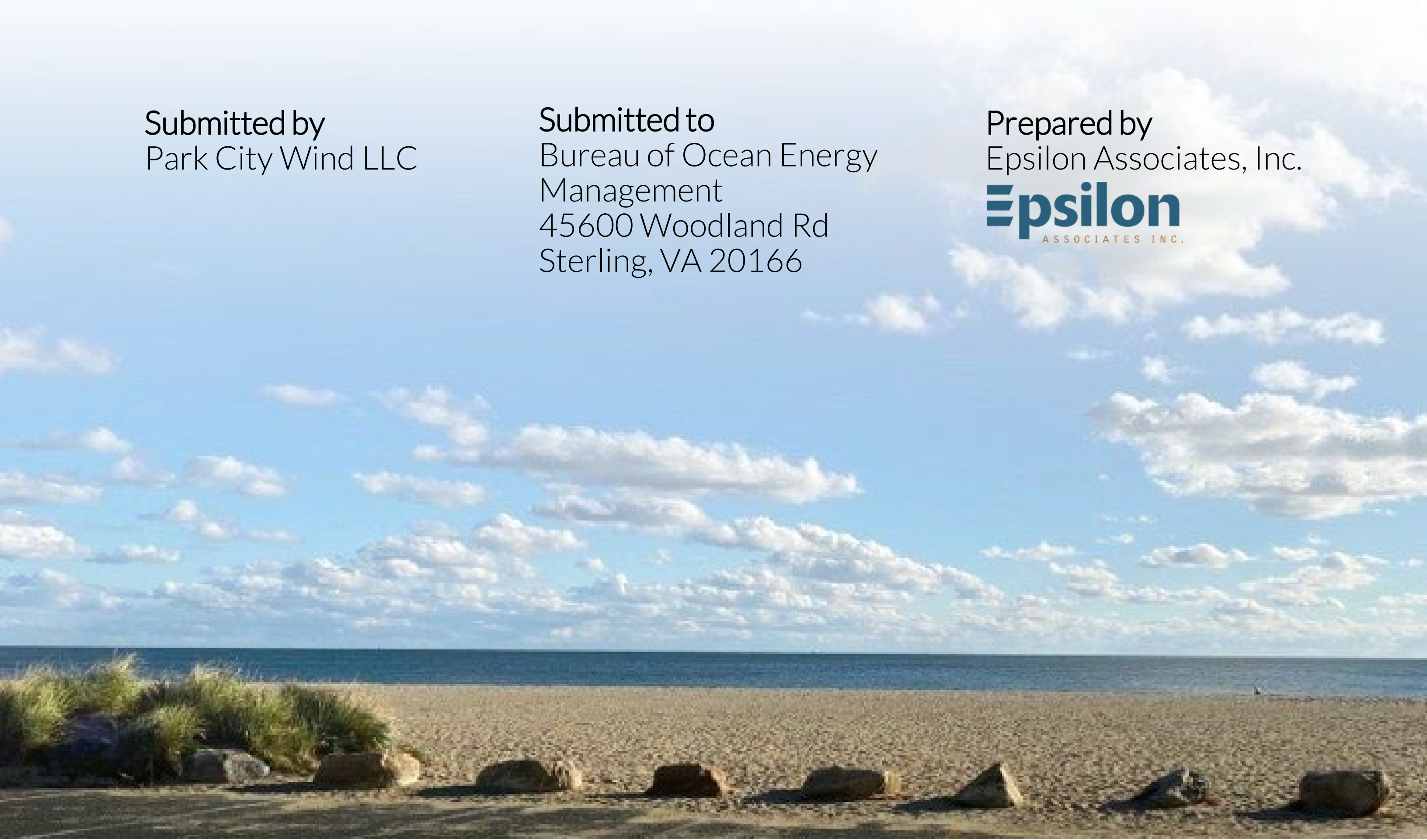
New England Wind

AVANGRID RENEWABLES

Draft Construction and Operations Plan Addendum for the Phase 2 Offshore Export Cable Corridor South Coast Variant

Appendices

April 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.

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April 2022

Appendix B

Sediment Transport Modeling

FINAL TECHNICAL REPORT

ADDENDUM: SOUTH COAST VARIANT SEDIMENT TRANSPORT MODELING

New England Wind Offshore Cable Installation

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List of Acronyms

BOEM	Bureau of Ocean Energy Management
COP	Construction and Operations Plan
ESP	Electrical Service Platform
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

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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: Phase 1 (also known as Park City Wind) and Phase 2 (also known as Commonwealth Wind). Four or five offshore export cables (two for Phase 1 and two or three for Phase 2) will transmit electricity generated by the wind turbine generators (WTGs) to onshore transmission systems (Figure 1). 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.

The Proponent has identified an Offshore Export Cable Corridor (OECC) for the installation of the offshore export cables (Figure 1). The OECC travels north from Lease Area OCS-A 0534 along the eastern side of Muskeget Channel towards landfall sites in the Town of Barnstable, Massachusetts. The expected grid interconnection point for both Phases of New England Wind is the West Barnstable Substation. While the Proponent intends to install all Phase 2 offshore export cables within this OECC, the Proponent has identified two variations of the OECC that may be employed for Phase 2: the Western Muskeget Variant (which passes along the western side of Muskeget Channel) and the South Coast Variant (which connects to a potential second grid interconnection point) (Figure 1). These variations are necessary to provide the Proponent with commercial flexibility should technical, logistical, grid interconnection, or other unforeseen issues arise during the Construction and Operations Plan (COP) review and engineering processes.

The Proponent has submitted a draft New England Wind COP that describes the OECC and both potential Phase 2 OECC variants, with accompanying data and analysis for the OECC and the Western Muskeget Variant. The purpose of this COP Addendum is to provide relevant data and analysis supporting the South Coast Variant in federal waters for New England Wind. This COP Addendum incorporates by reference the analyses in the COP (including the appendices) and is focused on describing impacts that are unique to the South Coast Variant. Accordingly, descriptions of impacts that are associated with the OECC or its Variants more generally and that are not specific to the South Coast Variant are not repeated in this COP Addendum.

As shown in Figure 1, the South Coast Variant diverges from the OECC at the northern boundary of Lease Area OCS-A 0501 and travels west-northwest to the state waters boundary near Buzzards Bay. From the Southern Wind Development Area (SWDA)[1] boundary (excluding the two separate aliquots that are closer to shore) through federal waters to the state waters boundary, the South Coast Variant is approximately 79 km (42 NM) in length and approximately 720 m (2,360 ft) in width. To allow additional cable length for turns and micro-siting of the cable within the corridor, the maximum length of each cable within this variation of the OECC (from the SWDA boundary to the state waters boundary) is ~84 km (~45 NM).[2] An additional length of offshore export cable within the SWDA (up to ~34–42 km [~18–23 NM] per cable) will be needed to reach the Phase 2 electrical service platforms (ESPs). Thus, the maximum length of each Phase 2 offshore export cable that employs the South Coast Variant is 118–126 km (64–68 NM) between the state waters boundary and the ESP(s). If three Phase 2 offshore export cables use the South Coast Variant, the maximum total length of the Phase 2 offshore export cables within federal waters (assuming three cables) is ~362 km (~196 NM).

