

**ATTACHMENT L-8: BASELINE  
CHARACTERIZATION ENVIRONMENTAL  
SAMPLE ANALYTICAL RESULTS  
(AUGUST 9, 2019)**



Project	I-64 Hampton Roads Bridge-Tunnel
To	Hampton Roads Connector Partners (HRCP)
From	Mott MacDonald
Subject	Baseline Characterization Environmental Sample Analytical Results
Date	August 9, 2019
Attachments	Figure 1 – Sample Location Plan- South Island Tables 1 through 7 – Summary of Analytical Results

Baseline Characterization Environmental Sampling was conducted for the South Island Entrance portal portion of the I-64 Hampton Roads Bridge Tunnel (HRBT) Project on April 24 through May 13, 2019. Environmental sampling was conducted concurrent with Geotechnical investigation activities.

Soil, sediment, and water baseline characterization sampling was conducted in order to evaluate reuse and disposal options for materials anticipated to be encountered/excavated during construction activities relating to the HRBT Project. The reuse and disposal options being evaluated for the HRBT Project include the utilization of soils and sediment for tunnel construction (as ballast) and/or island expansion (inclusive of in-water placement), the disposal of excess soils and sediment at Port Tobacco at Weanack, Dominion Recycling and/or other upland disposal facilities, and the treatment and disposal of water generated during construction activities.

Sampling was conducted to obtain baseline characterization data from material that will be excavated or generated during construction activities at the South Island Entrance portal location. Additional sampling will most likely be required to fulfill regulatory and/or facility requirements prior to or during disposal activities. Hampton Roads Connector Partners (HRCP) will need to coordinate with the applicable regulatory agencies and disposal facilities to discuss the results of the baseline characterization environmental sampling, and to determine any additional sampling requirements.

**1. SAMPLE COLLECTION ACTIVITIES**

Eight (8) soil borings were installed within the South Island Entrance portal location via sonic drilling. The boring locations are depicted on Figure 1. As the top 25 feet of soils at the project site were imported as part of island development, one composite “fill” sample was collected from the 0-25 feet below site grade (bsg) interval of each soil boring. Each “fill” sample was analyzed for Standard Chemistry, Elutriate and Toxicity Characteristic Leaching Procedure (TCLP) analysis. A second composite sample was collected from the 25’ to the end interval of each soil boring and analyzed for Standard Chemistry, Elutriate and TCLP analysis. Groundwater samples ENV-081-GW (30’) and ENV-081-GW (127’) were collected from soil boring location HRCP-L-ENV-081. Surface water samples HRCP-L-ENV-RW (4/30/19) and HRCP-L-ENV-RW (5/9/2019) were collected from the James River, in the vicinity of the project area, as surface water from the James River was utilized as elutriate preparation water. The soil boring sampling conducted April 24 through May 13, 2019 is depicted on the following table:

Boring ID	Depth (Feet bsg)	Sample	Analysis
HRCP-L-ENV-024	0-25	HRCP-L-ENV-024-Fill	Elutriate
		HRCP-L-ENV-024-Fill	Standard Chemistry, TCLP
	25-90	HRCP-L-ENV-024	Standard Chemistry, TCLP
		HRCP-L-ENV-024 Elutriate	Elutriate
HRCP-L-ENV-025	0-25	HRCP-L-ENV-025-Fill	Elutriate
		HRCP-L-ENV-025-Fill	Standard Chemistry, TCLP
	25-90	HRCP-L-ENV-025	Standard Chemistry, TCLP
		HRCP-L-ENV-025 Elutriate	Elutriate
HRCP-L-ENV-026	0-25	HRCP-L-ENV-026-Fill	Elutriate
		HRCP-L-ENV-026-Fill	Standard Chemistry, TCLP
	25-70	HRCP-L-ENV-026	Standard Chemistry, TCLP
		HRCP-L-ENV-026 Elutriate	Elutriate
HRCP-L-ENV-027	0-25	HRCP-L-ENV-027-Fill	Elutriate
		HRCP-L-ENV-027-Fill	Standard Chemistry, TCLP
	25-55	HRCP-L-ENV-027	Standard Chemistry, TCLP
		HRCP-L-ENV-027 Elutriate	Elutriate
HRCP-L-ENV-082	0-25	HRCP-L-ENV-082-Fill	Elutriate
		HRCP-L-ENV-082-Fill	Standard Chemistry, TCLP
	25-200	HRCP-L-ENV-082	Standard Chemistry, TCLP
		HRCP-L-ENV-082 Elutriate	Elutriate
HRCP-L-ENV-083	0-25	HRCP-L-ENV-083-Fill	Elutriate
		HRCP-L-ENV-083-Fill	Standard Chemistry, TCLP
	25-60	HRCP-L-ENV-083	Standard Chemistry, TCLP
		HRCP-L-ENV-083 Elutriate	Elutriate
HRCP-L-ENV-084	0-25	HRCP-L-ENV-084-Fill	Elutriate
		HRCP-L-ENV-084-Fill	Standard Chemistry, TCLP
	25-45	HRCP-L-ENV-084	Standard Chemistry, TCLP
		HRCP-L-ENV-084 Elutriate	Elutriate
HRCP-L-ENV-085	0-25	HRCP-L-ENV-085-Fill	Elutriate
		HRCP-L-ENV-085-Fill	Standard Chemistry, TCLP
	25-45	HRCP-L-ENV-085	Standard Chemistry, TCLP
		HRCP-L-ENV-085 Elutriate	Elutriate

Samples were analyzed for the following parameters:

Parameters	Method	Media
Metals (ITM List)	SW846 6020	Soil, Water, Elutriate
Mercury	SW846 7471A	Soil, Water, Elutriate
Butyltins	Unger Method / Rice 1987	Soil, Water, Elutriate
PCB Congeners	SW846 8082	Soil, Water, Elutriate
PCB Aroclors	SW846 8082A	Soil, Water, Elutriate
Semi volatile Organic Compounds	SW846 8270C	Soil, Water, Elutriate
Polynuclear Aromatic Hydrocarbons (PAHs)		Soil, Water, Elutriate
Cyanide	SW846 9012A	Soil, Water, Elutriate
pH	EPA 9054D	Soil, Water, Elutriate
Nitrate/Nitrite	EPA 353.2	Soil, Water, Elutriate
Chlorinated Pesticides	SW846 8081A	Soil, Water, Elutriate
Herbicides	SW846 8151A	Soil, Water, Elutriate
Volatile Organic Compounds	SW846 8260C	Soil, Water, Elutriate
Dioxins/Furans (2,3,7,8-TCDD and 2,3,7,8-TCDF only)	EPA 1613B	Soil, Water, Elutriate
Extractable Organic Halides (EOX)	SW846 9023	Soil
TPH - DRO/ORO (C10 to C34)	SW846 8015 D	Soil
TPH - GRO (C6 to C10)		Soil
Ammonia (as N)	EPA 350.1	Soil, Water, Elutriate
Total Kjeldahl Nitrogen (TKN)	SM 4500 Norg_C	Soil, Water, Elutriate
Total Phosphorus	SM4500_P_E	Soil, Water, Elutriate
Sulfide	EPA 9030B/9034	Soil, Water, Elutriate
Potential Acidity	VA Tech method	Soil
Neutralization Potential	Neutralization Potential	Soil
Acid Base Accounting	Calculation	Soil
Calcium Carbonate Equivalence	AOAC 955.01	Soil
Pyritic Sulfur (Fizz Rating)	Calculation	Soil
Saturated Paste pH & Conductivity	Saturated paste extract	Soil
Flashpoint	7.1.2	Soil
Paint Filter Test	SW846 9095A	Soil (Fill Only)
Total Organic Carbon	Lloyd Kahn	Soil, Water, Elutriate
Total Solids	SM 2540G	Soil
Atterberg Limits	ASTM D4381	Soil
Specific Gravity	ASTM D854	Soil
Grain Size(Sieve and Hydrometer)	ASTM D422	Soil
TCLP Analysis (Includes Volatiles, Semi volatiles, Pesticides, Herbicides, Metals, Mercury, and TCLP)	SW846,8260B,8270C,8081A,8151A, 6010B, 7470A, 1311	Soil

### 1.1. Screening Levels

Soil and sediment analytical data was compared to the marine sediment quality guidelines (specifically Threshold Effect Levels (TEs) and Probable Effect Levels (PELs) (MacDonald et al. 1996), the Estuarine NOAA-based Effects Range-Median (ER-M) Sediment Screening Values (Buchanan, M.F. 1999)), and the

Virginia Department of Environmental Quality's Groundwater Soil Screening Levels (GWSSL), Ecological Soil Screening Levels (ESSL), Residential Soil Screening Levels (RSSL) and Industrial Soil Screening Levels (ISSL) for the beneficial reuse of soils/sediments. The marine sediment quality guidelines determine concentration thresholds in which compounds may have negative ecological effects in a marine environment. Exceedances of the marine sediment quality guidelines indicate that the subject materials are not suitable for in-water placement. The Virginia Department of Environmental Quality's Soil Screening Levels dictate whether materials can be utilized for beneficial reuse. Sediment/soil exceeding the ESSL and GWSSL cannot be utilized for beneficial reuse within 200' of surface water, or within any ecologically sensitive environments. Sediment/soil exceeding the RSSL cannot be utilized for beneficial reuse at residential locations. Sediment/soil exceeding the ISSL cannot be utilized for beneficial reuse at industrial locations. If analytical data reveals petroleum hydrocarbons to be present in soil and sediment above 50 ppm, the subject soil and sediment may be required to be disposed of in a lined landfill.

Elutriate analytical data was compared to the Virginia Criteria for Surface Water (9VAC25-260-140). Elutriate analysis is designed to simulate the chemical compound concentrations of water in contact with the subject soil and sediment. Elutriate analytical results in exceedance of the Virginia Criteria for Surface Water would indicate that the in-water placement of the subject material would create conditions that exceed the Virginia Criteria for Surface Water.

TCLP analytical data was compared to the United States Environmental Protection Agency's (USEPA) Maximum Concentration of Contaminants for the Toxicity Characteristic criteria. TCLP analysis is designed to simulate leaching through a landfill. An exceedance of the USEPA's Maximum Concentration of Contaminants for the Toxicity Characteristic criteria would indicate that the subject material is classified as Hazardous Waste under the Resource Conservation and Recovery Act (RCRA), and is subject to the transportation and disposal requirements of RCRA.

Groundwater analytical data was compared to Virginia Criteria for Surface Water (9VAC25-260-140). An exceedance of the Virginia Criteria for Surface Water would indicate that water generated during dewatering operations in the location of the groundwater sample cannot be discharged to surface water without prior treatment.

Please note, jet grout residuals and jet grout decant water with pH levels greater than 12.5 are classified as Hazardous Waste under RCRA, and are therefore subject to special transportation and disposal requirements. High pH concentrations in jet grout residuals and jet grout decant water may alter the chemical characteristics of materials in contact with the subject jet grout residuals and jet grout decant water.

## **2. SAMPLE ANALYTICAL RESULTS**

Analytical results from the sampling effort outlined within this memorandum are presented herein.

### **2.1. “Fill” Samples (0-25 feet bsg)**

#### **2.1.1. Standard Chemistry Results**

Sample analytical results from the “fill” sediment samples revealed the following:

- Sediment Sample HRCP-L-ENV-024-Fill was found to exceed the Effects Range-Median (ERM) ecological screening level for calcium; the Residential Soil Screening Level (RSSL) for chromium; and the Groundwater Soil Screening Level (GWSSL) for cobalt, and iron.
- Sediment Sample HRCP-L-ENV-025-Fill was found to exceed the ERM ecological screening level for calcium; the RSSL for chromium; and the GWSSL for cobalt, and iron.
- Sediment Sample HRCP-L-ENV-026-Fill was found to exceed the ERM ecological screening level for calcium; the RSSL and Industrial Soil Screening Level (ISSL) for chromium; and the GWSSL for cobalt, and iron.
- Sediment Sample HRCP-L-ENV-027-Fill was found to exceed the ERM ecological screening level for calcium; the RSSL for chromium; and the GWSSL for cobalt, and iron.
- Sediment Sample HRCP-L-ENV-082-Fill was found to exceed the ERM ecological screening level for calcium; the RSSL for chromium; and was the GWSSL for cobalt and iron.
- Sediment Sample HRCP-L-ENV-083-Fill was found to exceed the ERM ecological screening level for calcium; the RSSL for chromium; and the GWSSL for cobalt and iron.
- Sediment Sample HRCP-L-ENV-084-Fill was found to exceed the ERM ecological screening level for calcium; the RSSL for chromium; and the GWSSL for cobalt, iron, and manganese.
- Sediment Sample HRCP-L-ENV-085-Fill was found to exceed the ERM ecological screening level for calcium; the RSSL for chromium; and the GWSSL for cobalt and iron.

#### **2.1.2. Elutriate Results**

Sample analytical results from the “fill” elutriate samples revealed the following:

- Elutriate Sample HRCP-L-ENV-024-Fill was found to exceed the Surface Water Criteria for iron; and the Weanack Clean Fill Criteria for manganese, and zinc.

- Elutriate Sample HRCP-L-ENV-025-Fill was found to exceed the Virginia Criteria for Surface Water for PCBs (specifically Congeners PCB 18, & PCB 184), copper, and iron; and the Weanack Clean Fill Criteria for manganese.
- Elutriate Sample HRCP-L-ENV-026-Fill was found to exceed the Virginia Criteria for Surface Water for iron, manganese, and zinc.
- Elutriate Sample HRCP-L-ENV-027-Fill was found to exceed the Virginia Surface Water Criteria for iron; and the Weanack Clean Fill Criteria for manganese.
- Elutriate Sample HRCP-L-ENV-082-Fill was found to exceed the Virginia Criteria for Surface Water for iron; and the Weanack Clean Fill Criteria for manganese.
- Elutriate Sample HRCP-L-ENV-083-Fill was found to exceed the Virginia Criteria for Surface Water for iron; and the Weanack Clean Fill Criteria for manganese.
- Elutriate Sample HRCP-L-ENV-084-Fill was found to exceed the Virginia Criteria for Surface Water for iron; and the Weanack Clean Fill Criteria for manganese.
- Elutriate Sample HRCP-L-ENV-085-Fill was found to exceed the Virginia Criteria for Surface Water for PCBs (specifically Congener PCB 184), and iron; and the Weanack Clean Fill Criteria for manganese.

