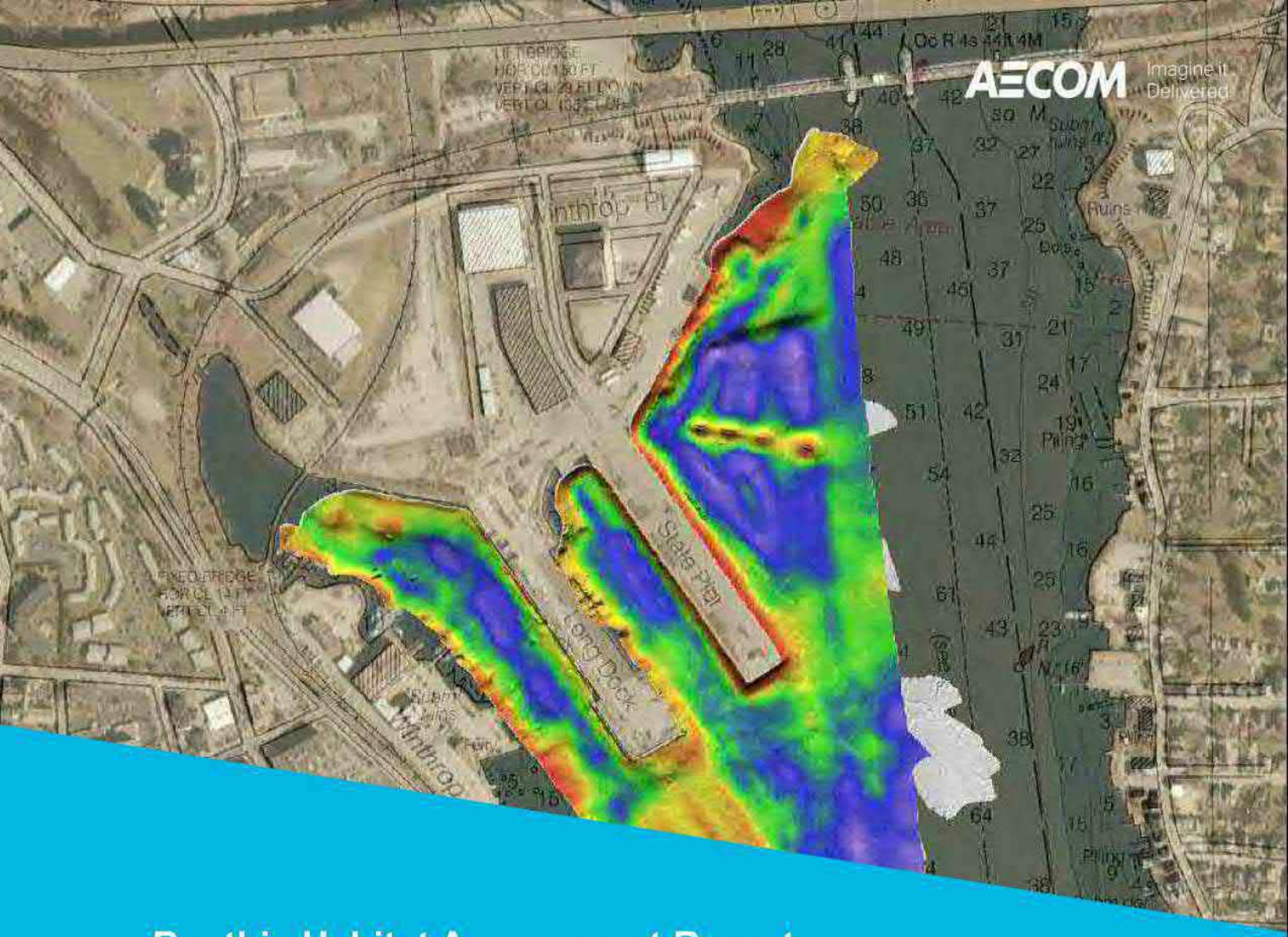
ATTACHMENT M1B

BENTHIC HABITAT ASSESSMENT REPORT



Benthic Habitat Assessment Report

In support of the Environmental Assessment for the State Pier Infrastructure Improvements Project

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Table of Contents

1. Introduction

The purpose and objectives of this document are to provide results and discussion from a four (4) day benthic habitat field survey led by AECOM to support environmental permitting of the State Pier Infrastructure Improvements (SPII or the Project). The project location is within and adjacent to the Thames River/New London Harbor, New London, Connecticut. Survey dates were on July 25, 26, 29 and 30, 2019. AECOM's benthic survey was designed with input from the Connecticut Department of Energy and Environmental Protection (CTDEEP), the U.S. Army Corps of Engineers (USACE) and Connecticut Port Authority (CPA) to identify existing shellfish and benthic infaunal natural resources as well as determine presence/absence of submerged aquatic vegetation (eelgrass – *Zostera marina*) in the area of the proposed project. These studies were performed to obtain the baseline data necessary to develop an understanding of potential ecological resource function to develop appropriate levels of mitigation based on the proposed Project impacts. Eelgrass is considered by the U.S. Environmental Protection Agency (USEPA) to be a "special aquatic site" and it has been determined by Connecticut Department of Environmental Protection (CTDEP) to support "essential fish habitat" as defined by the National Oceanic and Atmospheric Administration (NOAA) as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity". requirements for the state and federal permitting process. Previously mapped natural resources in the proposed Project area are shown in **Figure 1-1**, **Figure 1-2**, **Figure 1-3, Figure 1-4, and Figure 1-5**.

Project Description

The Connecticut Port Authority proposes improvements to the State Pier facility to create infrastructure that will serve as a long-term regional wind turbine generation (WTG) port facility while at the same time continuing to support other existing long-term breakbulk operations for steel, coil steel, salt, lumber, copper billets, as well as other cargo. To accomplish this objective, expansion of the pier surface area is needed, requiring the filling an approximately 7.4-acre area between the existing Central Vermont Railroad (CVRR) Pier and Admiral Shear State Pier that would require approximately 390,000 cubic yards (CY) of fill. CPA plans to use dredged material from the maintenance process of the berthing pocket for incoming vessels on site to fill in the 7.4-acre area. In addition to this dredged material being used as fill, CPA plans to level an upland area on site to provide approximately half (185,000 CY) of the required fill material. The final elevation of the filled area will match the existing State Pier deck elevation of nine (9) feet. The filled material will be confined on the eastern edge by the existing earth berm under the State Pier and on the western edge by the CVRR pier earth fill and new armored wall. The existing State Pier will remain as is and utilized for turbine blade storage. A steel cellular cofferdam will be installed across the southern end of the filled area.

The proposed work is anticipated to occur in two phases. Phase One "Upland Area" will occur primarily within upland portions of the site and will include the following actions:

- Demolition of various buildings,
- Site grading and installation of stormwater collection and treatment systems,
- Installation of potable and fire suppression water systems,
- Installation of perimeter fencing and associated lighting and security systems,
- Installation of electrical infrastructure to meet site requirements,
- Installation of dense graded aggregate top surface,
- Demolition of existing pile supported platform at western end of northeast bulkhead (NE BH),
- Installation of anchored combination wall bulkhead directly offshore of existing NE BH,
- Installation of energy absorbing fenders and bollards at NE BH,
- Demolition of four existing mooring dolphins in Thames River, and

Phase Two, "Waterfront Works" will consist of water-based work, accomplished either from onshore or from barges, depending on the location and requirements of the task. This work will occur outshore of the upland NE BH, bulkheads on the State and CVRR Piers and the area between these two piers and will consist of the following actions:

- Dredging at NE BH to accommodate import vessels,
- Selective demolition of SW corner of State Pier and SE corner of CVRR pier to accommodate the king pile wall,
- Installation of anchored king pile combination bulkhead between State and CVRR Piers,
- Placement of seven acres of fill between the CVRR and State Piers to match elevation of State Pier,
- Raising elevation of remaining horizontal surface of the CVRR Pier to match that of the State Pier,
- Installation of dense graded aggregate top surface,
- Installation of energy absorbing fenders and bollards,
- Dredging to south of king pile wall between State and CVRR Piers for jack-up installation vessel, and
- Seabed preparation for jack-up installation vessel.

On July 25 to 26 and July 29 to 30, 2019, AECOM in coordination with CR Environmental, Inc. conducted habitat assessment surveys for eelgrass, shellfish, and benthic infaunal community structure at the New London State Pier Facility, Connecticut as part of the environmental documentation and assessment of the Connecticut Port Authority's (CPA) goal to implement repairs, improvements and expansion of the existing port facility.

Surveys consisted of a combination of single beam echo sounding with precision navigation and underwater video to map out the extent of eelgrass, and sediment grab sampling for benthic community analysis and shellfish collections. Prior to the commencement of survey operations, multibeam bathymetric data collected by CR Environmental in July 2018 (CR, 2018) was evaluated for the presence of eelgrass and to plan the 2019 field operations.

