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New Bedford Harbor Superfund Site

U.S. Army Corps of Engineers New England District

Final Upper Harbor Sediment Caps Remedial Action Report

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Acronyms and Abbreviations

CDF	Confined Disposal Facility
Cogg-East	Coggeshall-East
Cogg-West	Coggeshall-West
cm	centimeter
CQC Plan	Construction Quality Control Plan
CRE	CR Environmental, Inc.
cy	cubic yards
EPA	U.S Environmental Protection Agency
ft	feet
g/cm^3	grams per cubic meter
G. Lopes	G. Lopes Construction, Inc.
Jacobs	Jacobs Engineering Group Inc.
LH	Lower Harbor
LTM	Long term monitoring
LSA	Location Specific Addendum
NBHSS	New Bedford Harbor Superfund Site
NPL	National Priorities List
OH	Outer harbor
PCB	polychlorinated biphenyl
ppm	parts per million
PVC	polyvinyl chloride
QC	quality control
ROD	Record of Decision
RTK GPS	real-time kinematic global positioning system
SVOC	semi-volatile organic compound
SES	Sevenson Environmental Services, Inc.
sf	square feet
TCL	target cleanup level
TOC	Total Organic Carbon
USACE-NAE	United States Army Corps. Of Engineers – New England District
UH	Upper Harbor
VOC	volatile organic compound
WZ4	West Zone 4
%	percent
3DCQ	3-Dimensional Spherical Coordinate Quality

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1. Introduction

The U.S. Environmental Protection Agency (EPA) and U.S. Army Corps of Engineers New England District (USACE-NAE) determined a permanent isolation capping system would be developed and implemented in seven areas of upper New Bedford Harbor Superfund Site (NBHSS) where dredging was not feasible or cost-effective to achieve the Record of Decision (ROD) target cleanup levels (TCLs) (EPA 1998). The remedial goals of the permanent sediment cap designs include:

- Establishing a physical exposure barrier to prevent impact to human health and the environment;
- Prevent the migration and resuspension of polychlorinated biphenyl (PCB) impacted sediment through the permanent cap to the surface water;
- Prevent the migration of dissolved PCB constituents into the surface water; and
- Where applicable, provide a suitable environmental habitat for ecological receptors.

The purpose of the *Upper Harbor Sediment Caps Remedial Action Report* is to document the cap installation process, illustrate quality control (QC) results, and describe the long term monitoring (LTM) of seven permanent sediment caps constructed in the Upper Harbor (UH) of NBHSS in 2020. The seven sediment cap locations, north to south, are named: O-711 Cap, Crib Cap, , L-014 Cap, L-114 Cap, Area C Pilot Confined Disposal Facility (CDF) Shoreline Cap, Coggeshall West (Cogg-West) Cap, and Coggeshall East (Cogg-East) Cap. Locations of the sediment caps are found in Figure 1. Note that an eighth permanent sediment cap was installed in 2016 between Sawyer Street and Coggeshall Street in New Bedford as part of the NBHSS Parcel 265 intertidal remediation, and that an interim sediment cap was installed at the Aerovox facility in 2018-2019 (Figure 1).

1.1 Site History

New Bedford Harbor was proposed for the Superfund National Priorities List (NPL) in 1982 and finalized on the NPL in 1983. Pursuant to 40 CFR 300.425 (c)(2), the Commonwealth of Massachusetts nominated the harbor as its priority site for listing on the NPL. The NBHSS is located approximately 55 miles south of Boston, in Bristol County, Massachusetts and is bounded to the east by the Town of Acushnet and Town of Fairhaven; and bounded to the west by the City of New Bedford and the Town of Dartmouth. The NBHSS covers approximately 18,000 acres, extending from the shallow northern reaches of the Acushnet River Estuary, southward through the commercial harbor of New Bedford and into the adjacent section of Buzzards Bay. Based on the different geographic, environmental, and man-made features in the harbor, it has been subdivided into three sections identified as the UH, Lower Harbor (LH), and the Outer Harbor (OH).

The subtidal area and impacted intertidal zones of the UH comprise approximately 236 acres and is bounded to the North by the Wood Street Bridge area and to the South by the Coggeshall Street Bridge (Figure 1). The LH comprises approximately 750 acres and is bounded to the north by the Coggeshall Street Bridge and to the south by the New Bedford Hurricane Barrier. The OH (approximately 17,000 acres) begins at the Hurricane Barrier and extends southward into Buzzards Bay to an imaginary line extending from Rock Point (the southern tip of West Island in Fairhaven) southwesterly to a New Bedford Harbor navigational channel buoy, Buoy C3 and then southwesterly to Mishaum Point in Dartmouth.

PCB contamination of the sediments and seafood in and around New Bedford Harbor was first identified in the mid-1970s. Site-specific investigations by the EPA began in 1983 and 1984 and included pilot dredging and disposal studies and extensive physical and chemical computer modeling. These early studies are summarized

in the 1990 Feasibility Study for the NBHSS (Ebasco, 1990), and in the 1998 ROD for OU1 UH and LH (EPA, 1998).

Based on the results of these investigations and knowledge of the operations at the former Aerovox Site at 740 Belleville Avenue in New Bedford, the Aerovox site was identified as the principal source of PCB contamination in the UH. During operations at this facility (1940s – 1970s), PCB wastes were discharged directly to the UH through open trenches or spills and direct dumping; and indirectly via the City's sewerage system. During the same general time period, inputs of PCBs were also contributed to the NBHSS by operations at the Cornell Dubilier Electronics, Inc. facility, located just south of the New Bedford Hurricane Barrier in the OH.

Operations at the Aerovox Site resulted in significantly elevated PCB concentrations in UH sediments that generally decreased from north to south across the NBHSS. Prior to the completion of remedial efforts, UH sediments contained PCB concentrations that ranged from below detection to more than 100,000 parts per million (ppm) in localized areas. As a tidal embayment with diurnal 4-foot (ft) tides, intertidal mudflats and vegetated saltmarshes became contaminated with PCBs in the UH and in certain, localized shoreline areas of the LH. This report documents the remedial capping activities that occurred during 2020 in the seven areas of the UH mentioned above.

1.2 Sediment Cap Overview

For each UH cap, a *Location Specific Addendum* (LSA) (Jacobs 2020a,2020b,2020c,2020d,2020e,2020f,2020g) was developed by Jacobs Engineering Group Inc. (Jacobs) in coordination with Lally Consulting LLC. Each LSA addressed design deviations from the *Draft Final Upper Harbor Permanent Caps Generic Design* (Generic Design) (Jacobs 2020h), and included cap-specific modeling, cap material specifications, cap footprint coordinates, and example cross-sections.

Installation of the caps was performed by Sevenson Environmental Services, Inc. (SES) at the direction of Jacobs. Cap installation began on 24 August 2020 and was completed on 22 December 2020. Construction followed the *Draft Final Upper Harbor Subaqueous Cap Construction Work Plan* (Work Plan) (Jacobs 2020i). Deviations from the Generic Design, LSAs, or Work Plan are presented in Section 5.

2. Pre-Construction Activities

In addition to the submittal of the Generic Design, LSAs, and Work Plan documents, the notable pre-construction efforts included: mobilization of capping equipment, laboratory testing of cap chemical isolation material to ensure the material met design specifications, and as described further below, excavation and relocation of western shore intertidal areas abutting the landward boundaries of the L-014 and L-114 caps.

2.1 Mobilization

Mobilization efforts for sediment capping commenced on 27 July 2020 with the construction of the 40-ft x 40-ft deck barges. Steel plates and I-beams were welded onto the deck barges in preparation for receiving and transporting cap material. Mobilization of the 40-ft x 80-ft Poseidon® capping barge began in August 2020, outfitting it with the Komatsu® PC490-LC, MQ Power® 45 kVA generator, and CONEX boxes. Figure 2 shows the capping barge configuration. Once mobilization was complete, the capping barge was transported by a SES tugboat to the

O-711 Cap location on 24 August 2020. Deck barges and scows were loaded with cap material at the North Dock staging area (Figure 1) with the Sennebogen® 850.

2.2 Cap Material Testing

Isolation layer material was manufactured at G. Lopes Construction Inc (G. Lopes), located in Raynham MA, and tested to comply with acceptability ranges set forth in the *Draft Final Addendum 1 Construction Quality Control Plan for Upper Harbor Subaqueous Caps* (CQC Plan) (Jacobs 2020j). Acceptability criteria for manufactured material are outlined in the table below.

Parameter	Acceptable Range
MCP Soil Category S-1 Characteristics	Pass / Fail
Grain Size	80-90 percent (%) sand | 10-15 % silt/clay | <1% gravel
In-Situ Moisture Content	1-10 %
Bulk Density	1.7-2.0 grams per cubic centimeter (g/cm^3)
Specific Gravity	2.6-2.8 g/cm^3
Total Organic Carbon	$\geq$1.5%

Additional detail on laboratory testing is provided in Section 4.4. Material test results are summarized in Table 1 and data are available in Appendix A.

2.3 Excavation of Western Shore Intertidal Areas

Caps L-014 and L-114 are located adjacent to the planned intertidal excavation area West Zone 4 (WZ4). As such, it was necessary to excavate contaminated material adjacent to the landward cap toe of slope to ensure that the cap would not be disrupted while excavating WZ4. A 10-ft wide buffer area between the cap toe of slope and the abutting WZ4 area was created by removing the WZ4 material and placing it into the footprint of the full engineered cap. The buffer area was then backfilled with clean sand material. Excavation at both of these caps was performed in September 2020 with the capping barge and Komatsu® PC490-LC.

As described further in Sections 3.6 and 3.7 below, excavation and relocation was also required at the Cogg-West cap (to allow for positive drainage of a City outfall) and the pilot CDF Shoreline cap (to capture material not excavated during the Parcel 265 intertidal remediation).

3. Sediment Cap Construction Activities

The following subsections provide key dates and metrics from the construction of each of the seven UH subtidal permanent caps. These subsections also describe changes made to the cap designs, construction or QC procedures that occurred during the cap construction.

Cap construction sequence generally started with the placement of isolation layer material followed by armor stone in locations and thicknesses specified in the cap specific LSAs. As discussed herein, certain locations required excavation and relocation of in-situ sediment prior to isolation layer placement. Compliance to LSA cap design specifications was verified with confirmatory push core samples and bathymetric surveys (see Section 4).

Confirmatory push core samples were collected after placement of the isolation layer to assure proper material thickness. A summary of confirmatory push core data is found in Table 2, and maps showing the core locations are found in Appendix B. A full compilation of photos documenting the confirmatory push cores is found in Appendix C.

Bathymetric surveying of the layers was performed by SES, and difference maps were created by Jacobs that compared the elevations of the isolation layer to pre-cap bathymetric data and compared the armor layer to the isolation layer. Difference maps and the raw bathymetric data were provided to the USACE and their consultant, Lally Consulting LLC, after each layer was completed. Additional material was placed or removed where USACE directed. Final difference maps (Appendix D) were used by USACE to approve each cap's construction. The final isolation layer and armor layer material quantities for each cap are summarized in Table 3.

3.1 O-711 Cap

Capping activities began at the O-711 Cap on 25 August 2020 with the placement of the isolation layer. As outlined in Project Note 002 (Jacobs 2020l) and described in Section 5.2, a 12-inch layer of organoclay-sand mix was substituted for the originally planned 24-inch layer of material manufactured at G. Lopes. This substitution utilized high TOC material left over from the 2018-2019 Aerovox Interim Cap which was stockpiled at the Sawyer Street Facility. A total of 470 cubic yards (cy) of organoclay-sand mix was applied to the entire cap area totaling 12,320 square feet (sf) (Table 3). The isolation layer thickness across the cap averaged 12 inches, ranging from 8.4 inches to 16.8 inches (Table 3). The O-711 Cap armor layer was completed on 27 August 2020 with a total of 581 cy of stone placed over the isolation layer. The average thickness of the armor layer was 15.3 inches, ranging from 8.4 inches to 24 inches (Table 3). A final third-party bathymetric survey of the O-711 Cap, performed by CR Environmental, Inc. (CRE) on 14 January 2021 is shown in Figure 3. Specifics on QC are covered in Section 4.0 and described in greater detail in the CQC Plan (Jacobs 2020j).