At the state waters boundary, the South Coast Variant broadens to a “Phase 2 South Coast Variant Offshore Routing Envelope” that indicates a region within Buzzards Bay where the Phase 2 offshore export cable(s)

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[1] 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 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.

[2] The offshore export cable length includes a 15% allowance for micro-siting within Lease Areas OCS-A 0534 and OCS-A 0501 and a 5% allowance for micro-siting within the OECC and South Coast Variant outside the lease areas.

may be installed before making landfall along the southwest coast of Massachusetts within the Offshore Routing Envelope. If it becomes necessary to employ the South Coast Variant and a second grid interconnection point is secured, the Proponent understands that BOEM would conduct a supplemental review of those portions of the South Coast Variant not otherwise considered in the final environmental impact statement.

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

- **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.

The scenario modeled included a representative offshore export cable route along the South Coast Variant, traversing through federal waters, from the northern boundary of Lease Area OCS-A 0501 to the state waters boundary near Buzzards Bay. One sediment modeling scenario was carried out using an RPS in house model Suspended Sediment FATE (SSFATE) to evaluate potential impacts associated with cable installation along the representative South Coast Variant.

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 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. 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, 25, 50, 100, 200, and 650 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

The simulations of the cable installation showed that the maximum excursion of the 10 mg/L excess plume extended up to 0.9 km, though typically less than 150 m from the route centerline. The excess concentrations stemming from cable installation remain relatively close to the route centerline, are constrained to the bottom of the water column, and are short-lived (typically dissipating within four to six hours). Deposition greater than 1.0 mm was limited to within 200 m from the route centerline for typical installation parameters.

In general, trends of rapid decrease of area with increasing time and/or increasing concentration threshold are noted for this scenario, as was reported for the representative cable installation scenarios along the OECC and the Western Muskeget Variant. While the concentration and depositional areas impacted were larger for 1 hour and longer, the areas impacted by water column concentrations were similar for 2 hours or longer.

Importantly, the 10 mg/L excess plume typically dissipated within four to six hours for the South Coast Variant and deposition was predicted to remain close to the cable centerline with a maximum thickness less than 5 mm, which is similar to modeled results along the OECC and Western Muskeget Variant. Differences in the extent and persistence of the plumes and the extent and thickness of deposition for the South Coast Variant and the OECC and the Western Muskeget Variant modeling may be attributed to route orientation relative to currents, the magnitude of the currents, the timing of currents, 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: Phase 1 (also known as Park City Wind) and Phase 2 (also known as Commonwealth Wind). Four or five offshore export cables (two for Phase 1 and two or three for Phase 2) will transmit electricity generated by the wind turbine generators (WTGs) to onshore transmission systems (Figure 1). 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.

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1.1 Overview of the Phase 2 OECC South Coast Variant

As shown in Figure 1, the South Coast Variant diverges from the OECC at the northern boundary of Lease Area OCS-A 0501 and travels west-northwest to the state waters boundary near Buzzards Bay. From the Southern Wind Development Area (SWDA)[3] boundary (excluding the two separate aliquots that are closer to shore) through federal waters to the state waters boundary, the South Coast Variant is approximately 79 km (42 NM) in length and approximately 720 m (2,360 ft) in width. To allow additional cable length for turns and micro-siting of the cable within the corridor, the maximum length of each cable within this variation of the OECC (from the SWDA boundary to the state waters boundary) is ~84 km (~45 NM).[4] An additional length of offshore export cable within the SWDA (up to ~34–42 km [~18–23 NM] per cable) will be needed to reach the Phase 2 electrical service platforms (ESPs). Thus, the maximum length of each Phase 2 offshore export cable that employs the South Coast Variant is 118–126 km (64–68 NM) between the state waters boundary and the ESP(s). If three Phase 2 offshore export cables use the South Coast Variant, the maximum total length of the Phase 2 offshore export cables within federal waters (assuming three cables) is ~362 km (~196 NM).

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[4] The offshore export cable length includes a 15% allowance for micro-siting within Lease Areas OCS-A 0534 and OCS-A 0501 and a 5% allowance for micro-siting within the OECC and South Coast Variant outside the lease areas.

At the state waters boundary, the South Coast Variant broadens to a “Phase 2 South Coast Variant Offshore Routing Envelope” that indicates a region within Buzzards Bay where the Phase 2 offshore export cable(s) may be installed before making landfall along the southwest coast of Massachusetts within the Offshore Routing Envelope. If it becomes necessary to employ the South Coast Variant and a second grid interconnection point is secured, the Proponent understands that BOEM would conduct a supplemental review of those portions of the South Coast Variant not otherwise considered in the final environmental impact statement.

The South Coast Variant is included in the COP to provide the Proponent with the commercial flexibility required should technical, logistical, grid interconnection, or other unforeseen issues arise during the COP review and engineering processes that preclude one or more Phase 2 export cables from interconnecting at the West Barnstable Substation. If the South Coast Variant is used for Phase 2, there will be either: (1) one export cable installed in the South Coast Variant and two export cables installed in the OECC, (2) two export cables installed in the South Coast Variant and one export cable installed in the OECC, or (3) three export cables installed in the South Coast Variant.

To evaluate potential impacts associated with cable installation along the South Coast Variant route, sediment modeling was carried out using an RPS in-house model, Suspended Sediment FATE (SSFATE). SSFATE computes total suspended solids (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 waterbody bathymetry, and parameterization of the sediment disturbance (source), which includes sediment grain size data and 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 Appendix III-A of COP Volume III.

