TISBURY MARINE TERMINAL

Essential Fish Habitat Assessment Review

Prepared by:

RPS

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1 INTRODUCTION

RPS was contracted by Foth Infrastructure & Environment, LLC to conduct an Essential Fish Habitat (EFH) Assessment in support of the Tisbury Marine Terminal, LLC (TMT) to determine impacts of improving an existing marine infrastructure pier to support offshore windfarm operation. The subject property is in Vineyard Haven Harbor, Martha's Vineyard and currently is utilized for the receipt/transfer of materials, cargo, and storage (Figure 1-1). The marine terminal currently accommodates a variety of land and water-based equipment, vessels, and barges. The 1.4-acre site at the TMT has been in operation since the late 1800s and provides essential services for the entire island of Martha's Vineyard.

The primary goals/objectives of the proposed project are the following:

- Create a centralized control facility that has the unique ability to provide operational and maintenance services for offshore wind farms;
- Reduce global green-house gases by providing O&M services required to support offshore wind farms;
- Economic growth and job creation on Martha's Vineyard;
- Maintain and improve TMT marine infrastructure; and
- Enhanced public access to the shoreline while maintaining the working waterfront.

This EFH Assessment document covers the proposed project plan as updated recently in June of 2021 in Section 2. Section 3 describes the available habitat and associated sampling conducted in the Project Area. Section 4 provides a compilation of species that have EFH designations within the Project Area listed by life stage and habitat requirements. An analysis of all potential impacts to EFH during construction and operation of the TMT is then outlined in Section 5. In Section 6, this document then concludes with a EFH impact determination section with timelines of recovery and recommendations for mitigation.

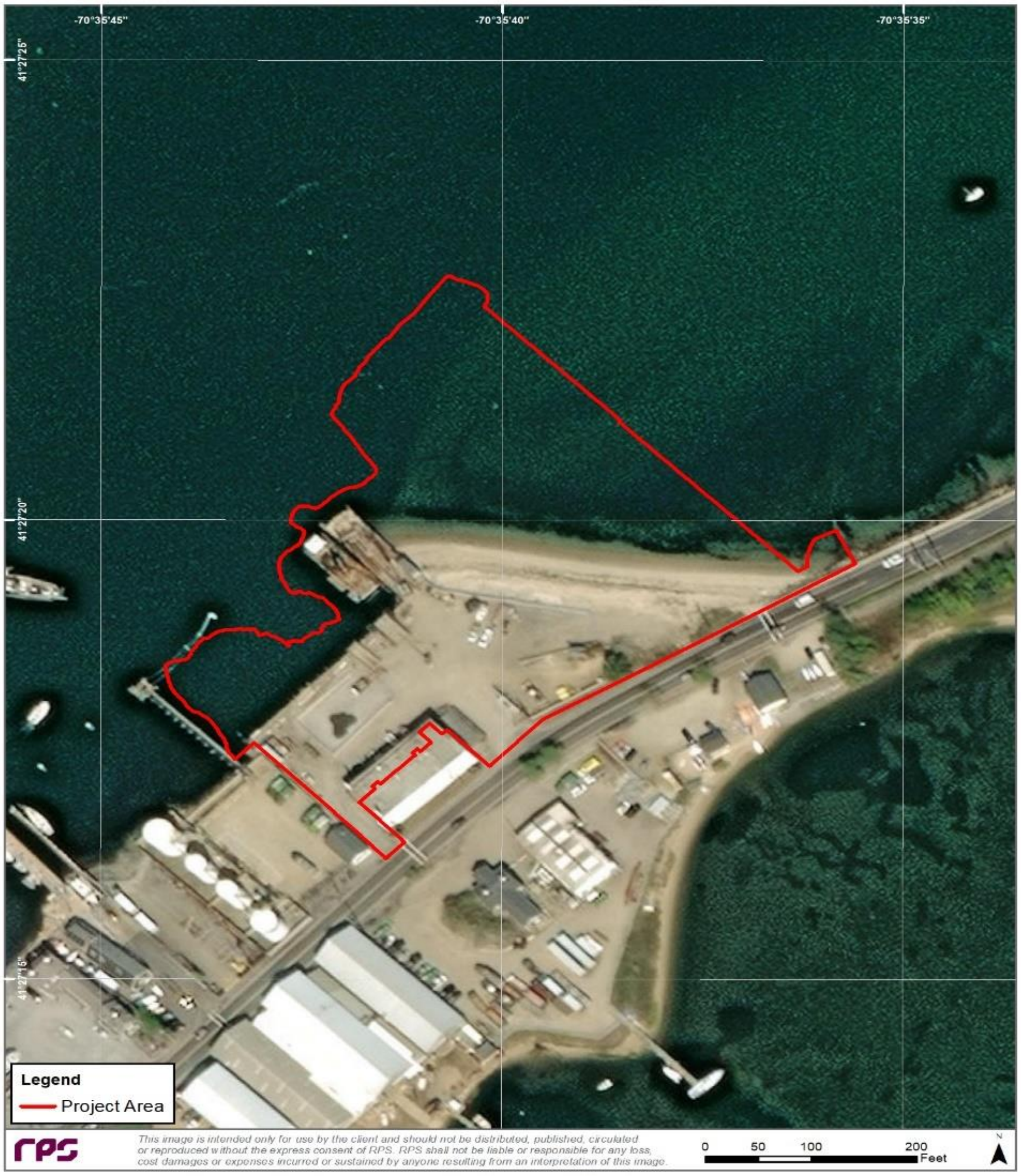

Figure 1-1. Aerial image of proposed Project Area with existing pier within construction and dredging footprint**.**

The Magnuson-Stevens Act mandates that federal agencies conduct an Essential Fish Habitat (EFH) assessment for any activity that may adversely affect EFH of federally managed fish species. The Magnuson-Stevens Act was amended in 1996 by the U.S. Congress under the Sustainable Fisheries Act (SFA). The SFA recognized that many fisheries depend on marine, nearshore, and estuarine habitats for at least part of their lifecycles and introduced requirements to protect estuarine and marine ecosystems through identification and conservation of EFH for those species regulated under a federal fisheries management plan. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Included in the Magnuson-Stevens Act in 1996, 16 U.S.C. ch. 38 § 1801 et seq., the primary goal of EFH designation is to identify and protect important fish habitat from certain fishing activities or coastal and marine development. EFH is designated by National Oceanic and Atmospheric Administration's (NOAA) Fisheries and Regional Fishery Management Councils (P.L. 104-297). EFH is typically assigned by egg, larvae, juvenile and adult life stages and designated as waters or as substrates. NOAA Fisheries defines waters and substrate as (50 C.F.R. § 600.10):

- Waters—Aquatic areas and their associated physical, chemical, and biological properties that are used by fish and, where appropriate, may include aquatic areas historically used by fish.
- Substrate—Sediments, hard bottoms, structures underlying the waters, and associated biological communities.

Additionally, the Regional Fishery Management Councils identify Habitat Areas of Particular Concern (HAPCs) within their Fishery Management Plans (FMPs). HAPCs are discrete subsets of EFH that serve extremely important ecological functions or are especially vulnerable to degradation.

2 PROJECT PLAN

The proposed project includes the dredging of materials for beneficial re-use; rebuilding of the solid-filled pier; oversheeting the existing bulkhead; installation of new steel bulkheads; a steel sheet pile wave fence; two barge ramps; a pile-supported concrete deck; and a public access platform with timber stairs for coastal access (Figure 2-1). The proposed project includes two primary sections. The Southern Section will continue to support current TMT operations and be utilized as a materials, cargo and bulk transfer/storage facility and marine terminal accommodating a variety of land and water-based equipment, vessels, and barges. The Northern Section of the site will serve as the new Operations and Maintenance (O&M) facility for future offshore wind operations and a vessel berthing area.

The project site consists of maintained gravel surfaces extending to the edge of the existing solid fill pier and a sandy coastal beach to the north. The current TMT operations are located within a Waterfront/Commercial zoned district which allows for industrial uses to occur along the waterfront. The project site includes a variety of coastal resource areas including coastal beach, coastal dune, rocky intertidal shore, land under the ocean (LUO), barrier beach, land containing shellfish, land subject to coastal storm flowage (LSCSF), and is also within the 30.5 m (100 ft) buffer zone to these resource areas. Other regulated areas within the proposed Project Area include historically mapped eelgrass and Natural Heritage and Endangered Species Program (NHESP) Priority and Estimated Habitat for rare species. According to the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map (FIRM) 25007C0103J and 25007C0104J effective July 20, 2016, the entire Project Area is located within a designated Velocity Zone (VE Zone) with a Base Flood Elevation (BFE) of El. 13 feet (ft) NAVD88 and AE Zone with a BFE of 11 ft NAVD88.

The recently reviewed project included three (3) barge ramps extending seaward of the sheet pile bulkhead on the TMT terminal side of the property. The changes to the TMT facility operations include removal of the third barge ramp, designing the proposed barge ramps to the landward side of the steel sheet pile bulkhead, and removal of the three (3) timber pile dolphins on the southwest side of the berthing area and constructing three (3) timber piles along the northern side of the TMT facility. The oversheeting of the steel bulkhead, realigning and filling of the solid fill wharf, proposed fill to level site to 6.0’ NAVD88, and maintenance dredging is not changing in the proposed project. A positive of the recent project changes is a reduction of acres of impervious area from 0.36 acres to 0.13 acres. The gross square footage of structures was reduced from 1,469 square meter (m^2) (15,811 square feet [SF]) to 529 m^2 (5,700 SF), and the maximum height of all structures was also reduced from 11 m (36 ft) to 6 m (20 ft).

2.1 TMT Facility Operations (Southern Section)

The project recently reviewed by regulatory agencies included three (3) barge ramps extending seaward of the sheet pile bulkhead on the TMT Terminal side of the property. The current changes to the TMT Facility Operations include removal of the third barge ramp; designing the proposed barge ramps to the landward side of the steel sheet pile bulkhead; and removal of the three (3) timber pile dolphins on the southwest side of the berthing area and berthing area and constructing three (3) timber piles along the northern side of the TMT facility. The oversheeting of the steel bulkhead; realigning and filling of the solid fill wharf; proposed fill to level site to 6.0’ NAVD88 (Table 2-1); and maintenance dredging is not changing in the proposed project. The proposed changes to the TMT Facility Operations reduce the overall footprint within coastal resource areas from the previously proposed, recently reviewed project (Table 2-2).

Table 2-1. Summary of TMT Facility Operations Area – Southern Section

Project Component	Currently Proposed Project Area
Level Landward Site Grade to +6.0’ NAVD88	4,249 m^2
Dredge to EL -14’ NAVD88 +1’ O.D.	2,837 m^2 (6,020 cubic yards [CY])

Table 2-2. Summary of Resource Area Impacts within TMT Facility Operations Area

Project Component	Land Under Ocean	Land Containing Shellfish
TMT Bulkhead (including Return to O&M)	0.009 m^2 (3 LF)	0.37 m^2 (101 LF)
Sediment Fill on TMT Lot to El. +6 ft NAVD88*	0 SF	2,428 m^2
TMT Facility Dredging (-14’ NAVD88 + 1’ OD)	2,836 m^2 (4,601 CY)	3,055 m^2 (6,020 CY)

*The solid-filled pier is being reduced in overall size by 23.4 m^2 which is within Land Under Ocean. The area will be dredged to -14’ NAVD88 where being removed, then fill placed to top of solid-filled pier elevation, +6’ NAVD88.

2.2 O&M Facility (Northern Section)

The changes to the recently reviewed project within the proposed O&M Facility area include changes to the dredge area, pile-supported pier, marine support building, and access road. The O&M marine support building has been removed from the proposed project due to a change in operational constraints of the proposed project site. The removal of the support building from the site also includes removing the access roadway along the existing grade and allows for changes to site access.

The O&M facility and dredge footprint has been reduced in area and shifted approximately 5 ft to the north. The proposed site access is through a ramp from Beach Road within the pile-supported pier. With the change of access and removal of the O&M marine support building, the pier for the O&M facility has been redesigned as a rectangular pile supported pier to optimize function and usability to meet the project needs. The proposed pier is a steel pipe pile-supported concrete deck with a deck elevation of 2.4 m NAVD88, which was elevated an additional 0.61 m to accommodate projected sea level rise (SLR). The proposed pier is approximately 3,607 m^2 supported by 204 steel pipe piles (Table 2-3). This pier design change reduces the access road impact to land subject to coastal storm flowage (LSCSF) and Coastal Beach. The construction of the pier will include temporary impact to the Coastal Beach. The sediments in the area around the beams will be excavated to approximately 0.91 m NAVD88 and stockpiled to allow for placement of the support beams. Once placement is complete, the stockpiled sediment will be replaced to pre-construction conditions around the beams.

The bulkhead from the TMT Facility northern barge ramp to the intersection of TMT Facility and O&M Facility operations will not change. The bulkhead landward return will extend at a 1.8 m elevation along the intersection of the facilities to serve as the interface between the pile-supported pier and the landside stone revetment. Installation of three 36-inch pipe pile mooring dolphins along the southern boundary of the O&M facility to replace previously proposed timber pile dolphins. The diagonal bulkhead along the Coastal Beach has been removed from the design. The existing riprap along the Coastal Beach will remain, and stones will be reset around the proposed access ramp apron. The revetment located along the Coastal Beach was previously permitted. The proposed project includes resetting stones in the revetment to support the landward area.

The sheet pile wall and fender system, wave fence, gangway, and float within the berthing area of the O&M facility have not changed within the proposed reconfiguration zone. The dredge depth did not change and remains at -18.39 ft NAVD88 with a 1.8 m allowable overdredge depth. The dolphins between the small and large berthing area in the recently reviewed project have not changed.

Table 2-3. Summary of O&M Facility Operations Area – Northern Section

Project Component	Currently Proposed Project Area
O&M Bulkhead with Fender System	0.68 m^2 (186 LF)
36” Diameter Mooring Piles (3)	1.9 m^2
12” Diameter Timber Piles (180)	13.2 m^2
O&M Bulkhead Landward Return	0.37 m^2 (101 LF)
O&M Pile Supported Pier with Concrete Deck to +8.0’ – DECK AREA	3,606 m^2
O&M Pile Supported Pier with Concrete Deck to +8.0’ – PILE AREA	41.3 m^2
Reset Revetment Stones	85 m^2
Dredge to EL. -18.39 + 1’ O.D.	3,842 m^2 (13,929 CY)

The recently reviewed project included a pile supported public lookout located on the Town of Tisbury property east of the O&M Facility and connected to the Beach Road crosswalk by a 10 ft wide boardwalk (Table 2-4). This public lookout landing allows for public access along the beach and remains in the proposed project with the beach nourishment component.

Table 2-4. Summary of Public Access Area

Project Component	Currently Proposed Project Area
Public Lookout Access Boardwalk – PILES	1.2 m^2
Public Lookout Access Platform Timber Stairs	3.5 m^2

The proposed changes to the O&M facility reduce the overall footprint within Coastal resource areas from the previously proposed, recently reviewed project (Table 2-5; Table 2-6). The previously reviewed project and currently proposed project included impact in the following Coastal Resource areas: Coastal Beach, Coastal Bank, Land Subject to Coastal Storm Flowage, Land Under the Ocean, Coastal Dune, and Habitat for endangered and threatened species under Natural Heritage Endangered Species Program (NHESP). The changes minimize the impacts to Coastal Beach, Coastal Dune, and Land Under the Ocean resource areas while reaching the project goals of the TMT and O&M facilities to serve offshore wind.

Table 2-5. Summary of Resource Area Impacts within O&M Facility Operations Area

Project Component	Land Under Ocean	Land Containing Shellfish
Offshore Wind O&M Bulkhead along Berth Area	0.92 m^2 (186 LF)	0.92 m^2 (186 LF)
Offshore Wind O&M – Wave Fence	8.4 m^2 (203 LF)	8.4 m^2 (203 LF)
Timber O&M Pile-Supported Deck – PILES	24.7 m^2	41.2 m^2
O&M Dredging (-14’ NAVD88 + 1’ OD)	3,834 m^2 (13,884 CY)	3,824 m^2 (13,929 CY)

Table 2-6. Summary of Resource Area Impacts within Public Access Area

Project Component	Land Under Ocean	Land Containing Shellfish
Public Lookout Boardwalk and Lookout - PILES	0 SF	2.2 m^2
10’ x 7’ Timber Stairs	0 SF	6.5 m^2

There will be sediment and erosion control features in place throughout construction to minimize and potentially avoid impact of sediment to areas outside of the work site. The project team will work with the state agencies on the appropriate mitigation and will follow standard construction best management practices.