3.2 Crib Cap

Capping began in Crib Cap on 28 August 2020 with placement of the isolation layer material manufactured at G. [Lopes. Placement of material in the northern cove section of Crib Cap was limited to high tide for barge access. On 2 September 2020, during low tide, a 40-ft long polyvinyl chloride (PVC) pipe was inserted into the existing drainage outfall on the western shoreline to extend the drainage outfall through the cap. Figure 14 of the Crib Cap LSA (Jacobs 2020b) presents a detailed drawing of the pipe extension along with dimensions. A number of spot-check push cores were collected on 11 September 2020 to verify bathymetric survey data of the isolation layer as elevation discrepancies were occasionally observed between the survey data and cores. The discrepancies were collectively resolved by Jacobs, SES, USACE, EPA, and Lally Consulting (the Capping Team) and attributed largely to the tinning of data (i.e., software generated spatial estimations between data points). Isolation layer placement then resumed.

In total, 1,672 cy of isolation layer material was applied to the cap area in order to achieve the 24-inch minimum thickness requirement (Table 3). Isolation layer thickness ranged from 26.4 inches to 44.4 inches across the cap, averaging 27.2-inches (Table 3). The 12 confirmatory push cores demonstrated that appropriate thickness was achieved (Table 2, Appendix B, C). Approval for stone armoring was received beginning on 16 September 2020. The armor stone layer was completed on 22 September 2020 with 926 cy placed (Table 3). Placement of armor stone resulted in an average thickness of 18.7 inches, ranging from 13.2 inches to 30.0 inches across the cap

(Table 3). A final third-party bathymetric survey of the Crib Cap, performed on 21 December 2020, is shown in Figure 4.

3.3 L-014 Cap

Excavation and relocation of abutting contaminated intertidal sediment, as described above (Section 2.3) and in the L-014 Cap LSA (Jacobs 2020c) and Construction Workplan (Jacobs 2020i), began on 1 September 2020. Material in a 10-ft wide buffer around the landward toe of the cap was relocated into the cap area. A total of 159 cy of intertidal sediment was relocated. Included with this material was heavy debris (e.g., concrete, boulders) and large timbers. Oily sheen developed during the removal process and oil boom was deployed around the excavation area. Excavation/relocation was fully completed on 8 September 2020. On 11 September 2020, a meeting to discuss the excavated and relocated material found outside of its intended location was held between the Capping Team. It was determined the material was accurately placed but had migrated seaward due to its proximity to the slope and instability of the material. Additional isolation layer material and armor stone was added to the slope area for added protection and coverage of the excavated and relocated material.

Isolation layer sand placement began on 8 September 2020 and was completed on 15 September 2020. A total of 643 cy of sand was placed, resulting in isolation layer thickness ranging from 26.4 in to 39.6 in and averaging 32.1 in (Table 3). Three confirmatory push cores (Table 2, Appendix B, C) and bathymetric surveying confirmed appropriate layer thickness. Approval for armor stone placement was received on 10 September 2020. The armor stone layer was completed on 15 September 2020. A total of 342 cy of armor stone was applied to the L-014 Cap area (Table 3), including the additional stone to cover the debris. The average thickness of the armor layer was 21.2 inches, ranging from 13.2 inches to 25.2 inches across the cap (Table 3). A final third-party bathymetric survey of the L-014 Cap, performed on 21 December 2020, is presented in Figure 5.

3.4 L-114 Cap

Excavation and relocation of contaminated intertidal sediment was also required at the L-114 Cap, as described above and in the L114 Cap LSA (Jacobs 2020d). Excavation was started and completed on 1 September 2020. A total of 220 cy of excavated material was placed inside the cap boundary for it to be covered by isolation layer material, which started on 9 September 2020. The isolation layer was largely completed on 22 September 2020 with a total of 798 cy placed. An additional 53 cy of isolation layer material was placed on 5 October 2020 along the excavated intertidal WZ4 shoreline, bringing the total amount of isolation layer material to 851 cy (Table 3). Isolation layer thickness ranged from 27.6 inches to 52.8 inches across the cap, with an average of 39.9 inches (Table 3).

Approval for areas to receive armor stone was based on the four confirmatory push cores (Table 2, Appendix B, C) and bathymetric survey results. Stone placement began on 16 September 2020 and was completed on 22 September 2020. A total of 389 cy of armor stone was placed, encompassing 4,847 sf of cap area (Table 3). Placement of armor stone resulted in a thickness range of 13.2 inches to 27.6 inches across the cap, with an average thickness of 26.0 inches (Table 3). A final third-party bathymetric survey of the L-114 Cap, performed on 21 December 2020, is shown in Figure 6.

3.5 Coggeshall East Cap

Specifics to the Cogg-East Cap design are found in the Cogg-East LSA (Jacobs 2020e). Capping activities began on 23 September 2020 with isolation layer material being placed in the easternmost lane of the cap closest to the Fairhaven shoreline, which was only accessible during high tide. Due to areas being tidally restricted, armor stone placement was approved on 24 September 2020 through an expedited QC process that allowed placing armor stone immediately after sand placement (See Project Note 006, Jacobs 2020p). This expedited QC process used real-time kinematic global positioning system (RTK GPS) pole-rover and sediment coring to measure the sand thickness in a work area instead of waiting for a full bathymetric survey following complete sand placement. In the tidally restricted capping areas, this rapid QC process was repeated. Deeper portions of the cap were quality checked using single beam bathymetry.

In early October 2020, after reviewing bathymetric survey data, it was determined that isolation layer material was migrating outside of the western and northern cap boundaries due to the material consistency and steep slope of the area. The Capping Team decided that a 3-ft high subaqueous berm constructed out of armor stone should be put in place along the western and northern cap boundaries to contain the isolation layer material (see Project Note 007, Jacobs 2020q). On 6 October 2020, the berm was put in place. An additional section of berm was added to the western side of the existing berm in vicinity of Coggeshall Bridge on 19-20 November 2020 per direction of USACE to stabilize the slope. A final third-party bathymetric survey of the Cogg-East Cap and the berm performed on 22 December 2020 is found in Figure 7.

Placement of isolation layer material was completed on 17 November 2020. A total of 7,454 cy of isolation layer material was applied to the Cogg-East Cap (Table 3). Isolation layer thickness ranged from 22.8 inches to 42.0 inches with an average thickness of 25.6 inches (Table 3). The total amount of armor stone used to protect the isolation layer was 4,615 cy (Table 3) and was completed on 24 November 2020. Armor stone layer thickness ranged from 8.4 inches to 28.8 inches with an average thickness of 15.9 inches (Table 3). A total of 70 confirmatory push cores were collected at the Cogg-East cap to confirm adequate isolation layer thickness (Table 2, Appendix B, C).

3.6 Coggeshall West Cap

To allow positive drainage from a City storm drain after placement of cap material, the Cogg-West Cap required excavation and relocation of existing sediment before capping, as described in the Cogg-West LSA (Jacobs 2020f). A total of 62 cy of contaminated sediment was excavated from the southwestern footprint of the cap on 22 September 2020. The excavated material was placed within the center of the cap footprint for it to be covered by the isolation layer.

The Capping Team expected that the Cogg-West Cap would experience isolation layer material migration, similar to what was experienced at Cogg-East, and decided that a berm should be put in place for the Cogg-West Cap as well as for the Area C Pilot CDF Shoreline Cap prior to isolation layer placement. This deviation from the LSA designs is documented in Project Note 007 and summarized in Section 5.7. On 21 October 2020, approval of the Cogg-West Cap berm design was received, and the construction of the submerged 3-ft high structure began.

Application of the isolation layer was started on 23 October 2020 following completion of the berm. The isolation layer was completed on 3 November 2020 with a total of 1,713 cy. Isolation layer thickness ranged from 10.8 inches to 42.0 inches across the cap, with an average of 23.9 inches (Table 3). A total of 19 confirmatory

push cores were collected to affirm sufficient isolation layer thickness (Table 2, Appendix B, C). Approval was received to move forward without the collection of cores PC20, PC021 and PC22 due to their proximity to the shoreline and the difficulties of the material remaining in place along the embankment (Project Note 007). The armor stone layer was completed on 17 November 2020 using a total of 1,984 cy of material. Armor stone layer thickness ranged from 9.6 inches to 32.4 inches resulting in an average of 21.3 inches (Table 3). At the direction of USACE, additional stone was added along the eastern shoreline of the cap on 15 December 2020 totaling 20 cy. This additional stone was blended into the existing shoreline armor layer on the Coggeshall Street Bridge embankment to further reinforce the steep sloped area and prevent erosion. Material totals are found in Table 3. A final third-party bathymetric survey of the Cogg-West Cap and berm, performed on 22 December 2020, is shown in Figure 8.

3.7 Area C Pilot CDF Shoreline Cap

The Area C dock was relocated out of the cap area prior to commencement of capping. Beginning on 12 November 2020, floating portions of the dock were disconnected and temporarily anchored in the deeper part of the Acushnet River. The remaining non-floating dock structures were dismantled and moved up onto land at the Sawyer Street Facility (Figure 1). A bathymetric survey over the dock area was conducted by SES on 16 November 2020 and tied into the design bathymetric survey data. Removal of the remaining gravel ramp that lead to the Area C Dock and the associated sheet piling was completed on 12 December 2020.

On 17 November 2020, USACE approved construction of the berm for the Area C Pilot CDF Shoreline Cap. Berm construction initially began on 18 November 2020 when construction activities on Cogg-East Cap became tide restricted. The southern portion of the berm was later completed on 30 November 2020. Changes to the construction means and methods are incorporated in Project Note 008 (Jacobs 2020h), which is summarized in Section 5.8.

Excavation of limited intertidal material not removed during the 2016 Parcel 265 remediation, and relocation of this material to within the full engineered cap as outlined in the Area C Pilot CDF Shoreline Cap LSA (Jacobs 2020g), was started and completed on 1 December 2020 using the amphibious excavator. Cap placement also began on 1 December 2020 and was later completed on 22 December 2020. In total, 3,046 cy of isolation layer material was placed with thickness ranging from 16.8 inches to 25.2 inches and averaging 18.0 inches (Table 3). Based on the higher than expected TOC content of the manufactured material, and the fact that much of the cap was meant to cover exposed geotextile fabric installed in 1988 and 2011 (rather than capping PCB contamination), the minimum isolation layer acceptance thickness was reduced from 20-inches to 16-inches, per direction of USACE (Project Note 008, Jacobs 2020r). Modeling results showed that the reduction in isolation layer thickness would not compromise effectiveness of the cap. A total of 47 confirmatory push cores were collected to confirm isolation layer thickness (Table 2, Appendix B, C). At four locations (PC11, PC12, PC13, PC15) cores were collected with a hand auger instead of the push corer due to the material being dry and exposed on the shoreline. The average thickness of these 47 confirmatory cores was 18.5 in. Push core PC1 was not collected due to its location on the berm. The armor layer comprises a total of 3,250 cy of stone with thickness ranging from 8.4 inches to 25.2 inches and an average thickness of 15.0 inches (Table 3). A final third-party bathymetric survey, performed on 14 January 2021, showing the completed Area C Pilot CDF Shoreline Cap and berm is found in Figure 9.

4. Construction Quality Control

The CQC Plan (Jacobs 2020j) established project specific performance criteria for the construction of the UH permanent sediment caps. Effective implementation of the detailed QC procedures, requirements, and reports developed from this plan ensured the completed work complied with the contract requirements.

4.1 Confirmatory Sediment Cores

Cap layer thickness confirmation was measured using bathymetry and supplemented by the collection of sediment push cores at each cap. Sediment core locations were predetermined and spaced to represent approximately 1,200 sf of each cap area (Jacobs 2020j). Maps showing push core locations for each cap are found in Appendix B. All confirmatory push cores were collected within less than 3-ft of the assigned location coordinates. A total of 163 confirmatory push cores were collected across all seven UH caps (Table 2).

Push cores were collected after bathymetric or RTK GPS pole-rover surveying indicated adequate isolation layer thickness was achieved. Once collected, sediment cores were brought onto the survey vessel and the isolation layer height was measured and photo documented. An example of a confirmatory sediment core showing 14 inches of cap material placed over the existing sediment is shown in Figure 10. At this location (O-711 cap) the design thickness of the isolation layer was 12 inches (see Section 3.1 above). The isolation layer height was identified as the distance from the top of the placed sediment to the point of transition between the native material. A complete set of sediment core photos can be found in Appendix C.

4.2 RTK GPS Pole-Rover Surveying

An RTK GPS pole-rover was used to survey cap layers that were too shallow for bathymetric surveying. A Trimble® SPS985 rover with a TSC3 SCS900 handheld controller (software V 3.0) was used to collect survey data with accuracy of ± 1 centimeter (cm) horizontally and ± 2 cm vertically. An error tolerance of less than 0.1 spherical coordinate quality (3DCQ) was established to ensure accuracy and precision. Additional consistency was ensured throughout the UH capping process by collecting RTK GPS survey data by the same Jacobs QC staff member or SES survey technician for the duration of the capping project.