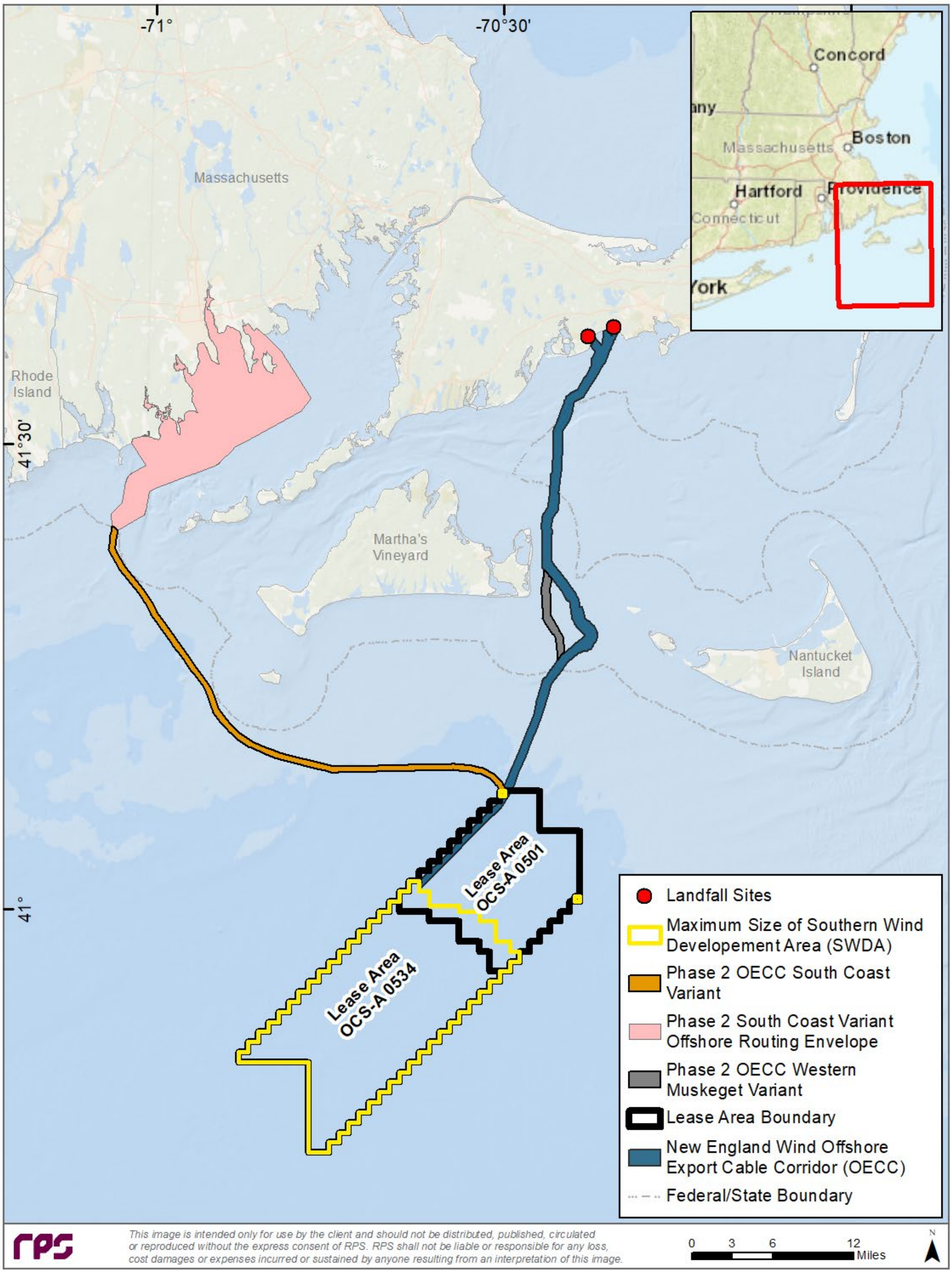

Figure 1. Map of Study Area with Indicative Locations for New England Wind's Offshore Components.

1.2 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 (see Appendix III-A of COP Volume III); 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 benthic resources and finfish and invertebrate 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, 24, and 48 hours
- Seabed deposition thresholds: 1, 5, 10, 20, 50, and 100 mm

1.3 Scenario Components: Routes and Approaches

This study assessed one representative cable installation scenario along the South Coast Variant (; Figure 2), and this appendix was developed to summarize the model inputs, modeling approach, and results for this simulation. 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. However, pre-dredging and sand wave removal were not simulated along the South Coast Variant as the expected volume of dredging is less along the South Coast Variant than along the OECC and extensive modeling was conducted in Appendix III-A of COP Volume III. Based on model results for sandwave and pre-dredging along the OECC and Western Muskeget Variant (Appendix III-A of COP Volume I) and results from this study, the potential resuspension and deposition associated with pre-dredging and sandwave removal along the South Coast Variant will be qualitatively discussed in Section 2.3.3 of this document.

The modeled offshore export cable route was selected along an approximate centerline within the South Coast Variant, and one distinct approach (e.g., jetting technique) was used to simulate the installation of the cable. This modeling assumes any required dredging was completed prior to cable installation so that the use of jetting techniques would successfully lay the cable. Cable installation was assumed to start from the northern boundary of Lease Area OCS-A 0501 and traverse west/northwest to the state waters boundary near Buzzards Bay.