Figure 1-1 Existing Coastal Resource Area

Figure 1-2 Existing Coastal Resource Area

Figure 1-3 Existing Coastal Resource Area

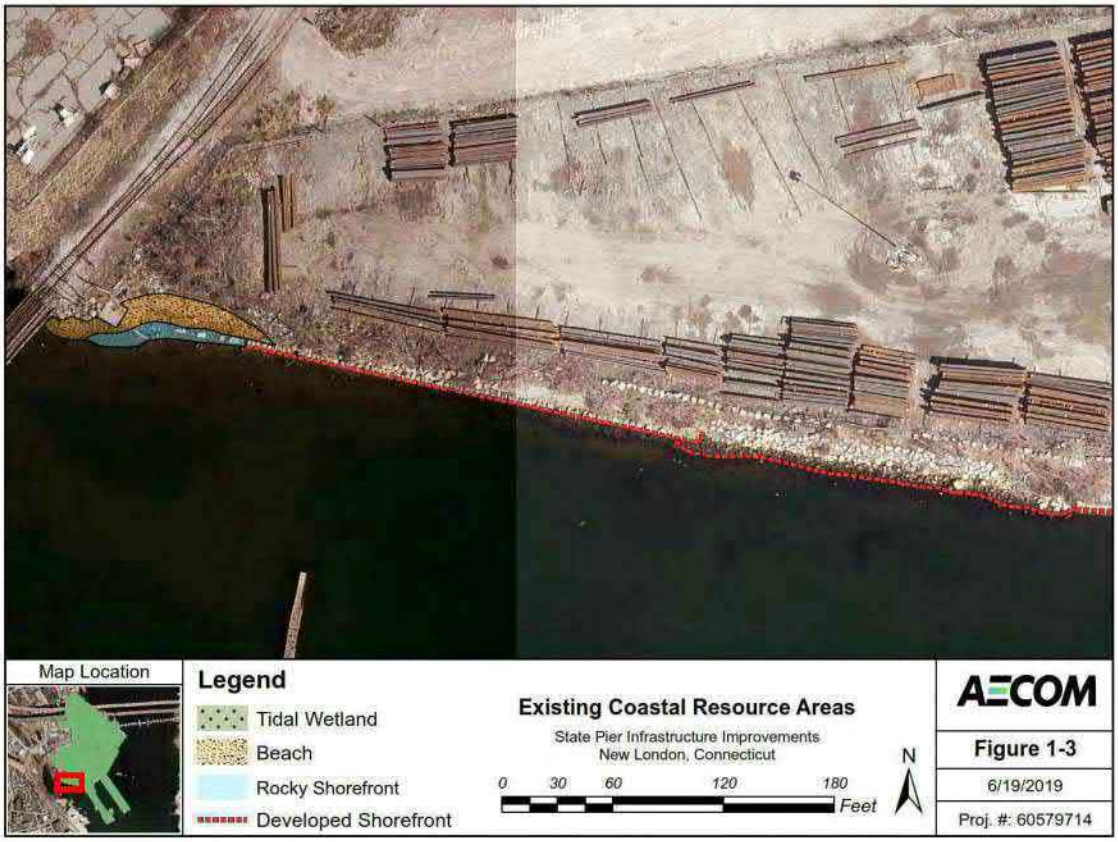


Figure 1-4 Shellfish Suitability Areas

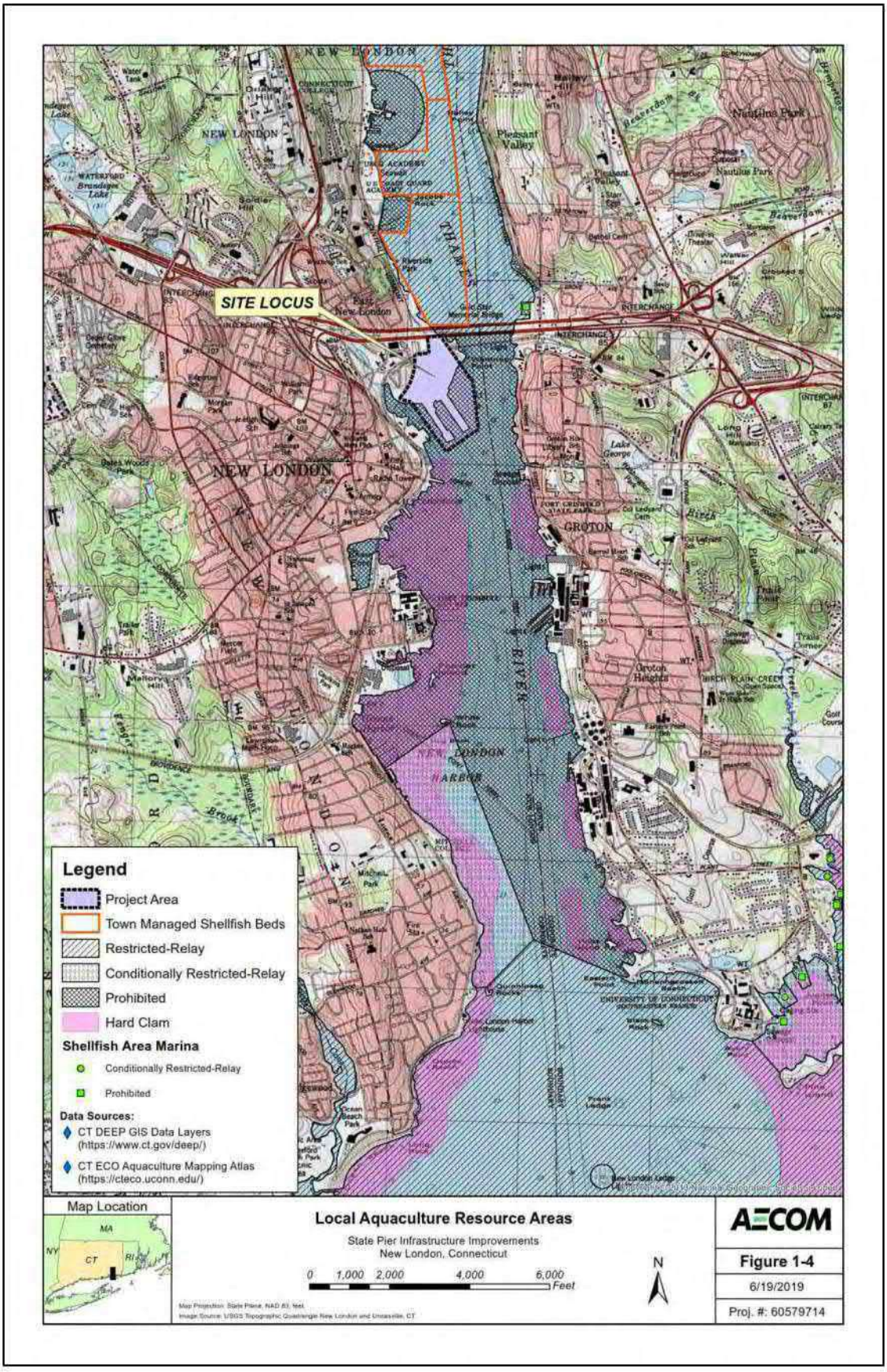
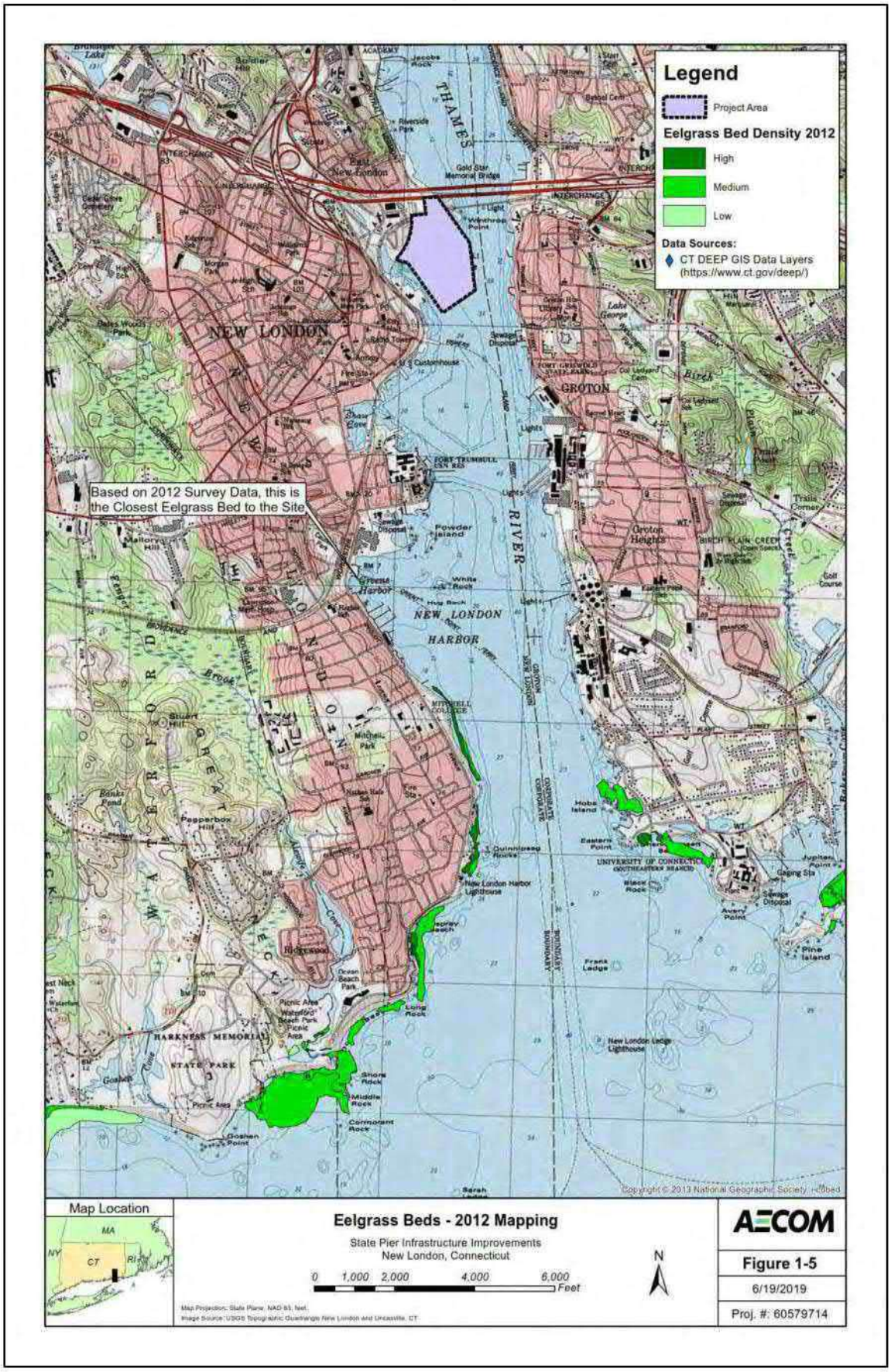


Figure 1-5 Eelgrass Habitat (2012 CTDEEP Mapping)



2. Survey Methodology

Vessel and Navigation

Vessel operations were performed from CR Environmental' s 26-foot custom built aluminum landing craft style vessel, R/V *LOPHIUS*. The vessel has an enclosed pilothouse, benches for survey equipment, over the side transducer boom, stern mounted davit and hauler, and bow mounted A-frame with hydraulic winch. Operations were staged at Thieler Fisheries in Winthrop Cove adjacent to the State Pier, New London, CT. Navigation for the survey effort was accomplished using a Hemisphere VS330 Real-time Kinematic Global Positioning System (RTK GPS). The horizontal accuracy of the navigation system is approximately 1.0 centimeter horizontally and 2 centimeters vertically (Root Mean Squared 1-sigma). Horizontal accuracy in differential or float mode is approximately 1 foot. RTK corrections were provided via NTRIP internet connection by KeyNet GPS, Inc.

