Management Act (CZMA), as amended, requires any applicant who submits an Outer Continental Shelf (OCS) plan[8] to the Department of the Interior to also provide a certification that each activity described in the OCS plan affecting any land or water use or natural resource of a state's coastal zone complies with the enforceable policies of that state's approved coastal management program and will be carried out in a manner consistent with such program (see 16 U.S.C. § 1456(c)(3)(B)). On July 2, 2020, the Proponent submitted an OCS plan— the New England Wind COP— to the Department of Interior's Bureau of Ocean Energy Management for approval. Thus, the portions of New England Wind, both within and outside of the Massachusetts coastal zone, that have reasonably foreseeable effects on the coastal zone's uses and natural resources are subject to federal consistency review by MA CZM under 15 CFR Part 930, Subparts D and E (see Figure 1).

The official Massachusetts coastal zone includes the lands and waters within an area defined by the seaward limit of the state's territorial sea, extending from the Massachusetts-New Hampshire border south to the Massachusetts-Rhode Island border, and landward to 100 feet inland of specified major roads, rail lines, other visible rights-of-way, or in the absence these, at the coordinates specified by MA CZM. The coastal zone includes all of Cape Cod, Nantucket, Martha's Vineyard, and the Elizabeth Islands. As such, the portions of New England Wind within the Massachusetts coastal zone include the segment of the OECC within state waters, the landfall sites, the Onshore Export Cable Routes, the onshore substations, and the Grid Interconnection Routes. The offshore WTGs, ESPs, their foundations, inter-array cables, inter-link cables, and the remainder of the OECC are located in federal waters outside the Massachusetts coastal zone (see Figure 1.0-1). However, the Proponent has voluntarily agreed to having CZM's federal consistency review address the portions of New England Wind (both Phases 1 and 2) in federal waters as well as within the Massachusetts coastal zone.

[8] *OCS plan* means "any plan for the exploration or development of, or production from, any area which has been leased under the Outer Continental Shelf Lands Act (43 U.S.C. 1331 et seq.), and the regulations under that Act, which is submitted to the Secretary of the Interior or designee following management program approval and which describes in detail federal license or permit activities." The New England Wind Construction and Operations Plan submitted to BOEM is an OCS plan.

3.2 Consistency with MA CZM Enforceable Policies

The following sections demonstrate New England Wind's compliance with the enforceable policies of the Massachusetts Coastal Program as set forth in the 2011 MA CZM Policy Guide. The sections below rely on detailed information provided in the New England Wind COP. The New England Wind COP will be provided to MA CZM following BOEM's completeness and sufficiency review and is incorporated by reference.

Coastal Hazards

Coastal Hazard Policy #1

Preserve, protect, restore, and enhance the beneficial functions of storm damage prevention and flood control provided by natural coastal landforms, such as dunes, beaches, barrier beaches, coastal banks, land subject to coastal storm flowage, salt marshes, and land under the ocean.

The coastal wetland resource areas located in and near the New England Wind landfall sites for both Phase 1 and Phase 2 include dunes, beaches, salt marsh, land subject to coastal storm flowage, and land under the ocean, as well as barrier beach (for the Dowses Beach Landfall Site only). These wetland resource areas are generally not degraded and provide the beneficial functions that are protected interests of the Massachusetts Wetlands Protection Act (WPA). Through careful route selection, compliance with the municipal Conservation Commission's Order of Conditions (once issued), and proper use of construction techniques such as HDD and other trenchless crossings where appropriate, Phase 1 and Phase 2 will avoid potential wetlands impacts to the maximum extent practicable and will minimize and mitigate unavoidable impacts.

All proposed landfall sites for Phase 1 (Craigville Public Beach or Covell's Beach) and Phase 2 (Dowses Beach and/or Wianno Avenue) are located within paved parking lots. At the Phase 1 landfall site (either Craigville Public Beach or Covell's Beach), HDD is proposed to accomplish the offshore-to-onshore transition. This will avoid impacts to the most sensitive resource areas along and near the shoreline. At the Phase 2 landfall site (either Dowses Beach and/or Wianno Avenue), HDD is expected to be used, though open trenching may also be used during Phase 2 if it is not feasible to use the Dowses Beach Landfall Site and open trenching is needed at the Wianno Avenue Landfall Site.

While some work in the paved parking lots of either Phase 1 landfall site may be located within 100 feet of coastal dune, Phase 1 will have no impacts to coastal dune itself except perhaps a very narrow strip of dune located between the paved Craigville Beach parking lot and Craigville Beach Road; the duct bank route may need to cross through this narrow strip, in which case the dune would be fully restored following burial of the duct bank. Similarly, Phase 1 will have no direct impacts to coastal beach, with the only impacts to the beach system being within and beneath paved roadways. In addition, Phase 1 will cross the Centerville River and several crossing methods

are under consideration. Trenchless crossing alternatives would avoid any direct impacts to the tidal river or salt marsh and will be used if feasible. The parallel utility bridge option would have some direct impacts, but all disturbed areas would be restored upon completion of construction.

One of the Phase 2 landfall sites (Dowses Beach) is located on a barrier beach and some work in the paved parking lot may be located near coastal dune and salt marsh. (The Wianno Avenue Landfall Site is not located on a barrier beach and does not include coastal dune or salt marsh.) From Dowses Beach, the onshore export cables would either continue beneath public roadway layouts or, using a trenchless crossing, travel beneath East Bay to one of two potential locations on East Bay Road. Phase 2 will have no impacts to coastal dune or salt marsh due to the planned use of HDD for the offshore-to-onshore transition at the Dowses Beach Landfall Site and the planned use of a trenchless crossing beneath Easy Bay (if required). Likewise, while Coastal Beach is present at or near both Phase 2 landfall sites, no direct impacts are expected to Coastal Beach at the Dowses Beach Landfall Site since all HDD activities will be staged from a paved parking lot. The Wianno Avenue Landfall Site is less suited for HDD than open trenching due to the elevated onshore topography and slope of the parking lot. This landfall site is suitable for open trenching because the coastal beach has already been altered by the installation of a riprap seawall, a portion of which would be temporarily removed and replaced following cable installation. The Proponent only expects to use the Wianno Avenue Landfall Site if unforeseen challenges arise that make it infeasible to use the Dowses Beach Landfall Site to accommodate all or some of the Phase 2 offshore export cables. Any disturbed areas of Coastal Beach would be restored following construction.

The Phase 1 and Phase 2 onshore routes will require some work within wetland resource areas, principally land subject to coastal storm flowage (LSCSF). No significant changes to topography are proposed within LSCSF. Further, no above-ground structures are proposed except for the Centerville River crossing for Phase 1, where a parallel utility bridge may be constructed (see Section 3.3.1.10.2 of COP Volume I). As noted previously, construction footprints will be returned to pre-existing grade following installation. Therefore, New England Wind will have no effect on flood velocities or floodplain storage capacity.

For both Phases, the offshore export cables will each be buried within the OECC in Land Under the Ocean. As described in Section 3.3.1.3.6 of COP Volume I, impacts from cable installation are expected to include an up to 1 m (3.3 ft) wide cable installation trench and an up to 3 m (10 ft) wide temporary disturbance zone from the skids/tracks of the cable installation equipment that will slide over the surface of the seafloor (each skid/track is assumed to be approximately 1.5 m [5 ft] wide). Following installation, marine sediments will naturally settle and fill the trench. Limited dredging of the tops of mobile sand waves may also be required in certain locations. Nonetheless, New England Wind activities along the OECC in Land Under the Ocean are not expected to alter existing bathymetry in a way that would result in any significant or long-term changes to hydrodynamics.

Coastal Hazard Policy #2

Ensure construction in water bodies and contiguous land areas will minimize interference with water circulation and sediment transport. Flood or erosion control projects must demonstrate no significant adverse effects on the project site or adjacent or downcoast areas.

New England Wind will not adversely interfere with water circulation or sediment transport because it will not significantly alter the morphology or composition of the seafloor or coastal wetland resource areas. As noted above, the offshore-to-onshore transition is expected to be made using HDD for Phase 1 and Phase 2, though open trenching may also be used during Phase 2 if it is not feasible to use the Dowses Beach Landfall Site and open trenching is needed at the Wianno Avenue Landfall Site. The export cables have a target burial depth of 1.5–2.5 m (5–8 ft) below the seafloor.

Any dredging performed for New England Wind will be discontinuous and limited to the tops of sand wave features where it may be necessary to remove material to achieve sufficient cable burial within the stable seabed. These existing sand waves are in high-energy areas where morphological changes occur constantly; therefore, any bathymetric changes due to dredging are expected to be temporary.

Coastal Hazard Policy #3

Ensure that state and federally funded public works projects proposed for locations within the coastal zone will: (1) not exacerbate existing hazards or damage natural buffers or other natural resources; (2) be reasonably safe from flood and erosion related damage; (3) not promote growth and development in hazard-prone or buffer areas, especially in velocity zones and Areas of Critical Environmental Concern; and (4) not be used on Coastal Barrier Resource Units for new or substantial reconstruction of structures in a manner inconsistent with the Coastal Barrier Resource/Improvements Acts.

New England Wind is not a state or federally funded public works project; therefore, this policy does not apply.

Coastal Hazard Policy #4

Prioritize public funds for acquisition of hazardous coastal areas for conservation or recreation use, and relocation of structures out of coastal high hazard areas, giving due consideration to the effects of coastal hazards at the location to the use and manageability of the area.

New England Wind does not involve public funds, and therefore this policy does not apply.

Energy

Energy Policy #1

For coastally dependent energy facilities, consider siting in alternative coastal locations. For non-coastally dependent energy facilities, consider siting in areas outside of the coastal zone. Weigh the environmental and safety impacts of locating proposed energy facilities at alternative sites.

Large-scale offshore wind energy generation, and the transmission of that energy to shore, is by nature a coastally dependent energy facility. Accordingly, New England Wind is coastally dependent, since it is necessary to bring the energy generated offshore to an interconnection point onshore. In its analysis of routing alternatives, the Proponent considered and evaluated numerous potential landfall sites and offshore routes for New England Wind before selecting the proposed OECC (see Section 2.4 and Appendix I-G of COP Volume I). As previously noted, New England Wind's offshore renewable wind energy facilities are within the offshore MA WEA in federal waters of the OCS, an area designated by BOEM for offshore wind development due in large part to its distance from coastal locations.

Energy Policy #2

Encourage energy conservation and the use of alternative sources such as solar and wind power in order to assist in meeting the energy needs of the Commonwealth.

New England Wind Phase 1 will deliver power to one or more Northeastern states and/or to other offtake users, including but not limited to 804 MW of power to the ISO-NE electric grid. Phase 2 will deliver power to one or more Northeastern states and/or to other offtake users, including 1,232 MW of power to the ISO-NE electric grid to meet the Proponent's obligations under long-term contracts with Massachusetts electric distribution companies. The purpose of this is to assist in meeting renewable energy targets, to enhance energy security by increasing the reliability and diversity of the energy supply, to reduce greenhouse gas emissions, and to achieve significant health and environmental benefits.

Growth Management

Growth Management Policy #1

Encourage sustainable development that is consistent with state, regional, and local plans and supports the quality and character of the community.

As described above, New England Wind is a sustainable development of renewable energy and is consistent with the goals of Massachusetts' Global Warming Solutions Act (GWSA). New England Wind is located in the MA WEA, which was identified by BOEM as suitable for offshore wind energy development and sited far from shore to minimize visual impacts. Within the SWDA, the

closest WTG is approximately 34 km (21 mi) off the coast of Martha's Vineyard (Squibnocket Point) and 40 km (25 mi) off the coast of Nantucket (Madaket). A Visual Impacts Assessment for New England Wind has been prepared and is included as Appendix III-H.a.

All offshore cables will be submerged and will not be visible. The Phase 1 onshore export cables and grid interconnection cables will be installed entirely underground and will not be visible, except for except for at-grade manhole covers and possibly at the Phase 1 Centerville River crossing. The Phase 2 onshore cables are also expected to be installed underground. New onshore substations will be constructed in the Town of Barnstable. The Phase 1 onshore substation will include vegetated screening (see Section 3.2.2.3 of COP Volume I). The need for vegetative or other screening will be determined for the Phase 2 substation once the site is selected.

Growth Management Policy #2

Ensure that state and federally funded infrastructure projects in the coastal zone primarily serve existing developed areas, assigning highest priority to projects that meet the needs of urban and community development centers.