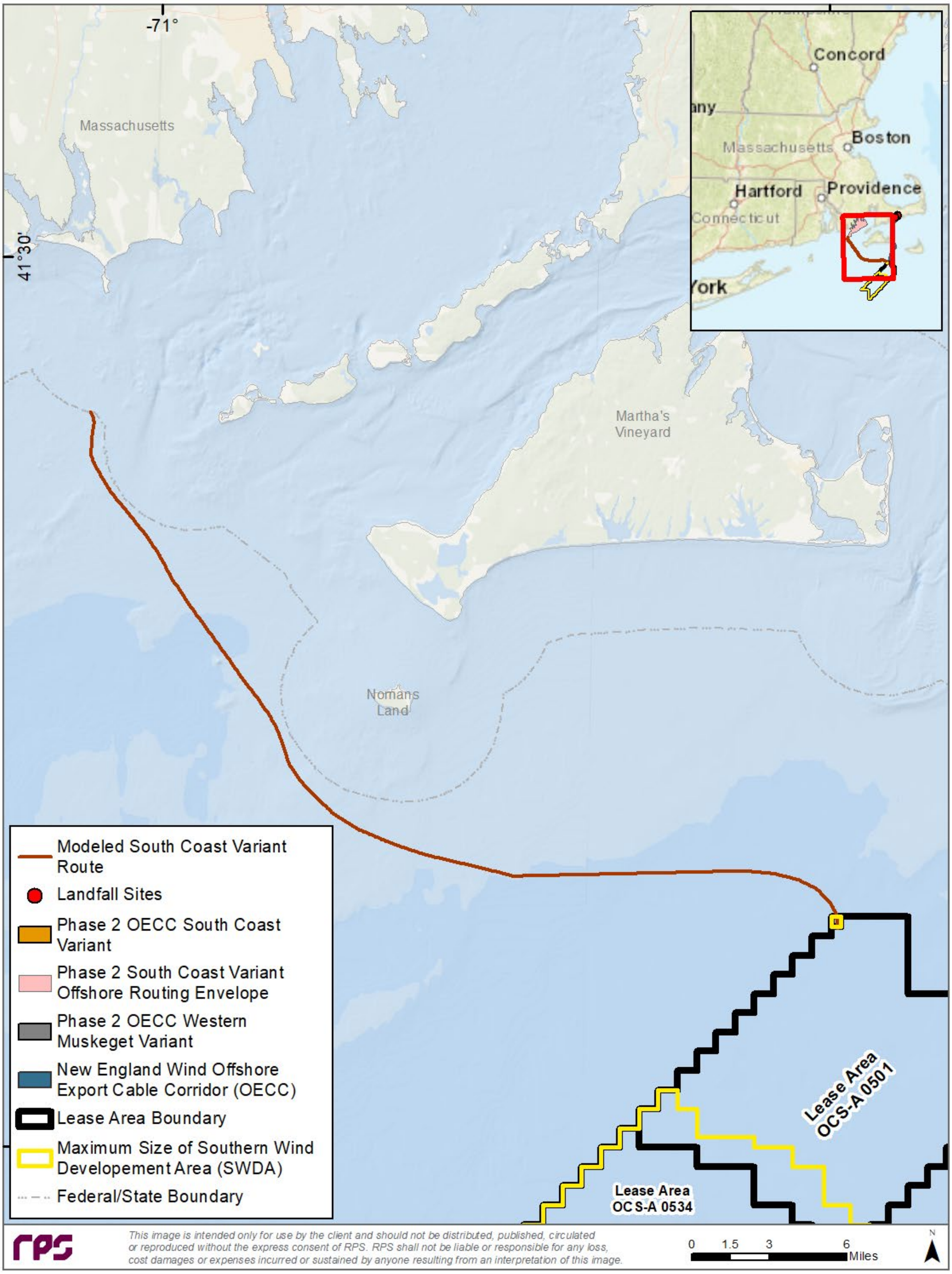

Figure 2. Map of the South Coast Variant's modeled route.

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

The impact cable installation parameters (Table 1 and Table 2) 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.

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 used in this study 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 3). Additionally, operations were assumed to be continuous (i.e., 24 hours per day).

Table 1. Summary of typical cable installation impact parameters.

Scenario Description	Grain Size Distribution	Trench Width (m)	Trench Depth (m)	Trench Volume per Meter (m^3)	Percent Mobilized (%)
Typical – Cable Installation	Depth weighted to 2 m	1	2	2	25

Table 2. Advance rate, length of modeled route, and dredge duration for the cable installation simulation.

Scenario Description	Advance Rate (m/hr)	Modeled Route Length (m)	Modeled Duration (days)
Typical – Cable Installation	200	63,984	13.3

Table 3. Summary of vertical initial distribution of mass associated with cable installation.

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 vibracore (i.e., sediment core) samples from an offshore survey. Sediment data was provided by the Proponent for 75 samples along the South Coast Variant. The vibracore stations all yielded sieve data and moisture content, and for areas consisting of high fractions of fine material, those samples contained hydrometer analysis results. Sediment analysis at multiple depths (typically two) within the upper three meters of the seabed were available at most 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 4).

Table 4. 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

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. Using the vibracore data, the distribution was developed by depth weighting the samples to the typical scenario target depth (i.e., two-meter target depth).

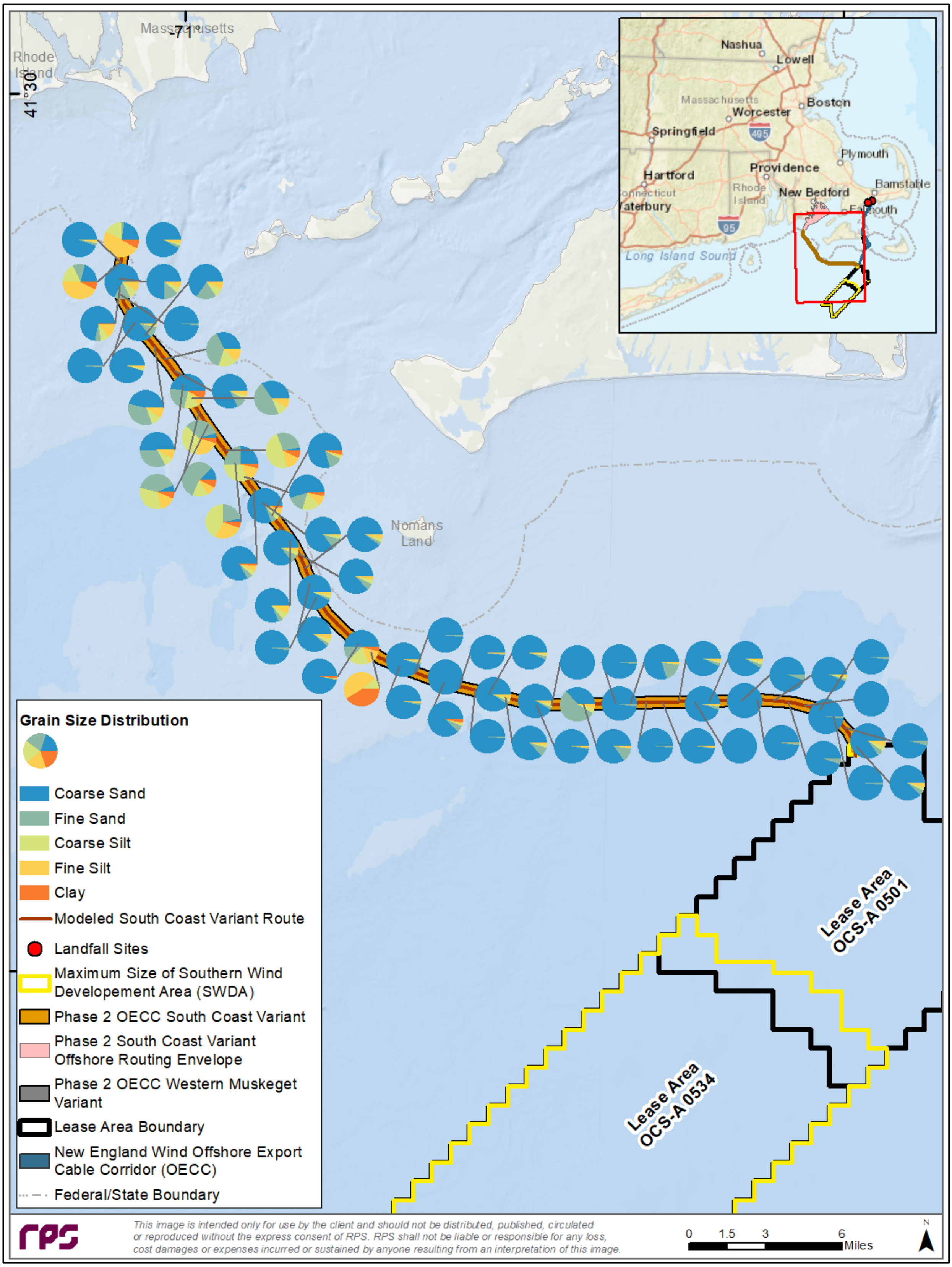

Figure 3. Sediment Grain Size Distributions along the South Coast Variant route.