The RTK GPS was serially interfaced to a shipboard computer running HYPACK 2015 hydrographic surveying software. This system calculated X and Y positions in the desired grid system (CT State Plane, NAD83, US Foot), recorded the water depth, navigation data, and provided a steering display for the vessel captain. The progress of the survey and sampling operations was followed in HYPACK used georeferenced imagery (e.g. orthophotos) as a background file ensuring the entire survey area was adequately insonified and samples were collected at the designated positions.

Benthic habitat assessment was initiated on July 25, 2019 with a survey for eelgrass habitat. Benthic infaunal samples were collected on July 26, 2019. Shellfish samples were obtained on July 29 and 30, 2019.

Eelgrass Survey

Single beam bathymetric soundings were taken to map the presence of eelgrass at the port facility on July 25, 2019. Bathymetric soundings covered waters adjacent to the Northwest Bulkhead in Winthrop Cove, around the CVRR Pier, Central Wharf, State Pier, and the northeast bulkhead up to Winthrop Point (Locus - CT Port Authority Figure, Existing Topographic and Hydrographic Conditions, New London, CT, Moffatt & Nichol).

Bathymetric data were acquired using a Teledyne Odom Hydrographic Echotrac CV-100 single (vertical) beam echo sounder (VBES) equipped with an 8-degree 200-kHz transducer. Approximately five survey lines with 10-foot spacing were occupied around the piers. Along the northeast bulkhead near Winthrop Point, additional survey lines were added to create an approximately 5-foot line spacing once the echo sounder display indicated potential submerged aquatic vegetation (SAV) (**Figure 2-1**).

Processing of the single beam echosounder data consisted of the removal of outlying data points associated with water column interference (e.g., debris). Data cleaning was guided by detailed inspection of profile echograms for each line file. Portions of data files without signatures associated with eelgrass were deleted, yielding a database indicating eelgrass presence. These eelgrass points were plotted in GIS and used to digitize a shapefile depicting the extent of the eelgrass.

An underwater video sled survey was performed on July 25, 2019 to confirm (i.e. ground truth) that the SAV boundary derived from the echo sounder data was eelgrass, and to provide photographic documentation of eelgrass density, plant health, bottom substrate and biota. A total of 18 video transects from 2 - 6 minutes in duration were occupied along the State Pier Facility (**Figure 2-2**).

Underwater video data were collected with CR's portable towed video sled consisting of a lightweight aluminum frame, Outland Technologies' high-definition color camera, and two wide-angle LED video lights with variable output control. The video camera was cabled to an OTI-1080 HD DVR recorder and high-resolution daylight monitor at the surface. The video sled was raised and lowered using a stern mounted davit and lobster pot hauler, and the height of the system off the bottom was continually adjusted to achieve the best bottom coverage and video quality. When the video camera was one foot off the bottom, the viewing area of the camera was approximately 1.5 feet x 1.5 feet (18 inches x 18 inches), and the video quality was optimal for bottom sediment characterizations and biota identifications.

The underwater video data were reviewed by a marine biologist at the CR office and AECOM office. The presence or absence of eelgrass was noted from each transect, as well as, the bottom substrate and visible biota. Representative underwater video screen captures were created for 16 of the 18 video transects. Video screen captures were not made for two of the underwater video transects (8 and 10) in the deeper waters (20-30 feet) along the State Pier as visibility was poor and no features were noted beyond a muddy sand bottom

Figure 2-1 Single Beam Bathymetry Tracklines

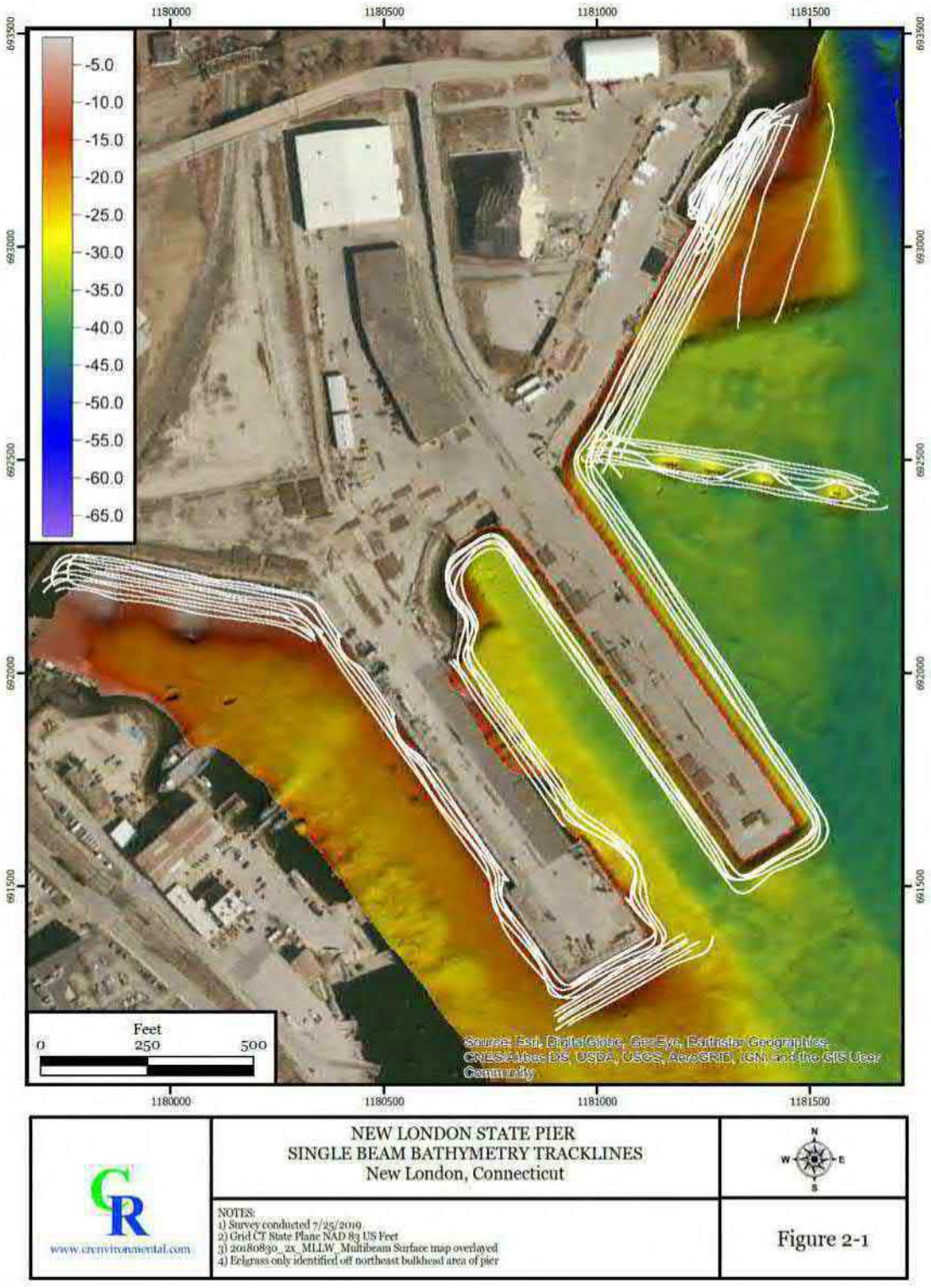
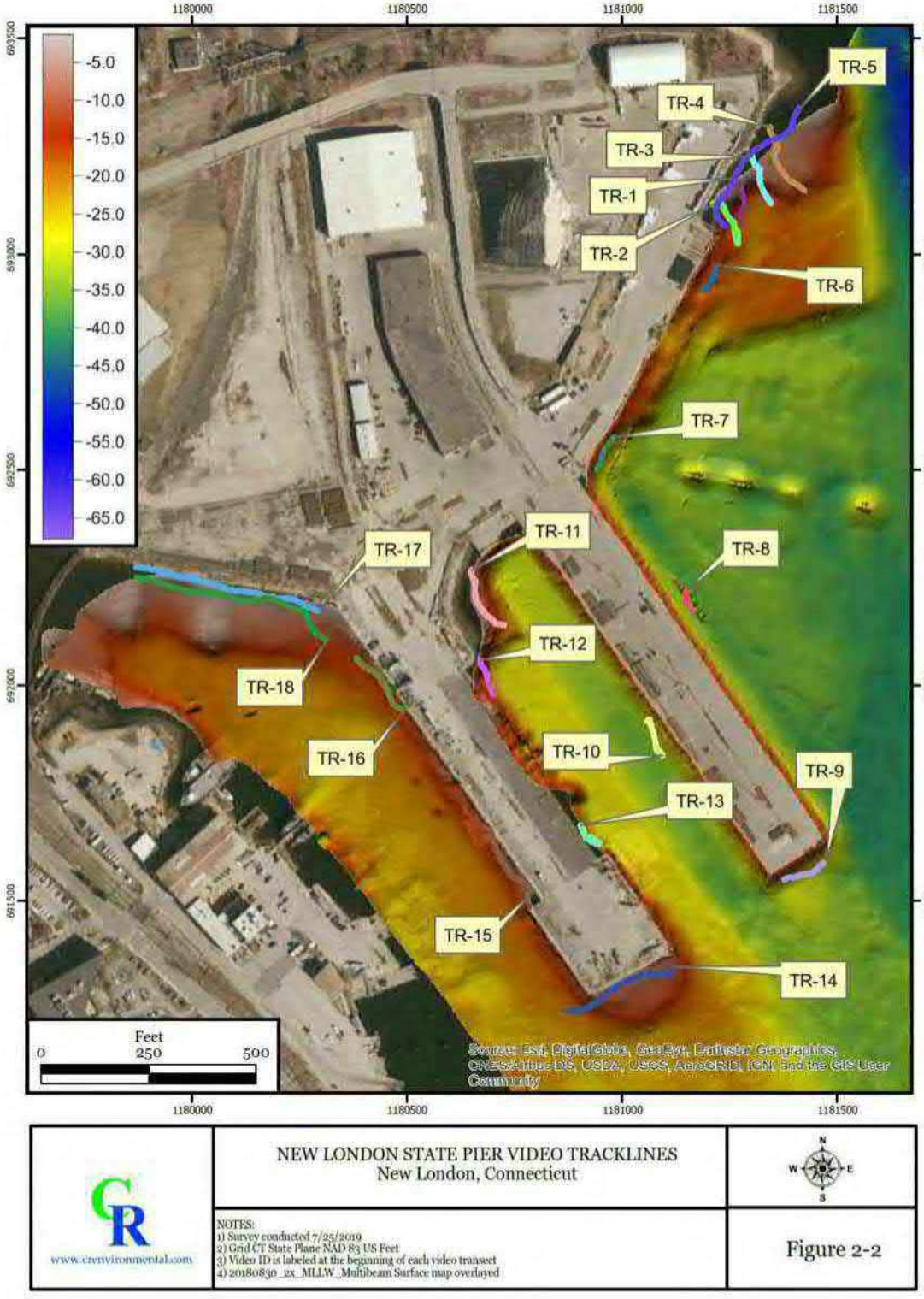


