Remedial Action Plan and Engineered Control Variance Request Part 1
Mystic River Boathouse Project

123 Greenmanville Avenue
Mystic, Connecticut

Kent + Frost Landscape Architecture

Mystic, Connecticut

February 2020

146 Hartford Road
Manchester, Connecticut 06040

Project No. 20170167.A10

FUSS & O'NEILL

February 5, 2020

Mr. Chad Frost
Kent + Frost Landscape Architecture
1 High Street
Mystic, CT 06355

RE: Remedial Action Plan and Engineered Control Variance Request Part 1
123 Greenmanville Avenue, Mystic CT

Dear Mr. Frost:

We are pleased to submit this Remedial Action Plan (RAP) and Engineered Control Variance Request Part 1 (ECVR) on behalf of the Town of Stonington for the above-referenced site. This RAP/ECVR presents the conceptual remedial strategy proposed as a step in the process of meeting the clean-up objectives in the Connecticut Department of Energy and Environmental Protection's (DEEP's) Remediation Standard Regulations (RSRs) should formal regulatory approval ultimately be required for this site.

Please contact the undersigned if we can be of further assistance.

Sincerely,

Daniel R Jahne

Daniel R. Jahne, LEP
Associate/Department Manager

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List of Common Abbreviations

Units of Measurement	
ug	micrograms
mg	milligrams
kg	kilograms
L	liter
ppb	parts per billion
ppm	parts per million
Analytical Parameters and Chemical Compounds	
ETPH	extractable total petroleum hydrocarbons
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PCE	tetrachloroethylene
SPLP	synthetic precipitate leaching procedure
SVOCs	semivolatile organic compounds
TCLP	toxicity characteristic leaching procedure
TCE	trichloroethylene
TPH	total petroleum hydrocarbons
VOCs	volatile organic compounds
Regulatory Abbreviations	
CFR	Code of Federal Regulations
DEC	direct exposure criteria
DEEP[1]	Department of Energy and Environmental Protection
ECAF	Environmental Condition Assessment Form
GWPC	groundwater protection criteria
I/C	industrial/commercial
PMC	pollutant mobility criteria
RCRA	Resource Conservation and Recovery Act
RCSA	Regulations of Connecticut State Agencies
Res	residential
RSRs	Remediation Standard Regulations
TSCA	Toxic Substances Control Act
SWPC	surface water protection criteria
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VC	volatilization criteria
Other	
AOC	area of concern
AST	aboveground storage tank
COC	constituent of concern
QA/QC	quality assurance/quality control
UST	underground storage tank

[1] In portions of this report we refer to the Connecticut Department of Energy and Environmental Protection (DEEP). The Connecticut Department of Environmental Protection (CTDEP) was re-named the Department of Energy and Environmental Protection (DEEP) in July 2011. For convenience and consistency, we refer to the agency as the DEEP throughout this report, including the timeframe prior to July 2011.

1 Introduction

Fuss & O'Neill, Inc. has prepared this Remedial Action Plan (RAP) on behalf of the Town of Stonington for 123 Greenmanville Avenue, Mystic CT (Figure 1). The RAP summarizes the remedial strategy for the Site. At this time, the Town is not obligated to formally follow the state's remedial cleanup process through participation in a voluntary remediation program. Therefore, the current remedial objective is to clean up the Site "in the spirit" of the state's cleanup standards Connecticut Remediation Standard Regulations (RSRs) through use of the alternatives and options described in the regulations, without formally implementing the RSR administrative requirements.

However, entrance into a formal state voluntary remediation program will be a requirement should the Town successfully obtain a remediation grant from the Connecticut Department of Economic and Community Development (DECD) or U.S Environmental Protection Agency (USEPA) for cleanup of the Site. Therefore, this document has been prepared to include a description of engineered controls to support Part 1 of the Connecticut Department of Energy and Environmental Protection's (DEEP's) Application for Engineered Control Variance (ECVR). The ECVR portion of this document was prepared in accordance with the Guidance Document, Engineered Controls Pursuant to Section 22a-133k-2(f) of the Connecticut Remediation Standard Regulations published by the DEEP in February 2009 and revised January 2013.

1.1 Redevelopment and Remedial Overview

The Site currently comprises an approximate 1.42 acre, irregularly shaped parcel of land bordering the Mystic River owned by the Town of Stonington since 2015. The Town has established the Mystic River Boathouse Park Committee to plan and facilitate conversion of the Site into a public park. The Town's objective is to construct a high-value town-controlled public access park with 370 feet of riverfront to enable boaters to access land-based activities in the neighborhood and vice versa. The park will also serve as a public place for additional non-motorized water sports along the Mystic riverfront. The Park will serve as a place for passive recreation (bird watching) and for active water sports such as rowing and kayaking. To facilitate construction of the park an existing 2,692 square feet two-story residential structure will be incorporated into the construction of a new boathouse. An existing 1,980 square foot garage will be demolished. Kent + Frost Landscape Architects lead the park design team working for the Town Boathouse Park Committee.

1.2 Regulatory Program

The Site is owned by the Town of Stonington and is not currently enrolled in a formal state remediation program that requires formal cleanup subject to the RSRs. The RSRs are the clean-up standards in the State of Connecticut that contain procedures to evaluate whether actions (e.g., remediation or institutional controls) will be required to address identified releases of hazardous substances.

Although the RSRs do not officially apply to the Site, as described above, the Town's current remedial objective is to use the RSRs as the benchmark to clean up the Site without implementing the administrative requirements associated with participating in a formal state remediation program. The administrative requirements would include DEEP approval of additional polluting substances criteria, department approval of an engineered control variance request, filing an environmental land use restriction (ELUR), and a Licensed Environmental Professional (LEP) verification filing. However, the Town may be seeking a remediation grant in the future for the park. If the Town is successful in obtaining state or federal funding for the park remediation, an obligation of the grant funding will be to enter the Site into a formal state remediation program and the RSRs would formally apply. The format of this document has been set up such that it can be updated if necessary at an appropriate time to reflect participation in a formal state remediation program.

1.3 RSR Soil Criteria

This section provides a description of the RSR criteria relative to Sites that are required to formally comply with the regulations. The RSR Soil Remediation Standards (RCSA Section 22a-133k-2) require polluted soil at a release area to be remediated to the following criteria:

- Direct Exposure Criteria (DEC) – Intended to protect human health from exposure to constituents of concern
- Pollutant Mobility Criteria (PMC) – Intended to prevent the pollution of groundwater through the leaching of constituents from impacted soil

1.3.1 Direct Exposure Criteria

The DEC protect human health from exposure to constituents of concern. In general, the direct exposure criteria apply to soil located within 15 feet of the ground surface. Soil impacted by a release must be remediated to a concentration that is consistent with the residential direct exposure criteria. Compliance with the direct exposure criteria can be demonstrated by comparing the 95 percent upper confidence interval of the mean of all samples within the release area to the default criteria. Variances and alternatives to compliance with the default residential criteria are discussed below:

- Inaccessible Soil – The DEC for soil can be waived if the soil is considered inaccessible and an ELUR prohibiting disturbance of such soil is recorded. Inaccessible soil is defined as follows:
    - More than four feet below the ground surface
    - More than two feet below a paved surface consisting of at least three-inches of bituminous concrete or concrete, which two feet may include the pavement sub-base
    - Polluted fill beneath a bituminous concrete or concrete surface consisting of at least three-inches of bituminous concrete or concrete if such fill meets the following criteria:
        - Semi-volatile compounds or petroleum hydrocarbons in the fill exceeding the DEC are normal constituents of bituminous concrete
        - Metals in the fill do not exceed two times the applicable DEC

        - No other compounds exceed the DEC
    - Beneath an existing building or DEEP-approved permanent structure

- Engineered Controls – Section 22a-133k-2(f)(2) of the RSRs provides a variance to the DEC if a DEEP-approved engineered control is installed to physically isolate the underlying soil, thereby minimizing the potential for contact with the soil. With such an engineered control in place and an ELUR prohibiting unauthorized disturbance of the engineered control recorded, the DEC do not apply.

1.3.2 Pollutant Mobility Criteria

The PMC protect groundwater from constituents leaching out of impacted soil and are dependent upon the groundwater quality classification of the Site. The site is located in a GB-designated area, therefore, the GB pollutant mobility criteria apply. The GB pollutant mobility criteria apply only to soil located above the seasonal high water table. Compliance with pollutant mobility criteria can be demonstrated by comparing the 95 percent upper confidence interval of the mean of at least 20 samples within the release area to the default criteria. Variances and alternatives to compliance with the default pollutant mobility criteria are discussed below:

- SPLP Analysis – In order to evaluate the leaching potential of constituents of concern, samples can be extracted using the synthetic precipitation leaching procedure (SPLP), analyzed, and, for GB areas, compared to ten the groundwater protection criteria. The PMC for metals is already based on the analysis of SPLP extractions. In some instances, this method of analysis was also used to further evaluate constituents of concern including polynuclear aromatic hydrocarbons, extractable petroleum hydrocarbons, and volatile organic compounds for which mass results were higher than the baseline pollutant mobility criteria.

- Environmentally Isolated Soil – Soil beneath buildings that contains contaminants other than VOCs can be considered environmentally isolated. The PMC do not apply to environmentally isolated soils, provided an appropriate ELUR is in place.

- Engineered Controls – Similar to the direct exposure criteria, Section 22a-133k-2(f)(2) of the RSRs provides a variance to the PMC if a DEEP-approved impermeable engineered control is constructed to minimizes the migration of liquids through the soil. With such an engineered control in place and an ELUR prohibiting unauthorized disturbance of the engineered control recorded, the PMC will not apply.

- Groundwater Monitoring – For substances other than VOCs, Section 22a-133k-2(c)(4)(C) of the RSRs allows an exemption from the PMC based on four consecutive quarters of groundwater sampling under certain conditions that consider precipitation infiltration, compliance with applicable groundwater criteria, representativeness of sampling locations, stability of the groundwater plume.

- Variance for Wood and Coal Ash – Section 22a-133k-2(c)(4)(B) of the RSRs include a pollutant mobility criteria variance for fill containing only coal, coal ash, wood ash, and/or asphalt fragments.

- Site-Specific Dilution Factor (GB Areas Only) – Section 22a-133k-2(c)(2)(E) of the RSRs allow for the calculation of a site-specific dilution factor for constituents in a GB-classified area.

1.4 RSR Groundwater Criteria

This section provides a description of the RSR criteria relative to Sites that are required to formally comply with the regulations. The RSR Groundwater Remediation Standards (RCSA Section 22a-133k-3) require that remediation of a groundwater plume shall result in the attainment of the following:

- The surface water protection criteria and volatilization criteria or the background concentration for groundwater for each substance in the plume.

These criteria are discussed in more detail below. As with soil, the RSRs specify self-implementing options and exceptions associated with determining compliance with groundwater criteria.