### **2.1.3. TCLP Results**

No exceedances of the US Environmental Protection Agency's (USEPA) TCLP Criteria were detected in the "fill" sediment samples.

## **2.2. "Native" Samples (deeper than 25 feet bsg)**

### **2.2.1 Standard Chemistry Results**

Sample analytical results from the deep interval sediment samples revealed the following:

- Sediment Sample HRCP-L-ENV-024 was found to exceed the ERM ecological screening level for calcium; the GWSSL, the ISSL, and the RSSL for arsenic; the Threshold Effect Level (TEL) ecological screening level and the Ecological Soil Screening Level (ESSL) for cadmium; the GWSSL, ISSL, and RSSL for chromium; the GWSSL and RSSL for cobalt; the GWSSL and RSSL for iron; the ESSL for magnesium; the GWSSL, the RSSL, and the ESSL for manganese; the TEL for nickel; the ESSL for Vanadium; the ESSL for zinc; and the ESSL and TEL for PCBs (specifically Congener PCB 8).

- Sediment sample HRCP-L-ENV-025 was found to exceed the RSSL for aluminum; the GWSSL, ISSL and RSSL for arsenic; the ERM for calcium; the GWSSL, ISSL, RSSL, and ESSL for chromium; the GWSSL and RSSL for cobalt; the GWSSL and RSSL for iron; the ESSL for magnesium; the RSSL and GWSSL for manganese; the ESSL for vanadium; and the ESSL for zinc.
- Sediment sample HRCP-L-ENV-026 was found to exceed the RSSL for arsenic; the TEL and ESSL for cadmium; the ERM for calcium; the GWSSL, ISSL and RSSL for chromium; the GWSSL and RSSL for cobalt; the GWSSL and RSSL for iron; the GWSSL and RSSL for manganese; the ESSL for vanadium; and the ESSL and TEL for PCBs (specifically Congeners PCB 101, PCB 118, PCB 138, PCB, 153, PCB 170, PCB 180, PCB 187, PCB 49, PCB 66, PCB 77, PCB 8, & PCB 206).
- Sediment sample HRCP-L-ENV-027 was found to exceed the GWSSL, ISSL and RSSL for arsenic; the TEL and ESSL for cadmium; the ERM for calcium; the ISSL and RSSL for chromium; the GWSSL and RSSL for cobalt; the GWSSL and RSSL for iron; the GWSSL for manganese; and the ESSL for vanadium.
- Sediment sample HRCP-L-ENV-082 was found to exceed the RSSL for arsenic; the TEL and ESSL for cadmium; the ERM for calcium; the GWSSL, the ISSL and the RSSL for chromium; the GWSSL and RSSL for cobalt; the GWSSL and RSSL for iron; the ESSL for magnesium; the GWSSL, RSSL and ESSL for manganese; and the ESSL for vanadium.
- Sediment sample HRCP-L-ENV-083 was found to exceed the RSSL for aluminum; the GWSSL and RSSL for arsenic; the TEL and ESSL for cadmium; the ISSL and RSSL for chromium; the GWSSL and RSSL for iron; the GWSSL for manganese; and the ESSL for vanadium.
- Sediment sample HRCP-L-ENV-084 was found to exceed the ERM for calcium; the ISSL and RSSL for chromium; the GWSSL for cobalt; the GWSSL for iron; and the GWSSL for manganese.
- Sediment sample HRCP-L-ENV-085 was found to exceed the RSSL for aluminum; the RSSL for arsenic; the ERM for cadmium, the ISSL and RSSL for chromium; the GWSSL and RSSL for cobalt; the GWSSL and RSSL for iron; the GWSSL and RSSL for manganese; and the ESSL for vanadium.

### **2.2.2 Elutriate Results**

Sample analytical results from the deep interval elutriate samples revealed the following:

- Elutriate Sample HRCP-L-ENV-024 Elutriate was found to exceed the Virginia Criteria for Surface Water for copper, iron, and PCBs (specifically Congeners PCB 28 & PCB 66).
- Elutriate Sample HRCP-L-ENV-025 Elutriate was found to exceed the Virginia Criteria for Surface Water for iron and PCBs (specifically Congeners PCB 18 & PCB 66); and the Weanack Clean Fill



Criteria for manganese.

- Elutriate Sample HRCP-L-ENV-026 Elutriate was found to exceed the Virginia Criteria for Surface Water for copper, iron and PCBs (specifically Congener PCB 187); and the Weanack Clean Fill Criteria for manganese.
- Elutriate Sample HRCP-L-ENV-027 Elutriate was found to exceed the Virginia Criteria for Surface Water for copper, iron and PCBs (specifically Congeners PCB 18, PCB 187, PCB 28, & PCB 44); and the Weanack Clean Fill Criteria for manganese.
- Elutriate Sample HRCP-L-ENV-082 Elutriate was found to exceed the Virginia Criteria for Surface Water for copper, iron and PCBs (specifically Congeners PCB 156, PCB 18, PCB 183, & PCB 184); and the Weanack Clean Fill Criteria for manganese.
- Elutriate Sample HRCP-L-ENV-083 Elutriate was found to the Virginia Criteria for Surface Water for copper, iron, heptachlor epoxide and PCBs (specifically Congeners PCB 18, & 66).
- Elutriate Sample HRCP-L-ENV-084 Elutriate was found to exceed the Virginia Criteria for Surface Water for copper, iron and PCBs (specifically Congeners PCB 18, PCB 187, PCB 28, & PCB 44); and the Weanack Clean Fill Criteria for manganese.
- Elutriate Sample HRCP-L-ENV-085 Elutriate was found to exceed Virginia Criteria for Surface Water for copper, and iron.

### **2.2.3 TCLP Results**

No exceedances of the USEPA's TCLP Criteria were detected in the deep interval sediment samples.

### **2.3. Surface Water Samples**

Surface water (James River) analytical results revealed samples HRCP-L-ENV-RW (4/30/19) to exceed the Virginia Criteria for Surface Water (9VAC25-260-140) for PCBs (specifically Congener PCB 18).

### **2.4. Groundwater Samples**

Sample analytical results from groundwater sample ENV-081-GW (30') revealed concentrations of bromodichloromethane, copper, and zinc in exceedance of the Virginia Criteria for Surface Water (9VAC25-260-140), and concentrations of zinc in exceedance of the Virginia Ground Water Standards (9VAC25-280-40).

Sample analytical results from groundwater sample ENV-081-GW (127') revealed concentrations of arsenic, copper, endosulfan I, lead, nickel, dissolved nickel, zinc, and dissolved zinc in exceedance of the Virginia Criteria for Surface Water (9VAC25-260-140) and concentrations of cadmium and zinc in exceedance of the Virginia Ground Water Standards (9VAC25-280-40).

Sample Analytical Results are summarized in Tables 1 through 7, attached.

### **3. COMPARISON TO STANDARDS**

#### **3.1. Comparison to Requirements for In-Water Placement**

Soil and sediment analytical data was compared to the marine sediment quality guidelines (specifically Threshold Effect Levels (TELs) and Probable Effect Levels (PELs) (MacDonald et al. 1996), the Estuarine NOAA-based Effects Range-Median (ER-M) Sediment Screening Values (Buchanan, M.F. 1999)), and the Virginia Department of Environmental Quality's GWSSL, ESSL, RSSL, and ISSL for the beneficial reuse of soils/sediments. Elutriate analytical data was compared to the Virginia Criteria for Surface Water (9VAC25-260-140).

PCBs were detected in exceedance of the TEL and ESSL in two (2) of the deep interval sediment samples (specifically samples HRCP-L-ENV-024 and HRCP-L-ENV-026). PCBs were detected in exceedance of the Virginia Criteria for Surface Water in seven (7) deep interval elutriate samples (specifically samples HRCP-L-ENV-024 through HRCP-L-ENV-084). PCBs were detected in exceedance of the Virginia Criteria for Surface Water in two (2) "fill" elutriate samples (specifically samples HRCP-L-ENV-025-FILL and HRCP-L-ENV-085-FILL).

Heptachlor Epoxide was detected in exceedance of the Virginia Criteria for Surface Water in one (1) deep interval elutriate sample (specifically sample HRCP-L-ENV-083). No potential sources of Heptachlor Epoxide were identified during sampling activities.

Aluminum, arsenic, calcium, chromium, cobalt, iron, magnesium, manganese, vanadium, and zinc were detected in exceedance of the ERM, TEL, and ESSL in all sixteen (16) sediment samples. Exceedances of the Virginia Criteria for Surface Water for these naturally occurring compounds were also detected in all sixteen (16) elutriate samples.

No other exceedances were identified in the samples other than those listed above.

Due to exceedances of the ESSL and TEL, the sediment represented by samples HRCP-L-ENV-024 and HRCP-L-ENV-026 cannot be utilized in water placement, or for beneficial reuse within 200' of surface water, or within any ecologically sensitive environments. Due to elutriate sample exceedances of the VA Criteria for Surface Water, the sediment represented by samples HRCP-L-ENV-024, HRCP-L-ENV-025, HRCP-L-ENV-026, HRCP-L-ENV-027, HRCP-L-ENV-082, HRCP-L-ENV-083, HRCP-L-ENV-084, HRCP-L-ENV-025-FILL, and HRCP-L-ENV-085-FILL cannot be utilized for in water placement.

Samples HRCP-L-ENV-024-FILL, HRCP-L-ENV-026-FILL, HRCP-L-ENV-027-FILL, HRCP-L-ENV-082-FILL, HRCP-L-ENV-083-FILL, HRCP-L-ENV-083-FILL, and HRCP-L-ENV-084-FILL only contain exceedances of the applicable ecological and beneficial reuse standards for naturally occurring compounds. Approval from the applicable regulatory agencies will be required in order to utilize the sediment represented by these samples for in water placement.

### **3.2. Comparison to Requirements for Placement at Port Tobacco at Weanack**

All soil and sediment samples were found to be in compliance with the Port Tobacco at Weanack Exclusion Criteria, pending the results of Acid-Base Accounting, and H<sub>2</sub>O<sub>2</sub> Potential Acidity analysis.

Preliminary data from Acid-Base Accounting, and H<sub>2</sub>O<sub>2</sub> Potential Acidity analysis indicate lime addition may be required to offset acidity in soils and sediment prior to placement at Port Tobacco at Weanack.

### **3.3. Comparison to Requirements for Other Upland Placement Options**

#### **3.3.1. TCLP Analysis**

TCLP analysis analytical results revealed no exceedances of the USEPA's Maximum Concentration of Contaminants for the Toxicity Characteristic criteria in the soil and sediment samples. Therefore, the soils and sediment would not be considered hazardous by the USEPA, and, would not require management under the Virginia Hazardous Waste Management Code.

#### **3.3.2. Soil Contaminated with Petroleum Products**

Petroleum hydrocarbons were not detected in the soil and sediment samples. No evidence of petroleum impact was observed during the installation of soil borings. Therefore, the requirements outlined in the Commonwealth of Virginia's Soil Contaminated with Petroleum Products regulation (9VAC20-81-660) are not applicable.

#### **3.3.3. Comparison with the Beneficial Reuse Soil Screening Levels**

Sample analytical results were compared to the Virginia Department of Environmental Quality's GWSSL, ESSL, RSSL, and ISSL for the beneficial reuse of soils in order to determine if materials can be utilized for beneficial reuse at upland locations. Sediment/soil exceeding the ESSL and GWSSL cannot be utilized for beneficial reuse within 200' of surface water, or within any ecologically sensitive environments. Sediment/soil exceeding the RSSL cannot be utilized for beneficial reuse at residential locations. Sediment/soil exceeding the ISSL cannot be utilized for beneficial reuse at industrial locations.

PCBs were detected in exceedance of the ESSL in two (2) of the deep interval sediment samples (specifically samples HRCP-L-ENV-024 and HRCP-L-ENV-026). Material represented by sample HRCP-L-ENV-024 and sample HRCP-L-ENV-026 cannot be utilized for beneficial reuse within 200' of surface water, or within any ecologically sensitive environments.

Aluminum, arsenic, calcium, chromium, cobalt, iron, magnesium, manganese, vanadium, and zinc were detected in exceedance of the RSSLs, and the GWSSLs in all sixteen (16) sediment samples; and in exceedances of the ISSLs in nine (9) of the sixteen (16) sediment sample (Specifically samples HRCP-L-ENV-026-Fill, HRCP-L-ENV-024 through HRCP-L-ENV-027, and HRCP-L-ENV-083 through HRCP-L-ENV-085). Therefore, soil/sediment represented by all sixteen samples cannot be utilized for beneficial reuse within 200' of surface water, or within any ecologically sensitive environments, or at residential locations. Soil/sediment represented by samples HRCP-L-ENV-026-Fill, HRCP-L-ENV-024 through HRCP-L-ENV-027, and HRCP-L-ENV-083 through HRCP-L-ENV-085 cannot be utilized for beneficial reuse at industrial locations.

### **3.4. Comparison to Groundwater Disposal Criteria**

Groundwater analytical results revealed bromodichloromethane in exceedance of the human health based Public Water Supply standard in sample ENV-081-GW (30'). As the project area is not located within a Public Water Supply, this standard is not applicable. Endosulfan I was detected in exceedance of the acute and chronic ecological standards in sample ENV-081-GW (127'). Water generated from the sample location during construction activities will be required to be evaluated, and if necessary, treated to address potential Endosulfan contamination. No potential sources of Endosulfan I contamination were identified during sampling activities.

## **4. CONCLUSIONS AND RECOMMENDATIONS**

### **4.1. PCBs**

The presence of PCBs in excess of the surface water threshold and the ESSL in 7 of the 8 samples collected from material at depth (greater than 25 feet below grade), which precludes use of this material as fill for in-water placement for the North Island Expansion or within 200' of ecological receptors. Further, geotechnical properties of the material at depth may not be suitable for reuse for island expansion due to its high clay content.

PCBs were detected in 2 of the 8 samples obtained from the fill material (surface to 25 feet below grade) at concentrations in excess of the surface water threshold. A more detailed sampling effort could delineate and segregate materials in excess of the surface water threshold. Delineation efforts, if successful, may result in the reuse of up to 80,000 cubic yards of material for in-water placement.

