New Bedford Harbor Superfund Site

U.S. Army Corps of Engineers New England District

Draft Final Intertidal Work Plan for Parcel 25-24, East Zone 1, Revision 3

ACE-J23-35BG2000-M1-0121

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New Bedford Harbor Superfund Site

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Document history and status

Revision	Date	Description	By	Review	Approved

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Tables

Appendix

Acronyms and Abbreviations

cy	cubic yards
deconned	decontaminated
EPA	U.S. Environmental Protection Agency
ft.	foot/feet
GAC	granular activated carbon
GPS	Global Positioning System
MADOT	Massachusetts Department of Transportation
mg/kg	milligrams per kilogram
MHHW	Mean Higher High Water
NAE	U.S. Army Corps of Engineers, New England District
NBHSS	New Bedford Harbor Superfund Site
NTU	nephelometric turbidity unit
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RTK	Real Time Kinematic
SVOC	semi-volatile organic compound
sf	square feet
TCL	target cleanup level
TCLP	Toxicity Characteristic Leaching Procedure
TSCA	Toxic Substances Control Act
VOC	volatile organic compound

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1.0 Introduction

This Work Plan for Parcel 25-24 provides information concerning shoreline remediation and restoration pursuant to the New Bedford Harbor Superfund Site (NBHSS), including maps and figures of the excavation area, equipment access plans, sample locations, and existing and proposed wetland cover and topography. As described herein, certain areas of the sediment and soil on the parcel contain polychlorinated biphenyl (PCB) contamination that exceeds the established target cleanup levels (TCLs) for intertidal sediment. The PCB TCLs are included in the 1998 U.S. Environmental Protection Agency (EPA) Record of Decision (ROD) for the NBHSS (USEPA 1998). The TCL for sediment and soil in saltmarshes and shoreline areas with little or no public access is 50 milligrams per kilogram (mg/kg), which is a not-to-exceed value. The TCL for Upper Harbor mudflats and subtidal areas is 10 mg/kg, which must be attained as an average on an Upper Harbor-wide basis. Soil and sediment contaminated with PCBs in exceedance of the TCLs will be removed and disposed of in an off-site Toxic Substances Control Act (TSCA) permitted landfill. Following contaminated sediment removal, areas that originally supported vegetative cover will be backfilled with clean soil and restored with a similar vegetation type and, to the extent practicable, restored to the original elevation.

2.0 Parcel Description

Parcel 25-24 is the northernmost parcel within the intertidal management area referred to as East Zone 1 on the eastern shore of the Acushnet River in Acushnet, MA. The river widens in this area to become the New Bedford Upper Harbor. A site location map showing the parcel location and the limit of planned excavation within the parcel is provided in Figure 2-1. The parcel includes urban development in the northern and northwestern portions of the property with the former Titleist Ball Plant 1 structure and asphalt parking lots; it is undeveloped in the central, south and southeast portions. The undeveloped portions consist of vegetative cover, primarily clusters of trees, shrubs, salt grass and the invasive grass, *Phragmites australis*. The parcel is bounded to the north by Slocum St., to the east by Titleist Drive and residential properties and to the south by Parcel 25-31. The western side of the parcel is bounded by New Bedford Upper Harbor. The shoreline adjacent to the northern developed portion at the former Ball Plant 1 is armored with riprap. The central and southern areas exhibit natural, undeveloped shoreline. Remediation of contaminated sediments will take place along the undeveloped shoreline to the toe of the riprap. The riprap will not be disturbed during the remediation effort.

The existing wetland vegetation was surveyed by Jacobs in 2017. The mapped results of that survey and the outline of the excavation area are included in Figure 2-2. The intertidal zone of this parcel includes mudflats, low marsh grass and *Phragmites*.

Sediment and soil samples collected during the site investigation/characterization phase were analyzed for total PCBs. The analytical results shown in Table 2-1 were used to support remediation planning. The sample locations used to delineate the extent of PCB contamination within Parcel 25-24 are shown in Figure 2-3.

3.0 Excavation

3.1 Equipment and Site Preparation

Excavation will be conducted using an excavator mounted on an amphibious carrier (i.e., pontoons). The amphibious excavator has the capability to access the remediation area by water and will be floated into the area with the assistance of push boats. Land-based equipment (e.g., dump trucks, service equipment, etc.) will also

be used. Access to the portions of the parcel requiring remediation will be through private property that is currently under an access agreement obtained by EPA. Temporary roads will be built to create equipment access to the remediation areas. A construction site plan showing excavation areas, staging area, containment area and temporary access roads is included as Figure 3-1.

Prior to any site clearing or grubbing necessary to build the access road to the excavation areas, mature, non-invasive tree and shrub species will be marked in the field and will be preserved when possible during construction. A native tree and shrub inventory included as Appendix A was used to develop the post-excavation revegetation plan described in Section 8.1. Other vegetation will be cleared from the site as necessary to permit access road construction and remedial excavation. Disturbance of property will be minimized to the extent practicable.

3.2 Excavation Plan

Using PCB data collected through multiple rounds of sampling, a 3-dimensional excavation model was developed as depicted in the Parcel 25-24 Excavation Plan in Figure 3-2. The cut depth, areal extent of contamination and pre-excavation surface elevations for the contaminant removal areas within Parcel 25-24 are shown in Figure 3-2A (northern portion of the parcel) and Figure 3-2B (southern portion of the parcel). The total area to be excavated within the parcel is approximately 40,860 square feet (sf) and has a corresponding volume of 2,022 cubic yards (cy). An additional 71 cy of uncontaminated soil also will be excavated to achieve the restoration design described in Section 8.0. Excavation will proceed from the northwestern portion of the parcel and work toward the south. The excavation sequence may change as field work progresses to account for tidal or other site-specific constraints.

Using the existing surface elevation as the starting reference, the Excavation Plan displays (with color shading) the required depth to meet the TCL and achieve the restoration design. The excavation plan will be loaded into the excavator operator's computer that uses Real Time Kinematic (RTK) Global Positioning System (GPS) guidance system software to provide information on excavation depth and elevation. Jacobs' quality control personnel will perform visual inspections and elevation measurements using RTK GPS survey equipment.

3.2.1 Shoreline Dredging

A barge-mounted dredge was used to remove the majority of the mudflat sediments adjacent to Parcel 25-24. The landward extent of dredging is shown in Figures 3-2, 3-2A and 3-2B. Mudflat sediment that was not removed with the dredge will be removed with the amphibious excavator.

3.2.2 Amphibious Excavator

Following completion of shoreline dredging, the amphibious excavator will remove contaminated sediment in the mudflat, saltmarsh and upland areas. The excavator will progress generally from north to south, removing material in accordance with the depth and areal extent shown on the excavation plan (Figures 3-2A and 3-2B). If the *Phragmites* roots come up as a single mass that is thicker than the cut depth, the entire mass will be removed. Following excavation, the area will be smoothed with the excavator as needed to create an even surface prior to placement of backfill.

The material removed by the amphibious excavator will be allowed to drain by placing it into temporary stockpiles on unexcavated contaminated material above the Mean Higher High Water (MHHW) line. At the southern

boundary of Parcel 25-24, excavated material may be temporarily stockpiled on unexcavated contaminated material on the adjacent parcel. After initial drainage, the material will be loaded into all-terrain dump trucks for transport to a containment cell for stabilization and further drainage as described in Section 3.6 below. If excavation within the adjacent parcel does not proceed directly after Parcel 25-24, material excavated at the parcel boundary will be direct loaded into the all-terrain dump truck. If necessary, temporary construction mats will be used on top of unexcavated material to support the all-terrain dump truck.

3.3 Post-Excavation Compliance

Confirmation of compliance with the TCLs will be based on collection and analysis of confirmatory samples and verification that the target elevations necessary to achieve the cleanup standards were achieved. The confirmatory sample locations shown in Figure 3-3 include excavation sidewall and floor locations where PCB congener concentrations were previously determined to be below the TCL. Confirmatory sample locations for saltmarsh areas are spaced at approximate 100-ft. intervals along the excavation sidewall and in an approximate 100-ft. grid pattern on the excavation floor. Confirmatory samples will be analyzed for PCB congeners with a 5-day turnaround time for the analysis. Confirmatory sample locations are not needed on the western side of the excavation because it will be subtidal after excavation. Confirmatory samples for mudflats that are subtidal after excavation will be collected as part of the Upper Harbor subtidal confirmatory sampling program. Prior to backfilling with clean material in saltmarsh and upland areas, post-excavation sample results will be compared to the 50 mg/kg TCL to verify that remaining levels are less than the TCL. In addition, the elevations of the confirmatory sample locations will be measured by RTK GPS to verify that design elevations were achieved. Compaction by heavy equipment after excavation will be avoided until target elevations are confirmed by the RTK survey. A survey control table will be developed to document the elevations of the pre- and post-excavation compliance sample locations. If the PCB concentration in a post-excavation confirmatory sample exceeds the applicable TCL, additional removal and sampling will be performed as described in Section 4.5 of the *Draft Final Rev1 Generic Upper Harbor Intertidal Work Plan* (Jacobs 2019a).

3.4 Decontamination and Demobilization

Upon completion of excavation, and prior to demobilization from the area, equipment will be dry decontaminated (deconned) using hand tools and brushes to remove mud and debris. Workers performing dry decon will use appropriate personal protective equipment in accordance with the *New Bedford Harbor Superfund Site Accident Prevention Plan (Version 3)* (Jacobs 2017). To avoid spreading contaminants, tools and equipment that cannot be dry deconned at the excavation area will be wrapped with poly sheeting prior to transport to the staging area at the Area C decon facility. Equipment that is removed from the NBHSS completely to be used on other projects will be deconned at the Area C decon facility using U.S. Army Corps of Engineers, New England District (NAE)-approved solvent wash, pressure wash, steam cleaning and brush cleaning procedures.

3.5 Access Roads

A temporary gravel access road to the remediation area from Main Street, through Parcel 25-34A and Parcel 25-31 will be constructed. The approximate location of the access road is shown in Figure 3-1. The conceptual design of the access road is shown in Figure 3-4. Access road construction details may be revised to accommodate field conditions. The location and number of construction mats to be used for access road construction will be determined when the roads are cleared. The all-terrain dump truck will use the access road to transport excavated material from the excavation areas to the containment cell in the staging area described below.

3.6 Staging Area and Containment Cell

A staging area for equipment storage and placement of a containment cell for excavated material will be constructed at the location shown in Figure 3-1. The dimensions of the staging area will be approximately 70 feet (ft.) by 130 ft. as shown in the conceptual design layout in Figure 3-5. Dimensions and the final location may be altered based on field conditions. The cell will be constructed with reinforced polyethylene liner and berms designed to contain drainage water and precipitation. The cell design will include the following features:

- A sand and gravel sub-base to avoid puncture from beneath the liner;
- Berms developed from sand and gravel or other suitable material;
- Mixing scows (2) to augment the excavated material with a stabilizing agent (Portland cement (or equivalent));
- Stockpile area for loadout;
- Floor drainage sump;
- Sump pump, discharge hose and frac tank; and
- Particulate filter, granular activated carbon (GAC) filter, and discharge pump.

Excavated material will be transferred to the containment cell via all-terrain dump truck. A stabilizing agent (e.g., Portland cement) will be added to the material in a mixing scow as necessary to adsorb excess moisture. Following stabilization, the material will be loaded into dump trucks with sealed tailgates, liners and covers for loadout and disposal. A temporary access gate and warning signs will be installed near the active excavation area and the containment cell area to alert site visitors of the chemical and physical hazards on site.

Drainage water from excavated material and precipitation will collect in a sump built into the floor of the cell and will be pumped to a frac tank. After settlement in the frac tank, the water will be pumped through a particulate filter and a GAC filter prior to discharge back into the harbor. The discharge from the filter system will not exceed 50 nephelometric turbidity units (NTU). Upon completion of remedial operations, the liner, sump and GAC filter media will be disposed of as hazardous waste.

Soil samples will be collected from the staging area prior to the construction of the containment cell to establish baseline conditions following the guidelines provided in the *Draft Final Rev1 Generic Upper Harbor Intertidal Work Plan* (Jacobs 2019a). Samples will be collected from the soil under the frac tank or containment cell liner as needed during or after remedial operations if there is any evidence of punctures or leakage.

4.0 Loadout and Disposal

Excavated material stockpiled in the containment cell will be loaded into Massachusetts Department of Transportation (MADOT)-approved 30-cy dump trucks, equipped with watertight tailgate seals and liners, for transport to a truck-to-rail transload facility in Worcester, MA. At the transload facility, rail cars will be loaded, weighed, and manifested prior to travel to the Wayne Hazardous Waste Disposal facility in Belleville, MI for final disposal.

As required by the disposal facility, one representative composite sample will be collected from the excavated material and analyzed by the EPA Toxicity Characteristic Leaching Procedure (TCLP) for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), Resource Conservation and Recovery Act

(RCRA) 8 metals and total PCBs (as Aroclors). Jacobs will be responsible for sample collection and analysis and will provide the data to the waste disposal facility.