1.4.1 Surface Water Protection Criteria

The SWPC ensure that surface water quality is not impaired by the discharge of contaminated groundwater into a surface water body at constituent concentrations above the Water Quality Standards. The RSRs specify the following methods for determining compliance with the SWPC:

- The 95 percent upper confidence limit (UCL) of the arithmetic mean of all sample results representative of the groundwater plume is equal to or less than the SWPC.
- The SWPC apply to a groundwater plume at the point where it discharges to a surface water body, in this instance, the Mystic River. In instances where a surface water body is not located adjacent to the site, the downgradient property boundary is often considered to be the "point of discharge" for the site.
- Site-specific SWPC may be calculated.

1.4.2 Volatilization Criteria

The VC protect human health from volatile substances in shallow groundwater that may migrate into overlying buildings. Under the current regulations, the volatilization criteria are considered for areas where groundwater is within 15 feet of the ground surface or a structure intended for human occupancy. Alternatives to strict compliance with the residential groundwater VC are provided below.

- Soil Vapor Sampling – Soil vapor samples may be used as an alternative to determining compliance with the groundwater volatilization criteria.

- Other Acceptable Measures – Section 22a-133k-3(c)(3)(B) of the RSRs states that the volatilization criteria do not apply if the following conditions are met:

    - Measures acceptable to the Commissioner are taken to prevent the migration of VOCs into the overlying building
    - A program is implemented to maintain and monitor such measures
    - Notice of such measures, incorporating the requirements of Section 22a-133k-3(c)(3)(B)(iii) is provided to the Commissioner

- Use of the Draft 2003 Volatilization Criteria – In 2003, the DEEP released draft VC that, if promulgated, would apply to groundwater up to 30 feet below grade. These proposed changes are based on data collected by the USEPA, DEEP, Connecticut Department of Health (DPH), and other State agencies and are intended to make State regulations more consistent with draft guidance issued by United States Environmental Protection Agency (USEPA) in 2002.

2 Site Overview

This section provides a summary of the information used to construct the conceptual model for the site, which, in turn, has been modified as a result of further site investigations. Information such as the site's operational history, geology, hydrogeology, and potential receptors help identify areas where releases of hazardous materials could occur and how they might impact human health and the environment.

2.1 Physical Description

The Site is located on the east side of Greenmanville Avenue in a high-density residential zone of Stonington, Connecticut (New London County). A portion of a United States Geological Survey (USGS) topographic map showing the Site location is provided as Figure 1.

According to Town records, the Site is an approximately 1.42-acre irregularly shaped parcel of land, owned by the Town of Stonington since 2015. The Site is improved with two structures comprised of a garage and residence. Access is via a gravel driveway on the northeastern portion of the Site. The two-story residential structure encompasses approximately 2,692 square feet of gross living space and is located on the southeast portion of the Site. An approximately 1,980 square foot single-story detached garage is located north of the residential structure. The garage is currently used as a training and storage area for crew and rowing activities. The western portion of the Site is grassed open space, which decreases gently in elevation towards a thin sandy-bank bordering the Mystic River. A site plan is provided as Figure 2.

The surrounding land use includes a mix of commercial and residential properties along Greenmanville Avenue. The property north of the Site is occupied by a small, seasonal restaurant. The properties across Greenmanville Avenue to the northeast are occupied by residential structures. The former Rossie Velvet Mill is located across Greenmanville Avenue to the East. The former mill is currently occupied

by Mystic Seaport. A restaurant associated with the Mystic Seaport is located south of the Site. The Mystic River provides the western Site boundary.

2.2 Site History

An 1879 map of Mystic and an 1898 post card of the former Rossie Velvet Mill indicate that the Site formerly occupied a very narrow strip of land extending north-south along the western side of Greenmanville Avenue. Sanborn fire insurance maps dated 1903 through 1924 depict the gradual extension of the land further into the Mystic River, indicating that much of the Site is comprised of fill.

A two-story residential structure with a basement appears on the 1903 Sanborn fire insurance map in approximately the same location as the existing residential structure. Town records indicate that the existing residential structure was built in 1945. An inlet, likely used for boat mooring, can be observed on the 1911 Sanborn fire insurance map, along with an associated dock and structures labeled "boat box, no floor." A covered coal storage building located north of the residential structure and a small automobile garage north of the coal storage building are observed on the 1911 Sanborn map.

In the 1924 Sanborn fire insurance map, the coal storage building appears to have been replaced with a twelve-car garage positioned in approximately the same location as the existing garage structure. An unidentified single-story structure of similar size as the garage and located perpendicular to the northwest corner of the garage is also shown in the 1924 Sanborn map. Evidence of the former foundation for this structure still being in place was identified during the field investigation by way of visual observation of a concrete foundation wall located north of the garage and shallow refusal for borings advanced in the approximate area of the building footprint.

Both buildings are labeled as belonging to the Rossie Velvet Co. Although still present in a 1934 aerial photograph, the unidentified structure is absent in the 1939 Sanborn map. A detached structure housing a gasoline engine can be observed north of the northeast corner of the garage in the 1924 Sanborn map.

In the 1963 Sanborn map, the garage is labeled as an automobile painting facility and city directories reportedly indicate that from at least 1957 through 1961 the auto painters Charles Lamphere Co. occupied the Site. The garage is no longer labeled as belonging to Rossie Velvet Co. in the 1963 Sanborn map, as the mill facilities to the east are labeled as General Dynamics, Electric Boat Company.

From 1966 through 1977, city directories reportedly indicate that the residential dwelling was occupied and that the Electric Boat division of General Dynamics used the garage structure as a warehouse.

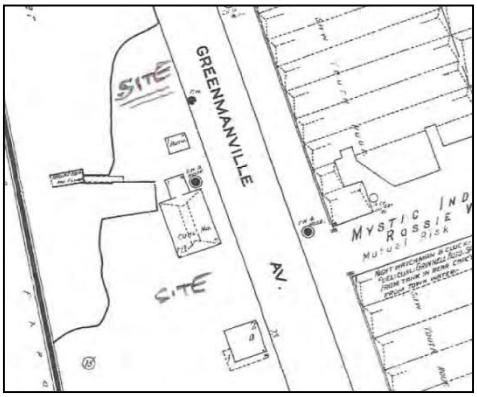
An interview with a former employee of the Rossie Velvet Co., recorded in the 2008 Phase I ESA, indicates that coal was transported to the Site via the Mystic River and stored there for use by the Rossie Mill. The coal was reportedly transported across Greenmanville Avenue to the Rossie Mill boiler on an electric battery operated cart via an underground tunnel. The interview confirms that the garage structure was used for mill vehicle storage. Both the residential structure and the garage structure, as well as the surrounding neighborhood, are included in the National Register of Historic (NRH) places.

2.3 Site Utilities

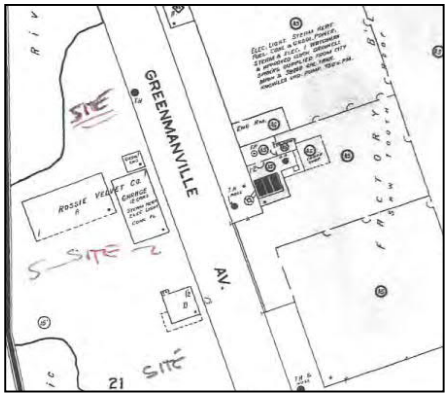
A 2016 Phase I ESA reported that the Site is connected to public water, sewer, and electricity. Town records confirm that the Site is served by public sewer and previous reports indicate that the property was not connected to the town sewer system until 1973. The Phase I ESA indicated that a private septic system (no longer in use) is located south of the residential structure. Town records indicate that the residential structure is heated using oil. Electrical service is provided to the Site by overhead lines extending along the eastern side of Greenmanville Road.

An approximate 8-inch diameter hole was observed in the garage along the center of the east wall bordering Greenmanville Avenue. Visual and down-hole camera inspection of the hole revealed that a void space measuring approximately 6 to 10 feet square by at least 8 feet deep exists below this portion of the garage. Based on review of historical mapping, we conclude the void space is associated with a sump for a fire pump that existed in 1911 to serve the former Rossi Velvet Mill located across the street (Section 2.2). In 1911 the garage building was smaller than the present day configuration and the shoreline extended right up to the corner of the building.

Based on visual observation with the down-hole camera during the Phase II/III ESA there is piping representative of fire pump apparatus at the bottom of the void space. A conduit at the bottom of the void extended west to the shoreline to provide a water supply for the mill fire suppression system. The black circle shown on the 1911 map below is the symbol for a fire pump. By 1924 the garage was extended further to the north and the shoreline filled. The conduit to the shoreline may have been extended further to the west and may still be in place based on field observation of a suspected intake pipe that was observed protruding from the river during low tide (see Figure 2).



1911 Sanborne Depicting Garage



1924 Sanborne Depicting Garage

The pipes visible in the void space below the garage appear to extend to the east below Greenmanville Avenue to the former mill.

A storm water line from Greenmanville Avenue extends along the southern boundary of the Site through a twenty feet wide drainage easement area with the discharge outlet visible to the Mystic River (Figure 2). Based on visual inspection of the riverbank during low tide, there are at least three other pipes

that protrude from the northern portion of the site that could be legacy utilities serving the former mill across the street.

2.4 Environmental Setting

2.4.1 Topographic Setting

Both the Site and regional topography slope gradually to moderately down to the west toward the Mystic River, which makes up the western boundary of the Site (USGS, 1984).

2.4.2 Geology

Surficial Geology

Surficial material at the site is mapped as sand and gravel overlying sand (USGS, 1992). Based on soil borings advanced on the Site during the investigation activities and during previous investigations, these natural deposits are overlain by 6-10 feet of fill material comprised of coal and coal ash, brick, glass, and metal slag.

Bedrock Geology

Bedrock beneath the site is mapped as Mamacoke Formation, an interlayered light- to dark-grey, medium-grained gneiss (USGS, 1985). Bedrock outcroppings were not encountered during Site reconnaissance and bedrock was not encountered during the investigation.

2.4.3 Hydrogeology

Depth to groundwater at the Site ranges between 9 feet below the ground surface on the eastern portion of the Site to 2 feet below the ground surface on the western and southern portions of the Site. Groundwater elevation data indicates that groundwater at the Site generally flows radially toward the Mystic River.

In February 2018 the river tidal range and groundwater elevations were measured using pressure transducers to assess tidal influence on the groundwater depths over a 48-hour period. The tidal range observed in the Mystic River was measured at approximately 2.5 feet. The fluctuation of groundwater levels in the two monitoring wells at the Site were 0.25 feet and 0.5 feet, respectively.

The foundation associated with the building historically located east of the garage structure, the tunnels associated with the Rossie Mill, the fire pump on the Site, or other underground features related to these structures may affect groundwater flow on the Site.