#### **4.1.1. Potential PCB impacts to Elutriate Preparation Water**

The James River surface water sample HRCP-L-ENV-RW (4/30/2019) was found to exceed the Virginia Criteria for Surface Water for PCBs (specifically Congener PCB 18). James River water was used as elutriate preparation water in all elutriate samples. As none of the elutriate sample PCB exceedances were solely for PCB Congener 18, it is unlikely that the PCB concentrations detected in the elutriate samples are solely from contaminated elutriate preparation water. The PCB contamination detected in the sediment, elutriate, and surface water samples is likely due to persistent diffuse contamination and the historic industrial nature of the area, and not a point source discharge.

### **4.2. Chromium**

Total chromium was detected in excess of the industrial and residential soil screening criteria, indicating that the sediments/soils cannot be utilized on industrial and residential use properties. Sediments/soils were additionally analyzed for hexavalent chromium, as prior results from the area indicated levels of total chromium in excess of the numerical value utilized as a trigger for the evaluation of hexavalent chromium. Hexavalent chromium was not detected in any samples. However, it should be noted that the high pH of the jet grouting process may alter the chemical composition of total or trivalent chromium, which could result in the presence of hexavalent chromium. The potential presence of hexavalent chromium should be further evaluated through the TBM bench-scale testing. If hexavalent chromium is present in filtrate water, additional treatment will be required prior to discharge to the

river. An ion exchange unit and associated exchange media could be required as part of the treatment plant process.

#### **4.3. Metals**

Aluminum, arsenic, calcium, cobalt, iron, magnesium, manganese, vanadium and zinc were detected in all 16 samples collected (fill material and material at depth) in excess of the ERM, TEL, ESSL and Virginia Surface Water Criteria. Excess of these standards would not allow any material excavated to be reused for in-water placement for island expansion or placed within 200' of ecological receptors. It is recommended to discuss the applicability of these standards with the appropriate regulatory agencies as these nine metals are naturally occurring.

#### **4.4. Groundwater**

Groundwater was collected at a shallow and deep interval to identify any parameters that may require special treatment in the STP/WTP plant. Analytical results indicated elevated concentrations of metals and Endosulfan I (pesticide) in excess of the Virginia Surface Water Criteria. Design of the treatment plant should include elements that will address these compounds prior to discharging water back into the River.

#### **4.5. Disposal**

Analytical results generated to date indicate that material excavated as part of the portal entry and tricell construction would not be acceptable for in-water placement or placement within 200' of ecological receptors without agency consultation.

Preliminary data from Acid-Base Accounting, and H<sub>2</sub>O<sub>2</sub> Potential Acidity analysis indicate lime addition may be required to offset acidity in soils and sediment prior to placement at Port Tobacco at Weanack. Port Tobacco at Weanack will establish a sampling protocol to test materials prior to disposal at the Site in order to identify if lime is needed and at what quantity.

Petroleum hydrocarbons were not detected in the soil and sediment samples, and no evidence of petroleum impacts were observed during the installation of soil borings. Further, analytical results for other classes of compounds indicate the material is not hazardous and is not anticipated to be required to be disposed of at a lined landfill.



## FIGURES



**LEGEND:**  
 ● Proposed environmental boring

Scale: 1" = 100'

FINAL PLAN REVISIONS SUBMITTAL DATE:							
NO.	DATE	AUTH.	DESCRIPTION	NO.	DATE	AUTH.	DESCRIPTION



Designed: ..E.L.S.  
 Drawn: .....CEM.  
 Checked: ...EKM.

STRUCTURE AND BRIDGE DIVISION  
 DATE: March 15, 2019.

TWIN BORED TUNNEL  
 SOUTH ISLAND  
 ENVIRONMENTAL BORING LOCATION PLAN

FIGURE  
 1

Sheet No.  
 ENV(002)



**TABLES**



Table 1  
HRBT Expansion  
Summary of Analytical Results  
Sediment - Standard Chemistry

Parameter	Unit	Most Stringent	TEL*	PEL*	GW SSL*	ESSL*	ISLL***	RSSL**	ERMA***	Waanack Exclusion Criteria	Waanack Clean Fill Criteria	HRCP-L-ENV-024		HRCP-L-ENV-025		HRCP-L-ENV-026		HRCP-L-ENV-027		HRCP-L-ENV-028		HRCP-L-ENV-033		HRCP-L-ENV-034		HRCP-L-ENV-035													
												19D1291		19E0632		19D1291		19D1291		19D1291		19D1291		19D1291		19D1291		19D1291		19D1291		19D1291		19D1291		19D1291		19D1291	
												Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result
1,1,1-Trichloroethane	µg/kg	1810	--	--	1810	--	3600000	810000	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA									
1,1,2,2-Tetrachloroethane	µg/kg	0.44	--	--	0.44	127	2700	600	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA									
1,1,2-Trichloroethane	µg/kg	29	--	--	29	300	5000	1100	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA									
1,1-Dichloroethane	µg/kg	8	--	--	8	300	16000	3600	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA									
1,2,4-Trichlorobenzene	µg/kg	10	--	--	7210	10	110000	24000	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA									
1,2-Dichlorobenzene	µg/kg	10	--	--	21200	10	930000	180000	--	10,000,000	5,100,000	ND	1	ND	1	ND	1	ND	1	ND	1	ND	1	ND	1	ND	1	ND	1	ND									
1,2-Dichloroethane	µg/kg	10	--	--	21200	10	930000	180000	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA									
1,2-Dichloropropane	µg/kg	300	--	--	--	300	4400	1000	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA									
1,2-Diphenylhydrazine	µg/kg	--	--	--	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA									
1,3-Dichlorobenzene	µg/kg	10	--	--	225	10	900000	190000	--	5,100,000	5,100,000	ND	1.2	ND	1.2	ND	1.2	ND	1.2	ND	1.2	ND	1.2	ND	1.2	ND	1.2	ND	1.2	ND									
1,4-Dichlorobenzene	µg/kg	10	--	--	3390	10	11000	2600	--	570,000	13,000	ND	1.7	ND	1.7	ND	1.7	ND	1.7	ND	1.7	ND	1.7	ND	1.7	ND	1.7	ND	1.7	ND									
1-Methylnaphthalene	µg/kg	--	--	--	--	--	--	--	--	2.1	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND									
2,2'-Oxylidene(1-Chloropropane)	µg/kg	5.41	--	--	4.41	--	470000	310000	--	2,300,000	2,300,000	2.4	2.4	ND	2.5	ND	2.5	ND	2.4	ND	2.5	ND	2.4	ND	2.5	ND	2.4	ND	2.5										
2,3,7,8-TCDF	ng/kg	0.199	--	--	6060	0.199	22	4.8	--	18000000	4300000	0.000015	J	0.000039	0.0002	J	0.000069	0.00012	J	0.000034	0.00024	J	0.000018	J	0.000025	0.0001	J	0.000028	0.00012	J									
2,4,6-Trichlorophenol	µg/kg	38.5	--	--	38.5	--	--	--	--	0.00012	J	0.000015	ND	1.8	ND	1.8	ND	1.8	ND	1.8	ND	1.8	ND	1.8	ND	1.8	ND	1.8	ND	1.8									
2,4-Ddd	µg/kg	100	--	--	100	210000	49000	--	--	160000	62000	ND	0.094	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND									
2,4-Dde	µg/kg	--	--	--	--	--	--	--	--	--	--	ND	0.14	ND	0.15	ND	0.15	ND	0.15	ND	0.15	ND	0.15	ND	0.15	ND	0.15	ND	0.15	ND									
2,4-Ddt	µg/kg	3	--	--	3.45	3	250000	19000	--	12,000,000	1,100,000	ND	2.5	ND	2.5	ND	2.5	ND	2.5	ND	2.5	ND	2.5	ND	2.5	ND	2.5	ND	2.5	ND									
2,4-Dichlorophenol	µg/kg	3	--	--	3.45	3	250000	19000	--	12,000,000	1,100,000	ND	2.5	ND	2.5	ND	2.5	ND	2.5	ND	2.5	ND	2.5	ND	2.5	ND	2.5	ND	2.5	ND									
2,4-Dimethylphenol	µg/kg	10	--	--	323	10	1600000	130000	--	1,800,000	170000	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND									
2,4-Dinitrophenol	µg/kg	3	--	--	3	60	16000	13000	--	1,200,000	110000	ND	88	ND	89	ND	89	ND	88	ND	89	ND	88	ND	89	ND	88	ND	89	ND									
2,4-Dinitrotoluene	µg/kg	1.39	--	--	1.39	1280	7400	1700	--	1,200,000	110000	ND	2	ND	1.8	ND	1.7	ND	1.6	ND	1.6	ND	1.6	ND	1.6	ND	1.6	ND	1.6	ND									
2,4-Dinitrotoluene	µg/kg	5.92	--	--	5.92	32.8	1500	360	--	620000	61000	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND									
2-Chloronaphthalene	µg/kg	12.2	--	--	7000	12.2	6000000	480000	--	--	--	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND									
2-Chlorophenol	µg/kg	10	--	--	173	10	580000	39000	--	5,100,000	280000	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND									
2-Chlorophenol	µg/kg	20.2	20.2	201.3	610	2000	3000	24000	--	4,100,000	670	2.1	J	1.6	1.8	J	1.6	1.8	J	1.6	1.8	J	1.6	1.8	J	1.6	1.8	J	1.6	1.8									
2-Methylphenol	µg/kg	100	--	--	429	100	4100000	320000	--	2,800,000	2,800,000	ND	9.4	ND	9.5	ND	9.5	ND	9.3	ND	9.5	ND	9.4	ND	9.5	ND	9.4	ND	9.5	ND									
2-Nitrophenol	µg/kg	160	--	--	160	--	--	--	--	--	--	ND	30	ND	5.5	ND	5.3	ND	5.2	ND	5.3	ND	5.2	ND	5.3	ND	5.2	ND	5.3	ND									
2,6-Dichlorobenzidine	µg/kg	58.2	--	--	18.7	58.2	600	1200	--	490,000,000	10,000,000	ND	30	ND	31	ND	31	ND	31	ND	31	ND	31	ND	31	ND	31	ND	31	ND									
4,4'-Dde	µg/kg	1.22	1.22	7.81	13900	21	9600	2300	20	--	--	ND	0.23	ND	0.25	ND	0.25	ND	0.043	ND	0.26	ND	0.043	ND	0.047	ND	0.047	ND	0.047	ND									
4,4'-Ddt	µg/kg	2.07	2.07	374	4710	21	9300	2000	27	7200	3000	ND	0.11	ND	0.12	ND	0.12	ND	0.02	ND	0.12	ND	0.02	ND	0.022	ND	0.022	ND	0.022	ND									
4,4'-Ddt	µg/kg	1.19	1.19	4.77	2150	21	1900	1900	--	5100	2000	ND	0.23	ND	0.23	ND	0.23	ND	0.04	ND	0.23	ND	0.04	ND	0.043	ND	0.043	ND	0.043	ND									
4,6-Dinitro-2-Methylphenol	µg/kg	0.136	--	--	0.136	144	6600	510	--	--	--	ND	5.6	ND	5.7	ND	5.6	ND	5.7	ND	5.6	ND	5.7	ND	5.6	ND	5.7	ND	5.6	ND									
4-Bromophenyl Phenyl Ether	µg/kg	--	--	--	--	--	--	--	--	--	--	ND	2.3	ND	2.3	ND	2.3	ND	2.3	ND	2.3	ND	2.3	ND	2.3	ND	2.3	ND	2.3	ND									
4-Bromo-3-Methylphenol	µg/kg	740	--	--	7470	7950	8200000	830000	--	10,000,000	10,000,000	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND									
4-Chlorophenyl Phenyl Ether	µg/kg	100	--	--	100	--	--	--	--	--	--	ND	23	ND	23	ND	23	ND	23	ND	23	ND	23	ND	23	ND	23	ND	23	ND									
4-Nitrophenol	µg/kg	100	--	--	100	--	--	--	--	--	--	ND	23	ND	23	ND	23	ND	23	ND	23	ND	23	ND	23	ND	23	ND	23	ND									
Acenaphthene	µg/kg	6.7	88.3	17200	28000	4500000	390000	500	33,000,000	3,400,000	4.5	J	1.9	ND	1.9	2.2	J	1.9	ND	1.9	2.2	J	1.9	ND	1.9	2.2	J	1.9	ND	1.9									
Acenaphthylene	µg/kg	6.7	88.3	17200	28000	4500000	390000	500	33,000,000	3,400,000	4.5	J	1.9	ND	1.9	2.2	J	1.9	ND	1.9	2.2	J	1.9	ND	1.9	2.2	J	1.9	ND	1.9									
Acridine	µg/kg	2.5	--	--	3.36	2.5	180	39	--	110	40	ND	0.16	ND	0.16	ND	0.16	ND	0.031	ND	0.19	ND	0.031	ND	0.034	ND	0.034	ND	0.034	ND									
Acridone	µg/kg	0.461	--	--	0.461	2.5	360	86	--	--	--	ND	0.18	ND	0.15	ND	0.14	ND	0.025	ND	0.15	ND	0.025	ND	0.027	ND	0.027	ND	0.027	ND									
Aluminum	mg/kg	7700	--	--	24000	--	110000	7700	--	--	--	ND	3.04	18000	343	ND	340	ND	2.75	ND	3.23	295	3330	269	8500	337	3370	269	8500	337									
Ammonia AS N	mg/kg	--	--	--	--	--	--	--	--	--	--	131	12.2	136	14.3	89.2	14.4	ND	11.5	121	13.4	19.1	12.2	13.9	11.7	14	11.7	14	11.7	14									
Anthracene	µg/kg	46.9	46.9	245	185000	29000	23000000	1800000	1100	170,000,000	10,000,000	2.4	J	1.7	ND	1.7	4																						

Table 1  
HRBT Expansion  
Summary of Analytical Results  
Sediment - Standard Chemistry