2.3 Sediment Modeling Results

SSFATE simulations were performed for cable installation activities along the South Coast Variant. Sediment concentrations were computed on a grid with resolution of 75 m x 75 m in the horizontal dimension and 0.5 m in the vertical dimension. The model time step and output results saving interval was 10 minutes for the cable installation. 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 cable installation scenario. Mapped results are presented in Section 2.3.1 and tabular results are presented in Section 2.3.2.

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 Cable Installation

Mapped results for the representative cable installation simulation, along the South Coast Variant, are discussed in this section. This representative modeling assumed any required pre-dredging or sandwave removal occurred prior to cable installation. A snapshot of the instantaneous concentrations from the representative cable installation 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 are local to the bottom of the water column.

The map of maximum time-integrated concentrations is presented in Figure 5, the duration of exposure to TSS above ambient ≥10 mg/L is presented in Figure 6, and the seabed deposition is shown in Figure 7. 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 and/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 km from the centerline, though typically remaining within ~150 m or less from the centerline. The cross-sectional view of the maximum concentration (Figure 5) 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 ~200 m from the centerline (Figure 7). 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.

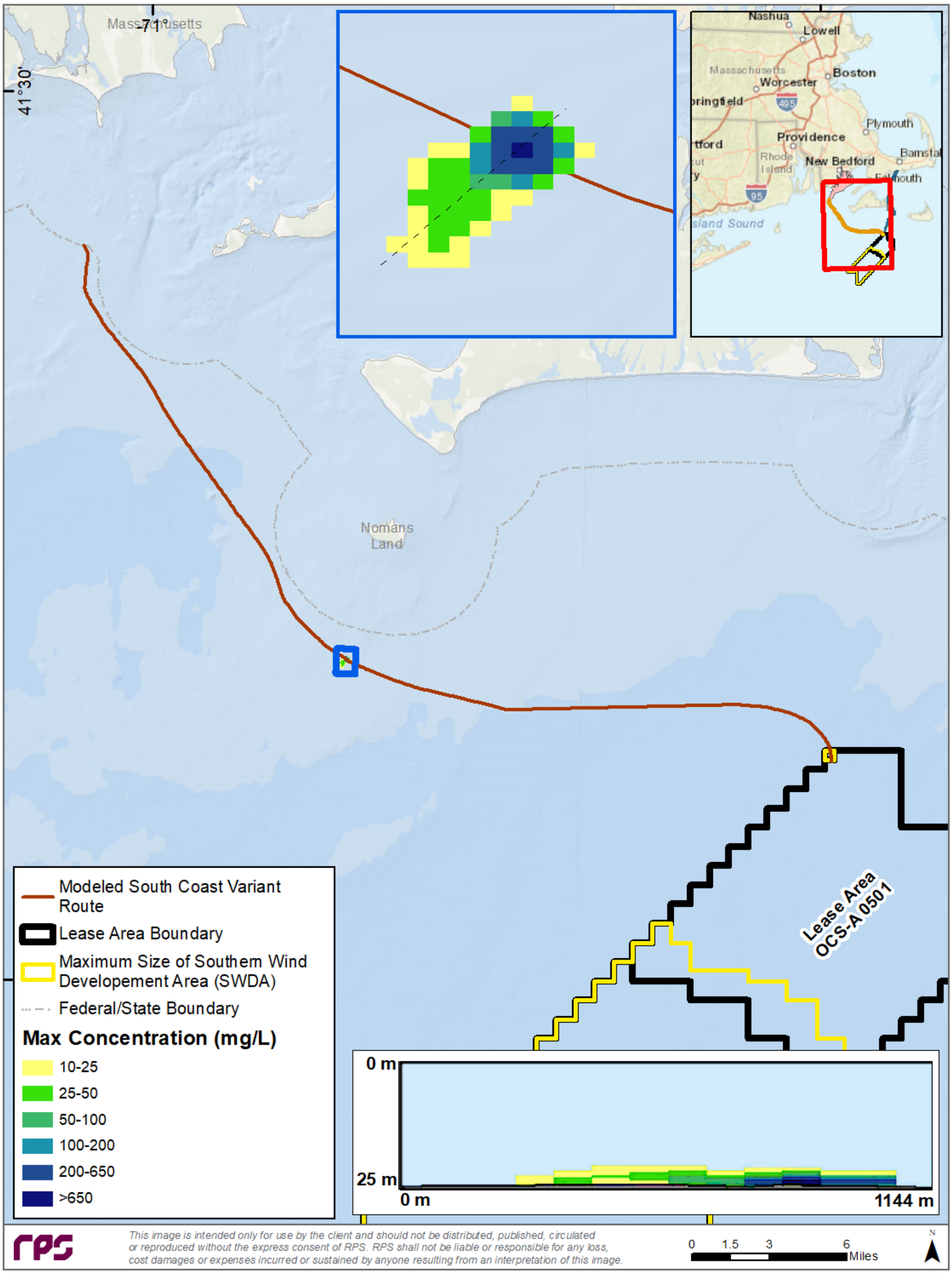

Figure 4. Snapshot of instantaneous TSS concentrations for a time step during simulation of representative cable installation within the South Coast Variant.[1]

Notes:

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

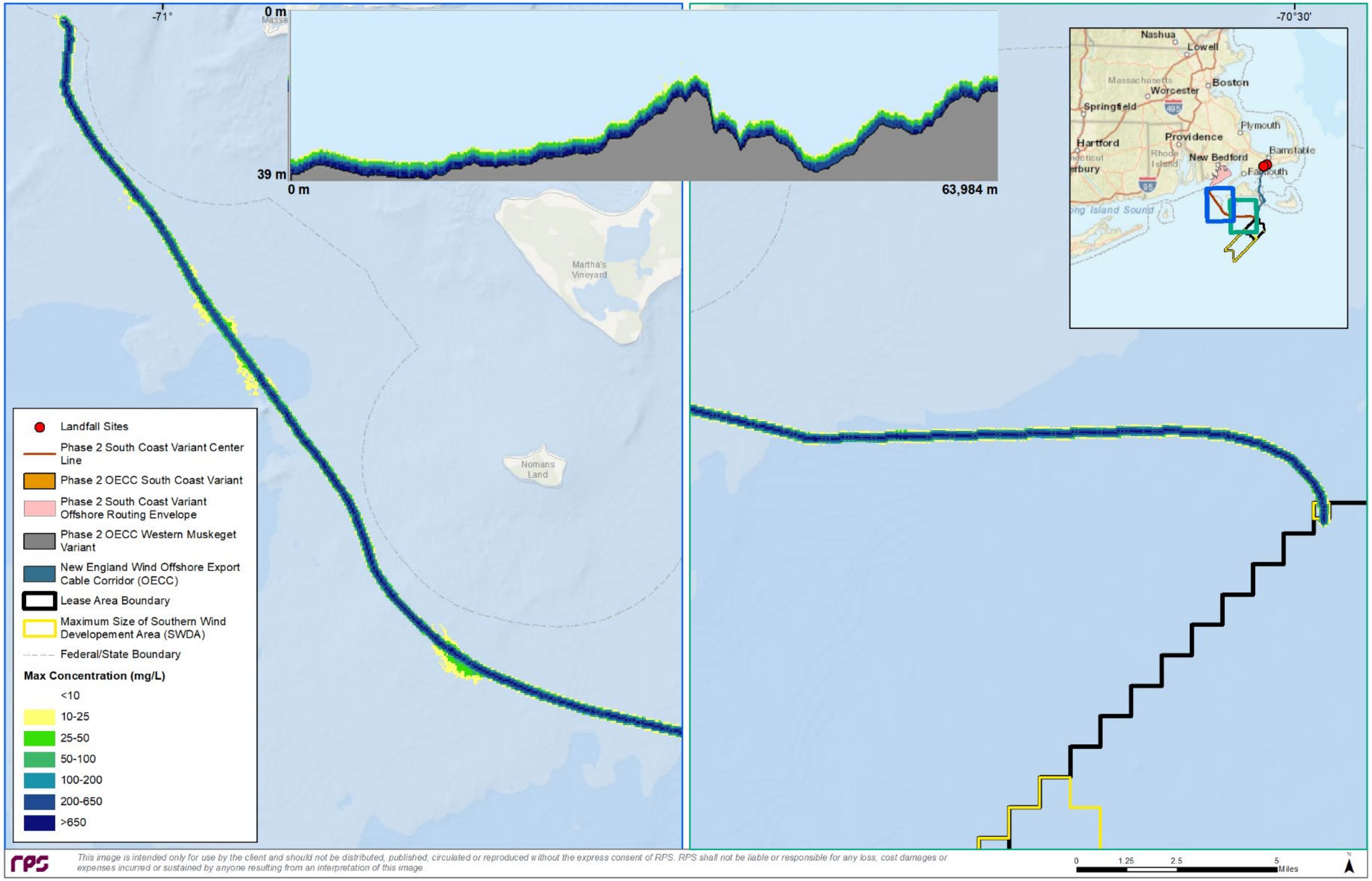

Figure 5. Map of time-integrated maximum concentrations associated with representative cable installation within the South Coast Variant.[1]

Notes:

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

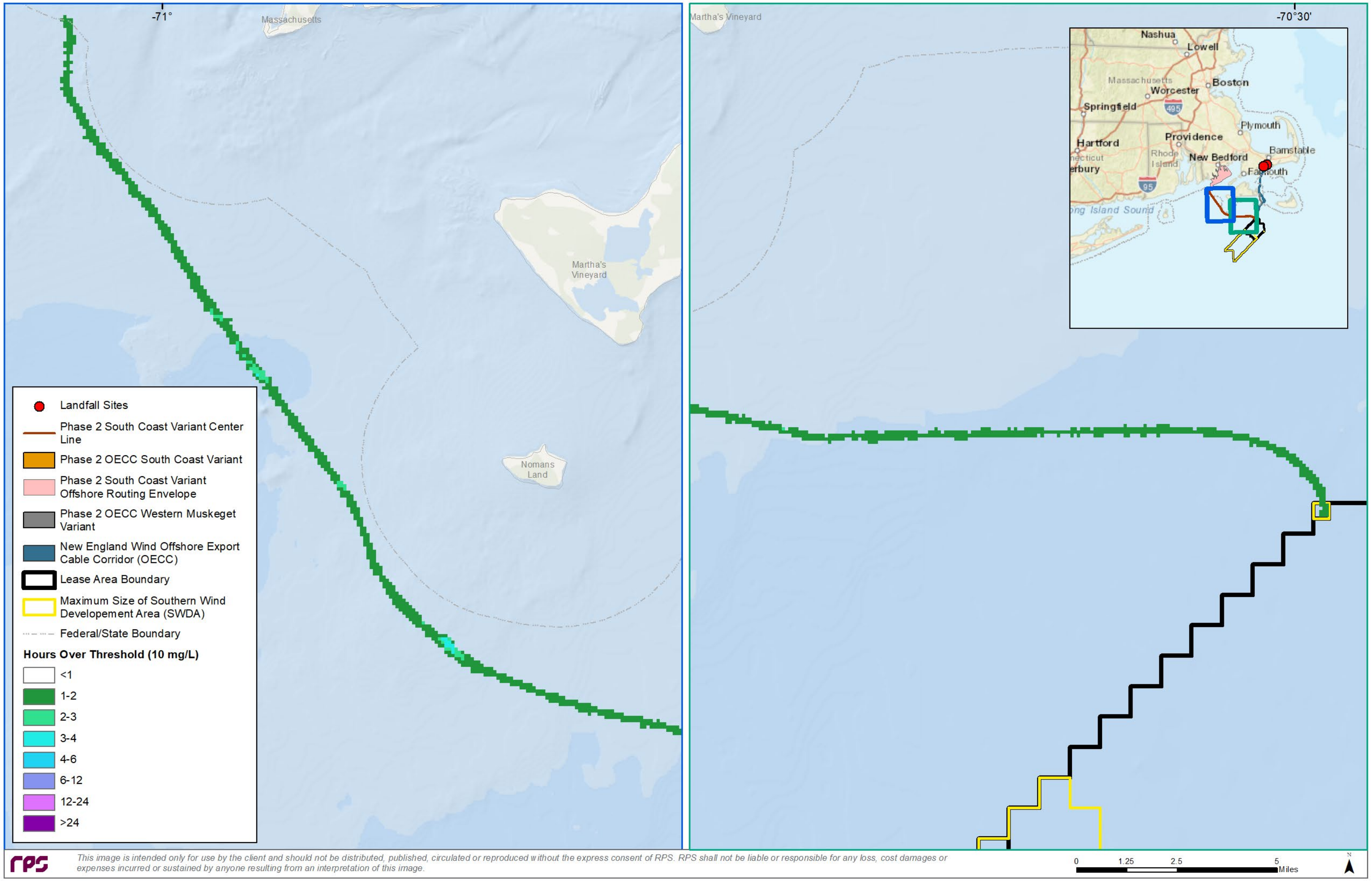

Figure 6. Map of duration of TSS ≥ 10 mg/L associated with representative cable installation within the South Coast Variant.