New England Wind involves private development of wind energy generation; therefore, this policy does not apply.

Growth Management Policy #3

Encourage the revitalization and enhancement of existing development centers in the coastal zone through technical assistance and federal and state financial support for residential, commercial, and industrial development.

New England Wind consists of two or more privately financed projects, which will bring substantial economic benefits to the region. Phase 1, also known as Park City Wind, will deliver power to one or more Northeastern states and/or other offtake users, including but not limited to 804 MW of clean, renewable power to the ISO-NE electric grid, thus improving the reliability of the New England's energy mix. Phase 2 will deliver clean, renewable energy to one or more Northeastern states and/or to other offtake users, including 1,232 MW of power to the ISO-NE electric grid to meet the Proponent's obligations under long-term contracts with Massachusetts electric distribution companies. The Proponent has committed to providing substantive technical assistance in the form of workforce training and job opportunities in existing development centers in the coastal zone to support Phases 1 and 2. The Proponent will continue to work cooperatively with southeastern Massachusetts educational institutions, such as the Massachusetts Maritime Academy, University of Massachusetts Dartmouth, Bristol Community College, Cape Cod Community College and others to maintain and further evolve training and educational opportunities for their students and faculty throughout each Phase of New England Wind (see Section 7.1.2.1 of COP Volume III).

Unless technical, logistical, grid interconnection, or other unforeseen issues arise, both Phases will make landfall within the Town of Barnstable. A Host Community Agreement (HCA) with the Town of Barnstable was executed on May 6, 2022, which provides funding to the Town to offset potential impacts associated with hosting the onshore facilities for Park City Wind. See Section 4.1.2 of COP Volume III for additional details.

Both Phases will use regional port facilities for frequent crew transfer, offloading/loading shipments of components, storing components, and possibly some component fabrication and assembly, thus generating local employment and spurring others to perform related infrastructure improvements, as needed. These activities will help revitalize existing ports. See Sections 3.2.2.5 and 4.2.2.5 of COP Volume I for addition information related to port usage.

Additional information related to the revitalization and enhancement of existing infrastructure is presented in Section 7.1 (Demographics, Employment, and Economics); Section 7.2 (Environmental Justice Assessment); Section 7.6 (Commercial Fisheries and For-Hire Recreational Fishing); Section 7.7 (Land Use and Coastal Infrastructure); and Appendix III-O (Community and Environmental Benefits) of COP Volume III.

Habitat

Habitat Policy #1

Protect coastal, estuarine, and marine habitats – including salt marshes, shellfish beds, submerged aquatic vegetation, dunes, beaches, barrier beaches, banks, salt ponds, eelgrass beds, tidal flats, rocky shores, bays, sounds, and other ocean habitats – and coastal freshwater streams, ponds, and wetlands to preserve critical wildlife habitat and other important functions and services including nutrient and sediment attenuation, wave and storm damage protection, and landform movement and processes.

As described below, New England Wind is designed to avoid impacts to marine, coastal, and wetland habitats to the maximum extent practicable and to minimize and mitigate unavoidable impacts in accordance with applicable federal, state, and local regulations.

<u>*Coastal, Estuarine, and Marine Habitats*</u>

The Proponent has conducted an extensive analysis of coastal habitats that may be impacted by New England Wind. Section 6.4 of COP Volume III describes the habitats within the Commonwealth of Massachusetts' coastal zone that are located around the New England Wind landfall sites and within the portion of the OECC in State waters (including the Western Muskeget Variant). Section 6.5 (Benthic Resources) of COP Volume III and Appendix III-F (Essential Fish Habitat) provide a thorough analysis of New England Wind's potential impacts to benthic habitat as well as measures to mitigate those impacts. Section 6.6 of COP Volume III contains an extensive discussion of fish and invertebrate species within the Offshore Development Area. Popular and other important areas to commercial and recreational fisheries are discussed in Sections 7.5 and 7.6 of COP Volume III.

The Proponent has conducted surveys of epifauna and infauna along the OECC using underwater video transects and sediment grab samples, respectively. Soft Bottom habitats are the most common along the OECC and make up approximately 59% of the entire corridor. These areas typically contain a sandy surficial layer that is either highly mobile and comprised of migrating bedforms or flat and stable, mostly void of active sediment transport features. Several locations within Massachusetts waters (i.e. primarily within Muskeget Channel, including the Western Muskeget Variant) contained coarse deposits and hard bottom habitats consisting of pebble-cobble habitat with sulfur sponge (*Cliona celata*) communities. See COP Volume II for a comprehensive analysis of the data collected during geophysical and geotechnical surveys conducted for New England Wind. Section 5.2 of COP Volume II describes how benthic habitats have been classified according to the Coastal and Marine Ecological Classification Standard (CMECS) modified by National Marine Fisheries Service (NMFS) (2021).

The Proponent has routed the proposed OECC to avoid and minimize impacts to sensitive habitats where feasible. The preliminary routing of the Phase 1 and Phase 2 cables has avoided sensitive habitats including eelgrass, hard bottom, and complex bottom (i.e., sand waves) where feasible, but avoidance of all sensitive habitats is not always possible. A single eelgrass bed has been identified within the OECC. Video transects and a diver survey delineated a patch of eelgrass offshore that is co-located within the OECC and associated with an area of hard bottom (a rock pile) known as Spindle Rock (see Figure 6.4-1 of COP Volume III). Patches of grass intertwined with macroalgae inhabit the discontinuous sandy bottom in and around the rock pile. It is expected that the identified eelgrass resources near Spindle Rock in proximity to the landfall sites will be avoided. It is also expected that isolated areas of hard bottom may be avoided, such as at Spindle Rock; however, in areas such as Muskeget Channel where hard bottom extends across the entire corridor, it will not be possible to avoid hard bottom (see Section 3.3.4.2 below for further discussion of potential impacts from cable installation).

The Phase 2 landfall sites have similarly been surveyed to identify any sensitive nearshore habitats. As described in Section 5.2.3 of COP Volume II, a patch of eelgrass was found to the southwest, outside the OECC landfall area of Dowses Beach, at the very end of a video transect. This may indicate the edge of a bed that extends to the southwest or inshore, but does not occur within the OECC.

For each Phase, prior to the start of construction, contractors will be provided with a map of sensitive habitats to allow them to plan their mooring positions accordingly. Vessel anchors and legs will be required to avoid known eelgrass beds and will also be required to avoid other sensitive seafloor habitats (hard/complex bottom) as long as such avoidance does not compromise the vessel's safety or the cable's installation. Where it is considered impossible or impracticable to avoid a sensitive seafloor habitat when anchoring, use of mid-line anchor buoys will be considered, where feasible and considered safe, as a potential measure to reduce and minimize potential impacts from anchor line sweep. Such sensitive habitats are largely absent from the SWDA and are primarily located within portions of the OECC.

Based on information provided by MA Division of Marine Fisheries (DMF), local shellfish constables, commercial fishermen, maps, and studies, the OECC will transverse over suitable shellfish habitat for Atlantic surf clam, blue mussel (*Mytilus edulis*), bay scallop (*Argopecten irradians*), and quahog (*Mercenaria mercenaria*) (NEODP 2021). It has also been reported that species of large gastropod whelks (*Busycon carica* and *Busycotypus canaliculatum*) are abundant in Nantucket Sound coastal waters (Davis and Sisson 1988; USDOE MMS 2009). Impacts to shellfish would result primarily from direct disturbance to the seafloor within the footprint of cable installation activities, as well as temporary sediment suspension and deposition during cable installation and dredging (if required). Shellfish in the direct path of the 1 m (3 ft) wide cable installation trench, the 3 m (10 ft) wide disturbance zone from the cable installation equipment's skids/tracks, areas of dredging (if required), anchors, and vessel legs would also experience direct mortality or injury. Burial and mortality of some shellfish may occur where sediment deposition exceeds 20 mm (0.8 in). Sediment dispersion modeling results indicate that lethal deposition levels are not expected from cable installation activities and are only expected from dredging and dumping in small, localized areas along the OECC extending up to 900 m (0.49 NM) from the route centerline. Modeling showed that suspended sediments from dredging and cable installation activities within the OECC (including the Western Muskeget Variant) settle out of suspension within three to six hours, which is well below lethal thresholds (see Appendix III-A of COP Volume III and Sections 6.5 and 6.6 of COP Volume III).

To assess impacts to marine and coastal benthic habitat, the Proponent is committed to developing an appropriate benthic monitoring framework for New England Wind, should it be necessary, in consultation with BOEM and other agencies as appropriate (see Section 3.3.3). See Appendix III-U for the draft framework.

Coastal Freshwater Streams, Ponds, and Wetlands

Wetlands impacts along the Phase 1 and Phase 2 onshore routes will largely be limited to LSCSF, riverfront area (RFA), and paved areas within the beach system. Additionally, Variant 2 of the Phase 1 Oak Street Onshore Export Cable Route may affect bordering vegetated wetland (BVW), but a trenchless crossing would likely be used to avoid any impact if that variant is used. The Phase 1 Onshore Export Cable Route from the landfall site to the onshore substation site will cross the Centerville River; the parallel utility bridge option would have some direct impacts within and adjacent to the river, but the trenchless crossing options would avoid any direct impacts to the river. The Phase 2 onshore cables may traverse wetlands or waterbodies, depending on the final Onshore Export Cable Route(s) and Grid Interconnection Route(s) selected. Specialty trenchless crossing methods are expected to be used if the Phase 2 Onshore Export Cable Route(s) and Grid Interconnection Route(s) traverse wetlands or waterbodies in order to avoid impacts to those features.

To protect wetlands and waterways, it is expected that nearly all vehicle fueling, and all major equipment maintenance, will be performed offsite at commercial service stations or a contractor's yard. Field refueling will not be performed within 30 meters (m) (100 feet [ft]) of wetlands or waterways, within 30 m (100 ft) of known private or community potable wells, or

within any Town of Barnstable water supply Zone I area. Proper spill containment gear and absorption materials will be maintained for immediate use in the event of any inadvertent spills or leaks.

No changes to topography are proposed within LSCSF, except the limited permanent footprint of the utility bridge abutments for the Centerville River crossing (if used for Phase 1). Further, no above-ground structures are proposed except for the Centerville River crossing, where a parallel utility bridge may be constructed (see Section 3.3.1.10.2 of COP Volume I). Phase 1 and Phase 2 will have no effect on flood velocities or floodplain storage capacity. Further, New England Wind will protect wetland interests by complying with all performance standards identified in the Massachusetts WPA and the terms and conditions of the applicable municipal Conservation Commissions. Further detail can be found in Section 6.1 of COP Volume III.

Habitat Policy #2

Advance the restoration of degraded or former habitats in coastal and marine areas.

As noted above, the coastal and marine resource areas located in and near New England Wind are generally not degraded and provide the beneficial functions that are protected interests of the Massachusetts WPA. As described under Habitat Policy #1, New England Wind is designed to avoid impacts to wetland resource areas to the maximum extent practicable and to minimize and mitigate unavoidable impacts in accordance with applicable federal, state, and local regulations. Through careful route selection and the use of proper construction techniques such as HDD and other trenchless crossings, New England Wind will not permanently degrade any wetland resource areas.

Ocean Resources

Ocean Resources Policy #1

Support the development of sustainable aquaculture, both for commercial and enhancement (public shellfish stocking) purposes. Ensure that the review process regulating aquaculture facility sites (and access routes to those areas) protects significant ecological resources (salt marshes, dunes, beaches, barrier beaches, and salt ponds) and minimizes adverse effects on the coastal and marine environment and other water-dependent uses.

New England Wind is not an aquaculture project; therefore, this policy does not apply.

Ocean Resources Policy #2

Except where such activity is prohibited by the Ocean Sanctuaries Act, the Massachusetts Ocean Management Plan, or other applicable provision of law, the extraction of oil, natural gas, or marine minerals (other than sand and gravel) in or affecting the coastal zone must protect marine resources, marine water quality, fisheries, and navigational, recreational, and other uses.

New England Wind does not involve extracting oil, natural gas, or marine minerals; therefore, this policy does not apply.

Ocean Resources Policy #3

Accommodate offshore sand and gravel extraction needs in areas and in ways that will not adversely affect marine resources, navigation, or shoreline areas due to alteration of wave direction and dynamics. Extraction of sand and gravel, when and where permitted, will be primarily for the purpose of beach nourishment or shoreline stabilization.