Parameter	Unit	Most Stringent	TEL*	PEL*	GW SSL*	ESSL*	ISLL***	RSSL***	ERMs****	Wanack Exclusion Criteria	Wanack Clean Fill Criteria	HRCP-LENV-024		HRCP-LENV-025		HRCP-LENV-026		HRCP-LENV-027		HRCP-LENV-082		HRCP-LENV-083		HRCP-LENV-084		HRCP-LENV-085											
												1901291		1901291		1901291		1901291		1901291		1901291		1901291		1901291		1901291		1901291		1901291		1901291		1901291	
												4/25/2019		5/9/2019		4/26/2019		4/27/2019		4/27/2019		4/24/2019		4/28/2019		9/28/2019		9/30/2019		9/30/2019		9/30/2019		9/30/2019		9/30/2019	
												Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q
Conductivity (Saturated Paste)	ds/m	--	--	--	--	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										
Copper	mg/kg	19	18.7	108	5570	28	4700	310	270	4,300	1,500	5,59	0.607	3,38	J	0.0686	3,95	0.699	2,89	0.551	4,09	0.646	1,97	J	0.589	1,24	J	0.577	1,33	J	0.675						
Cyanide	mg/kg	0	--	--	20	0.005	--	--	--	20,000	1,100	ND	--	ND	--	ND	1.42	ND	1.02	ND	1.31	ND	1.1	ND	1.1	ND	1.42	ND	1.42	ND	1.42						
Delta-BHC	µg/kg	1.51	--	--	1.51	9940	360	86	--	--	--	ND	0.17	ND	0.19	ND	0.18	ND	0.032	ND	0.19	ND	0.032	ND	0.032	ND	0.032	ND	0.032	ND	0.032						
Dibenz(A,H)Anthracene	µg/kg	6.2	6.2	134.6	427	1100	290	16	260	880	210	ND	1.5	ND	1.5	2.2	J	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5							
Dieldrin	µg/kg	391	--	--	10000	7300	--	--	--	--	--	5.5	J	1.4	ND	1.5	2.6	J	1.5	ND	1.4	8.8	J	1.5	ND	1.4	ND	1.5	ND	1.5							
Dichlorobromomethane	µg/kg	2050	--	--	2050	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA							
Dichlorodifluoromethane	µg/kg	595	--	--	595	39500	37000	8700	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA							
Dieldrin	µg/kg	0.715	0.715	4.3	0.434	4.9	140	34	8	110	42	ND	0.13	ND	0.15	ND	0.15	ND	0.025	ND	0.15	ND	0.025	ND	0.15	ND	0.025	ND	0.027	0.027							
Diethyl Phthalate	µg/kg	18800	--	--	18800	24800	66000000	5100000	--	490,000,000	10,000,000	ND	11	ND	12	ND	12	ND	12	ND	12	ND	12	ND	12	ND	12	ND	12	ND							
Dimethyl Phthalate	µg/kg	200000	--	--	200000	--	--	--	--	10,000,000	10,000,000	ND	1.2	ND	1.2	ND	1.2	ND	1.2	ND	1.2	ND	1.2	ND	1.2	ND	1.2	ND	1.2	ND	1.2						
Di-N-Butyl Phthalate	µg/kg	450	--	--	17800	150	8200000	630000	--	5,700,000	5,700,000	ND	14	ND	15	ND	15	ND	14	ND	15	ND	14	ND	15	ND	14	ND	15	ND	15						
Di-N-Octyl Phthalate	µg/kg	70900	--	--	70900	--	--	--	--	ND	19	ND	19	ND	19	ND	19	ND	19	ND	19	ND	19	ND	19	ND	19	ND	19	ND							
Endosulfan I	µg/kg	100	--	--	1730	100	700000	47000	--	3,700,000	--	ND	0.12	ND	0.13	0.38	J	0.13	ND	0.022	ND	0.13	ND	0.022	ND	0.022	ND	0.024	ND	0.024							
Endosulfan II	µg/kg	100	--	--	1730	100	700000	47000	--	3,700,000	--	ND	0.12	ND	0.13	0.38	J	0.13	ND	0.022	ND	0.13	ND	0.022	ND	0.022	ND	0.024	ND	0.024							
Endosulfan Sulfate	µg/kg	35.8	--	--	1270	35.8	700000	47000	--	3,700,000	--	ND	0.14	ND	0.15	ND	0.15	ND	0.026	ND	0.16	ND	0.026	ND	0.026	ND	0.028	ND	0.028	0.028							
Endrin	µg/kg	1	--	--	589	1	25000	1900	--	1800000	17000	ND	0.21	ND	0.23	ND	0.23	ND	0.039	ND	0.24	ND	0.039	ND	0.039	ND	0.043	ND	0.043	0.043							
Endrin Aldehyde	µg/kg	10.5	--	--	231	10.5	25000	1900	--	1800000	17000	ND	0.19	ND	0.21	ND	0.21	ND	0.038	ND	0.22	ND	0.038	ND	0.038	ND	0.039	ND	0.039	0.039							
Ethylbenzene	µg/kg	50	--	--	16800	50	25000	5800	--	--	--	ND	6.24	ND	7.12	ND	7.2	ND	5.84	ND	6.71	ND	6.17	ND	6.17	ND	6.17	ND	6.17	6.17							
Extractable Organic Halides (EOH)	µg/kg	--	--	--	--	--	--	--	--	--	--	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10						
Extractable Organic Halogens	µg/kg	--	--	--	--	--	--	--	--	--	--	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10						
Fizz Rating	µg/kg	--	--	--	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA							
Flash Point	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--							
Fluoranthene	µg/kg	112.8	112.8	1483.8	27800	1100	300000	240000	5100	22,000,000	2,300,000	> 65	20	> 65	20	> 65	20	> 65	20	> 65	20	> 65	20	> 65	20	> 65	20	> 65	20	> 65	20						
Fluorene	µg/kg	21.2	21.2	144.4	17000	29000	300000	240000	5100	22,000,000	2,300,000	8.6	1.7	26	J	1.3	26	J	1.3	8.6	J	1.7	26	J	1.3	26	J	1.7	26	J	1.7						
Gamma-BHC (Lindane)	µg/kg	0.05	0.32	0.99	11	0.05	2500	570	--	520	520	ND	0.18	ND	0.2	ND	0.2	ND	0.034	ND	0.21	ND	0.034	ND	0.034	ND	0.037	ND	0.037	0.037							
Heptachlor Epoxide	µg/kg	5.96	--	--	425	5.96	830	130	--	380	150	ND	0.17	ND	0.18	ND	0.18	ND	0.041	ND	0.19	ND	0.041	ND	0.041	ND	0.044	ND	0.044	0.044							
Hexachlorobenzene	µg/kg	70	--	--	24400	70	24400	330	70	130	130	ND	3.14	ND	3.4	ND	3.4	ND	2.06	ND	3.4	ND	3.3	ND	3.3	ND	3.4	ND	3.4	ND							
Hexachlorobenzene	µg/kg	2.5	--	--	9960	2.5	1100	660	--	1100	660	ND	2.3	ND	2.4	ND	2.4	ND	0.226	ND	2.4	ND	0.226	ND	0.226	ND	0.228	ND	0.228	0.228							
Hexachlorobenzene	µg/kg	29.8	--	--	781	39.8	5300	1200	--	22000	1000	ND	3.9	ND	4.1	ND	4.1	ND	1.9	ND	1.9	ND	1.9	ND	1.9	ND	1.9	ND	1.9	ND							
Hexachlorocyclopentadiene	µg/kg	400000	--	--	400000	--	--	--	--	3,700,000	40000	ND	3.3	ND	3.4	ND	3.4	ND	3.4	ND	3.4	ND	3.4	ND	3.4	ND	3.4	ND	3.4	ND	3.4						
Hexachlorocyclopentadiene	µg/kg	347	--	--	347	596	8000	1800	--	120000	6000	ND	1.7	ND	1.7	ND	1.7	ND	1.7	ND	1.7	ND	1.7	ND	1.7	ND	1.7	ND	1.7	ND	1.7						
Ignitability	None	--	--	--	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA						
Polymethyl 2,3-CdI/Pyrene	µg/kg	1100	--	--	5160	1100	3000000	240000	--	2100	900	ND	1.3	ND	1.4	ND	1.4	ND	1.3	ND	1.3	ND	1.3	ND	1.3	ND	1.3	ND	1.3	ND	1.3						
Iron	mg/kg	276	--	--	276	--	--	--	--	150,000	150,000	26700	607	26600	68.6	16100	69.9	10300	55.1	21900	64.6	12900	58.9	4620	57.7	11400	67.5	3080	67.5	3080	67.5						
Isothorpone	µg/kg	243	--	--	243	139000	2400000	570000	--	1,800,000	1,100,000	ND	1.7	ND	F2	1.7	ND	1.7	ND	1.7	ND	1.7	ND	1.7	ND	1.7	ND	1.7	ND	1.7							
Leachate	µg/kg	11	30.24	112	138	11	800	400	218	800	300	8.21	0.027	8.04	0.068	8.19	0.069	8.03	0.551	8.22	0.646	8.09	0.577	8.12	0.577	8.12	0.577	8.12	0.577	8.12							
M,P-Xylenes	µg/kg	--	--	--	--	--	--	--	--	--	--	ND	6.24	ND	6.95	ND	7.2	ND	5.84	ND	6.61	ND	6.17	ND	6.17	ND	6.17	ND	6.17	6.17							
Magnesium	mg/kg	4400	--	--	4400	--	--	--	--	5550	607	5600	68.6	3970	69.9	2710	55.1	5620	64.6	3620	58.9	1370	57.7	3080	67.5	3080	67.5	3080	67.5	3080	67.5						
Manganese	mg/kg	20.8	--	--	20.8	220	2600	180	--	21	607	ND	0.011	ND	0.011	ND	0.011	ND	0.009	ND	0.011	ND	0.009	ND	0.009	ND	0.009	ND	0.009	0.009							
Mercury	µg/kg	0.06	0.1	1	0.04	0.06	4.6	1.1	710	100	14	0.022	0.01	ND	0.011	ND	0.012	ND	0.009	ND	0.011	ND	0.009	ND	0.009	ND	0.009	ND	0.009	0.009							
Methoxychlor	µg/kg	19.9	--	--	134000	19.9	410000	32000	--	3,100,000	280000	ND	0.21	ND	0.23	ND	0.23	ND	0.039	ND	0.24	ND	0.039	ND	0.043	ND</											

Table 1  
HRBT Expansion  
Summary of Analytical Results  
Sediment - Standard Chemistry

Parameter	Unit	Most Stringent	TEL*	PEL*	GW SSL*	ESSL*	ISSL***	RSSL****	ERMs****	Weanack Exclusion Criteria	Weanack Clean Fill Criteria	HRCPL-ENV-024		HRCPL-ENV-025		HRCPL-ENV-026		HRCPL-ENV-027		HRCPL-ENV-082		HRCPL-ENV-083		HRCPL-ENV-084		HRCPL-ENV-085													
												19D1291		19E0632		19D1291		19D1291		19D1291		19D1291		19D1291		19D1291		19D1291		19D1291		19D1291		19D1291		19E0632			
												4/25/2019		5/15/2019		4/26/2019		4/27/2019		4/28/2019		4/29/2019		4/28/2019		4/28/2019		4/28/2019		4/28/2019		4/28/2019		4/28/2019		5/13/2019		5/13/2019	
												Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result
Potassium	mg/kg	--	--	--	--	--	--	--	--	--	--	3050	30.4	2950	34.3	1940	34.9	1300	27.5	2800	32.3	1710	29.5	647	28.9	1450	33.7												
Pyrene	µg/kg	152.7	152.7	1397.6	32700	1100	2300000	180000	2600	17,000,000	1,700,000	4.4	1.5	ND	1.6	25	1.6	ND	1.5	2.5	1.6	1.9	1.5	ND	1.8	1.7	J	1.6											
Pyritic Sulfur	%	< 0.25	--	--	--	--	--	--	2	< 0.25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA										
Selenium	mg/kg	2.55	--	--	2.55	0.52	580	39	--	5,100	63	ND	3.04	ND	3.43	ND	3.49	ND	2.75	ND	ND	2.95	ND	2.89	ND	3.37													
Silver	mg/kg	0.596	0.73	1.77	0.596	4.2	580	39	--	5,100	110	ND	0.607	ND	0.686	ND	0.699	ND	0.551	ND	0.646	ND	0.589	ND	0.577	ND	0.675												
Sodium	mg/kg	--	--	--	--	--	--	--	--	--	--	3060	30.4	3070	34.3	2000	34.9	1980	27.5	2670	32.3	2210	29.5	1510	28.9	1300	33.7												
Sulfide	mg/kg	--	--	--	--	--	--	--	--	--	--	1850	427	2830	566	3650	548	2300	407	3830	522	2500	441	2430	405	1910	552												
tetrachloroethene	µg/kg	10	--	--	189	10	100000	24000	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA									
Thallium	mg/kg	0.001	--	--	1	0.001	1.2	0.078	--	5	1	ND	3.04	ND	0.968	ND	3.49	ND	2.75	ND	3.23	ND	2.95	ND	2.89	ND	0.95												
Tin	mg/kg	--	--	--	--	--	--	--	--	--	--	ND	1.23	ND	1.37	ND	1.39	ND	1.15	ND	1.29	ND	1.15	ND	1.12	ND	1.35												
Tkn As N	mg/kg	--	--	--	--	--	--	--	--	--	--	198	25.2	836	29.5	550	29.1	209	23.4	974	26.9	172	24.9	111	24	356	28												
Toluene	µg/kg	50	--	--	11900	50	4700000	490000	--	--	--	ND	6.24	ND	7.12	ND	7.2	ND	5.84	ND	6.71	ND	6.17	ND	5.95	ND	6.98												
Total Organic Carbon	%	< 5%	--	--	--	--	--	--	--	--	--	< 5%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA								
Total Petroleum Hydrocarbons (As Diesel)	mg/kg	--	--	--	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA								
Total Petroleum Hydrocarbons (As Gasoline)	µg/kg	--	--	--	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA							
Total Solids (TS)	µg/kg	--	--	--	--	--	--	--	--	--	--	1000000	252	1020000	286	1180000	291	1000000	234	1000000	269	970000	249	1000000	240	940000	280												
Total Sulfur	mg/kg	--	--	--	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA						
Tosaphene	µg/kg	100	--	--	9860	119	2100	499	--	1600	100	ND	12.2	ND	14.1	ND	14.5	ND	11.2	ND	13.4	ND	11.9	ND	11.4	ND	13.9												
Tph-Semi-Volatiles (Dro)	µg/kg	--	--	--	--	--	--	--	--	--	--	ND	0.13	ND	0.14	ND	0.15	ND	0.12	ND	0.13	ND	0.12	ND	0.12	ND	0.12	ND	0.12	ND	0.12	ND	0.63						
Tph-Volatiles (Gro)	µg/kg	300	--	--	498	300	2300000	160000	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA						
Trans-1,2-Dichloroethene	µg/kg	1.6	--	--	1.6	398	8200	1800	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA						
Trans-1,3-Dichloropropene	µg/kg	1	--	--	39	1	6000	940	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA						
Trichloroethene	µg/kg	1740	--	--	1740	16400	35000000	2300000	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA						
Trichloroethene	µg/kg	1.8	--	--	--	25	1.8	--	--	--	--	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1						
Vanadium	mg/kg	7.8	--	--	7.8	7.8	580	39	--	5,200	370	30.4	0.607	33.5	0.686	19.4	0.699	15.7	0.551	25.9	0.646	16.3	0.589	6.94	0.577	16.1	0.675												
Vinyl Chloride	µg/kg	7.92	--	--	7.92	10	1700	59	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA						
Xylenes, Total	mg/kg	--	--	--	--	--	--	--	--	--	--	ND	18.7	ND	21.4	ND	21.6	ND	17.5	ND	20.1	ND	18.5	ND	17.9	ND	20.9												
Zinc	mg/kg	46	124	271	292	46	35000	2300	410	7,500	1,500	52.4	0.607	47.8	0.686	32.6	0.699	30.3	0.551	44.5	0.646	29.1	0.589	12.8	0.577	23.4	0.675												

ND: Not Detected at Method Detection Limit

DL: Lower Detection Limit

NA: Not Analyzed

\*Source: MacDonald et al. 1996. Ecotoxicology 5: 253-278.