Figure 2-2 Video Tracklines



Benthic Infauna Sampling

Benthic infauna samples were collected using a 0.04 m^2Ted Young modified Van Veen grab. Samples were collected on July 26, 2019 at fourteen (14) stations in and around the Project area including adjacent to the New London State Pier structures and north of the train bridge (**Figure 2-3**). Samples were transferred to buckets and transported to shore where they were sieved on a 500 µm mesh screen using filtered seawater. The sediment remaining on the sieve was preserved in 10% buffered formaldehyde. Infaunal samples were transported to AECOM's benthic lab in Pocasset, Massachusetts where they were re-sieved on a 500 µm mesh sieve with running tap water and then transferred to a 70% ethanol solution and stained using Rose Bengal (a vital dye used to assist with sorting macroinvertebrates). Following sorting, benthic infauna were enumerated and classified to the lowest practical taxonomic level. This methodology was used to balance taxonomic effort while providing cost efficiency. Infauna analysis included calculation of Family level richness, abundance of organisms by Family, Pileou's evenness (J') for Family level and multivariate Bray-Curtis Similarity and non-linear multidimensional scaling to assess community structure using Primer E v. 7.0 software.

Community Metrics

Abundance: The number of individuals observed within a sample collected from a station location.

Pileou's Evenness (J'): Pileou's Evenness metric is a diversity index that evaluates the evenness of distribution within the biological community. Evenness is measured on a scale of 0 to 1. If community composition is proportionally distributed to show a high degree of evenness, it will have a value near 1, and if there is a greater disparity between the abundance of various taxa, then the community will demonstrate less evenness with a value closer to 0.

Bray-Curtis Similarity (BSC): is a multivariate statistic used to quantify the compositional dissimilarity between two different sites, based on counts at each site.

Nonlinear Multidimensional Scaling (nMDS): is a means of visualizing the level of similarity of individual cases of a dataset. MDS is used to translate information about the pairwise 'distances' among a set of individuals/objects into a configuration of mapped into an abstract space

Shellfish Sampling

Fifty-two (52) stations were sampled for the presence, abundance, and identification of commercially important shellfish species (**Figure 2-3**) on July 26, 29, and 30, 2019. Abundance for the following shellfish species were noted if present as part of AECOM's assessment:

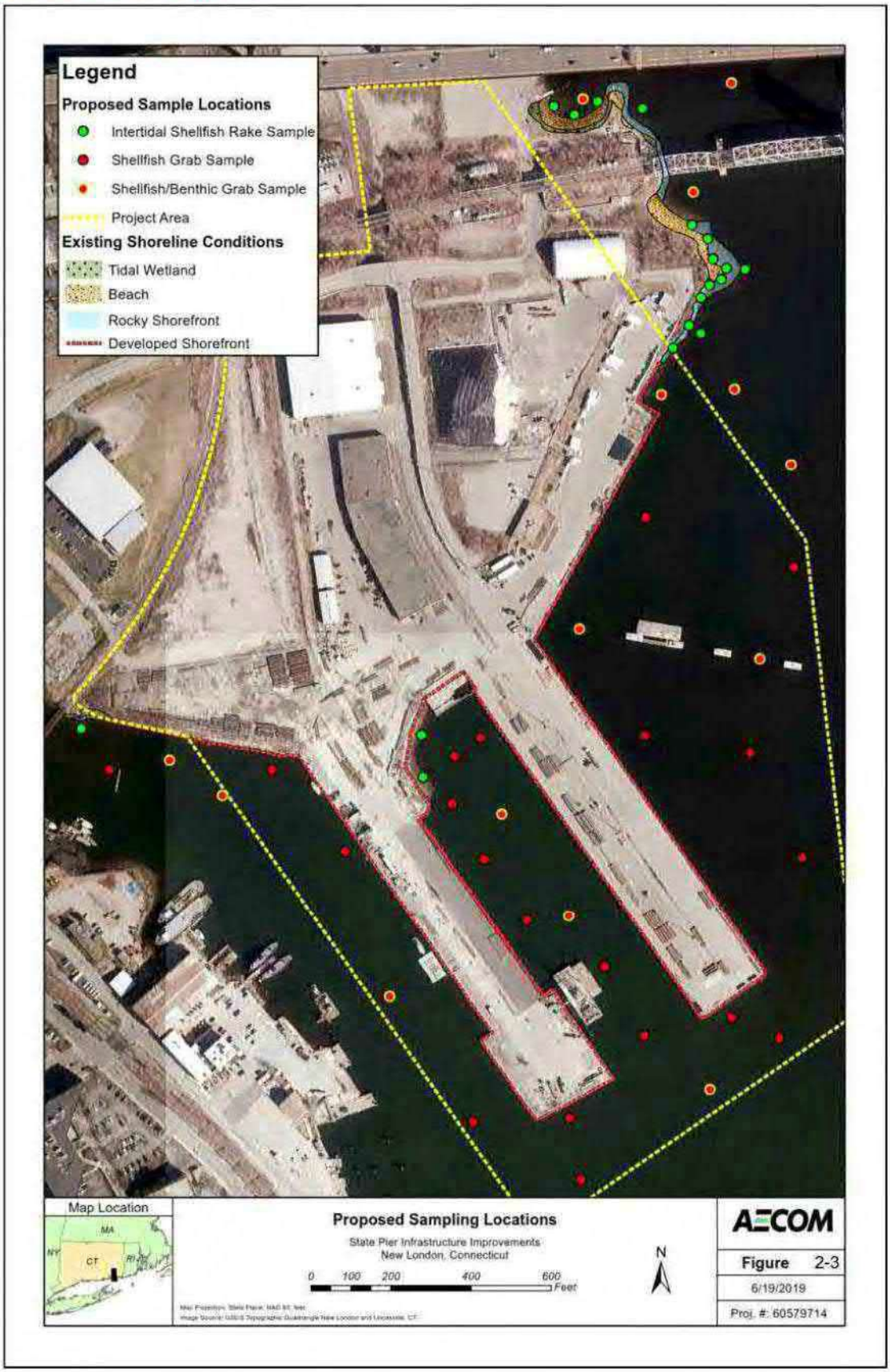
- quahogs (*Mercenaria mercenaria*),
- soft-shell clams (*Mya arenaria*),
- bay scallops (*Argopecten irradians*),
- razor clams (*Ensis leei*),
- American oysters (*Crassostrea virginica*).

Sediment characteristics were visually observed and recorded at each sample location along with presence of other benthic infauna and algae. Shellfish samples were collected using the following methodology:

1. Intertidal samples along the shore were collected using a modified calm rake lined with ¼ inch mesh basket liner. The mesh lining allowed for capture of juvenile stages of shellfish species. Approximately 1 foot $(ft.)^2$ of sediment was processed at each nearshore station. Eighteen (18) intertidal shellfish samples were collected. Nearshore shellfish sample locations are shown on **Figure 2-3**.

2. Samples beyond the intertidal (*i.e.* subtidal) were collected using a double 0.01 m^2 Ted Young modified Van Veen grab (Figure 4). Sediment grabs were washed through a ¼ inch mesh screen bucket. Species identifications and measurements were performed onboard by AECOM personnel prior to returning shellfish and other biota to the area where they were originally collected. Thirty-four (34) stations were sampled using the grab methodology. Subtidal shellfish sample locations are shown on **Figure 2-3**.