2.4.4 Water Quality Classifications

Groundwater Classification

The quality of groundwater beneath the subject site is classified by the DEEP as GB, which is identified as groundwater that may not be suitable for human consumption without treatment due to waste discharges, spills, leaks of chemicals, or land use impacts (DEEP, 2017).

Surface Water Classification

The nearest surface water body is the Mystic River, which provides the western boundary of the Site. The Mystic River is classified by the DEEP as SB, which is identified as surface waters that are known or presumed to be suitable for the following designated uses: habitat for marine fish and aquatic life and wildlife, commercial shellfish harvesting, recreation, industrial water supply, and navigation (DEEP, 2017).

2.4.5 Potential Receptors

An assessment was conducted to evaluate whether sensitive human health or ecological receptors are present at or directly downgradient of the Site. The results of this evaluation are presented below:

- Endangered Species – No potential threatened or endangered species habitats are present at the Site or within 0.25 miles of the Site (CTECO, June 2019).
- Ecological Receptors – An ecological risk assessment has not been conducted; however, the Site is located in a developed area of Mystic and is surrounded by commercial facilities and closely spaced residences. The investigations of the Site performed to date indicated no evidence of ongoing releases of hazardous substances to the Mystic River. The potential for ecological receptors to be impacted by Site conditions is low.
- Wetlands – Tidal wetlands along the shoreline have been delineated and are shown on the property mapping.
- Surface Waters – The nearest surface water body is the Mystic River, abutting the Site to the east.
- Aquifer Protection Areas – No aquifer protection areas were identified within a 0.5-mile radius of the Site (CTECO, June 2019).
- Public Water Supply Wells – The Atlas of Public Water Supply Sources and Drainage Basins of Connecticut (CTDEEP, 1982) shows no public water supply wells within 0.5-mile radius of the Site.

3 Previous Investigations

Documents that describe investigation activities conducted at the Site are listed below. Individual AOCs are summarized on Table 1.

Date/Consultant	Document Title and Content Description
July 2008 Paul Burgess, LLC	Phase I Environmental Site Assessment – 123 Greenmanville Avenue, Mystic, Connecticut.
October 2016 GEI Consultants, Inc.	Phase I Environmental Site Assessment – Baumgarten Property, 123 Greenmanville Avenue, Mystic, Connecticut.
March 2018 Fuss & O'Neill, Inc.	Phase II/III Environmental Site Assessment – Mystic River Boathouse Project, 123 Greenmanville Avenue, Mystic, Connecticut.

3.1 Areas of Concern

Six (6) Areas of Concern at the Site were identified and evaluated consisting of the following:

- AOC 1 – Site Wide Fill
- AOC 2 – Former Tunnel & Fire Pump Conduit
- AOC 3 – Former 500 Gallon UST
- AOC 4 – Floor Drain in Garage
- AOC 5 – Above Ground Storage Tanks
- AOC 6 – Septic Leaching Field

REC-specific conceptual models that include discussion of historical processes, investigations, and results are presented in Table 1. Releases to soil have been identified at the following AOCs:

AOC	Building or Area	Released Constituents	Constituents Detected Above Baseline RSR Criteria (Y/N)
AOC-01	Site Wide Fill	Metals, PAHs, PCBs, ETPH	Yes
AOC-02	Former Tunnel/Fire Pump Void/Conduit	VOCs	Yes
AOC-03	Former 500-Gallon Gasoline UST/former Gas Engine	VOCs, PAHs, ETPH	Yes

The Site is "made land" comprised of fill ranging in thickness from 6 to 12 feet overlying estuarine deposits. The fill contains coal ash, slag, coal fragments, metal fragments, glass, concrete, brick, and wood. Infrastructure associated with the Former Rossie Velvet Mill operations across the street still exists at the Site within the fill. This includes former building foundations, piping and conduit for a

former fire suppression system, a septic leaching field, and other piping where the past use is unknown. The fill contains pollutants comprised of petroleum hydrocarbons, metals (primarily arsenic and lead). Due to the heterogeneity of the fill (particularly the occurrence of coal ash), which is inferred to be the primary source of the petroleum hydrocarbons and metals, concentrations of pollutants in the fill have the potential to exceed the Remediation Standard Regulations Direct Exposure Criteria. Samples of the fill collected from the upland and the shoreline bank above the high tide line exceed the baseline Direct Exposure Criteria for one or more of these constituents.

A release area of at least 400 square feet in size is associated with a former mill fire suppression system or a former building where the subsurface foundation is likely still in place (Figure 2). Concentrations of the chlorinated volatile organic compounds cis-1,2-dichloroethene, and trichloroethene exist in the 5 to 8 feet depth interval below the ground surface. Concentrations of these pollutants exceed the baseline RSR Pollutant Mobility Criteria. Groundwater samples collected from a well downgradient of the area contained low concentrations of these pollutants in one of two sampling rounds.

A release area of approximately 2,000 square feet in size exists in the northern portion of the Site below the garage and north of the garage at a former underground storage tank location (Figure 2). Petroleum impacted soil at concentrations above RSR baseline Direct Exposure and Pollutant Mobility Criteria was encountered in a depth interval between 6 and 11 feet below the ground surface between the seasonal low and high water table.

4 Remedial Approach

The remedial approach for the Site will be integrated with the park earthwork construction activities. Current plans for the park call for the adaptive reuse of the house and the removal of the garage. In order to create parking for the facility and still maintain the shoreline qualities at the north end of the parcel, the house will be moved intact approximately 88 feet to the north, keeping its original orientation and setback relative to Greenmanville Avenue. It is anticipated that the house will be renovated as office space for the new boathouse complex. New additions for a training room and boat-storage will be constructed to the south and west of the house, attached to its southwest corner.

The exterior grounds will be improved with new public parking space, a boat rigging and gathering plaza, a boardwalk, lawn, and sidewalk. Shoreline improvements will embrace a living concept design with aspects to facilitate natural marsh enhancement, marsh creation, and coastal bank protection. A crew dock, public float dock, and public boat ramp for car top watercraft are also proposed. A preliminary Site Improvement Plan is provided as Appendix A.

The remedial strategy to meet the objectives includes the following.

1. Abatement of identified hazardous building materials
2. Garage demolition
3. Residential building relocation
4. Petroleum-contaminated soil excavation and off-site disposal
5. Management and reuse of site fill associated with park construction earthwork grading

6. Construction of the park improvement infrastructure as engineered controls to prevent human contact with the underlying contaminated soil

4.1 Public Notice

At this time formal public notice is not planned as would be required by participation in a formal state voluntary remediation program to meet the requirements for public notice of engineered controls as required by RCSA 22a-133k-2(f)(2)(A)(iv).

However, public notice will be performed as part of the site plan permit approval process as required by local regulations.

4.2 Abatement of Hazardous Building Materials

A hazardous building material inspection report for the garage and residential structure has previously been prepared. Specifications for abatement of identified hazardous building materials will be prepared by a licensed project designer. These specifications will be incorporated into the bid package for the demolition and renovation contract. Abatement of identified hazardous building materials will occur in coordinated sequence with demolition activities.

4.3 AOC 1 Site Wide Fill

Excavation activities at the Site will generate volumes of polluted fill that will require management and handling. Due to the heterogeneity of the fill composition, concentrations of pollutants across the Site could exceed the baseline RSR DEC. Preliminary 95% upper confidence level calculations using the procedure described in Section 1.3 indicate that compliance with the baseline DEC cannot be achieved through statistical analysis of the data. Therefore, the material will need to be properly managed as it is excavated.

Excavation and handling of material will need to be managed in accordance with a site grading plan based on the proposed development such that earthwork volumes for "cut" and "fill" areas are determined. The goal should be to balance the site to the extent feasible such that excess polluted fill can be reused as general backfill above the water table in identified "fill" areas. Excess material that cannot be reused on-site will need to be disposed of off-site at a permitted facility.

The ground surface in all areas of the site whether they are disturbed or undisturbed by site grading activities will be covered with direct exposure engineered controls as further described in Section 4.6. Reuse of the fill on-site that is generated by remediation and development activities on-site will minimize costs for off-site soil disposal. The project construction documents will specify on-site handling of impacted soil/fill, procedures for separating reusable material from material that must be disposed of at

a licensed facility, locations of temporary stockpile areas, erosion control, dust control, and transport and disposal practices.

4.4 AOC 2 Former Tunnel & Fire Pump Void/Conduit

An anomaly consistent with a void representing a utility conduit or possibly a tunnel was identified along the eastern side of the garage and sidewalk (Figure 2). The anomaly extended below the roadway toward the former mill building across the street. The exterior location of the anomaly is adjacent to an 8-inch diameter hole and void space below the garage, which likely represents the former mill fire pump system.

At low tide a 24-inch diameter pipe positioned vertically in the river bed is visible. Review of the historical Sanborn maps circa 1911 indicate that this structure is located in approximately the same area as the mouth of the fire pump shoreline inlet. Based on observation and orientation of the void space below the garage and the position of the 24-inch diameter pipe in the river, the fire pump conduit may still be in place (Figure 2).

Soil borings advanced within the garage and along the suspected pipe conduit indicated the presence of VOCs at approximately 6-7.5 feet below grade. Analytical soil results indicated that cis-1,2-dichloroethene (cis-1,2-DCE) was detected above laboratory detection limits but below the applicable RSR criteria and that trichloroethene (TCE) was detected above the pollutant mobility criteria (PMC) for GB areas. The area of impact was delineated to consist of an approximately 20-foot by 20-foot area west of the northwest corner of the garage in the location of the suspected conduit. Groundwater samples collected from monitoring wells installed at the soil release area had detections of cis-1,2-DCE and TCE above their respective laboratory reporting limits but below the applicable RSR criteria.

The area of the fire pump conduit will be disturbed during site activities associated with shoreline grading, general site grading, and installation of the boardwalk. The remedial approach will be to remove through targeted excavation and off-site disposal at a permitted facility soil at the 20 x 20 feet area with VOC concentrations exceeding the GB PMC (Figure 2). Exploratory excavation of the conduit will also occur during site grading activities. The conduit will be removed to the extent that it interferes with planned construction activities.

The volume of contaminated soil exceeding the GB PMC for off-site disposal is estimated to be approximately 100 cubic yards. This estimate does not include soil or material volumes that will be generated by general removal of the fire pipe conduit. Following excavation, sidewall and bottom soil samples will be collected for laboratory analysis to obtain data necessary to demonstrate compliance with the GB PMC.

- Sidewall Samples: 1 sample per 20 linear feet of sidewall with a minimum of 1 sample per sidewall.
- Bottom Samples: 1 sample per 20-foot by 20-foot area

4.5 AOC 3 Former 500-Gallon Gasoline UST/Former Gas Engine

A 500-gallon exterior gasoline underground storage tank was removed from the northern wall of the garage June 18, 2008. Reportedly, there was no visible evidence of any holes or a release. Sanborn Insurance maps indicate that a gasoline engine was formerly located in approximately the same area.