\*\* Source: Virginia Department of Environmental Quality Solid Waste Guidance Memorandum, July 2012.

\*\*\* Source: Virginia Department of Environmental Quality Waste Guidance Memorandum, July 2012 or USEPA Regional Screening Levels, USEPA, May 2016. For non-carcinogens, value shown is equal to 1/10 the residential or industrial soil value.

\*\*\*\* Source: National Oceanic and Atmospheric Administration's Screening Quick Reference Tables





Table 2  
 HRBT Expansion  
 Summary of Analytical Results  
 Fill Samples - Standard Chemistry

Parameter	Unit	Most Stringent	TEL*	PEL*	GW SSL*	ESSL*	ISSL**	RSSL***	ERMs****	Weanack Exclusion Criteria	Weanack Clean Fill Criteria	HRCP-L-ENV-024-Fill		HRCP-L-ENV-025-Fill			HRCP-L-ENV-026-Fill			HRCP-L-ENV-027-Fill			HRCP-L-ENV-082-Fill			HRCP-L-ENV-083-Fill			HRCP-L-ENV-084-Fill			HRCP-L-ENV-085-Fill					
												19D1288		19E0632			19D1288			19D1288			19D1288			19D1288			19D1288			19D1288			19E0632		
												4/25/2019		5/8/2019			4/26/2019			4/26/2019			4/26/2019			4/24/2019			4/28/2019			4/27/2019			5/13/2019		
												1:05:00 PM		5:00:00 AM			10:15:00 AM			12:00:00 PM			2:50:00 AM			9:15:00 AM			12:30:00 PM			9:15:00 AM					
Result		Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL				
Pyritic Sulfur	%	< 0.25	--	--	--	--	--	--	--	2	< 0.25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Selenium	mg/kg	2.55	--	--	2.55	0.52	580	39	--	5,100	63	ND	2.67	ND	2.67	ND	2.5	ND	2.57	ND	2.62	ND	2.54	ND	2.65	ND	2.5	ND	2.5	ND	2.5	ND	2.5				
Silver	mg/kg	0.596	0.73	1.77	0.596	4.2	580	39	--	5,100	110	ND	0.534	ND	0.535	ND	0.5	ND	0.514	ND	0.525	ND	0.509	ND	0.53	ND	0.5	ND	0.5	ND	0.5	ND	0.5				
Sodium	mg/kg	--	--	--	--	--	--	--	--	--	--	ND	26.7	33.2	26.7	31.1	25	ND	25.7	94.9	26.2	64.7	25.4	42.6	26.5	ND	25	ND	25	ND	25	ND	25				
Sulfide	mg/kg	--	--	--	--	--	--	--	--	--	--	1430	429	1680	436	2450	408	1950	418	1810	416	2100	421	2620	423	1830	415	ND	415	ND	415	ND	415				
Tetrachloroethene	µg/kg	10	--	--	189	10	100000	24000	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Thallium	mg/kg	0.001	--	--	1	0.001	1.2	0.078	--	5	1	ND	2.67	ND	2.67	ND	2.5	ND	2.57	ND	2.62	ND	2.54	ND	2.65	ND	2.5	ND	2.5	ND	2.5	ND	2.5				
Tin	--	--	--	--	--	--	--	--	--	--	--	ND	5.22	ND	5.35	ND	5.05	ND	1.01	ND	5.31	ND	1.03	ND	1.01	ND	5	ND	5	ND	5	ND	5				
Tin As N	mg/kg	--	--	--	--	--	--	--	--	--	--	27	53.7	ND	55.1	63.4	52.8	81.7	21.1	86.8	53.4	37.9	21.3	ND	21.2	35.3	J	52.3	J	52.3	J	52.3	J				
Toluene	µg/kg	50	--	--	11900	50	4700000	480000	--	--	--	ND	24	ND	27.6	ND	24.4	ND	23	ND	26.7	ND	26.1	ND	23.5	ND	26.2	ND	26.2	ND	26.2	ND	26.2				
Total Organic Carbon	%	< 5%	--	--	--	--	--	--	--	--	--	< 5%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Total Petroleum Hydrocarbons (As Diesel)	mg/kg	--	--	--	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Total Petroleum Hydrocarbons (As Gasoline)	µg/kg	--	--	--	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
Total Solids (Ts)	--	--	--	--	--	--	--	--	--	--	--	997000	215	1000000	221	978000	207	990000	211	972000	214	1000000	213	996000	212	997000	210	NA	210	NA	210	NA	210	NA			
Total Sulfur	mg/kg	--	--	--	--	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
Toxaphene	µg/kg	100	--	--	9860	119	2100	490	--	1600	100	ND	2.4	ND	2.7	ND	12	ND	2.3	ND	2.3	ND	2.4	ND	2.4	ND	50	ND	50	ND	50	ND	50				
Tph-Semi-Volatiles (Dro)	mg/kg	--	--	--	--	--	--	--	--	--	--	ND	10.4	ND	11	ND	10.1	ND	10.3	ND	10.6	ND	10.5	ND	10.4	ND	10.3	ND	10.3	ND	10.3	ND	10.3				
Tph-Volatiles (Gro)	mg/kg	--	--	--	--	--	--	--	--	--	--	ND	0.11	ND	0.11	ND	0.1	ND	0.1	ND	0.11	ND	0.11	ND	0.11	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND			
Trans-1,2-Dichloroethene	µg/kg	300	--	--	498	300	2300000	160000	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
Trans-1,3-Dichloropropene	µg/kg	1.8	--	--	1.8	398	8200	1800	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
Tributyltin	mg/kg	1.8	--	--	--	--	25	1.8	--	--	--	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND			
Trichloroethene	µg/kg	1	--	--	39	1	6000	940	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
Trichlorofluoromethane	µg/kg	1740	--	--	1740	16400	35000000	2300000	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
Vanadium	mg/kg	7.8	--	--	7.8	7.8	580	39	--	5,200	370	1.78	0.534	1.5	0.535	2.79	0.5	1.13	0.514	1.99	0.525	1.81	0.509	1.72	0.53	1.85	0.5	ND	0.5	ND	0.5	ND					
Vinyl Chloride	µg/kg	7.92	--	--	7.92	10	1700	59	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
Xlenes, Total	--	--	--	--	--	--	--	--	--	--	--	ND	72	ND	82.7	ND	73.3	ND	68.9	ND	80.1	ND	78.3	ND	70.4	ND	78.7	ND	78.7	ND	78.7	ND	78.7				
Zinc	mg/kg	46	124	271	292	46	35000	2300	410	7,500	1,500	2.62	0.534	2	0.535	5.27	0.5	1.49	0.514	3.15	0.525	3.35	0.509	2.63	0.53	2.23	0.5	ND	0.5	ND	0.5	ND					

ND: Not Detected at Method Detection Limit  
 DL: Lower Detection Limit  
 NA: Not Analyzed  
 \*Source: MacDonald et al. 1996, Ecotoxicology 5: 253-278.  
 \*\* Source: Virginia Department of Environmental Quality Solid Waste Guidance Memorandum, July 2012.  
 \*\*\* Source: Virginia Department of Environmental Quality Solid Waste Guidance Memorandum, July 2012 or USEPA Regional Screening Levels, USEPA, May 2016. For non-carcinogens, value shown is equal to 1/10 the residential or industrial soil value.  
 \*\*\*\* Source: National Oceanic and Atmospheric Administration's Screening Quick Reference Tables

Table 3  
 HRBT Expansion  
 Summary of Analytical Results  
 Sediment - TCLP

Parameter	Units	TCLP Criteria	HRCP-L-ENV-024			HRCP-L-ENV-025			HRCP-L-ENV-026			HRCP-L-ENV-027			HRCP-L-ENV-082			HRCP-L-ENV-083			HRCP-L-ENV-084			HRCP-L-ENV-085		
			19D1291			19E0632			19D1291			19D1291			19D1291			19D1291			19D1291			19E0632		
			4/25/2019			5/9/2019			4/26/2019			4/27/2019			4/24/2019			4/28/2019			4/28/2019			5/13/2019		
			1:30:00 PM			5:15:00 PM			12:10:00 PM			12:40:00 PM			4:00:00 PM			9:30:00 AM			12:15:00 AM			9:30:00 AM		
			Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
1,1-Dichloroethylene	mg/L	0.7	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
1,2-Dichloroethane	mg/L	0.5	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
1,4-Dichlorobenzene	mg/L	7.5	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
2-(2,4,5-Trichlorophenoxy) Propionic acid (Silvex)	mg/L	1	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005
2,4,5-Trichlorophenol	mg/L	400	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
2,4,6-Trichlorophenol	mg/L	2	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
2,4-Dichlorophenoxy Acetic Acid (2,4-D)	mg/L	10	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005
2,4-Dinitrotoluene	mg/L	0.13	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
2-Butanone (MEK)	mg/L	200	ND		0.2	ND		0.2	ND		0.2	ND		0.2	ND		0.2	ND		0.2	ND		0.2	ND		0.2
Arsenic	mg/L	5	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Barium	mg/L	100	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Benzene	mg/L	0.5	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Cadmium	mg/L	1	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Carbon tetrachloride	mg/L	0.5	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Chlordane	mg/L	0.03	ND		0.002	ND		0.002	ND		0.002	ND		0.002	ND		0.002	ND		0.002	ND		0.002	ND		0.002
Chlorobenzene	mg/L	100	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Chloroform	mg/L	6	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Chromium	mg/L	5	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Endrin	mg/L	0.02	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005
Extraction Fluid, Metals	#		1		0	1		0	1		0	1		0	1		0	1		0	1		0	1		0
Extraction Fluid, ZHE	#		1		0	1		0	1		0	1		0	1		0	1		0	1		0	1		0
gamma-BHC (Lindane, Hexachlorocyclohexane)	mg/L	0.4	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005
Heptachlor	mg/L	0.008	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005
Heptachlor Epoxide	mg/L		ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005
Hexachlorobenzene	mg/L	0.13	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Hexachlorobutadiene	mg/L	0.5	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Hexachloroethane	mg/L	3	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Lead	mg/L	5	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
m+p-Cresols	mg/L	200	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Mercury	mg/L	0.2	ND		0.008	ND		0.008	ND		0.008	ND		0.008	ND		0.008	ND		0.008	ND		0.008	ND		0.008
Methoxychlor	mg/L	10	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005
Nitrobenzene	mg/L	2	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
o+m+p-Cresols	mg/L	200	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
o-Cresol	mg/L	200	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Pentachlorophenol	mg/L	100	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Pyridine	mg/L	5	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Selenium	mg/L	1	ND		0.25	ND		0.25	ND		0.25	ND		0.25	ND		0.25	ND		0.25	ND		0.25	ND		0.25
Silver	mg/L	5	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Tetrachloroethylene (PCE)	mg/L	0.7	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Toxaphene	mg/L	0.5	ND		0.002	ND		0.002	ND		0.002	ND		0.002	ND		0.002	ND		0.002	ND		0.002	ND		0.002
Trichloroethylene	mg/L	0.5	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Vinyl chloride	mg/L	0.2	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02

ND: Not Detected at Method Detection Limit  
 DL: Lower Detection Limit  
 NA: Not Analyzed