Figure 2-3 Sample Locations



3. Survey Results

3.1 Bathymetric and Submerged Aquatic Vegetation Results

Examination of the single beam trackline echograms indicated no SAV proximate to the New London State Pier Facility excluding lines off the northern portion of the northeast bulkhead near Winthrop Point. These echograms showed a distinct acoustic signature indicating patchy stands of SAV rising above the seabed (**Figure 3-1**). The narrow band of potential eelgrass was estimated to be approximately 4,600 ft.^{2} (**Figures 3-2 and 3-3**).

A previous multibeam survey in the same region for AECOM performed by CR Environmental did not include the northern shallow water area where eelgrass was detected with single beam (**Figure 2-2**) in 2018. However, examination of the data for SAV corroborated that no other areas of SAV were found within Project area including between the two existing pier structures.

3.2 Underwater Video Eelgrass Ground Truth Results

The underwater video data confirmed the detected signal by the single beam echosounder at the northern extent of the survey area was eelgrass (*Zostera marina*). It was observed to be present in a narrow band along the northeast bulkhead near Winthrop Point. Eelgrass was observed at the inshore ends of video transects TR-1 through TR-4 and along the entire length of TR-5 that ran southwest directly through the narrow eelgrass stand (**Figure 2-2, Plates 1-4, 5A and B**).

Eelgrass within the stand was patchy and the relative density ranged from sparse to moderate with a plant height of 1 to 3 feet. Plants were covered with epiphytic algae, bryozoans, and were not robust. Water column visibility was observed in the video to be poor and benthic macroalgae was abundant, which is a probable indicator of eutrophication (*e.g.*, the CVRR Pier - **Plates 9**, **10, 12A** and **B**; the Northwest Bulkhead **-Plates 15A** and **B, 16**). Macroalgal species observed in the video included kelp (*Saccharina latissima*), sea lettuce (*Ulva latuca*), purple laver (*Porphyra* sp.), dulse (*Palmaria palmata*), as well as unidentifiable branching red and brown algae.

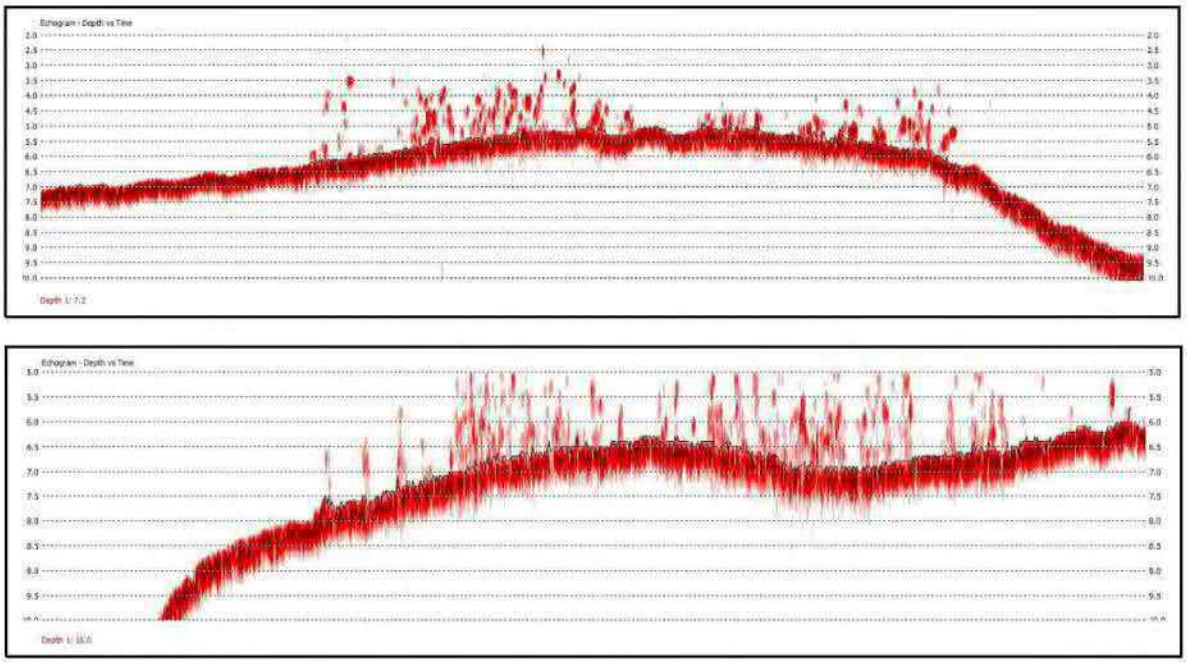
Industrial debris was observed from transect TR-6 located near the northeast bulkhead, transect TR-8 and transect TR-10 along the State Pier; therefore, only minimal video footage was obtained. No eelgrass was observed within the Project area. The substrate where eelgrass was observed outside the Project area was comprised of a sandy substrate (**Plate 1**). The substrate adjacent to the State Pier was characterized as a mix silty and sandy sediment (**Plate 8**). The sediment seafloor adjacent to CVRR Pier was comprised of sand and pebbles with shell hash interspersed (**Plates 12A** and **B, 13**). Areas of pebble, stones, and small boulders were observed along the northeastern and southwestern faces of the CVRR Pier. Along the northwest bulkhead sediment was characterized to be comprised of sand mixed with with shell has and silty sediment (**Plates 15A** and **B, 16**).

Ten (10) epifaunal species were observed during the video survey that included: blue crabs (*Calinectes sapidus*), spider crabs (*Libinia emarginata*), hermit crabs (*Pagurus* sp.), mud snails (*Nassarius obseleta)*, oyster drills (*Urosalpinx cinerea*), channeled whelks (*Busycotypus canaliculatus*), blue mussels (*Mytilus edulis*), quahogs (*Mercenaria mercenaria*), barnacles (*Balanus* sp.), and unidentifiable bushy bryozoans (**Plates 5B, 8**). Fish species were also observed and included mummichogs (*Fudulus heteroclitus*), juvenile sea bass (*Morone saxatilis*), cunner (*Tautogolabrus adspersus*), and summer flounder (*Paralichthys dentatus*).

Benthic Infauna

Seven (7) benthic samples were collected from within the Project area and seven (7) from outside the proposed project footprint (**Figure 2-3**). From these samples, there were 7,841 individuals enumerated and identified belonging to sixty-four (64) different taxonomic Families. Some individual organisms were readily identifiable to the species level while others were remained at a higher classification to expedite sample analysis while balancing level of taxonomic effort. Polychaeta were the dominant taxonomic group from the samples followed by Bivalvia in abundance (**Table 1**). Pileou's evenness (J') calculated at the Family level ranged from 0.44 (B-23) to 0.86 (Station B-18) (**Table 2**). A taxonomic species list from stations sampled with abundances is provided in **Appendix A**.

Figure 3-1 Echograms



CR www.crenvironmental.com	SAMPLE SINGLE-BEAM ECHOGRAMS NEW LONDON STATE PIER - July 25, 2019 New London, Connecticut	N W E S
	NOTES: 1) Survey Conducted 7/25/2019 2) Grid CT State Plane NAD 83 US Feet 3) Single-beam track lines spaced 5-ft apart in eel grass area	Figure 3-1

Figure 3-2 Echo Sounder Eelgrass Mapping

Figure 3-3 Northern Bulkhead Echo Sounder

Table 1. Matrix of family abundance by station

Family	B 17	B 18	B 21	B 23	B 25	B 38	B 39	B 4	B 43	B 46	B 51	B 52	B 6	B 7	Grand Total
Acteonidae										2					2
Ampeliscidae		2		1	1			6	2	2				3	17
Ampharetidae	1	2	3	4	1				2	4			9	1	27
Ampithoidae								5							5
Anadarinae													8		8
Aoridae	20	17				1		128			130	1	4	16	317
Arcidae		1			1								12		14
Calyptraeidae	2	8			4								27		41
Capitellidae	3		9	326		388	277	12	173	592	37	378	1	55	2251
Caprellidae										2			2		4
Carinomidae	2	5							2	4		2		2	17
Chaetopteridae				1			1								2
Cirratulidae		18	1	1	20	6	1		1	1	2	3	60		114
Columbellidae		1			1								8		10
Corophiidae		15			4			25	1		78		5	1	129
Cossuridae			6	868		450	268		110	197		40			1939
Flabelligeridae		10		2	15	1	2			1		1	4	1	37
Glyceridae	7									1			4	2	14
Goniadidae		4										2			6
Harrimaniidae										2					2
Idoteidae				1				3						2	6
Ischyroceridae						1					2				3
Leptocheliidae								5							5
Leuconidae				1					1			5			7
Lumbrineridae	19	3	4		4			2		6			2	46	86
Lyonsiidae	1														1
Mactridae				1											1
Maldanidae	9	12	11	1	7				4	3		1	14	1	63
Melitidae								20							20
Myidae	2						1	118		2				2	125
Mytilidae	3							3				1			7
Nassariidae	2										78	3			83
Naticidae											1				1
Nemertea			1	10	1		4	1				1	2		20
Nephtyidae		2	5	4	2	5	1		3	1		1			24
Nereidae	1				1			16	1		3			3	25
Nuculidae	1	5	184	224	103	105	51		361	106	1	44	7	1	1193
Oligochaeta				29		60	18		6	22		16		1	152
Onuphidae	1														1
Opheliidae	7					3								2	12
Orbiniidae							5	6	1	11		61	1		85
Paguridae	3												1		4
Panopeidae								2							2
Paraonidae		1	17	18	1	19	21		21	19		1	1	1	120
Pectinariidae	1							1				1		1	4