Soil borings were advanced at the former UST and during drilling activities; field screening indicated a detection of petroleum hydrocarbons at a depth between approximately 10-14 feet below grade at each boring location. Physical evidence of petroleum, including evidence of a sheen and a petroleum odor, was also observed at approximately the same interval. A petroleum odor was also identified in the 8 to 10 foot sample in a downgradient boring (SB-6). Analytical results identify the detection of several metals, VOCs (including sec-butylbenzene), and the PAH 2-methynaphthalene above their respective laboratory reporting limits. Additionally, the VOCs 1,2,4- and 1,3,5-trimethylbenzene concentrations exceeded the GB PMC and the ETPH concentration exceeded the ResDEC.

During a second mobilization two soil borings (SB-13 and SB-14) were advanced inside of the garage structure to evaluate the extent of the petroleum impacts towards the south. Both field screening and physical observations indicated petroleum impacts around 12-13.5 feet below grade at both SB-13 and SB-14. Field screening and physical observations at SB-06, including staining and a petroleum odor, indicated VOC-impacted soil in the interval approximately 6.2-7.2 feet below grade and one sample was collected from that interval. Analytical results indicate concentrations of ETPH, the VOC carbon disulfide, and the PAHs fluoranthene and pyrene above the laboratory reporting limits but below applicable RSR criteria. The size of the release area spanning borings SB-6, SB-09, MW-04, and SB-13 is approximately 2,000 square feet with impacted petroleum containing-soil located between the seasonal high and low water table between 6 and 11 feet below the ground surface.

ETPH was detected in the groundwater sample collected from a well in the vicinity of the former 500-gallon UST in one sampling round. Several VOCs, including sec-butylbenzene, 1,2,4- and 1,3,5-trimethylbenzene, were detected in the same well (MW-04) at concentrations above their respective laboratory reporting limits, but below the applicable RSR criteria. PAHs, including 2-methynaphthalene, acenaphthalene, and phenanthrene were also detected, with two of the constituents at concentrations above the SWPC.

The area of the former UST will be disturbed during site activities associated with demolition of the garage, filling the void space associated with the former fire pump, and general site grading. The remedial approach will be to remove through targeted excavation and off-site disposal at a permitted facility soil at the 2,000 square feet release area with petroleum and VOC concentrations exceeding the GB PMC (Figure 2).

The volume of contaminated soil exceeding the GB PMC for off-site disposal is estimated to be approximately 400 cubic yards. This estimate does not include soil or material volumes that will be generated by removal of the utility apparatus and existing infrastructure. Following excavation, sidewall and bottom soil samples will be collected for laboratory analysis to obtain data necessary to demonstrate compliance with the GB PMC.

- Sidewall Samples: 1 sample per 20 linear feet of sidewall with a minimum of 1 sample per sidewall.
- Bottom Samples: 1 sample per 20-foot by 20-foot area

4.6 Engineered Control Design

The purpose of the engineered control is to prevent direct human contact with the site polluted fill (AOC 1). As previously discussed, at this time the Town is not obligated to follow the state's remedial cleanup process through a formal voluntary remediation program. Therefore, the Town is not obligated to obtain approval by DEEP for the engineered controls to be constructed at the Site. However, the Town may seek grant funding in the future that would obligate formal cleanup of the Site through participation in a state cleanup program. Therefore, the following sections of this document comprise a description of the engineered controls to support a future Part 1 filing of DEEP's Application for Engineered Control Variance (ECVR). The ECVR portion of this document was prepared in accordance with the Guidance Document, Engineered Controls Pursuant to Section 22a-133k-2(f) of the Connecticut Remediation Standard Regulations published by the DEEP in February 2009 and revised January 2013.

The objective is that the new site surface features constructed for the development will serve as the engineered controls that will physically isolate and mitigate the potential for direct human contact with the underlying impacted fill. These features have been designed to accommodate the intended use of the property given the geotechnical conditions of the site and the code requirements of the Town of Stonington. The components described herein are part of the Preliminary Site Improvement Plan submitted to the Town of Stonington. An overall Site Layout Plan depicting the proposed development is provided as Appendix A.

Engineered control (EC) design details associated with the site development are provided in Appendix B. As needed, impacted soil will be excavated to facilitate the construction of the engineered control as summarized below. The engineered control will consist of the following elements:

- Bituminous Concrete Pavement: This EC is comprised of 24-inches of bituminous concrete, processed aggregate base comprised of ¾-inch processed stone, 3.5-inch of compacted bankrun gravel, and approved imported general fill.

- Concrete Pavement: This EC is comprised of 24-inches of concrete with wire mesh reinforcement, processed aggregate base comprised of ¾-inch crushed stone, approved imported general fill and underlain by MIRAFI 140ML (or approved equal) demarcation fabric.

- Pavers: This EC is comprised of a 24 inch profile consisting of concrete pavers, crushed stone setting bed, ¾-inch crushed stone subbase, approved imported general fill and underlain by MIRAFI 140ML (or approved equal) demarcation fabric.

- Boardwalk: This EC is comprised of a 24 inch profile consisting of concrete grade beam to support the elevated boardwalk timber framing, ¾-inch crushed stone subbase, approved imported general fill and underlain by MIRAFI 140ML (or approved equal) demarcation fabric.

- Lawn: This EC will consist of a 24 inch profile consisting of topsoil, approved imported general fill and and underlain by MIRAFI 140ML (or approved equal) demarcation fabric.

- Planting Bed: This EC will consist of a 24 inch profile consisting of mulch, topsoil, approved imported general fill and underlain by MIRAFI 140ML (or approved equal) demarcation fabric.

- Tree Plantings: This EC will allow for tree planting pits with excavation width to be three times the width of the root ball. The depth of the planting pit will be a minimum of 4 feet below the bottom of the root ball underlain by MIRAFI 140ML (or approved equal) demarcation fabric. Approved imported topsoil and general fill will be applied under and around the root ball.

- Living Shoreline: This EC will incorporate the following profile to the property boundary defined by the high water line at elevation 0.99 (NAVD 88). The shoreline will be graded to a 3:1 slope comprised of approved imported general fill and underlain by MIRAFI 140ML (or approved equal) demarcation fabric. The slope will incorporate toe protection comprised of rock, coastal plantings, and coir logs.

Utilities will be placed in a "clean corridor" that are not owned by the Town and where the utility company will be responsible for the repair of the line. Utility trenches will be excavated to a depth of five (5) feet below the ground surface and backfilled with approved imported material. In established "clean corridors" the MIRAFI 140ML separation fabric will not be used. The utility trench excavation depth of five feet typically eliminates the need for a separation fabric, which is an important consideration should the Site be subject in the future to utility subordination associated with an environmental land use restriction requirement.

4.7 Conceptual ELUR

At this time the Site has not been entered into a formal state cleanup program and would not be required to record an ELUR following site redevelopment. Should this be a requirement in the future as an obligation of receipt of public funding, an ELUR will need to be recorded for the Site to prohibit actions that would expose impacted soil. The restrictions that would be established in the ELUR include:

1. No demolition of the building or disturbance of the building floor slab which render underlying soil inaccessible because such soil poses an unacceptable risk to human health
2. No unauthorized disturbance of the engineered controls or underlying polluted soil because such soil poses an unacceptable risk to human health

The ELUR will need to be prepared in accordance with the latest version of the DEEP's Environmental Land Use Restriction Guidance Document. The process of recording an ELUR (if needed) includes the following:

1. Public notice the intent to record an ELUR
2. Prepare and submit to the DEEP for administrative and technical review the Application for Environmental Land Use Restriction
3. Review title documents and obtain any necessary subordination agreements
4. Receive DEEP approvals
5. Record the ELUR on the Town of Stonington land records
6. Submit to the Commissioner a certificate of title that certifies that each holder of an interest in the property subject to the ELUR has irrevocably subordinated such interest to the ELUR or the Commissioner has waived the requirement for interests that are so minor as to not affect the ELUR.
7. Send a copy of the ELUR by certified mail, return receipt requested, to: the chief administrative officer of the Town of Stonington, the chairman of the municipal planning, zoning, or planning and zoning commission, the local Director of Health, and any person who submitted comments on the ELUR during the public notice period. Submit copies of these letters to the DEEP.

4.8 Imported Backfill Acceptance Criteria

Backfill (soil, topsoil, loam, subbase) imported to the site that is used for construction of clean cover surface profiles for the engineered controls and utility clean corridors will need to be approved by the owner's representative for acceptable environmental quality. Approval will be based on chemical testing data for constituents of concern collected at a frequency described below.

One composite sample for every 500 cubic yards of soil/material with at least three samples for each soil/material type from each borrow source location. Samples will be analyzed for pesticides (EPA Method 8081), chlorinated herbicides (EPA Method 8151), polyaromatic hydrocarbons (EPA Method 8270), total petroleum hydrocarbons (CTETPH method), total RCRA 8 Metals (EPA Method 6010 / 7421 / 7470), volatile organic compounds (EPA Method 8260), and polychlorinated biphenyls (EPA Method 8082). Based on the results of this testing, additional synthetic precipitation leaching procedure (SPLP) or toxicity characteristic leaching procedure (TCLP) testing may be required.

Satisfactory soil/material shall not exceed laboratory detection limits for concentrations of pesticides, chlorinated herbicides, polyaromatic hydrocarbons, total petroleum hydrocarbons, volatile organic compounds, and polychlorinated biphenyls. Satisfactory soil/material shall not exceed naturally occurring background levels for concentrations of RCRA-8 Metals in native soils on site. In no case shall soil/material exceed any GB pollutant mobility criteria (GA PMC) or residential direct exposure

criteria (RES DEC) established in Sections 22a-133k-1 through 22a-133k-3 of the regulations of Connecticut state agencies.

Acceptance submittals will need to include a description for each originating off-site location or project from which imported soil/material is obtained, including known historical activities occurring on the site, and any possible releases that have occurred. The following are not acceptable:

- Soils/materials originating from sites subject to any Federal or State remediation program.
- Soils/materials that have undergone any treatment process for one or more chemical constituents listed within the Connecticut Remediation Standard Regulations (CT RSRs).

5 Request for Variance for Engineered Control

5.1 Application for Variance – Part 1

If in the future the Town is required to file a formal engineered control variance request with DEEP as an obligation of receipt of public funding, this section can be used to provide the rationale and strategy for justification for use of an engineered control. In accordance with 22a-133k-2(f)(2)(A)(iv), the remedial strategy for the Site and the request for the Commissioner's approval to use an engineered control are based on the following circumstances:

aa) The cost of remediating the polluted soil at such release area is significantly greater than the cost of installing and maintaining an engineered control for such soil and conducting ground-water monitoring

bb) The significantly greater cost of remediation outweighs the risk to the environment and human health if the engineered control fails to prevent the mobilization of a substance in the soil or human exposure to such substance

In order to evaluate the cost and technical feasibility of remedial strategies to achieve RSR objectives at the Site, Fuss & O'Neill conducted a remedial alternatives screening followed by a more detailed technical evaluation and financial assessment of potentially suitable technologies.