New England Wind does not involve offshore sand and gravel extraction; therefore, this policy does not apply.

Port and Harbors

Ports and Harbors Policy #1

Ensure that dredging and disposal of dredged material minimize adverse effects on water quality, physical processes, marine productivity, and public health and take full advantage of opportunities for beneficial re-use.

New England Wind involves some limited dredging within the OECC[9] to ensure sufficient cable burial depth in areas of the seafloor affected by sand waves (see Section 3.3.4.2). For both offshore export cables combined (Phase 1), dredging may impact approximately 0.21 km^2 (52 acres)[10] along ~15.3 km (~8.3 NM) and may include up to approximately 134,800 cubic meters (176,300 cubic yards) of dredged material. For three offshore export cables combined (Phase 2), dredging may impact approximately 0.27 km^2 (67 acres)[11] along ~19.4 km (~10.5 NM) and may include up to approximately 180,000 cubic meters (235,400 cubic yards) of dredged material. If the Western Muskeget Variant is used for Phase 2, there will be either (1) one export cable installed in the Western Muskeget Variant and two export cables installed in the OECC or (2) two export cables installed in the Western Muskeget Variant and one export cable installed in the OECC. In either scenario involving the Western Muskeget Variant, dredging may impact

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9 Based on preliminary survey data for the SWDA, dredging may not be necessary prior to inter-array or inter-link cable laying, but this will be confirmed through additional data analyses.

10 Since the dredging area will overlap with the 1 m (3.3 ft) wide cable installation trench and 3 m (10 ft) wide temporary disturbance zone from the tracks or skids during cable installation (see Section 3.3.1.3.6 of COP Volume I), these areas have been subtracted from the dredging area to avoid double-counting impacts. The total dredging area including the cable installation trench is approximately 0.27 km^2 (67 acres).

11 Since the dredging area will overlap with the 1 m (3.3 ft) wide cable installation trench and 3 m (10 ft) wide temporary disturbance zone from the tracks or skids during cable installation (see Section 4.3.1.3.6 of COP Volume I), these areas have been subtracted from the dredging area to avoid double-counting impacts. The total dredging area including the cable installation trench is approximately 0.35 km^2 (86 acres).

approximately up to 0.30 km^2 (73 acres)[12] along up to ~21.1 km (~11.3 NM) and may include up to approximately 210,100 cubic meters (274,800 cubic yards) of dredged material. Actual dredge volumes will depend on the final offshore export cable alignments and cable installation method(s); a cable installation method that can achieve a deeper burial depth will require less dredging. As described in Section 3.3.4.2, bottom dumping of dredged material would only occur within sand waves.

Simulations of sand wave dredging using a trailing suction hopper dredge (TSHD) and associated disposal activities along the OECC (including the Western Muskeget Variant) show that above-ambient total suspended solids (TSS) originating from the source is intermittent along the route, matching the intermittent need for dredging. Above-ambient TSS concentrations may be present throughout the entire water column since sediments are released at or near the water surface.

Above-ambient TSS concentrations of 10 mg/L extend up to a maximum of 16 kilometers (km) (8.6 NM) from the area of activity for the TSHD model scenarios; however, concentrations greater than 10 mg/L persist less than six hours, which is well below any lethal thresholds. Deposition greater than 1 mm (0.04 in) associated with the TSHD drag arm is mainly constrained to within 150 m (492 ft) of the area of activity, whereas the same deposition thickness associated with overflow and dredged material release extends greater distances from the source, resulting in deposition mainly within 1 km (0.6 mi) but extending up to 2.3 km (1.4 mi) in isolated patches when subject to swift currents through Muskeget Channel. TSHD disposal, which releases the entire hopper of sediment in one location, results in areas with deposition of 100 mm (4 in) or greater, which is substantially greater than the cable installation scenarios.

Due to the largely coarse-grained nature of surficial sediments within the OECC, any New England Wind-generated turbidity related to cable installation or HDD at the landfall sites is expected to be temporary and limited in spatial scope (see the discussion under Water Quality Policy #2). Additional discussion of sediment dispersion modeling is provided in Section 5.2.2 of COP Volume III and Appendix III- A.

Ports and Harbors Policy #2

Obtain the widest possible public benefit from channel dredging and ensure that Designated Port Areas and developed harbors are given highest priority in the allocation of resources.

New England Wind does not involve dredging any navigation channels or Designated Port Areas (DPAs); therefore, this policy does not apply. However, although New England Wind itself is not located in a DPA, the Proponent may utilize a number of port facilities, some of which are located

[12] Since the dredging area will overlap with the 1 m (3.3 ft) wide cable installation trench and 3 m (10 ft) wide temporary disturbance zone from the tracks or skids during cable installation (see Section 4.3.1.3.6 of COP Volume I), these areas have been subtracted from the dredging area to avoid double-counting impacts.

within DPAs. Ports that may be utilized to support Phase 1 and Phase 2 activities are identified in Sections 3.2.2.5, 3.2.2.6, 4.2.2.5, and 4.2.2.6 of COP Volume I. It should be noted that not all listed ports will be utilized for New England Wind activities.

Ports and Harbors Policy #3

Preserve and enhance the capacity of Designated Port Areas to accommodate water-dependent industrial uses and prevent the exclusion of such uses from tidelands and any other DPA lands over which an EEA agency exerts control by virtue of ownership or other legal authority.

Although New England Wind itself is not located within a DPA, it may utilize a number of port facilities, some of which are located within DPAs (see Ports and Harbors Policy #2 for more information).

Ports and Harbors Policy #4

For development on tidelands and other coastal waterways, preserve and enhance the immediate waterfront for vessel-related activities that require sufficient space and suitable facilities along the water's edge for operational purposes.

New England Wind will have no impact on the availability of the waterfront for vessel-related activities except for brief periods during construction. The Proponent is identifying a wide range of ports that could be used for each Phase. It is not expected that all the ports identified would be used; it is more likely that only some ports would be used during construction depending upon final commercial agreements and construction logistics planning. By identifying a wide range of ports, the Proponent expects to avoid or minimize any potential conflicts over port usage with other northeast offshore wind developers. See Section 7.7 of COP Volume III for further discussion of New England Wind's potential impacts on coastal infrastructure.

Ports and Harbors Policy #5

Encourage, through technical and financial assistance, expansion of water-dependent uses in Designated Port Areas and developed harbors, re-development of urban waterfronts, and expansion of physical and visual access.

New England Wind's facilities are not located in a DPA, developed harbor, or urban waterfront; therefore, this policy does not apply. However, although New England Wind itself is not located within a DPA, it may utilize a number of port facilities, some of which are located within DPAs.

Protected Areas

Protected Areas Policy #1

Preserve, restore, and enhance coastal Areas of Critical Environmental Concern, which are complexes of natural and cultural resources of regional or statewide significance.

New England Wind is not located within or in the immediate vicinity of any ACECs and will therefore not have any adverse impacts on ACECs. Thus, New England Wind complies with this policy.

Protected Areas Policy #2

Protect state designated scenic rivers in the coastal zone.

New England Wind is not located in or near any state designated scenic rivers; therefore, this policy does not apply.

Protected Areas Policy #3

Ensure that proposed developments in or near designated or registered historic places respect the preservation intent of the designation and that potential adverse effects are minimized.

Terrestrial and marine cultural resources management (CRM) archaeological studies, field investigations, and assessments of the visual impact assessments of New England Wind on historic resources have been conducted by qualified independent CRM professionals on behalf of the Proponent. The studies are designed to identify cultural and historic resources that may be affected by New England Wind activities and are approved in advance by applicable regulatory agencies. Details of relevant studies and findings can be found in Section 7.3 (Cultural, Historical, and Archaeological Resources); Section 7.4 (Visual Resources), Appendix III-G (Preliminary Terrestrial Archaeological Resources Report and Permit Applications), Appendix III-H.a (Visual Impact Assessment), Appendix III-H.b (Historic Properties Visual Impact Assessment), and Volume II-D (Marine Archaeological Resources Assessment).

Avoidance, minimization, and mitigation measures for terrestrial and submarine historical and archaeological resources will be determined in consultation with BOEM, Massachusetts Historical Commission (MHC), tribes, and other relevant consulting parties through the Section 106 and NEPA processes.

Public Access

Public Access Policy #1

Ensure that development (both water-dependent or nonwater-dependent) of coastal sites subject to state waterways regulation will promote general public use and enjoyment of the water's edge, to an extent commensurate with the Commonwealth's interests in flowed and filled tidelands under the Public Trust Doctrine.

Other than the construction of new onshore substations located several kilometers inland from the shoreline, New England Wind does not involve above-ground development of coastal sites and will only use coastal sites at the water's edge for landfall sites (see Coastal Hazard Policy #1 for a description of potential crossing options at the Centerville River). Construction at the Phase

1 and Phase 2 landfall sites and along the onshore cable routes may temporarily limit pedestrian access to limited areas and cause temporary noise and dust. To mitigate temporary impacts, the Proponent will adhere to the general summer limitations on construction activities on Cape Cod for Phase 1 and Phase 2. Activities at the landfall site where transmission will transition from offshore to onshore are not expected to be performed during the months of June through September unless authorized by the Town of Barnstable. Activities along the Onshore Export Cable Route and Grid Interconnection Route (particularly where the route follows public roadway layouts) will also likely be subject to significant construction limitations from Memorial Day through Labor Day unless authorized by Barnstable but could extend through June 15 subject to consent from the Department of Public Works (DPW). The Proponent will also consult with the Town of Barnstable regarding the construction schedules for both Phases.

For Phase 1, beach disturbance at the landfall site will largely be avoided through the use of HDD, which will allow the cables to pass under the beach, intertidal zone, and nearshore areas. The cables will come ashore in an existing paved parking area or other previously disturbed area and further avoid disturbing the beach. For Phase 2, For Phase 2, the Dowses Beach Landfall Site would also use HDD and the Wianno Avenue Landfall Site would use HDD or open trenching. However, the Proponent only expects to use the Wianno Avenue Landfall Site if unforeseen challenges arise that make it infeasible to use the Dowses Beach Landfall Site to accommodate all of some of the Phase 2 offshore export cables. Wianno Avenue is less suited for HDD due to the elevated onshore topography and slope of the parking lot. This landfall site is suitable for open trenching because the shoreline has already been altered by the installation of a riprap seawall, a portion of which would be temporarily removed and replaced following cable installation. Because the infrastructure proposed at the landfall site and in nearshore areas will be buried, New England Wind is not expected to cause any long-term impacts to the public's use or enjoyment of the area.

Public Access Policy #2

Improve public access to existing coastal recreation facilities and alleviate auto traffic and parking problems through improvements in public transportation and trail links (land- or water-based) to other nearby facilities. Increase capacity of existing recreation areas by facilitating multiple use and by improving management, maintenance, and public support facilities. Ensure that the adverse impacts of developments proposed near existing public access and recreation sites are minimized.

The Proponent's onshore construction schedule minimizes impacts to existing public access and recreation sites to the greatest extent practicable by limiting onshore construction activities during peak summer months and other times when demands on these resources are elevated. Specifically for Phase 1 and Phase 2, temporary construction activities at the landfall site are not expected to be performed during the months of June through September, unless authorized by the Town of Barnstable, which would minimize impacts to recreational use by the public. The Proponent will restore the Phase 1 and Phase 2 landfall sites to match existing conditions. Any paved areas that have been disturbed will be properly repaved.

Prior to construction, the Proponent will work closely with the Town of Barnstable to develop a Traffic Management Plan (TMP) for construction for Phase 1 and Phase 2. The TMP will be submitted for review and approval by appropriate municipal authorities (typically DPW/Town Engineer and Police). The TMP will be a living document such that any unanticipated change in construction location, timing, or method previously identified will result in revision of the TMP and approval by the appropriate authorities before any construction changes are implemented. The Proponent will utilize various methods of public outreach prior to and during construction to keep residents, business owners, and officials updated on the construction schedules, vehicular access, lane closures, detours, and other traffic management information, local parking availability, emergency vehicle access, construction crew movement and parking, laydown areas, staging, and equipment delivery, nighttime or weekend construction, and road repaving.

An HCA with the Town of Barnstable was executed on May 6, 2022, which provides funding to the Town to offset potential impacts associated with hosting the onshore facilities for Park City Wind. See Section 4.1.2 of COP Volume III for additional information regarding the HCA.