Family	B 17	B 18	B 21	B 23	B 25	B 38	B 39	B 4	B 43	B 46	B 51	B 52	B 6	B 7	Grand Total
Periplomatidae			2						7						9
Pharidae	1			1						2					4
Phoronidae						7									7
Phyllodocidae	2				5	1	1	12	4	5	1	1		5	37
Pilargidae		2	2	5		3	2								14
Platyhelminthe										1					1
Polynoidae		4													4
Pyramidellidae					2				6				5		13
Sabellidae							1						1		2
Sigalionidae					5			1					18	2	26
Solemyidae	3														3
Spionidae	9	2	18	38		78	9	64	9	61	32	49		30	399
Syllidae			1	4		1	1		1	18	1	7			34
Tellinidae	7	1	4	10	2	22	11		10	27		13	3		110
Terebellidae	1			1								5		2	9
Tornatinidae				3						2					5
Veneridae	1		1		1			4						1	8
Xanthidae											1				1
Yoldiidae	1		7	31	8	20	3		37	24		4			135

Table 3-1 Summary of benthic infauna data

Stations	Number of Families	Abundance	Evenness (J')
B4	20	434	0.68
B6	23	199	0.79
B7	23	181	0.66
B17	26	110	0.84
B18	20	115	0.86
B21	17	276	0.51
B23	24	1585	0.44
B25	21	189	0.60
B38	18	1171	0.57
B39	19	678	0.49
B43	22	763	0.52
B46	27	1118	0.51
B51	13	367	0.64
B52	24	641	0.50

The Bray-Curtis similarity analysis determined three distinct subgroups of stations and two outliers based on Family level taxonomic identifications. (**Figure 3-6**). There was no trend observed that correlated with sediment type being a factor to differentiate these groups. In general, the sediment at the stations sampled was comprised of black, silty mud indicative of anoxia and had sulfidic odor. This is also represented in the nMDS plot (**Figure 3-7**). The three main subgroups that were observed have different colored bars below. Stations B51 and B4 are considered outliers to these three main subgroups because the lacked correlation in taxa. Station B51 has a fewer Families when compared to the other stations. Also, the taxa at station B51 were comprised predominantly of Aoridae, Nassariidae and Corophiidae, which was dissimilar from the other station results. Station B51 was the only location sampled that had Nassariidae and Corophiidae in the top three taxa. Station B4 had higher abundances of Phyllodocidae and Myidae when compared to the other sample. Myidae were found with 94% of their abundance from Station B4. These differences in taxa separated station B4 from the other samples. Half of the station sampled (7) were grouped together based on abundances of Oligochaeta, Capitellidae and Yoldiidae (blue bar). The group comprised of Station B18, B25, and B21 (green bar) was a result of Ampharetids and Maldanidae presence. Station B7 and B17 were

grouped together (orange bar) based on presence of Lumbrineridae and the absence of other taxa found in the remaining samples.

Figure 3-6. Bray-Curtis Analysis at Family Level.

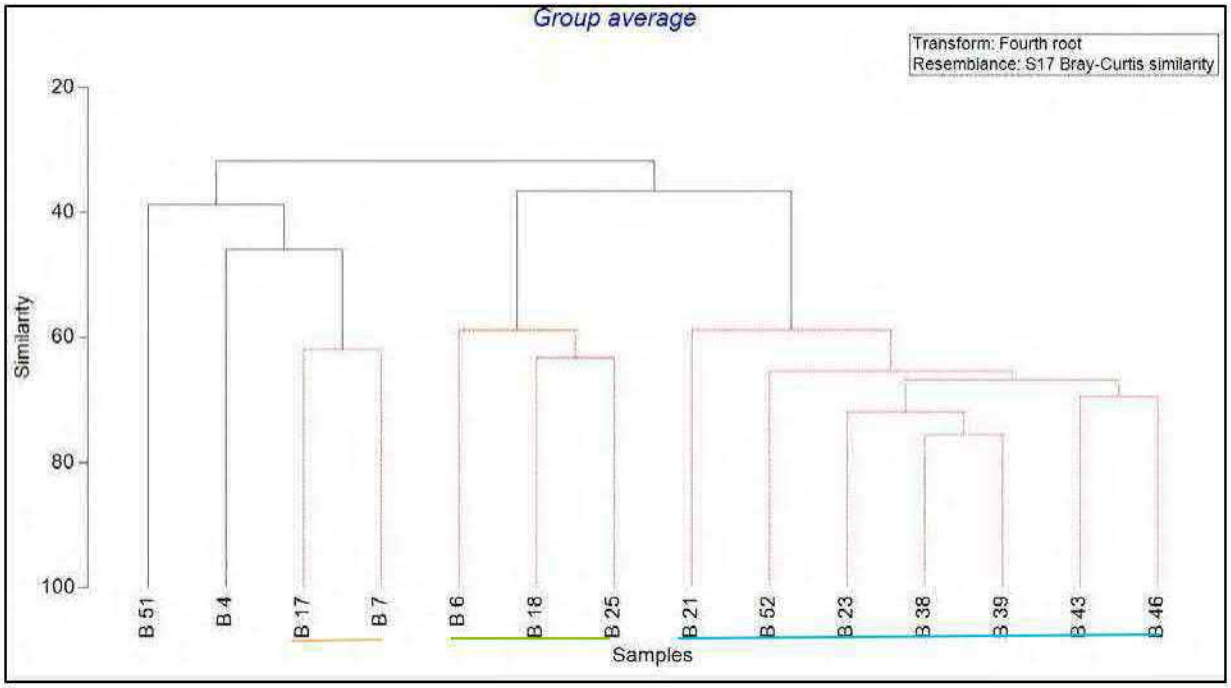


Figure 3-7. Nonlinear multidimensional scaling results for the benthic infaunal stations based on Bray-Curtis similarity.

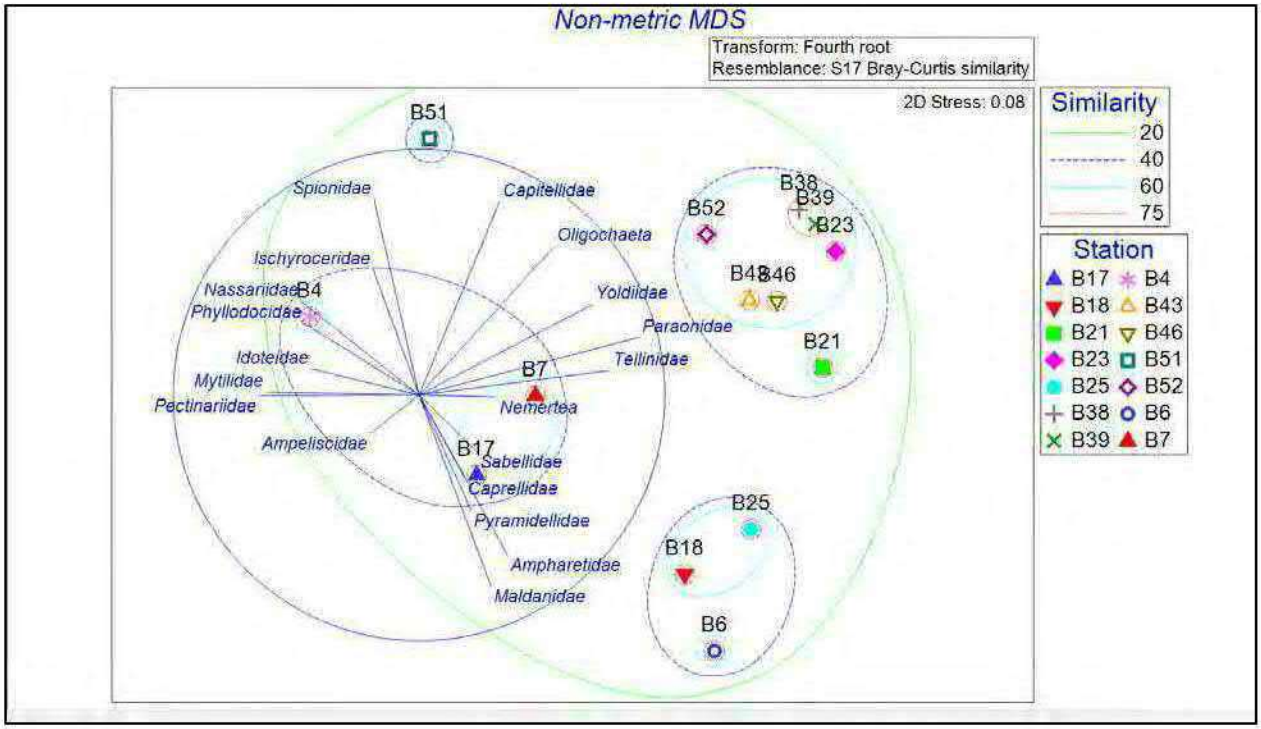


Figure 3-8 Sampling results – Sediment composition

Figure 3-9 Sampling Results -Shellfish

Shellfish Samples

Sample locations for shellfish habitat assessment are shown in **Figure 2-3.** Visual characterization of the subtidal shellfish samples collected with the Van Veen grab had sediment comprised of a mix of black, anoxic silt with a sulfidic odor and varying amounts of sand, clay, pebbles, and shell hash (**Figure 3-8**). Half of the intertidal shellfish samples (9) that were collected using the hand rake were from areas with small boulders and had no shellfish. The remaining shellfish samples consisted of a mix of pebbles and sand. Visual sediment characterization is shown in (**Figure 3-8)**. A description of the visual sediment type is provided within **Appendix B**. Of the fifty-two (52) samples collected for shellfish habitat assessment, twelve (12) were found to have commercially important shellfish. Commercially important shellfish species were identified from 23% of the samples collected. There were thirty-one (31) quahogs, three (3) soft shell clams and twenty-one (21) blue mussels collected during the AECOM survey (**Figure 3-9**). More than half (62%) of the shellfish collected were from stations outside the Project footprint. Station SG-50 had eleven (11) quahogs and twenty-one (21) blue mussels, which comprised 58% of the total number of Commercially important shellfish collected. From within the project area, twenty-eight (28) stations were sampled with six (6) of these stations (Stations 17, 24, 42, 44, 47 and 48) having a combined total of thirteen (13) quahogs and one (1) station (Station 23) had two (2) soft shell calms. Shellfish measurements are provided within **Appendix B.** Reprehensive photographs from shellfish samples are within **Plates 17-22.**