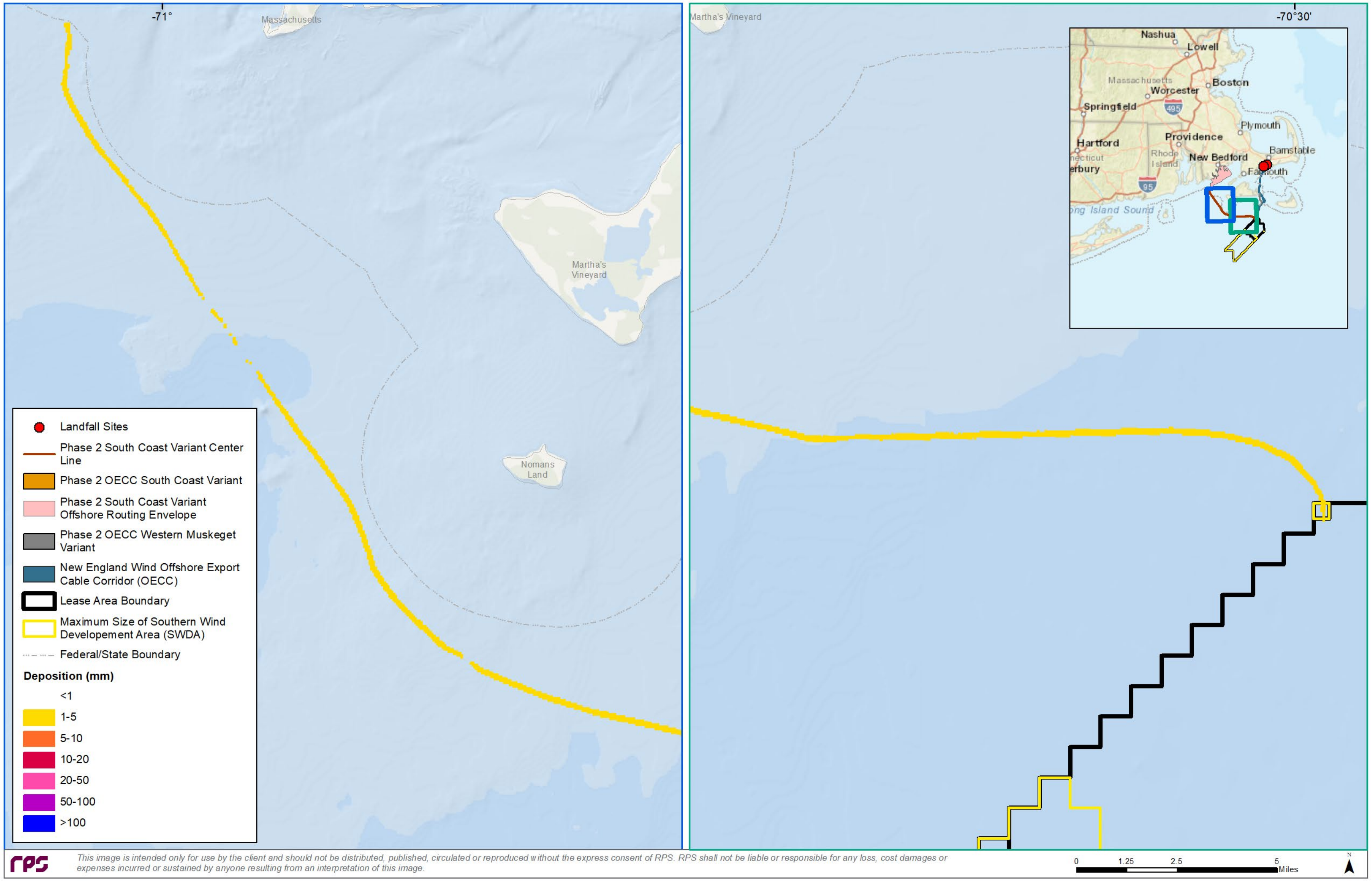

Figure 7. Map of deposition thickness associated with representative cable installation within the South Coast Variant.

2.3.2 Results Summary Tables

Results from the modeled scenario 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 5 through Table 8 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 75 m in the horizontal plane. For a route approximately 64 km long, the area covered by the grid cells along the route is therefore 4.8 km^2 (63,984 m x 75 m = 4.8 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 4.8 km^2 or 24 km^2.

These results tables illustrate that areas exposed to above-ambient TSS concentrations are largest when assessing concentrations ≥10 mg/L, and that the areas rapidly decrease in size with increasing concentration threshold and increasing duration. For example, the representative South Coast Variant cable installation scenario has 20.8 km^2 ≥10 mg/L for 1 hour, which reduces to 1 km^2 ≥200 mg/L and no area was predicted to be impacted by concentrations ≥650 mg/L (Table 5). Above-ambient TSS concentrations similarly decrease quickly with time: the concentrations ≥10 mg/L reduce from 20.8 km^2 for 1 hour (Table 5) to 0.9 km^2 for 2 hours (Table 6), to 0.2 km^2 for 3 hours (Table 7), and to 0.01 km^2 for 4 hours (Table 8). Also, for this representative scenario, concentrations ≥50 mg/L are not predicted to endure for 2 hours or longer. Similar trends of rapid decrease of area with increasing time and/or increasing threshold were noted in previous modeling for the cable installation scenario along the OECC and Western Muskeget Variant (Appendix III-A of COP Volume III).

The areas affected by sediment deposition over various thickness thresholds for the entire simulation route (Table 9), and the maximum extent to deposition (1 mm and 20 mm) and concentration (10 mg/L) thresholds (Table 10) are summarized below. The representative cable installation scenario along the South Coast Variant resulted in a maximum thickness less than 5 mm, with approximately 10.31 km^2 predicted to have depositional thicknesses ≥1.0 mm (Table 9). The maximum extent to the 1.0 mm thickness threshold was approximately 0.2 km, and a maximum extent of 0.9 km to the concentration threshold of 10 mg/L (Table 10).

Table 5. Summary of area over threshold concentrations for 1 hour or longer.*

OECC Route - Method	Concentration Thresholds in mg/L					
	10	25	50	100	200	650
	Areas above Concentration Threshold (km²)					
South Coast Variant - Cable Installation	20.8	18.0	13.6	7.8	1.0	N/A

*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 6. Summary of area over threshold concentrations for 2 hours or longer.*

OECC Route - Method	Concentration Thresholds in mg/L					
	10	25	50	100	200	650
	Areas above Concentration Threshold (km²)					
South Coast Variant - Cable Installation	0.9	0.2	N/A	N/A	N/A	N/A

*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 7. Summary of area over threshold concentrations for 3 hours or longer.*

OECC Route - Method	Concentration Thresholds in mg/L					
	10	25	50	100	200	650
	Areas above Concentration Threshold (km²)					
South Coast Variant - Cable Installation	0.2	N/A	N/A	N/A	N/A	N/A

*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 8. Summary of area over threshold concentrations for 4 hours or longer.*

OECC Route - Method	Concentration Thresholds in mg/L					
	10	25	50	100	200	650
	Areas above Concentration Threshold (km²)					
South Coast Variant - Cable Installation	0.01	N/A	N/A	N/A	N/A	N/A

*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 9. Summary of deposition area over threshold thicknesses for all complete routes.