Dredge sediment reuse/disposal is pending a Suitability Determination by the USACE based on testing of grain size distribution and chemical analyses as required to determine allowable reuse/disposal options for dredge sediments. At this time, the following alternatives are being considered for reuse/disposal of dredge sediments.

Sediment Disposal Alternative 1

On-site Beneficial Re-use Beach Nourishment: If sediments are deemed suitable, they may be used for nourishment shoreline areas within the project site. Under this option, sediments will remain within the native littoral system and placed along down-drift location(s) from the dredge areas.

Fill: If beach nourishment within the project site is not a viable option for sediments, they will be evaluated for on-site reuse as fill.

Sediment Disposal Alternative 2

Off-site Beneficial Reuse (island wide) Beach Nourishment: Any grain-size compatible sediment can be used for beneficial re-use nourishment for beaches on the Vineyard, including the Eastville Beach. This alternative would not require a substantial effort in trucking and would promote beach use and provide aid to sediment buffer systems such as barrier beaches and developed areas near the project site. Other similar areas may be available for nourishment and will be vetted through the permitting process.

Fill: If beach nourishment is not a viable option for sediments, they will be evaluated for off-site reuse as fill.

Sediment Disposal Alternative 3

Beneficial Reuse as Daily Cover/Disposal at MA Landfill: Should the grain-size and chemical analysis determine the dredged sediments are not suitable for the purpose of beach nourishment (on or off-site) or reuse as fill (on or off-site), they may be used as daily cover or placed at a regulated Massachusetts landfill facility provided the physical and chemical analyses performed meet the requirements for daily reuse or landfill disposal as per Massachusetts regulations cited under 314 CMR 9.00 and COMM Policy #97-001.

Sediment Disposal Alternative 4

Unconfined Offshore Disposal: At this time, available offshore disposal sites within the state of Massachusetts are limited to the two sites located in Massachusetts Bay and Cape Cod Bay. Due to the proximity of the project site, it is anticipated that towing fees could exceed transportation fees associated with an upland disposal option(s). However, once the Suitability Determination has been completed, a cost analysis will be performed for all possible reuse/disposal alternatives at which time offshore disposal may be revisited.

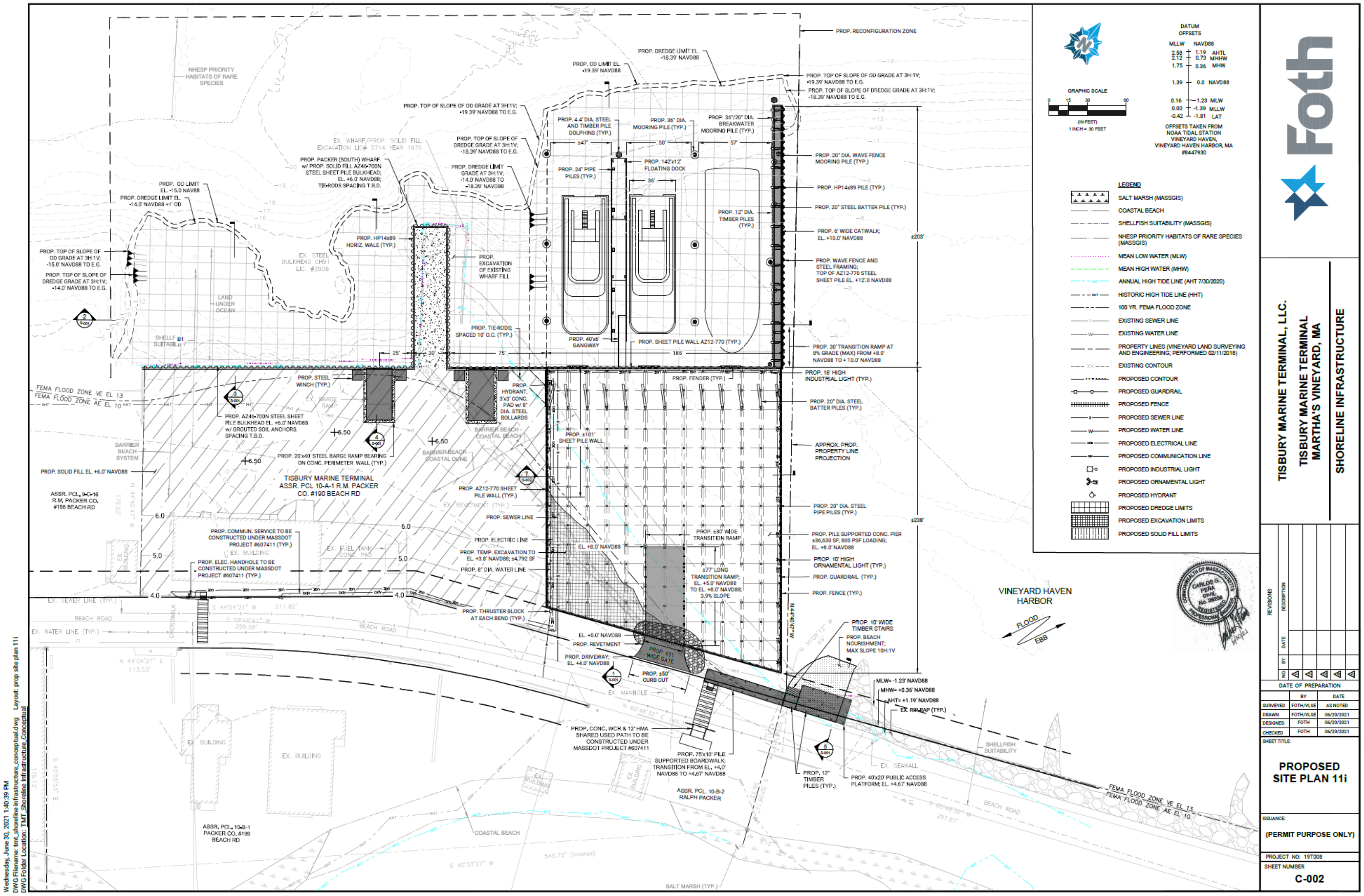

Figure 2-1. Updated proposed project plan, 30 June 2021.

3 SITE HABITAT DESCRIPTION

The proposed project is located on the northern coast of Martha's Vineyard in Vineyard Haven Harbor off Beach Road of Tisbury, MA (41°27'37.96'N, Longitude 70°35'18.01W; Figure 3-1). The 1.4-acre project site is partially located on a barrier beach, which extends along the south side of Vineyard Haven Harbor and Lagoon Pond. The Project Area is adjacent to an existing marine terminal to the southwest and approximately 340 meters (m) east of the Vineyard Haven Ferry Terminal. The site has a water depth of 0 to >16.8 ft mean low water (MLW) and a salinity of 32 parts per thousand (ppt). The water temperature ranges from 2 to 22 degrees Celsius (C).

The western portion of the proposed Project Area has sandy sediments and is a berth area for barges. Results from 18 sediments samples indicated that there was an average of 84.1% composition of sand or finer sediments and only four samples had > 30% gravel (described further in Section 3.3; Table 3-1). Desktop research indicated that the property contains four buried tanks that previously contained petroleum hydrocarbons. None of the tanks are currently in use. Massachusetts Department of Environmental Protection (MA DEP) last inspected the site in October 2013, and all areas surrounding the tanks were free of contaminants. A Termination of Notice of Activity and Use Limitation was recorded on November 3, 2020.

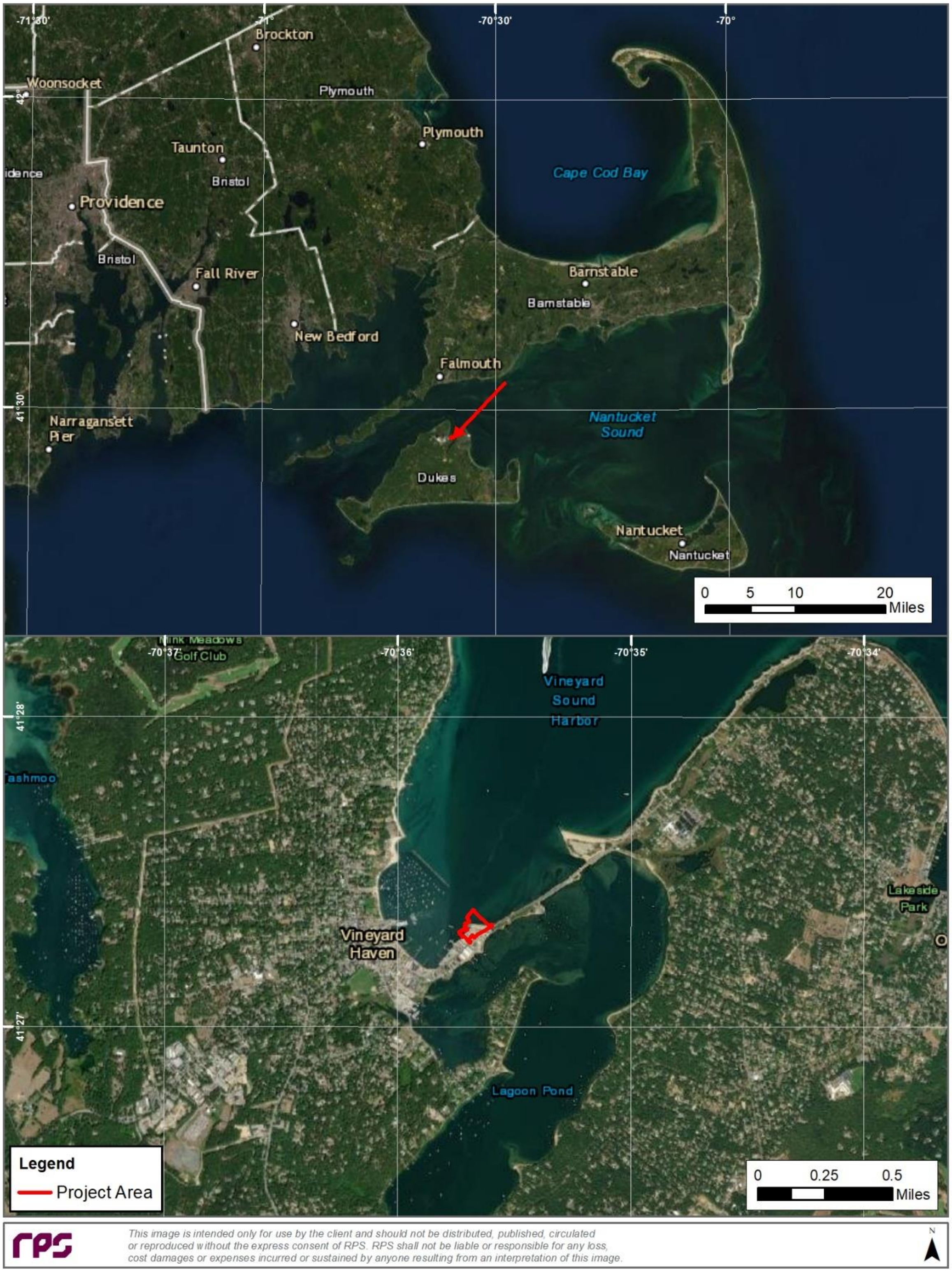

Figure 3-1. Maps depicting (a) the project location on Martha's Vineyard and (b) an aerial view of Project Area including existing pier, dock construction, public access lookout, and dredging footprint.

3.1 Eelgrass

The eastern portion of the Project Area is sandy coastal beach. Eelgrass beds have been mapped locally by the MA DEP and documented in the waters to the northeast of the Project Area. The presence of eelgrass has been diminishing over the past 24 years to a currently non-existent state in the most recent survey in 2019 (1995 – 2019; Figure 3-2 a-f; MassGIS 2020). In support of the TMT project, an extensive eelgrass field survey was completed by Foth Infrastructure and Environmental, LLC to determine the presence or absence of eelgrass and/or widgeon grass beds within the vicinity of the area of impact for proposed work. This on-site survey was conducted on 7 June 2019 to confirm the eelgrass limits in the Project Area. The survey consisted of 20 transects perpendicular to shore starting 91 m (300 ft) beyond the eastern-most extent of the project (adjacent to Beach Road) and extending south towards the existing pier structure approximately 91 m (300 ft) beyond the project limits to the south. The spacing was determined by the requirement of coverage and a real-time initial review of the data. Transects started at approximately the 5 ft depth contour and extended out approximately 27 m (90 ft) in the Western Section and 119 m (390 ft) in the Eastern Section (Figure 3-3). The survey was performed using guidance provided in the *Massachusetts Division of Marine Fisheries Technical Report TR-43, "Technical Guidelines for the Delineation, Restoration, and Monitoring of Eelgrass (Zostera marina) in Massachusetts Coastal Water"* (MDMF 2010) and *Joint Federal Regulatory Resource Agency Submerged Aquatic Vegetation Survey Guidance for the New England Region* (USACOE 2016).

The determination of presence/absence and extent of eelgrass started with a desktop study and initial site investigation conducted by Foth Infrastructure and Environmental, LLC. The desktop study included a review of the MassGIS OLIVER[1] eelgrass mapping (MassGIS 2020; Figure 3-2). Maps including waters adjacent to the Project Area indicated the presence of eelgrass beds on the north end of the Project Area from 1995 and 2001. No eelgrass was present in the project vicinity in the 2006-2007 mapped area, while the beds migrated further north outside of the Project Area according to the 2010-2013 and 2015-2017 MA DEP GIS data. The extent of the beds decreased from the initial map in 1995 to the latest map in 2019-2022.

The eelgrass video survey was performed utilizing an underwater camera attached to a reinforced cable. The camera was raised, lowered, and directed in a fashion that produced images of the bottom that allowed for the determination of the presence/absence of eelgrass. The images were georeferenced using a video overlay device that indicated the position of the image relative to the State Plane Coordinate System, NAD83. Video files were logged to a computer and reviewed in the office to determine the

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[1] http://maps.massgis.state.ma.us/map_ol/oliver.php

presence/absence, relative density, and extent of eelgrass. Foth Infrastructure and Environmental, LLC survey personnel implemented further ground-truthing techniques as a quality control measure to confirm the absence of eelgrass beds in shallow water by observing the ocean bottom over the sides of the survey vessel. Results of the survey indicated that eelgrass was not present within the survey area.

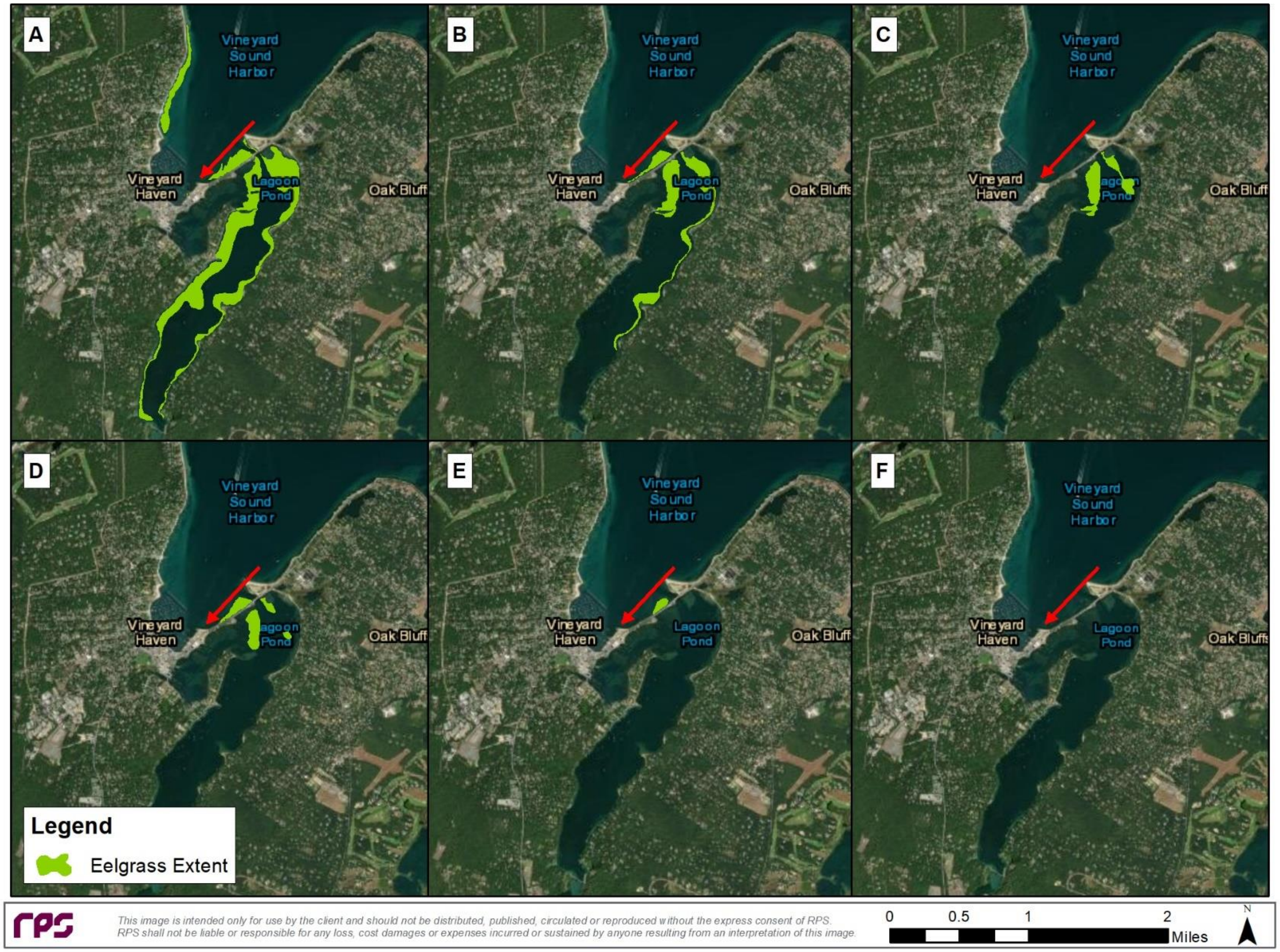

Figure 3-2. MassDEP seagrass maps from (a) 1995 (b) 2001 (c) 2006-2007 (d) 2010-2013 (e) 2015-2017 and (f) 2019-2022. All seagrass in green shaded areas is eelgrass (No *Ruppia* present) and project site is the red arrow.