5.1.1 Remedial Technologies Screening

A screening of potential remedial options was conducted to identify remedial technologies capable of remediating pollutants in fill to the direct exposure criteria. The table below summarizes the results of the screening analysis:

Remedial Technologies Screening for
Fill Exceeding the Direct Exposure Criteria

Remedial Technology	Considered Further?	Rationale for No Further Consideration
Excavation and Institutional Control A minimum of two feet of impacted fill is excavated and disposed off-site. Asphalt pavement and two feet of clean soil would render the remaining fill inaccessible. In landscaped areas, four feet of material would be excavated and replaced with clean fill. An institutional control is also required.	Yes	---
Engineered / Institutional Controls These alternatives physically isolate soil to prevent human contact.	Yes	---
Biological / Chemical Treatment A variety of chemical and biological agents can be used to bring materials into contact with subsurface contaminants to remediate the contamination.	No	Not appropriate for all constituents requiring remediation. Not necessarily effective above the water table. Not compatible with construction schedule.
In-situ Thermal Treatment In-situ thermal treatment consists of heating the subsurface to destroy or enhance the removal of organic contaminants.	No	Not appropriate for all constituents to be remediated. Not necessarily effective above the water table. Not compatible with construction schedule.

The remedial strategies selected for more detailed consideration are described below:

Option 1: Excavation of Impacted Fill and Rendering Remaining Soils Inaccessible

This approach would address direct exposure criteria exceedances in fill by using a combination of excavation and the import of clean fill to render the remaining material inaccessible in accordance with the self-implementing mechanism in Section 22a-133k-1(a)(32)(B) of the RSRs, which defines inaccessible soil as:

1. More than four feet below the ground surface
2. More than two feet below a paved surface consisting of at least three-inches of bituminous concrete or concrete, which two feet may include the pavement sub-base

This approach also requires the use of institutional controls to prohibit the unauthorized disturbance of inaccessible material and would include the following actions that would not already be part of the planned construction:

- Excavation of fill beneath from 1 to 4 feet depth across the site to create a 4 feet depth interval required for a clean cover profile section for landscaped areas.
- Excavation, management, and potential disposal of approximately 5,000 cubic yards (cy) of excavated material based on an estimate of 1.42 acre area with an average excavation depth of two feet.
- Record an institutional control to prohibit the unauthorized disturbance of the inaccessible material below the clean cover surface profiles.

Option 2: Construction of Direct Exposure Engineered Control

The proposed direct exposure engineered control is detailed in Section 4.6. Details are provided in Appendix B. In summary, this approach would incorporate the construction of an engineered pavement, hardscape, or soil cross section to physically isolate the underlying material and recording an institutional control to prohibit the disturbance of both the engineered control and isolated material.

The engineered control cross section would be consistent with the park redevelopment plan. The only additional construction element would be the geotextile marker layer. Because both Option 1 and Option 2 leave impacted soil in place beneath an isolating layer, the engineered control option can be considered a more "green" approach because it minimizes the quantity of polluted soil that needs to be disturbed and transported off-site, resulting in far fewer truck trips, both to remove material and to bring in clean fill.

5.1.2 Order-of-Magnitude Cost Evaluation

The primary difference in cost between excavation and rendering fill inaccessible (Option 1) and the engineered control (Option 2) is associated with the volume of soil that would need to be excavated, handled, and disposed associated with creation of the clean soil interval below the surface profiles. Option 1 would require between one (1) to four (4) feet of excavation below the surface profiles to create a four feet deep interval of clean soil that is required for the self-implementing inaccessible mechanism under the RSRs. The volume of excess material that would be generated by the excavation activity would not be able to be reuse on-site and would have to be disposed of off-site at a permitted facility. The deeper interval required for the clean profile associated with Option 1 would also require more imported backfill.

The surface completion costs and cost to record an ELUR for both options will be the same. A comparison of the costs associated with Options 1 and 2 is provided below:

Remedial Option Cost Comparison

Remedial Option	Excavation		Backfill			Total Cost
	Impacted Soil Volume	Cost at $105/ton(1)	Clean Fill Volume(2,3)	Cost at $40/cy		
Option 1 Soil Excavation	5,000 cy	$840,000	5,500 cy	$220,000		$1,060,000
	Excavation		Backfill & Demarcation Fabric			
	Impacted Soil Volume	Cost at $5/cy(4)	Clean Fill Volume(5)	Separation Fabric (6)	Separation Fabric Cost at $0.25/sf	
Option 2 Engineered Control	200 cy	$1,000	0	54,000 sf	$13,500	$14,500

(1)Assumes 5,000 CY at 1.6 tons per cubic yard for excavation, handling, and off-site disposal (assumed non-hazardous).
(2)Assumes 5,500 CY of imported approved clean backfill to replace the material excavated.
(3)Assumes a 10 percent compression factor; the actual volume of soil needed is 1.1 times excavation volume
(4) Assumes based on preliminary grading analysis, an excess of 200 cy will be generated to accommodate the engineered control surface profiles. This material will be relocated on-site below the engineered controls. Cost is for excavation and on-site relocation. No off-site disposal.
(5)Additional clean fill beyond what is required to construct the engineered control profiles will not be required because the earthwork volumes on the site will balance.
(6)Assumes the majority of the 1.24 acre site will be underlain with separation fabric as part of the engineered control surface profile.

As shown above, the cost to excavate and dispose of one to four feet of polluted fill and backfill the void space with clean fill is approximately $1.0 million more than constructing a direct exposure engineered control.

5.1.3 Justification for Use of an Engineered Control

Based on an assessment of site redevelopment plans, technical feasibility, sustainability, and cost relative to potential benefit, the selected remedial alternative is Option 2: Construction of Direct Exposure Engineered Control. This strategy, which will prevent contact with fill, meets the conditions necessary for the Commissioner of the DEEP to approve the construction of the engineered control, as presented below:

- **Condition aa - Cost of Remediation vs. Cost of Engineered Control**
  As demonstrated in Section 5.1.2, the cost of excavating one to four feet of fill and replacing it with clean backfill to render the remaining soil inaccessible is significantly greater than (approximately 73 times) the cost of installing and maintaining an engineered control.

- **Condition bb - Cost of Engineered Control vs. Potential Risk**
  With respect to condition bb, the greater cost of extensive soil excavation outweighs the risk to the environment and human health if the engineered control fails to prevent exposure to the

polluted soils. The pollutants present beneath the control (metals, PAHs, and ETPH) do not pose short term risk, and in order for a significant exposure to occur, a disturbance of 24 inches deep over a large enough area of the engineered control to allow contact with the underlying soil would be necessary. If the Site is subject to meeting formal compliance with the RSRs in the future, disturbance of the engineered control and polluted soils will be legally prohibited by an ELUR, and an operations and maintenance plan will be implemented to minimize the potential for cap failure, and groundwater will be monitored to demonstrate compliance with applicable RSR groundwater criteria.

5.1.4 Additional Details Supporting Appropriateness of an Engineered Control

In addition to the above requirements, Part 1 of the Application for Engineered Control requests the following supporting information:

Nature and Extent of Contamination Appropriately Defined

As presented in Section 3, the extent and chemical composition of the release areas have been sufficiently characterized to determine the appropriateness of using an engineered control.

Impact of Other Constituents of Concern on the Engineered Control

The engineered control is intended to address impacted fill and residual concentrations of similar constituents (ETPH, PAHs, and metals) at other release areas that exceed only the DEC. Other release areas at the Site will not affect the implementation, integrity, or functionality of the engineered control.

Effect of the Engineered Control on Remediating Other Release Areas

Section 3 discusses other remediation will be conducted at the Site, which includes excavation of petroleum-impacted soil and removal of below grade infrastructure. It is anticipated that excavation and other required subsurface activities will be conducted prior to completing the engineered control; therefore, the engineered control will have no effect on these remedial efforts.

Potential Short-Term Risks Associated with Failure of the Engineered Control

Failure of the engineered control will not pose an unacceptable short term risk to human health and the environment. The engineered control is being constructed to prevent direct human exposure to polluted soil. The pollutants present beneath the control (metals, PAHs, and petroleum hydrocarbons) do not

pose short term (i.e., acute) risk to human health or the environment. In addition, a maintenance plan will be in place to identify and repair damage to the engineered control.

Consistency with On- and Off-Site Land Use

The Site is located in an area zoned for both residential and commercial and is surrounded by the river, and Mystic Seaport. The engineered control design includes both landscaped and paved parking elements that will fit into the property's future use as public open space. The property provides features including walks, a boardwalk, and gathering space that enhance connectivity with the surrounding neighborhood. Design elements for the shoreline reconstruction factor in climate resiliency features including living shoreline components and hardscape (boulders, oyster castles, coir logs) for wave energy dissipation and slope protection.

Receptor Assessment

An evaluation of potential receptors is provided in Section 2.4.5.

Similar Approach Approved by DEEP in the Past

Use of an engineered control to manage soil exceeding direct exposure criteria is one of the three basic types of engineered controls referenced in the Guidance Document for Engineered Controls (DEEP, 2010). Engineered controls consisting of asphalt caps, hardscape, and landscape have been approved by the DEEP for numerous Sites including the following locations where impacted fill containing asphalt, coal, and/or ash was present:

- 585 East Main Street, New Britain
- 344 Winchester Avenue, New Haven
- 275 Winchester Avenue, New Haven
- 1 Bass Pro Drive and 545 Stratford Avenue, Bridgeport
- 470 James Street, New Haven

6 Additional Requirements

Additional requirements will depend on if the Town is obligated to achieve formal compliance with the state cleanup standards as a result of construction funding commitments. We recommend that a summary report be prepared following site remediation to document the activities undertaken.

Should the Town be obligated to achieve formal compliance with the cleanup standards through participation in a state voluntary cleanup program additional requirements will include:

- Entry into a voluntary remediation program
- Preparation, filing, and DEEP approval of a Part 2 ECVR Request
- Preparation and implementation of an engineered control operations and maintenance plan

- Posting financial assurance for the engineered control
- Preparation, filing, and DEEP approval of an environmental land use restriction
- Installation of monitoring wells and post remediation groundwater monitoring
- Preparation and filing of an LEP Verification and LEP Verification Report

An implementation schedule is uncertain as the Town is currently exploring options for construction funding.