Survey data collected after each event was promptly downloaded from the handheld controller and reviewed internally by Jacobs and SES for elevation compliance. Difference maps comparing elevation data between surveys were created by a Jacobs engineer which highlighted any areas of the cap requiring additional material. The areas requiring additional material were relayed back to the capping barge and addressed. Any RTK GPS pole-rover survey data and difference maps for cap areas determined to be complete were provided to Lally Consulting and USACE for review and approval.

4.3 Bathymetric Surveying

Single beam bathymetric surveying was the primary means and preferred technique for assessing elevation of the UH caps. Survey data was collected when the water level was approximately greater than 2 ft, which allowed for the echo sounder transducer to receive proper return signals. A CEE-LINE™ echo sounder (33 & 200 kHz frequency) was mounted over the side of a SES work skiff or pontoon boat and was paired with an RTK antenna and receiver. Transects over capped areas were conducted by the SES survey engineer. Results from the single beam surveys were reviewed internally by Jacobs and SES for elevation deficiencies by creating difference maps.

Completed bathymetric data was provided to Lally Consulting and USACE for review and approval. Final difference maps comparing the isolation layer material layer and stone layer for each cap are retained in Appendix D. Daily progress maps provided by SES are compiled in Appendix E.

Final third-party single beam surveys performed by CRE were completed for each cap area (Figures 3-9). Surveying of L-014, L-114, and Crib Cap was conducted on 21 Dec 2020. The Cogg-East and Cogg-West Caps were surveyed on 22 Dec 2020, and O-711 Cap and Area C Pilot CDF Shoreline Cap were surveyed 14 January 2021.

4.4 Laboratory Testing of Cap Material

Isolation layer material manufactured at G. Lopes was laboratory tested every 500 cy before being delivered to the NBHSS Sawyer Street Facility. This process ensured cap material met specifications as outlined in the CQC Plan (Jacobs 2020j) before placement. In total, approximately 35,000 cy of isolation layer material was sampled at the vendors site for the following:

- Massachusetts Contingency Plan (MCP) Soil Category S-1 Parameters; PCBs as Aroclors (SW8082B), volatile organic compounds (VOCs) (SW8260C), semi-volatile organic compounds (SVOCs) (SW8270D), metals (SW6010C/7471B), cyanide (SW9012), pesticides (SW8081A), and hydrocarbons (MA EPH/VPH)
- Grain Size (ASTM D422-63);
- In Situ Moisture Content (ASTM 2216);
- Bulk Density (ASTM D5057);
- Specific Gravity (ASTM D5057); and
- Total Organic Carbon (TOC) (Lloyd Khan 1988 method or equivalent).

Data was validated before the material was accepted and used for the caps. A summary of laboratory results is shown in Table 1. Certified hardcopies of results provided by the laboratories (Katahdin Analytical Services and GeoTesting Express) are retained in Appendix A. All material results were found to comply with the range criteria established in the CQC Plan (Jacobs 2020j) and Project Note 001 (Jacobs 2020k). Project Note 001 allowed small amounts of larger sized organics (twigs and bark) in the manufactured material to be considered acceptable, as well as removed the requirement for the duplicate pre-placement TOC sample collection once material arrived at the Sawyer Street Facility.

In-situ TOC samples were collected from the isolation layer of each cap to ensure TOC content remained above the 0.5 percent (%) tolerance minimum after placement as set forth in the CQC Plan (Jacobs 2020j). Samples were collected at each cap location within 1-day of the isolation layer material placement. Three in-situ TOC samples were collected at each of the seven UH caps, at locations also designated for confirmatory push core samples (Appendix B) and shipped to an offsite laboratory for analysis. Adhering to the CQC Plan threshold, TOC results ranged from 1.0% to 12.0% (Table 4).

5. Deviations from Work Plan and Design Documents

A series of deviations from the Work Plan (Jacobs 2020i) and design documents (Jacobs 2020a, 2020b, 2020c, 2020d, 2020e, 2020f, 2020g, 2020h, 2020i, 2020h) were adopted after capping operations began. Project Notes outlining client approved operational changes were documented by Jacobs. Below is a summarized description of each Project Note.

5.1 Material Specifications and Requirements | (Project Note 001)

A requirement listed in the Non-Compliance and Corrective Action section (Section 4.0) of the CQC Plan (Jacobs 2020j) stated “Twigs, bark, etc. will be considered unacceptable components of compost material due to their tendency to float when placed in water. Material will be rejected, and a suitable source will be obtained”. The manufactured isolation material by G. Lopes was found to contain a high concentration of organic compost that included small twigs and bark approximately 1-inch to 1.5-inch lengths and less than ¼-inch diameter.

Before the material was considered acceptable for capping, a simulated ‘bucket drop’ was performed for the USACE and EPA which demonstrated how much material would be floating as a result of cap placement. Based on the demonstration, approval was given to use the material as long as all other capping material adhered to the chemical and physical analytical parameters in the CQC Plan (Jacobs 2020j).

Project Note 001 (Jacobs 2020k) also addressed a requirement established in the CQC Plan (Jacobs 2020j) for a second TOC sample to be collected upon delivery to the project site (prior to placement). USACE and EPA agreed that the second, pre-placement test for TOC would not be necessary if the initial test of the material collected at the vendor’s facility met the specification for TOC of at least 1.5%.

5.2 Substitution of Organoclay-Sand Mix | O-711 Cap (Project Note 002)

Approximately 600 cy of organoclay material left over from the Interim Aerovox Cap installation in 2018-19 was substituted for the isolation layer material originally planned for in the design of the O-711 cap. The Aerovox Cap organoclay contained 20% TOC (prior to placement, Table 1) which exceeded the 1.5% requirement for the permanent sediment caps. Therefore, a reduction in isolation layer thickness from 24 inches to 12 inches was proposed. Approval was given by USACE to use the left over organoclay. Use of the organoclay reduced material expense and equipment and labor cost for the construction of the O-711 cap.

5.3 Quality Control Revisions | O-711 Cap (Project Note 003)

Project Note 003 (Jacobs 2020m) addressed a QC error made in the processing of data files during construction of the O-711 Cap. Two separate single beam bathymetric surveys had mistakenly been combined into one file, providing incorrect bathymetry. The error was discovered when Lally Consulting observed that the bathymetry showed the isolation layer thickness in a northern portion of the cap ranged from 0.7 ft to 0.9 ft and did not satisfy the 1.0-ft minimum thickness requirement. Following correction of the file, Jacobs implemented an additional QC step of reviewing interim surveys and layer completion surveys.

5.4 Cap Material Gradation | (Project Note 004)

Project Note 004 (Jacobs 2020n) concerned the evaluation of gradation test results of four samples of the manufactured isolation material from G. Lopes and the requirements established in the CQC Plan (Jacobs 2020j). Sample results for four samples of material collected at the vendor’s site showed higher percentages of finer grain size particles than previous samples. It was determined that the increase of the finer fractions of the capping material was due to addition of blended carbon materials needed to meet the in-place TOC requirement. Katahdin Laboratory test results indicated a 4 to 6% TOC content for the material. The capping sand was determined to comply with the design requirements and considered acceptable for incorporation into the UH permanent caps.

5.5 Quality Control Revisions | Crib Cap (Project Note 005)

The Crib Cap was remodeled using the in-situ TOC sample results, which were greater than originally modeled in the LSA, to determine if a thinner isolation layer could be placed. Model results based on the samples collected 10 September 2020 indicated a 12-inch minimum layer of the manufactured material would provide protection of the cap for 300 years, which was the protectiveness requirement set forth in the Generic Design (2020h). The Capping Team agreed to a 20-inch minimum of isolation layer material for the remainder of capping operations (Cogg-East, Cogg-West, and Area C pilot CDF - though see section 3.7 above regarding further reduction of the pilot CDF shoreline cap depth to 16-in).

5.6 Quality Control Process | Coggeshall East & West Cap (Project Note 006)

The intent of Project Note 006 (Jacobs 2020p) was to improve the review and approval process of the constructed cap layers to minimize delays and increase production in areas where construction was tide restricted. The improved process allowed Jacobs to provide 1-day notice to USACE and Lally Consulting of final progress survey data, and USACE and Lally Consulting to review the data and providing approval within 6 hours. The improved process significantly improved production rates and saved equipment and labor costs.

5.7 Cap Construction Details | Coggeshall East & West Cap (Project Note 007)

Project Note 007 (Jacobs 2020q) documented a number of topics discussed by the Capping Team, which included berm design, discussion and documentation of construction means and methods for isolation layer management, placement of armor stone, cap limits along Coggeshall Street causeway embankment, cap construction production data, and Outfall No. 40 excavation material relocation at the Cogg-West Cap.

5.8 Berm Design Details | Area C Pilot CDF Cap (Project Note 008)

Project Note 008 (Jacobs 2020r) captured a range of important revisions to the Generic Design and Area C Pilot CDF Shoreline Cap LSA. These topics include Area C Pilot CDF Shoreline Cap berm design, revised construction methods involving amphibious excavators, isolation layer thickness revisions, material excavation, relic silt curtain handling and disposition, and cap toe limits.

5.9 Berm Construction and Cap Details | Area C Pilot CDF Cap (Project Note 009)

Project Note 009 (Jacobs 2020s) addressed three topics: the adjusted tie-in to the existing shoreline berm, removal of sheet piles and the remaining portion of Area C dock ramp, and removal of a relic water treatment plant outfall pipe and headwall. As for the shoreline, the limits provided by the design left gaps between the proposed cap construction and the existing berm armor stone layer. Therefore, design modifications were proposed to completely tie into the existing shoreline. Secondly, the sheet piling would be addressed by cutting it level to the existing elevation during low tide, and the remaining ramp would be re-graded to the appropriate slope for receiving cap material. Lastly, the relic water treatment plant outfall pipe and headwall would be removed with land based heavy equipment.

6. Demobilization

The demobilization of capping equipment began on 4 January 2021. Disassembling of deck barges, scows, and the capping barge was conducted primarily at North Dock (Figure 1). The bottoms of all deck barges and scows

were scraped and pressure washed to remove marine fouling organisms and hauled out of the water. The Komatsu® PC490-LC was walked off the capping barge on 7 January 2021 on Coffin Street across Pierce Mill Cove and loaded onto a flatbed truck to be brought back to the Sawyer Street site. A crane was brought in to remove spuds, scows, and floats at North Dock in late January 2021. All SES owned heavy equipment not required for intertidal remediation was loaded onto trucks and returned to their headquarters in Niagara Falls, NY. Demobilization was completed in February 2021.

7. Long Term Monitoring

Post-capping monitoring activities have been established to assess the integrity and effectiveness of the cap over its lifetime. Long term monitoring (LTM) of the eight permanent sediment caps will include a combination of bathymetric surveying and visual inspections as outlined in the *Draft Final Upper Harbor Permanent Caps Long Term Monitoring Plan* (Jacobs 2020t). Visual inspections will assess any disturbances to the intertidal armor layer due to meteorological events or human impact. In addition, bathymetric surveys will document the subtidal condition of the caps at the time of the survey and changes in the caps over time. A schedule of LTM events is provided in Appendix F. Coordinates for each cap are provided in Appendix G for future surveying reference and LTM comparisons. Repairs to the caps will be performed if LTM results indicate significant changes.

The EPA performed a visual inspection of the seven sediment caps constructed in 2020 on 26 February 2021, documenting the completed condition of those caps. A copy of the inspection report is provided in Appendix H.

8. References

EPA, 1998. Record of Decision, U.S. Environmental Protection Agency (EPA) Region One.

Ebasco Services, Inc., 1990. Draft Final Feasibility Study of Remedial Alternatives for the Estuary and Lower Harbor/Bay, New Bedford, Massachusetts. Volumes I, II and III. August 1990.

Jacobs. 2020a. *Draft Final O-711 Cap Location Specific Addendum*, New Bedford Harbor Superfund Site. ACE-J23-35BG6000-M17-0037 | 0. (February 2020).

———. 2020b. *Draft Final Crib Cap Location Specific Addendum*, New Bedford Harbor Superfund Site. ACE-J23-35BG6000-M17-0038 | 0. (February 2020).

———. 2020c. *Draft Final L-014 Cap Location Specific Addendum*, New Bedford Harbor Superfund Site. ACE-J23-35BG6000-M17-0056 | 0. (April 2020).

———. 2020d. *Draft Final L-114 Cap Location Specific Addendum*, New Bedford Harbor Superfund Site. ACE-J23-35BG6000-M17-0055 | 0. (April 2020).