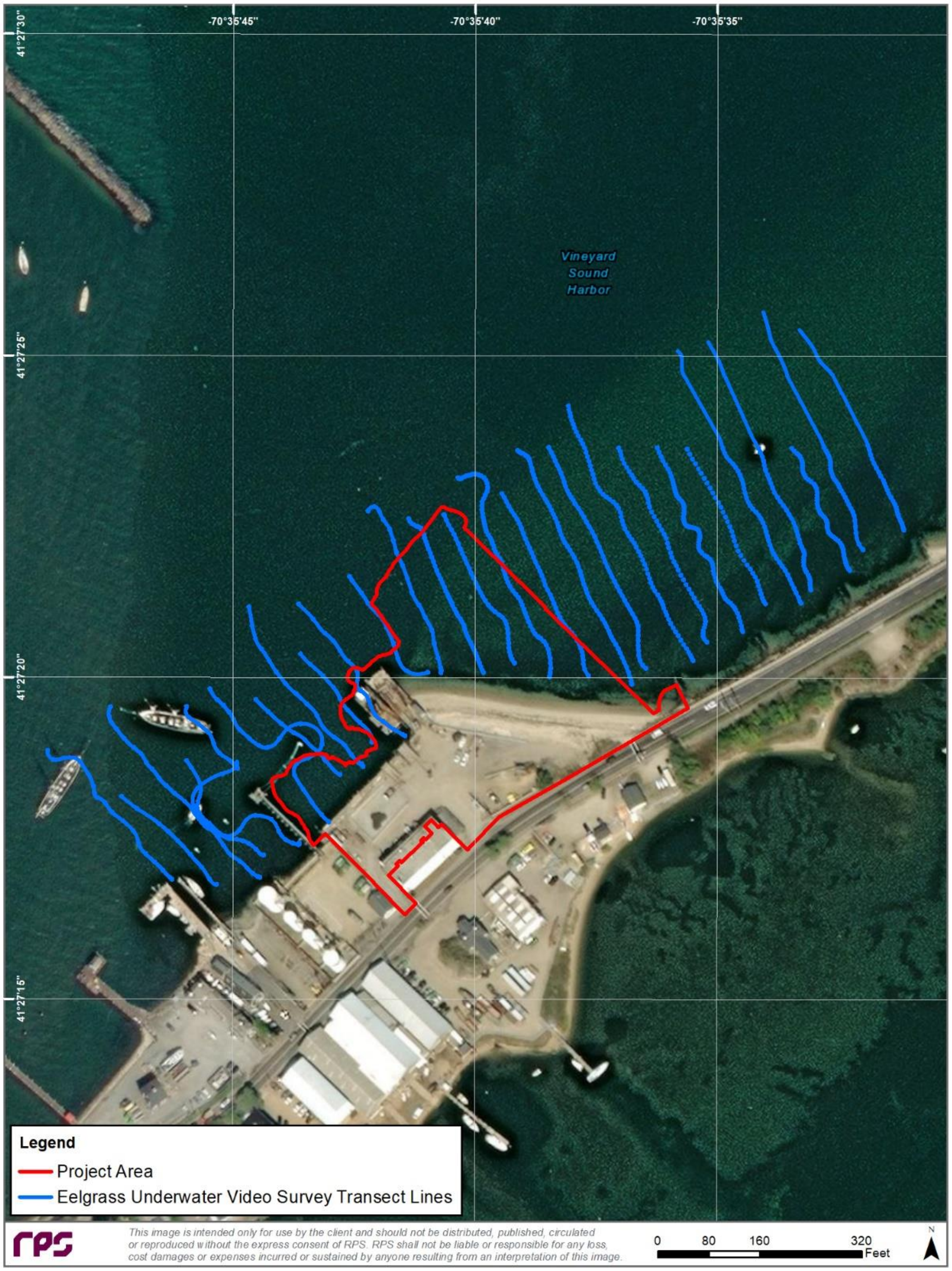

Figure 3-3. Eelgrass survey transects (outlined in blue) in the Project Area (outlined in red).

3.2 Shellfish

According to the MassGIS online mapping tool OLIVER, three shellfish species, blue mussel (*Mytilus edulis*), quahog (*Mercenaria mercenaria*), and bay scallop (*Argopecten irradians*) have habitat suitability areas that may occur in the Project Area (Figure 3-4; MassGIS 2020).

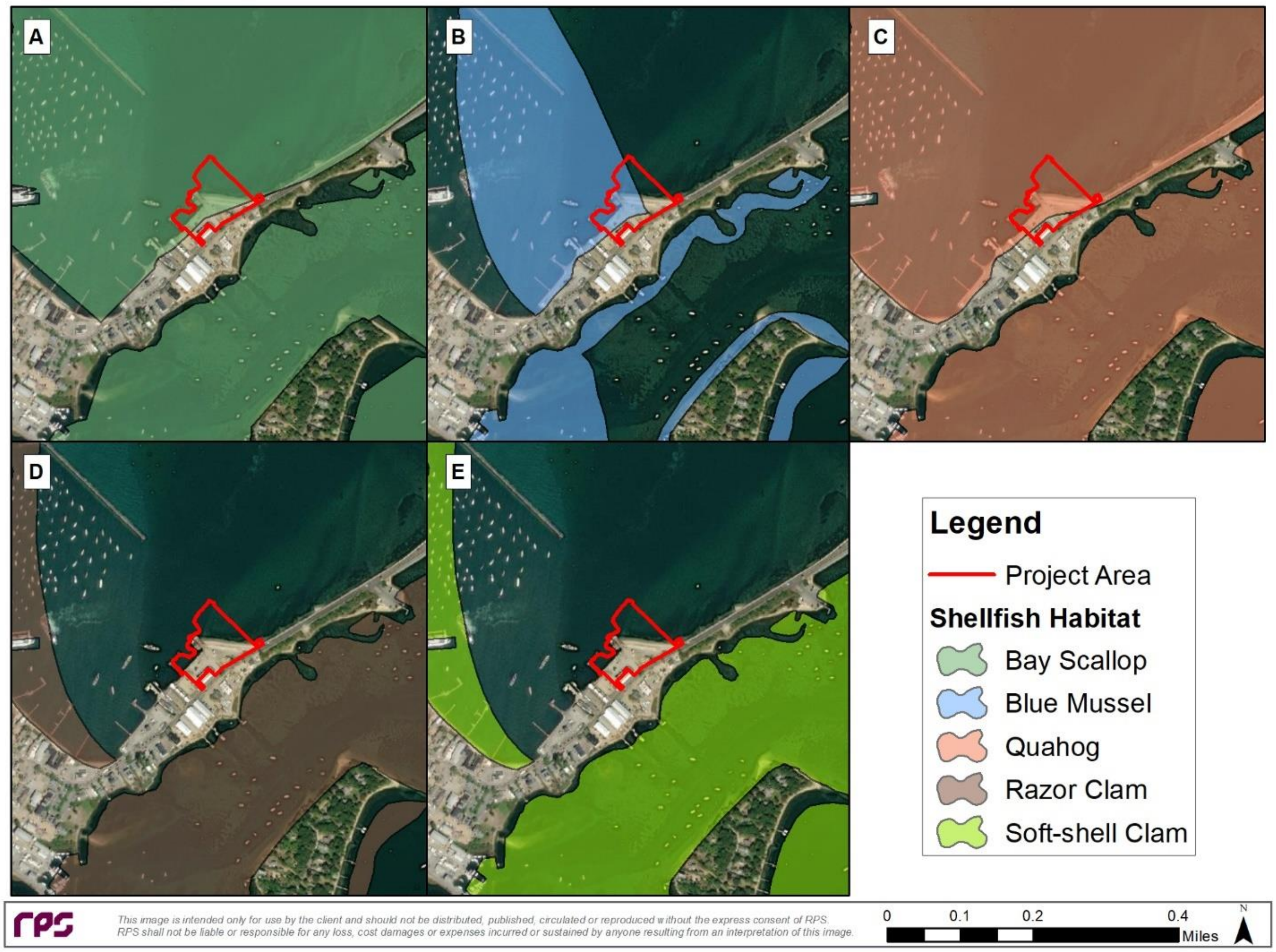

Figure 3-4. Map of the Project Area (red outline) overlaid on shellfish suitability areas for (A) Bay Scallop, (B) Blue Mussel, (C) Quahog, (D) Razor Clam, and (E) Soft-shell Clam (Mass GIS 2020).

3.3 Sediment Grain Size

Sediment grain size was determined from 18 boring samples from within the Project Area collected in February 2021 (Figure 3-5). The sediment consisted primarily of fine sand to coarse sand (0.125 millimeter [mm] to < 2.00 mm; Wentworth 1922), with an average of 75% and range of 34 to 93%. Pebble/granule (2.0 mm to < 4.0 mm) was present in all but one sample with an average of 17% and range of 0 to 48%

(Table 3-1; Figure 3-6). The boring location with the lowest proportion of granule/pebble (0%) is in the proposed new berth dredge site near the -5 ft depth contour in the Eastern Section of the project. The boring location with the highest proportion of granule/pebble (48%) is near the mean high-water mark in the southwestern portion of the Project Area adjacent to the solid fill portion of the pier. The percentage of silt among samples was low with an average of 9% and range of 1 to 18%.

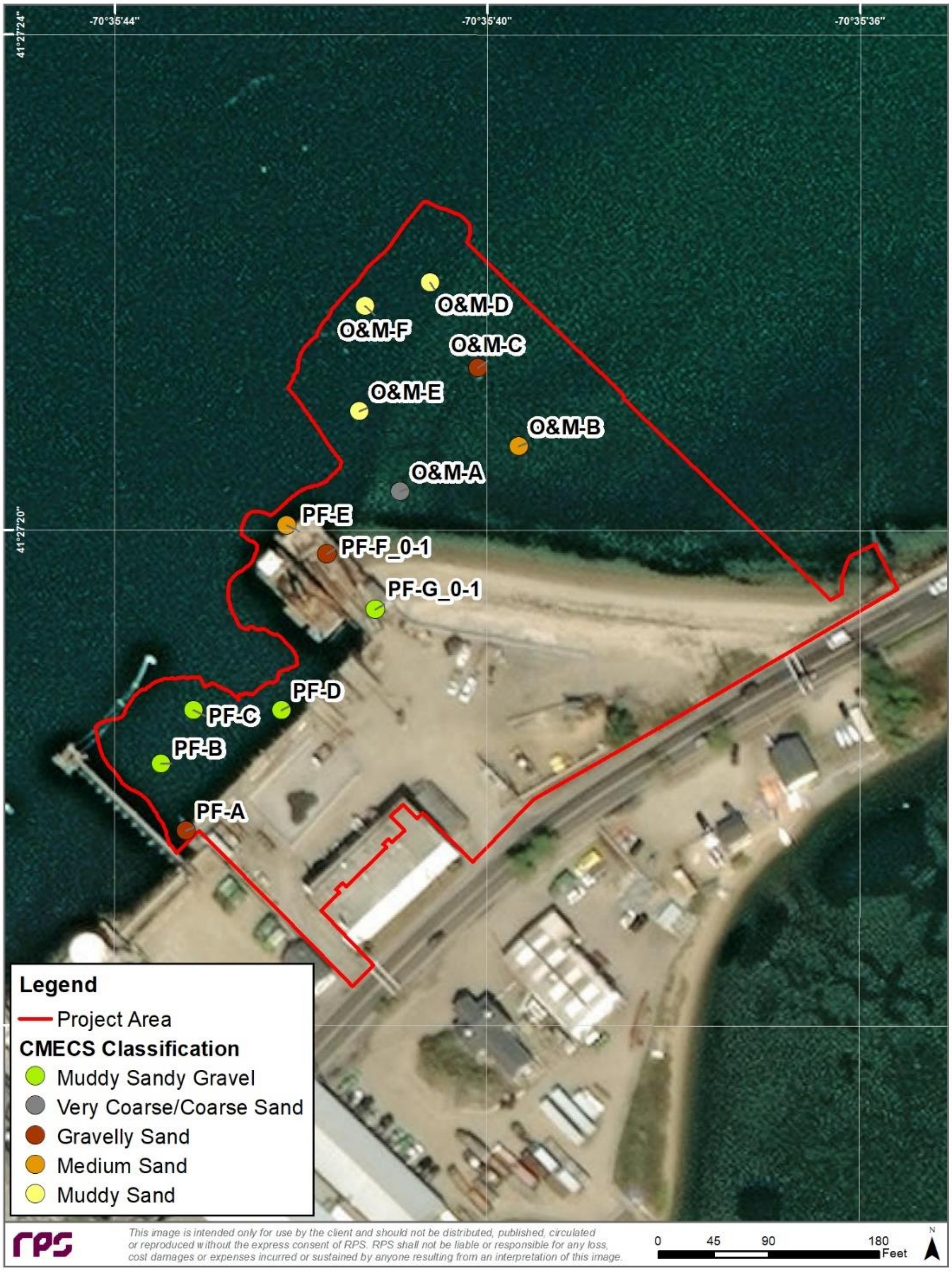

Figure 3-5. Tisbury Marine Terminal sediment sample location with NOAA CMECS classifications.

Table 3-1. Percent sediment type from boring samples within the Project Area, 2020.