5.0 Backfill

Upon verification that compliance with the TCLs has been met, the excavation area will be backfilled with clean manufactured topsoil following the restoration plan described in Section 8.0. The topsoil will meet the quality requirements identified in the *Draft Final Topsoil Acceptance Plan* (Jacobs 2019b). Where excavation depth exceeds 1 ft., a 3-inch minus clean gravel substrate will be placed to within 1 ft. of the target grade and topsoil will be placed on top of the substrate to bring the surface to the target elevation. A specification for the gravel backfill is provided in the *Draft Final Rev1 Generic Upper Harbor Intertidal Work Plan* (Jacobs 2019a). The gravel substrate and topsoil will be delivered to the restoration areas by over-the-road dump trucks and offloaded into stockpiles near the excavation area. A clean, decontaminated all-terrain dump truck or tracked excavator will transport the topsoil for spreading. Low ground-pressure equipment and temporary construction mats (as required) will be used to minimize soil compaction during backfilling and the backfill will be placed at the farthest extents first to reduce driving over backfilled areas. Post-backfill saltmarsh topography will match the restoration surface described in Section 8.0 within a tolerance of +/-0.3 feet except in areas previously colonized by *Phragmites*, where the surface may be lower than the planned restoration surface if additional *Phragmites* root mass is removed during excavation. The surface may be restored to an elevation of 0.1 to 0.2 ft. above the planned grade to allow for natural soil compaction. During the restoration process, the elevation of the placed topsoil will be checked periodically with the GPS Rover and with the excavator bucket. Elevation measurements will be taken after each area is backfilled, prior to relocating the excavator.

6.0 Schedule

The durations of the remedial activities included in this Work Plan are listed below. A more detailed construction planning schedule will be developed prior to field activities and will be attached to this work plan as Appendix C. Daily and weekly field construction schedules will be prepared by the Jacobs field management team and will be provided to NAE and EPA before and during field construction activities. An After Action Report will be prepared upon completion of site restoration activities.

Activity	Anticipated Duration
Excavation	2 Months
Restoration	1 Months
After Action Report	3 Months

7.0 Air Monitoring

The evaluation of existing PCB congener data (Table 2-1) indicates that the maximum concentration at Parcel 25-24 is 12,740 mg/kg. As stipulated in the *NBHSS Draft Final Ambient Air Monitoring Plan for Remediation Activities Revision 2* (Jacobs 2018a), daily particulate monitoring during excavation will be conducted because the concentrations of PCBs in the sediment/soil are greater than the threshold of 500 mg/kg. Particulate and airborne PCB monitoring will be conducted in accordance with the guidelines provided in the *NBHSS Draft Final Ambient Air Monitoring Plan for Remediation Activities Revision 2* (Jacobs 2018a).

8.0 Restoration

Restoration has been planned to achieve the following objectives:

1) Restore impacted vegetated wetlands on an approximate 1:1 net basis for functions and, where possible and cost-effective, replace non-native invasive species with indigenous plants;
2) Minimize re-engineering of site topography; and
3) Emulate pre-cleanup soils, slopes and hydrology.

The pre-construction wetland cover conditions shown on Figure 2-2 include extensive stands of the non-native invasive grass *Phragmites*. *Phragmites* and other invasive species will be replaced with indigenous species of salt grass, shrubs and trees as topographically appropriate. A pre-construction tree and shrub inventory of plants within the excavation area and access road is included in Appendix A. All excavated areas except mudflats will be backfilled, regraded, and revegetated to best replicate the pre-remediation conditions and restrict the reestablishment of invasive species. The restoration surface has been designed to be lower than the current elevations on the seaward side of the parcel where possible to increase tidal inundation and discourage *Phragmites* recolonization. Engineered swales also were added to the design to increase tidal inundation. Backfill material and plant species selection will be consistent with the *Draft Final Restoration Basis of Design/Design Analysis Report (90%) Remedial Design for New Bedford Harbor Superfund Site* (FW 2002) and the pre-construction inventory. Proposed finished elevations are based generally on the pre-construction topographic survey, except as discussed above. Restored vegetation types within the remediation area are shown in plan view in Figure 8-1. An as-built conceptual cross section is provided in Figure 8-2 and construction cross sections are provided in Appendix B.

Topsoil backfill for saltmarsh and upland areas will consist of 6 to 12 inches of manufactured topsoil to support vegetation regrowth and achieve the restoration surface elevations shown in Figure 8-1. The topsoil will be sandy loam that meets the criteria included in the *Draft Final Topsoil Acceptance Plan* (Jacobs 2019b). Final graded slopes for low marsh restoration will not exceed 1V:5H to prevent tidal erosion and will not be less than 1V:15H to enable adequate drainage and prevent hypersaline conditions. Final graded slopes for high marsh areas will not exceed 1V:2H. Coir fiber rolls will be installed to dissipate wave energy at the base of the low marsh slope as shown on Figures 8-1 and 8-2 such that the top of the log is approximately at final grade. Connecting edges of the rolls will be secured together with twine or another suitable tie. All coir rolls will be staked in place with 2-inch hardwood stakes with approximate 2-ft. spacing.

The proposed post-restoration acreage of each cover type, in comparison with pre-excavation totals, is summarized in Table 8-1. Appropriate construction methodologies and environmental controls will be implemented to ensure successful establishment of the wetland restoration areas without adversely impacting safety, public health or adjacent land uses. Erosion protection measures, such as the placement of silt fence, will be implemented during the work as appropriate to prevent excessive bank scouring and erosion. Herbivory deterrents will be used to protect the seedlings during the establishment period. A combination fence and rope grid system similar to the one installed at the Pierce Mill Cove intertidal restoration area will be constructed (Jacobs, 2018b). If unforeseen conditions are identified that could affect the ability of the restoration to achieve the success standards adopted for the program, appropriate adaptive management measures will be developed and implemented in coordination with the NAE and EPA. At the conclusion of all restoration activities, final

vegetation and topographic surveys will be conducted to document the as-built elevation and vegetative cover conditions.

8.1 Revegetation

Areas will be revegetated with the appropriate plant species to reestablish the plant community composition to an approximate 1:1 basis on wetland functions and values compared to the pre-construction cover type. High marsh areas will be revegetated with 50 percent saltmeadow cordgrass (*Spartina patens*) and 50 percent coastal salt grass (*Distichlis spicata*) while areas of low marsh will be revegetated by 100 percent smooth cordgrass (*Spartina alterniflora*). Black Grass (*Juncus gerardii*) will be used as an alternative high marsh plant in the event of product availability issues. Generally, as shown in Figure 8-1, each marsh type will be planted in the areas where it was growing prior to site remediation. Planting of 2-inch diameter bare-root salt grass plugs 12 inches on center will be conducted after excavation and backfill in accordance with favorable weather conditions and within the planting season from approximately April 15 to June 30 or in the early fall. Planting of trees and shrubs will be conducted coincident with planting of salt grass. A slow-release fertilizer (type and quantity as recommended by the supplier) will be mixed into the soil used for planting the trees and shrubs. Salt grass plants will be obtained from a nursery that can provide plugs grown from a Northeastern U.S. genotype seed stock. Saltmarsh grass plantings will be installed 12 inches on center with roots separated to encourage growth.

Upland areas impacted by construction will be stabilized and seeded with the New England Conservation/Wildlife Seed Mixture (Table 8-2) as necessary to restore the areas to pre-construction conditions. The locations of proposed shrub restoration areas are shown in Figure 8-1. Shrub species identified for restoration are specified in Table 8-3 and in the Shrub Restoration Area Plantings notes included in Figure 8-1. Any native mature trees that were removed during construction will be replaced.

Phragmites are present in both dense, nearly monospecific stands and in sparse stands growing interspersed among other coastal vegetation. As indicated on Table 8-1, approximately 0.43 acres of *Phragmites* stands currently exist on the parcel. *Phragmites* that occurs within the excavation area will be removed and disposed of with the excavated sediment and replaced with the appropriate wetland species for the restored, slightly lower elevation (typically high marsh salt grass). Although a portion of the *Phragmites* root mat may remain at depth after excavation, no measures will be taken to remove or treat the residual roots and rhizomes because complete removal would require significant over-excavation and the likely presence of water in the excavation precludes other approaches such as burning root stock or broad application of herbicides. No mechanical removal of *Phragmites* is proposed outside of excavation boundaries. All remaining areas of *Phragmites* within 30 ft. of the restored marsh will be treated with herbicide as needed to promote a *Phragmites* free buffer. Treatment generally occurs when the *Phragmites* flowers in late August to early September and again two weeks after the initial treatment. The *Phragmites* control program will be implemented for five years after remediation is complete.

8.2 Monitoring and Maintenance

After upland plants are installed to restore areas impacted by construction, maintenance will include watering and weeding of tree and shrub plantings as needed to enhance survival during the establishment period. Visual field reconnaissance will be performed by an experienced environmental scientist. Invasive species regrowth controls will be implemented within the restored wetlands and immediately abutting treated areas during the first five years to contain regrowth of the wetland species *Phragmites australis*, Purple Loosestrife (*Lythrum salicaria*) and knotweed (*Polygonum cuspidatum*). Installed trees and shrubs will have a 12-month warranty period and will be

replaced and replanted by the plant supplier if found to be unhealthy. Beyond the warranty period, the allowable mortality rate is 15 percent or less for planted trees and shrubs.

All plantings and invasive species controls on the site will be monitored for the first five full growing seasons following completion of restoration. Quantitative assessments of vegetation, soils and hydrology will be completed for the first three growing seasons, and observations will occur at least two times during the growing season – in late spring/early summer and again in late summer/early fall. If the marsh grass plant mortality rate exceeds 25 percent within any wetland habitat type (i.e., low marsh and high marsh) during the first growing season, the site will be evaluated and appropriate measures will be taken to ensure successful restoration. Qualitative monitoring and invasive species controls will be completed for two additional full growing seasons following the three seasons of biannual monitoring. An Annual Monitoring Report will be prepared and submitted to the NAE and EPA.

9.0 References

U.S. Environmental Protection Agency (EPA). 1998 (September). *Record of Decision for the Upper and Lower Harbor Operable Unit, New Bedford Harbor Superfund Site*. USEPA Region 1 – New England.

Foster Wheeler (FW). 2002 (November). *Draft Final Restoration Basis of Design/Design Analysis Report (90%) Remedial Design for New Bedford Harbor Superfund Site.*

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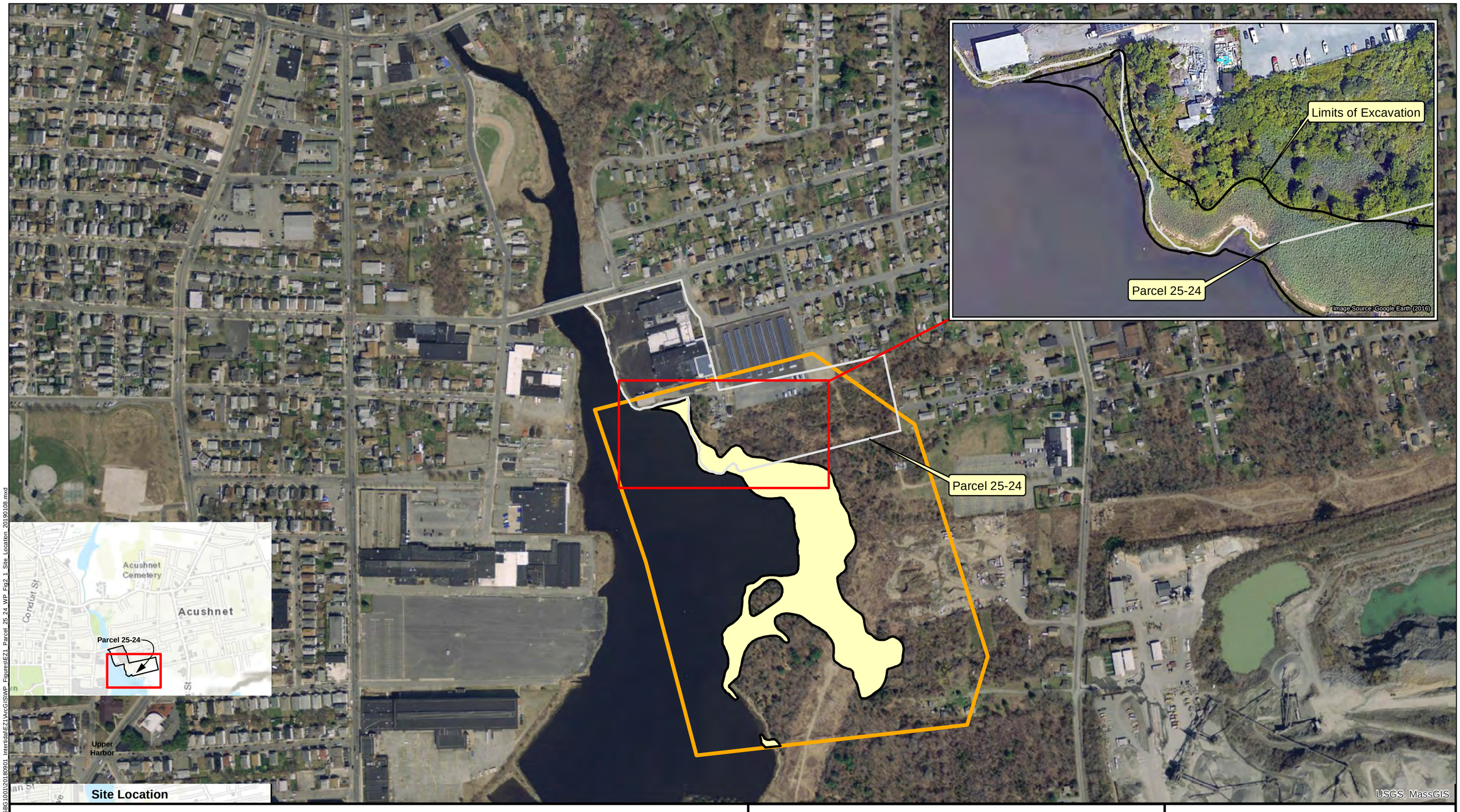
Figures