4. Discussion

Detailed review of the 2019 single beam bathymetric survey data did not detect eelgrass proximate to the existing State Pier Facility except for a narrow band detected in shallow water outside the Project footprint adjacent to the northeast bulkhead near Winthrop Point (**Figures 3-2 and 3-3**). The 2019 video sled survey observations confirmed the presence of patchy eelgrass ranging from 1-3 feet in height. The eelgrass observed appeared to be covered in epiphytic algae and bushy bryozoans and suggested that it may be experiencing ecological stress. Water visibility was low in the Thames River at the time of the AECOM survey. The eelgrass habitat observed and confirmed by underwater video was measured to be approximately 4,600 ft^2. Eelgrass was not identified between the existing pier structures. The samples collected for AECOM's shellfish habitat assessment were representative of typical New England estuarine environments. Samples were observed to be comprised largely of black and anoxic sediment with sulfidic odor, which can most likely be attributed to eutrophication conditions in the Thames River. No shellfish were collected between the existing piers in the area proposed to be filled.

Benthic infaunal community had taxa typical for southern New England estuarine habitat. The majority of the observed biota are opportunistic, primarily consisting of surface-dwelling polychaetes with intermediate successional stage amphipods. Fewer deeper-dwelling taxa (e.g. deposit-feeding Maldanidae and Bivalvia) were also observed, which has been commonly observed in anthropogenically disturbed marine environments (Valente et al. 2003, Pembroke et al. 2016). Non-indigenous (i.e. introduced) species were not identified from the samples collected by AECOM. The benthic communities observed within the Project footprint were consistent with the long-term use of the area as an active port with a largely developed shorefront, being comprised of opportunistic species that rapidly colonize benthic habitat subsequent to disturbance.

The project will require filling the area between CVRR and State Piers to create a heavy lift platform accessible for deep draft vessels. This will result in loss of nearshore subtidal estuarine habitat. This area will be converted from an open water ship berthing facility, with an anoxic seafloor between the two existing piers, to a support structure to facilitate wind energy construction and operations. The habitat that is proposed to be filled was determined to be anthropogenically disturbed based on benthic infaunal community and sedimentary observations and no eelgrass was present. Therefore, localized adverse impacts to the natural resources will occur in the direct proposed project impact area, but overall there will not be discernible functional impacts to the Thames River estuary. No impacts to existing eelgrass are expected as eelgrass is not present between the existing peer structures. Overall, the impacts to benthic habitat would be minimal, and are not expected to have any lasting effect upon the overall ecosystem services in the Thames River estuary.

In addition to fill impacts, dredging will be performed in order to create ample berthing areas and maintain sufficient depths for deep draft vessels. Although the effects of the new dredged depths in the vessel berthing areas may temporarily change the species composition and abundance, the post-dredge benthic habitats are expected to exhibit characteristics that are consistent with existing baseline conditions.

The Connecticut Port Authority would comply with all specified permit conditions to avoid generating excessive amounts of sediment and causing irreversible impacts to marine resources during dredging and sediment fill activities. Temporary construction-period impacts will be minimized through use of appropriate Best Management

Practices (BMPs) and an "In Lieu-Fee" to DEEP Fisheries will be made for habitat restoration efforts in the Project area or elsewhere to be determined by state agency regulators. Permanent impacts to coastal resources from implantation of SPII will be offset by implementation of a comprehensive mitigation strategy. A conceptual mitigation plan is presented in JPA Attachment M8.

As described above, it is AECOM's opinion that the adverse impacts on coastal resources from the Project activities will be minimal. Further, mitigation measures are proposed as part of the Project which will address the unavoidable adverse impacts. The mitigation measures include a substantial investment in funding of fisheries enhancement projects in Connecticut as advocated and directed by the Connecticut DEEP Fisheries division. These fisheries enhancement measures are anticipated to have an overall net improvement in fisheries resources along the Connecticut coastal area compared to the anticipated direct Project impacts. The Project is also proposing to implement living shoreline enhancement measures along the Thames River shoreline immediately north of the Project activities. The living shoreline enhancements are anticipated to contribute to the local intertidal and subtidal habitat functions, providing an "in-kind and on-site" mitigation of the minimal adverse impacts identified in this assessment.

5. References

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Pembroke, AE, Diaz RJ, Nestler EC. 2016. Boston Harbor Benthic Monitoring Report: 2016 Results. Boston: Massachusetts Water Resources Authority. Report 2017-10. 45 pages.

Valente, Raymond & Fredette, Thomas. (2003). Benthic Recolonization of a Capped Dredged Material Mound at an Open Water Disposal Site in Long Island Sound. Dredging, Key Technologies for Global Prosperity. 1-14. 10.1061/40680(2003)46.

Appendix A Species Abundance by Station

	B 17	B 18	B 21	B 23	B 25	B 38	B 39	B 4	B 43	B 46	B 51	B 52	B 6	B 7	Grand Total
Amphipoda	**20**	**34**		**1**	**8**	**2**		**184**	**3**	**4**	**210**	**1**	**11**	**20**	**498**
Ampelisca abdita		2		1	1			6	2	2				3	17
Amphipoda					3										3
Ampithoe valida								5							5
Aoridae		15						128			130	1	4		278
Caprellidae										2			2		4
Carassicorophium bonellii		13			2			25	1		78		4	1	124
Grandidirella sp1	10					1								12	23
Jassa falcata						1					2				3
Leptocheirus pinguis		2			2								1		5
Megamoera dentata								13							13
Melita nitida								7							7
Microdeutopus anomalus		2													2
Microduetopus gryllotalpa	10													4	14
Bivalvia	**20**	**7**	**198**	**267**	**115**	**147**	**66**	**125**	**415**	**161**	**1**	**62**	**30**	**4**	**1618**
Ameritella agilis	7		4	10	2	21	8		9	25		13	3		102
Anadara transversa		1			1								12		14
Anadarinae													8		8
Ensis leei	1			1						2					4
Limecola balthica						1				2					3
lyonsia arenosa	1														1
Macoma calcarea		1					3		1						5
Mercenaria mercenari	1							4						1	6
Modiolus modiolus	3							3				1			7
Mya arenaria	2						1	118		2				2	125
Nucula proxima	1	5	184	224	103	105	51		361	106	1	44	7	1	1193
Periploma papyratium			2						7						9

	B 17	B 18	B 21	B 23	B 25	B 38	B 39	B 4	B 43	B 46	B 51	B 52	B 6	B 7	Grand Total
Pitar morrhuanus			1		1										2
Solemya velum	3														3
Spisula solidissima				1											1
Yoldia limatula	1		7	31	8	20	3		37	24		4			135
Brachyura				**1**				**2**			**1**				**4**
Dyapanopeus sayi								2							2
Megalopa				1											1
Xanthidae											1				1
Crustacea													**1**		**1**
Paguridae													1		1
Cumacea				**1**					**1**			**5**			**7**
Leucon americanus				1					1			5			7
Decapoda	**3**					**3**			**2**	**4**					**12**
Brachyura megalopa						3			1	2					6
Pagurus sp.	3														3
Shrimp larva									1	2					3
Entroptneusta										**2**					**2**
Saccoglussa kowalskii										2					2
Gastrododa	**4**	**9**		**3**	**7**				**6**	**4**	**79**	**3**	**40**		**155**
Acteocina canaliculata				3						2					5
Acteon punctostriatis										2					2
Anachis lafresnayi		1			1										2
Columbellidae													8		8
Crepidula fornicata	2	8			4								27		41
Fargoa bartschi									1						1
Ilyanassa obsoleta											78	3			81
Ilyanassa trivitta	2														2
Naticidae											1				1
Pyramidellidae													5		5
Roonea seminuda					1										1

	B 17	B 18	B 21	B 23	B 25	B 38	B 39	B 4	B 43	B 46	B 51	B 52	B 6	B 7	Grand Total
Turbonilla c.f. *nivea*					1										1
Turbonilla elegantula									5						5
Isopoda				**1**				**3**						**2**	**6**
Edotia triloba				1				3							4
Edotia triphora														2	2
Nemertea	**2**	**5**	**1**	**10**	**1**		**4**	**1**	**2**	**4**		**3**	**2**	**2**	**37**
Carinomella lactea	2	5							2	4		2		2	17
Nemertea			1	10	1		4	1				1	2		20
Phoronida						**7**									**7**
Phoronid asp.						7									7
Platyhelminthe										**1**					**1**
Platyhelminthes sp.										1					1
Polychaeta	**61**	**60**	**77**	**1273**	**61**	**955**	**590**	**114**	**330**	**920**	**76**	**551**	**115**	**152**	**5335**
Ampharetidae	1	2	3	4	1				2	4			9	1	27
Capitellidae			9	326		388	277	12	173	592	37	378	1	55	2248
Cirratulidae		18	1	1	20	6	1		1	1	2	3	60		114
Clymenella	9														9
Cossura longocirrata						450									450
Cossuridae			6	868			268		110	197		40			1489
Diopatra cuprea	1														1
Eteone lactea						1									1
Flabelligeridae		10		2	15	1	2			1		1	4	1	37
Glycera dibranchiata	7														7
Glyceridae										1			4	2	7
Goniadidae		4										2			6
Lumbrineridae		3	4		4			2		6			2		21
Lumbrineris	19													46	65
Maldanidae		12	11	1	7				4	3		1	14	1	54
Mediomastus ambiseta	3														3
Nephtyidae		2	5	4	2		1		3	1		1			19