Sample ID	Gravel	Coarse Sand	Medium Sand	Fine Sand	Mud	Median Grain Size (d50, mm)	NOAA CMECS Category
O&M-A	3.8	5.9	53.4	34.1	2.8	0.5793	Very Coarse/Coarse Sand
O&M-B	1	4.5	40.1	45.6	8.8	0.3738	Medium Sand
O&M-C	13.1	10	52.7	20.1	4.1	0.8823	Gravelly Sand
O&M-D	ND	1.1	18.4	66.7	13.8	0.2387	Muddy Sand
O&M-E	1.2	5.4	41	36.8	15.6	0.3893	Muddy Sand
O&M-F	1.1	0.2	10.9	70.4	17.4	0.2104	Muddy Sand
PF-A	9.1	13.6	58.1	11.3	7.9	0.9582	Gravelly Sand
PF-B	48	7.5	16.2	10.5	17.8	3.6545	Muddy Sandy Gravel
PF-C	40.1	8.3	25.9	13.0	12.7	1.7754	Muddy Sandy Gravel
PF-D	30.3	16.3	28.4	14	11	1.5955	Muddy Sandy Gravel
PF-E	2.6	5.5	39.8	44.3	7.8	0.4031	Medium Sand
PF-F_0-1	28.9	12.5	34.4	19.9	4.3	1.3657	Gravelly Sand
PF-F_1-2	4.7	3.3	43.1	37.8	11.1	0.4361	Muddy Sand
PF-F_6-7	29.2	10.7	40	18.1	2	1.154	Gravelly Sand
PF-F_7-18.6	3.2	3.4	53.1	34.6	5.7	0.5249	Very Coarse/Coarse Sand
PF-G_0-1	31.3	10.7	32.2	17.6	8.2	1.1709	Muddy Sandy Gravel
PF-G_3-6	17	11.8	55.8	14.1	1.3	1.0662	Gravelly Sand
PF-G_6-18.6	22.1	9.1	48.1	19.3	1.4	0.9459	Gravelly Sand

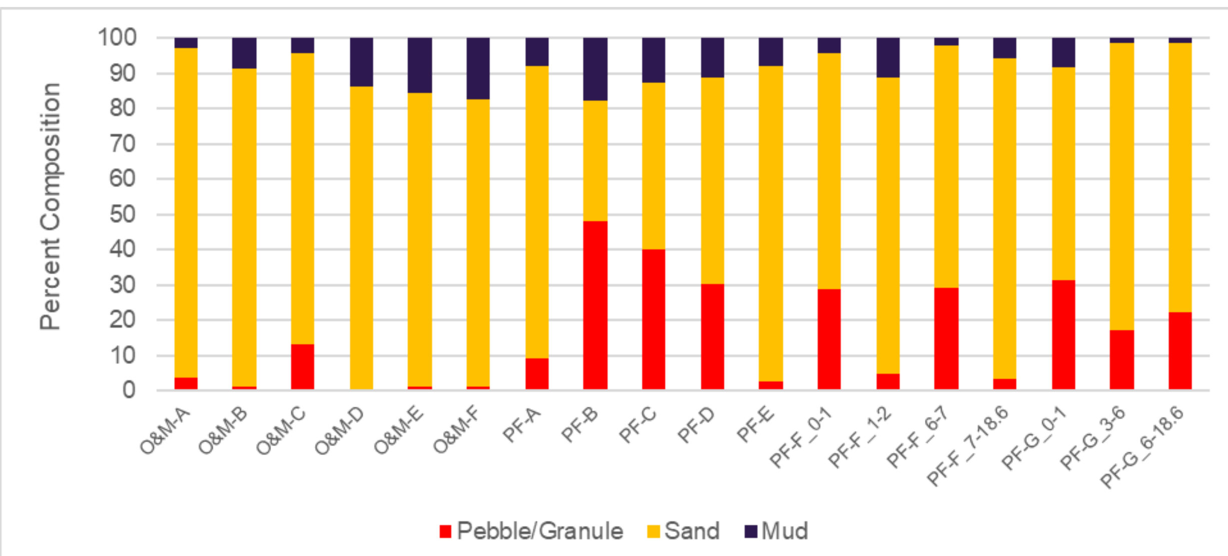

Figure 3-6. Grain size of boring samples taken in the TMT Project Area on 10 January 2020. See Figure 3-5 for boring locations.

3.4 Macroalgae

Segments of the underwater eelgrass video transects were reviewed by RPS to determine presence of macroalgae underneath and adjacent to the proposed pier construction area. Still images were created with even spacing along transects, and only images with passing visibility were used in the analysis. In PhotoQuad image analysis software (Trygonis and Sini 2012), a quadrat was drawn around the visible portion of the still with the fewest nodes necessary, and 50 points were distributed uniformly throughout the quadrat (Figure 3-7).

Figure 3-7. Example still image with quadrat and 50 uniformly distributed points with Photoquad software (Trygonis and Sini 2012).

Percent cover of macroalgae across all passing stills for each transect ranged from 0 – 52%, with an average of 10% macroalgal coverage per transect (Figure 3-8; Table 3-2). There were 2 transects that occurred underneath the proposed concrete pier, with an average of 19.5% macroalgal cover. There were no lasers in the videos provided; thus, quadrat area or total area sampled was not able to be calculated.

Table 3-2. Percent Presence of Macroalgae along Underwater Video Transects in the Project Area Footprint, January 2020.

Transect Number (loggings[1])	Location Relative to Project Element	Total number of stills	Number of stills w/ No Data	Macroalgal Percentage (%)
19 (629-635)	North of concrete deck	7	4	52
18 (679-741)	North of concrete deck	23	5	6
17 (744-783)	Under and north of concrete deck	15	12	34
16 (786-852)	Under concrete deck, western berth, & wavebreak	24	6	5
15 (856-890)	Western berth (dredge)	13	3	4
14 (894-943)	Western berth (dredge)	18	5	8
13 (986-1004)	Western berth (dredge)	14	6	1
12 (1007-1014)	Western berth (dredge)	9	3	1
11(1016-1029)	Eastern berth (dredge)	16	9	1
10 (1032-1039)	Eastern berth (dredge)	9	6	0
9 (1043-1055)	Eastern berth (dredge)	16	9	10
8 (1058-1065)	Eastern berth (dredge)	9	3	2
7 (1068-1088)	Eastern berth (dredge)	23	14	1
6 (1089-1109)	North of Eastern berth dredge area	25	17	15
Average		**16**	**7**	**10%**

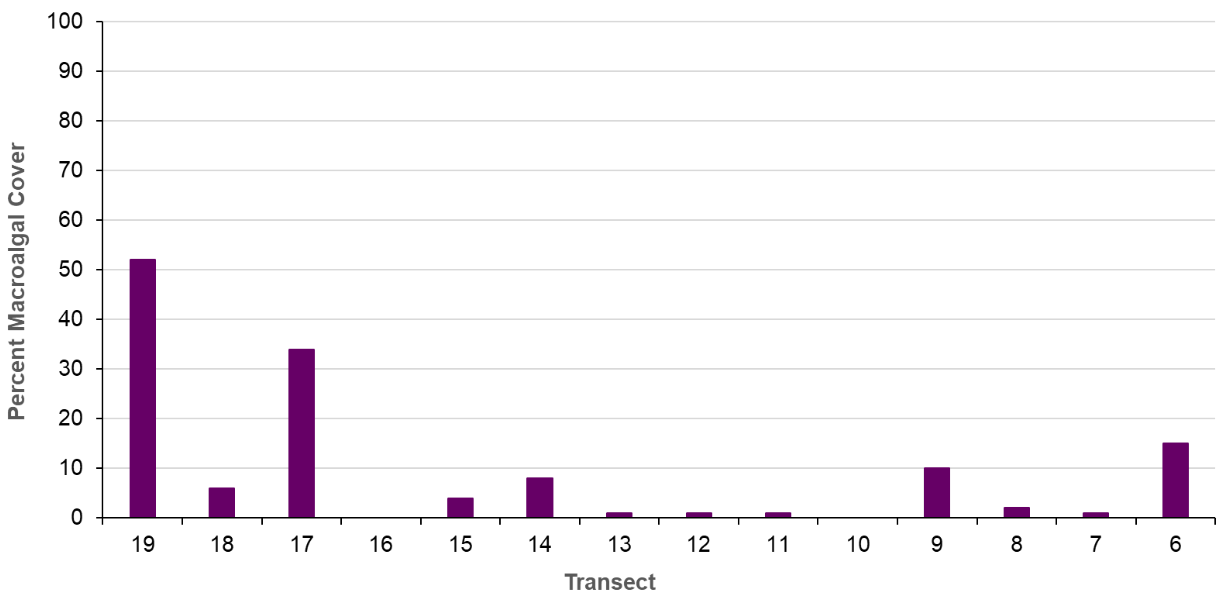

Figure 3-8. Percent macroalgal cover from still image point count analysis along eelgrass survey transects (7 June 2019).

a. First track on the west in the Southern Section of the Project Area, Track 6 #1107, pebble/granule and macroalgae.

b. Track 11 #1029, in dredge footprint of the Southern Section. Silt covered shell hash and pebble/granule with sparse macroalgae (white arrow).

c. Track 14 #928, in the dredge footprint of the Northern Section. Soft sediment with shell hash and macroalgae (white arrow).

d. Track 14 # 930, in the dredge footprint of the Eastern Section. Cobble and shell hash with macroalgae (white arrow).

e. Track 16 #847, under timber pier. Soft sediment and pebble/granule mix with shell hash and macroalgae.

f. Track 18 #742, just north of the timber pier. Soft sediment and pebble/granule mix with shell hash and patches of macroalgae.

Figure 3-9. Example still images collected in the eelgrass survey and processed to determine macroalgae density in the Project Area.

Although most of the video transects were relatively blurry, the example stills (Figure 3-9) show that the macroalgae present in the 2019 field survey appears filamentous and ephemeral. Small brown tufts attached to gravel or shell was the dominant macroalgae, with sparse small red tufts and *Codium* sp. occurring infrequently.

3.5 Circulation and Sediment Transport Model

Analyses of tidal circulation and sediment transport were performed to quantify any potential alterations to the coastal environment associated with proposed improvements at the Packer and Tisbury Marine Terminal Facility (Packer Facility) in Vineyard Haven Harbor (Ramsey et al. 2020). This analysis was done by Applied Coastal based on the original project design that was approved on 15 April 2020. They used a combined hydrodynamic, wave, and sediment transport model to evaluate the influence of design alternatives on tidal circulation, accretion, and erosion in the Project Area. The following five scenarios including existing conditions were modeled:

- Scenario 1: Existing conditions
- Scenario 2: Conceptual design as presented in the Proposed Site Plan dated 26 November 2019 that extends the existing Packer Facility basin to the east at a facility depth of -5.6 m (18.4 ft) NAVD. This proposed design includes the following elements:
    a. Solid fill pier reconfigured with a slightly reduced footprint.
    b. New bulkhead extending ~58 m (190 ft) to the east to from a contiguous shoreline with the existing Packer Marine Facility bulkhead. The elevation of this bulkhead is +1.8 m (6 ft) NAVD.
    c. Incorporation of a solid wave fence extending from the eastern end of the new bulkhead for a distance of ~65 m (212 ft) to the north.
    d. Incorporation of a pile-supported platform south of the new bulkhead, where the 0.3 m (1 ft) diameter wood piles are spaced on a 4.5 m (15 ft) grid. The landward edge of the platform will consist of a wall feature that is landward of the active sediment transport zone; therefore, there is no interaction of this wall with wave action.
- Scenario 3: Implementation of Scenario 2, with a revised bulkhead elevation that lowers the top height of the bulkhead to an elevation that is 0.6 m (2 ft) above the existing grade to the

adjacent area south of the bulkhead. This modification potentially could improve tidal circulation by allowing tidal flow to circulate over the structure.

- Scenario 4: Implementation of Scenario 3, with the wave fence designed in a manner that allows a gap along the seafloor to potentially improve tidal circulation. The bottom of the wave fence for this simulation was 3 ft above the seafloor, with a transition from -5.6 m (18.4 ft) NAVD to the existing grade at a 1:3 (v:h) slope from the Wave Fence extending in an easterly direction.

- Scenario 5: Implementation of Scenario 2, with a revised bulkhead elevation that lowers the top height of the bulkhead to an elevation that -1.5 m (5 ft) NAVD for a distance of 12 m (40 ft) south of the wave fence end and -1.2 m (4 ft) NAVD for another 12 m (40 ft) south of that. This bulkhead lowering creates a 24 m (80 ft) "window" opening of the bulkhead to allow flow to pass. This potentially could improve tidal circulation by allowing tidal flow to circulate over the structure, while still reducing infilling of the boat basin.

Overall, tidal circulation (i.e., the strength of tidal currents) in the Project Area is relatively weak due to the microtidal conditions within the harbor system. Maximum modeled currents under existing conditions in the vicinity of the Project Area are approximately 8 centimeters/second (cm/s) or 0.25 feet/second (ft/s). These existing currents are relatively small, and do not provide the necessary magnitude to mobilize *in situ* sediments. Therefore, any changes to flow within the Project Area associated with engineering improvements would not alter tidally induced sediment transport patterns within the system (Ramsey et al. 2020). Additionally, numerical modeling of tidal hydrodynamics indicated that none of the alternatives evaluated generate tidal currents sufficient to mobilize sediment at the facility. Therefore, it is only the combination of waves and tidal currents that can mobilize sediment in the Project Area, and the evaluation of sediment transport was restricted to the evaluation of these combined effects.

Changes to circulation patterns in the system were also evaluated by numerical simulation of a conservative tracer. A comparison of tracer concentrations for the five scenarios in four locations within the region of the proposed dredged basin indicated that near complete dispersion of the tracer occurs within 1-to-4 hours at all four locations for all scenarios, except Scenario 2 (full-height bulkhead). For Scenario 2, the combination of the full-height bulkhead and wave fence creates an area where circulation is inhibited. For the other scenarios, tidal circulation remained similar to existing conditions, indicating negligible impacts to tidal circulation for Scenarios 3, 4, and 5 in relation to existing conditions.

Annual sediment flux was examined across three cross-sections 1, 2, and 3, respectively, in the Project Area. Results indicate a positive sediment transport flux to the west and north along the beach (Figure 3-10). At Cross-Section 1, transport along the existing beach is slightly over 10 CY per year (i.e., about one dump truck load). Over the simulation period that represents one-year of transport, movement of sediment along the beach is dominated by short periods of increased transport rates associated with storm wave activity. During relatively quiescent wave conditions, sediment flux approaches zero. Due to direct wave sheltering provided by the wave fence and bulkhead, sediment transport flux immediately south of the bulkhead is near zero for Scenarios 2, 3, 4, and 5 (Ramsey et al. 2020).

Figure 3-10. Map of study area with transect lines used to compute annualized cumulative sediment transport flux across Cross-sections 1, 2, and 3. The direction of the arrow on each cross-section indicates the direction of positive flux (Ramsey et al. 2020).

In general, the rate of sediment transport along the beach is minimal for all scenarios. Therefore, alterations to the beach associated with the four scenarios that included alternatives are negligible relative to existing conditions. The slight reversals in sediment transport flux at Cross-sections 2 and 3 caused by the structural enhancements would actually create a wider beach along the shoreline area sheltered by the combined bulkhead and wave fence. For Cross-sections 2 and 3, sediment transport flux is altered slightly for each of the three scenarios that represent structural improvements to the Packer Facility. These alterations to sediment flux are insignificant due to the very low transport rates along the beach, where the flux changes from approximately +5 CY per year for existing to a maximum of -3 CY per year for scenario 4 at Cross-section 2. The flux changes from approximately +3 CY per year for existing conditions to a maximum of -1.5 CY per year for Scenarios 3 and 5 at Cross-section 3 (Ramsey et al. 2020).

3.6 Contaminants

A sampling and analysis plan (SAP) was required by the Army Corps of Engineers to assess disposal options of dredged sediment. With these data, RPS investigated to determine whether these samples exceed biological threshold levels and impact any of the species with EFH designations within the Project Area. Petroleum hydrocarbon levels varied widely between sediment samples from non-detectable to as high as 27,600 micrograms/kilogram (µg/kg) in sample PF-B (Table 3-3). Only three samples had reactive sulfide, with between 22 and 140 milligrams/kilogram (mg/kg) detected. Specific conductance was relatively consistent between samples and only ranged from 1000 to 1600 micromhos/centimeter (µmhos/cm), and total percent solids also averaged 80.2% and only ranged from 75.5% to 84.2%.

Table 3-3. Inorganic chemical and petroleum levels in eight sediment samples.

Sample ID	Specific Conductance @ 25 C (µmhos/cm)	Sulfide, Reactive (mg/kg)	Solids, Total (%)	Petroleum Hydrocarbon (µg/kg)
PF-A	1400	ND	82.7	14100
PF-B	1600	ND	77.4	27600
PF-C	1000	140	78.1	14000
PF-D	1400	ND	80.8	20200
PF-E	1600	105	75.5	6920
O&M-A	1460	ND	84.2	ND
COMP 1	1200	ND	83.4	7810
COMP 2	1400	22	79.8	14800

ND = Not Detected

Organic and semivolatile compounds are tested to assess whether they are under biological toxicity thresholds, which would allow for sediment to be used in beach renourishment or offshore disposal at two available sites in Massachusetts Bay and Cape Cod Bay. If the chemical analysis determines that dredged sediment is not suitable for beneficial reuse beach renourishment, it will be transported to a regulated Massachusetts landfill facility. Of the 74 volatile organic compounds, only two were present at detectable levels. The most common volatile organic compound was carbon disulfide, which occurred in six samples ranging from 5.1 – 14 µg/kg (Table 3-4). The other organic compound present was acetone in four sediment samples ranging from 6.5 – 47 µg/kg.

Table 3-4. Volatile organic compounds in ten sediment samples.