Legend

- Proposed Limits of Excavation
- Parcel Boundary
- East Zone 1 Management Area

Elevation Data NAVD88 ft

0 400 800 Feet

Basemap Data Source: MassGIS, ESRI

January 2019

Intertidal Eastern Zone 1
Parcel 25-24
Site Location and Features

New Bedford Harbor Superfund Site

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Figure 2-1

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Legend

- Mean Higher High Water
- Mean Lower Low Water
- 1-foot Contour
- Parcel Boundary
- 0-1' Excavation Depth
- 1-2' Excavation Depth
- 2-3' Excavation Depth
- 3-4' Excavation Depth
- Phragmites
- Low Marsh
- Mudflat
- Rip Rap
- Upland

January 2019

Basemap Data Source:
MassGIS, ESRI

Vertical Datum:
NAVD88

Upper Harbor East Zone 1, Parcel 25-24
Existing Vegetation and Topography

New Bedford Harbor Superfund Site

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Figure 2 -2

Legend

- Proposed Excavation Footprint
- Sample Location
- NWS Remediation Area
- Parcel Boundary
- MHHW (1.99 ft)
- MLLW (-1.97 ft)

0 120 240 Feet

Basemap Data Source:
MassGIS, ESRI

November 2018

Intertidal Eastern Zone 1
Parcel 25-24
Sampling Locations and Excavation Footprint

New Bedford Harbor Superfund Site

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Figure 2-3

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Slocum St
Tittleist Dr
Hope St
Rock St
Prouteau St
25-24
Temporary Gravel Access Road
25-31
Temporary Gravel Access Road
Approximate Frac Tank Discharge Point
East Zone 1
116-94
112-65
112-88
112-252
25-34A
Staging Area, Containment Cell and Load Out Area
S Main St
25-34
Lecuyer Ln
25-36
25-43

Legend

- Proposed Limits of Excavation
- Proposed Staging Area / Containment Cell
- MHHW (1.99 ft.)
- MLLW (-1.97 ft.)
- Temporary Gravel Access Road
- Parcel Boundary

N

Aerial Photography MassGIS 2013-2014

0 110 220 Feet

1:2,640

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Intertidal East Zone 1 Construction SIte Plan

New Bedford Harbor Superfund Site

January 2019 | Figure 3-1

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See Figure 3-2a

25-24

See Figure 3-2b

25-31

New Bedford

Acushnet

USGS, MassGIS

Legend

- Inland Reach of Dredge
- MHHW (1.99 ft.)
- MLLW (-1.97 ft.)
- Parcel Boundary

Feet of Sediment To Remove

- 4
- 3
- 2
- 1

2.1 Pre-Excavation Elevations NAVD88 ft. (Green Seal, May, 2018)

Pre-Excavation MHHW and MLLW Elevations NAVD88 ft. (Green Seal, May, 2018)

0 50 100 Feet

N

Basemap Data Source: MassGIS, ESRI

July 2019

Intertidal East Zone 1
Parcel 25-24
Excavation Plan
Showing Cut Depths and Pre-Excavation Elevations

New Bedford Harbor Superfund Site

JACOBS

Figure 3-2

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Legend

- Inland Reach of Dredge
- MHHW (1.99 ft.)
- MLLW (-1.97 ft.)
- Parcel Boundary

Feet of Sediment To Remove

- 4
- 3
- 2
- 1

2.1 Pre-Excavation Elevations NAVD88 ft. (Green Seal, May, 2018)

Pre-Excavation MHHW and MLLW Elevations NAVD88 ft. (Green Seal, May, 2018)

0 50 Feet

Basemap Data Source: MassGIS, ESRI

July 2019

Intertidal East Zone 1
Northern Portion of Parcel 25-24
Excavation Plan
Showing Cut Depths and Pre-Excavation Elevations

New Bedford Harbor Superfund Site

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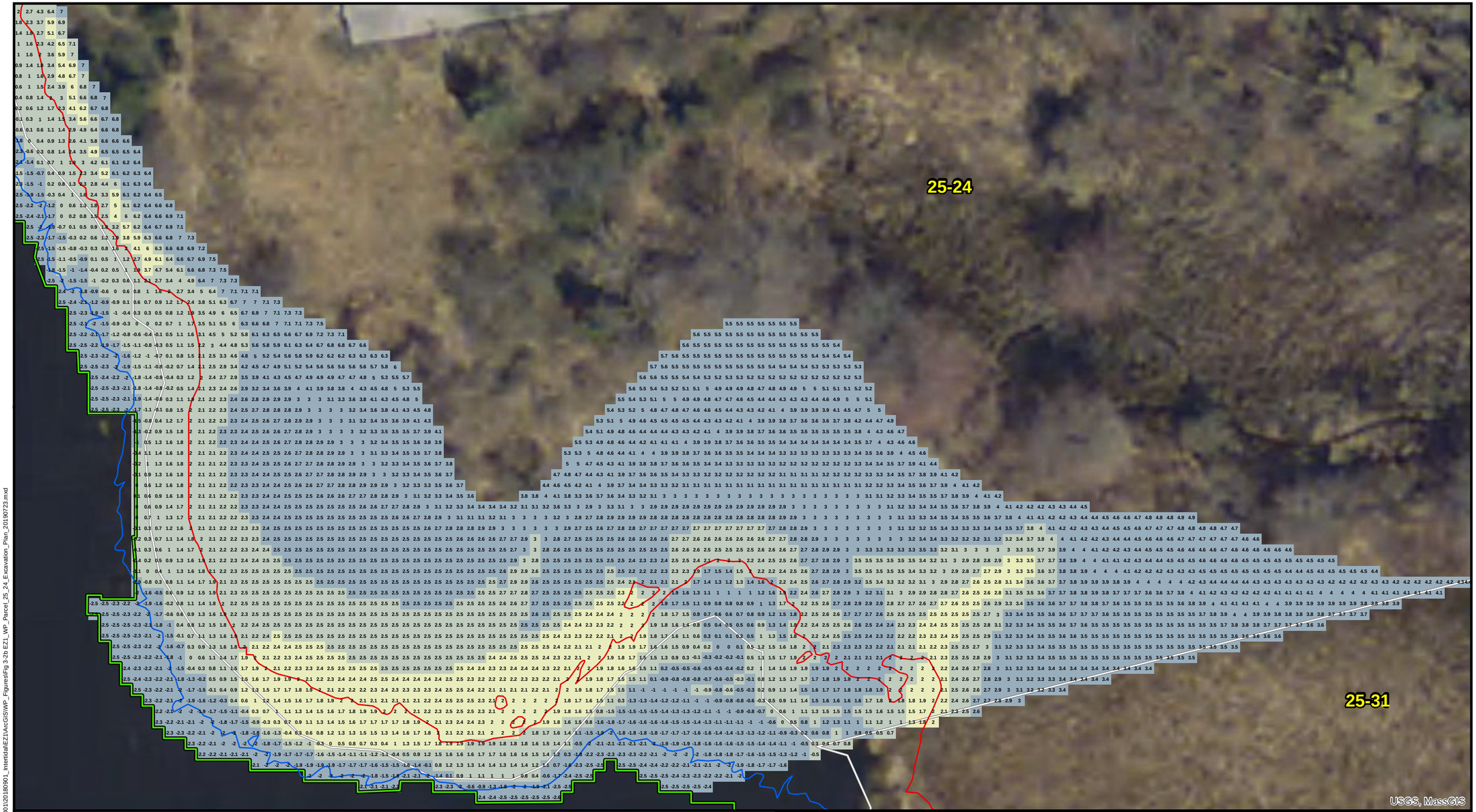
Figure 3-2a

Path: C:\Users\scottga\Documents\NBH\35BG10012018\0901_IntertidalEZ1\ArcGIS\WP_Figures\Fig 3-2a EZ1_ WP_ Parcel_ 25_ 24_ Excavation_ Plan_ 20190723.mxd



Legend

- Inland Reach of Dredge
- MHHW (1.99 ft.)
- MLLW (-1.97 ft.)
- Parcel Boundary

Feet of Sediment To Remove

- 3
- 2
- 1

2.1 Pre-Excavation Elevations NAVD88 ft. (Green Seal, May, 2018)

Pre-Excavation MHHW and MLLW Elevations NAVD88 ft. (Green Seal, May, 2018)

0 50 Feet

Basemap Data Source: MassGIS, ESRI

July 2019

Intertidal East Zone 1
Southern Portion of Parcel 25-24
Excavation Plan
Showing Cut Depths and Pre-Excavation Elevations

New Bedford Harbor Superfund Site

JACOBS

Figure 3-2b

Path: C:\Users\scottga\Documents\NBH\35BG100120180901_Intertidal\EZ1\ArcGIS\WP_Figures\Fig 3-2b EZ1_ WP_ Parcel_25_24_Excavation_Plan_20190723.mxd

ES079C
ES002
25-24
ES005
ES007
ES006
ES074
ES008
S-3231
ES009
ES013
ES010
25-31
Acushnet
New Bedford
USGS

Legend

- Sidewall Confirmatory Sample Location
- Floor Confirmatory Sample Location
- Excavation Footprint
- MHHW (1.99 ft)
- MLLW (-1.97 ft)
- Property Parcel Line

0 100 200 Feet

Basemap Data Source:
MassGIS, ESRI

December 2019

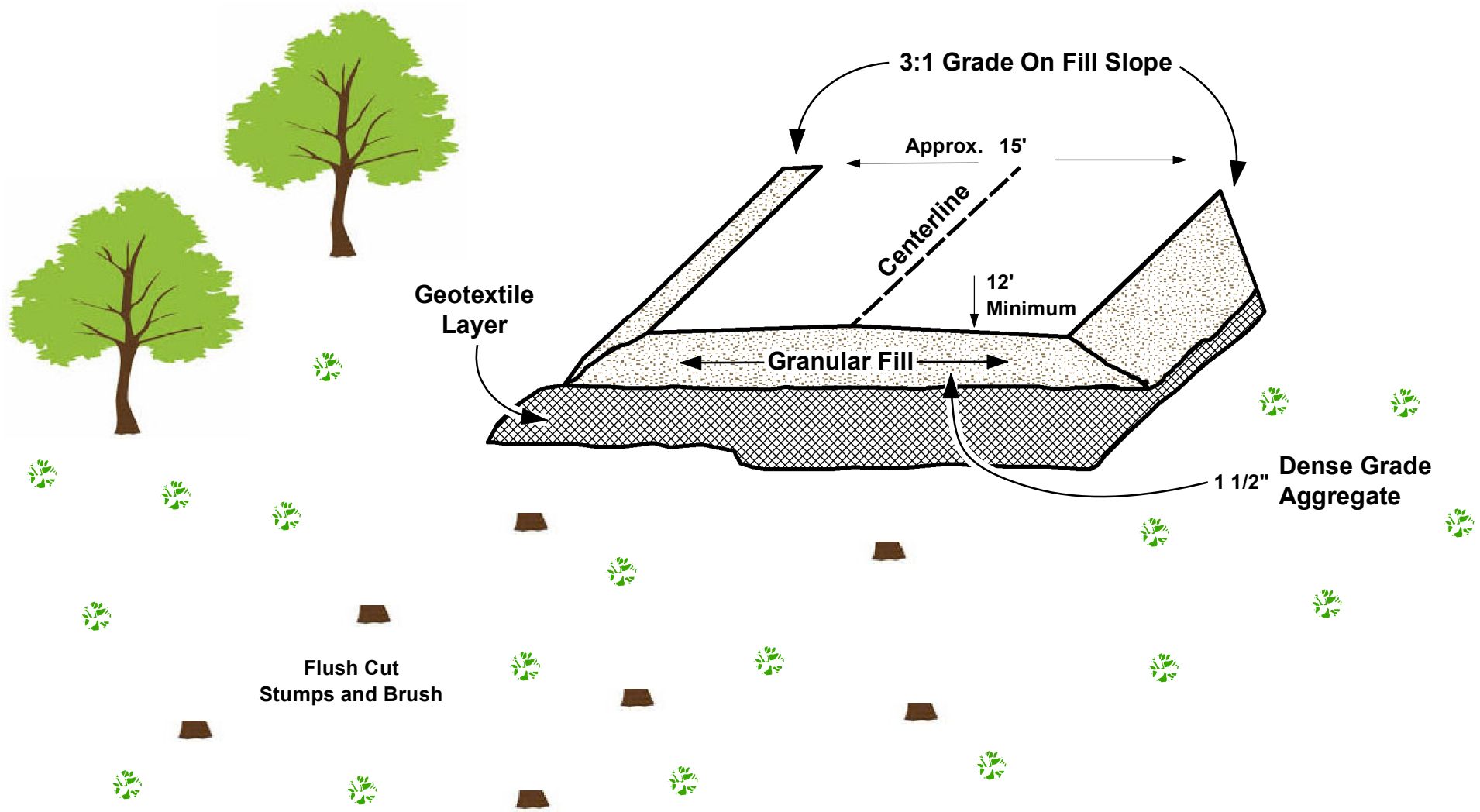
Intertidal Eastern Zone 1
Parcel 25-24
Confirmatory Sample Locations

New Bedford Harbor Superfund Site

JACOBS

Figure 3-3

Path: C:\Users\scottgal\Documents\NBH\35BG1001\20180901_IntertidalEZ1\ArcGIS\WP_Figures\EZ1_Parcel_25_24_WP_Fig3_3_Confirmatory_Sample_Locations_20181022.mxd



Note:
As an option, an underlying layer of wood chips could be added to reduce disposal cost of biomass that may be removed restoration. Off-setting construction costs may be incurred as a result.