Public Access Policy #3

Expand existing recreation facilities and acquire and develop new public areas for coastal recreational activities, giving highest priority to regions of high need or limited site availability. Provide technical assistance to developers of both public and private recreation facilities and sites that increase public access to the shoreline to ensure that both transportation access and the recreation facilities are compatible with social and environmental characteristics of surrounding communities.

New England Wind will not significantly interfere with existing recreational facilities. See Public Access Policy #2.

Water Quality

Water Quality Policy #1

Ensure that point-source discharges and withdrawals in or affecting the coastal zone do not compromise water quality standards and protect designated uses and other interests.

New England Wind does not propose any new point-source discharges within state waters. Limited withdrawals during construction may include water for offshore cable installation and vessel functions (e.g. for bilge/ballast water). These modest and temporary water withdrawals are not anticipated to have any meaningful impact on water quality. The Proponent will comply with the conditions contained in each Phase's Water Quality Certification under Section 401 of the Clean Water Act.

Water Quality Policy #2

Ensure the implementation of nonpoint source pollution controls to promote the attainment of water quality standards and protect designated uses and other interests.

New England Wind will not alter existing stormwater volumes or drainage patterns. Onshore construction-period sedimentation and erosion controls will be implemented. Since Phase 1 onshore construction will disturb more than one acre of land, a National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater will be obtained. A NPDES General Permit for Stormwater will likely be obtained for Phase 2 as well. As noted under Habitat Policy #1, field refueling will not be performed within 30 meters (m) (100 feet [ft]) of wetlands or waterways, within 30 m (100 ft) of known private or community potable wells, or within any Town of Barnstable water supply Zone I area. Proper spill containment gear and absorption materials will be maintained for immediate use in the event of any inadvertent spills or leaks. Any Phase 1 or Phase 2 onshore substation equipment will be equipped with full containment for any components containing dielectric fluid.

The Proponent will require all vessels to comply with regulatory requirements related to the prevention and control of discharges and the prevention and control of accidental spills. The Proponent has also developed a draft Oil Spill Response Plan for New England Wind, which is included in Appendix I-F. Measures to minimize the already-remote potential for seafloor disturbance through HDD drilling fluid seepage (i.e., frac-out) are described in Section 8.6 of COP Volume III.

Offshore cable installation and dredging will result in some temporary elevated turbidity, but sediment is expected to remain relatively close to the installation activities. For offshore export cable installation within the OECC (including the Western Muskeget Variant), TSS concentrations greater than 10 mg/L typically stayed within 200 m (656 ft) of the alignment but could extend a maximum distance of approximately 2.1 km (1.1 NM). The modeling showed that most of the sediment settles out in less than three to four hours. Simulations of typical cable installation parameters (without sand wave removal) in the OECC indicated that deposition of 1 mm (0.04 in) or greater (i.e., the threshold of concern for demersal eggs) was constrained to within 100 m (328 ft) from the route centerline and maximum deposition was typically less than 5 mm (0.20 in), though there was a small isolated area associated with the vertical injector model scenario with deposition between 5 to 10 mm (0.2 to 0.4 in). A summary of the sediment dispersion modeling results for dredging is provided under Ports and Harbors Policy #1. Additional discussion of sediment dispersion modeling is provided in Section 5.2.2 of COP Volume III and Appendix III-A.

Water Quality Policy #3

Ensure that subsurface waste discharges conform to applicable standards, including the siting, construction, and maintenance requirements for on-site wastewater disposal systems, water quality standards, established Total Maximum Daily Load limits, and prohibitions on facilities in high-hazard areas.

New England Wind does not propose any subsurface waste discharges; therefore, this policy is not applicable.

3.3 Supplemental Information Related to the Massachusetts Ocean Management Plan

The Massachusetts Ocean Management Plan (OMP) is incorporated into the Massachusetts Coastal Zone Management Plan. Thus, New England Wind activities with reasonably foreseeable effects on the Massachusetts coastal zone must also comply with and be conducted in a manner consistent with the OMP.

In consultation with MA CZM, the Proponent is providing supplemental information related to key Special, Sensitive, or Unique (SSU) resources and concentrations of water-dependent uses for community-scale wind facilities such as commercial fishing, recreational fishing, and important bird habitat. A full review of consistency with the OMP is provided for Phase 1 as part of the New England Wind 1 Connector Energy Facilities Siting Board (EFSB) Petition and is expected to be provided for Phase 2 as part of a future EFSB petition.

3.3.1 Commercial Fishing

We understand from MA CZM that a principal coastal effect of concern associated with the New England Wind development is to Massachusetts-based commercial fishing interests (a coastal use). Section 7.6 of COP Volume III (Commercial Fisheries and For-Hire Recreational Fishing) provides a thorough analysis of New England Wind's potential impacts to commercial fisheries and measures to mitigate those impacts. Impact producing factors evaluated include habitat alteration, vessel traffic, cable installation/maintenance (including impacts from cable protection), navigation hazard, and fish aggregation.

Other sections of the New England Wind COP most relevant to these issues are located in Volume III and include Section 6.5 (Benthic Resources), Section 6.6 (Finfish and Invertebrates), Section 7.5 (Recreation and Tourism [Including Recreational Fishing]), Section 7.8 (Navigation and Vessel Traffic), Section 7.9 (Other Uses), Appendix III-E (Fisheries Communication Plan), Appendix III-F (Essential Fish Habitat), Appendix III-I (Navigation Safety Risk Assessment), and Appendix III-N (Economic Exposure of Commercial Fisheries).

As summarized in Section 4 and detailed in Section 7.6 of COP Volume III, the Proponent is already implementing measures to avoid and minimize impacts to commercial fishing interests, including adopting the east-west 1 x 1 NM layout strongly recommended by commercial fishermen, minimizing the potential need for cable protection, and conducting fisheries studies to obtain baseline data against which to measure potential short and long-term fisheries impacts. In addition, Appendix III-N of the COP contains a draft analysis of the value of commercial fishing harvest from New England Wind based on the most recent available data. Each of these measures is discussed in more detail below. Accordingly, it is anticipated that New England Wind will not have a significant adverse impact on commercial fishing in the Massachusetts coastal zone.

3.3.1.1 WTG and ESP Siting

The SWDA is within the MA WEA. The original siting of the MA WEA by BOEM included a significant public engagement process. Through this process, and in response to stakeholder concerns, the MA WEA was extensively modified. BOEM excluded areas of high fisheries value from the MA WEA to reduce potential conflict with commercial and recreational fishing activities. This careful siting of MA WEA, which includes the SWDA, avoids many impacts to commercial fisheries.

3.3.1.2 WTG and ESP Layout

In direct response to input from regional commercial fishermen and maritime users during review of the adjacent Vineyard Wind 1 project, the WTGs, and ESPs in the SWDA will be oriented in fixed east-to-west rows and north-to-south columns with one nautical mile (1.85 km) spacing between WTG/ESP positions. This uniform grid layout provides 1 NM wide corridors in the east-west and north-south directions as well as 0.7 NM (1.3 km) wide corridors in the northwest-southeast and northeast-southwest directions. The Proponent expects this 1 x 1 NM layout to be adopted by other developers throughout the MA WEA and Rhode Island/Massachusetts Wind energy Area (RI/MA WEA) as described in the November 1, 2019, letter sent by New England offshore wind leaseholders to the USCG.

It is important to note that offshore renewable wind energy facilities are typically designed to maximize the amount of energy that can be generated within a given area. In general, the most optimal WTG layout for wind energy production is a non-grid WTG layout with closer turbine spacing and a higher density of WTGs around the edges of the wind farm; such a design maximizes the number of WTGs per area while minimizing wake effects that impact the efficiency of downwind turbines. Thus, the Proponent has modified the WTG/ESP layout from a more typical, optimized non-grid design to minimize adverse impacts to commercial fishing operations.

In addition to minimizing adverse impacts to commercial fisheries, the 1 x 1 NM WTG/ESP layout of New England Wind minimizes potential impacts to navigation within the SWDA. The 1 x 1 NM layout of New England Wind is consistent with the USCG's recommendations contained in the Massachusetts Rhode Island Port Access Route Study (MARIPARS) published in the Federal Register on May 27, 2020 (USCG-2019-0131). The final MARIPARS found that, "After considering all options and the vessel traffic patterns within the MA/RI WEA, a standard and uniform grid pattern with at least three lines of orientation throughout the MA/RI WEA would allow for safe navigation and continuity of USCG missions through seven adjacent wind farm lease areas over more than 1400 square miles of ocean." More specifically, USCG recommended:

- "Lanes for vessel transit should be oriented in a northwest to southeast direction, 0.6 NM to 0.8 NM wide. This width will allow vessels the ability to maneuver in accordance with the COLREGS while transiting through the MA/RI WEA.

- Lanes for commercial fishing vessels actively engaged in fishing should be oriented in an east to west direction, 1 NM wide.

- Lanes for USCG SAR operations should be oriented in a north to south and east to west direction, 1 NM wide. This will ensure two lines of orientation for USCG helicopters to conduct SAR operations."

The USCG specifically recognized traditional commercial fishing patterns when making their recommendations on WTG layouts within the MA WEA and RI/MA WEA (together the "WEAs"). As stated in MARIPARS:

> "Based on fishing vessel tracks, specifically squid, mackerel, and butterfish vessels, there is significant east to west fishing activity in the WEA, particularly in August and September, following the north to south migration of the fish. Based on comments received on this report, there is a 'gentlemen's agreement' between the fixed gear fishermen and the mobile gear fishermen to prevent gear entanglement. The fixed gear fishermen set their gear along traditional LORAN-C lines that are generally in an east to west direction. The mobile gear fishermen fish in functional lanes between the set fixed gear, in a general east to west direction."

Based on these findings and recommendations from the USCG, the proposed layout is expected to accommodate traditional fishing patterns, including the "gentlemen's agreement" regarding the placement of mobile and fixed gear within the WEAs.

As described in Section 7.8.1 of COP Volume III and the Navigation Safety Risk Assessment, analyses of automatic identification system (AIS) data from 2016 to 2019 have indicated that historical vessel traffic levels within the SWDA are relatively low. From 2016 to 2019, the average number of annual fishing vessel transits through the SWDA was 422 (see Appendix III-I). AIS data indicate that most of the vessels transiting the Offshore Development Region[13] currently choose to navigate outside of the MA WEA and RI/MA WEA even when no WTGs or ESPs are present (see Section 7.8.1.1 of COP Volume III; Baird 2019). Of those vessels transiting the WEAs, many travel just inside the edge of the WEAs. Overall, based on this historical low level of traffic in the SWDA, the risk of collision between vessels is relatively low (see Section 8.1 of COP Volume III and Appendix III-I).

With the exception of New Bedford, key Massachusetts commercial fishing ports described in Section 7.6.1.1 of COP Volume III are not expected to be used for New England Wind activities and should not experience direct impacts such as increased traffic congestion or competition for dockside services. Near port facilities or adjacent waterways, New England Wind vessels may require other vessels transiting navigation channels or other areas of confined navigation (e.g. the

[13] With respect to navigation and vessel traffic, the Offshore Development Region is the broader offshore geographic region surrounding the SWDA, the OECC, and ports that could be affected by New England Wind-related activities. This includes Nantucket Sound, areas south of Martha's Vineyard and Nantucket, the MA WEA, the RI/MA WEA, and waters surrounding potential vessel routes to the ports identified for use by New England Wind.

New Bedford hurricane barrier) to adjust course, where possible, or adjust their departure/arrival times to avoid navigational conflicts. However, with the mitigation measures described in Section 3.3.1.6, the increased vessel traffic is not anticipated to result in significant disruption of vessel traffic in and around the ports.

3.3.1.3 Scour Protection and Cable Protection

Scour protection consisting of rock material may be placed around the base of each WTG and ESP foundation. It is anticipated that scour protection will be needed for the larger diameter monopiles and suction buckets, but may or may not be needed for the smaller diameter piles used for jacket and bottom-frame foundations. Scour protection will have a maximum height of 3 m (9.8 ft). Depending on the foundation type(s) selected, the maximum area of scour protection around each foundation ranges from 4,072–9,754 m^2 (1.0-2.4 acres) for the WTG foundations and 4,072–21,316 m^2 (1.0–5.3 acres) for one to five ESP foundations. Details of the specific area of scour protection for each foundation type are found in Sections 3.2.1.4 and 4.2.1.4 of COP Volume I. For WTG monopile foundations, which are expected to be used for Phase 1 and may also be used for Phase 2, the maximum expected radius of scour protection is 36–39 m (118–128 ft) compared to the 1,852 m (1 NM) spacing between foundations. The total maximum area of scour protection for both Phases is 1.04 km^2 (258 acres), which is approximately 0.23% of the maximum size of the SWDA. Thus, scour protection will cover an extremely limited portion of the SWDA.