7 References

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Table

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Table 1
Summary of Areas of Concern
Remedial Action Plan
Mystic River Boathouse Project
Mystic, Connecticut

Area of Concern (AOC)		Constituents of Concern[1] (Bold = Release)	Conceptual Model Summary	RSR Exceedances[2]	Recommended Remedial Strategies
1	Site-Wide Fill	Metals PAHS PCBs ETPH VOCs	The Site is "made land" comprised of fill ranging in thickness from 6 to 12 feet overlying estuarine deposits. The fill contains coal ash, slag, coal fragments, metal fragments, glass, concrete, brick, and wood. Infrastructure associated with the Former Rossie Velvet Mill operations across the street still exists at the Site within the fill. This includes former building foundations, piping and conduit for a former fire suppression system, a septic leaching field, and other piping where the past use is unknown. The fill contains pollutants comprised of petroleum hydrocarbons, metals (primarily arsenic and lead), and a local area containing relatively low concentrations of PCBs (2.5 mg/kg). Due to the heterogeneity of the fill (particularly the occurrence of coal ash), which is inferred to be the primary source of the petroleum hydrocarbons and metals, concentrations of pollutants in the fill have the potential to exceed the Remediation Standard Regulations Direct Exposure Criteria. Samples of the fill collected from the upland and the shoreline bank above the high tide line exceed the baseline Direct Exposure Criteria for one or more of these constituents.	DEC Res 2x I/C 2x arsenic ■ ■ ■ ■ lead ■ ■ ■ PAHs ■ ■ ■ PCBs ■ ■ ETPH ■ ■ ■ PMC RSR PMC Variance for Coal Ash SWPC No exceedances at the downgradient well	Use the surface completions as engineered controls (hardscape, landscape) and building to prevent human contact with the underlying soil.
2	Former Tunnel & Fire Pump Void/Conduit	Metals PAHs PCBs ETPH VOCs	A GPR anomaly consistent with a void was identified along the eastern side of the garage and sidewalk during the investigation. The anomaly extended below the roadway toward the former mill building across the street. The exterior location of the anomaly possibly representing the tunnel is adjacent to the 8-inch diameter hole and void space below the garage which likely represents a former fire pump system. Observation of the river bed at low tide revealed an approximately 24-inch diameter metal pipe positioned vertically in the sand. Review of the historical Sanborn maps indicates that this structure is located in approximately the same area as the mouth of the shoreline inlet observed in the 1911 map. Based on observation and orientation of the void space below the garage and the position of the 24-inch diameter pipe in the river, the fire pump conduit from the garage to the river may still be in place. Borings advanced within the suspected conduit area had detections of VOCs at approximately 6-7.5 feet below grade. Analytical soil results indicated that cis-1,2-dichloroethene (cis-1,2-DCE) was detected above laboratory detection limits but below the applicable RSR criteria and that trichloroethene (TCE) was detected above the pollutant mobility criteria (PMC) for class GB areas. A release area of at least 400 square feet in size is associated with a former mill fire suppression system or a former building where the subsurface foundation is likely still in place. Concentrations of chlorinated volatile organic compounds of cis-1,2-dichloroethene, and trichloroethene exist in the 5 to 8 feet depth interval below the ground surface. Concentrations of these pollutants exceed the baseline RSR Pollutant Mobility Criteria. Groundwater samples collected from a well downgradient of the area contained low concentrations of these pollutants in one of two sampling rounds.	DEC Res 2x I/C 2x No exceedances of DEC for VOCs PMC GB 2x VOCs ■ SWPC No exceedances VC No exceedances	Targeted excavation and off-site disposal of impacted soil within the release area.
3	Former 500-Gallon UST	Metals PAHs PCBs ETPH VOCs	A former 500-gallon gasoline UST, located north of the northeast corner of the garage was removed in 2008 and confirmatory soil samples from the tank grave reportedly indicated that the soil in the grave was clean. Historic Sanborn fire insurance maps indicate that a gasoline engine was formerly located in approximately the same area. It is therefore possible that the tank that was removed in 2008 was not the original tank and that the tank grave sampled following the tank removal was not the original tank grave soils. Samples collected from five borings advanced at an adjacent to the AOC identified petroleum and VOCs at depths between approximately 8-14 feet below grade. The VOCs 1,2,4- and 1,3,5-trimethylbenzene concentrations exceeded the GB PMC and the ETPH concentration exceeded the ResDEC. The size of the release area spanning borings SB-6, SB-09, MW-04, and SB-13 is approximately 2,000 square feet with impacted petroleum containing-soil located between the seasonal high and low water table between 6 and 11 feet below the ground surface.	DEC Res 2x I/C 2x ETPH ■ PMC GB 2x VOCs ■ SWPC Petroleum hydrocarbon contamination is present in groundwater at the release area. VC No exceedances	Targeted excavation and off-site disposal of impacted soil within the release area.

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Table 1
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Remedial Action Plan
Mystic River Boathouse Project
Mystic, Connecticut

Area of Concern (AOC)		Constituents of Concern[1] (Bold = Release)	Conceptual Model Summary	RSR Exceedances[2]	Recommended Remedial Strategies
4	Floor Drain in Garage	Metals PAHs PCBs ETPH VOCs	A boring was advanced at a floor drain in the center of the garage floor. The concrete floor surrounding the floor drain appeared to be in good condition and no staining was observed. An external connection to the floor drain was not evident. A soil sample was collected from the first 6 inches of soil below the bottom of the floor slab where a release would most likely be identified in one had occurred.. Several metals and the PAHs chrysene and pyrene were detected at concentrations typical of the concentrations detected in the site-wide fill. There was no evidence that a release from the floor drain had occurred.	None	No further action
5	Above Ground Storage Tanks	Metals PAHs PCBs ETPH VOCs	The residential structure located on the southern portion of the Site was historically heated by a 275-gallon AST located in the basement of the structure. The AST was contained in a dedicated, walled-in room and no visual evidence of leaks or of petroleum impacts was observed. No evidence of petroleum impacts were observed in soil boring SB-01, located just south of the residential structure. A former fuel oil AST was historically located in the southwestern corner of the crawl space found below the floor in the southern portion of the garage structure. The tank has since been removed and Site reconnaissance has confirmed that it is no longer present on Site. A soil boring (SB-05) was advanced just west of the garage structure to evaluate the soil for petroleum impacts associated with the former tank. No physical evidence of petroleum impacts was observed and the analytical results indicate that no ETPH or VOCs were detected.	None	No further action
6	Septic Leaching Field	Metals PAHs PCBs ETPH VOCs	An out of use septic leach field is located south of the residence. The leach field is no longer in use as reportedly the Site has been served by public sewer since 1973. Two soil borings were advanced in the area of the former leach field, one of which was completed as a monitoring well (SB-01 and MW-01). No physical impacts were identified in either of the borings. Analytical results indicate that several PAHs were detected in the soil at MW-01 at concentrations below the applicable RSR criteria and at levels consistent with the fill observed across the Site.	None	No further action

Page 2 of 3

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Table 1
Summary of Areas of Concern
Remedial Action Plan
Mystic River Boathouse Project
Mystic, Connecticut

[1]Constituents of concern
- Bold text = release
- VOCs = volatile organic compounds
- ETPH = extractable total petroleum hydrocarbons
- SVOCs = semivolatile organic compounds
- PAHs = polycyclic aromatic hydrocarbons
- PCBs = polychlorinated biphenyls
- Metals (As=arsenic, Ba=barium, Be=beryllium, Cd=cadmium, Cr=chromium, Cu-copper, Pb=lead, Hg=mercury, Ni-nickel, Ag=silver, Zn=zinc)
- Meth Cl = methylene chloride
- 1,1-DCE – 1,1-dichloroethylene
- BEHP = bis(2-ethylhexyl)phthalate

[2]RSR Criteria
- ---- = no RSR exceedance identified
- NA = not applicable
- DEC = direct exposure criteria
- Res = residential
- I/C = industrial/commercial
- PMC = pollutant mobility criteria
- SWPC = surface water protection criteria
- Res VC = residential volatilization criteria

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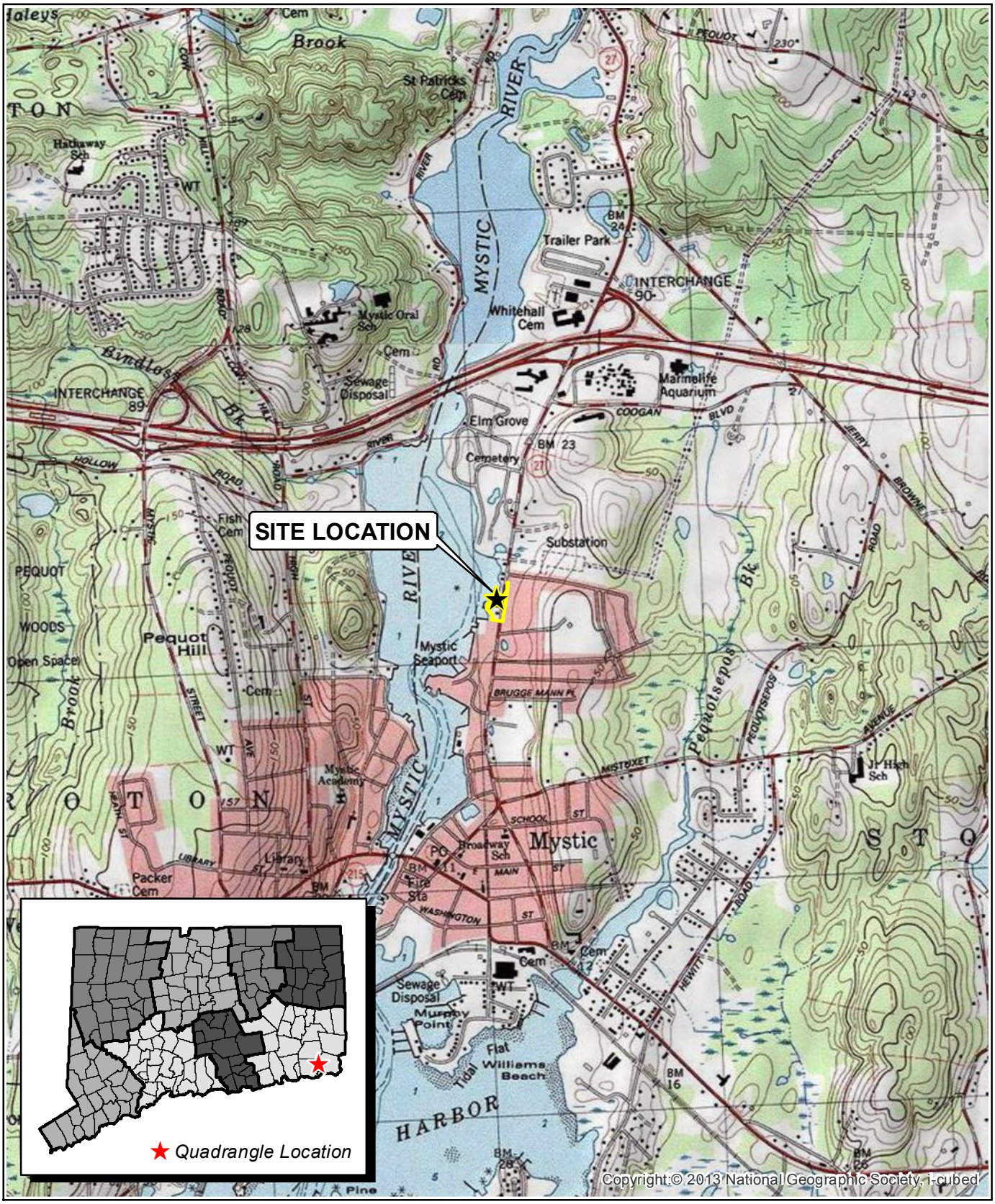
Figures



Path: F:\P2017\0167\A10\Phase II ESA - Report\GIS\Phase_I_Figures_Basemap.mxd

N

0 0.25 0.5

Miles

Data Source(s):
1. Parcel boundaries - CT DEEP
2. Basemap - National Geographic TOPO! 1:24,000-scale maps; TOPO! maps are seamless, scanned images of United States Geological Survey (USGS) paper topographic maps. http://goto.arcgisonline.com/maps/USA_Topo_Maps

Disclaimer: This map is not the product of a Professional Land Survey. It was created by Fuss & O'Neill, Inc. for general reference, informational, planning and guidance use, and is not a legally authoratative source as to location of natural or manmade features. Proper interpretation of this map may require the assistance of appropriate professional services. Fuss & O'Neill, Inc. makes no warrantee, express or implied, related to the spatial accuracy, reliability, completeness, or currentness of this map.