———. 2020e. *Draft Final Coggeshall East Cap Locations Specific Addendum*, New Bedford Harbor Superfund Site. ACE-J23-35BG6000-M17-0066 | 0. (June 2020).

———. 2020f. *Draft Final Coggeshall West Cap Location Specific Addendum*, New Bedford Harbor Superfund Site. ACE-J23-35B6000-M17-0067 | 0. (June 2020).

———.. 2020g. *Draft Final Area C Pilot CDF Cap Location Specific Addendum*, New Bedford Harbor Superfund Site. ACE-J23-35BG6000-M17-0062 | 0. (May 2020).

———. 2020h. *Draft Final Upper Harbor Permanent Caps Generic Design*, New Bedford Harbor Superfund Site. ACE-J23-35BG6000-M17-0057 | 3. (May 2020).

———. 2020i. *Draft Final Upper Harbor Subaqueous Cap Construction Workplan*, New Bedford Harbor Superfund Site. ACE-J23-35BG6000-M17-0065. (June 2020).

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———. 2020m. Project Note 003: Quality Control Revisions, New Bedford Harbor Superfund Site. ACE-J23-35BG6000-P1-0005. (August 2020).

———. 2020n. Project Note 004: Capping Sand Gradation, New Bedford Harbor Superfund Site. ACE-J23-35BG6000-P1-0005. (September 2020).

———. 2020o. Project Note 005: Quality Control Revisions, New Bedford Harbor Superfund Site. ACE-J23-35BG6000-P1-0005. (September 2020).

———. 2020p. Project Note 006: Quality Control Process for Cogg-East/Cogg-West Caps, New Bedford Harbor Superfund Site. ACE-J23-35BG2000-P1-003806. (September 2020).

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———. 2020s. Project Note 009: Area C Cap Toe Berm Design Amendment, New Bedford Harbor Superfund Site. ACE-J23-35BG8000-P1-0003. (December 2020).

———. 2020t. Draft Final Upper Harbor Permanent Caps Long Term Monitoring Plan, New Bedford Harbor Superfund Site. ACE-J23-35BG6000-M1-0072|0. (June 2020).

Figures

Legend

- Completed Aerovox Interim Sediment Cap (2018-2019)
- Completed Parcel 265 Cap (2016)
- Completed Sediment Cover/Capping Areas

N

0 300 600 Feet

1:7,200

Aerial Photography MASSGIS 2014

JACOBS

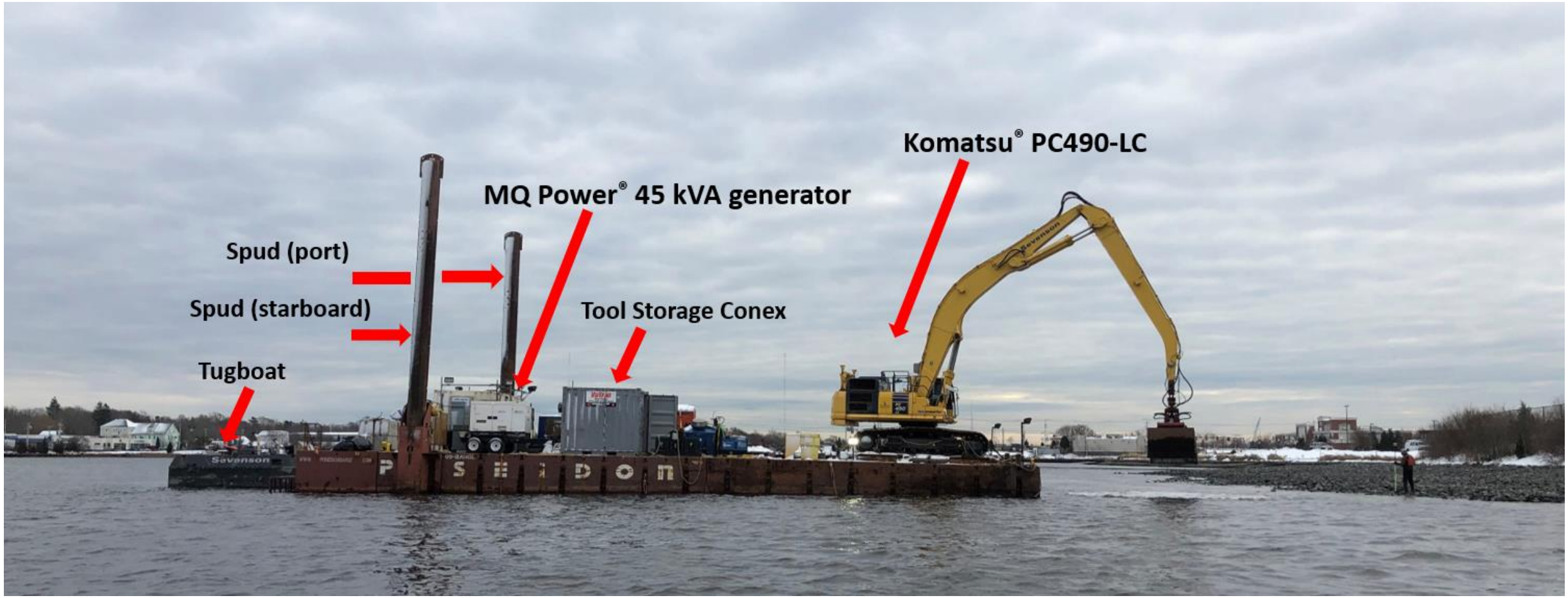
Upper Harbor Sediment Cap Locations

New Bedford Harbor Superfund Site

NAME: jpiccuito Date: 3/25/2021

Figure 1

Path: Y:\NBH\Projects\35BG1001\20210222_Caps_RA_RCL\ArcGIS\Subtidal_Dredge_Areas_Post_Capping_RA_Location_Map_20210222.mxd



Not to Scale

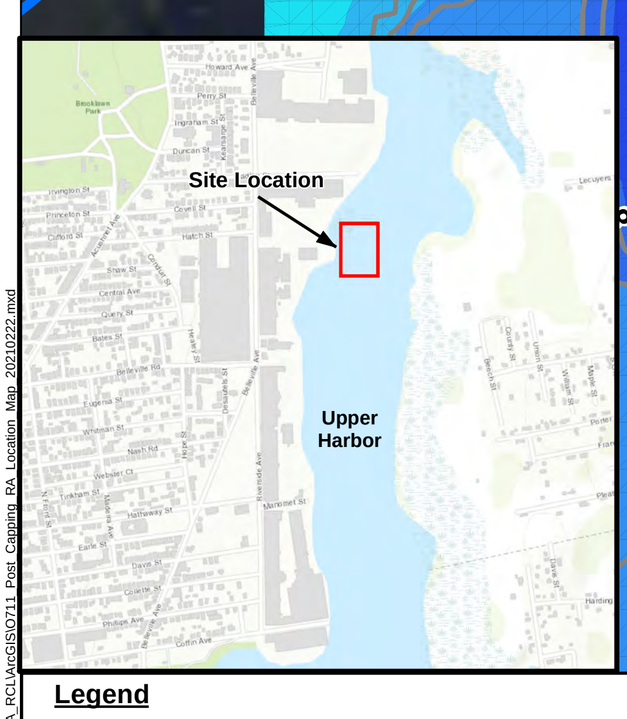
Jacobs

Capping Barge Layout

Figure 2

30 DEC 2020

Location	Easting (X)	Northing (Y)
A28	815433.34	2705877.67
A117	815401.85	2705904.96
A199	815374.92	2705933.75
A262	815357.24	2705960.16
A303	815368.85	2705986.11
A328	815401.85	2706001.79
A378	815432.68	2705990.97
A446	815445.07	2705958.31
A514	815455.76	2705923.52
A574	815472.71	2705896.35
A610	815460.40	2705871.99
B22	815425.59	2706010.88
B52	815444.83	2705977.50
B70	815459.13	2705948.14
B106	815479.19	2705906.98
B124	815475.20	2705874.59
B141	815443.04	2705861.43
B166	815414.53	2705885.51
B196	815379.36	2705912.14
B225	815354.86	2705947.75
B246	815351.94	2705978.48
B274	815383.52	2706003.45



Elevation NAVD88 - ft

-3.8 - -2.2	-8.5 - -6.9
-5.3 - -3.8	-10.0 - -8.5
-6.9 - -5.3	-11.6 - -10.0

Cap bathymetry: 01/14/21; Background bathymetry 02/20/19
Elevations within the cap limit represent post-capping conditions.

USGS, MassGIS

Legend

- Full depth engineered cap
- Cap limits at the toe of slope
- -5 1ft contour line
- MLLW
- MHHW
- A28 O-711 Cap Coordinates

(full set of coordinates located in Appendix G)
Datum: NAD1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

Aerial Photography MASSGIS 2014

0 40 Feet

N

1:180

JACOBS®

Final Third-Party Bathymetric Survey O-711 Cap

New Bedford Harbor Superfund Site

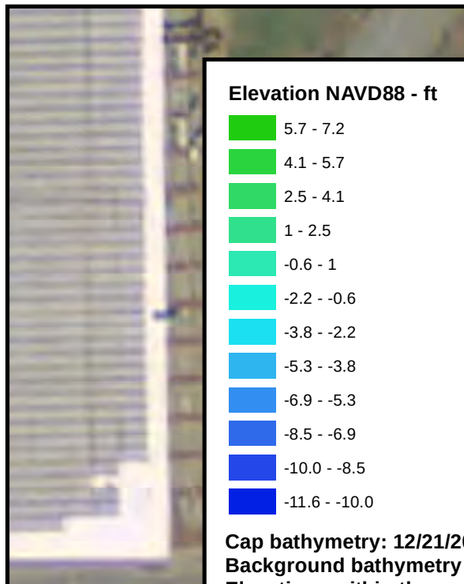
NAME: jpiccuito Date: 3/29/2021 **Figure 3**

Path: Y:\NBH\Projects\35BG1001\20210222_Caps_RA_RCL\ArcGIS\O711_Post_Capping_RA_Location_Map_20210222.mxd

Elevation NAVD88 - ft

- 5.7 - 7.2
- 4.1 - 5.7
- 2.5 - 4.1
- 1 - 2.5
- -0.6 - 1
- -2.2 - -0.6
- -3.8 - -2.2
- -5.3 - -3.8
- -6.9 - -5.3
- -8.5 - -6.9
- -10.0 - -8.5
- -11.6 - -10.0

Cap bathymetry: 12/21/20 and 01/06/21; Background bathymetry 12/19/19
Elevations within the cap limit represent post-capping conditions.



Location	Easting (X)	Northing (Y)
A94	814917.66	2705172.80
A252	814915.15	2705206.13
A379	814904.77	2705229.60
A463	814889.28	2705252.71
A476	814853.18	2705274.62
A597	814886.54	2705304.47
A706	814926.48	2705321.33
A919	814980.10	2705284.00
A1047	814984.14	2705237.65
A1167	814971.79	2705193.52
A1286	814940.46	2705161.05
B19	814909.05	2705195.98
B33	814901.77	2705216.77
B42	814889.28	2705252.71
B57	814843.79	2705282.98
B71	814866.62	2705300.30
B91	814899.59	2705326.07
B116	814962.45	2705318.79
B142	814991.05	2705264.31
B164	814990.34	2705214.50
B184	814965.90	2705168.96
B221	814920.60	2705144.95

USGS, MassGIS

Legend

- Full depth engineered cap
- Cap limits at the toe of slope
- Site Drainage Outlet
- -5 1ft contour line
- MLLW
- MHHW
- A94 Crib Cap Coordinates

(full set of coordinates located in Appendix G)
Datum: NAD1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

0 40 80 Feet

Basemap Data Source: MassGIS, ESRI

March 2021

Final Third-Party Bathymetric Survey Crib Cap

New Bedford Harbor Superfund Site

JACOBS

Figure 4

Path: Y:\NBH\Projects\35BG1001\20210222_Caps_RA_RCL\ArcGIS\Crib_Areas_Post_Capping_RA_Location_Map_20210222.mxd

Elevation NAVD88 - ft

5.7 - 7.2	-3.8 - -2.2	-13.5 - -11.6
4.1 - 5.7	-5.3 - -3.8	-15.5 - -13.5
2.5 - 4.1	-6.9 - -5.3	-17.5 - -15.5
0.9 - 2.5	-8.5 - -6.9	-19.5 - -17.5
-0.6 - 0.9	-10.0 - -8.5	-21.5 - -19.5
-2.2 - -0.6	-11.6 - -10.0	-23.5 - -21.5

Cap bathymetry: 12/21/20 and 01/06/21; Background bathymetry 09/27/19
Elevations within the cap limit represent post-capping conditions.