	B 17	B 18	B 21	B 23	B 25	B 38	B 39	B 4	B 43	B 46	B 51	B 52	B 6	B 7	Grand Total
Nepthys incisa						5									5
Nereidae					1			16	1		3			3	24
Nereis pelagica	1														1
Ophelia	6					3								2	11
Ophelina	1														1
Orbiniidae							5	6	1	11		61	1		85
Paraonidae		1	17	18	1	19	21		21	19		1	1	1	120
Pectinaria gouldii	1							1						1	3
Pectinariidae												1			1
Phyllodocidae	2				5		1	12	4	5	1	1		5	36
Pilargidae		2	2	5			2								11
Pista cristata	1														1
Polydora cornuta	5														5
Polynoidae		4													4
Sabellidae							1						1		2
Sigalionidae					5			1					18	2	26
Siganbra tentaculata						3									3
Sipochaetopterus oculatus				1			1								2
Spionidae	2	2	18	38			9	64	9	61	32	49		30	314
Spiophanes bombex	2														2
Strebliospia benidicti						78									78
Syllidae			1	4		1	1		1	18	1	7			34
Terebellidae				1								5		2	8
Tanaidacea								**5**							**5**
Leptochelia cf. *dubia*								5							5
Vertebrate											**1**				**1**
Ichthyoplankton											1				1
Oligochaeta				**29**		**60**	**18**		**6**	**22**		**16**		**1**	**152**
Oligochaeta				29		60	18		6	22		16		1	152
Grand Total	**110**	**115**	**276**	**1586**	**192**	**1174**	**678**	**434**	**765**	**1122**	**368**	**641**	**199**	**181**	**7841**

Appendix B Sediment composition and shellfish results.

Sample ID	Sediment composition	Shellfish
SG-4	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-6	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-7	Silty black mud / black sand / black gravel / anoxic	4 *Mercenaria mercenaria* (Quahogs) 2x2
SG-17	Silty black mud / black sand / black gravel / anoxic	*3 Mercenaria mercenaria* (Quahogs)1(2x2) 2 (1x1)
SG-18	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-21	Silty black mud / black sand / black gravel / anoxic	1 *Mercenaria mercenaria* (Quahogs) 1x1
SG-22	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-23	Silty black mud / black sand / black gravel / anoxic	2 *Mya actinaria* (Softshell) > 1/2"
SG-24	Silty black mud / black sand / black gravel / anoxic	1 *Mercenaria mercenaria* (Quahog) 1/4x1/4
SG-25	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-26	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-27	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-28	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-31	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-32	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-33	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-34	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-35	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-36	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-37	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-38	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-39	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-40	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-41	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-42	Silty black mud / black sand / black gravel / anoxic	2 *Mercenaria mercenaria* (Quahog) 2x2
SG-43	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-44	Silty black mud / black sand / black gravel / anoxic	1 *Mercenaria mercenaria* (Quahog) 3x3

Sample ID	Sediment composition	Shellfish
SG-45	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-46	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-47	Silty black mud / black sand / black gravel / anoxic	1 *Mercenaria mercenaria* (Quahog) 3x3
SG-48	Silty black mud / black sand / black gravel / anoxic	5 *Mercenaria mercenaria* (Quahog) 2x2
SG-50	Silty black mud / black sand / black gravel / anoxic	11 *Mercenaria mercenaria* (Quahog) 9 (3x3) 2 (1x1)21 Mytilus edulis (blue mussels)
SG-51	Silty black mud / black sand / black gravel / anoxic	No commercial species
SG-52	Silty black mud / black sand / black gravel / anoxic	No commercial species
SR-49	Gravel / coarse-med sand / black anoxic	2 *Mercenaria mercenaria* (Quahogs) 1x1
SR-30	Stone / industrial debris	No commercial species
SR-29	Small Boulders	No commercial species
SR-1	Silty black mud / black sand / black gravel / anoxic	No commercial species
SR-2	Silty black mud / black sand / black gravel / anoxic	No commercial species
SR-3	Small Boulders	No commercial species
SR-5	Gravel/stone	No commercial species
SR-7	Sand/ Gravel	No commercial species
SR-8	Sand/ Gravel	1 *Mya arenaria* (Softshell)
SR-9	Black gravel	No commercial species
SR-10	Black gravel	No commercial species
SR-19	Small Boulders	No commercial species
SR-12	Small Boulders	No commercial species
SR-11	Small Boulders	No commercial species
SR-13	Small Boulders	No commercial species
SR-14	Small Boulders	No commercial species
SR-20	Small Boulders	No commercial species
SR-15	Small Boulders	No commercial species

Plates

Moderate eelgrass with epiphytic algae

Sparse eelgrass on sand bottom

Branching Red Algae

Plate 1. Video Screen Captures of Bottom Substrate and Biota at TR-1 along northern portion of the Northeast Bulkhead

Moderate eelgrass

Kelp, branching brown algae

Wreckage, debris, purple laver

Plate 2. **Video Screen Captures of Bottom Substrate and Biota at TR-2 along the northern portion of the Northeast Bulkhead**

Moderate eelgrass with epiphytic algae

Macro Algae, sand/pebble bottom with shell hash

Kelp, sand bottom

Plate 3. **Video Screen Captures of Bottom Substrate and Biota at TR-3 along the northern portion of the Northeast Bulkhead near Winthrop Point**

Moderate eelgrass

Sea lettuce, red branching algae

Kelp, purple laver

Plate 4. **Video Screen Captures of Bottom Substrate and Biota at TR-4 northern extent of Northeast Bulkhead**

Moderate eelgrass with epiphytic algae

Plate 5A. Video Screen Captures of Bottom Substrate and Biota at TR-5 through the eelgrass bed adjacent to the northern portion of the Northeast Bulkhead

Blue crab on sand bottom

Sparse eelgrass

Moderate eelgrass with epiphytic algae

Plate 5B. Video Screen Captures of Bottom Substrate and Biota at TR-5 through the eelgrass bed adjacent to the northern portion of the Northeast Bulkhead

Debris, muddy sand bottom

Muddy sand bottom, macro algae

Muddy sand bottom

Plate 6. **Video Screen Captures of Bottom Substrate and Biota at TR-6 along the southern portion of the Northeast Bulkhead**

Muddy sand, Dulse

Wreckage, debris

Muddy sand bottom, blue mussels

Plate 7. **Video Screen Captures of Bottom Substrate and Biota at TR-7 at the southern end of the Northeast Bulkhead inshore of the Old Pier**

Muddy sand bottom with shell

Muddy sand bottom with shell

Muddy sand, whelk, debris

Plate 8. **Video Screen Captures of Bottom Substrate and Biota at TR-9 along the southern end of the State Pier**

Small boulders, cobbles, abundant macro algae

Pebbles, cobbles, branching red algae

Wreckage, debris, macro algae

Plate 9. **Video Screen Captures of Bottom Substrate and Biota at TR-11 along riprap rubble nearshore end of the CVRR Pier**

Boulder with macro algae

Pebble, cobble with macro algae

Muddy sand bottom with branching red algae

Plate 10. Video Screen Captures of Bottom Substrate and Biota at TR-12 along the northeastern side of the CVRR Pier

Muddy sand, pebble bottom

Wreckage, debris

Muddy sand bottom, debris

Plate 11. Video Screen Captures of Bottom Substrate and Biota at TR-13 along the northeast side of the CVRR Pier

Kelp, red branching algae on a sand pebble bottom

Plate 12A. Video Screen Captures of Bottom Substrate and Biota at TR-14 at the southern end of the CVRR Pier

Abundant macro algae

Purple laver

Quahog, Kelp with hold fast

Plate 12B. Video Screen Captures of Bottom Substrate and Biota at TR-14 at the southern end of the CVRR Pier

Sand, pebble bottom, with shell hash

Sand bottom, kelp

Sand, pebble bottom, purple laver

Plate 13. Video Screen Captures of Bottom Substrate and Biota at TR-15 along the southwest side of the CVRR Pier

Muddy sand bottom, debris

Lobster trap remains

Muddy sand bottom with diatom mat, whelk

Plate 14. Video Screen Captures of Bottom Substrate and Biota at TR-16 at the western nearshore end of the CVRR Pier

Sand bottom with shell

Sea lettuce abundant

Sea lettuce, red branching algae abundant

Plate 15A. Video Screen Captures of Bottom Substrate and Biota at TR-17 along the Northwest Bulkhead

Sand bottom, Blue crab

Sea lettuce, red branching algae abundant

Boulder with macro algae

Plate 15B. Video Screen Captures of Bottom Substrate and Biota at TR-17 along the Northwest Bulkhead

Muddy sand, worm egg sacks

Boulder with red branching algae

Sea lettuce, branching red algae abundant

Plate 16. Video Screen Captures of Bottom Substrate and Biota at TR-18 along the Northwest Bulkhead

Plate 17.

Plate 17. Shellfish Grab SG-4, SG-6 before and after processing.

Plate 18.

Plate 18. Shellfish Grab SG-7, SG-21 before and after processing.

Plate 19.

Plate 19. Shellfish Grab SG-18, SG-46 before and after processing.

Plate 20.

Plate 21. Shellfish Grab SG-47, SG-37 before and after processing.

Plate 22.

Plate 22. Shellfish Grab SG-22, SG-24 before and after processing.

Plate 23.

Plate 23. Shellfish Grab SG-35, SG-38 before and after processing.