Table 4  
HRBT Expansion  
Summary of Analytical Results  
Fill Samples - TCLP

Parameter	Units	TCLP Criteria	HRCP-L-ENV-024-FILL			HRCP-L-ENV-025-FILL			HRCP-L-ENV-026-FILL			HRCP-L-ENV-027-FILL			HRCP-L-ENV-082-FILL			HRCP-L-ENV-083-FILL			HRCP-L-ENV-084-FILL			HRCP-L-ENV-085-FILL		
			19D1288			19E0632			19D1288			19D1288			19D1288			19D1288			19D1288			19E0632		
			4/25/2019			5/9/2019			4/26/2019			4/27/2019			4/24/2019			4/24/2019			4/28/2019			5/13/2019		
			1:05:00 PM			5:00:00 PM			10:15:00 PM			12:30:00 PM			2:50:00 PM			12:00:00 PM			9:15:00 PM					
			Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
1,1-Dichloroethylene	mg/L	0.7	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
1,2-Dichloroethane	mg/L	0.5	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
1,4-Dichlorobenzene	mg/L	7.5	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
2-(2,4,5-Trichlorophenoxy) Propionic acid (Silvex)	mg/L	1	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005
2,4,5-Trichlorophenol	mg/L	400	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
2,4,6-Trichlorophenol	mg/L	2	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
2,4-Dichlorophenoxy Acetic Acid (2,4-D)	mg/L	10	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005	ND		0.0005
2,4-Dinitrotoluene	mg/L	0.13	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
2-Butanone (MEK)	mg/L	200	ND		0.2	ND		0.2	ND		0.2	ND		0.2	ND		0.2	ND		0.2	ND		0.2	ND		0.2
Arsenic	mg/L	5	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Barium	mg/L	100	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Benzene	mg/L	0.5	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Cadmium	mg/L	1	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Carbon tetrachloride	mg/L	0.5	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Chlordane	mg/L	0.03	ND		0.002	ND		0.002	ND		0.002	ND		0.002	ND		0.002	ND		0.002	ND		0.002	ND		0.002
Chlorobenzene	mg/L	100	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Chloroform	mg/L	6	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Chromium	mg/L	5	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Endrin	mg/L	0.02	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005
Extraction Fluid, Metals	#		1		0	1		0	1		0	1		0	1		0	1		0	1		0	1		0
Extraction Fluid, ZHE	#		1		0	1		0	1		0	1		0	1		0	1		0	1		0	1		0
gamma-BHC (Lindane, Hexachlorocyclohexane)	mg/L	0.4	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005
Heptachlor	mg/L	0.008	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005
Heptachlor Epoxide	mg/L	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	0.00005
Hexachlorobenzene	mg/L	0.13	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Hexachlorobutadiene	mg/L	0.5	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Hexachloroethane	mg/L	3	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Lead	mg/L	5	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
m+p-Cresols	mg/L	200	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Mercury	mg/L	0.2	ND		0.008	ND		0.008	ND		0.008	ND		0.008	ND		0.008	ND		0.008	ND		0.008	ND		0.008
Methoxychlor	mg/L	10	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005	ND		0.00005
Nitrobenzene	mg/L	2	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
o+m+p-Cresols	mg/L	200	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
o-Cresol	mg/L	200	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Pentachlorophenol	mg/L	100	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Pyridine	mg/L	5	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Selenium	mg/L	1	ND		0.25	ND		0.25	ND		0.25	ND		0.25	ND		0.25	ND		0.25	ND		0.25	ND		0.25
Silver	mg/L	5	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Tetrachloroethylene (PCE)	mg/L	0.7	ND		0.05	ND		0.02	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.02
Toxaphene	mg/L	0.5	ND		0.002	ND		0.002	ND		0.002	ND		0.002	ND		0.002	ND		0.002	ND		0.002	ND		0.002
Trichloroethylene	mg/L	0.5	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02
Vinyl chloride	mg/L	0.2	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02	ND		0.02

ND: Not Detected at Method Detection Limit  
DL: Lower Detection Limit  
NA: Not Analyzed



Table 5  
 HRBT Expansion  
 Summary of Analytical Results  
 Elutriate Sediment - Standard Chemistry

Parameter	Units	Most Stringent Criteria	USEPA Acute Ecological Criteria	VA Acute Ecological Criteria	Public Water Supply	VA Surface Water	Weanack Clean Fill Criteria	HRCPL-ENV-024 Elutriate			HRCPL-ENV-025 Elutriate			HRCPL-ENV-026 Elutriate			HRCPL-ENV-027 Elutriate			HRCPL-ENV-082 Elutriate			HRCPL-ENV-083 Elutriate			HRCPL-ENV-084 Elutriate			HRCPL-ENV-095 Elutriate					
								19E0014			19E0634			19E0014			19E0014			19E0014			19E0014			19E0014			19E0014			19E0634		
								Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
1.1.1.2-Tetrachloroethane	µg/L	--	--	--	--	--	--	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4			
1.1.1-Trichloroethane	µg/L	--	--	--	--	--	--	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6			
1.1.2.2-Trichloroethane	µg/L	1.7	--	--	1.7	40	1.7	ND	0.3	0.3	ND	0.3	0.3	ND	0.3	0.3	ND	0.3	0.3	ND	0.3	0.3	ND	0.3	0.3	ND	0.3	0.3	ND	0.3	0.3			
1.1.2-Trichloroethane	µg/L	5.9	--	--	5.9	160	5.9	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5			
1.1-Dichloroethane	µg/L	3.8	--	--	3.8	370	3.8	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6			
1.1-Dichloroethylene	µg/L	330	--	--	320	7100	320	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7			
1.1-Dichloropropane	µg/L	--	--	--	--	--	--	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6			
1.2.3-Trichlorobenzene	µg/L	--	--	--	--	--	--	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7			
1.2.3-Trichloropropane	µg/L	--	--	--	--	--	--	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4			
1.2.4-Trichlorobenzene	µg/L	35	--	--	35	70	35	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5			
1.2.4-Trichloropropane	µg/L	35	--	--	35	70	35	ND	4.12	4.17	ND	4.12	4.17	ND	4.12	4.17	ND	4.12	4.17	ND	4.12	4.17	ND	4.12	4.17	ND	4.12	4.17	ND	4.12	4.17			
1.2.4-Trimethylbenzene	µg/L	--	--	--	--	--	--	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4			
1.2-Dibromo-3-chloropropane (DBCP)	µg/L	--	--	--	--	--	--	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6			
1.2-Dibromoethane (EDB)	µg/L	--	--	--	--	--	--	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4			
1.2-Dichlorobenzene	µg/L	420	--	--	420	1300	420	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4			
1.2-Dichloroethane	µg/L	--	--	--	--	--	--	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7	ND	0.7	0.7			
1.2-Dichloropropane	µg/L	5	--	--	5	150	5	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4			
1.2-Diphenylhydrazine	µg/L	0.36	--	--	0.36	2	0.36	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33			
1.3.5-Trimethylbenzene	µg/L	--	--	--	--	--	--	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4			
1.3-Dichlorobenzene	µg/L	320	--	--	320	960	320	ND	0.3	0.3	ND	0.3	0.3	ND	0.3	0.3	ND	0.3	0.3	ND	0.3	0.3	ND	0.3	0.3	ND	0.3	0.3	ND	0.3	0.3			
1.3-Dichloropropane	µg/L	3.4	--	--	3.4	210	3.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4			
1.4'-DDT	µg/L	0.13	0.13	0.13	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
1.4-Dichlorobenzene	µg/L	63	--	--	63	190	63	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4	ND	0.4	0.4			
1-Methylnaphthalene	µg/L	--	--	--	--	--	--	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33			
2(2,4,5-Trichlorophenoxy) Propionic acid (Silvex)	µg/L	10	--	--	10	--	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
2.2-Dichloropropane	µg/L	--	--	--	--	--	--	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6	ND	0.6	0.6			
2.2-Oxybis (1-chloropropane)	µg/L	1400	--	--	1400	--	1400	ND	3.09	3.12	ND	3.09	3.12	ND	3.09	3.12	ND	3.09	3.12	ND	3.09	3.12	ND	3.09	3.12	ND	3.09	3.12	ND	3.09	3.12			
2.3,8-TCDD	pg/L	0.05	--	--	0.05	--	0.05	ND	0.24	0.24	ND	0.24	0.24	ND	0.24	0.24	ND	0.24	0.24	ND	0.24	0.24	ND	0.24	0.24	ND	0.24	0.24	ND	0.24	0.24			
2.4.6-Trichlorophenol	µg/L	14	--	--	14	24	14	ND	3.09	3.12	ND	3.09	3.12	ND	3.09	3.12	ND	3.09	3.12	ND	3.09	3.12	ND	3.09	3.12	ND	3.09	3.12	ND	3.09	3.12			
2.4-Dichlorophenol	µg/L	77	--	--	77	290	77	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
2.4-Dichlorophenoxy Acetic Acid (2,4-D)	µg/L	100	--	--	100	--	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
2.4-Dimethylphenol	µg/L	380	--	--	380	850	380	ND	0.52	0.52	C	0.52	0.52	ND	0.52	0.52	ND	0.52	0.52	ND	0.52	0.52	ND	0.52	0.52	ND	0.52	0.52	ND	0.52	0.52			
2.4-Dinitrophenol	µg/L	69	--	--	69	5300	69	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33	ND	8.25	8.33			
2.4-Dinitrotoluene	µg/L	1.1	--	--	1.1	34	1.1	ND	2.58	2.6	ND	2.58	2.6	ND	2.58	2.6	ND	2.58	2.6	ND	2.58	2.6	ND	2.58	2.6	ND	2.58	2.6	ND	2.58	2.6			
2.6-Dichlorophenol	µg/L	--	--	--	--	--	--	ND	1.93	1.94	ND	1.93	1.94	ND	1.93	1.94	ND	1.93	1.94	ND	1.93	1.94	ND	1.93	1.94	ND	1.93	1.94	ND	1.93	1.94			
2.6-Dinitrotoluene	µg/L	--	--	--	--	--	--	ND	4.12	4.17	ND	4.12	4.17	ND	4.12	4.17	ND	4.12	4.17	ND	4.12	4.17	ND	4.12	4.17	ND	4.12	4.17	ND	4.12	4.17			
2-Butanone (MEK)	µg/L	--	--	--	--	--	--	ND	3	3	ND	3	3	ND	3	3	ND	3	3	ND	3	3	ND	3	3	ND	3	3	ND	3	3			
2-Chloronaphthalene	µg/L	1000	--	--	1000	1600	1000	ND	4.64	4.69	ND	4.64	4.69	ND	4.64	4.69	ND	4.64	4.69	ND	4.64	4.69	ND	4.64	4.69	ND	4.64	4.69	ND	4.64	4.69			
2-Chlorophenol	µg/L	81	--	--	81	150	81	ND	3.61	3.65	ND	3.61	3.65	ND	3.61	3.65	ND	3.61	3.65	ND	3.61	3.65	ND	3.61	3.65	ND	3.61	3.65	ND	3.61	3.65			
2-Chlorotoluene	µg/L	--	--	--	--	--	--	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5	ND	0.5	0.5			
2-Hexanone (MBK)	µg/L	--	--	--	--	--	--	ND	2.2	2.2	ND	2.2	2.2	ND	2.2	2.2	ND	2.2	2.2	ND	2.2	2.2	ND	2.2	2.2	ND	2.2	2.2	ND	2.2	2.2			
2-Methylnaphthalene	µg/L	--	--	--	--	--	--	ND	0.21	0.21	ND	0.21	0.21	ND	0.21	0.21	ND	0.21	0.21	ND	0.21	0.21	ND	0.21	0.21	ND	0.21	0.21	ND	0.21	0.21			
2-Methylphenol	µg/L	--	--	--	--	--	--	NA	8.25																									

Table 5  
 HRBT Expansion  
 Summary of Analytical Results  
 Elutriate Sediment - Standard Chemistry