B259, B233, A142, A150, B318, B191, A163, A112, B141, A191, B391, A76, A204, B96, A60, B439, B67, A43, A239, B482, B20, A260, A4, B511, B545

Location	Easting (X)	Northing (Y)
A4	814946.06	2704264.27
A43	814939.28	2704290.30
A60	814933.34	2704302.00
A76	814928.04	2704315.24
A112	814930.77	2704344.00
A142	814930.11	2704363.57
A150	814935.62	2704358.83
A163	814947.02	2704350.48
A191	814964.80	2704329.00
A204	814963.14	2704314.63
A239	814955.44	2704287.56
A260	814954.78	2704266.77
B20	814938.92	2704270.42
B67	814932.56	2704294.54
B96	814920.61	2704306.96
B141	814922.67	2704329.01
B191	814924.80	2704351.76
B233	814925.42	2704367.53
B259	814939.26	2704374.56
B318	814963.51	2704356.00
B391	814978.63	2704320.00
B439	814969.97	2704297.98
B482	814969.51	2704277.98
B511	814965.91	2704260.91
B545	814949.32	2704258.34

Upper Harbor
Site Location

USGS, MassGIS

Legend

- Full depth engineered cap
- Cap limits at the toe of slope
- Excavation Extent with Sand Backfill and Cap
- -5 1ft contour line
- A60 L-014 Cap Coordinates (full set of coordinates located in Appendix G)
  Datum: NAD1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
- MLLW
- MHHW

Aerial Photography MASSGIS 2014

0 25 Feet

1:150

JACOBS®

Final Third-Party Bathymetric Survey L-014 Cap

New Bedford Harbor Superfund Site

NAME: jpiccuito Date: 4/12/2021 **Figure 5**

Path: Y:\NB\Projects\35BG1001\20210222_Caps_RA_RCL\ArcGIS\L014_Post_Capping_RA_Location_Map_20210222.mxd

Elevation NAVD88 - ft

5.7 - 7.2	-3.8 - -2.2	-13.5 - -11.6
4.1 - 5.7	-5.3 - -3.8	-15.5 - -13.5
2.5 - 4.1	-6.9 - -5.3	-17.5 - -15.5
0.9 - 2.5	-8.5 - -6.9	-19.5 - -17.5
-0.6 - 0.9	-10.0 - -8.5	-21.5 - -19.5
-2.2 - -0.6	-11.6 - -10.0	-23.5 - -21.5

Cap bathymetry: 12/21/20 and 01/06/21; Background bathymetry 10/16/19
Elevations within the cap limit represent post-capping conditions.

B272, B207, B180, A206, A34, B339, A201, B149, A187, A64, B103, B404, A168, A98, B50, A132, B475, A151, B555, B528

Location	Easting (X)	Northing (Y)
A34	815058.77	2704008.00
A64	815069.01	2703984.99
A98	815059.57	2703962.02
A132	815037.57	2703949.36
A151	815021.06	2703949.27
A168	815015.60	2703969.44
A187	815012.50	2703995.27
A201	815014.44	2704012.44
A206	815019.00	2704015.12
B50	815013.09	2703959.53
B103	815004.15	2703980.59
B149	815008.19	2704005.05
B180	815011.41	2704017.60
B207	815018.90	2704022.66
B272	815044.52	2704023.70
B339	815073.95	2704004.57
B404	815075.12	2703972.88
B475	815056.61	2703948.52
B528	815034.23	2703940.27
B555	815023.01	2703941.17

Upper Harbor
Site Location

USGS, MassGIS

Legend

- Full depth engineered cap
- Cap limits at the toe of slope
- Excavation Extent with Sand Backfill and Cap
- -5 1ft contour line
- A98 L-114 Cap Coordinates (full set of coordinates located in Appendix G)
  Datum: NAD1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
- MLLW
- MHHW

Aerial Photography MASSGIS 2014

0 25 Feet

1:150

JACOBS®

Final Third-Party Bathymetric Survey L-114 Cap

New Bedford Harbor Superfund Site

NAME: jpiccuito Date: 4/12/2021 **Figure 6**

Path: Y:\NB\Projects\35BG1001\20210222_Caps_RA_RCL\ArcGIS\L114_Post_Capping_RA_Location_Map_20210222.mxd

Elevation NAVD88 - ft

5.7 - 7.2	-3.8 - -2.2	-13.5 - -11.6
4.1 - 5.7	-5.3 - -3.8	-15.5 - -13.5
2.5 - 4.1	-6.9 - -5.3	-17.5 - -15.5
0.9 - 2.5	-8.5 - -6.9	-19.5 - -17.5
-0.6 - 0.9	-10.0 - -8.5	-21.5 - -19.5
-2.2 - -0.6	-11.6 - -10.0	-23.5 - -21.5

Cap bathymetry: 11/30/20 and 12/22/20;
Background bathymetry 08/22/19
Elevations within the cap limit represent post-capping conditions.

Location	Easting (X)	Northing (Y)
A1	815500.04	2700323.50
A4	815662.04	2700320.50
A5	815719.04	2700320.50
A7	815777.40	2700317.50
A25	815880.14	2700350.50
A132	815920.00	2700412.90
A234	815865.00	2700463.56
A319	815781.59	2700521.05
A417	815703.88	2700566.34
A502	815631.50	2700594.50
A591	815557.04	2700603.62
A716	815538.49	2700537.00
A835	815537.01	2700458.50
A891	815521.67	2700383.26
A994	815505.92	2700343.72
B2	815483.35	2700327.80
B50	815491.04	2700369.79
B128	815521.59	2700422.23
B267	815529.34	2700498.56
B485	815523.10	2700581.50
B666	815592.69	2700617.15
B820	815668.43	2700587.50
B995	815752.04	2700558.05
B1183	815827.04	2700492.23
B1343	815913.58	2700446.19
B1545	815920.24	2700375.08
B1780	815812.44	2700317.90

Coggeshall St.

Legend

- Full depth engineered cap
- Cap limits at the toe of slope
- -5 1ft contour line
- City Drainage Outfall
- MLLW
- MHHW
- A1 Coggeshall East Cap Coordinates

(full set of coordinates located in Appendix G)
Datum: NAD1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

0 40 80 Feet

Basemap Data Source: MassGIS, ESRI

March 2021

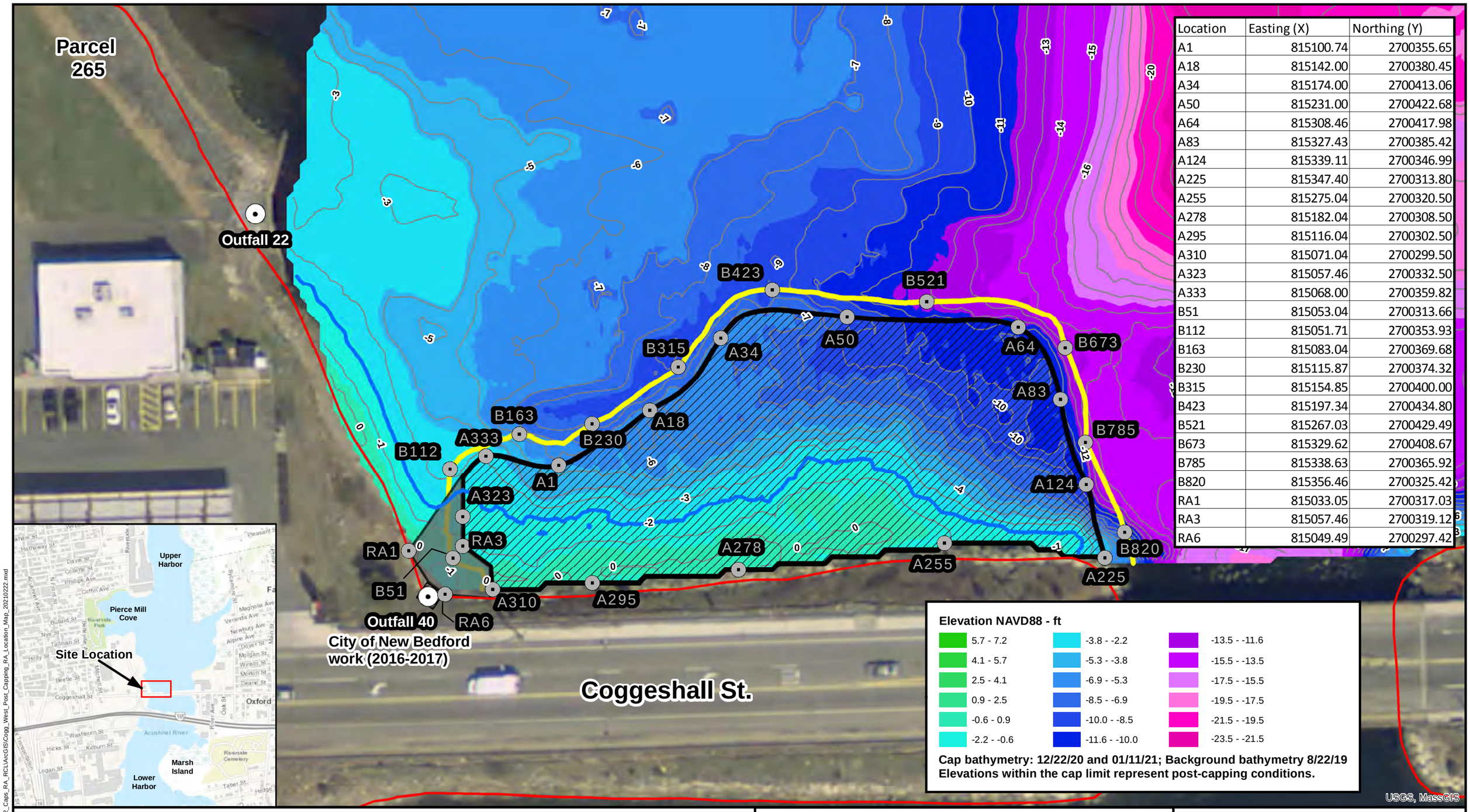
Final Third-Party Bathymetirc Survey
Coggeshall East Cap

New Bedford Harbor Superfund Site

JACOBS

Figure 7

Path: Y:\NBH\Projects\35BG100\20210222_Caps_RA_RC1\ArcGIS\Cogg_East_Post_Capping_RA_Location_Map_20210222.mxd



Location	Easting (X)	Northing (Y)
A1	815100.74	2700355.65
A18	815142.00	2700380.45
A34	815174.00	2700413.06
A50	815231.00	2700422.68
A64	815308.46	2700417.98
A83	815327.43	2700385.42
A124	815339.11	2700346.99
A225	815347.40	2700313.80
A255	815275.04	2700320.50
A278	815182.04	2700308.50
A295	815116.04	2700302.50
A310	815071.04	2700299.50
A323	815057.46	2700332.50
A333	815068.00	2700359.82
B51	815053.04	2700313.66
B112	815051.71	2700353.93
B163	815083.04	2700369.68
B230	815115.87	2700374.32
B315	815154.85	2700400.00
B423	815197.34	2700434.80
B521	815267.03	2700429.49
B673	815329.62	2700408.67
B785	815338.63	2700365.92
B820	815356.46	2700325.42
RA1	815033.05	2700317.03
RA3	815057.46	2700319.12
RA6	815049.49	2700297.42

Legend

- Full depth engineered cap
- Cap limits at the toe of slope
- -5 1ft contour line
- City Drainage Outfall
- MLLW
- MHHW
- Riprap Apron
- A1 Coggeshall West Cap Coordinates

(full set of coordinates located in Appendix G)
Datum: NAD1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