The installation of submarine cables within the SWDA and along the OECC is not anticipated to adversely impact commercial fishing activities. The target burial depth for all inter-array, inter-link, and offshore export cables is 1.5–2.5 m (5–8 ft) below the seafloor, which engineers have determined is more than twice the burial depth that is required to protect the cables from potential fishing activities and also provides a maximum of 1 in 100,000 year probability of anchor strike, which is considered a negligible risk. Except for limited areas where the sufficient cable burial is not achieved and placement of cable protection on the seafloor is required, the inter-array, export, and offshore cables are not anticipated to interfere with any typical fishing practices.

If sufficient burial depths cannot be achieved, the cables need to cross other infrastructure (e.g. existing cables, pipes, etc.), or a cable joint requires protection, cable protection may be necessary. Based on initial survey data for the SWDA, it is conservatively estimated that up to 2% of the total length of the inter-array and inter-link cables (~11 km [6 NM]) for both Phases may potentially require cable protection, with the majority of any needed cable protection likely located immediately adjacent to the foundation's scour protection. The Proponent conservatively estimates that approximately 6% of the offshore export cables within the OECC for both Phases (or up to 7% of the offshore export cables within the OECC for both Phases if the Western Muskeget Variant is used for one or two Phase 2 export cables) and approximately 2% of the offshore export cables within the SWDA (~27 km [15 NM] total) could require cable protection. The Proponent intends to avoid or minimize the need for cable protection to the greatest extent feasible through careful site assessment and thoughtful selection of the most appropriate cable installation tool to achieve sufficient burial; therefore, the estimates of cable protection are

expected to be conservative. Given that little bottom trawling or dredging occurs along the OECC, the risk of bottom fishing gear snagging on cable protection in the OECC is low. The use of pots and traps, predominantly deployed along the OECC within Nantucket Sound in Massachusetts waters, is not expected to be impacted by New England Wind.

Fishermen have expressed concerns about fishing gear becoming entangled on scour protection and cable protection. Should cable protection be required in the SWDA and OECC, it will be designed to minimize impacts to fishing gear to the extent feasible, and fishermen will be informed of the areas where cable protection is used. Upon decommissioning, scour protection would be removed. Furthermore, the Proponent is developing and implementing procedures for handling compensation to fishermen for potential gear loss. See the Fisheries Communication Plan, which is included as Appendix III-E of the COPs, for additional discussion of gear loss compensation.

The addition of foundations and scour protection, as well as cable protection in some areas, which may act as an artificial reef and provide rocky habitat previously absent from the area, could result in modest, positive impacts to recreational fisheries. In the event WTGs aggregate recreationally-targeted species, based on the intensity of recreational fishing within the SWDA and its geographic scale, neither congestion effects nor gear conflicts are expected.

3.3.1.4 Access to the SWDA and OECC

For each Phase of New England Wind, construction and installation activities will occur within very limited and well-defined areas of the SWDA and along the OECC. During construction, fishing vessels will not be precluded from operating in or transiting through the SWDA or the OECC other than where temporary safety buffer zones are established in the immediate vicinity around construction and installation vessels. Accordingly, the majority of the SWDA and OECC will remain accessible to commercial fishing vessels throughout the construction of New England Wind.

During O&M, the SWDA will be open to marine traffic, and no permanent vessel restrictions are proposed within the SWDA or along the OECC. If in-water maintenance activities are required, there could be temporary safety buffer zones established around work areas in limited areas of the SWDA or along the OECC. However, it is expected that most maintenance activities will not require in-water work but will instead be based on the WTGs and ESP structures themselves.

3.3.1.5 Economic Exposure and Impacts to Massachusetts Commercial Fisheries

While the Proponent is implementing several key measures to minimize impacts to commercial fisheries (such as the adoption of a 1 x 1 NM WTG/ESP layout and efforts to minimize cable protection), New England Wind may lead to potential changes in commercial fishing practices in the SWDA and OECC. The economic exposure and potential economic impacts to commercial fisheries, including Massachusetts-based commercial fisheries, are analyzed in detail in Appendix III-N. This draft analysis considers the potential direct impacts to commercial fisheries, as well as fisheries-related indirect and induced shoreside economic impacts, which are characterized as

either upstream (related to businesses that supply inputs used in fishing) or downstream (related to businesses that buy fish for processing or distribution). The analysis is based on the most current available revenue data, including the National Oceanic and Atmospheric Administration's (NOAA) Fisheries' "Socioeconomic Impacts of Atlantic Offshore Wind Development," which indicates that the SWDA does not include high-value commercial fishing grounds. It also shows that approximately 45.21% of the landings revenue from the SWDA is from Massachusetts.

A number of factors suggest that any economic impact from New England Wind will be only a small percentage of the estimated economic exposure (i.e., a measure of fishing that occurs within the SWDA). Commercial fishing vessels will continue to have access to the SWDA and OECC as currently permitted by regulation and the east-west 1 x 1 NM layout is expected to accommodate traditional fishing patterns, including the "gentlemen's agreement" regarding the placement of mobile and fixed gear within the WEA. In addition, alternative fishing grounds with a demonstrated higher fishery revenue density are available nearby and may be fished at little to no additional cost.

Fishing congestion impacts could occur when a high concentration of vessels operating in a fishing area causes fishing vessels and gear to interfere with one another resulting in increases in fleetwide or vessel-specific fishing costs or reductions in fishing revenues, or both. As described in Appendix III-N, any modification of fishing in the SWDA and OECC or shifts in fishing effort from those areas to other areas would not be sufficient to cause fishing congestion impacts. Commercial fishing activity in the SWDA and OECC is low to modest, and fishing trips that transect the SWDA and OECC already spend most of their time and generate most of their revenues in nearby fishing areas outside the SWDA and OECC.

3.3.1.6 Avoidance, Minimization, and Mitigation Measures

As noted above, vessel restrictions are not generally proposed other than temporary safety buffer zones in the immediate vicinity of construction and installation vessels. Accordingly, the majority of the SWDA and OECC will remain accessible to commercial fishing vessels throughout the construction and O&M.

New England Wind's 1 x 1 NM WTG/ESP layout is the result of input from numerous stakeholders, including the USCG and fishermen who use or transit the SWDA, and is expected to accommodate traditional fishing patterns. To aid mariners navigating the SWDA, each WTG/ESP will be maintained as a PATON in accordance with USCG's PATON marking guidance for offshore wind facilities in First District-area waters. The Proponent will implement a uniform system of marine navigation lighting and marking for New England Wind's offshore facilities, which is currently expected to include yellow flashing lights on every WTG foundation, ESP, unique alphanumeric identifiers on the WTGs, ESPs, and/or their foundations, and high-visibility yellow paint on each foundation. The lights and alphanumeric identifiers would be visible from all directions. Mariner Radio Activated Sound Signals (MRASS) and AIS transponders are included in the offshore facilities' design to enhance marine navigation safety.

To minimize hazards to navigation, all New England Wind vessels and equipment will display the required navigation lighting and day shapes. The Proponent will issue Offshore Wind Mariner Update Bulletins and coordinate with the USCG to provide Notices to Mariners (NTMs) to notify recreational and commercial vessels of their intended operations within the Offshore Development Area (i.e., where New England Wind's offshore facilities are physically located, which includes the SWDA and the OECC).

To further minimize impacts, the Proponent has developed a Fisheries Communication Plan (FCP) (included as Appendix III-E of the COP). The purpose of the FCP is to define outreach and engagement to potentially affected fishing interests during design, development, construction, operation, and final decommissioning of offshore wind projects. Fisheries communication is conducted through several roles, including Fisheries Liaisons (FLs) and Fisheries Representatives. FLs are employed by the Proponent and are responsible for the implementation of the FCP whereas FRs represent the interests of different fisheries and fishing communities to the Proponent. The Proponent also employs a Marine Operations Liaison Officer, who is responsible for safe marine operations by the Proponent. In addition, in an effort to provide fishermen with the most accurate and precise information on work within the SWDA and along the OECC, the Proponent is currently providing and will continue to provide portable digital media with electronic charts depicting locations of New England Wind-related activities. Each WTG and ESP will also be clearly identified on NOAA charts. Finally, as stated above, the Proponent is developing and implementing procedures for handling compensation to fishermen for potential gear loss. Additional information is provided in Appendix III-E.

As described in Section 3.3.3 below, the Proponent is committed to fisheries science and research as it relates to offshore wind energy development. The Proponent is already collecting pre-construction fisheries data (via trawl and drop camera surveys) within the SWDA.

In summary, the Proponent is already implementing multiple measures to avoid and minimize impacts to commercial fisheries, most notably the adoption of an east-west 1 x 1 NM layout.

3.3.2 Recreational Fishing

Section 7.5 (Recreation and Tourism [Including Recreational Fishing]) and Section 7.6 (Commercial Fisheries and For-Hire Recreational Fishing) of COP Volume III provide a thorough analysis of New England Wind's potential impact to recreational fisheries, including for-hire reactional fishing, and measures to mitigate those impacts. A brief summary is provided below.

3.2.2.1 Potential Impacts

With respect to recreational fishing, impact producing factors evaluated include habitat alteration, vessel traffic, cable installation/maintenance (including impacts from cable protection), navigation hazard, and fish aggregation.

During construction of New England Wind, the construction vessels operating in the SWDA and along the OECC may temporarily preclude recreational boating and fishing activities in the immediate vicinity of construction vessels or cause recreational fishermen to slightly alter their navigation routes. Construction activities may affect recreational fishing activities by impacting recreationally-important species. While the SWDA is targeted by recreational fishermen, other areas within and outside the MA WEA and RI/MA WEA have higher concentrations of recreational fishing activity (Kneebone and Capizzano 2020). The proximity of the SWDA and OECC to numerous productive recreational fishing areas suggests that the highly localized impacts of construction and installation activities will result in only minimal impacts to recreational species.

During O&M, recreational fisheries may be impacted by fish aggregation and potential navigation hazards due to the presence of structures in the Offshore Development Area. As noted under Section 3.3.1.2, the 1 x 1 NM WTG/ESP layout will facilitate safe navigation through the SWDA. Given the typically smaller size of recreational vessels, navigation impacts through the SWDA are not anticipated.

In fact, New England Wind could result in modest, positive impacts to recreational fisheries. The addition of foundations and scour protection, as well as cable protection in some areas, may act as an artificial reef and provide rocky habitat previously absent from the area. Increases in biodiversity and abundance of fish have been observed around WTG foundations due to attraction of fish species to new structured habitat (Riefolo et al. 2016; Raoux et al. 2017). In the event WTGs aggregate recreationally targeted species, based on the intensity of recreational fishing within the SWDA and its geographic scale, neither congestion effects nor gear conflicts are expected. Anglers' interest in visiting the SWDA may also lead to an increased number of fishing trips out of nearby ports which could support an increase in angler expenditures at local bait shops, gas stations, and other shoreside dependents (Kirkpatrick et al. 2017).

3.2.2.2 Avoidance, Minimization, and Mitigation Measures

As discussed under Section 3.3.1.6, the Proponent will implement measures to avoid, minimize, and mitigate potential impacts to recreational fisheries, including:

- Adopting a 1 x 1 NM WTG/ESP layout to facilitate vessel navigation through the SWDA.
- Maintaining all WTGs/ESPs as PATONs in accordance with USCG guidance.
- Equipping all New England Wind-related vessels and equipment with the required marine navigation lighting and day shapes.
- Using temporary safety buffer zones to improve safety in the vicinity of active work areas.
- Issuing Offshore Wind Mariner Update Bulletins and coordinating with the USCG to provide NTMs.

- Implementing an FCP to facilitate regular and productive communication with fishermen, including recreational fishermen (see Appendix III-E).