Parameter	Units	Most Stringent Criteria	USEPA Acute Ecological Criteria	VA Acute Ecological Criteria	Public Water Supply	VA Surface Water	Weanack Clean Fill Criteria	HRCPL-ENV-024 Elutriate			HRCPL-ENV-025 Elutriate			HRCPL-ENV-026 Elutriate			HRCPL-ENV-027 Elutriate			HRCPL-ENV-082 Elutriate			HRCPL-ENV-083 Elutriate			HRCPL-ENV-084 Elutriate			HRCPL-ENV-085 Elutriate					
								19E0014			19E0634			19E0014			19E0014			19E0014			19E0014			19E0014			19E0014			19E0634		
								5/2/2019			5/15/2019			5/2/2019			5/2/2019			5/1/2019			5/2/2019			5/2/2019			5/2/2019			5/16/2019		
								11:28:00 AM			3:55:00 PM			12:05:00 AM			1:05:00 PM			4:15:00 PM			1:05:00 PM			1:05:00 PM			2:32:00 PM					
								Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL			
Beryllium	µg/L	--	--	--	--	--	--	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2			
beta-BHC (Hexachlorocyclohexane)	µg/L	0.091	--	--	0.091	0.017	0.091	ND		0.00037	ND		0.00037	ND		0.00037	ND		0.00037	ND		0.00037	ND		0.00037	ND		0.00037	ND		0.00037			
beta-Endosulfan	µg/L	0.034	0.034	0.034	62	89	0.22	ND		0.00032	ND		0.00032	ND		0.00032	ND		0.00032	ND		0.00032	ND		0.00032	ND		0.00032	ND		0.00032			
bis (2-Chloroethoxy) methane	µg/L	--	--	--	--	--	--	ND		3.61	ND		3.65	ND		3.61	ND		3.61	ND		3.65	ND		3.68	ND		3.65	ND		3.65			
bis (2-Chloroethyl) ether	µg/L	0.3	--	--	0.3	5.3	0.3	ND		3.61	ND		3.65	ND		3.61	ND		3.61	ND		3.65	ND		3.68	ND		3.65	ND		3.65			
bis (2-Ethylhexyl) phthalate	µg/L	12	--	--	12	22	12	ND		6.19	ND		6.25	ND		6.19	ND		6.19	ND		6.25	ND		6.32	ND		6.25	ND		6.25			
Bromobenzene	µg/L	--	--	--	--	--	--	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5			
Bromochloromethane	µg/L	--	--	--	--	--	--	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5			
Bromodichloromethane	µg/L	5.5	--	--	--	5.5	--	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4			
Bromoform	µg/L	43	--	--	43	1400	43	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4			
Bromomethane	µg/L	47	--	--	--	47	--	ND		0.8	ND		0.8	ND		0.8	ND		0.8	ND		0.8	ND		0.8	ND		0.8	ND		0.8			
Butyl benzyl phthalate	µg/L	1500	--	--	1500	1900	1500	ND		7.22	ND	C	7.29	ND		7.22	ND		7.22	ND		7.29	ND		7.37	ND		7.29	ND		7.29			
Cadmium	µg/L	0.4	40	40	43	1400	0.4	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2			
Carbon disulfide	µg/L	--	--	--	--	--	--	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1			
Carbon tetrachloride	µg/L	2.3	--	--	--	2.3	--	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5			
Chlordane	µg/L	0.008	0.9	--	0.008	0.0081	0.008	ND		0.0074	ND		0.0074	ND		0.0074	ND		0.0074	ND		0.0074	ND		0.0074	ND		0.0074	ND		0.0074			
Chloride	µg/L	50000	--	--	--	50000	--	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA			
Chlorobenzene	µg/L	130	--	--	130	1600	130	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4			
Chloroethane	µg/L	--	--	--	--	--	--	ND		0.7	ND		0.7	ND		0.7	ND		0.7	ND		0.7	ND		0.7	ND		0.7	ND		0.7			
Chloroform	µg/L	340	--	--	340	11000	340	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5			
Chloromethane	µg/L	--	--	--	--	--	--	ND		0.95	ND		0.95	ND		0.95	ND		0.95	ND		0.95	ND		0.95	ND		0.95	ND		0.95			
Chloropyrifos	µg/L	0.1	--	--	--	0.083	--	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA			
Chromium	µg/L	50	1100	1100	--	50	6.2	J		4	ND		4	8.5	J		4	10.9		4	8.4	J		4	8.3	J		4	11.6		4			
Chromium III, Dissolved	µg/L	180	--	--	180	--	180	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA			
Chromium VI, Dissolved	µg/L	16	--	--	--	16	--	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA			
Chrysene	µg/L	0.0038	--	--	0.0038	0.018	0.0038	ND		0.21	ND		0.21	ND		0.21	ND		0.21	ND		0.21	ND		0.21	ND		0.21	ND		0.21			
cis-1,2-Dichloroethylene	µg/L	--	--	--	--	--	--	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4			
cis-1,3-Dichloropropene	µg/L	--	--	--	--	--	--	ND		0.3	ND		0.3	ND		0.3	ND		0.3	ND		0.3	ND		0.3	ND		0.3	ND		0.3			
Cobalt	µg/L	--	--	--	--	--	--	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2			
Copper	µg/L	3.6	4.8	4.8	1300	--	3.6	5	J		3	ND	3	5.6	J		3	5.3	J	3	5.8	J		3	6	J	3	ND		3				
Cyanide	µg/L	1.3	1.3	1.3	140	16000	5	ND	CI		10	ND	10	ND	CI		10	ND	CI	10	ND	CI		10	ND	CI	10	ND		10				
Cyanide, Free	µg/L	22	--	--	140	16000	22	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA			
Diazinon	µg/L	0.2	--	--	--	0.17	--	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA			
Dibenz (a,h) anthracene	µg/L	0.038	--	--	0.038	0.18	0.038	ND		0.21	ND		0.21	ND		0.21	ND		0.21	ND		0.21	ND		0.21	ND		0.21	ND		0.21			
Dibenzofuran	µg/L	--	--	--	--	--	--	ND		2.06	ND		2.08	ND		2.06	ND		2.06	ND		2.08	ND		2.11	ND		2.08	ND		2.08			
Dibromodichloromethane	µg/L	4	--	--	--	4	--	ND		0.35	ND		0.35	ND		0.35	ND		0.35	ND		0.35	ND		0.35	ND		0.35	ND		0.35			
Dibromomethane	µg/L	--	--	--	--	--	--	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4			
Dichlorodifluoromethane	µg/L	--	--	--	--	--	--	ND		0.95	ND		0.95	ND		0.95	ND		0.95	ND		0.95	ND		0.95	ND		0.95	ND		0.95			
Dieldrin	µg/L	0.00052	0.7	0.71	0.00052	0.00054	0.00052	ND		0.00028	ND		0.00028	ND		0.00028	ND		0.00028	ND		0.00028	ND		0.00028	ND		0.00028	ND		0.00028			
Diethyl phthalate	µg/L	17000	--	--	17000	44000	17000	ND		3.09	ND		3.12	ND		3.09	ND		3.12	ND		3.12	ND		3.12	ND		3.12	ND		3.12			
Di-isopropyl ether (DIPE)	µg/L	3	--	--	--	3	--	ND		3	ND		3	ND		3	ND		3	ND		3	ND		3	ND		3	ND		3			
Dimethyl phthalate	µg/L	270000	--	--	270000	1100000	270000	ND		3.61	ND		3.65	ND		3.61	ND		3.61	ND		3.65	ND		3.68	ND		3.65	ND		3.65			
Di-n-butyl phthalate	µg/L	2000	--	--	2000	4500	2000	ND		4.12	ND		4.17	ND		4.12	ND		4.12	ND		4.17	ND		4.21	ND		4.17	ND		4.17			
Di-n-octyl phthalate	µg/L	--	--	--	--	--	--	ND		8.25	ND		8.33	ND		8.25	ND		8.25	ND		8.33	ND		8.42	ND		8.33	ND		8.33			
Endosulfan	µg/L	0.034	0.034	0.034	62	89	62	ND		0.00065	ND		0.00065	ND		0.00065	ND		0.00065	ND		0.00065	ND		0.00065	ND		0.00065	ND		0.00065			
Endosulfan sulfate	µg/L	0.004	0.037	0.037	0.059	0.06	0.004	ND		0.00023	ND		0.00023	ND		0.00023	ND		0.00023	ND		0.00023	ND		0.00023	ND		0.00023	ND		0.00023			
Endrin	µg/L	0.037	0.037	0.037	0.29	0.3	0.29	ND		0.00053	ND		0.00053	ND		0.00053	ND		0.00053	ND		0.00053	ND		0.00053	ND		0.00053	ND		0.00053			
Endrin aldehyde	µg/L	530	--	--	530	2100	530	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4	ND		0.4			
Ethylbenzene	µg/L	1100	--	--	1100	140	1100	ND		0.21	ND		0.21	ND		0.21	ND		0.21	ND		0.21	ND		0.21	ND		0.21	ND		0.21			
Fluoranthene	µg/L	1100	--	--	1100	5300	1100	ND		0.21	ND		0.21	ND		0.21	ND		0.21	ND		0.21	ND		0.21	ND		0.21	ND		0.21			
Fluorene	µg/L	1400	--	--	1100	5300	1400	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA			
Fluoride	µg/L	0.01	0.16	0.16	0.98	1.8	0.01	ND		0.0003	ND	F2	0.0003	ND		0.0003	ND		0.0003	ND		0.0003	ND		0.0003	ND		0.0003	ND		0.0003			
gamma-BHC (Lindane, Hexachlorocyclohexane)	µg/L	0.00079	0.053	0.053	0.00079	0.00079	0.00079	ND		0.00046	ND		0.00046	ND		0.00046	ND		0.00046	ND		0.00046	ND		0.00046	ND		0.00046	ND		0.00046			
Heptachlor	µg/L	0.00039	0.053	0.053	0.																													

Table 5  
HRBT Expansion  
Summary of Analytical Results  
Elutriate Sediment - Standard Chemistry

Parameter	Units	Most Stringent Criteria	USEPA Acute Ecological Criteria	VA Acute Ecological Criteria	Public Water Supply	VA Surface Water	Weanack Clean Fill Criteria	HRCPL-ENV-024 Elutriate		HRCPL-ENV-025 Elutriate		HRCPL-ENV-026 Elutriate		HRCPL-ENV-027 Elutriate		HRCPL-ENV-082 Elutriate		HRCPL-ENV-083 Elutriate		HRCPL-ENV-084 Elutriate		HRCPL-ENV-085 Elutriate					
								19E0014		19E0634		19E0014		19E0014		19E0014		19E0014		19E0014		19E0014		19E0014		19E0634	
								5/2/2019		5/15/2019		5/2/2019		5/2/2019		5/2/2019		5/2/2019		5/11/2019		5/2/2019		5/2/2019		5/16/2019	
								11:28:00 AM		3:55:00 PM		12:05:00 AM		1:05:00 PM		4:15:00 PM		1:05:00 PM		1:05:00 PM		1:05:00 PM		2:32:00 PM			
								Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL		
Nonylphenol	µg/L	28	--	--	--	--	28	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA		
n-Propylbenzene	µg/L	--	--	--	--	--	--	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4		
o-Xylene	µg/L	--	--	--	--	--	--	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4		
Parathion	µg/L	0.065	--	--	--	--	0.065	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Pentachlorophenol	µg/L	2.7	--	--	2.7	30	2.7	ND	6.19	ND	C	6.25	ND	6.19	ND	6.19	ND	6.25	ND	6.32	ND	6.25	ND	6.25	6.25		
Phenanthrene	µg/L	--	--	--	--	--	--	0.23	B	0.21	ND	0.21	0.25	B	0.21	0.26	B	0.21	0.22	B	0.21	0.29	B	0.21	0.27		
Phenol	µg/L	10000	--	--	10000	860000	10000	ND	2.58	ND	2.6	ND	2.58	ND	2.58	ND	2.6	ND	2.63	ND	2.6	ND	2.6	ND	2.6		
Phosphorus, Total	mg/L	--	--	--	--	--	--	0.052	0.01	ND	0.01	ND	0.01	ND	0.01	0.017	J	0.01	0.09	0.01	0.071	0.01	0.01	ND	0.01		
Pyrene	µg/L	830	--	--	--	--	830	ND	0.21	ND	0.21	ND	0.21	ND	0.21	ND	0.21	ND	0.21	ND	0.21	ND	0.21	ND	0.21		
sec-Butylbenzene	µg/L	--	--	--	--	--	--	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4		
Selenium	µg/L	10	290	290	170	4200	10	ND	40	ND	40	ND	40	ND	40	ND	40	ND	40	ND	40	ND	40	ND	40		
Silver	µg/L	1.9	1.9	1.9	--	--	--	ND	5	ND	5	ND	5	ND	5	ND	5	ND	5	ND	5	ND	5	ND	5		
Styrene	µg/L	--	--	--	--	--	--	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4		
Sulfate	µg/L	50000	--	--	250000	--	50000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Sulfide	mg/L	--	--	--	--	--	--	ND	0.8	ND	0.8	ND	0.8	ND	0.8	ND	0.8	ND	0.8	ND	0.8	ND	0.8	ND	0.8		
tert-Butylbenzene	µg/L	--	--	--	--	--	--	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4		
Tetrachloroethylene (PCE)	µg/L	6.9	--	--	6.9	33	6.9	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4		
Thallium	µg/L	--	--	--	--	--	--	ND	9	ND	9	ND	9	ND	9	ND	9	ND	9	ND	9	ND	9	ND	9		
Tin	µg/L	--	--	--	--	--	--	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20		
TKN as N	mg/L	--	--	--	--	--	--	2.86	0.2	4.17	0.2	3.29	0.2	1.43	0.2	4.49	0.2	1.53	0.2	1.33	0.2	1.53	0.2	1.53	0.2		
TOC (Max)	mg/L	--	--	--	--	--	--	1	1	ND	1	ND	1	ND	1	1.2	1	1.8	1	1.8	1	1.8	1	ND	1		
TOC (Mean)	mg/L	--	--	--	--	--	--	1	1	ND	1	ND	1	ND	1	1	1.8	1	1.8	1	1.8	1	1	ND	1		
TOC (Min)	mg/L	--	--	--	--	--	--	1	1	ND	1	ND	1	ND	1	1	1.7	1	1.8	1	1.8	1	1	ND	1		
Toluene	µg/L	510	--	--	510	6000	510	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5		
PCB-101	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.28	ND	0.28	ND	0.28	ND	0.28	ND	0.28	ND	0.28	ND	0.28	ND	0.28	ND	0.28		
PCB-105	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.51	ND	0.51	ND	0.51	ND	0.51	ND	0.51	ND	0.51	ND	0.51	ND	0.51	ND	0.51		
PCB-118	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.75	ND	0.75	ND	0.75	ND	0.75	ND	0.75	ND	0.75	ND	0.75	ND	0.75	ND	0.75		
PCB-126	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.74	ND	0.74	ND	0.74	ND	0.74	ND	0.74	ND	0.74	ND	0.74	ND	0.73	ND	0.74		
PCB-128	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.25	ND	0.25	ND	0.25	ND	0.25	ND	0.25	ND	0.25	ND	0.25	ND	0.25	ND	0.25		
PCB-138	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.51	ND	0.51	ND	0.51	ND	0.51	ND	0.51	ND	0.51	ND	0.51	ND	0.51	ND	0.51		
PCB-153	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.54	ND	0.54	ND	0.54	ND	0.54	ND	0.54	ND	0.54	ND	0.53	ND	0.54	ND	0.54		
PCB-156	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.67	ND	0.67	ND	0.67	ND	0.67	1	0.67	ND	0.67	ND	0.67	ND	0.67	ND	0.67		
PCB-169	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.71	ND	0.71	ND	0.71	ND	0.71	ND	0.71	ND	0.71	ND	0.71	ND	0.71	ND	0.71		
PCB-170	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.34	ND	0.34	ND	0.34	ND	0.34	ND	0.34	ND	0.34	ND	0.34	ND	0.34	ND	0.34		
PCB-18	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.26	2.5	0.26	ND	0.26	2.1	0.26	1.5	0.26	2	0.26	1.1	0.26	1.1	0.26	ND	0.26		
PCB-180	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7		
PCB-183	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.65	ND	0.65	ND	0.65	ND	0.65	2.5	0.65	ND	0.65	ND	0.65	ND	0.65	ND	0.65		
PCB-184	ng/L	0.64	--	--	0.64	0.64	0.64	0.62	J	0.26	ND	0.26	ND	0.26	ND	0.26	ND	0.26	ND	0.26	ND	0.26	ND	0.26	0.26		
PCB-187	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.65	ND	0.65	0.9	J	0.65	2	0.65	ND	0.65	ND	0.65	1	0.64	ND	0.65	0.65		
PCB-195	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.36	ND	0.36	ND	0.36	ND	0.36	ND	0.36	ND	0.36	ND	0.36	ND	0.36	ND	0.36		
PCB-206	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.89	ND	0.89	ND	0.89	ND	0.89	ND	0.89	ND	0.89	ND	0.89	ND	0.89	ND	0.89		
PCB-209	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.84	ND	0.84	ND	0.84	ND	0.84	ND	0.84	ND	0.84	ND	0.84	ND	0.83	ND	0.84		
PCB-28	ng/L	0.64	--	--	0.64	0.64	0.64	1.2	p	0.5	ND	F1	0.5	ND	0.5	2.9	p	0.5	ND	0.5	1.9	p	0.5	ND	0.5		
PCB-44	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.28	ND	0.28	ND	0.28	ND	0.28	1.2	0.28	ND	0.28	ND	0.96	J	0.27	ND	0.28		
PCB-49	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.34	ND	F1	0.34	ND	0.34	ND	0.34	ND	0.34	ND	0.34	ND	0.34	ND	0.34	0.34		
PCB-52	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.48	ND	0.48	ND	0.48	ND	0.48	ND	0.48	ND	0.48	ND	0.48	ND	0.47	ND	0.48		
PCB-66	ng/L	0.64	--	--	0.64	0.64	0.64	1.8	0.61	1.5	p	0.61	ND	0.61	ND	0.61	1.2	0.61	ND	0.61	ND	0.61	ND	0.61	0.61		
PCB-77	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.72	ND	p	0.72	ND	0.72	ND	0.72	ND	0.72	ND	0.72	ND	0.71	ND	0.72	0.72		
PCB-8	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.41	ND	0.41	ND	0.41	ND	0.41	ND	0.41	ND	0.41	ND	0.41	ND	0.41	ND	0.41		
PCB-87	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.25	ND	0.25	ND	0.25	ND	0.25	ND	0.25	ND	0.25	ND	0.25	ND	0.25	ND	0.25		
Total PCBs, all congeners	ng/L	0.64	--	--	0.64	0.64	0.64	3.62	0.25	4	0.25	0.9	0.25	8.2	0.25	6.3	0.25	3.2	0.25	4.96	0.25	4.96	0.25	ND	0.25		
Total petroleum hydrocarbons (TPH)	mg/kg	10000	--	--	--	--	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Total phenols (phenolic compounds)	µg/L	1	--	--	--	--	1	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05		
Toxaphene	µg/L	0.21	0.21	0.21	--	--	--	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6		
trans-1,2-Dichloroethylene	µg/L	140	--	--	--	--	140	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3		
trans-1,3-Dichloropropene	µg/L	--	--	--	--	--	--	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3		
Trichloroethylene	µg/L	25	--	--	25	300	25	NA	NA	ND	0.03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.03			
Trichlorofluoromethane	µg/L	--	--	--	--	--	--	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4		
Tributyltin	µg/L	0.46	0.46	--	--	--	0.46	ND	0.8	ND	0.8	ND	0.8	ND	0.8	ND	0.8	ND	0.8	ND	0.8	ND	0.8	ND	0.8		
Vinyl acetate	µg/L	0.46																									