Parameter (µg/kg)	PF-A	PF-D	PF-F	PF-G	O&M-A	O&M-B	O&M-C	O&M-E	PF-G_FILL	PF-F_FILL
Methylene chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichloropropene, Total	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl tert butyl ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p/m-Xylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes, Total	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene, Total	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromomethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobutane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	47	ND	8.3	ND	ND	ND	6.5	10	ND	ND
Carbon disulfide	14	ND	4.7	ND	7.9	9.2	5.1	9.7	ND	ND

Parameter (µg/kg)	PF-A	PF-D	PF-F	PF-G	O&M-A	O&M-B	O&M-C	O&M-E	PF-G_FILL	PF-F_FILL
2-Butanone	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl acetate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl methacrylate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrahydrofuran	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromoethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Butylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
sec-Butylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
tert-Butylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Chlorotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Chlorotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Isopropyltoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,4-Dichloro-2-butene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = Not Detected

Only four of the eight sediment samples contained any detectable levels of the 41 semivolatiles that were tested. The most common semivolatile was phenol, which occurred in three samples ranging from 31 – 100 µg/kg (Table 3-5). There was also 100 µg/kg of Bis(2-ethylhexyl) phthalate in sample COMP 1 and 40 µg/kg of Dibenzofuran in sample PF-D. Those were the only semivolatiles detected, and samples PF-B, PF-C, O&M-A, and COMP 2 all had no detectable semivolatiles.

Table 3-5. Semivolatiles in eight sediment samples.

Parameter	PF-A	PF-B	PF-C	PF-D	PF-E	O&M-A	COMP 1	COMP 2
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroethyl)ether	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND
Azobenzene	ND	ND	ND	ND	ND	ND	ND	ND
4-Bromophenyl phenyl ether	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroethoxy)methane	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	100 µg/kg	ND
Butyl benzyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butylphthalate	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octylphthalate	ND	ND	ND	ND	ND	ND	ND	ND
Diethyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND
Aniline	ND	ND	ND	ND	ND	ND	ND	ND
4-Chloroaniline	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	40 µg/kg	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND
Acetophenone	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	59 µg/kg	ND	ND	31 µg/kg	100 µg/kg	ND	ND	ND
2-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND
3-Methylphenol/4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND

ND = Not Detected

4 ESSENTIAL FISH HABITAT DESIGNATIONS

The EFH designations in this section correspond to the currently accepted designations by the New England Fishery Management Council (NEFMC), Mid-Atlantic Fishery Management Council (MAFMC), South Atlantic Fishery Management Council (SAFMC), and NOAA Highly Migratory Species Division (NEFMC 2017; Table 4-1; Table 4-2). Many EFH designations are determined for each cell in a 10' x 10' longitude square grid in state and federal waters.

Table 4-1. Summary of the twenty-five species with EFH designations in the Project Area by life stage.

Species	Eggs	Larval/Neonate*	Juveniles	Adults	HAPC
Atlantic albacore tuna (*Thunnus alalunga*)			●	●	
Atlantic bluefin tuna (*Thunnus thynnus*)			●	●	
Atlantic cod (*Gadus morhua*)	●	●	●		●
Atlantic skipjack tuna (*Katsuwonus pelami*)				●	
Atlantic sea herring (*Clupea harengus*)			●		
Atlantic surfclam (*Spisula solidissima*)			●	●	
Atlantic wolffish (*Anarhichas lupus*)[1,2]	●	●	●	●	
Atlantic yellowfin tuna (*Thunnus albacares*)			●		
Black sea bass (*Centropristis striata*)			●	●	
Common thresher shark (*Alopias vulpinus*)[1]	●	●	●	●	
Little skate (*Leucoraia erinacea*)			●	●	
Longfin inshore squid (*Loligo pealeii*)	●		●	●	
Northern shortfin squid (*Illex illecebrosus*)				●	
Red hake (*Urophycis chuss*)	●	●	●		
Sand tiger shark (*Carcharias taurus*)[2]		●	●		
Sandbar shark (*Carcharhinus plumbeus*)			●		
Scup (*Merluccius bilinearis*)			●	●	
Silver hake (*Stenotomus chrysops*)	●	●			
Smoothhound Shark Complex (Atlantic Stock)	●	●	●	●	
Summer flounder (*Paralichthys dentatus*)	●	●	●	●	●
White hake (*Urophycis tenuis*)		●	●		

Species	Eggs	Larval/Neonate*	Juveniles	Adults	HAPC
White shark (*Carcharodon carcharias*)[1]			●	●	
Windowpane flounder (*Scophthalmus aguosus*)			●	●	
Winter flounder (*Pseudopleuronectes americanus*)	●	●	●	●	
Winter skate (*Leucoraja ocellate*)			●	●	

* Shark species emerge from egg cases fully developed and are referred to as neonates.
[1] Indicates EFH designations are the same for all life stages or designations are not specified by life stage.
[2] Indicates Species of Concern.

Atlantic albacore tuna (*Thunnus alalunga*)

Albacore tuna EFH is designated in the Project Area for juvenile and adult life stages. EFH for juvenile albacore tuna is designated as offshore the US east coast from Cape Cod to Cape Hatteras. Juveniles migrate to northeastern Atlantic waters in the summer for feeding. Adult albacore tuna EFH is designated on the Atlantic east coast from Cape Cod to Cape Hatteras generally further offshore than EFH for juveniles. Adults are commonly found in northern Atlantic waters in September and October for feeding. Albacore tuna are top pelagic predators and opportunistic foragers (NMFS 2009a).

Atlantic bluefin tuna (*Thunnus thynnus*) *Species of Concern

Bluefin tuna EFH is designated in the Project Area for juvenile and adult life stages. EFH for juvenile bluefin tuna is waters off Cape Cod to Cape Hatteras. EFH for adult bluefin tuna is pelagic waters from the mid-coast of Maine to southern New England. Bluefin tuna inhabit northeastern waters to feed and move south to spawning grounds in the spring. Both juveniles and adults exhibit opportunistic foraging behaviors and diets typically consist of fish, jellyfish, and crustaceans (Atlantic Bluefin Tuna Status Review Team 2011). Bluefin tuna is considered a Species of Concern because they support important recreation and commercial fisheries and population size is unknown (NMFS 2011a).

Atlantic cod (*Gadus morhua*)

Atlantic cod EFH is designated in the Project Area for egg, larvae, and juvenile life stages. EFH for Atlantic cod eggs is designated as surface waters from the Gulf of Maine to southern New England. Cod eggs are found in the fall, winter, and spring in water depths less than 110 m. EFH for larval cod is in waters less than 75 m from the Gulf of Maine to southern New England and are primarily observed in the spring. EFH for juvenile cod is designated as bottom habitats with substrates composed of cobble or gravel from the Gulf of Maine to southern New England. Inshore juvenile Atlantic cod HAPC is designated in coastal areas (from the shore to 20 m depth contour) from Maine to Rhode Island, and inshore waters around Cape Cod to Martha's Vineyard and Nantucket (Figure 4-1, NEFMC 2017). These areas include all habitats that contain structurally complex areas, including eelgrass, macroalgae, mixed sand and gravel, and rocky habitats (NEFMC 2017). These habitats are particularly important for juvenile Atlantic cod as it provides protection from predation and readily available prey sources. Cod spawn primarily in bottom habitats composed of sand, rocks, pebbles, or gravel during fall, winter, and early spring (NOAA 2007). Juvenile cod are opportunistic foragers and consume a wide variety of items including small crustaceans, benthic invertebrates, and fish (Lough 2004).

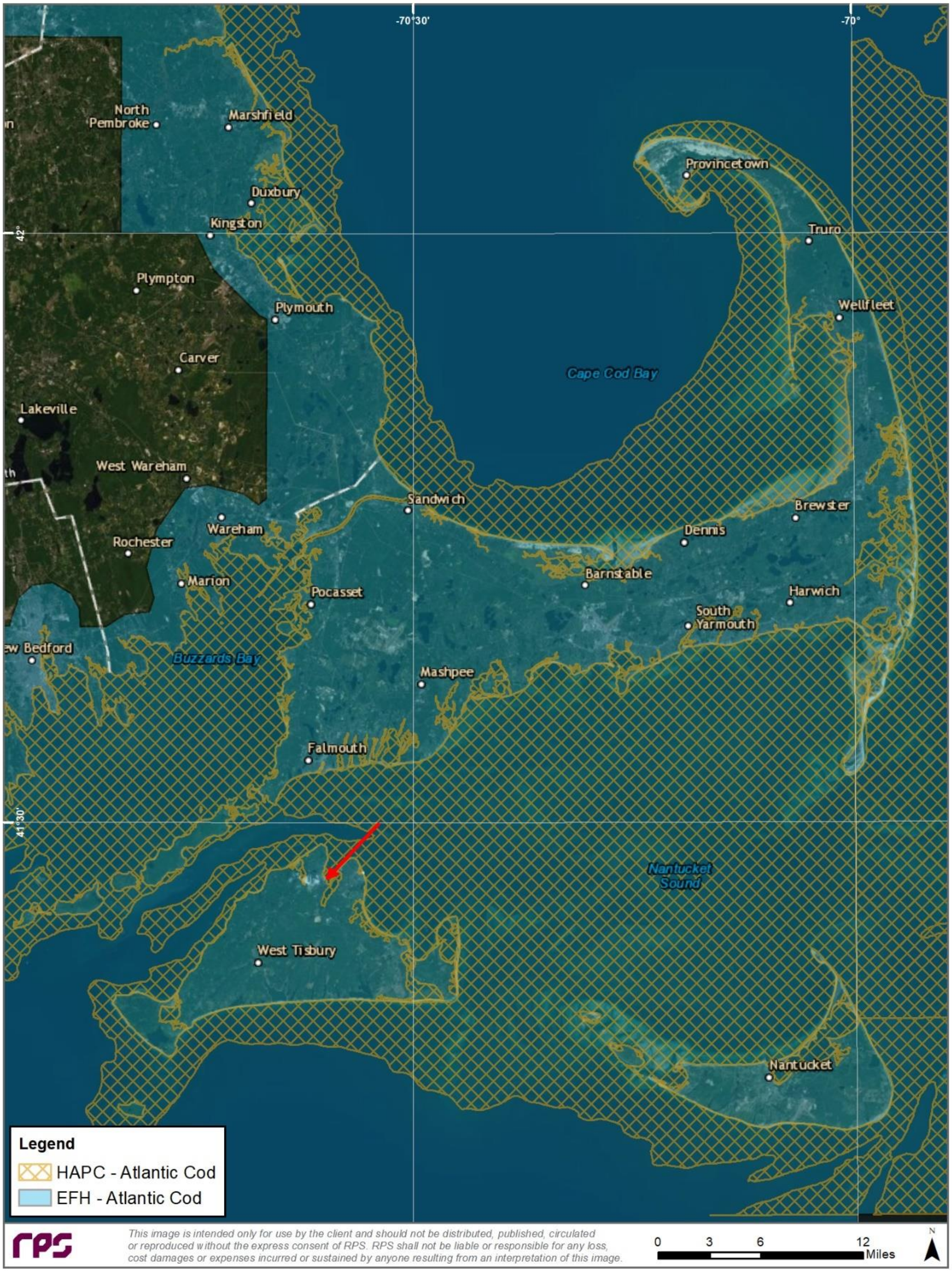

Figure 4-1. Atlantic cod juvenile EFH and HAPC (NEFMC and NMFS 2017).

Atlantic skipjack tuna (*Katsuwonus pelami*)

Skipjack tuna EFH is designated in the Project Area for the adult life stage. EFH for juvenile and adult skipjack tuna is similar and includes coastal and offshore habitats between Massachusetts and South Carolina. Skipjack tuna are opportunistic foragers that feed primarily in surface waters but have also been caught in longline fisheries at greater depths (NMFS 2017).

Atlantic sea herring (*Clupea harengus*)

Atlantic sea herring EFH is designated in the Project Area for the juvenile life stage. EFH for juvenile and adult herring is pelagic and bottom habitats in the Gulf of Maine, Georges Bank, and southern New England. Juvenile herring are found in areas with water depths from 0-300 m. Herring opportunistically feed on zooplankton, with forage species changing as herring size increases (Reid et al. 1999).

Atlantic surfclam (*Spisula solidissima*)

Atlantic surfclam EFH is designated in the Project Area for juvenile and adult life stages. EFH for surfclams is throughout the substrate, to a depth of three ft below the water/ sediment interface, from the eastern edge of Georges Bank and the Gulf of Maine throughout the Atlantic EEZ. Surfclams are generally located from the tidal zone to a depth of about 38 m (125 ft) (NOAA 2007).

Atlantic wolffish (*Anarhichas lupus*) *Species of Concern

Atlantic wolffish EFH is designated in the Project Area for egg, larvae, juvenile, and adult life stages. EFH for wolffish eggs is bottom habitats over the continental shelf and slope within the Gulf of Maine south to Cape Cod. Wolffish eggs are deposited in rocky substrates in brood nests and are present throughout the year. EFH for wolffish larvae is water from the surface to the seafloor within the Gulf of Maine south to Cape Cod. EFH for juvenile and adult wolffish is bottom habitats of the continental shelf and slop within the Gulf of Maine south to Cape Cod. The depth range for all life stages ranges from 40–240 m. Spawning is thought to occur in September and October. Wolffish utilize rocky habitats for shelter and nesting and softer substrate habitats for feeding (NOAA 2007). Although the diets of wolffish can vary, generally they feed on mollusks, crustaceans, and echinoderms (NMFS 2009b). Atlantic wolffish is considered a Species of Concern because the stock is overexploited and severely depleted. Wolffish biomass has shown a consistent downward trend since the 1980’s and continues to decline because of capture as bycatch in the otter trawl fishery (NMFS 2009b).

Atlantic yellowfin tuna (*Thunnus albacares*)

Yellowfin tuna EFH is designated in the Project Area for the juvenile life stage. EFH for juveniles is in offshore waters from Cape Cod to the mid-east coast of Florida. Yellowfin tuna diets primarily consist of Sargassum or Sargassum-associated fauna (NMFS 2009a).

Black sea bass (*Centropristis striata*)

Black sea bass EFH is designated in the Project Area for juvenile and adult life stages. EFH for juvenile and adult black sea bass is demersal waters over the continental shelf from the Gulf of Maine to Cape Hatteras (NOAA 2007). Juveniles prey on benthic and epibenthic crustaceans and small fish while adults tend to forage more generally for crustaceans, fish, and squids. Adults are generally associated with structurally complex habitats. Juveniles and adults are most commonly observed in the spring and fall (Drohan et al. 2007; NEFSC n.d.; NEODP 2020).

Common thresher shark (*Alopias vulpinus*)

Common thresher shark EFH is designated in the Project Area for all life stages. EFH for all life stages is coastal and pelagic waters from Cape Cod to North Carolina and in other localized areas off the Atlantic coast. Common thresher sharks occur in coastal and oceanic waters but are more common within 64–80 kilometers (km) of the shoreline. Small pelagic fishes and pelagic crustaceans make up much of common thresher shark diet (NMFS 2017).

Little skate (*Leucoraja erinacea*)

Little skate EFH is designated in the Project Area for juvenile and adult life stages. EFH is similar for both life stages and includes intertidal and sub-tidal benthic habitats in coastal waters of the Gulf of Maine and in the mid-Atlantic region. EFH primarily occurs on sand and gravel substrates, but also is found on mud (NEFMC 2017).

Longfin inshore squid *(Loligo pealeii)*

Longfin inshore squid EFH is designated in the Project Area for egg, juvenile (pre-recruit), and adult (recruit) life stages. EFH for longfin inshore squid eggs is inshore and offshore bottom habitats from Georges Bank to Cape Hatteras. Longfin inshore squids lay eggs in masses referred to as “mops” that are demersal and anchored to various substrates and hard bottom types, including shells, lobster pots, fish traps, boulders, submerged aquatic vegetation, sand, and mud (NOAA 2007). Female longfin squid lay these egg mops during three-week periods which can occur throughout the year (reviewed in Hendrickson 2017). EFH for juveniles and adults, also referred to as pre-recruits and recruits, is pelagic habitats inshore and offshore continental shelf waters from Georges Bank to South Carolina. Pre-recruits and recruits inhabit inshore areas in the spring and summer and migrate to deeper, offshore areas in the fall to overwinter (NOAA 2007). Forage base for longfin inshore squid varies with individual size, where small squids feed on planktonic organisms and large squids feed on crustaceans and small fishes (Jacobson 2005).

Northern shortfin squid (*Illex illecebrosus*)

Northern shortfin squid EFH is designated in the Project Area for the adult life stage. EFH for adult northern shortfin squid is pelagic habitat on the continental shelf and slope from Georges Bank to South Carolina and in inshore waters of the Gulf of Maine and southern New England. Adult northern shortfin squid primarily forage for fish, euphausiids, and smaller squids (MAFMC and NOAA 2011).