0 40 80 Feet

Basemap Data Source: MassGIS, ESRI

March 2021

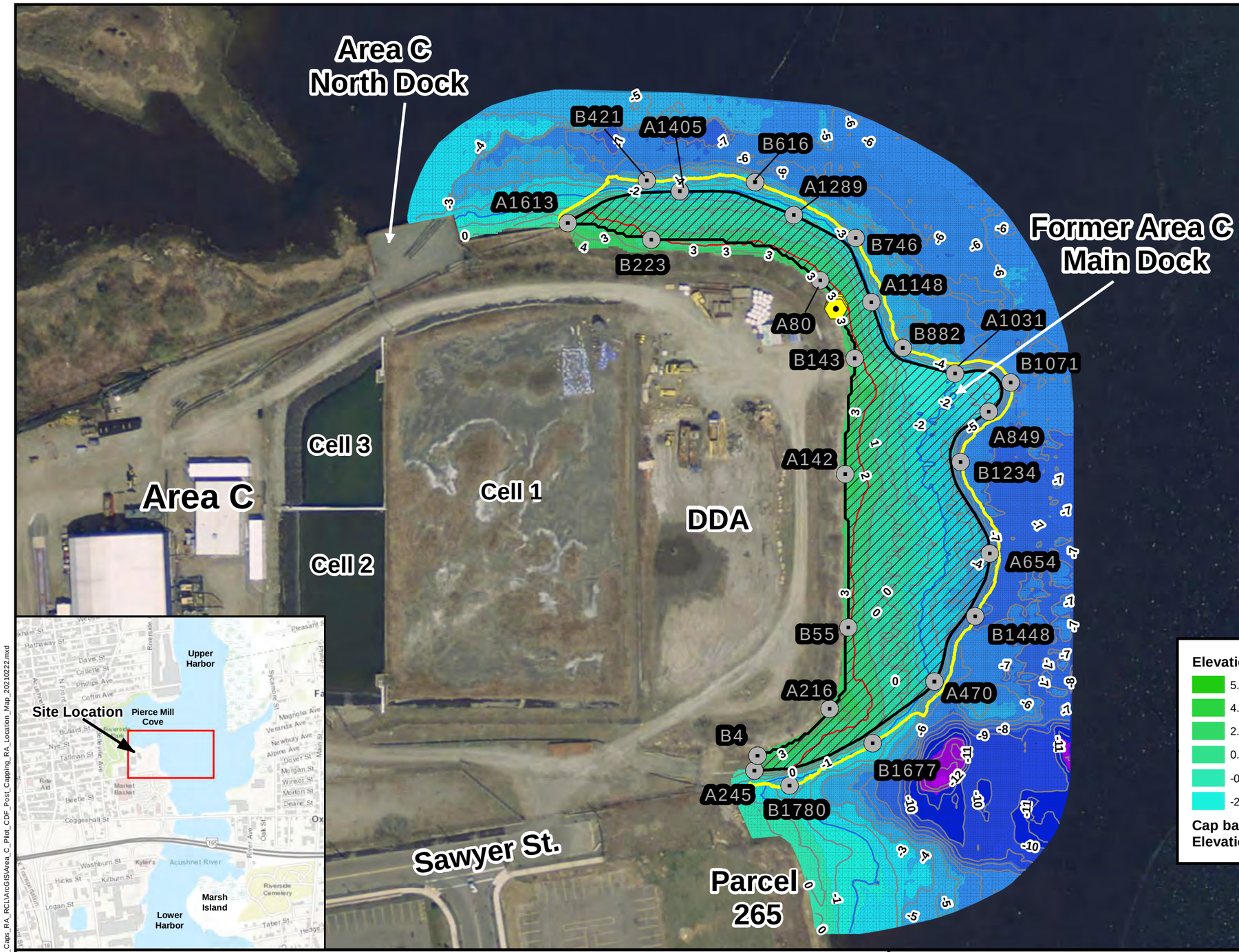
Final Third-Party Bathymetric Survey Coggeshall West Cap

New Bedford Harbor Superfund Site

JACOBS

Figure 8

Path: Y:\NBH\Projects\358G1001\20210222_Caps_RA_RCL\ArcGIS\Cogg_West_Post_Capping_RA_Location_Map_20210222.mxd



Location	Easting (X)	Northing (Y)
A80	814883.44	2701655.40
A142	814907.44	2701469.40
A216	814892.44	2701244.40
A245	814820.40	2701185.26
A470	814993.01	2701270.38
A654	815046.04	2701393.49
A849	815044.90	2701529.40
A1031	815012.77	2701566.18
A1148	814932.36	2701634.40
A1289	814858.05	2701718.06
A1405	814748.63	2701740.52
A1613	814641.42	2701710.38
B4	814823.44	2701199.40
B55	814910.44	2701322.40
B143	814916.44	2701580.40
B223	814721.44	2701694.40
B421	814716.99	2701751.29
B616	814821.20	2701749.37
B746	814917.41	2701696.26
B882	814962.68	2701590.64
B1071	815065.96	2701557.39
B1234	815018.13	2701481.09
B1448	815032.08	2701333.21
B1677	814933.84	2701211.40
B1780	814854.15	2701170.83

Elevation NAVD88 - ft

5.7 - 7.2	-3.8 - -2.2	-13.5 - -11.6
4.1 - 5.7	-5.3 - -3.8	-15.5 - -13.5
2.5 - 4.1	-6.9 - -5.3	-17.5 - -15.5
0.9 - 2.5	-8.5 - -6.9	-19.5 - -17.5
-0.6 - 0.9	-10.0 - -8.5	-21.5 - -19.5
-2.2 - -0.6	-11.6 - -10.0	-23.5 - -21.5

Cap bathymetry: 12/22/20 and 01/14/21; Background bathymetry 08/26/19
Elevations within the cap limit represent post-capping conditions.

Legend

- Full depth engineered cap
- Cap limits at the toe of slope
- MLLW
- MHHW
- -5 1ft contour line
- Area C Headwall Marker
- A80 Area C Pilot CDF Cap Coordinates

(full set of coordinates located in Appendix G)
Datum: NAD1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

0 100 200 Feet

Basemap Data Source: MassGIS, ESRI

March 2021

Final Third-Party Bathymetric Survey
Area C Pilot CDF Shoreline Cap

New Bedford Harbor Superfund Site

JACOBS

Figure 9

Path: Y:\NBH\Projects\35BG10012021022_Caps_RA_RCL\ArcGIS\Area_C_Pilot_CDF_Post_Capping_RA_Location_Map_20210222.mxd

Legend

Note: A confirmatory sediment core showing
14-in of cap material placed over the existing sediment.

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Example Confirmatory Sediment Core Photo

New Bedford Harbor Superfund Site

Date: 3/5/2021 | Figure 10

Path: Y:\NBH\Projects\35BG1001\00210222_Caps_RA_RCL\ArcGIS\Example Confirmatory Sediment Core Photo_20210305.mxd

Tables

Table 1
Summary of Cap Isolation Material Laboratory Test Results

			Parameter and Acceptable Range															
			Geotechnical Characteristics				Grain Size (D422, Sieve Only)			Massachusetts Contingency Plan (MCP) S-1 Soil Category Standards								
Cubic Yard	Date Sampled	Appendix A page ref.	Moisture Content	Bulk Density	Specific Gravity	Total Organic Carbon	Sand	Silt/Clay	Gravel	Total Metals	Cyanide	Petroleum Hydrocarbons (VPH)	Petroleum Hydrocarbons (EPH)	VOCs	SVOCs	Pesticides	PCB Aroclors
			1 -10%	1.7 - 2.0 (g/cm^3)	2.6 - 2.8 (g/cm^3)	≥ 1.5%	80 - 90%	10 - 15%	<1%								
Organoclay	28-Aug-2018	1, 1700-1703	1.4	0.75	1.49	20	97.1	2.9	0	NA	NA	NA	NA	NA	NA	NA	NA
500	14-Aug-2020	2-201, 1610-1616	28.3	1.32	2.54	6	62.2	14.1	23.7	√	√	√	√	√	√	√	√
1000			22	1.31	2.53	5.6	51.8	11.8	36.4	√	√	√	√	√	√	√	√
1500			29	1.19	2.55	5.7	71.5	14.5	14	√	√	√	√	√	√	√	√
2000			27.6	1.26	2.58	5.7	68	13.7	18.3	√	√	√	√	√	√	√	√
2500	26-Aug-2020	202-286, 1617-1621	28.8	1.33	2.54	5.1	65.8	17.7	16.5	√	√	√	√	√	√	√	√
3000			27.4	1.31	2.56	4.6	66.3	17.2	16.5	√	√	√	√	√	√	√	√
3500	28-Aug-2020	287-380, 1617-1619, 1622-1624	35	1.45	2.49	7.9	66.9	15.7	17.4	√	√	√	√	√	√	√	√
4000			30.9	1.40	2.58	3.8	66.1	14.4	19.5	√	√	√	√	√	√	√	√
4500			26.4	1.37	2.53	4.4	67.4	15.7	16.9	√	√	√	√	√	√	√	√
5000	31-Aug-2020	381-432, 1617-1619, 1625-	32.6	1.41	2.48	4.1	90	4.6	5.4	√	√	√	√	√	√	√	√
5500			28.6	1.34	2.57	3.8	86.9	5.7	7.4	√	√	√	√	√	√	√	√
6000	1-Sep-2020	433-493, 1617-1619, 1627-	33.9	1.28	2.51	6.2	75.6	11	13.4	√	√	√	√	√	√	√	√
6500			31.6	1.34	2.55	4.7	74.1	11.1	14.8	√	√	√	√	√	√	√	√
7000	9-Sep-2020	494-564, 1629, 1631, 1633, 1635-1638	30.7	1.22	2.49	6.1	82.4	7.3	10.3	√	√	√	√	√	√	√	√
7500			25.2	1.30	2.51	5.2	74.8	9	16.2	√	√	√	√	√	√	√	√
8000			28.9	1.22	2.46	6.5	81.9	10.1	8	√	√	√	√	√	√	√	√
8500			28.2	1.15	2.48	5.2	84.8	9	6.2	√	√	√	√	√	√	√	√
9000	11-Sep-2020	565-645, 1630, 1632, 1634, 1639-1642	26.2	1.34	2.5	4.1	82.5	7.2	10.3	√	√	√	√	√	√	√	√
9500			30.1	1.29	2.47	5.7	78.3	8.4	13.3	√	√	√	√	√	√	√	√
10000			28.1	1.31	2.49	5.4	87.9	6.7	5.4	√	√	√	√	√	√	√	√
10500			27.0	1.20	2.5	4.8	85.1	7.5	7.4	√	√	√	√	√	√	√	√
11000	18-Sep-2020	646-824, 1643-1651	24.1	1.23	2.49	5.9	75.7	6.4	17.9	√	√	√	√	√	√	√	√
11500			32.3	1.19	2.42	9.2	69.6	9.4	21	√	√	√	√	√	√	√	√
12000			35.6	1.24	2.47	7.5	76	7.8	16.2	√	√	√	√	√	√	√	√
12500			37.2	1.29	2.47	7.4	72.4	6.4	21.2	√	√	√	√	√	√	√	√
13000			32.1	1.25	2.46	6.9	74.3	8.9	16.8	√	√	√	√	√	√	√	√
13500			29.2	1.21	2.47	7.7	78.1	7	14.9	√	√	√	√	√	√	√	√
14000	30-Sep-2020	825-940, 1652-1658	36.9	1.42	2.5	4.8	79.7	17.8	2.5	√	√	√	√	√	√	√	√
14500			37.4	1.45	2.5	5.3	76.6	15.5	7.9	√	√	√	√	√	√	√	√
15000			35.4	1.34	2.46	5.9	76.2	10.1	13.7	√	√	√	√	√	√	√	√
15500			31.7	1.09	2.41	9.5	81.7	11.5	6.8	√	√	√	√	√	√	√	√
16000	7-Oct-2020	941-1068, 1659-1665	30.9	1.24	2.46	7.7	65.5	14.7	19.8	√	√	√	√	√	√	√	√
16500			28.6	1.33	2.5	5.6	77.1	15.5	7.4	√	√	√	√	√	√	√	√
17000			30.0	1.40	2.49	4.6	69.6	16.3	14.1	√	√	√	√	√	√	√	√
17500			31.6	1.27	2.48	5.6	72.7	13.8	13.5	√	√	√	√	√	√	√	√
18000	14-Oct-2020	1069-1166, 1666-1672	26.4	1.27	2.55	4.8	75.7	13.2	11.1	√	√	√	√	√	√	√	√
18500			29.4	1.27	2.55	5.6	70.8	18.3	10.9	√	√	√	√	√	√	√	√
19000			28.9	1.21	2.53	6.5	76.8	15.3	7.9	√	√	√	√	√	√	√	√
19500			25.4	1.32	2.55	5.4	70.8	17.5	11.7	√	√	√	√	√	√	√	√