Site Location Map
Mystic Boathouse

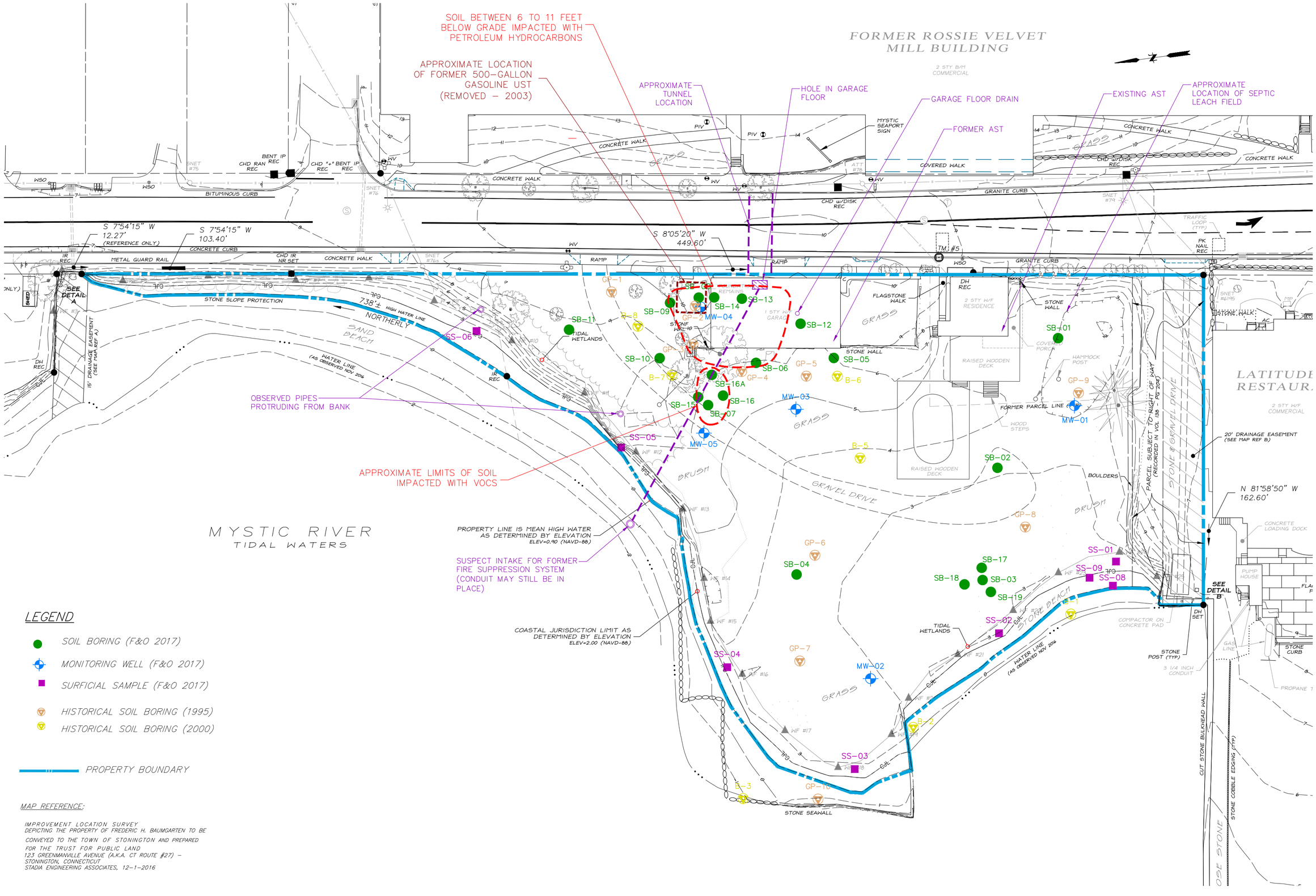
MYSTIC CONNECTICUT

FUSS & O'NEILL
146 Hartford Road
Manchester, CT 06040
860.646.2469 | www.fando.com

PROJ. No. 20170167.A10

DATE: February 2020

FIGURE 1



LEGEND

- SOIL BORING (F&O 2017)
- MONITORING WELL (F&O 2017)
- SURFICIAL SAMPLE (F&O 2017)
- HISTORICAL SOIL BORING (1995)
- HISTORICAL SOIL BORING (2000)
- PROPERTY BOUNDARY

MAP REFERENCE:

IMPROVEMENT LOCATION SURVEY
DEPICTING THE PROPERTY OF FREDERIC H. BAUMGARTEN TO BE CONVEYED TO THE TOWN OF STONINGTON AND PREPARED FOR THE TRUST FOR PUBLIC LAND
123 GREENMANVILLE AVENUE (A.K.A. CT ROUTE #27) – STONINGTON, CONNECTICUT
STADIA ENGINEERING ASSOCIATES, 12-1-2016

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
1.			XX/XX	XX

SCALE:
HORZ.: 1" = 30'
VERT.:
DATUM:
HORZ.:
VERT.:
0 15 30
GRAPHIC SCALE

FUSS & O'NEILL
146 HARTFORD ROAD
MANCHESTER, CONNECTICUT 06040
860.646.2469
www.fando.com

SITE PLAN AND SAMPLING LOCATIONS

123 GREENMANVILLE AVENUE

MYSTIC CONNECTICUT

PROJ. No.: 20170167A10
DATE: MARCH 2018

FIGURE 2

File Path: J:\DWG\P20170167\A10\Environmental\Plan\20170167A10_STP01.dwg Layout: 18X24-L Plotted: Thu, March 22, 2018 - 4:19 PM User: bchurch
MS VIEW: LAYER STATE: Plotter: DWG TO PDF.PC3 CTB File: FO HALF.STB

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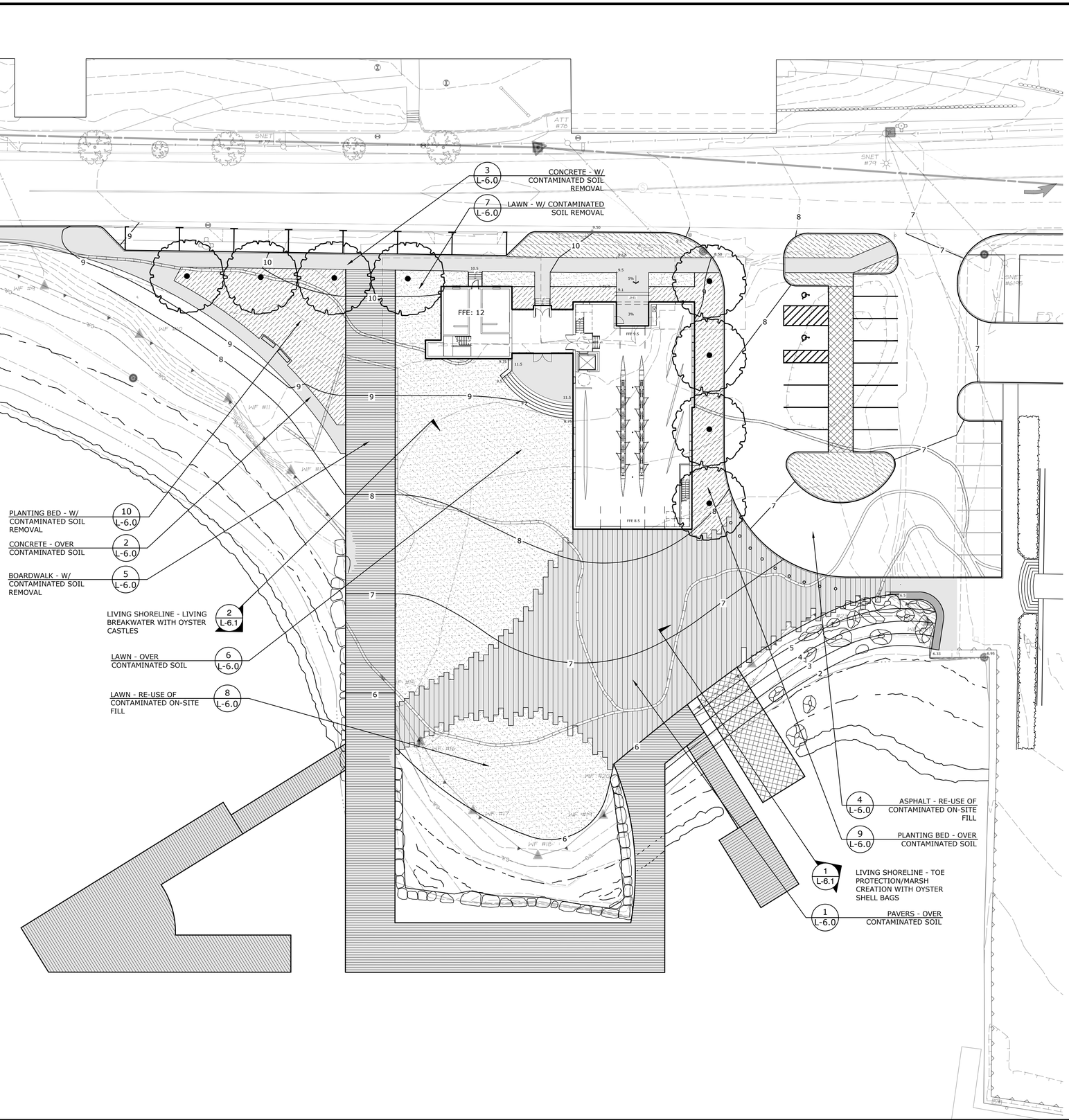
Appendix A