Red hake (*Urophycis chuss*)

Red hake EFH is designated in the Project Area for eggs, larvae, and juvenile life stages. EFH for red hake eggs and larvae is surface waters of the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Red hake eggs are generally observed from May through November while larvae are commonly observed from May through December. EFH for juvenile red hake is bottom habitats with a substrate of shell fragments in the Gulf of Maine, on Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras (NOAA 2007). Juvenile red hake are pelagic and congregate around floating debris for a time before descending to the bottom (Steimle et al. 1999a). Red hake larvae primarily consume copepods; juveniles prey upon small benthic and pelagic crustaceans; and adults prey upon benthic and pelagic crustaceans, fish, and squid (Steimle et al. 1999a).

Sand tiger shark (*Carcharias taurus*) *Species of Concern

Sand tiger shark EFH is designated in the Project Area for neonates and juveniles (NMFS 2017). EFH for sand tiger shark neonates is along the Atlantic east coast from Cape Cod to Northern Florida. Neonate sand tiger sharks inhabit shallow coastal waters within the 25 m (82 ft) isobath (NMFS 2017). EFH for juvenile sand tiger sharks is designated in habitats between Massachusetts and New York and between New Jersey and Florida (NFMS 2017). The sand tiger shark is a Species of Concern because population levels are estimated to be only 10% of pre-fishery conditions. Population declines were primarily caused by historic overfishing while continued decline is due to capture as bycatch. Although fishing is restricted for sand tiger sharks, low fecundity has limited their ability to recover (NMFS 2010b).

Sandbar shark (*Carcharhinus plumbeus*)

Sandbar shark EFH is designated in the Project Area for the juvenile life stage. EFH for juvenile sandbar shark includes coastal areas of the Atlantic Ocean between southern New England and Georgia (NMFS 2017). Sandbar sharks are a bottom-dwelling shark species that primarily forages for small bony fishes and crustaceans (NMFS 2009a).

Scup (*Stenotomus chrysops*)

Scup EFH is designated in the Project Area for juvenile and adult life stages. EFH for juvenile and adult scup are the inshore and offshore demersal waters over the continental shelf from the Gulf of Maine to Cape Hatteras (NOAA 2007). Juvenile scup feed mainly on polychaetes, epibenthic amphipods, and small crustaceans, mollusks, and fish eggs while adults have a similar diet, they also feed on small squid, vegetable detritus, insect larvae, sand dollars, and small fish (Steimle et al. 1999c). Scup occupy inshore areas in the spring, summer, and fall and migrate offshore to overwinter in warmer waters on the outer continental shelf (Steimle et al. 1999c). Scup was a dominant finfish species captured in the NEFSC Multispecies Bottom Trawl survey during spring, summer, and fall surveys and in the Massachusetts Division of Marine Fisheries trawl surveys in the spring and fall.

Silver hake (*Merluccius bilinearis*)

Whiting, also known as silver hake, EFH is designated in the Project Area for egg and larval life stages. EFH for the egg and larval stages is surface waters of the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Whiting eggs and larvae are observed all year with peaks in egg observations from June through October and peaks in larvae observations from July through September.

Smoothhound Shark Complex (Atlantic stock)

The smoothhound shark complex was split into two regional stocks in 2015 after a stock assessment led NMFS to manage each stock complex separately. Due to insufficient information on the individual life stages (neonate, juvenile, and adult), EFH for smooth dogfish is designated for all life stages combined and occurs in the Project Area. EFH for smooth dogfish includes coastal areas and inshore bays and estuaries from Cape Cod Bay, Massachusetts to South Carolina (NMFS 2017). Smooth dogfish are primarily demersal and undergo temperature stimulated migrations between inshore and offshore waters. Throughout their region, diets are dominated by invertebrates, especially American lobsters; however, they also feed on small bony fishes throughout New England (NMFS 2017).

Summer flounder (*Paralichthys dentatus*)

Summer flounder EFH is designated in the Project Area for juveniles and adults. EFH for juvenile and adult summer flounder is demersal waters over the continental shelf from the Gulf of Maine to Cape Hatteras. In addition to EFH designations, there are also HAPC designations throughout the region. HAPC is designated as areas of all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH (NOAA 2007). Juvenile summer flounder inhabit inshore areas such as salt march creeks, seagrass beds, and mudflats in the spring, summer, and fall and move to deeper waters offshore in the winter. Adults inhabit shallow coastal and estuarine areas during the warmer seasons and migrate offshore during the winter (Packer et al. 1999). Summer flounder are opportunistic feeders and diets generally correspond to prey availability in relation to flounder size, with smaller individuals primarily consuming crustaceans and polychaetes and larger individuals focusing more on fish prey (Packer et al. 1999).

White hake (*Urophycis tenuis*)

White hake EFH is designated in the Project Area for juvenile life stages (NEFMC 2017). Juveniles are pelagic until they reach a certain length and become demersal (Chang et al. 1999a). EFH for the juvenile stage is designated as intertidal and sub-tidal estuarine and marine habitats in the Gulf of Maine, on Georges Bank, and in southern New England, including mixed and high salinity zones in a number of bays and estuaries north of Cape Cod, to a maximum depth of 300 m (NEFMC 2017). For the demersal phase, EFH occurs on fine-grained, sandy substrates in eel grass, macroalgae, and un-vegetated habitats.

White shark (*Carcharodon carcharias*)

White shark EFH is designated in the Project Area for neonate, juvenile, and adult life stages. EFH for neonates is inshore waters out to 105 km (65.2 mi) from Cape Cod to New Jersey. EFH for juvenile and adult white shark is combined and includes inshore waters out to 105 km (65.2 mi) from Cape Ann, Massachusetts to Cape Canaveral (NMFS 2017). As neonates and juveniles below 300 centimeters (cm) (120 inches) total length, white shark primarily consume fish. Upon reaching lengths greater than 300 cm (120 inches), white sharks begin consuming primarily marine mammals (Estrada et al. 2006).

Windowpane flounder (*Scophthalmus aquosus*)

Windowpane flounder EFH is designated in the Project Area for juvenile and adult life stages. EFH for juvenile and adult life stages is bottom habitats that consist of mud or fine-grained sand substrate around the perimeter of the Gulf of Maine, Georges Bank, southern New England, and the middle Atlantic south to

Cape Hatteras (NOAA 2007). Juvenile and adult windowpane flounder feed on small crustaceans, especially mysid and decapod shrimp, and fish larvae (Chang et al. 1999b).

Winter flounder (*Pseudopleuronectes americanus*)

Winter flounder EFH is designated in the Project Area for eggs, larvae, juvenile and adult life stages. EFH for eggs is bottom habitats with sandy, muddy, mixed sand/mud, and gravel substrates on Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to the Delaware Bay. Eggs are primarily observed from February through June. EFH for larvae is pelagic and bottom waters in Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to Delaware Bay. Larvae are generally observed from March through July. EFH for juvenile and adult Winter Flounder is bottom habitats with muddy or sandy substrate in Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to Delaware Bay. Winter flounder spawning occurs in the winter with peaks in February and March (NOAA 2007). Winter flounder are considered opportunistic feeders throughout each life stage and consume a wide range of prey. Adults feed on bivalves, eggs, and fish, but shift diets based on prey availability (Pereira et al. 1999).

Winter skate (*Leucoraja ocellate*)

Winter skate EFH is designated in the Project Area for juvenile and adult life stages (NEFMC 2017). EFH for juvenile and adult winter skate includes sand and gravel substrates in sub-tidal benthic habitats in depths from the shore to 80–90 m (262–295 ft) from eastern Maine to Delaware Bay and on the continental shelf in southern New England and the mid-Atlantic region, and on Georges Bank. As a demersal species, winter skate consume a large variety of demersal prey including polychaetes, amphipods, and crustaceans (Packer et al. 2003b).

Table 4-2. Annual presence of each life stage of EFH species in the Project Area overlain with the proposed months for the TMT construction window (as outlined in green).

Construction Window	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dredge												
Pile Driving												
EFH Species												
Atlantic albacore tuna (*Thunnus alalunga*) [1]						J A	J A	J A	J A	J A	J A	
Atlantic bluefin tuna (*Thunnus thynnus*) [1]						J A	J A	J A	J A	J A	J A	
Atlantic cod (*Gadus morhua*) - HAPC[1]	J	J	J	J	J	J	J	J	J	J	J	J
Atlantic herring (*Clupea harengus*) [1]						J	J	J	J			
Atlantic skipjack tuna (*Katsuwonus pelami*) [1]						A	A	A	A			
Atlantic surf clam (*Spisula solidissima*) [1]	J A	J A	J A	J A	J A	J A	J A	J A	J A	J A	J A	J A
Atlantic wolffish (*Anarhichas lupus*)[2]					All	All						
Atlantic yellowfin tuna (*Thunnus albacares*) [1]						J A	J A	J A	J A	J A	J A	
Black sea bass (*Centropristis striata*) [1]					J A	J A	J A	J A	J A	J A	J A	
Common thresher shark (*Alopias vulpinus*) [2]						N J A	N J A	N J A				
Little skate (*Leucoraja erinacea*) [1]				All	All	All	All	All	All	All	All	
Longfin inshore squid (*Loligo pealeii*) [1]				E J A	E J A	E J A	E J A	E J A	J A	J A	J A	
Northern shortfin squid (*Illex illecebrosu*) [1]				A	A	A	A	A	A	A		
Red hake (*Urophycis chuss*) [1]	J A	J A	J A	J A	J A	J A	All	All	All	All	J A	J A
Sand tiger shark (*Carcharias taurus*)							N J	N J	N J			
Sandbar shark (*Carcharhinus plumbeus*)						J A	J A	J A	J A	J A		
Scup (*Stenotomus chrysops*) [1]					All	All	All	All	All	L J A	J	
Silver Hake *(Merluccius bilinearis)* [1]	E L	E L	E L	E L	E L	E L	E L	E L	E L	E L	E L	E L
Smoothhound shark complex (Atlantic stock)[1,2]					N J A	N J A	N J A	N J A	N J A	N J A	N J A	N J A
Summer flounder *(Paralichthys dentatus)*					J A	J A	J A	J A	J A	J A		

Construction Window	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dredge												
Pile Driving												
EFH Species												
White hake (*Urophycis tenuis*) [1]			J	J	J	J	J	J	J	J	J	
White shark (*Carcharodon carcharias*) [2]					J A	J A	J A	J A	J A	J A	J A	J A
Windowpane flounder (*Scophthalmus aquosus*) [1]	J A	J A	J A	J A	E J A	All	All	All	All	L J A	J A	J A
Winter flounder (*Pseudopleuronectes americanus*) [1]	A	E A	All	All	All	L J A	J	J	J	J A	J A	A
Winter skate (*Leucoraja ocellata*) [1]	J A	J A	J A	J A	J A	J A	J A	J A	J A	J A	J A	J A

E–Eggs; L–Larvae, N–Neonate; J–Juvenile, A–Adult, All–All life stages potentially present throughout the year; R–Rare

[1] Species of commercial or recreational importance.

[2] Indicates EFH designations are the same for All life stages or designations are not specified by life stage.

5 ANALYSIS OF POTENTIAL IMPACTS TO EFH

The proposed project plan is to rebuild the existing solid-filled pier, oversheeting the existing bulkhead, and maintenance dredging up to -5.6 m (18.39 ft) NAVD88 with a 0.3 m (1 ft) allowable overdredge depth. The last time that the Project Area was dredged for maintenance was in April of 1993 where 1,400 CY of sediment were removed. As described in Section 2, the Project Area will include the installation of new steel bulkheads; a steel sheet pile wave fence; two barge ramps; a pile-supported concrete deck; and a public access platform with timber stairs for coastal access. The existing riprap along the Coastal Beach will remain and the existing solid filled pier will be reconstructed, and stones will be reset around the proposed access ramp apron. The proposed project includes resetting stones in the revetment to support the landward area. Impact causing factors related to the construction/installation and operation/maintenance of the project are presented in Table 5-1 and described in detail in the following sections.

Potential project impacts will be minimized to the extent possible through strategic project design and mitigative measures. There will be sediment and erosion control features in place throughout construction to minimize and potentially avoid impact of sediment to areas outside of the work site. Vibratory hammering will be used as the primary method for pile installation, and the use of the louder impact hammer will be limited as much as possible. Air bubble curtains will be used during impact pile installation to mitigate any potential noise impacts. The project team will work with the state agencies on the appropriate mitigation and will follow standard construction best management practices.

Table 5-1. Impact-producing factors for finfish and invertebrates with EFH within the Project Area.

Impact-producing Factors	Construction and Installation	Operations and Maintenance
Pile driving for 36” diameter steel piles	X	
Habitat disturbance	X	
Habitat alteration	X	X
Increased noise	X	X
Dredging	X	
Shading		X
Runoff		X
Increased vessel traffic	X	X

5.1 Dredging

5.1.1 Habitat Disturbance and Alteration

Dredging activities are planned to remove a total of approximately 6,679 m^2 (71,892 ft^2: 71,805 ft^2 subtidal/intertidal habitat and 87 ft^2 of coastal beach; 1.65 acres total) of sediment using a mechanical dredge (clam shell and/or backhoe). Sediment samples were mostly sand, with an average of 75.5% sand per sample and 84.1% sand or finer (Table 3-1). Of the 18 sediment samples, 10 contained over 5% gravel and only four of those samples contained over 30% gravel. All those samples were in the southwestern portion (PF-B, PF-C, and PF-D) or on land adjacent to the existing pier (PF-G_0-1). An average of 10% macroalgal coverage was estimated through still image point count analysis across 14 video transects within the Project Area. This area represents approximately 0.2% of similar habitat surrounding the Project Area in the body of water between West Chop and East Chop (approximately 827 acres). Removal of sediment will result in a temporary loss of habitat and associated prey for the following life stages of EFH species: Atlantic cod (juvenile and adult, HAPC for juveniles), Atlantic wolffish (adult), summer flounder (HAPC for adults), red hake (juvenile and adult), white hake (juveniles), winter flounder (egg, larvae, juvenile, adult), scup (juvenile and adult), sandbar shark (juvenile), smoothhound shark complex (neonate, juvenile, adult), sand tiger shark (neonate, juvenile), little skate (juvenile and adult), winter skate (juvenile and adult), windowpane flounder (juveniles and adults), and surf clam (juvenile and adult).

Recovery rates of bottom habitats are variable depending on several environmental factors including water depth, sediment type, and size of the dredge area (Newell et al. 1998). A review of dredge monitoring studies indicates that impacts to coastal sandy gravel habitats are temporary, with recovery likely to occur within several months to a few years (Newell et al 1998; Burlas et al 2001; Bolam and Rees 2003; and USACOE 2013). In naturally stressed areas (i.e., the nearshore zone exposed to wave action and strong currents), recovery is generally achieved within 9 months, although deeper polyhaline habitats can take up to 2 years to recover (Bolam and Rees 2003). For example, the offshore benthic community in the USACE-NYD's Manasquan Inlet study recovered rapidly following sand borrow area dredging in 1997 and 1999; by the spring of 2000 no statistically detectable differences were noted between dredged and reference areas in benthic abundance and biomass (USACE 2001).

In a study of a similar habitat type of sandy/shell hash in the Anchorage Channel, total density of organisms was an order of magnitude higher about two years after dredging. In 2005, the total density of organisms was 260 organisms/m^2 which consisted primarily of annelids (60%), arthropods (30%), and molluscs (10%). Two years post-dredging in 2012, there were 12,838 organisms/m^2 with annelids (17%), arthropods (5%), and molluscs (77%, primarily blue mussels; ACOE 2013). Results of the study indicated the physical conditions and sandy shell hash sediment habitats in the navigation channels following dredging were generally comparable to the baseline conditions at one to two and a half years following dredging. This indicates a potential benefit to blue mussels or other molluscs, such as bay scallops and quahogs, that occur within the Project Area (Figure 3-4) as they recolonize the disturbed sediment.

In addition, recovery for some benthic forage species may occur within one to two years. A monitoring program designed to detect changes in benthos at sand borrow areas off Belmar, New Jersey found that the benthic forage habitat recovered within a year after dredging. The food habits of winter flounder (a benthic omnivore) and summer flounder (an epibenthic feeder) did not change appreciably between the baseline period and the during-dredging (1997) and post-dredging (1998 and 1999) time periods (Burlas et al 2001). These results indicate that post-dredge conditions were still favorable for some important forage resources for at least two species with different foraging strategies.

Impacts from the loss of habitat are expected to be temporary as sandy nearshore habitats are likely to recover within one to five years (Bolam and Rees 2003; USACOE 2013; DON 2019). The applicant will work with the agencies through the permitting process to develop appropriate mitigation plans related to shellfish.