3.3.3 Fisheries Studies and Monitoring Plans

As described in Section 6.5, Section 6.6, and Appendix III-F of COP Volume III, impacts to finfish and invertebrates within the SWDA and along the OECC from construction of each Phase of New England Wind, including those species targeted by commercial fishermen, are expected to be short-term and localized. Only a small portion of available habitat in the area will be impacted by New England Wind construction activities and recovery is expected. Nevertheless, the Proponent will conduct fisheries and benthic habitat monitoring to assess the potential impacts of New England Wind on finfish, invertebrates, and their habitats.

Working with the Massachusetts School for Marine Science and Technology (SMAST), the Proponent is already developing and implementing fisheries studies. Specific to New England Wind, the Proponent is currently collecting pre-construction fisheries data within the SWDA. The surveys are being conducted by SMAST scientists onboard commercial fishing vessels.

Pre-construction surveys began in spring 2019. The primary goal of the pre-construction surveys is to provide data on seasonal fish abundance, distribution, population structure and community composition for a future environmental assessment using a beyond Before-After-Control-Impact (BACI) framework as recommended by BOEM (BOEM 2013). The pre-construction surveys in the SWDA[14] include trawl surveys and drop camera surveys.

- Trawl surveys are planned to occur each season (spring, summer, winter, fall) within the SWDA until the start of New England Wind construction. A demersal otter trawl, further referred to as a trawl, is a net that is towed behind a vessel along the seafloor expanded horizontally by a pair of otter boards or trawl doors. Trawls tend to be relatively indiscriminate in the fish and invertebrates they collect; hence trawls are a general tool for assessing the biological communities along the seafloor and are widely used by institutions worldwide for ecological monitoring. The methodology for the trawl survey was adapted from the Atlantic States Marine Fisheries Commission's (ASMFC) Northeast Area Monitoring and Assessment Program (NEAMAP) nearshore trawl survey. Tow locations within the SWDA were selected using a systematic random sampling design. The study area (369 km^2) was sub-divided into 10 sub-areas (each ~36.9 km^2), and one trawl tow was made in each of the 10 sub-areas to ensure adequate spatial coverage

[14] The geographic area studied for the New England Wind pre-construction fisheries studies is currently referred to as the "501 South Study Area."

throughout the survey area. As of August 2021, a total of eight trawl surveys have been conducted: spring 2019, summer 2019, fall 2019, winter 2020, summer 2020, fall 2020, winter 2021, and spring 2021.[15]

- Drop camera surveys are planned to occur twice per year in the SWDA until the start of New England Wind construction. The minimally invasive, image-based drop camera surveys allow for practical data collection of the epibenthic community without causing a disturbance to the seafloor. The SMAST drop camera surveys can be used to better understand benthic macrofaunal community characteristics, substrate, and the spatial and temporal scales of potential impacts on these communities and habitats. Samples are taken at 13 stations placed 5.6 km apart following a grid design. As of August 2021, five drop camera surveys have been completed (in July 2019, October 2019, July 2020, October 2020, and May 2021).

In partnership with Vineyard Wind 1, the New England Aquarium's Anderson Cabot Center for Ocean Life studied highly migratory species presence across the Massachusetts Wind Energy Area (MA WEA) and Rhode Island/Massachusetts Wind Energy Area (RI/MA WEA) based on a desktop review and input from the pelagic recreational fleet. The study determined that recreational effort for highly migratory species is widespread throughout southern New England, with the highest levels of recreational fishing activity occurring to the west of the MA WEA and RI/MA WEA in the waters south and east of Montauk Point and Block Island (Kneebone and Capizzano 2020). The results of this effort are included in Sections 7.5 and 7.6 of Volume III of the COP. This study resulted in an additional funding proposal from INSPIRE Environmental in partnership with the New England Aquarium to the Massachusetts Clean Energy Center (MassCEC) to support a two-year acoustic tagging and tracking study of highly migratory species at recreational fishing hotspots in the MA WEA and RI/MA WEA that were identified in the initial study. The Proponent, in conjunction with other offshore wind developers, plans to further support this study effort by deploying additional receivers in their lease areas. For more information on the highly migratory species surveys and New England Wind fisheries surveys (as well as several seasons of survey reports), see https://www.parkcitywind.com/fisheries.

The Proponent also plans to develop a framework for fisheries studies within the SWDA during and post-construction. In recognition of the regional nature of fisheries science, the Proponent expects that such during- and post-construction studies will involve coordination with other offshore wind energy developers in the MA WEA and RI/MA WEA, especially since there may be some offshore wind energy construction occurring concurrently in multiple lease areas. The Proponent is already engaging in collaboration with other developers, fishing industry representatives, and state and federal agencies through its participation in the Responsible Offshore Science Alliance (ROSA) and a Regional Wildlife Science Entity (RWSE). The Proponent

[15] The spring 2020 trawl survey did not occur due to concerns regarding risk of exposure to COVID-19 onboard the planned vessel.

also expects the development of the fisheries studies will be undertaken in coordination with BOEM, federal and state agencies such as NOAA Fisheries and the Massachusetts Division of Marine Fisheries, fisheries stakeholders, academic institutions, and other stakeholders. The Proponent has collaborated and will continue to collaborate with federal and state agencies to design surveys that align with established survey methods so that the data generated can be compared to previous data and ongoing regional studies to support a regional, longer-term study program to monitor the regional impacts of offshore wind development.

In addition, the Proponent is committed to developing an appropriate benthic monitoring framework for New England Wind, should it be necessary, in consultation with BOEM and other agencies as appropriate (See Appendix III-U for the draft framework). The framework for New England Wind will consider the draft Benthic Habitat Monitoring Plan for Vineyard Wind 1 in Lease Area OCS-A 0501. Due to the similarities in habitat across Lease Areas OCS-A 0501 and OCS-A 0534, the monitoring data collected during the Vineyard Wind 1 monitoring effort may also inform expected impacts to and recovery of benthic communities within the SWDA.

The survey and monitoring work conducted by the Proponent will generate a substantial body of environmental, fisheries, and other data, which will be available in the public domain in a manner consistent with other academic research. Much of the data is publicly available through the federal and state permitting process, as well as reports or academic publications that may come out of the survey or monitoring work. The Proponent also plans to make all fisheries monitoring data generated publicly available on its website. For other environmental and fisheries data, the Proponent will explore cost-effective and appropriate ways to store and make data publicly available and easy to access. Through ROSA and an RWSE, the Proponent will work with fishermen, regulators, stakeholders, and neighboring developers to find ways to streamline and standardize available data across all offshore efforts.

3.3.4 Cable Installation and Monitoring

As described in Section 2, four to five offshore export cables will be installed for New England Wind. Offshore export cable installation is described in detail in Sections 3.3.1.3 and 4.3.1.3 of COP Volume I for Phases 1 and 2, respectively. The following section provides a discussion of key concerns identified by MA CZM in relation to offshore export cable installation activities.

3.3.4.1 Co-Location of New England Wind and Vineyard Wind 1 Offshore Export Cables

As described in Section 2.3 of COP Volume I, based upon careful consideration of multiple technical, environmental, and commercial factors, the Proponent identified the OECC for New England Wind that is largely the same OECC included in the approved Vineyard Wind 1 COP, but it has been widened by approximately 300 m (984 ft) to the west along the entire corridor and by approximately 300 m (984 ft) to the east in portions of Muskeget Channel, for a total width of approximately 950–1,700 m (3,100–5,500 ft).

It is expected that the Vineyard Wind 1 offshore export cables will be located in the central or eastern portion of the OECC. To avoid cable crossings, the two Phase 1 cables are expected to be located to the west of the Vineyard Wind 1 cables and, subsequently, the two to three Phase 2 cables are expected to be installed to the west of the Phase 1 cables. The cables will typically be separated by a distance of 50–100 m (164–328 ft) to provide appropriate flexibility for routing and installation and to allow for maintenance or repairs, although this distance could be further adjusted pending ongoing routing evaluation (see Figure 2.3-1 of COP Volume I). While the Phase 1 and Phase 2 cable(s) are expected to be physically located west of the Vineyard Wind 1 cables, temporary construction impacts (e.g. use of anchors) during installation of the Phase 1 or Phase 2 cables may occur anywhere within the OECC.

For both New England Wind and Vineyard Wind 1, given currently available technology, the Proponent is using the fewest number of HVAC offshore export cables that can reliably deliver power from the projects to shore. Co-locating the Vineyard Wind 1 and New England Wind offshore export cables within a common OECC provides several benefits:

1. The OECC provides for an efficient, technically feasible connection of the SWDA to the grid interconnection point in West Barnstable. There are limited substations within reasonable proximity to Lease Area OCS-A 0534 that can accommodate power from Phase 1 and/or Phase 2, so Eversource's 345 kV West Barnstable Substation has been selected as the grid interconnection point for each Phase of New England Wind.[16] Accordingly, the offshore export cables must bring power from the SWDA to a landfall site within reasonable proximity to the West Barnstable grid interconnection, and the Proponent has identified that landfall sites will be located in Barnstable for both Phases. Further, because the SWDA is bordered to the northwest and southeast by other developers' lease areas[17], the only suitable route to shore is from the northeastern border of the SWDA. Given these considerations, there are limited options available to route cables from the northeastern boundary of the SWDA to landfall sites in Barnstable. As described in Appendix I-G, multiple route options were evaluated when siting the OECC for Vineyard Wind 1 and it was determined that the current OECC allows for less impacts than other alternatives evaluated, less electrical line losses, and lower installation and operational costs. Accordingly, using substantially the same OECC for New England Wind as Vineyard Wind 1 provides a viable route from the SWDA to the grid interconnection point that minimizes environmental, operational, and commercial impacts relative to longer alternative routes.

[16] As described in Section 4.1.3.3, one or more Phase 2 HVAC offshore export cables may deliver power to an alternative grid interconnection point if unforeseen technical, logistical, or grid interconnection issues arise.

[17] The SWDA is bordered to the northeast by Vineyard Wind 1, which is a joint venture between Avangrid Renewables and Copenhagen Infrastructure Partners.

2. The geological conditions within the OECC are well understood and the site geology and conditions are suitable for cable installation. Through the OECC survey work completed as part of Vineyard Wind 1, a large amount of survey data was collected. By the end of 2019, more than 4,272 km (2,307 NM) of geophysical trackline data, 123 vibracores, 83 cone penetrometer tests (CPTs), 82 benthic grab samples with still photographs, and 50 underwater video transects were gathered to support the characterization of the OECC.[18] Additionally, reconnaissance survey work for Vineyard Wind 1 (see Appendix I-G), which included coverage of the western portion of Muskeget Channel and routes to the east of Horseshoe Shoal in Nantucket Sound, did not identify areas where conditions appeared more favorable for cable installation. To the contrary, such reconnaissance survey work identified features outside of the OECC such as shoals, large concentrations of boulders, deep channels, and high currents that would make cable installation and maintenance in an alternate location more challenging. These factors would increase health and safety risk during installation and maintenance, risk of not achieving sufficient burial depths, and risk of cable exposure. The Proponent has also assessed the OECC for installation feasibility, which includes ensuring that water depths are suitable for fully-loaded cable installation vessels, slopes are workable for typical cable installation tools, sufficient room is available for anchoring, etc. Based on these detailed geotechnical and installation feasibility analyses, the Proponent has determined that the identified cable corridor is the most suitable for cable installation and the needs of New England Wind.

3. The use of a shared OECC has important commercial considerations while also helping to minimize environmental impacts. By utilizing a shared OECC, the Proponent is able to leverage the existing survey work already performed for Vineyard Wind 1, which means less survey vessel work and equipment usage, fewer man hours at sea and associated health and safety risks, fewer air emissions, and lower risk of potential impacts to marine species, as well as decreased survey costs, which are a significant portion of pre-construction costs. Lessons learned during the installation of Vineyard Wind 1's cables specific to the conditions within the OECC will undoubtedly inform and benefit the installation of New England Wind's offshore export cables. The use of the same OECC for Vineyard Wind 1 and New England Wind also limits the disturbed areas to a single corridor. The Proponent proposes a target burial depth below potential conflict with fishing gear. The Proponent will prioritize achieving sufficient cable burial depth; however, where sufficient burial depth cannot be achieved and cable protection is required, or should marine users elect to avoid these areas, co-locating the Vineyard Wind 1 and New England Wind cables within a shared OECC would limit the potential area of impact.