JACOBS®

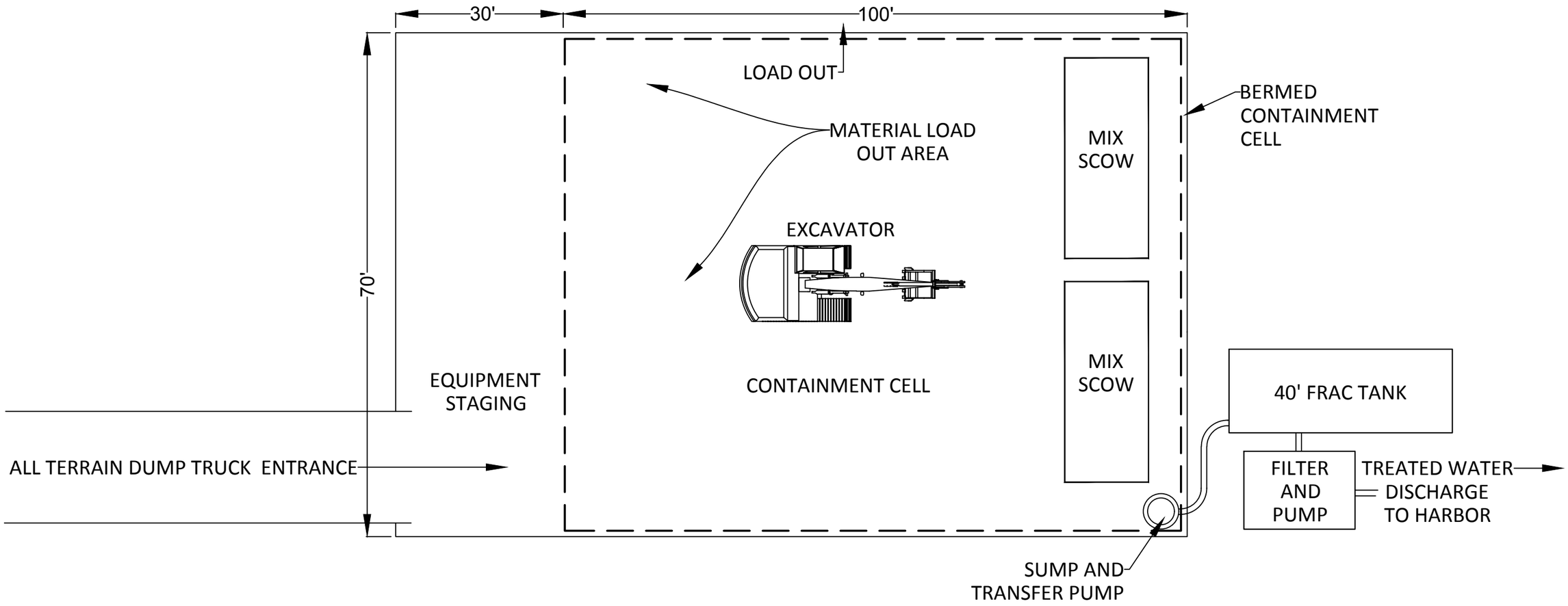
Conceptual Design
Access Road Cross Section

New Bedford Harbor Superfund Site

November 2018 | **Figure 3-4**

Path: Y:\NBH\Projects\35BG10012018090l_Interlida\EZ1\ArcGIS\WP_Figures\Fig3_4_Typical_Access_Road_Cross_Section_Conceptual_Design_20181022.mxd

ROADWAY FOR LOAD OUT - 30 CY DUMP TRAILER



Not To Scale

JACOBS™

Conceptual Staging and Containment Layout
(Subject to Field Adjustments)
Eastern Zone 1
New Bedford Harbor Superfund Site

November 2018 | Figure 3-5

Restoration Area Plantings
Area 1:
Iva frutescens (shrub), planted at edge of upland / low marsh interface, 1-gallon containers, 36" on-center spacing requirements.
Juniperus virginiana (tree), planted upland of Iva, 1-gallon containers, 48" on-center spacing requirements.

Area 2:
Iva frutescens (shrub), planted along seaward edge of area,1-gallon containers, 36" on-center spacing requirements.
Acer rubrum (tree), planted along upland edge of Iva, 1-gallon containers, 120" on-center spacing requirements.

Area 3:
Iva frutescens (shrub), planted along seaward edge,1-gallon containers, 36" on-center spacing requirements.
Clethra alnifolia (shrub), planted immediately upslope of Iva, 1-gallon containers, 48" on-center spacing requirements.
Juniperus virginiana (tree), within upland, 1-gallon containers, 48" on-center spacing requirements.
Cornus amomum (shrub), within high marsh and adjacent to toe of slope to upland, bare root, 30" on-center spacing requirements.
Rosa virginiana (shrub), mixed with Acer and within upland, 1-gallon containers, 36" on-center spacing requirements.
Acer rubrum (tree), 1-gallon containers, mixed with Rosa on upland edge,120" on-center spacing requirements.

Notes:
Proposed High Marsh plantings to include 50/50 mix of Spartina patens and Distichlis spicata, plugs, 12" on-center spacing requirements.

Proposed Low Marsh plantings to include Spartina alterniflora, plugs, 12" on-center spacing requirements.

Any native trees removed as part of access road construction or excavation will be replaced in-kind (1-gallon containers). Any invasive trees removed will be replaced on a one-to-one basis, with native tree species constituting similar growth form, habit, and size (1-gallon containers).

Areas of proposed restoration surface shall be uniformly graded with a smooth finished surface and will transition back to match existing grades upon completion of construction. Slight differences between depicted and constructed surfaces may occur due to microtopographic variations across the site.

Final elevations and/or cover types associated with the excavated Phragmites area may vary from what is shown. Final elevations and/or cover types within these areas will depend upon the amount of additional Phragmites root mass removed. Final restored elevations will be documented in the After Action Report.

MHHW and MLLW lines are approximate.

Legend

- Proposed Coir Log
- Proposed 1-foot Contours
- Mean Higher High Water
- Mean Lower Low Water
- Proposed Temporary Access Road
- 0-1' Excavation Depth
- 1-2' Excavation Depth
- 2-3' Excavation Depth
- 3-4' Excavation Depth
- Proposed Shrub Restoration Area 1
- Proposed Shrub Restoration Area 2
- Proposed Shrub Restoration Area 3
- Parcel Boundary
- Proposed High Marsh
- Mudflat / Subtidal (Minimal Backfill as Needed for Drainage or Slope Stability)
- Proposed Low Marsh
- Proposed Stream
- Proposed Upland

0 50 100 Feet

April 2019

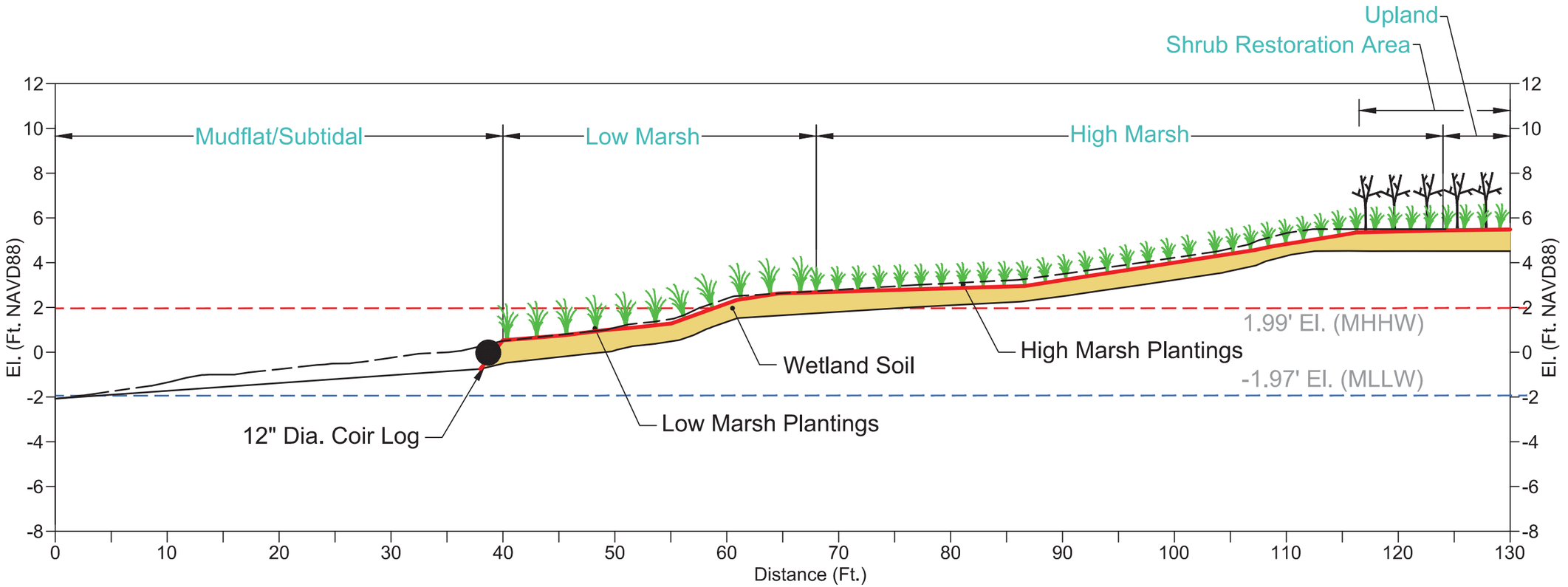
Basemap Data Source:
MassGIS

Upper Harbor East Zone 1, Parcel 25-24
Proposed Wetland Cover Types and Topography

New Bedford Harbor Superfund Site

JACOBS

Figure 8 - 1



Legend

- Pre-Construction Surface
- Bottom of Excavaton
- Post-Construction Surface
- (MHHW) Mean Higher High Water
- (MLLW) Mean Lower Low Water

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Upper Harbor East Zone 1
Conceptual Cross Section
New Bedford Harbor Superfund Site