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			1 -10%	1.7 - 2.0 (g/cm^3)	2.6 - 2.8 (g/cm^3)	≥ 1.5%	80 - 90%	10 - 15%	<1%								
20000	26-Oct-2020	1167-1300, 1673-1679	38.6	1.35	2.53	8.2	61.7	18.5	19.8	√	√	√	√	√	√	√	√
20500			30.6	1.34	2.56	4.5	70.4	19.8	9.8	√	√	√	√	√	√	√	√
21000			31.8	1.22	2.56	6.2	65.4	20.5	14.1	√	√	√	√	√	√	√	√
21500			35.2	1.43	2.52	5.9	67.7	20.3	12	√	√	√	√	√	√	√	√
22000	2-Nov-2020	1301-1394, 1680-1684	27.5	1.35	2.54	3.7	65	22.3	12.7	√	√	√	√	√	√	√	√
22500			33.2	1.52	2.52	6.8	61.4	21.9	16.7	√	√	√	√	√	√	√	√
23000	5-Nov-2020	1395-1507, 1685-1691	40.5	1.24	2.5	5.8	78.7	11	10.3	√	√	√	√	√	√	√	√
23500			25.6	1.45	2.55	4.9	61.2	19.4	19.4	√	√	√	√	√	√	√	√
24000			26.3	1.45	2.6	4.1	60.2	18.7	21.1	√	√	√	√	√	√	√	√
24500			26.2	1.39	2.55	3.8	58.5	18.5	23	√	√	√	√	√	√	√	√
25000	18-Nov-2020	1508-1609, 1692-1698	25.5	1.43	2.52	3.1	64.3	12.1	23.6	√	√	√	√	√	√	√	√
25500			28.3	1.39	2.53	4.7	63.6	12.6	23.8	√	√	√	√	√	√	√	√
30000			30.6	1.39	2.54	2.8	72.2	10.7	17.1	√	√	√	√	√	√	√	√
35000			28.1	1.50	2.54	4.6	75	12	13	√	√	√	√	√	√	√	√

Notes:
NA= Not Analyzed
√ = Analyzed and Compliant

Table 2
Confirmatory Sediment Core Data Summary

Cap	Core	Staked Easting	Staked Northing	Assigned E	Assigned N	Staked Elevation (ft NAVD88)	Isolation layer (inches)	Date	TOC Sample	Appendix D page reference	Notes
O-711	PC1	815380.71	2705979.12	815380	2705980	-7.34	19	26-Aug-2020		page 1	
O-711	PC2	815412.72	2705978.17	815414	2705980	-6.88	16	26-Aug-2020		page 2	
O-711	PC3	815380.81	2705944.51	815380	2705946	-7.37	14	26-Aug-2020		page 3	
O-711	PC4	815413.66	2705943.60	815414	2705946	-7.02	17	26-Aug-2020		page 4	
O-711	PC5	815446.70	2705945.49	815448	2705946	-7.31	13	26-Aug-2020		page 5	
O-711	PC6	815415.54	2705913.14	815414	2705912	-6.73	16	26-Aug-2020	x	page 6	
O-711	PC7	815450.48	2705910.86	815448	2705912	-6.36	16	26-Aug-2020	x	page 7	
O-711	PC8	815449.31	2705877.12	815448	2705878	-6.35	16	26-Aug-2020	x	page 8	
Crib Cap	PC1	814901.96	2705310.18	814903	2705311	-1.21	25	2-Sep-2020		page 9	
Crib Cap	PC2	814936.27	2705311.21	814937	2705311	-1.74	29	2-Sep-2020		page 10	
Crib Cap	PC3	814869.38	2705276.41	814869	2705277	0.38	26	2-Sep-2020		page 11	
Crib Cap	PC4	814901.72	2705277.46	814903	2705277	-0.04	31	2-Sep-2020		page 12	
Crib Cap	PC5	814937.97	2705277.66	814937	2705277	-1.96	34	3-Sep-2020		page 13	
Crib Cap	PC6	814969.17	2705275.90	814971	2705277	-3.51	24	3-Sep-2020		page 14	
Crib Cap	PC7	814903.25	2705244.40	814903	2705243	0.1	26	3-Sep-2020		page 15	
Crib Cap	PC8	814937.78	2705242.49	814937	2705243	-4.43	27	1-Sep-2020	x	page 16	
Crib Cap	PC9	814971.53	2705242.57	814971	2705243	-5.13	26	2-Sep-2020	x	page 17	
Crib Cap	PC10	814937.99	2705209.87	814937	2705209	-1.79	36	3-Sep-2020		page 18	
Crib Cap	PC11	814970.11	2705209.03	814971	2705209	-3.76	29	2-Sep-2020	x	page 19	
Crib Cap	PC12	814936.62	2705175.23	814937	2705175	-0.88	30	3-Sep-2020		page 20	
L-014	PC1	814951.30	2704343.62	814951	2704344	-4.06	24	9-Sep-2020	x	page 21	
L-014	PC2	814951.30	2704310.26	814951	2704310	-3.293	26	9-Sep-2020	x	page 22	
L-014	PC3	814949.09	2704274.82	814951	2704276	-3.85	29	9-Sep-2020	x	page 23	
L-114	PC1	815017.18	2704002.56	815019	2704004	-6.58	25	14-Sep-2020	x	page 24	
L-114	PC2	815053.48	2704003.16	815053	2704004	-6.79	30	14-Sep-2020		page 25	
L-114	PC3	815020.43	2703969.27	815019	2703970	-7.96	30	10-Sep-2020	x	page 26	
L-114	PC4	815053.2	2703968.88	815053	2703970	-7.95	25	14-Sep-2020	x	page 27	
Cogg-East	PC1	815560.66	2700574.34	815560	2700575	-12.87	21	13-Oct-2020		page 28	
Cogg-East	PC2	815592.30	2700574.16	815594	2700575	-11.24	23	9-Oct-2020		page 29	
Cogg-East	PC3	815627.24	2700574.70	815628	2700575	-9.72	28	9-Oct-2020		page 30	
Cogg-East	PC4	815662.20	2700574.24	815662	2700575	-7.42	22	13-Oct-2020		page 31	
Cogg-East	PC5	815559.75	2700540.27	815560	2700541	-12.18	29	13-Oct-2020		page 32	
Cogg-East	PC6	815591.98	2700540.99	815594	2700541	-10.86	24	9-Oct-2020		page 33	
Cogg-East	PC7	815628.81	2700540.17	815628	2700541	-9.86	23	9-Oct-2020		page 34	
Cogg-East	PC8	815660.93	2700541.57	815662	2700541	-7.88	26	13-Oct-2020		page 35	
Cogg-East	PC9	815695.20	2700540.32	815696	2700541	-5.31	25	13-Oct-2020		page 36	
Cogg-East	PC10	815730.58	2700540.35	815730	2700541	-3.81	20	22-Oct-2020		page 37	
Cogg-East	PC11	815560.47	2700507.46	815560	2700507	-11.68	29	14-Oct-2020		page 38	
Cogg-East	PC12	815594.13	2700508.53	815594	2700507	-10.389	26	6-Oct-2020		page 39	
Cogg-East	PC13	815627.20	2700507.71	815628	2700507	-9.647	26	6-Oct-2020		page 40	
Cogg-East	PC14	815663.48	2700506.31	815662	2700507	-7.32	26	9-Oct-2020		page 41	
Cogg-East	PC15	815696.64	2700507.31	815696	2700507	-5.49	22	15-Oct-2020		page 42	
Cogg-East	PC16	815729.14	2700507.75	815730	2700507	-3.601	24	3-Nov-2020		page 43	
Cogg-East	PC17	815763.67	2700508.37	815764	2700507	-2.815	21	3-Nov-2020		page 44	
Cogg-East	PC18	815559.50	2700473.70	815560	2700473	-12.3	26	14-Oct-2020		page 45	
Cogg-East	PC19	815594.39	2700472.47	815594	2700473	-10.47	29	6-Oct-2020		page 46	
Cogg-East	PC20	815627.33	2700473.53	815628	2700473	-9.38	26	6-Oct-2020		page 47	
Cogg-East	PC21	815662.64	2700472.71	815662	2700473	-7.36	26	6-Oct-2020		page 48	
Cogg-East	PC22	815695.08	2700472.84	815696	2700473	-5.32	24	15-Oct-2020		page 49	
Cogg-East	PC23	815729.209	2700472.74	815730	2700473	-3.434	29	3-Nov-2020		page 50	
Cogg-East	PC24	815764.88	2700473.23	815764	2700473	-2.751	23	3-Nov-2020		page 51	
Cogg-East	PC25	815798.41	2700472.65	815798	2700473	-2.08	28	22-Oct-2020		page 52	
Cogg-East	PC26	815831.62	2700472.49	815832	2700473	-2.01	22	20-Oct-2020		page 53	
Cogg-East	PC27	815560.27	2700438.36	815560	2700439	-12.07	26	2-Oct-2020		page 54	
Cogg-East	PC28	815594.98	2700437.67	815594	2700439	-10.54	26	2-Oct-2020		page 55	
Cogg-East	PC29	815659.47	2700439.30	815662	2700439	-7.52	26	5-Oct-2020		page 56	
Cogg-East	PC30	815627.31	2700439.45	815628	2700439	-9.26	24	5-Oct-2020		page 57	
Cogg-East	PC31	815696.94	2700438.62	815696	2700439	-4.76	28	15-Oct-2020		page 58	
Cogg-East	PC32	815730.56	2700440.00	815730	2700439	-3.218	28	3-Nov-2020		page 59	