OECC Route - Method	Deposition Thresholds					
	1 mm	5 mm	10 mm	20 mm	50 mm	100 mm
	Areas of Deposition above Threshold (km^2)					
South Coast Variant - Cable Installation	10.31	0.00	0.00	0.00	0.00	0.00

Table 10. Summary of maximum extent to deposition and concentration thresholds.

OECC Route - Method	Deposition Thresholds		Concentration Threshold
	1 mm	20 mm	10 mg/L
	Maximum Distance to Contour (km)		
South Coast Variant - Cable Installation	0.2	N/A	0.9

2.3.3 Model Results Discussion

In reviewing the mapped modeling results for this representative cable installation scenario along the South Coast Variant, assuming “typical” parameters, the cable installation activities may generate temporary plumes that are constrained to the bottom of the water column, do not extend far from the route centerline, and ultimately deposited along the route (Table 10). This was due, in part, to the combination of a relatively high fraction of coarse-grain material present along the South Coast Variant, the relatively weaker currents (as compared to those through the Muskeget Channel), and the introduction of sediment near the seabed.

The simulation of 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 ~1 km, though often less than 150 m from the route centerline, and typically dissipated within four to six hours. Deposition greater than 1.0 mm was limited to within 200 m from the route centerline for typical installation parameters.

As expected, areas containing higher fractions of fine material (Figure 3) resulted in a plume that lingered longer in the water column and oscillated with the currents, thus increasing the plume’s extent as it was transported away from the source. Areas with longer durations of exposure occurred due to the sediment composition containing higher fractions of fine material, and because the direction of the current either caused the plume to oscillate back-and-forth across the route or was in-line with the route, both of which compounded the duration of exposure.

If dredging were to occur along the South Coast Variant, based on results from simulations of sandwave dredging along the OECC and Western Muskeget Variant, the plumes originating from the source would likely be intermittent along the route because of the intermittent need for dredging. The extent of the TSS plume, with excess concentrations ≥10 mg/L, would likely be on the order of 10’s of km as those dredging scenarios introduced sediment at the water surface rather than near the seabed. This results in the released sediments taking longer to deposit on the seabed, and so are exposed to more tidal fluctuations which cause the suspended sediments to transport further from the release location. However, the extent may be smaller than those predicted for the OECC and Western Muskeget Variant as the magnitude of the currents along the South Coast Variant route were generally smaller. Slower currents may also increase the time it takes to dissipate the plume and so a longer duration of exposure may be expected, as well as slightly higher TSS concentrations (>1,000 mg/L). Based on larger areas predicted to be impacted by TSS concentrations and deposition ≥1.0 mm along the South Coast Variant, the areas exposed to water column concentrations for dredging scenarios would likely be larger than those predicted for the Muskeget Channel modeling. However, as with the Muskeget Channel modeling, concentrations ≥100 mg/L would likely persist for less than three to four hours, with excess concentrations ≥10 mg/L being temporary and typically dissipating within six hours. In locations with higher percentages of fine-grained material (e.g., clay, silt), a more persistent plume that extends further from the route centerline may be expected.

2.3.4 Literature Review: Hard Substrate Cable Installation

Based on results from the geotechnical survey, a section of the South Coast Variant route may intersect hard-bottom substrates (e.g., consolidated sediments, paved, gravel) so use of the modeled jetting technique alone may not be sufficient to install the cable. Use of a specialty installation tool, such as a mechanical trencher with a rotating chain or wheel cutter or mechanical dredger (e.g., bucket, backhoe) may be required to adequately install the cable in sections with hard-bottom substrates. Chain cutters are versatile as they can be used for pre-trenching, cable burial, or as a post-lay technique and are capable of loosening or removing high strength, cohesive soils, soft rocks, or fractured rock. In isolated sections of hard substrates, a chain or wheel cutter may be used as a pre-trenching method to loosen or remove enough hard sediment so that jetting techniques can be used to clear the remaining loose material and proceed with cable installation within the cleared trench (NYSERDA, 2021).

Although the production rate and resuspension rate vary depending on several factors (e.g., the material being dredged, volume being removed, equipment specifications), forward progress (i.e., advance rate) when using a chain cutter would likely be slower due to the nature of the hard substrate being cleared. Additionally, sources of subsurface sediment plumes that were not considered in this study may result from cutting hard formations, including but not limited to: 1) the dredged material being broken into micron sizes particles (i.e., material break-up), and 2) “washing” of particles as the blade emerges from the sediment and is exposed to the water column or as a result of over-burial of the cutter wheel.

Based on available literature for a cutter suction dredge, a lower resuspension rate (<1 %; Hayes et al., 2000; Hayes and Wu, 2001; Anchor Environmental, 2003) may be expected for a mechanical trencher with a chain or wheel cutter than for jetting techniques alone but is similar in that the majority of sediment resuspension occurs at the point of removal (i.e., near the seabed; Anchor Environmental, 2003). Removing or loosening of hard substrate material would likely cause subsurface sediment plumes in addition to those predicted for the cable installation modeled herein due to material break-up and “washing” of particles. Results for the representative OECC “Cable Installation Aided by Jetting” scenario (reported in Appendix III-A of COP Volume III), would likely be representative of impacts associated with use of a mechanical trencher (e.g., chain cutter) as that modeled scenario used a slower advance rate (100 m/hr) than cable installation alone, and a conservative resuspension rate (25%) to account for additional subsurface sediment plumes due to material break-up or washing of particles.

2.3.5 Conclusions

In general, trends of rapid decrease of area with increasing time and/or increasing concentration threshold are noted for this scenario, as was reported for the representative cable installation scenarios along the OECC and the Western Muskeget Variant. Larger areas were predicted to be impacted by water column concentrations (all thresholds) for 1 hour or longer and deposition ≥1 mm for the South Coast Variant than when compared to the representative cable installation scenarios along the OECC and the Western Muskeget Variant. While the depositional footprint extended slightly further from the route centerline and the concentration and depositional areas impacted were larger for 1 hour and longer, the areas impacted by water column concentrations were similar for 2 hours or longer, and the TSS plume was predicted to remain slightly closer to the route centerline for the representative cable installation scenario along the South Coast Variant. Importantly, the 10 mg/L excess plume typically dissipated within four to six hours for the South Coast Variant and deposition was predicted to remain close to the cable centerline with a maximum thickness less than 5 mm, which is similar to modeled results along the OECC and Western Muskeget Variant. Differences in the extent and persistence of the plumes and the extent and thickness of deposition for the South Coast Variant and the OECC and Western Muskeget Variant modeling may be attributed to route orientation relative to currents, the magnitude of the currents, the timing of currents, and sediment grain size distribution.

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