11/02/18 25-24 & 24-31.dwg

Figure 8-2

Tables

Table 2-1
Parcel 25-24 Pre-Excavation PCB Characterization Sample Results

Parcel	Type	Sample ID	Station ID	Sample Depth Top (ft)	Sample Depth Bottom (ft)	Sample Date	Description	Total PCB (mg/kg)	Final Qualifier
25-24	Mudflat	S-ES001-18FSP4-10-20	ES001	1.0	2.0	3/12/2018	Sum 209 PCB congeners	0.613	
25-24	Mudflat	S-ES001-18FSP4-20-30	ES001	2.0	3.0	3/12/2018	Sum 209 PCB congeners	0.548	
25-24	Saltmarsh	S-ES002-18FSP4-00-10	ES002	0.0	1.0	3/7/2018	Sum 209 PCB congeners	1.01	
25-24	Mudflat	S-ES003-18FSP4-10-20	ES003	1.0	2.0	3/20/2018	Sum 209 PCB congeners	0.124	
25-24	Mudflat	S-ES003-18FSP4-20-30	ES003	2.0	3.0	3/20/2018	Sum 209 PCB congeners	0.0682	
25-24	Mudflat	S-ES004-18FSP4-10-20	ES004	1.0	2.0	3/22/2018	Sum 209 PCB congeners	0.0745	
25-24	Mudflat	S-ES004-18FSP4-20-30	ES004	2.0	3.0	3/22/2018	Sum 209 PCB congeners	0.08	
25-24	Saltmarsh	S-ES005-18FSP4-00-10	ES005	0.0	1.0	3/7/2018	Sum 209 PCB congeners	0.455	
25-24	Saltmarsh	S-ES006-18FSP4-00-10	ES006	0.0	1.0	3/15/2018	Sum 209 PCB congeners	5.42	
25-24	Saltmarsh	S-ES007-18FSP4-00-10	ES007	0.0	1.0	3/7/2018	Sum 209 PCB congeners	0.761	
25-24	Saltmarsh	S-ES008-18FSP4-00-10	ES008	0.0	1.0	3/8/2018	Sum 209 PCB congeners	0.329	
25-24	Saltmarsh	S-ES009-18FSP4-10-20	ES009	1.0	2.0	3/8/2018	Sum 209 PCB congeners	29.8	
25-24	Saltmarsh	S-ES009-18FSP4-20-30	ES009	2.0	3.0	3/8/2018	Sum 209 PCB congeners	19.8	
25-24	Saltmarsh	S-ES010-18FSP4-10-20	ES010	1.0	2.0	3/20/2018	Sum 209 PCB congeners	0.223	
25-24	Saltmarsh	S-ES010-18FSP4-20-30	ES010	2.0	3.0	3/20/2018	Sum 209 PCB congeners	0.135	
25-24	Saltmarsh	S-ES010-18FSP4-30-32	ES010	3.0	3.2	3/20/2018	Sum 209 PCB congeners	3.62	
25-24	Saltmarsh	S-ES013-18FSP4-10-20	ES013	1.0	2.0	3/7/2018	Sum 209 PCB congeners	113	
25-24	Saltmarsh	S-ES013-18FSP4-20-29	ES013	2.0	2.9	3/7/2018	Sum 209 PCB congeners	158	
25-24	Saltmarsh	S-ES013-18FSP4-30-40	ES013	3.0	4.0	5/16/2018	Sum 209 PCB congeners	11.8	
25-24	Mudflat	S-ES014-18FSP4-10-20	ES014	1.0	2.0	3/7/2018	Sum 209 PCB congeners	0.00713	
25-24	Mudflat	S-ES014-18FSP4-20-30	ES014	2.0	3.0	3/7/2018	Sum 209 PCB congeners	0.0779	
25-24	Saltmarsh	S-ES074-18FSP4-10-20	ES074	1.0	2.0	4/16/2018	Sum 209 PCB congeners	12.2	
25-24	Saltmarsh	S-ES079-18FSP4-10-20	ES079	1.0	2.0	4/16/2018	Sum 209 PCB congeners	728	
25-24	Saltmarsh	S-ES079-18FSP4-20-30	ES079	2.0	3.0	4/16/2018	Sum 209 PCB congeners	1380	
25-24	Saltmarsh	S-ES079-18FSP4-30-40	ES079	3.0	4.0	5/16/2018	Sum 209 PCB congeners	140	
25-24	Saltmarsh	S-ES079C-18FSP4-40-50	ES079C	4.0	5.0	6/14/2018	Sum 209 PCB congeners	2.12	
25-24	Saltmarsh	S-ES079C-18FSP4-50-60	ES079C	5.0	6.0	6/14/2018	Sum 209 PCB congeners	0.00351	
25-24	Saltmarsh	S-ES079C-18FSP4-60-65	ES079C	6.0	6.5	6/14/2018	Sum 209 PCB congeners	0.0542	
25-24	Saltmarsh	S-ES084-18FSP4-35-45	ES084	3.5	4.5	6/14/2018	Sum 209 PCB congeners	2.28	
25-24	Saltmarsh	S-ES084-18FSP4-45-50	ES084	4.5	5.0	6/14/2018	Sum 209 PCB congeners	0.415	
25-24	Saltmarsh	S-ES084-18FSP4-50-60	ES084	5.0	6.0	6/14/2018	Sum 209 PCB congeners	0.53	
25-24	Saltmarsh	S-ES084-18FSP4-60-70	ES084	6.0	7.0	6/14/2018	Sum 209 PCB congeners	0.347	
25-24	Mudflat	S-15A-INT01-00-10	INT01	0.0	1.0	4/21/2015	Aroclor 1254 - Immunoassay	1910	D
25-24	Mudflat	S-15A-INT01-10-20	INT01	1.0	2.0	4/21/2015	Aroclor 1254 - Immunoassay	3.20	
25-24	Saltmarsh	S-15A-INT02-00-10	INT02	0.0	1.0	4/15/2015	Aroclor 1254 - Immunoassay	962	D
25-24	Saltmarsh	S-15A-INT02-10-20	INT02	1.0	2.0	4/15/2015	Aroclor 1254 - Immunoassay	4.30	
25-24	Saltmarsh	S-15A-INT03-00-10	INT03	0.0	1.0	4/15/2015	Aroclor 1254 - Immunoassay	1217	D
25-24	Saltmarsh	S-15A-INT03-10-20	INT03	1.0	2.0	4/15/2015	Aroclor 1254 - Immunoassay	3.90	
25-24	Saltmarsh	S-15A-INT04-00-10	INT04	0.0	1.0	4/15/2015	Aroclor 1254 - Immunoassay	2.30	
25-24	Saltmarsh	S-15A-INT04-10-17	INT04	1.0	1.7	4/15/2015	Aroclor 1254 - Immunoassay	1.50	
25-24	Saltmarsh	S-15A-INT05-00-10	INT05	0.0	1.0	4/15/2015	Aroclor 1254 - Immunoassay	3918	D

Table 2-1
Parcel 25-24 Pre-Excavation PCB Characterization Sample Results

Parcel	Type	Sample ID	Station ID	Sample Depth Top (ft)	Sample Depth Bottom (ft)	Sample Date	Description	Total PCB (mg/kg)	Final Qualifier
25-24	Saltmarsh	S-15A-INT05-10-20	INT05	1.0	2.0	4/15/2015	Aroclor 1254 - Immunoassay	4.10	
25-24	Saltmarsh	S-15A-INT13-00-10	INT13	0.0	1.0	4/16/2015	Aroclor 1254 - Immunoassay	0.90	
25-24	Saltmarsh	S-15A-INT13-10-20	INT13	1.0	2.0	4/16/2015	Aroclor 1254 - Immunoassay	1.20	
25-24	Saltmarsh	S-17Y-INT416-00-10	INT416	0.0	1.0	5/25/2017	Aroclor 1254 - Immunoassay	584	D
25-24	Saltmarsh	S-17Y-INT416-10-20	INT416	1.0	2.0	5/25/2017	Aroclor 1254 - Immunoassay	123	D
25-24	Saltmarsh	S-17Y-INT417-00-10	INT417	0.0	1.0	5/25/2017	Aroclor 1254 - Immunoassay	7.9	D
25-24	Saltmarsh	S-17Y-INT417-10-20	INT417	1.0	2.0	5/25/2017	Aroclor 1254 - Immunoassay	1.2	
25-24	Saltmarsh	S-0021-1	S-21	0.0	1.0	8/31/1999	Sum 18 NOAA PCB congeners X factor	1800	
25-24	Saltmarsh	S-0021-2	S-21	1.0	2.0	8/31/1999	Sum 18 NOAA PCB congeners X factor	230	
25-24	Saltmarsh	S-0021-3DUP	S-21	2.0	3.0	8/31/1999	Sum 18 NOAA PCB congeners X factor	1.70	
25-24	Saltmarsh	S-0021-3	S-21	2.0	3.0	8/31/1999	Sum 18 NOAA PCB congeners X factor	1.60	
25-24	Saltmarsh	S-0024-1	S-24	0.0	1.0	8/31/1999	Sum 18 NOAA PCB congeners X factor	4800	
25-24	Saltmarsh	S-0024-2	S-24	1.0	2.0	8/31/1999	Sum 18 NOAA PCB congeners X factor	430	
25-24	Saltmarsh	S-0024-3	S-24	2.0	3.0	8/31/1999	Sum 18 NOAA PCB congeners X factor	9.30	
25-24	Saltmarsh	S-0025-2	S-25	1.0	2.0	9/3/1999	Sum 18 NOAA PCB congeners X factor	450	
25-24	Saltmarsh	S-0026-1	S-26	0.0	1.0	9/9/1999	Sum 18 NOAA PCB congeners X factor	800	
25-24	Saltmarsh	S-0026-2	S-26	1.0	2.0	9/9/1999	Sum 18 NOAA PCB congeners X factor	240	
25-24	Saltmarsh	S-0026-3DUP	S-26	2.0	3.0	9/9/1999	Sum 18 NOAA PCB congeners X factor	300	
25-24	Saltmarsh	S-0026-3	S-26	2.0	3.0	9/9/1999	Sum 18 NOAA PCB congeners X factor	110	
25-24	Saltmarsh	S-3229-0.0-1.0	S-3229	0.0	1.0	10/24/2001	Sum 18 NOAA PCB congeners X 2.6	133	
25-24	Saltmarsh	S-3231-0.0-1.0	S-3231	0.0	1.0	10/24/2001	Sum 18 NOAA PCB congeners X 2.6	107	
25-24	Saltmarsh	S-3231-1.0-2.0	S-3231	1.0	2.0	10/24/2001	Sum 18 NOAA PCB congeners X 2.6	4.16	
25-24	Mudflat	S-3236-0.8-1.3	S-3236	0.8	1.3	9/4/2001	Sum 18 NOAA PCB congeners X 2.6	3.64	
25-24	Mudflat	S-3236-0.8-1.3REP	S-3236	0.8	1.3	9/4/2001	Sum 18 NOAA PCB congeners X 2.6	2.60	
25-24	Saltmarsh	S-3237-0.0-1.0REP	S-3237	0.0	1.0	10/25/2001	Sum 18 NOAA PCB congeners X 2.6	12740	
25-24	Saltmarsh	S-3237-0.0-1.0	S-3237	0.0	1.0	10/25/2001	Sum 18 NOAA PCB congeners X 2.6	11440	
25-24	Saltmarsh	S-3656-0.0-1.0	S-3656	0.0	1.0	11/15/2001	Sum 18 NOAA PCB congeners X 2.6	0.47	
25-24	Saltmarsh	S-3656-1.0-2.0	S-3656	1.0	2.0	11/15/2001	Sum 18 NOAA PCB congeners X 2.6	0.19	
25-24	Saltmarsh	S-3656-2.0-3.0	S-3656	2.0	3.0	11/15/2001	Sum 18 NOAA PCB congeners X 2.6	4.16	
25-24	Saltmarsh	S-3659-0.0-1.0	S-3659	0.0	1.0	11/14/2001	Sum 18 NOAA PCB congeners X 2.6	21.1	
25-24	Saltmarsh	S-3659-1.0-2.0	S-3659	1.0	2.0	11/14/2001	Sum 18 NOAA PCB congeners X 2.6	1.46	
25-24	Saltmarsh	S-3661-0.0-1.0	S-3661	0.0	1.0	10/5/2001	Sum 18 NOAA PCB congeners X 2.6	3.90	
25-24	Saltmarsh	S-3662-0.0-.6	S-3662	0.0	0.6	10/5/2001	Sum 18 NOAA PCB congeners X 2.6	0.75	
25-24	Saltmarsh	S-3662-.6-1.0	S-3662	0.6	1.0	10/5/2001	Sum 18 NOAA PCB congeners X 2.6	1.87	
25-24	Saltmarsh	S-3663-0.0-1.0	S-3663	0.0	1.0	10/24/2001	Sum 18 NOAA PCB congeners X 2.6	0.12	
25-24	Saltmarsh	S-3663-0.0-1.0REP	S-3663	0.0	1.0	10/24/2001	Sum 18 NOAA PCB congeners X 2.6	0.12	
25-24	Saltmarsh	S-3664-0.0-.5	S-3664	0.0	0.5	10/24/2001	Sum 18 NOAA PCB congeners X 2.6	12.0	
25-24	Saltmarsh	S-3664-2.0-3.0	S-3664	2.0	3.0	10/24/2001	Sum 18 NOAA PCB congeners X 2.6	31.2	
25-24	Saltmarsh	S-0724-1	S-724	0.0	1.0	10/3/2000	Sum 18 NOAA PCB congeners X 2.6	0.36	
25-24	Saltmarsh	S-0724-2	S-724	1.0	2.0	10/3/2000	Sum 18 NOAA PCB congeners X 2.6	0.44	
25-24	Saltmarsh	S-0729-1	S-729	0.0	1.0	10/3/2000	Sum 18 NOAA PCB congeners X 2.6	12.2	

Table 2-1
Parcel 25-24 Pre-Excavation PCB Characterization Sample Results

Parcel	Type	Sample ID	Station ID	Sample Depth Top (ft)	Sample Depth Bottom (ft)	Sample Date	Description	Total PCB (mg/kg)	Final Qualifier
25-24	Saltmarsh	S-0729-2	S-729	1.0	2.0	10/3/2000	Sum 18 NOAA PCB congeners X 2.6	0.70	
25-24	Saltmarsh	S-0730-1	S-730	0.0	1.0	10/3/2000	Sum 18 NOAA PCB congeners X 2.6	5460	
25-24	Saltmarsh	S-0730-2	S-730	1.0	2.0	10/3/2000	Sum 18 NOAA PCB congeners X 2.6	28.6	
25-24	Saltmarsh	S-0730-3	S-730	2.0	3.0	10/3/2000	Sum 18 NOAA PCB congeners X 2.6	1.74	

Notes:
D - reported value is from a dilution.
Pre-excavation confirmatory congener samples are highlighted green.

Table 8-1
Pre- and Post-Excavation Restoration Vegetation Types

Habitat Type within Excavation Boundary	Existing Areas [acres]	Proposed Area of Restoration [acres]
Upland	0.111	0.111
Low Marsh	0.179	0.300
Mudflat	0.208	0.000
High Marsh	0.000	0.298
Stream	0.000	0.003
Phragmites	0.427	0.000
TOTAL	**0.925**	**0.712**

Note: Actual restored mudflat acreage will depend on final as-built conditions.