[18] Additional survey data was collected for the expanded portions of the OECC in 2020; this data, in conjunction with the data already collected, will be used by the cable installation contractor (once selected) to further assess conditions present in the OECC, determine cable alignments within the OECC, and select cable installation tools that are appropriate for the site conditions.

4. The Vineyard Wind 1 OECC was thoroughly evaluated and approved by the Commonwealth of Massachusetts and BOEM. BOEM has also already reviewed all existing geophysical and geotechnical data for the Vineyard Wind 1 OECC.

To assess the feasibility of using the same OECC for Vineyard Wind 1 and New England Wind, the Proponent commissioned a preliminary route design study for the New England Wind cables, which is provided as Appendix III-P. This report includes a comprehensive assessment of the geophysical and geotechnical conditions along the route, including the presence of seabed features and considerations such as sand waves, magnetic anomalies, coarse deposits, rocks or boulders, water depths, and seabed slopes. Recommendations for cable installation tools that are appropriate for the site conditions are also included. Ultimately, the preliminary route design study demonstrates that it is technically feasible to place the additional New England Wind cables within the OECC. However, the preliminary cable alignments are expected to be refined following detailed engineering.

Thus, the Proponent is effectively achieving a cost-effective solution which looks much like "shared transmission" but with none of the attendant drawbacks (from a wind energy developer's perspective) including substantial technological, development, and regulatory risks.

3.3.4.2 Offshore Export Cable Installation

Prior to offshore export cable laying, a pre-lay grapnel run, and pre-lay survey will be performed to clear obstructions, such as abandoned fishing gear and other marine debris, and inspect the route. Large boulders along the route may need to be relocated prior to cable installation.

Some dredging of the upper portions of sand waves may also be required prior to cable laying to achieve sufficient burial depth below the stable sea bottom (see Sections 3.3.1.3.5 and 4.3.1.3.5 of COP Volume I). Dredging will be limited only to the extent required to achieve adequate cable burial depth during cable installation. Where dredging is necessary, it is conservatively assumed that the dredge corridor will typically be 15 m (50 ft) wide at the bottom (to allow for equipment maneuverability) with approximately 1:3 sideslopes for each of the two cables. However, the depth of dredging will vary with the height of sand waves; hence the dimensions of the sideslopes will likewise vary with the depth of dredging and sediment conditions. This dredge corridor includes the up to 1 m (3.3 ft) wide cable installation trench and the up to 3 m (10 ft) wide temporary disturbance zone from the tracks or skids of the cable installation equipment. The average dredge depth is approximately 0.5 m (1.6 ft) and may range up to 5.25 m (17 ft) in localized areas. The total vertical disturbance within sand waves is up to 8 m (26 ft), which includes dredging and cable installation.

For the two Phase 1 offshore export cables combined, dredging may impact approximately 0.21 km^2 (52 acres)[19] along ~15.3 km (~8.3 NM) and may include up to approximately 134,800 cubic meters (176,300 cubic yards) of dredged material. For the three Phase 2 offshore export cables combined, dredging may impact approximately 0.27 km^2 (67 acres)[20] along ~19.4 km (~10.5 NM) and may include up to approximately 180,000 cubic meters (235,400 cubic yards) of dredged material. If the Western Muskeget Variant is used for Phase 2, there will be either (1) one export cable installed in the Western Muskeget Variant and two export cables installed in the OECC or (2) two export cables installed in the Western Muskeget Variant and one export cable installed in the OECC. In either scenario involving the Western Muskeget Variant, dredging may impact approximately up to 0.30 km^2 (73 acres)[21] along up to ~21.1 km (~11.3 NM) and may include up to approximately 210,100 cubic meters (274,800 cubic yards) of dredged material. Actual dredge volumes will depend on the final cable alignments and cable installation method(s); a cable installation method that can achieve a deeper burial depth will require less dredging. Appendix III-P provides the maximum extent of dredging.

Dredging could be accomplished by several techniques. European offshore wind projects have typically used a TSHD. A TSHD vessel contains one or more drag arms that extend from the vessel, rest on the seafloor, and suction up sediments. Dredges of this type are also commonly used in the US for channel maintenance, beach nourishment, and other projects. For New England Wind, a TSHD would be used to remove enough of the top of a sand wave to allow subsequent cable installation into the stable seabed using one of the techniques described below. Should a TSHD be used, it is anticipated that the TSHD would dredge along the cable alignment until the hopper was filled to an appropriate capacity; then, the TSHD would sail several hundred meters away and deposit the dredged material within the OECC. Bottom dumping of dredged material would only occur within sand waves (see Figure 3.3-3 of COP Volume I).

A second dredging technique involves jetting by controlled flow excavation. Controlled flow excavation uses a pressurized stream of water to push sediments to the side. The controlled flow excavation tool draws in seawater from the sides and then propels the water out from a vertical downpipe at a specified pressure and volume. The downpipe is positioned over the cable alignment, enabling the stream of water to fluidize the sediments around the cable, which allows

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[19] Since the dredging area will overlap with the 1 m (3.3 ft) wide cable installation trench and 3 m (10 ft) wide temporary disturbance zone from the tracks or skids during cable installation (see Section 3.3.1.3.6), these areas have been subtracted from the dredging area to avoid double-counting impacts. The total dredging area including the cable installation trench is approximately 0.27 km^2 (67 acres).

[20] Since the dredging area will overlap with the 1 m (3.3 ft) wide cable installation trench and 3 m (10 ft) wide temporary disturbance zone from the tracks or skids during cable installation (see Section 4.3.1.3.6), these areas have been subtracted from the dredging area to avoid double-counting impacts. The total dredging area including the cable installation trench is approximately 0.35 km^2 (86 acres).

[21] Since the dredging area will overlap with the 1 m (3.3 ft) wide cable installation trench and 3 m (10 ft) wide temporary disturbance zone from the tracks or skids during cable installation (see Section 4.3.1.3.6 of COP Volume I), these areas have been subtracted from the dredging area to avoid double-counting impacts.

the cable to settle into the trench. This process causes the top layer of sediments to be sidecast to either side of the trench. In this way, controlled flow excavation simultaneously removes the top of the sand wave and bury the cable. Typically, a number of passes are required to lower the cable to the minimum sufficient burial depth.

A TSHD can be used in sand waves of most sizes, whereas the controlled flow excavation technique is most likely to be used in areas where sand waves are less than 2 m (6.6 ft) high. Therefore, sand wave dredging could be accomplished entirely by the TSHD on its own or through a combination of controlled flow excavation and TSHD, with controlled flow excavation used for smaller sand waves and TSHD used to remove larger sand waves.

Following the route clearance activities and any required dredging, the offshore export cables will be installed. The offshore export cables will have a target burial depth of 1.5 to 2.5 m (5 to 8 ft) below the seafloor, which the Proponent's engineers have determined is more than twice the burial depth required to protect the cables from fishing activities and also provides a maximum of 1 in 100,000 year probability of anchor strike, which is considered a negligible risk (see Appendix III-P of COP Volume III).

Several possible techniques may be used during cable installation to achieve the target burial depth (see further description below). Generally, jetting methods are better suited to sands or soft clays whereas a mechanical plow or mechanical trenching tool is better suited to stiffer soil conditions (but is also effective in a wide range of soil conditions). While the actual offshore export cable installation method(s) will be determined by the cable installer based on site-specific environmental conditions and the goal of selecting the most appropriate tool for achieving adequate burial depth, the Proponent will prioritize the least environmentally impactful cable installation alternative(s) that is/are practicable for each segment of cable installation. No blasting is proposed for cable installation.

In addition to selecting an appropriate tool for the site conditions, the Proponent will work to minimize the likelihood of insufficient cable burial. For example, if the target burial depth is not being achieved, operational modifications may be required. Subsequent attempts with a different tool (such as controlled flow excavation) may be required where engineering analysis indicates subsequent attempts may help achieve sufficient burial. As discussed in Sections 3.3.1.3.10 and 4.3.1.3.10 of COP Volume I, while every effort will be made to achieve sufficient burial, it is conservatively estimated that approximately 6% of the offshore export cables within the OECC may not achieve sufficient burial depth and will require cable protection (or up to 7% of the offshore export cables within the OECC for both Phases if the Western Muskeget Variant is used for one or two Phase 2 export cables).

The majority of the offshore export cables are expected to be installed using simultaneous lay and bury via jetting techniques (e.g. jet plow or jet trenching) or mechanical plow. Both cable installation methods are described below under "Typical Techniques." However, additional specialty techniques are retained as options to maximize the likelihood of achieving sufficient burial depth (such as in areas of coarser or more consolidated sediment, rocky bottom, or other

difficult conditions) while minimizing the need for possible cable protection and accommodating varying weather conditions. Additional techniques that may be used more rarely are described below under "Other Possible Specialty Techniques."

Typical Techniques

- **Jetting techniques (e.g. jet plowing or jet trenching):** Jetting tools may be deployed using a seabed tractor, a sled, or directly suspended from a vessel. Jetting tools typically have one or two arms that extend into the seabed (or alternatively a share that runs through the seabed) equipped with nozzles which direct pressurized seawater into the seafloor. As the tool moves along the installation route, the pressurized seawater fluidizes the sediment allowing the cable to sink by its own weight to the appropriate depth or be lowered to depth by the tool. Once the arm or share moves on, the fluidized sediment naturally settles out of suspension, backfilling the narrow trench. Depending on the actual jet-plowing/jet-trenching equipment used, the width of the fluidized trench could vary between 0.4–1 m (1.3–3.3 ft). While jet-plowing will fluidize a narrow swath of sediment, it is not expected to result in significant sidecast of materials from the trench. Offshore cable installation will therefore result in some temporary elevated turbidity, but sediment is expected to remain relatively close to the installation activities (see Section 5.2.2 of COP Volume III and Appendix III-A for a discussion of sediment dispersion modeling).

- **Mechanical plowing:** A mechanical plow is pulled by a vessel (or barge) and uses cutting edge(s) and moldboard, possibly with water jet assistance, to penetrate the seabed while feeding the cable into the trench created by the plow. While the plow share itself would likely only be approximately 0.5 m (1.6 ft) wide, a 1 m (3.3 ft) wide trench disturbance is also conservatively assumed for this tool. This narrow trench will infill behind the tool, either by slumping of the trench walls or by natural infill, usually over a relatively short period of time.

Other Possible Specialty Techniques

- **Mechanical trenching:** Mechanical trenching is typically only used in more resistant sediments. A rotating chain or wheel with cutting teeth/blades cuts a trench into the seabed. The cable is laid into the trench behind the trencher and the trench collapses and backfills naturally over time.

- **Shallow-water cable installation vehicle:** While any of the "Typical Techniques" described above could be used in shallow water, the Phase 1 Envelope also includes specialty shallow-water tools (if needed). These entail deployment of "Typical Technique" from a vehicle that operates in shallow water in places where larger cable laying vessels cannot efficiently operate. The cable is first laid on the seabed, and then a vehicle drives over or alongside the cable while operating an appropriate burial tool to complete installation. The vehicle is controlled and powered from a shallower-draft vessel that holds equipment and operators above the waterline.

- **Pre-pass jetting:** Prior to cable installation, a pre-pass jetting run using a jet plow or jet trencher may be conducted along targeted sections of the cable route with stiff or hard sediments. A pre-pass jetting run is an initial pass along the cable route by the cable installation tool to loosen sediments without installing the cable. A pre-pass jetting run maximizes the likelihood of achieving sufficient burial during a subsequent pass by the cable installation tool when the cable is installed. Pre-pass jetting run impacts are largely equivalent to the cable installation impacts from jetting, which are described under "Typical Techniques" above.

- **Pre-trenching:** Pre-trenching is typically used in areas of very stiff clays. A plow or other device is used to excavate a trench, the excavated sediment is placed next to the trench, and the cable is subsequently laid into the trench. Separately or simultaneously to laying the cable, the excavated sediment is returned to the trench to cover the cable. It is unlikely that the Proponent will use a pre-trench method because site conditions are not suitable (i.e., sandy sediments would simply fall back into the trench before the cable-laying could be completed).

- **Pre-lay plow:** In limited areas of resistant sediments or high concentrations of boulders, a larger tool may be necessary to achieve cable burial. One option is a robust mechanical plow that would push boulders aside while cutting a trench into the seabed for subsequent cable burial and trench backfill. Similar to pre-trenching, this tool would only be used in limited areas if needed to achieve sufficient cable burial.