Preliminary Site Improvement Plan

Mystic River Boathouse Park

123 Greenmanville Ave Mystic, CT 06355

LANDSCAPE
KENT+ FROST
ARCHITECTURE
1 HIGH STREET
MYSTIC, CT 06355
860.572.0784
kentfrost.com



PRELIMINARY REVIEW

Revisions	Date

NORTH

0 5 10 20

SITE IMPROVEMENTS PLAN

Scale	1" = 10'
Date	April 20, 2018
K+F Project No.	2017022
Drawing No.	L-1.0

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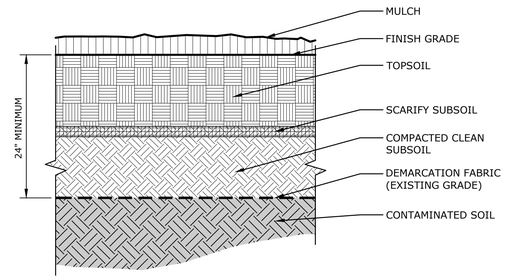
Appendix B

Engineered Control Details



9 PLANTING BED - OVER CONTAMINATED SOIL
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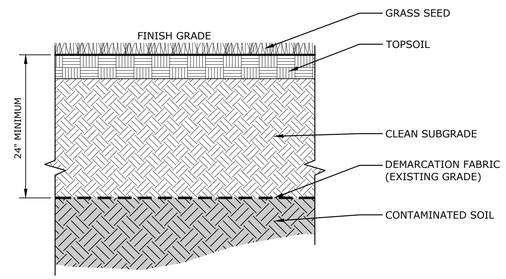

6 LAWN - OVER CONTAMINATED SOIL
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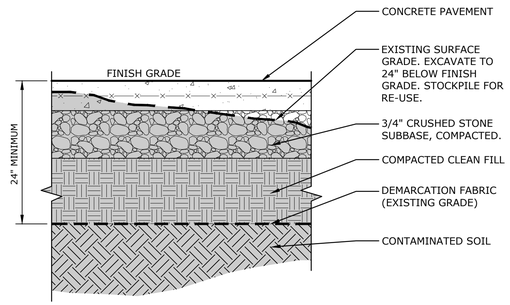

3 CONCRETE - W/ CONTAMINATED SOIL REMOVAL
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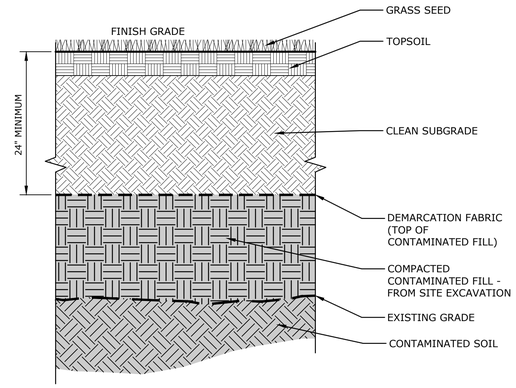

8 LAWN - RE-USE OF CONTAMINATED ON-SITE FILL
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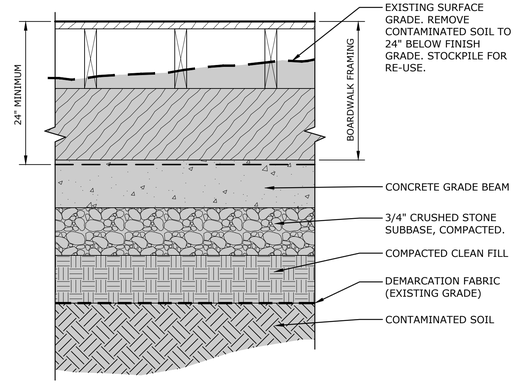

5 BOARDWALK - W/ CONTAMINATED SOIL REMOVAL
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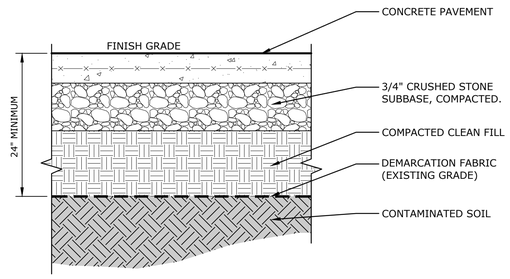

2 CONCRETE - OVER CONTAMINATED SOIL
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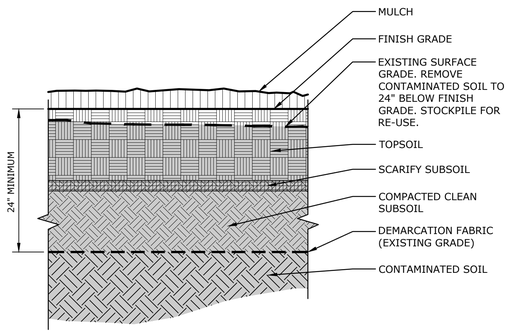

10 PLANTING BED - W/ CONTAMINATED SOIL REMOVAL
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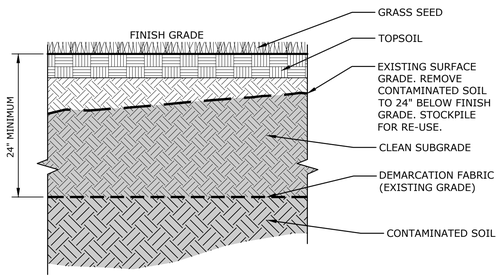

7 LAWN - W/ CONTAMINATED SOIL REMOVAL
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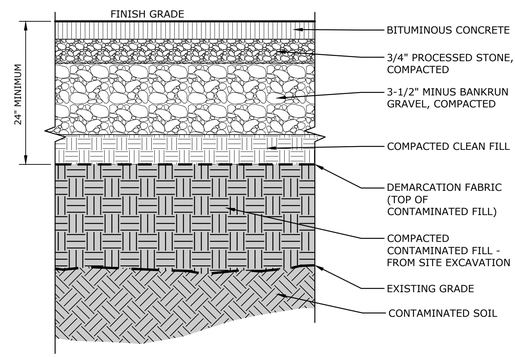

4 ASPHALT - RE-USE OF CONTAMINATED ON-SITE FILL
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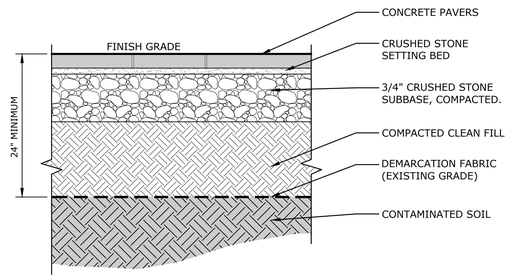


1 PAVERS - OVER CONTAMINATED SOIL
1" = 1'-0" P-2017-022-BOAT-45

MYSTIC RIVER BOATHOUSE PARK

125-129 Greenmanville Avenue
Stonington, CT

LANDSCAPE
KENT+ FROST
ARCHITECTURE
1 HIGH STREET
MYSTIC, CT 06355
860.572.0784
kentfrost.com

PRELIMINARY REVIEW

Revisions	Date

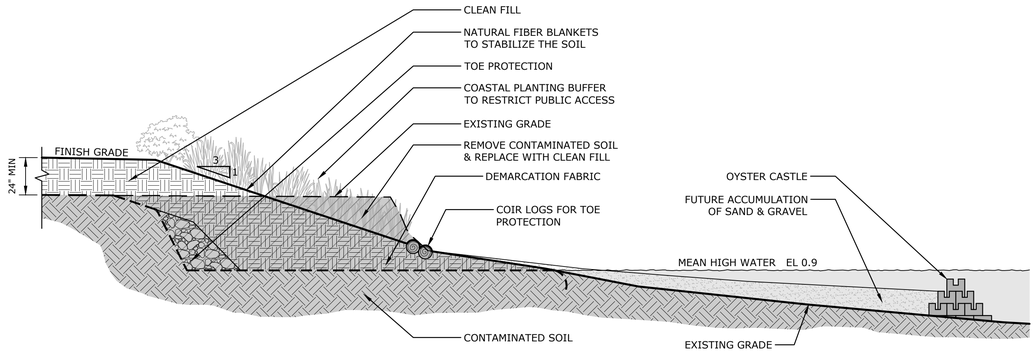
SITE DETAILS

Scale	
Date	December 16, 2019
K+F Project No.	2017022
Drawing No.	L-6.0

MYSTIC RIVER BOATHOUSE PARK

125-129 Greenmanville Avenue
Stonington, CT

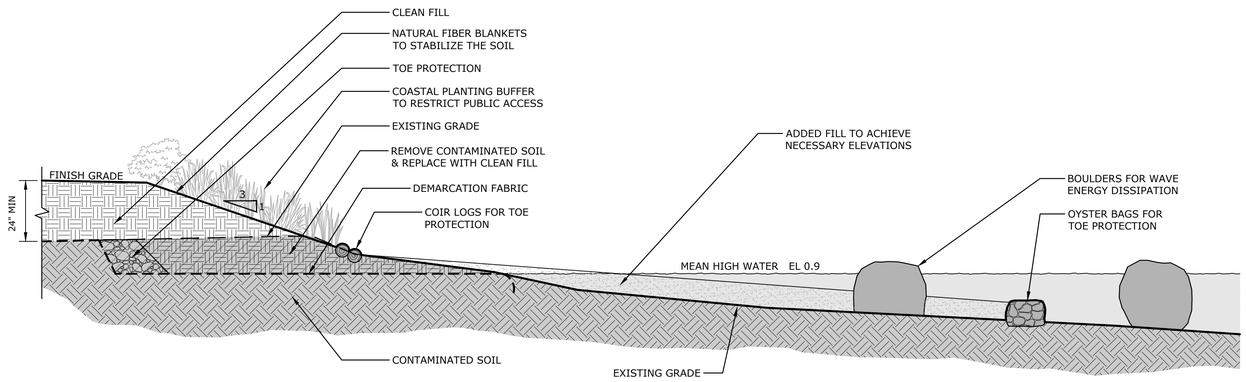
LANDSCAPE
KENT+ FROST
ARCHITECTURE
1 HIGH STREET
MYSTIC, CT 06355
860.572.0784
kentfrost.com



2 LIVING SHORELINE - LIVING BREAKWATER WITH OYSTER CASTLES

1/4" = 1'-0"

P-2017-022-BOAT-55



1 LIVING SHORELINE - TOE PROTECTION/MARSH CREATION WITH OYSTER SHELL BAGS

1/4" = 1'-0"

P-2017-022-BOAT-56

PRELIMINARY REVIEW

Revisions	Date

LIVING SHORELINE DETAILS

Scale	
Date	December 16, 2019
K+F Project No.	2017022
Drawing No.	

L-6.1