Table 8-2
New England Conservation/Wildlife Seed Mixture[1]

Botanical Name	Common Name	Wetland Indicator Status
Elymus virginicus	Virginia Wild Rye	FACW-
Schizachyrium scoparium	Little Bluestem	FACU
Festuca rubra	Red Fescue	FACU
Andropogon gerardii	Big Bluestem	FAC
Chamaecrista fasciculata	Partridge Pea	FACU
Desmodium canadense	Showy Tick Trefoil	FAC
Panicum virgatum	Switch Grass	FAC
Sorghastrum nutans	Indian Grass	UPL
Asclepias tuberosa	Butterfly Milkweed	NI
Biddens frondosa	Beggar Ticks	FACW
Rudbeckia hirta	Black Eyed Susan	FACU-
Eupatorium purpureum (Eutrochium maculatum)	Purple Joe Pye Weed	FAC
Solidago juncea	Early Goldenrod	n/a
Aster pilosus (Symphyotrichum pilosum)	Heath (or Hairy) Aster	UPL

[1] *New England Wetland Plants, Inc. may modify seed mixes at any time depending on seed avaliability (current on 9-2018)*

Table 8-3
Parcel 25-24 Shrub Restoration Summary

Scientific Name	Common Name	On-Center Spacing Requirements (inches)	Number of Proposed Plants	Shrub Restoration Area
Iva frutescens	high-tide bush	36"	355	Area 1
Juniperus virginiana	eastern red cedar	48"	128	Area 1
Iva frutescens	high-tide bush	36"	50	Area 2
Acer rubrum	red maple	120"	5	Area 2
Iva frutescens	high-tide bush	36"	38	Area 3
Clethra alnifolia	sweet pepperbush	48"	22	Area 3
Juniperus virginiana	eastern red cedar	48"	14	Area 3
Cornus amomum	silky dogwood	30"	22	Area 3
Rosa virginiana	Virginia rose	36"	38	Area 3
Acer rubrum	red maple	120"	3	Area 3
Total Proposed Trees/Shrubs for Parcel 25-24			**675**	

Appendix A

Parcel 25-24 Pre-Excavation Tree and Shrub Inventory

JACOBS

Memorandum

Subject	Parcel 25-24 Native Tree and Shrub Inventory	**Project Name**	New Bedford Harbor Superfund Site
Attention	Marie Esten, USACE	**Project No.**	35BG2000
From	Jessica Rebholz/Kim Degutis	**Document Control No.**	ACE-J23-35BG2000-M17-0121
Date	16 June 2018		

Attachments: Figure 1 Existing Trees and Shrubs, Parcels 25-24, Tables 3-1 through 3-4 (inventory results)

1.0 Background

Jacobs completed an inventory of existing trees and shrubs on Parcel 25-24 in the intertidal remediation area (Figure 1) on 31 May 2018. The purpose of the inventory was to identify existing trees and shrubs that would be removed in association with site remediation activities, including construction of the gravel access road and clearing for areas of excavation associated with contaminated sediment and soil removal. The information collected from this inventory is intended to be used to inform selection of proposed native woody species for future restoration plantings.

2.0 Methods

For the purposes of the inventory, trees were defined as any nonclimbing, woody plant that had at least one erect perennial stem (trunk) with a diameter at breast height (DBH) of 3.0 inches or greater, regardless of height. Jacobs' wetland biologists walked the planned remediation portions of Parcel 25-34 and identified all trees within the proposed excavation area and proposed access road. Tree locations were recorded using a Trimble Geo 7X GPS, capable of sub-meter accuracy.

For the purposes of the inventory, shrubs were defined as any nonclimbing, woody plant with a DBH less than 3.0 inches. Shrubs were inventoried according to dominant shrub types that appeared to constitute similar species diversity and percent areal cover. For purposes of documentation and reference, the results of the tree and shrub inventories are recorded by sub-area in separate tables included in Section 3 below.

3.0 Results

Eastern red cedar (*Juniperus virginiana*) is the dominant tree type within the inventoried area on Parcel 25-24. A total of 43 trees were inventoried on Parcel 25-24. The majority of the trees identified are considered native and non-invasive. A list of the trees identified is provided in Table 3-1. For each species, the number of individual trees noted was calculated as an indication of the relative dominance of the species on-site.

High-tide bush (*Iva frutescens*) is the dominant shrub type on Parcel 25-24. The majority of the shrubs identified are considered native and non-invasive (see Tables 3-2, 3-3 and 3-4). High-tide bush is a native, non-invasive upper saltmarsh plant typically found in wetlands.

Areas where shrubs were identified and inventoried are identified on Figure 1. Shrubs were classified by genus and when possible, species. Tables 3-2 through 3-4 also identify whether the shrubs occurred in upland or wetland areas.

4.0 Conclusion

The species makeup of Parcel 25-24 is comprised almost entirely of native, non-invasive trees and shrubs, with Iva frutescens being the dominant shrub and Juniperus virginiana being the dominant tree.

Legend

- Red cedar
- White pine
- Highbush blueberry
- Northern catalpa
- Siberian crab apple
- White oak
- White ash
- Black locust
- Black cherry
- Red maple
- White poplar
- Silky dogwood
- Russian olive
- Silky willow
- Staghorn sumac
- Inventoried Shrub Areas
- 0-1' Excavation Depth
- EZ1 Proposed Access Road
- MHHW
- MLLW
- Parcel Boundary

0 50 100 200 Feet

N

January 2019

Basemap Data Source:
MassGIS, ESRI

Parcel 25-24
Existing Trees and Shrubs

New Bedford Harbor Superfund Site

JACOBS

Figure 1

Table 3-1
Existing Tree Inventory for Parcel 25-24

Scientific Name	Common Name	Tree Count (≥3" DBH)[1]	Invasive[2]	Native/Non-Native[3]
Robinia pseudoacacia	black locust	1	yes	non-native, county documented
Acer rubrum	red maple	4	no	native, county documented
Catalpa speciosa	northern catalpa	1	no	non-native, state documented
Juniperus virginana	eastern red cedar	14	no	native, county documented
Prunus serotina	black cherry	5	no	native, county documented
Pyrus malus	crab apple	2	no	non-native, state documented
Quercus alba	white oak	1	no	native, county documented
Pinus strobus	white pine	1	no	native, county documented
Vaccinium corymbosum	highbush blueberry	4	no	native, county documented
Populus alba	white poplar	1	no	non-native, county documented
Elaeagnus angustifolia	Russian olive	2	yes	non-native, county documented
Salix sericea	silky willow	4	no	native, county documented
Fraxinus americana	white ash	1	no	native, county documented
Cornus amomum	silky dogwood	1	no	native, county documented
Rhus hirta	staghorn sumac	1	no	native, county documented
	Total	**43**		

Table 3-2
Existing Shrub Cover for Parcel 25-24, Area 1

Scientific Name	Common Name	Percent Areal Cover	Invasive[1]	Native/Non-Native[2]	Upland/Wetland
Juniperus virginana	eastern red cedar	15%	no	native, county documented	upland
Lonicera morrowii	Morrow's honeysuckle	10%	yes	non-native, county documented	upland
Rosa palustris	swamp rose	15%	no	native, county documented	upland
Rhus hirta	staghorn sumac	10%	no	native, county documented	upland
Elaeagnus angustifolia	Russian olive	20%	yes	non-native, state documented	upland
Pyrus malus	crab apple	5%	no	non-native, state documented	upland
Iva frutescens	high-tide bush	30%	no	native, county documented	wetland

[1]According to USDA, NRCS. 2018. The PLANTS Database (http://plants.usda.gov, 3 October 2018). National Plant Data Team, Greensboro, NC 27401-4901 USA.

[2]New England Wildflower Society. 2011. Go Botany, 12 April 2018 (https://gobotany.newenglandwild.org/). New England Wildflower Society, Framingham, MA

Table 3-3
Existing Shrub Cover for Parcel 25-24, Area 2

Scientific Name	Common Name	Percent Areal Cover	Invasive[1]	Native/Non-Native[2]	Upland/Wetland
Juniperus virginana	eastern red cedar	2%	no	native, county documented	upland
Lonicera morrowii	Morrow's honeysuckle	5%	yes	non-native, county documented	both
Rosa palustris	swamp rose	15%	no	native, county documented	upland
Cornus amomum	silky dogwood	10%	no	native, county documented	wetland
Clethra alnifolia	sweet pepperbush	10%	no	native, county documented	wetland
Iva frutescens	high-tide bush	25%	no	native, county documented	wetland
Viburnum dentatum	southern arrowwood	5%	no	native, county documented	wetland
Acer rubrum	red maple	5%	no	native, county documented	wetland

[1]According to USDA, NRCS. 2018. The PLANTS Database (http://plants.usda.gov, 3 October 2018). National Plant Data Team, Greensboro, NC 27401-4901 USA.

[2]New England Wildflower Society. 2011. Go Botany, 12 April 2018 (https://gobotany.newenglandwild.org/). New England Wildflower Society, Framingham, MA

Table 3-4
Existing Shrub Cover for Parcel 25-24, Area 3

Scientific Name	Common Name	Percent Areal Cover	Invasive[1]	Native/Non-Native[2]	Upland/Wetland	Notes
Juniperus virginana	eastern red cedar	1%	no	native, county documented	upland	
Prunus serotina	black cherry	1%	no	native, county documented	upland	
Cornus florida	flowering dogwood	1%	no	native, county documented	upland	
Lonicera morrowii	Morrow's honeysuckle	10%	yes	native, county documented	upland	
Iva frutescens	high-tide bush	30%	no	native, county documented	wetland	High-tide bush occurs at the slope break.
Clethra alnifolia	sweet pepperbush	5%	no	native, county documented	wetland	
Viburnum dentatum	southern arrowwood	5%	no	native, county documented	wetland	
Carpinus caroliniana	ironwood	2%	no	native, county documented	wetland	
Acer rubrum	red maple	10%	no	native, county documented	wetland	

[1]According to USDA, NRCS. 2018. The PLANTS Database (http://plants.usda.gov, 3 October 2018). National Plant Data Team, Greensboro, NC 27401-4901 USA.

[2]New England Wildflower Society. 2011. Go Botany, 12 April 2018 (https://gobotany.newenglandwild.org/). New England Wildflower Society, Framingham, MA

Appendix B
Cross Sections

A

A'

LOW MARSH

MUDFLAT

LOW MARSH

UPLAND

EXISTING SURFACE

RESTORED SURFACE

℄ STREAM

MHHW 1.99

MLLW -1.97

EXCAVATION LIMITS

ELEVATION (FT. NAVD88)

8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5

0+00
0+10
0+20
0+30
0+40
0+50
0+60
0+70
0+80

DISTANCE (FT.)

LEGEND:

MHHW (1.99 FT)

MLLW (-1.97 FT)

TOPSOIL BACKFILL

GRAVEL BACKFILL

NOTES:

1) The existing surface is shown where it is different from the restored surface.
2) Mudflats will be backfilled to pre-excavation elevations to approximately 10 feet seaward of the coir logs installed at the low marsh/mudflat boundary, then sloped downward to meet the existing harbor bottom.

0 1 2 3
1" = 3' VERTICAL

0 2 4 6
1" = 6' HORIZONTAL

JACOBS™

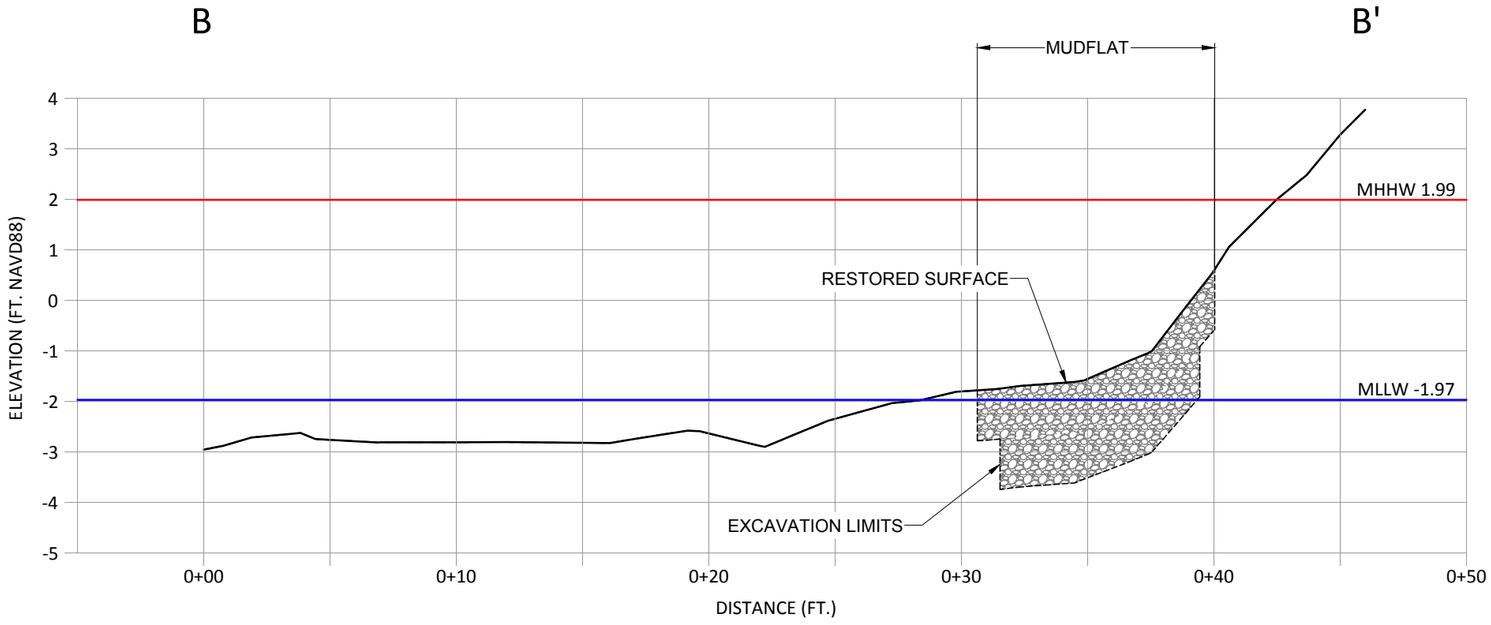
EAST ZONE 1
PARCEL 25-24
SECTION A-A'

NEW BEDFORD HARBOR

JANUARY 2019

FIGURE 1

last modified: 04/05/19 printed: 04/05/19 by sc C:\Users\scottga\Documents\NBH\35BG100120180901_Intertidal\EZ1\AutoCAD\Parcel 25-24\Parcel 25-24 Sections 2x vertical exag 20190404.dwg



LEGEND:

- MHHW (1.99 FT)
- MLLW (-1.97 FT)
- TOPSOIL BACKFILL
- GRAVEL BACKFILL

NOTES:

1) The existing surface is shown where it is different from the restored surface.
2) Mudflats will be backfilled to pre-excavation elevations to approximately 10 feet seaward of the coir logs installed at the low marsh/mudflat boundary, then sloped downward to meet the existing harbor bottom.