Table 2
Confirmatory Sediment Core Data Summary

Cap	Core	Staked Easting	Staked Northing	Assigned E	Assigned N	Staked Elevation (ft NAVD88)	Isolation layer (inches)	Date	TOC Sample	Appendix D page reference	Notes
Cogg-East	PC33	815763.08	2700439.25	815764	2700439	-2.11	28	10-Nov-2020		page 60	
Cogg-East	PC34	815798.15	2700438.26	815798	2700439	-2.16	27	10-Nov-2020		page 61	
Cogg-East	PC35	815832.23	2700440.07	815832	2700439	-1.78	26	20-Oct-2020		page 62	
Cogg-East	PC36	815864.94	2700439.23	815866	2700439	-0.93	24	28-Sep-2020		page 63	
Cogg-East	PC37	815899.75	2700437.84	815900	2700439	-0.47	27	23-Sep-2020	x	page 64	
Cogg-East	PC38	815559.30	2700406.34	815560	2700405	-10.32	28	29-Sep-2020		page 65	
Cogg-East	PC39	815593.68	2700405.85	815594	2700405	-8.75	22	29-Sep-2020		page 66	
Cogg-East	PC40	815627.55	2700404.36	815628	2700405	-7.49	24	29-Sep-2020		page 67	
Cogg-East	PC41	815662.40	2700406.24	815662	2700405	-6.31	23	29-Sep-2020		page 68	
Cogg-East	PC42	815695.23	2700403.70	815696	2700405	-4.4	27	29-Sep-2020		page 69	
Cogg-East	PC43	815728.80	2700405.91	815730	2700405	-3.274	27	3-Nov-2020		page 70	
Cogg-East	PC44	815763.20	2700403.83	815764	2700405	-2.01	31	10-Nov-2020		page 71	
Cogg-East	PC45	815796.15	2700405.91	815798	2700405	-2.44	25	10-Nov-2020		page 72	
Cogg-East	PC46	815832.59	2700404.58	815832	2700405	-1.38	28	20-Oct-2020		page 73	
Cogg-East	PC47	815866.63	2700404.78	815866	2700405	-0.81	24	29-Sep-2020		page 74	
Cogg-East	PC48	815900.07	2700403.61	815900	2700405	0.1	24	23-Sep-2020	x	page 75	
Cogg-East	PC49	815526.32	2700371.78	815526	2700371	-10.63	28	29-Sep-2020		page 76	
Cogg-East	PC50	815560.68	2700372.34	815560	2700371	-9.58	28	29-Sep-2020		page 77	
Cogg-East	PC51	815596.15	2700371.46	815594	2700371	-7.53	24	28-Sep-2020		page 78	
Cogg-East	PC52	815627.69	2700371.30	815628	2700371	-6.05	28	28-Sep-2020		page 79	
Cogg-East	PC53	815661.69	2700370.65	815662	2700371	-4.05	27	28-Sep-2020		page 80	
Cogg-East	PC54	815695.38	2700371.26	815696	2700371	-2.89	27	28-Sep-2020		page 81	
Cogg-East	PC55	815730.51	2700370.66	815730	2700371	-2.43	23	28-Sep-2020		page 82	
Cogg-East	PC56	815764.00	2700371.21	815764	2700371	-2.412	20	3-Nov-2020		page 83	
Cogg-East	PC57	815798.02	2700371.57	815798	2700371	-1.56	24	10-Nov-2020		page 84	
Cogg-East	PC58	815831.29	2700371.33	815832	2700371	-1.2	21	20-Oct-2020		page 85	
Cogg-East	PC59	815866.54	2700370.50	815866	2700371	0.11	24	1-Oct-2020		page 86	
Cogg-East	PC60	815897.65	2700370.94	815900	2700371	-0.08	22	23-Sep-2020	x	page 87	
Cogg-East	PC61	815525.12	2700337.54	815526	2700337	-4.28	22	25-Sep-2020		page 88	
Cogg-East	PC62	815558.59	2700337.45	815560	2700337	-2.56	24	25-Sep-2020		page 89	
Cogg-East	PC63	815593.46	2700337.62	815594	2700337	-2.96	27	25-Sep-2020		page 90	
Cogg-East	PC64	815627.16	2700337.33	815628	2700337	-2.4	31	25-Sep-2020		page 91	
Cogg-East	PC65	815660.13	2700336.31	815662	2700337	-2.06	25	25-Sep-2020		page 92	
Cogg-East	PC66	815693.05	2700336.77	815696	2700337	-2.14	22	25-Sep-2020		page 93	
Cogg-East	PC67	815728.28	2700338.01	815730	2700337	-1.69	25	24-Sep-2020		page 94	
Cogg-East	PC68	815764.32	2700338.03	815764	2700337	-1.04	26	1-Oct-2020		page 95	
Cogg-East	PC69	815797.54	2700336.27	815798	2700337	-0.77	26	1-Oct-2020		page 96	
Cogg-East	PC70	815831.46	2700337.46	815832	2700337	-0.42	25	1-Oct-2020		page 97	
Cogg-West	PC1	815189.47	2700410.45	815189	2700410	-8.177	27	27-Oct-2020		page 98	Relocated due to berm
Cogg-West	PC2	815210.88	2700410.02	815212	2700410	-9.223	27	27-Oct-2020		page 99	Relocated due to berm
Cogg-West	PC3	815247.43	2700407.45	815247	2700408	-10.891	23	28-Oct-2020		page 100	Relocated due to berm
Cogg-West	PC4	815280.73	2700410.58	815281	2700410	-11.352	22	28-Oct-2020		page 101	Relocated due to berm
Cogg-West	PC5	815179.50	2700383.40	815179	2700383	-7.766	27	27-Oct-2020		page 102	
Cogg-West	PC6	815212.67	2700381.34	815213	2700383	-9.173	30	27-Oct-2020		page 103	
Cogg-West	PC7	815247.20	2700380.96	815247	2700383	-8.681	25	27-Oct-2020		page 104	
Cogg-West	PC8	815280.51	2700380.40	815281	2700383	-10.918	21	27-Oct-2020		page 105	
Cogg-West	PC9	815313.31	2700382.15	815315	2700383	-11.712	21	28-Oct-2020		page 106	
Cogg-West	PC10	815076.41	2700348.44	815077	2700349	-4.889	28	27-Oct-2020	x	page 107	
Cogg-West	PC11	815110.01	2700350.39	815111	2700349	-6.451	27	27-Oct-2020	x	page 108	
Cogg-West	PC12	815143.73	2700348.50	815145	2700349	-6.771	21	27-Oct-2020		page 109	
Cogg-West	PC13	815178.96	2700349.66	815179	2700349	-6.062	25	27-Oct-2020		page 110	
Cogg-West	PC14	815211.96	2700348.20	815213	2700349	-3.583	23	27-Oct-2020		page 111	
Cogg-West	PC15	815246.44	2700347.39	815247	2700349	-3.523	24	27-Oct-2020		page 112	
Cogg-West	PC16	815281.04	2700348.81	815281	2700349	-7.308	24	27-Oct-2020		page 113	
Cogg-West	PC17	815313.46	2700348.46	815315	2700349	-10.805	21	27-Oct-2020	x	page 114	
Cogg-West	PC18	815078.15	2700313.62	815077	2700315	-2.882	21	27-Oct-2020		page 115	
Cogg-West	PC19	815110.83	2700315.40	815111	2700315	-1.975	26	27-Oct-2020		page 116	

Table 2
Confirmatory Sediment Core Data Summary

Cap	Core	Staked Easting	Staked Northing	Assigned E	Assigned N	Staked Elevation (ft NAVD88)	Isolation layer (inches)	Date	TOC Sample	Appendix D page reference	Notes
Area C CDF	PC2	814650.79	2701713.86	814651	2701714	0.96	18	2-Dec-2020		page 117	
Area C CDF	PC3	814684.97	2701713.58	814685	2701714	0.52	18	2-Dec-2020		page 118	
Area C CDF	PC4	814719.06	2701714.95	814791	2701714	-0.16	16	7-Dec-2020		page 119	
Area C CDF	PC5	814752.79	2701713.74	814753	2701714	-0.12	18	8-Dec-2020		page 120	
Area C CDF	PC6	814786.95	2701713.73	814787	2701714	-0.15	16	9-Dec-2020		page 121	
Area C CDF	PC7	814821.69	2701713.96	814821	2701714	-0.11	19	10-Dec-2020		page 122	
Area C CDF	PC8	814854.86	2701714.60	814855	2701714	-1.184	18	11-Dec-2020		page 123	
Area C CDF	PC9	814854.74	2701680.33	814855	2701680	0.98	20	12-Dec-2020		page 124	
Area C CDF	PC10	814888.85	2701679.99	814889	2701680	0.03	17	14-Dec-2020		page 125	
Area C CDF	PC11	814922.87	2701645.58	814923	2701646	-0.5	21	16-Dec-2020		page 126	Hand Auger used for collection
Area C CDF	PC12	814922.67	2701612.72	814923	2701612	-0.06	20	16-Dec-2020		page 127	Hand Auger used for collection
Area C CDF	PC13	814922.95	2701578.11	814923	2701578	0.89	20	18-Dec-2020		page 128	Hand Auger used for collection
Area C CDF	PC14	814956.57	2701578.81	814957	2701578	-2.22	17	21-Dec-2020		page 129	
Area C CDF	PC15	814922.71	2701544.45	814923	2701544	1.96	21	14-Dec-2020		page 130	Hand Auger used for collection
Area C CDF	PC16	814957.32	2701544.49	814957	2701544	-1.91	16.5	18-Dec-2020		page 131	
Area C CDF	PC17	814990.72	2701543.32	814991	2701544	-2.76	17	18-Dec-2020		page 132	
Area C CDF	PC18	815025.20	2701543.67	815025	2701544	-4.18	18.5	16-Dec-2020		page 133	
Area C CDF	PC19	814923.34	2701509.93	814923	2701510	0.52	19.5	10-Dec-2020		page 134	
Area C CDF	PC20	814957.37	2701510.41	814957	2701510	-1.72	19.5	16-Dec-2020		page 135	
Area C CDF	PC21	814991.66	2701510.12	814991	2701510	-3.66	17	16-Dec-2020		page 136	
Area C CDF	PC22	814923.30	2701476.22	814923	2701476	0.98	18	7-Dec-2020		page 137	
Area C CDF	PC23	814957.08	2701477.08	814957	2701476	-1.42	21	12-Dec-2020		page 138	
Area C CDF	PC24	814992.19	2701477.93	814991	2701476	-3.54	19	15-Dec-2020		page 139	
Area C CDF	PC25	814923.52	2701441.43	814923	2701442	0.73	17.5	7-Dec-2020		page 140	
Area C CDF	PC26	814957.23	2701441.34	814957	2701442	-1.02	18	14-Dec-2020		page 141	
Area C CDF	PC27	814989.81	2701441.40	814991	2701442	-2.83	18	15-Dec-2020		page 142	
Area C CDF	PC28	814923.66	2701407.83	814923	2701408	0.3	19	7-Dec-2020		page 143	
Area C CDF	PC29	814956.99	2701408.57	814957	2701408	-0.79	19	12-Dec-2020	x	page 144	
Area C CDF	PC30	814991.42	2701408.16	814991	2701408	-2.12	16.5	14-Dec-2020		page 145	
Area C CDF	PC31	815023.34	2701408.78	815025	2701408	-3.2	21	15-Dec-2020		page 146	
Area C CDF	PC32	814923.39	2701373.92	814923	2701374	-0.09	18	7-Dec-2020		page 147	
Area C CDF	PC33	814955.88	2701375.24	814957	2701374	-0.93	17.5	12-Dec-2020	x	page 148	
Area C CDF	PC34	814990.80	2701374.36	814991	2701374	-2.26	19	12-Dec-2020		page 149	
Area C CDF	PC35	815026.45	2701375.02	815025	2701374	-5.29	19	12-Dec-2020		page 150	
Area C CDF	PC36	814922.72	2701339.50	814923	2701340	0.03	18	7-Dec-2020		page 151	
Area C CDF	PC37	814957.76	2701339.69	814957	2701340	-0.88	20.5	11-Dec-2020		page 152	
Area C CDF	PC38	814991.29	2701339.99	814991	2701340	-4.11	21	12-Dec-2020		page 153	
Area C CDF	PC39	815017.08	2701338.45	815025	2701340	-5.28	20	12-Dec-2020		page 154	Relocated due to berm
Area C CDF	PC40	814922.96	2701305.77	814923	2701306	0.24	16.5	7-Dec-2020		page 155	
Area C CDF	PC41	814956.43	2701305.42	814957	2701306	-1.18	19	10-Dec-2020		page 156	
Area C CDF	PC42	814992.46	2701306.20	814991	2701306	-3.87	17	10-Dec-2020		page 157	
Area C CDF	PC43	814922.62	2701272.41	814923	2701272	0.82	22	3-Dec-2020		page 158	
Area C CDF	PC44	814957.28	2701271.98	814957	2701272	-0.98	16	10-Dec-2020		page 159	
Area C CDF	PC45	814984.59	2701272.72	814994	2701272	-3.11	21	12-Dec-2020	x	page 160	Relocated due to berm
Area C CDF	PC46	814922.47	2701237.71	814923	2701238	1.03	17	3-Dec-2020		page 161	Lost approx 2 inches due to compaction and fallout. Multiple attempts made
Area C CDF	PC47	814855.05	2701203.54	814855	2701203	1.6	19	1-Dec-2020		page 162	
Area C CDF	PC48	814888.27	2701204.52	814889	2701204	-0.1	17	2-Dec-2020		page 163	

Table 3
Cap Material Quantities

Cap	Isolation Layer				Armor Stone Layer			
	Volume (cy)	Area (ft^2)	Avg Thickness (in)	Thickness Range (in)	Volume (cy)	Area (ft^2)	Avg Thickness (in)	Thickness Range (in)
O-711	470	12,320	12.0	8.4 to 16.8	581	12,320	15.3	8.4 to 24.0
Crib	1,672	19,884	27.2	26.4 to 44.4	926	16,025	18.7	13.2 to 30.0
L-014	643	6,483	32.1	26.4 to 39.6	342	5,230	21.2	13.2 to 25.2
L-114	851	6,903	39.9	27.6 to 52.8	389	4,847	26.0	13.2 to 27.6
Cogg-East	7,454	94,492	25.6	22.8 to 42.0	4,615	94,211	15.9	8.4 to 28.8
Cogg-West	1,713	23,209	23.9	10.8 to 42.0	2,004	30,432	21.3	9.6 to 32.4
Area C Pilot CDF	3,046	54,782	18.0	16.8 to 25.2	3,250	70,276	15.0	8.4 to 25.2
TOTALS	**15,850**	**218,073**	**NA**	**NA**	**12,107**	**233,341**	**NA**	**NA**

*Note the armor stone thickness range for Cogg East and Cogg West includes the 20" minimum design thickness for armor stone within the inner shoreline cap boundary.

Table 4
In-situ Total Organic Carbon (TOC) Results

Cap	Push Core #	% TOC	Elevation (ft NAVD88)	Composite Core Length (in)
Crib	PC8	6.8	-4.43	27
Crib	PC9	5.7	-5.13	26
Crib	PC11	5.5	-3.76	29
O-711	PC6	1.0	-6.73	16
O-711	PC7	3.4	-6.36	16
O-711	PC8	2.9	-6.35	16
L-014	PC1	4.1	-4.06	24
L-014	PC2	7.2	-3.29	26
L-014	PC3	6.9	-3.85	29
L-114	PC1	4.1	-6.58	25
L-114	PC3	2.3	-7.96	30
L-114	PC4	3.4	-7.95	25
Cogg-East	PC60	5.2	-0.08	22
Cogg-East	PC48	13	0.10	24
Cogg-East	PC37	7.9	-0.47	27
Cogg-West	PC10	3.6	-4.89	28
Cogg-West	PC11	11.0	-6.45	27
Cogg-West	PC17	12.0	-10.81	21
Area C Pilot	PC33	6.2	-0.93	17.5
Area C Pilot	PC29	1.9	-0.79	19
Area C Pilot	PC45	3.1	-3.11	21