Substantial impacts are not expected for motile life stages of fish and invertebrate species with designated EFH in the dredge area as this mobility allows them to escape harm and move away from construction area. Direct mortality of non-motile life stages, such as pelagic and demersal eggs and larvae or sessile invertebrates, in the project path are expected during dredging. Longfin inshore squid are the only species with an EFH designation within the Project Area that lays eggs directly on various substrates of shells, boulders, submerged aquatic vegetation, sand, and mud (NOAA 2007). Other species lay demersal eggs; however, the egg life stage of their EFH is not within the Project Area. Nine of the species with EFH designations within the Project Area have sandy sediments listed as part of their EFH characteristics. These include inshore juvenile Atlantic cod HAPC, Atlantic wolffish adults, little skate juvenile/adult, longfin inshore squid eggs, white hake juveniles, red hake juveniles, windowpane flounder juvenile/adults, winter flounder egg/juvenile/adults, and winter skate juvenile/adults. Five of the species with EFH designations within the Project Area have gravel sediments listed as part of their EFH characteristics. These include inshore juvenile Atlantic cod HAPC, Atlantic wolffish adults, little skate juvenile/adults, winter skate juvenile/adults, and winter flounder eggs.

Potential adverse effects to eggs and larvae of species with EFH in the Project Area will be reduced through adherence to Time of Year (TOY) restrictions recommended for four of the EFH species (Atlantic cod, winter flounder, longfin inshore squid, and Northern shortfin squid) that may occur in the Project Area (Evans et al. 2015; Table 5-2). Proposed project dredging is planned to occur from September 1 to January 31, which is outside of the Time of Year restriction for each of these species with the exception of a two-week period for winter flounder (January 16 through 31) and a period for adult Northern shortfin squid. However, peak winter flounder spawning takes place in late winter (February and March) with eggs expected to potentially occur in the Project Area from February through May, suggesting there will be no overlap between this life stage and dredging activities (Pereira et al. 1999). Additionally, for Northern shortfin squid, the life stage that may occur in the Project Area is adults (Table 4-2), which are mobile and are thus able to move away from dredging activities. Therefore, the risk to these species will be mostly avoided.

Table 5-2. Time of year restrictions for Massachusetts Coastal Alteration Projects.

EFH	Time of Year Restriction
Winter Flounder	January 15 – May 31
Atlantic Cod	April 1 – June 30
Longfin Inshore Squid	April 15 – June 15
Northern Shortfin Squid	June 15 – October 15

Source: Massachusetts Division of Marine Fisheries, 2011.

In the Southern Section of the Project Area, proposed dredging will be to 4.3 m (14 ft) mean low water (MLW) and in the Eastern Section of the Project Area to 5.6 m (18.39 ft) MLW. The change in depth in the Eastern Section of the Project Area will technically reduce EFH for winter flounder spawning adults and eggs, which includes coastal benthic habitats from MLW to 5 m, 41,356 ft^2 (0.95 acres). However, spawning and egg survival are not expected to be negatively affected as recent research indicates that the Southern New England stock of winter flounder also successfully spawns in waters with depths > 5 m (Siskey et al. 2020). The change in water depth is not expected to adversely affect EFH or associated species because maximum water depth after dredging will still be available upon project completion.

Substantial adverse effects to EFH and associated species due to habitat disturbance and alteration and direct loss related to dredging in the Project Area is not expected due to the temporary nature of the disturbance (recovery expected in 1-5 years); small area total area (1.6 acres or 0.2% of similar habitat in the surrounding area); motility of most EFH species and life stages, which can move away from harm; and adherence to TOY restrictions for those species with EFH of sensitive life stages in the Project Area (as noted above).

5.1.2 Water Quality

Dredging will temporarily affect water column EFH and associated species as it causes a temporary decrease in water quality, increased turbidity, or total suspended solids (TSS), and potential release of contaminants. The severity of the effects of elevated TSS to fish and benthic organisms depend on concentration and duration of exposure. Some mollusk species have experienced reduced growth and oxygen consumption rates when sediment concentrations of 100 milligrams per liter (mg/L) persisted for two days (Wilber and Clarke 2001). Sublethal effects (i.e., fine sediment coating gills and cutting off gas exchange with water thus resulting in asphyxiation) in fish were observed when 650 mg/L of suspended sediments persisted for five days while lethal effects have been observed at concentrations greater than 1,000 mg/L that persisted for at least 24 hours (Sherk et al. 1974; Wilber and Clarke 2001). However, adverse effects to motile organisms or burrowing invertebrates are not expected due to the small size of the Project Area, abundance of similar habitat surrounding the Project Area (approximately 827 acres), and their ability to escape harm when necessary.

Fish eggs and larvae are typically more sensitive to suspended sediments as no or limited motility and delicate bodies increases the susceptibility to smothering and abrasion of outer tissues (Westerberg et al. 1996; Wilbur and Clarke 2001). Suspended sediment concentrations of 200 mg/L that occurred consistently for one and three days were found to increase mortality of Atlantic cod larvae and larvae, respectively (Westerberg et al. 1996). Prolonged and constant TSS levels that could result in injury or mortality to eggs and larvae are not expected due to the very low (approximately 2%) percentage of silt and high proportion of coarser material, which settles quickly upon disturbance, in the dredge area. Monitoring studies at several dredge sites in New York and New Jersey indicate that TSS levels of up to 445.0 mg/l may occur in the immediate vicinity of dredging, but would return to background levels within 373 m (600 ft) of the source in the upper water column and 1,491 m (2,400 ft) in the lower water column (USACE 2001; USACE 2015).

Dredging for this project would be conducted using a barge-mounted mechanical dredge (i.e., clamshell and/or backhoe). Due to the relatively low presence of silt/clay sediments in the Project Area (as described in Section 3.3), and the relatively slow currents (as described in Section 3.5), the sediment that would be disturbed by dredging is expected to settle out in a relatively short time frame, and especially as compared to an area with finer sediments. While sediment settling rates are dependent upon the grain size distribution and site-specific conditions for bathymetry, depth, and current speed, for comparison Miller et al. (2001) found that when dredging coarse sediments in the Delaware Bay using a hopper dredge, the sediments settled rapidly within the channel and returned to background conditions within an hour. Additionally, Dragos and Fitzpatrick (2009) reported that after the maintenance dredging of silty material within the inner portion of the Boston Harbor using a clamshell dredge, fine sediments from the dredge plumes remained in the water column for up to 1.5 to 2 hours after dredging.

As mentioned above, potential adverse effects to eggs and larvae of species with EFH in the Project Area will be additionally reduced through the adherence to Time of Year (TOY) restrictions recommended for four of the EFH species (Atlantic cod, winter flounder, longfin inshore squid, and Northern shortfin squid) that may occur in the Project Area (Evans et al. 2015; Table 5-2).

Dibenzofuran has a listed an ecotoxicity threshold of 2,000 parts per billion (ppb) for marine sediments (Buchman 2008), which is far higher than the 40 ppb in one sediment sample. Carbon disulfide did not have thresholds listed for marine sediments but had 17 ppb for acute and 0.92 ppb for chronic Tier II Secondary toxicity levels in fresh surface waters and a 94.1 ppb toxicity threshold in soils for mammals. Although carbon disulfide was present in six sediment samples ranging from 4.7 – 14 ppb (Table 3-4), which would be over the toxicity threshold for fresh surface waters, it is unknown if these thresholds are similar in marine sediments.

Acetone did not have thresholds listed for marine sediments but had 28,000 ppb for acute and 1,500 ppb for chronic Tier II Secondary toxicity levels in fresh surface waters and a 2,500 ppb toxicity threshold in soils for mammals. Diethylhexylphthalate was listed as proposed toxicity thresholds of 400 ppb acute and 360 ppb in marine surface waters. The lowest observed effect level of phenols in marine surface waters is 5,800 ppb, and for soils organisms had an environmental risk limit of 500 ppb. These acetone, diethylhexylphthalate, and phenol thresholds are all far above the measured levels in sediment samples, therefore no chemical impacts are expected on the benthic community from dredging (Table 3-5).

Overall, impacts to fish and invertebrates from dredging will be short-term and temporary, with TSS levels expected to return to baseline conditions within a short time frame (and potentially within hours) after dredging stops.

5.2 Pile Driving

The installation of piles will be required for this project and driving piles into the sediment will be the source of the largest sound energy level increases during the construction process. The main hammer type used for these types of pile driving will be the vibratory hammer. Impact hammers may be used for a limited number of piles when it is not technically feasible to install a pile with a vibratory hammer. Vibratory hammers vibrate the pile into the sediment with an oscillating hammer placed on top of the pile. Although vibratory hammers can be effective enough to install the pile to its desired depth for load bearing capacity, an impact hammer may be required to proof the load bearing capacity (NRC 2012). Impact pile driving is carried out using an impact hammer, which consists of a falling ram that strikes the top of a pile repeatedly and drives it into the ground. The ram is lifted or driven by one of several methods, including mechanical winching, diesel combustion, pneumatic air pressure, or hydraulic pressure. When the ram strikes the pile, the impact creates stress waves traveling down the length of the pile, which couples with the surrounding medium, radiating acoustic energy into the water.

Peak sound pressure can exceed 180 dB PK when installing piles with impact hammers, while vibratory pile driving noise levels are generally lower. The slower rise time of sound pressure waves made by vibratory hammers is thought to spread out the energy over time and therefore lessen the impact to organisms (Figure 5-1). Impacts to marine organisms have not been observed with the use of vibratory hammers, making it the preferred method for pile driving (NRC 2012). With an expected use of an impact hammer for a relatively small proportion of the pile driving for this project, the sound pressure effects have been modeled for both hammer types.

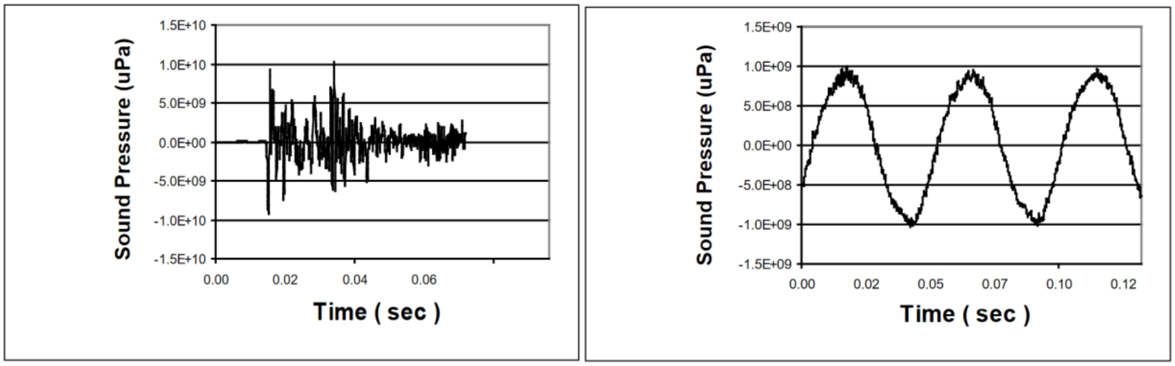

Figure 5-1. Typical wave form for a single pile strike with an impact hammer (left) and a vibratory hammer (right) (NRC, 2012).

5.2.1 Underwater Noise

Pile driving for this project will include nine dolphin piles that are 36 inches (0.91 m) in diameter and 100 ft in total length and 180 timber piles that are 12 inches in diameter (0.30 m). The primary installation method is vibratory hammering with impact piling only used if installation is not technically feasible with the vibratory hammer. If an impact hammer is required, a D46 impact hammer rated at 107,000 ft-lb with 12 strikes per inch of sediment penetration would be used.

Pile driving noise impacts fish and marine mammal species differently due to a wide range of hearing abilities (Hawkins and Popper 2017). Some fishes have no swim bladder or relatively small swim bladders, while others have connections from their auditory system to their swim bladder for increased hearing capabilities. Both Atlantic cod and Atlantic herring, which have designated EFH and HAPC (juvenile cod only) in the Project Area, have swim bladders connected or close to the inner ear and therefore can experience both recoverable and mortal injuries at lower noise levels than other species, e.g., 203 or 207 dB SEL, respectively (Thomsen et al. 2006, Popper et al. 2014; Hawkins and Popper 2020). For fishes that do not have swim bladders (e.g., winter flounder), or that have swim bladders not involved in hearing (e.g., yellowfin tuna), the potential for mortality, injury, or behavioral response is lower and is restricted to an area closer to the pile (Nedwell et al. 2004). The effects of impulsive sound on fish eggs and larvae are less clear; however, research has found that even at the highest exposure level tested (206 dB SEL_{SS}), no negative effects were observed (Bolle et al. 2012). It must be noted that swim bladder assisted hearing is not considered in the Greater Atlantic Regional Fisheries Office (GARFO [2020]) Acoustic Tool, which only calculates impacts to fishes greater or less than 2 grams (g; Table 5-3). Fishes greater than 2 (g) in weight have injury thresholds of 206 dB PK and 187 dB SEL, while fishes less than 2 g in weight have injury of thresholds of 206 dB and 183 dB SEL. All fishes have a behavioral threshold of 150 dB SPL. Vibratory pile driving produces lower peak sound pressure levels than impact pile driving, and no mortal injuries have been reported using this method in a recent review (Hawkins et al. 2015).

Table 5-3. Acoustic thresholds used to evaluate impacts to fish exposed to impact pile driving sound as adapted from NMFS Greater Atlantic Regional Fisheries Office Acoustics Tool (GARFO 2020).

Faunal group	Physiological Injury		Behavior
Unit	PK	SEL_{SS}	SPL
Fishes greater than 2g	> 206 [1]	187 [1]	150 [2]
Fishes less than 2g	> 206 [1]	183 [1]	150 [2]

Notes:
PK = peak sound pressure (dB re 1 µPa); SEL_{SS} = sound exposure level$_{single\ strike}$ (dB re 1 µPa^2·s); SPL = sound pressure level (dB re 1 µPa).
1 = Fisheries Hydroacoustic Working Group (FHWG) 2008; Stadler and Woodbury 2009
2 = Andersson et al. 2007; Mueller-Blenke et al. 2010; Purser and Radford 2011; Wysocki et al. 2007

To assess potential maximum noise output from impact pile driving, transmission loss calculations were determined using the GARFO Acoustic Tool (NOAA 2020, CALTRANS 2020). With the relatively shallow water depths of the proposed project, the Simplified Attenuation Formula was used (

Table 5-4; Table 5-5). Results indicate when an impact hammer is used during pile installation, noise at injury-inducing levels (206 PK using the GARFO guidelines) for fishes could extend 14 m from the source, for a total of 616 m^2 (0.15 acre) of habitat impacted by lethal or sublethal noise exposure (Table 5-6). The distance to behavioral disturbance sound pressure level thresholds (150 dB SPL) from the use of an impact hammer could extend up to 90 m from the source, for a total of 25,447 m^2 (6.29 acres) of habitat impacted or greater than the entire Project Area. Vibratory hammer usage is not expected to cause injury or reach peak sound levels of 206 dB PK sound intensity. Behavioral disturbance (based on 150 dB SPL) is calculated to extend up to 60 m from the source, for a total of 11,310 m^2 (2.8 acres) of habitat impacted or greater than the entire Project Area. With the behavioral disturbance area larger than the Project Area for both hammer types, it is expected that fish will leave the Project Area during pile installation. If impact hammer pile installation is needed, a soft start will be employed, with hammer strikes less than full strength that ramp up to full impact strength. This mitigation for impact pile driving only, will allow time for mobile organisms to evacuate the area of potential injury. This mitigation is not required for vibratory hammer piling.

Table 5-4. Proxy Projects for Estimating Underwater Noise (adapted from GARFO 2020).

Project Location	Water Depth (m)	Pile Size (inches)	Pile Type	Hammer Type	Attenuation rate (dB/10m)
NA	<5	36"	Steel Pipe	Impact	5
NA	5	36"	Steel Pipe	Vibratory	5
Stockton, CA	3-4	20”	Steel Pipe	Impact	3
Stockton, CA	3-4	20”	Steel Pipe	Vibratory	3
Norfolk, VA	12.2	12-16"	Timber	Vibratory	5

Table 5-5. Proxy-Based Estimates for Underwater Noise (adapted from GARFO 2020).

Type of Pile	Hammer Type	Estimated Peak Sound Pressure (PK)* (Physiological injury at 206 PK)	Estimated Sound Pressure Level (SPL)	Estimated Single Strike Sound Exposure Level (SEL_{SS})
36" Steel Pipe	Impact	208	190	180
36" Steel Pipe	Vibratory	185	175	175
20" Steel Pipe	Impact	208	187	176
20" Steel Pipe	Vibratory	198	177	166
12-16" Timber	Vibratory	176	165	165

*Note: A maximum 10 dB re 1 μPa reduction in dB PK is possible for 36” steel piles (ICF Jones & Stokes 2009).