- **Precision installation:** In situations where a large tool is not able to operate or where another specialized installation tool cannot complete cable installation, a diver or ROV may be used to complete installation. The diver or ROV may use small jets or other small tools to complete installation.

- **Jetting by controlled flow excavation:** As described in Section 3.3.1.3.5 of COP Volume I, jetting by controlled flow excavation can be used for cable installation as well as dredging. A controlled flow excavation tool draws in seawater from the sides and then propels pressurized water downward over the cable alignment, enabling the stream of water to fluidize the sediments around the cable and allowing the cable to settle into the trench. This process causes the top layer of sediments to be sidecast to either side of the trench. This method will not be used as the conventional burial method for the offshore export cables, but may be used in limited locations, such as to bury cable joints or bury the cable deeper and minimize the need for cable protection where initial burial of a section of cable does not achieve sufficient depth. Typically, a number of passes are required to lower the cable to the minimum sufficient burial depth, resulting in a wider disturbance than use of a jet-plow or mechanical plow. Jetting by controlled flow excavation is not to be confused with jet plowing or jet trenching (a typical cable installation method described above).

Impacts from cable installation are expected to include an up to 1 m (3.3 ft) wide cable installation trench and an up to 3 m (10 ft) wide temporary disturbance zone from the skids/tracks of the cable installation equipment that will slide over the surface of the seafloor (each skid/track is assumed to be approximately 1.5 m [5 ft] wide). The skids or tracks have the potential to disturb benthic habitat; however, because they are not expected to dig into the seabed, the impact is expected to be minor relative to the trench. The trench is expected to naturally backfill as sediments settle out of suspension and no separate provisions to facilitate restoration of a coarse substrate are required.

Typical cable installation speeds are expected to range from 100 to 200 meters per hour (5.5 to 11 feet per minute) and it is expected that offshore export cable installation activities will occur 24 hours per day. Once offshore export cable installation has begun, to preserve the integrity of the cable, cable installation will ideally be performed as a continuous action along the entire cable alignment between splices.

Anchored cable laying vessels may be used along the entire length of the offshore export cables due to varying water depths throughout the OECC and SWDA. Anchoring during installation of the offshore export cables is expected to require the use of a nine-point anchoring system. A nine-point anchor spread provides greater force on the cable burial tool than a spread with fewer anchors thereby enabling greater burial depth. On average, anchors are assumed to reposition approximately every 400 m (1,312 ft); however, anchor resetting is highly dependent on final contractor selection and the contractor's specific vessel(s). Anchored vessels may be equipped with spud legs that are deployed to secure the cable laying vessels while its anchors are being repositioned. To install the cable close to shore using tools that are best optimized to achieve sufficient cable burial, the cable laying vessel may temporarily ground nearshore. A jack-up vessel may be used to facilitate pulling the offshore export cables through HDD conduits installed at the landfall site. Any anchoring, jacking-up, spud leg deployment, or grounding will occur within areas of the OECC and SWDA that will have been surveyed.

Prior to the start of construction, contractors will be provided with a map of sensitive habitats with areas to avoid so they can plan their mooring positions accordingly (see the discussion under Habitat Policy #1).

3.3.4.3 Cable Monitoring

The export cables will be regularly monitored to assess depth of burial. The specific, as-built cable alignment will be monitored by the cable installation tool during installation to record the precise location (x and y) of each offshore export cable as well as the achieved burial depth (z). If the depth of burial cannot be clearly established from any of the installation techniques, additional survey work may be undertaken. While development of a final monitoring schedule is ongoing, it is expected that the cable will be surveyed with a higher frequency in the early post-construction years It is expected that the cables will be surveyed within six months of commissioning, at years one and two, and every three years thereafter. This monitoring schedule may be adjusted over time based on results of the ongoing surveys. Additionally, the cable design may include a

Distributed Temperature System (DTS), so that the temperature of the cable is monitored at all times; significant changes in temperature recorded by this system may also be used to indirectly indicate cable exposure.

3.3.5 Coastal and Marine Birds

The Proponent has conducted extensive studies, including desktop research and field surveys, to identify coastal and marine birds that may be affected by New England Wind and potential impacts to those species. These efforts have included conducting one year of monthly boat surveys in the SWDA (from October 2018 to September 2019). Section 6.2 of COP Volume III provides a detailed assessment of potential impacts to coastal and marine birds from New England Wind activities within the SWDA, along the OECC, and at the landfall site, along with avoidance, minimization, and mitigation measures. This analysis concludes that New England Wind activities are unlikely to cause population level impacts to any avian species or species group. The following section provides a summary of this assessment, with a focus on potential impacts along the OECC and at the landfall site.

3.3.5.1 Potential Impacts

Offshore export cables for both Phases will be installed within an OECC that travels north from the SWDA, passes through the eastern side of Muskeget Channel, and traverses Nantucket Sound to make landfall in the Town of Barnstable. The majority of the offshore export cables are expected to be installed using simultaneous lay and bury via jetting techniques (e.g. jet plow or jet trenching) or mechanical plow. Additionally, as described in Sections 3.3.1 and 4.3.1 of COP Volume I, sections of the OECC contain sand waves, which may need to be removed by dredging prior to cable installation.

A previous study (Veit et al. 2016) identified Muskeget Channel as a "hotspot" for common eiders, black scoters, long-tailed ducks, common and red-throated loons, and common and roseate terns. While the installation of four to five offshore export cables for New England Wind will temporarily impact only a tiny fraction of the identified "hotspot," a further assessment of potential impacts to roseate terns was conducted.

Roseate terns, particularly those nesting in southern New England and the Gulf of Maine are highly reliant on sand lance as their primary food source. For example, chick diets at a nesting colony in Long Island Sound, New York (Great Gull Island) consisted of 97% sand lance species, while those on Bird Island in Buzzard's Bay, Massachusetts averaged 69% (Goyert et al. 2015; Staudinger et al. 2020). Roseate terns generally feed by shallow plunge-diving or surface-dipping. A concern has been expressed that disturbance to sand lance during cable installation may in turn potentially impact roseate terns.

To assess potential disturbance to marine organisms, including fish such as sand lance, from cable installation activities, a sediment dispersion modeling study of dredging and cable installation activities was conducted and is provided in Appendix III-A of COP Volume III. The sediment

dispersion modeling study includes the portion of the OECC that falls within the avian hot spot identified by Veit et al. (2016) in Muskeget Channel (including the Western Muskeget Variant). Suspended sediments generated during dredging and disposal activities and subsequent cable installation activities within Muskeget Channel will be temporary and localized. During these activities, a very limited portion (<1%) of the avian hot spot identified by Veit et al. (2016) is impacted at any one time. Excess suspended sediments at any given point are only present for a short duration (typically less than 6 hours, and only 1-3 hours for cable installation), and will only occupy the bottom few meters of the water column during and after cable installation. As described in Sections 6.5 (Benthic Resources) and 6.6 (Finfish and Invertebrates) of COP Volume III, these concentrations and durations of exposure from suspended sediments are below those causing sub-lethal or lethal effects to fish and benthic organisms, including sand lance. Accordingly, suspension of sediments from dredging and cable installation operations are expected to have little to no effect on mobile organisms such as sand lance.

As roseate terns generally feed by shallow plunge-diving or surface-dipping, temporary increased turbidity in the bottom few meters of the water column caused by offshore export cable installation is unlikely to adversely affect foraging behavior or efficiency. Furthermore, of the two sand lance species most prevalent in the region (American sand lance and Northern sand lance [*Ammodyte dubius*]), the American sand lance is more likely to occupy nearshore, shallow habitats (<20 m [66 ft] but often <2 m [6.6 ft]) (Staudinger et al. 2020) outside the deeper parts of the channel where the cables will be installed. This predicted shallower distribution of the American sand lance matches the observed distribution of breeding and staging terns in the area, which appear to spend most of their time foraging close to the shores of Tuckernuck and Muskeget Island, and surrounding shoals, not in the deeper waters of the Muskeget Channel itself (Veit and Perkins 2014).

In summary, exposure of roseate terns to offshore export cable installation activities will be temporary and localized. Because of the limited extent and short-term duration of cable installation, the loss or disturbance of individual roseate terns is unlikely.

At the landfall site, the beach and some of the dunes may be used by piping plovers. The Natural Heritage and Endangered Species Program (NHESP) has established Priority Habitat along the Centerville Harbor shoreline that includes the beach and some of the dunes adjacent to the paved parking lots at the potential Phase 1 and Phase 2 landfall sites, which include Craigville Public Beach or Covell's Beach for Phase 1 and Dowses Beach or Wianno Avenue for Phase 2 (see Figure 6.1-2 of COP Volume III). NHESP has confirmed that the mapped Priority Habitat is for piping plover at the Phase 1 landfall sites. It is expected that the mapped Priority Habitat near the Phase 2 landfall sites is also for piping plover since the Priority Habitat mapping is continuous throughout Centerville Harbor, and the Proponent will be requesting confirmation from NHESP. With the exception of Wianno Avenue, disturbance of the beach at either landfall site will be largely avoided as the cable will pass under the beach, intertidal zone, and nearshore areas via HDD. The cable will come ashore in an existing paved parking area or other previously disturbed area and thus will avoid disturbing beach or dune habitat that might be used by piping plovers, other

migratory shorebirds, or seabirds. The Wianno Avenue Landfall Site is less suited for HDD than open trenching due to the elevated onshore topography and slope of the parking lot. This landfall site is suitable for open trenching because the shoreline has already been altered by the installation of a riprap seawall, a portion of which would be temporarily removed and replaced following cable installation thus, minimizing disturbance to beach or dune habitat. The Proponent only expects to use the Wianno Avenue Beach Landfall Site if unforeseen challenges arise that make it infeasible to use the Dowses Beach Landfall Site to accommodate all or some of the Phase 2 offshore export cables.

Nonetheless, due to the proximity of the coastal dune to the paved parking lots where staging activities would occur, the Proponent is developing a draft Piping Plover Protection Plan for construction activities at either landfall site that will mirror a similar plan assembled for Vineyard Wind 1 that was approved by NHESP (see Appendix III-R of COP Volume III). Based on consultations with NHESP for Vineyard Wind 1 for activities at the Covell's Beach landfall site, the Proponent expects that activities at either landfall site will begin in advance of April 1, or will not begin until after August 31, to avoid and minimize noise impacts to piping plover during the breeding season.

3.3.5.2 Avoidance, Minimization and Mitigation Measures

The SWDA is located within the MA WEA, which was established by BOEM through a multi-step process that involved significant agency and public input over a period of approximately six years. As described in Section 2 of COP Volume I, areas identified as important fishing areas and having high value sea duck habitat were excluded from the northeastern portion of the MA WEA (BOEM 2014). Effectively, the location of the SWDA minimizes and avoids exposure of birds to New England Wind's offshore wind energy generation facilities.

During construction and O&M, New England Wind will reduce lighting as much as practicable to avoid or minimize impacts to birds. In addition, whenever practicable, the Proponent will down-shield lighting or use down-lighting to limit bird attraction and disorientation. For Phase 1, the Proponent expects to use an ADLS that automatically activates all aviation obstruction lights when aircraft approach the Phase 1 WTGs, subject to BOEM approval. For Phase 2, the Proponent would expect to use the same or similar approaches to reduce lighting used for Vineyard Wind 1 and/or Phase 1, including the use of an ADLS. Use of ADLS would lessen the potential impacts of nighttime light on birds. Additionally, the Proponent will use a standardized protocol to document any dead or injured birds found on vessels and structures during construction, O&M, and decommissioning.

The Proponent is also developing a framework for a post-construction bird monitoring program in relation to Vineyard Wind 1 that can be adapted to New England Wind. This framework is being developed through consultation with federal, state, and local agencies, and with input from other stakeholders.

Finally, while cable installation is only expected to have temporary and localized impacts that will not significantly disturb roseate terns, the Proponent will incorporate any lessons learned from cable installation through Muskeget Channel for the Vineyard Wind 1 project on procedures to minimize suspended sediments. The Proponent will also incorporate information learned from the monitoring of sand lance being conducted for Vineyard Wind 1 as part of the Benthic Habitat Monitoring Plan for that project.

4.0 CONCLUSION

The Proponent has demonstrated that the proposed action described herein and in the New England Wind COP complies with the applicable enforceable policies of the approved Massachusetts Coastal Program and will be conducted in a manner consistent with such Program.

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