0 1 2 3
1" = 3' VERTICAL

0 2 4 6
1" = 6' HORIZONTAL

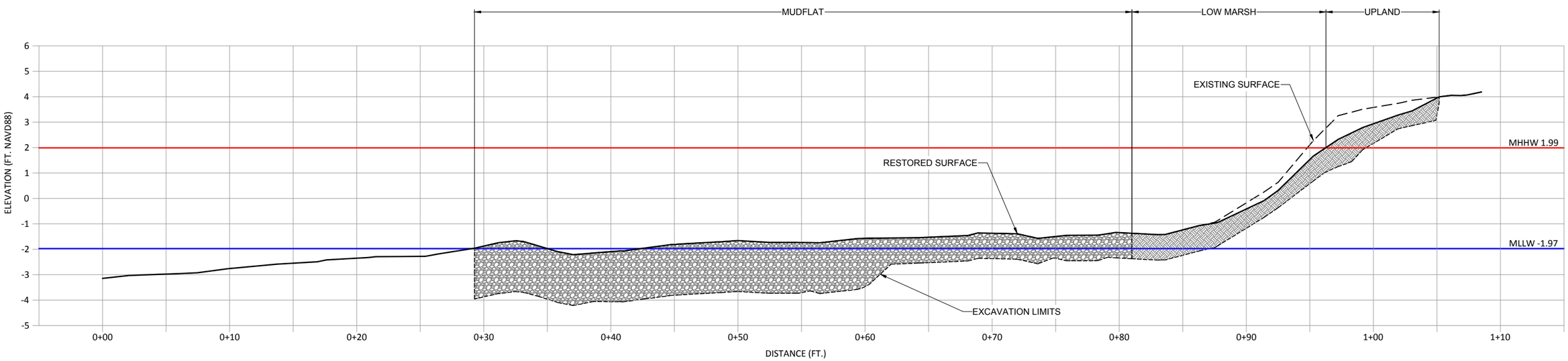
JACOBS™

EAST ZONE 1
PARCEL 25-24
SECTION B-B'
NEW BEDFORD HARBOR

JANUARY 2019 | FIGURE 2

C

C'



LEGEND:

- MHHW (1.99 FT)
- MLLW (-1.97 FT)
- TOPSOIL BACKFILL
- GRAVEL BACKFILL

0 1 2 3 4
1" = 4' VERTICAL

0 2 4 6 8
1" = 8' HORIZONTAL

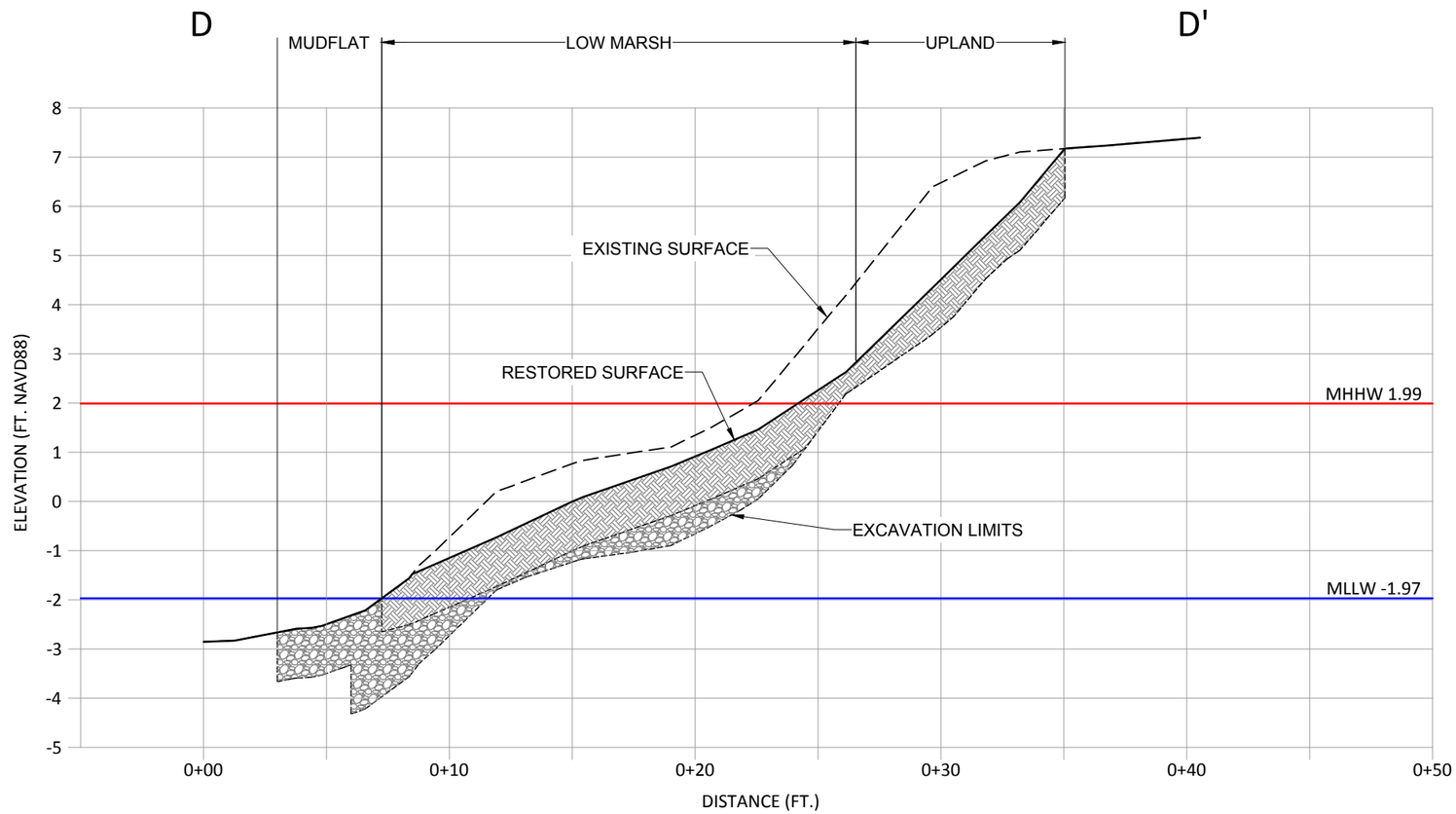
NOTES:

1) The existing surface is shown where it is different from the restored surface.
2) Mudflats will be backfilled to pre-excavation elevations to approximately 10 feet seaward of the coir logs installed at the low marsh/mudflat boundary, then sloped downward to meet the existing harbor bottom.

JACOBS™

EAST ZONE 1
PARCEL 25-24
SECTION C-C'
NEW BEDFORD HARBOR

JANUARY 2019 | FIGURE 3



LEGEND:

- MHHW (1.99 FT)
- MLLW (-1.97 FT)
- TOPSOIL BACKFILL
- GRAVEL BACKFILL

NOTES:

1) The existing surface is shown where it is different from the restored surface.
2) Mudflats will be backfilled to pre-excavation elevations to approximately 10 feet seaward of the coir logs installed at the low marsh/mudflat boundary, then sloped downward to meet the existing harbor bottom.

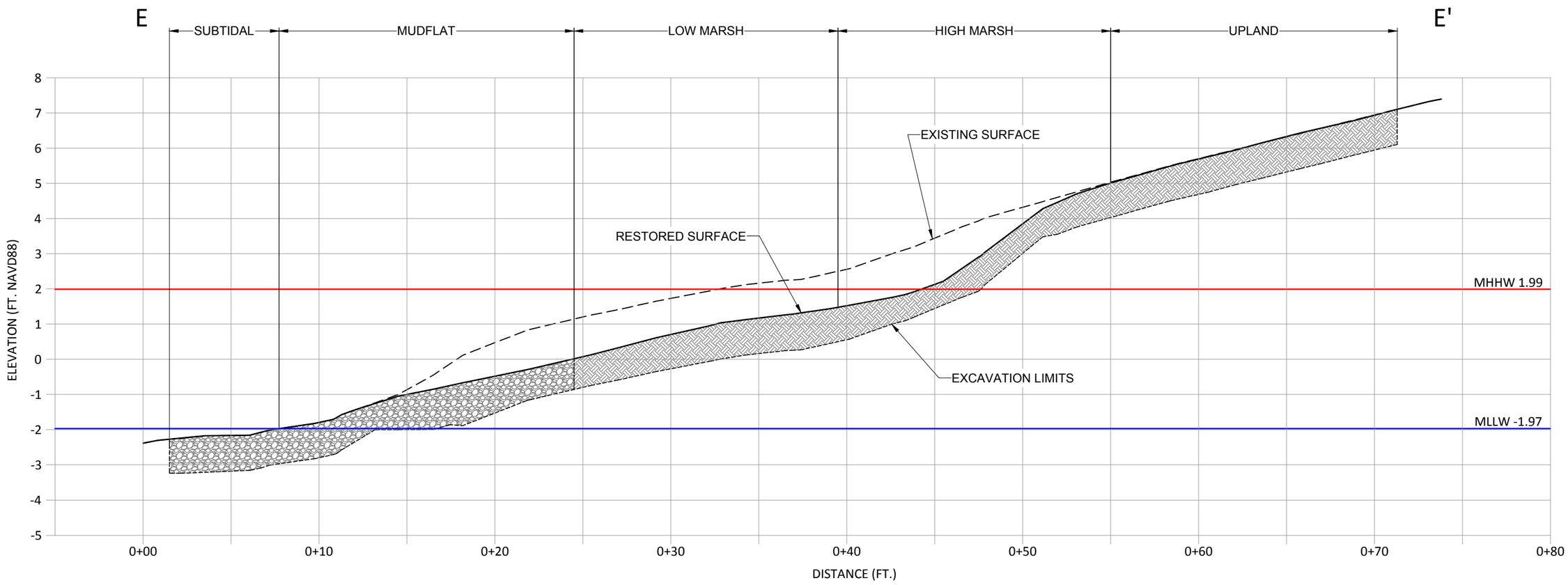
0 1 2 3
1" = 3' VERTICAL

0 2 4 6
1" = 6' HORIZONTAL

JACOBS™

EAST ZONE 1
PARCEL 25-24
SECTION D-D'
NEW BEDFORD HARBOR

JANUARY 2019 | FIGURE 4



LEGEND:

- MHHW (1.99 FT)
- MLLW (-1.97 FT)
- TOPSOIL BACKFILL
- GRAVEL BACKFILL

NOTES:

1) The existing surface is shown where it is different from the restored surface.
2) Mudflats will be backfilled to pre-excavation elevations to approximately 10 feet seaward of the coir logs installed at the low marsh/mudflat boundary, then sloped downward to meet the existing harbor bottom.