Table 5-6. Estimated Distances to Fish Injury and Behavioral Thresholds (adapted from GARFO 2020).

Type of Pile	Hammer Type	Distance (m) to 206 PK (injury)	Distance (m) to 150 dB SEL_{SS} (surrogate for 187 dB SEL_{SS} injury)	Distance (m) to Behavioral Disturbance Threshold (150 dB SPL)
36" Steel Pipe	Impact	14.0	70.0	90.0
36" Steel Pipe	Vibratory	NA	60.0	60.0
20" Steel Pipe	Impact	16.7	96.7	133.3
20" Steel Pipe	Vibratory	NA	63.3	100.0
12-16" Timber	Vibratory	NA	39.0	39.0

Adverse effects to EFH species from pile installation will be minimized by installing pilings with vibratory hammering and limiting the use of impact pile driving as much as feasible. The sandy sediment with no bedrock indicates that most, if not all, pile driving could be accomplished using the vibratory installation technique. An impact hammer will be used only when necessary. If an impact hammer is used, a soft start will be employed to give fish in the impact area time to avoid the noise source before full impact strikes are made. In addition, a bubble curtain will be deployed around each pile, which has been shown to achieve up to 10 dB reduction in peak sound pressure (ICF Jones & Stokes 2009). Although this reduction is the maximum attainable mitigation, the equipment used for the bubble curtain in this study and the equipment that will be used for this project are likely to be different. A more conservative estimate (3 to 5 dB attenuation) of the sound reduction is contemplated in the GARFO Acoustic Tool calculations shown in

Table 5-4. If greater levels of mitigation than what is included in the calculations are achieved, distances to acoustic thresholds for fishes will be decreased.

5.2.2 Water Quality

Installation and removal of steel pipe piles, timber piles, and sheet piles will temporarily disturb bottom sediments causing elevated turbidity/TSS. However, because the sediments in the project footprint are predominantly (98%) sand and gravel, it is expected that little material will be suspended and transported from the work area. Data for specific TSS levels and plume retention time for 98% sand and gravel are not available. Data are available from monitoring studies for the Tappan Zee Bridge Replacement Project in the Hudson River, where bottom sediments in the vicinity of the bridge comprise primarily clayey silt, with some accumulations of sand, silt, and clay material and gravelly sediments. Because the sediment in the Project Area is less silty, TSS levels and corresponding plumes are expected to be lower than those produced in the Hudson River. In the worst-case scenario, TSS levels may increase by 5 to 10 mg/l above background levels within approximately 300 ft of the pile (FHWA 2012). This relatively small turbidity plume is expected to settle out within a few hours. In addition, TSS levels will be below the threshold for adverse effects on fish (1,000 mg/l for most fish, and 200 mg/l for sensitive fish life stages) and benthic communities (390 mg/l; EPA 1986). TSS plumes during pile driving and pile removal are expected to be small and temporary; fish in the Project Area will be able to swim through the plume or avoid it by swimming away. Therefore, elevated TSS levels during pile driving is not likely to result in reductions in the quality or quantity of EFH or have substantial negative effects on species with designated EFH in the area.

5.2.3 Habitat Disturbance and Alteration

During the construction of the TMT upgrades, immobile life stages of fish species in or on benthic sediment (i.e., demersal eggs and larvae), demersal fish species, and benthic invertebrates with limited or no motility in the direct path of pile driving, sheetpile installation, or anchoring would be the most at risk of direct injury or mortality in the Project Area. Mobile demersal/benthic and pelagic fish and invertebrates may be temporarily displaced by increased suspended sediments and underwater construction but would likely be able to escape harm and avoid the Project Area while construction/installation occurs. Pile driving will occur year-round, but no impacts are expected due to limited and quickly dispersed sedimentation.

Changes in circulation and sediment transport patterns through the addition of the new project structures may alter natural sedimentation and passive transport of the pelagic egg and larval stages of EFH species. With the Project Area deep within Vineyard Haven Harbor and protected by the Eastville Point Beach breakwater, the maximum currents modeled under existing conditions are about 8 centimeters per second. With these relatively small currents, they do not necessarily have the magnitude to mobilize sediments or alter tidal sediment transport patterns (Ramsey et al. 2020). Circulation and sediment transport modeling indicated that the environmental windows included in the bulkhead design will allow for both water and sediment to flow through with overall circulation patterns expected remain similar to existing conditions, with negligible impacts to the tidal circulation. In addition, sediment transport patterns along the existing coastal beach habitat are not expected to be altered due to the new project structures, indicating no substantial adverse effect to EFH or associated species.

Installation of piles, the wave fence, reset revetment stones, and bulkhead will result in a change from the existing sandy/gravel/pebble bottom to approximately 142.5 m^2 (0.035 acres) and 87.5 m (287 linear ft) of hard vertical substrate. The change to vertical substrates may result in an increase in the prevalence of some structure-associated fish species (e.g., black sea bass), blue mussels, and fouling invertebrate species (e.g., tunicates, sponges, macroalgae, and barnacles) relative to existing conditions. However, it is likely that the unchanged sandy/gravel/pebble habitat surrounding the gangways and bulkhead in the Project Area would remain useful for other fish including EFH species. Therefore, because the footprint of habitat that will be changed from sandy/gravel/pebble to a hard vertical substrate (e.g., piles and bulkhead) is relatively small (0.035 acres) and comprises only 0.004% compared to similar habitat that will still be available to EFH species, this impact is not considered to be substantial.

5.3 Increased Overwater Structure

5.3.1 Shading

The proposed pile-supported concrete deck/pier will shade a maximum of 3,606 m^2 (0.89 acres) of EFH in the Project Area. Although a portion of the area under the concrete decking may not be permanently shaded due to solar sweep, maximum impact is assessed in this section. This area represents approximately 0.1% of similar habitat surrounding the Project Area in the body of water between West Chop and East Chop (approximately 827 acres). Shading from large industrial piers has been shown to impact the behavior and feeding of fishes and can reduce vegetative habitats (Able et al. 2013, Able and Duffy-Anderson 2006, Duffy-Anderson & Able 2001). EFH species and life stages that could be affected by habitat loss under the decking include: Atlantic cod (juvenile, HAPC), red hake (juvenile, adult), white hake (juvenile, adult), winter flounder (egg, larvae, juvenile, adult), yellowtail flounder (juvenile), windowpane (juvenile, adult), long-fin inshore squid (juvenile, adult), northern shortfin squid (juvenile, adult), summer flounder (adult, HAPC), scup (juvenile, adult), black sea bass (juvenile, adult), sandbar shark (juvenile), smoothhound shark complex (juvenile, adult), sand tiger shark (juvenile), bluefin tuna (juvenile, adult), little skate (juvenile, adult), and winter skate (juvenile, adult).

Specific studies of the distribution of benthic invertebrate prey for fishes around piers suggest that although lower relative to nearby unshaded habitats, prey abundance under piers is more than adequate to support fish growth (Duffy-Anderson & Able 2001). However, foraging is limited to fish that do not use vision to feed (e.g., American eel, naked goby, Atlantic tomcod, and selected decapod crustaceans; Able and Duffy-Anderson 2006). Studies indicate that fish species that use their vision to forage (e.g., *Pseudopleuronectes americanus, Tautoga onitis*) lost weight under piers (Duffy-Anderson and Able 1999, Able and Duffy-Anderson 2006). The industrial piers studied by Able and Duffy-Anderson shaded areas much larger (22 acres and 5 acres) than the 0.9 acres of potential shading by the pier proposed for the TMT project, and may have more extreme effects on habitat usage and foraging ability. These studies focus on reduced foraging and growth of fishes that were experimentally kept in cages both under and adjacent to the piers. This experimental design does not reflect the behaviors of most fish species which typically move between foraging and shelter habitat areas throughout the day. Other research investigating differences between fish habitat use of natural and artificial shading structures, more similar in size to the TMT pier, observed more diverse benthic communities and higher fish abundances associated with the artificial shading structures (Pereira et al. 2016). However, in general, the literature indicates significant reduction in habitat use by both juvenile and adult fish in response to shading from overwater pier and dock structures (as reviewed in Munsch et al. 2017).

Studies on the influence of docks and piers on benthic primary producers and consumers functional groups showed distinct but interrelated responses (Newcombe and Taylor 2010, Bulleri and Chapman 2010, Kihslinger and Woodin 2000). The macroalgae responds to lower irradiance levels available for photosynthetic activity, while macrofauna is mostly influenced by patchy or site-specific resources. All algal functional groups respond negatively to the abiotic and biotic conditions provided by docks and piers (Bulleri and Chapman 2010). With macrofauna, primary production reduction and the presence of the new habitats generally results in changes of the functional groups. Thus, docks and piers can exert a negative effect over base-trophic level organisms responsible for bottom-up controls. It is important to note, however, that many studies of dock and pier shading focus more on seagrasses, which require additional light for photosynthetic processes as aquatic plants, than macroalgae, which are better suited to low light situations (Macreadie et al. 2017).

Light regimes under fixed docks and piers show considerable variation depending upon the characteristics of the structure itself. Burdick and Short (1995) found dock height over the marine bottom to be the most important variable for predicting the relative light reaching the eelgrass and hence eelgrass bed quality under the docks. Increased dock height diminishes the intensity of shading by providing a greater distance for light to diffuse and refract around the dock surface before reaching the eelgrass canopy. The north-south orientation of the proposed dock and pier are also expected to allow for light penetration underneath, by allowing varying shadow periods as the sun moves across the sky. This movement of the shade footprint decreases the stress imposed on eelgrass and macroalgae (Burdick and Short 1995, 1999; Olson et al.1996,1997; Fresh et al. 1995).

Macroalgal percent cover in the Project Area was quantified by conducting a point count analysis using still images from video transects. Two transects that were directly underneath the proposed pier had an average of 19.5% macroalgal cover with an average of 10% macroalgal coverage for all transects within the Project Area (Table 3-2). Three species with EFH designations have macroalgae listed as part of their EFH characteristics. These include summer flounder juvenile/adults HAPC, white hake juveniles, and Atlantic cod juvenile HAPC.

The area of permanently lost macroalgae habitat, considered HAPC and EFH for multiple species, is estimated to be 703 m^2 (0.17 acres), calculated assuming macroalgae was present in 19.5% of the total shaded area. This area represents 0.1% and 0.2% of similar habitat in the surrounding the Project Area in the body of water between West Chop and East Chop assuming macroalgae coverage of 19.5% (average coverage in transects under proposed pier; 161.3 acres) and 10% (average coverage over all conducted video transects; 82.7 acres), respectively. Although the TMT pier would create new overwater shading, no appreciable reduction in primary production of macroalgae communities would be anticipated to occur due to the project location in an industrial area; localized nature of the shading; the design and size of the structures; and the short residence time of macroalgae under structures. Given the limited area of permanent loss to potential macroalgae habitat, designated as EFH and HAPC for multiple species, no substantial adverse effect caused by shading of the pier is anticipated.

5.3.2 Impervious Surfaces

Increases in impervious surfaces from the concrete decking/pier may increase stormwater runoff, potentially affecting quality of EFH if turbid and polluted runoff is emptied directly into the water. The concrete deck area is planned to be 3,606 m^2 (0.89 acres) with vehicular traffic, occasional parking, and overall transport of industrial cargo and materials. Although this surface is part over land and part over water, the combined area could run directly into the ocean depending on the direction of the pier slope. There will be 24,156 gallons of stormwater runoff generated per inch of rainfall from an impervious concrete deck of this size (USGS 2021).

Contaminant loading in sediments can occur from vessel discharges, boat washdowns, and bottom paint sloughing and scraping (Nightingale and Simenstad 2001). However, because of the existing industrial use of this area, minimal additional disturbance to species and habitat is expected. Recommended mitigation includes either designing a sloped drainage towards land so that the water can be filtered by the soil or installing stormwater filtration devices, which will allow direct discharge without impacting EFH. These filtration systems have been utilized in similar projects and have been recommended by Army Corps of Engineers as they trap sediment and oils or grease before discharging (USACE 2015).

5.4 Vessel Traffic

Vessel noise can impact fish species that have advanced hearing or communicate with low-frequency sound signals (Ladich and Myrberg 2006). Continuous noise above 170 dB root-mean-square (rms) for 48 hours can lead to injury, while exposure to noise of 158 dB rms or above for 12 hours can lead to behavioral disturbance (Hawkins and Popper 2017, Popper et al. 2014). A maximum sound pressure level of 192 dB re 1 µPa for numerous vessels with varying propulsion power under dynamic positioning is reported (McPherson et al. 2017), and that is under the injury threshold for fishes (Table 5-4). Unless construction operations occur for more than 12 hours without break, vessel noise is not expected to cause behavioral impacts or injury in the Project Area during construction.

Construction vessels for the Project include mechanical dredge, scow, pile driving barge(s), small crew vessels, and possibly tugboats used for docking. Potential impacts from construction vessels include barge grounding and vessel (and barge-mounted equipment) noise. Noise levels from all vessel activities are not expected to exceed those under current operating conditions in the Western Section of the Project Area and at the existing marine terminal adjacent to Project Area to the south.

Current vessel traffic rate at the terminal is approximately 3 to 4 vessel trips per week. The proposed Project would improve the three existing berths and add three more berths. Thus, the proposed TMT vessel rate will increase per week during operation. At this time, it is assumed there will only be a slight increase in risk from the minimal number of additional vessels added to baseline activity in the action area and that any associated increase in risk of a vessel strike would be too small to be detected or measured and effects to EFH are therefore insignificant. However, in regard to vessel noise, this will not be more than existing background vessel noise from existing vessels and ferry in the area, and species in the Project Area are acclimated to these levels.

6 EFH DETERMINATION

Determinations for potential impacts to EFH and designated species and HAPC from the Tisbury Marine Terminal Project are summarized in Table 6-1. Overall, project impacts are primarily expected to be temporary and cause no substantial adverse effect on habitat or associated species. Permanent impacts include habitat alteration in the dredge path, increased structured habitat, and shading under the pile supported pier. Given the small impact area of each of these project components and the availability of similar habitat in 0.2% larger project region, permanent alteration of these habitats is not expected to have substantial adverse effects of EFH, HAPC, or associated species.

Table 6-1. Determination of Potential Impacts from Tisbury Marine Terminal Project activities.

Project Activity	Impact	Potential Adverse Effect on EFH is not Substantial	Potential Adverse Effect on EFH is Substantial	Mitigation
Dredging	Habitat Removal 1.65 acres sand/granule/small pebble and macroalgae habitat	Temporary: Juvenile Cod HAPC, Adult Summer Flounder HAPC, 14 EFH species. Recovery expected in 1-5 years.	N/A	Mitigation to be negotiated with regulatory agencies.
	Change in Water Depth to 4.2 m (13.8 ft) MLW in Western Section and 5.5 m (18.2 ft) MLW in Eastern Section	Permanent, not expected to negatively impact as habitat at these depths will still be available: All EFH species	N/A	No mitigation required.
	Water Quality (TSS)	Minimal and Temporary: all EFH species	N/A	Dredging to adhere to TOY restrictions for sensitive life stages as described in Section 5.1.
	Direct Mortality	Minimal and Temporary: EFH species with demersal egg and larvae life stages that occur from September-January	N/A	Dredging to adhere to TOY restrictions for sensitive life stages as described in Section 5.1.
Pile Driving	Underwater Noise 6 acres (behavioral avoidance)	Temporary: Juvenile cod HAPC, Adult summer flounder HAPC, all EFH species	N/A	Use of vibratory pile driver Soft start and ramp up with start of impact driver Bubble curtain around impact pile driving
	Water Quality (TSS)	Minimal and Temporary: all EFH species	N/A	No mitigation required.
	Change from sandy sediments to hard vertical substrate 0.035 acres sand/granule/small pebble habitat	Permanent, minimal area: all EFH species	N/A	Mitigation to be negotiated with regulatory agencies.
Overwater Structure	Shading 0.89 acres shaded 0.18 acres macroalgae habitat	Permanent, small area: Juvenile cod HAPC and Adult summer flounder HAPC, 17 EFH species	N/A	Mitigation to be negotiated with regulatory agencies.
	Runoff pollution	Minimal: all EFH species	N/A	Sloping deck or Runoff filtration
Vessel Traffic	Noise and Barge Grounding	Minimal: all EFH species	N/A	No mitigation required.

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