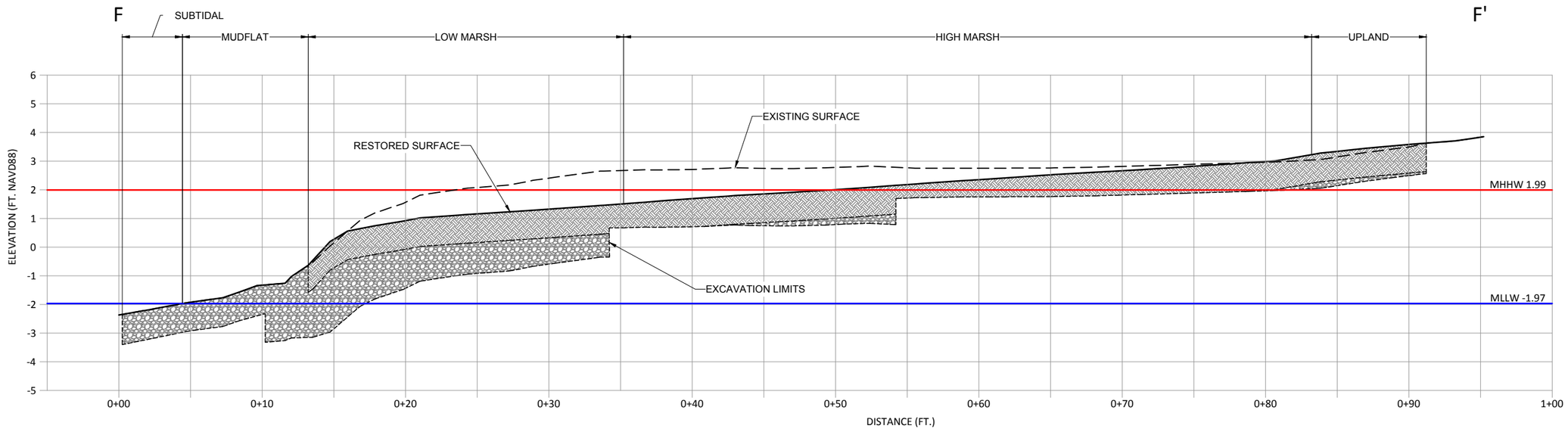
0 1 2 3
1" = 3' VERTICAL

0 2 4 6
1" = 6' HORIZONTAL

JACOBS™

EAST ZONE 1
PARCEL 25-24
SECTION E-E'
NEW BEDFORD HARBOR

JANUARY 2019 | FIGURE 5



LEGEND:

- MHHW (1.99 FT)
- MLLW (-1.97 FT)
- TOPSOIL BACKFILL
- GRAVEL BACKFILL

NOTES:

1) The existing surface is shown where it is different from the restored surface.
2) Mudflats will be backfilled to pre-excavation elevations to approximately 10 feet seaward of the coir logs installed at the low marsh/mudflat boundary, then sloped downward to meet the existing harbor bottom.

0 1 2 3 4
1" = 4' VERTICAL

0 2 4 6 8
1" = 8' HORIZONTAL

JACOBS™

EAST ZONE 1
PARCEL 25-24
SECTION F-F'
NEW BEDFORD HARBOR

JANUARY 2019 | FIGURE 6

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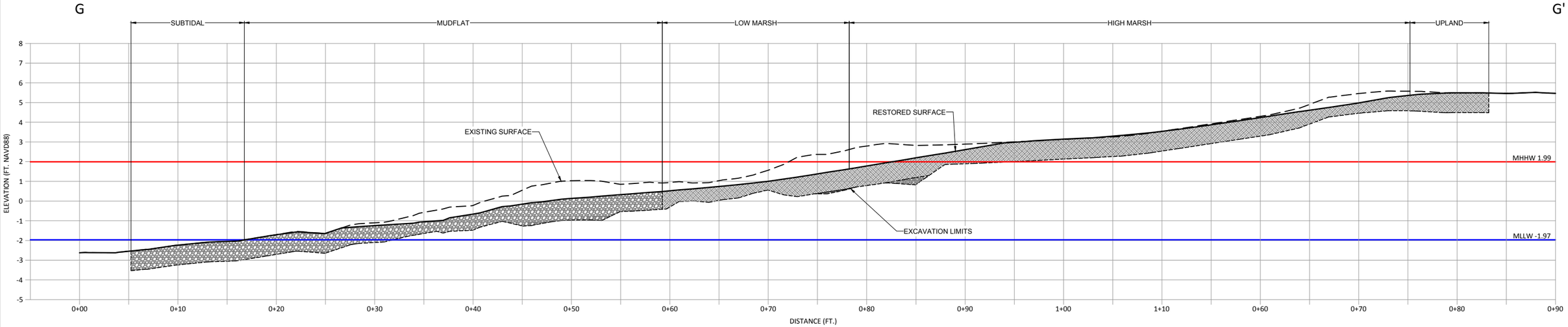

LEGEND:

- MHHW (1.99 FT)
- MLLW (-1.97 FT)
- TOPSOIL BACKFILL
- GRAVEL BACKFILL

NOTES:

1) The existing surface is shown where it is different from the restored surface.
2) Mudflats will be backfilled to pre-excavation elevations to approximately 10 feet seaward of the coir logs installed at the low marsh/mudflat boundary, then sloped downward to meet the existing harbor bottom.

0 1 2 3 4 5
1" = 5' HORIZONTAL

0 2 4 6 8 10
1" = 10' HORIZONTAL

JACOBS™

EAST ZONE 1
PARCEL 25-24
SECTION G-G'
NEW BEDFORD HARBOR

JANUARY 2019 | FIGURE 7

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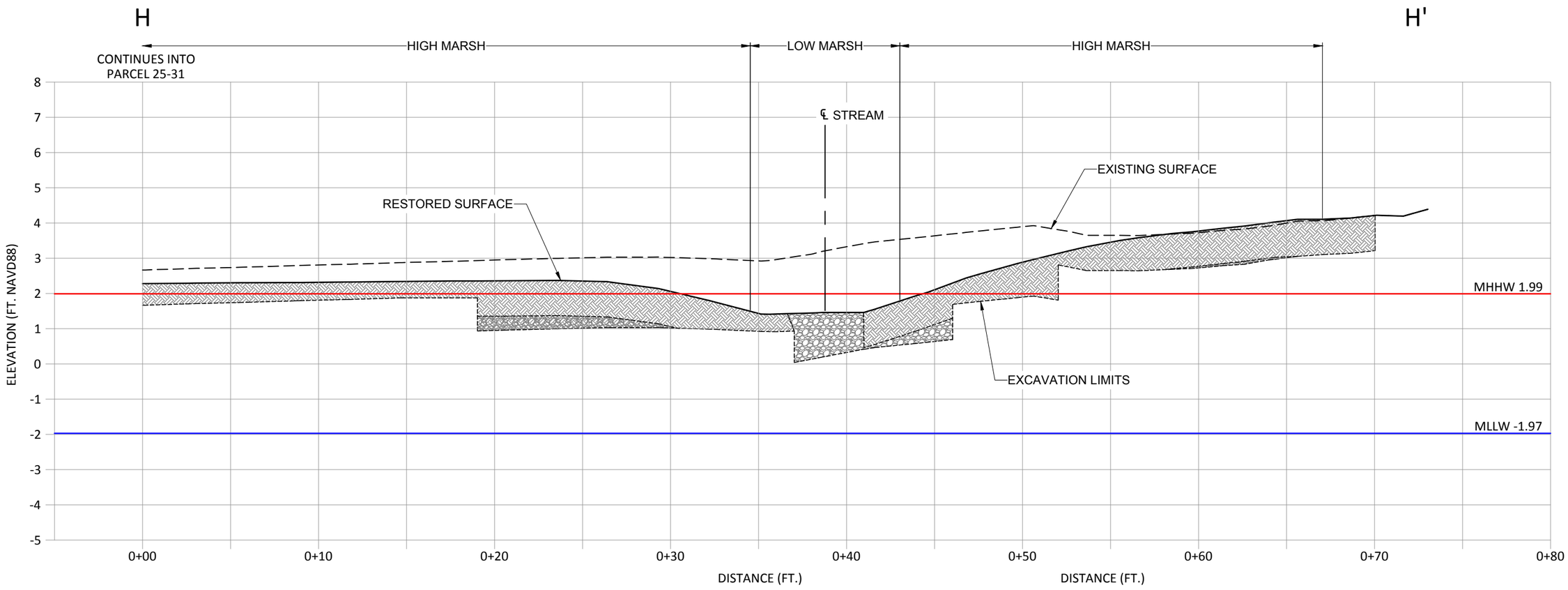


LEGEND:

- MHHW (1.99 FT)
- MLLW (-1.97 FT)
- TOPSOIL BACKFILL
- GRAVEL BACKFILL

NOTES:

1) The existing surface is shown where it is different from the restored surface.
2) Mudflats will be backfilled to pre-excavation elevations to approximately 10 feet seaward of the coir logs installed at the low marsh/mudflat boundary, then sloped downward to meet the existing harbor bottom.

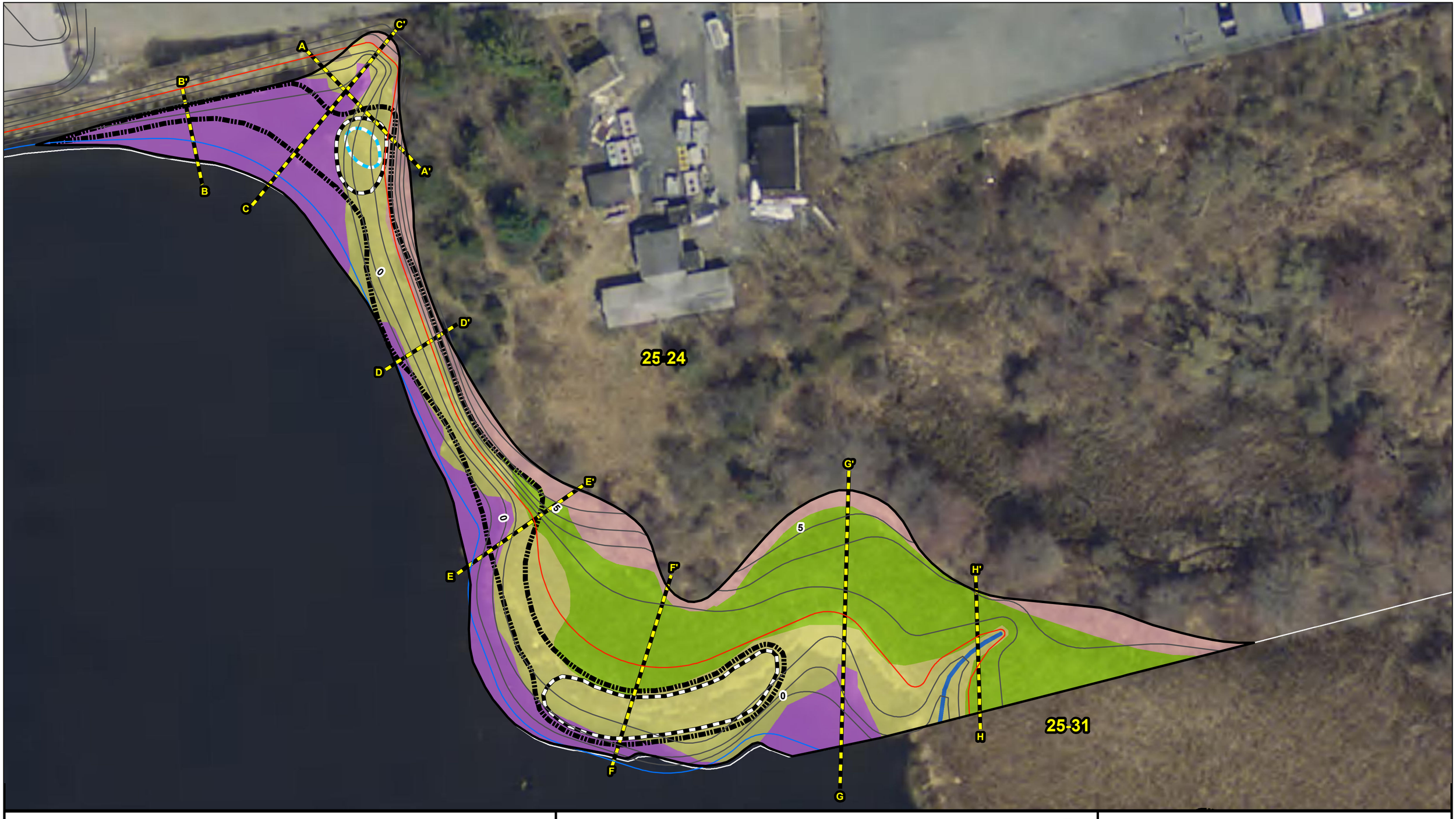
0 1 2 3
1" = 3' VERTICAL

0 2 4 6
1" = 6' HORIZONTAL

JACOBS™

EAST ZONE 1
PARCEL 25-24
SECTION H-H'
NEW BEDFORD HARBOR

JANUARY 2019 | FIGURE 8



Legend

- Cross Section Locations
- 0-1' Excavation Depth
- 1-2' Excavation Depth
- 2-3' Excavation Depth
- 3-4' Excavation Depth
- Parcel Boundary
- 1-foot Contour
- Mean Lower Low Water
- Mean Higher High Water
- Proposed High Marsh
- Mudflat/Subtidal (Minimal Backfill as Needed for Drainage or Slope Stability)
- Proposed Upland
- Proposed Low Marsh
- Proposed Stream

0 50 100 Feet

April 2019

Basemap Data Source: MassGIS

Vertical Datum: NAVD88

Upper Harbor East Zone 1 Parcel 25-24 Cross Section Locations

New Bedford Harbor Superfund Site

JACOBS

Figure 9

Appendix C

Schedule

(to be added at a later date)