Table 6  
HRBT Expansion  
Summary of Analytical Results  
Elutriate Fill Sediment - Standard Chemistry

Parameter	Units	Most Stringent Criteria	USEPA Acute Criteria	VA Acute Criteria	Public Water Supply	VA Surface Water	Weakness Clean Fill	HRCP-L-ENV-024-FILL		HRCP-L-ENV-025-FILL		HRCP-L-ENV-026-FILL		HRCP-L-ENV-027-FILL		HRCP-L-ENV-082-FILL		HRCP-L-ENV-083-FILL		HRCP-L-ENV-084-FILL		HRCP-L-ENV-085-FILL							
								19E0463		19E0634		19E0463		19E0463		19E0463		19E0463		19E0463		19E0463		19E0463		19E0463		19E0463	
								Result	O	Result	O	Result	O	Result	O	Result	O	Result	O	Result	O	Result	O	Result	O	Result	O	Result	O
1,1,1,2-Tetrachloroethane	µg/L	--	--	--	--	--	--	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4				
1,1,1,2-Tetrachloroethane	µg/L	--	--	--	--	--	--	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6				
1,1,2-Trichloroethane	µg/L	1.7	--	--	--	1.7	40	1.7	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND				
1,1,2-Trichloroethane	µg/L	5.9	--	--	5.9	160	5.9	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5				
1,1-Dichloroethane	µg/L	3.8	--	--	3.8	370	3.8	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6				
1,1-Dichloroethylene	µg/L	330	--	--	320	7100	320	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7				
1,1-Dichloropropene	µg/L	--	--	--	--	--	--	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7				
1,2,3-Trichlorobenzene	µg/L	--	--	--	--	--	--	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4				
1,2,3-Trichloropropene	µg/L	--	--	--	--	--	--	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4				
1,2,4-Trichlorobenzene	µg/L	35	--	--	35	70	35	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5				
1,2,4-Trichlorobenzene	µg/L	35	--	--	35	70	35	ND	4.17	ND	4.17	ND	4.21	ND	4.21	ND	4.04	ND	4.04	ND	4.04	ND	4.17	ND	4.17				
1,2,4-Trimethylbenzene	µg/L	--	--	--	--	--	--	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4				
1,2-Dibromo-3-chloropropane (DBCP)	µg/L	--	--	--	--	--	--	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6				
1,2-Dibromoethane (EDB)	µg/L	--	--	--	--	--	--	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4				
1,2-Dichlorobenzene	µg/L	420	--	--	420	1300	420	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4				
1,2-Dichloroethane	µg/L	--	--	--	--	--	--	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7				
1,2-Dichloropropane	µg/L	5	--	--	5	150	5	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4				
1,2-Diphenylhydrazine	µg/L	0.36	--	--	0.36	2	0.36	ND	8.33	ND	8.33	ND	8.42	ND	8.42	ND	8.08	ND	8.08	ND	8.08	ND	8.33	ND	8.33				
1,3,5-Trimethylbenzene	µg/L	--	--	--	--	--	--	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4				
1,3-Dichlorobenzene	µg/L	320	--	--	320	960	320	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3				
1,3-Dichloropropane	µg/L	3.4	--	--	3.4	210	3.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4				
1,4-DDT	µg/L	0.13	0.13	0.13	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
1,4-Dichlorobenzene	µg/L	63	--	--	63	190	63	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4				
1-Methylnaphthalene	µg/L	--	--	--	--	--	--	ND	8.33	ND	8.33	ND	8.42	ND	8.42	ND	8.08	ND	8.08	ND	8.08	ND	8.33	ND	8.33				
2-(2,4,5-Trichlorophenoxy) Propionic acid (Silvex)	µg/L	10	--	--	50	--	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
2,2-Dichloropropane	µg/L	--	--	--	--	--	--	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6				
2,2-Dyhalo (1-chloropropane)	µg/L	1400	--	--	--	--	1400	ND	3.12	ND	3.12	ND	3.16	ND	3.16	ND	3.03	ND	3.03	ND	3.03	ND	3.12	ND	3.12				
2,3,7,8-TCDD	µg/L	0.05	--	--	--	--	0.05	ND	0.66	ND	0.66	ND	0.64	ND	0.64	ND	0.77	ND	0.52	ND	0.52	ND	0.65	ND	0.77				
2,4,6-Trichlorophenol	µg/L	14	--	--	14	24	14	ND	3.12	ND	3.12	ND	3.16	ND	3.16	ND	3.03	ND	3.03	ND	3.03	ND	3.12	ND	3.12				
2,4-Dichlorophenol	µg/L	77	--	--	77	290	77	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
2,4-Dichlorophenoxy Acetic Acid (2,4-D)	µg/L	100	--	--	100	--	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
2,4-Dimethylphenol	µg/L	380	--	--	380	850	380	ND	0.52	ND	0.52	ND	0.53	ND	0.53	ND	0.51	ND	0.51	ND	0.52	ND	0.52	ND	0.52				
2,4-Dinitrophenol	µg/L	69	--	--	69	5300	69	ND	8.33	ND	8.33	ND	8.42	ND	8.42	ND	8.08	ND	8.08	ND	8.08	ND	8.33	ND	8.33				
2,4-Dinitrotoluene	µg/L	1.1	--	--	1.1	34	1.1	ND	2.6	ND	2.6	ND	2.63	ND	2.63	ND	2.53	ND	2.53	ND	2.53	ND	2.6	ND	2.6				
2,6-Dichlorophenol	µg/L	--	--	--	--	--	--	ND	1.04	ND	1.04	ND	1.05	ND	1.05	ND	1.01	ND	1.01	ND	1.01	ND	1.04	ND	1.04				
2,6-Dinitrotoluene	µg/L	--	--	--	--	--	--	ND	4.17	ND	4.17	ND	4.21	ND	4.21	ND	4.04	ND	4.04	ND	4.04	ND	4.17	ND	4.17				
2-Butanone (MEK)	µg/L	--	--	--	--	--	--	ND	3	ND	3	ND	3	ND	3	ND	3	ND	3	ND	3	ND	3	ND	3				
2-Chloronaphthalene	µg/L	1000	--	--	1000	1600	1000	ND	4.69	ND	4.69	ND	4.74	ND	4.74	ND	4.55	ND	4.55	ND	4.55	ND	4.69	ND	4.69				
2-Chlorophenol	µg/L	81	--	--	81	150	81	ND	3.65	ND	3.65	ND	3.68	ND	3.68	ND	3.54	ND	3.54	ND	3.54	ND	3.65	ND	3.65				
2-Chlorotoluene	µg/L	--	--	--	--	--	--	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5				
2-Hexanone (MBK)	µg/L	--	--	--	--	--	--	ND	2.2	ND	2.2	ND	2.2	ND	2.2	ND	2.2	ND	2.2	ND	2.2	ND	2.2	ND	2.2				
2-Methylnaphthalene	µg/L	--	--	--	--	--	--	ND	0.21	ND	0.21	ND	0.21	ND	0.21	ND	0.2	ND	0.2	ND	0.2	ND	0.21	ND	0.21				
2-Methylphenol	µg/L	--	--	--	--	--	--	ND	8.33	ND	8.33	ND	8.42	ND	8.42	ND	8.08	ND	8.08	ND	8.08	ND	8.33	ND	8.33				
2-Nitrophenol	µg/L	--	--	--	--	--	--	ND	3.12	ND	3.12	ND	3.16	ND	3.16	ND	3.03	ND	3.03	ND	3.03	ND	3.12	ND	3.12				
3,3-Dichlorobenzidine	µg/L	0.21	--	--	0.21	0.28	0.21	ND	4.17	ND	4.17	ND	4.21	ND	4.21	ND	4.04	ND	4.04	ND	4.04	ND	4.17	ND	4.17				
3,3-Dichlorobenzidine	µg/L	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
4,4-DDD	µg/L	0.0031	--	--	0.0031	0.0031	0.0031	0.00056	J p	0.00054	ND	0.00054	0.00092	J p	0.00054	ND	0.00054	ND	0.00054	ND	0.00054	0.00071	J p	0.00054	ND	0.00054			
4,4-DDE	µg/L	0.0022	--	--	0.0022	0.0022	0.0022	ND	0.0003	ND	0.0003	ND	0.0003	ND	0.0003	ND	0.0003	ND	0.0003	ND	0.0003	ND	0.0003	ND	0.0003				
4,4-DDT	µg/L	0.001	--	--	0.0022	0.0022	0.001	ND	0.0003	ND	0.0003	ND	0.0003	ND	0.0003	ND	0.0003	ND	0.0003	ND	0.0003	ND	0.0003	ND	0.0003				
4,6-Dinitro-2-methylphenol	µg/L	13	--	--	--	--	13	ND	8.33	ND	8.33	ND	8.42	ND	8.42	ND	8.08	ND	8.08	ND	8.08	ND	8.33	ND	8.33				
4-Bromophenyl phenyl ether	µg/L	--	--	--	--	--	--	ND	3.65	ND	3.65	ND	3.68	ND	3.68	ND	3.54	ND	3.54	ND	3.54	ND	3.65	ND	3.65				
4-Chloro-3-methylphenol	µg/L	--	--	--	--	--	--	ND	3.12	ND	3.12	ND	3.16	ND	3.16	ND	3.16	ND	3.16	ND	3.16	ND	3.12	ND	3.12				
4-Chlorophenyl phenyl ether	µg/L	--	--	--	--	--	--	ND	3.65	ND	3.65	ND	3.68	ND	3.68	ND	3.68	ND	3.68										



Table 6  
 HRBT Expansion  
 Summary of Analytical Results  
 Elutriate Fill Sediment - Standard Chemistry

Parameter	Units	Most Stringent Criteria	USEPA Acute Criteria	VA Acute Criteria	Public Water Supply	VA Surface Water	Weanack Clean Fill	HRCPL-ENV-024-FILL		HRCPL-ENV-025-FILL		HRCPL-ENV-026-FILL		HRCPL-ENV-027-FILL		HRCPL-ENV-082-FILL		HRCPL-ENV-083-FILL		HRCPL-ENV-084-FILL		HRCPL-ENV-085-FILL							
								19E0463		19E0634		19E0463		19E0463		19E0463		19E0463		19E0463		19E0463		19E0463		19E0463		19E0634	
								5/13/2019		5/15/2019		5/13/2019		5/13/2019		5/13/2019		5/13/2019		5/13/2019		5/13/2019		5/14/2019		5/16/2019		5/16/2019	
								3:45:00 PM		3:17:00 PM		1:35:00 PM		1:47:00 PM		1:35:00 PM		11:32:00 PM		11:47:00 PM		12:17:00 PM							
								Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL	Result	RL						
PCB-170	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.34	ND	0.34	ND	0.34	ND	0.34	ND	0.34	ND	0.34	ND	0.34	ND	0.34						
PCB-18	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.26	4	0.26	ND	0.26	ND	0.26	ND	0.26	ND	0.26	ND	0.26	ND	0.26						
PCB-180	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7	ND	0.7						
PCB-183	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.65	ND	0.65	ND	0.65	ND	0.65	ND	0.65	ND	0.65	ND	0.65	ND	0.65						
PCB-184	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.26	0.81	J	0.26	0.34	J	0.26	ND	0.26	ND	0.26	ND	0.26	1.6	0.26						
PCB-187	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.64	ND	0.65	ND	0.64	ND	0.64	ND	0.64	ND	0.64	ND	0.64	ND	0.65						
PCB-195	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.36	ND	0.36	ND	0.36	ND	0.36	ND	0.36	ND	0.36	ND	0.36	ND	0.36						
PCB-206	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.88	ND	0.89	ND	0.88	ND	0.88	ND	0.88	ND	0.88	ND	0.88	ND	0.89						
PCB-209	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.83	ND	0.84	ND	0.83	ND	0.83	ND	0.83	ND	0.83	ND	0.83	ND	0.84						
PCB-28	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5						
PCB-44	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.27	ND	0.28	ND	0.27	ND	0.27	ND	0.27	ND	0.27	ND	0.27	ND	0.28						
PCB-49	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.34	ND	0.34	ND	0.34	ND	0.34	ND	0.34	ND	0.34	ND	0.34	ND	0.34						
PCB-52	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.47	ND	0.48	ND	0.47	ND	0.47	ND	0.47	ND	0.47	ND	0.47	ND	0.48						
PCB-66	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.6	ND	0.61	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.61						
PCB-77	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.71	ND	0.72	ND	0.71	ND	0.71	ND	0.71	ND	0.71	ND	0.71	ND	0.72						
PCB-8	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.41	ND	0.41	ND	0.41	ND	0.41	ND	0.41	ND	0.41	ND	0.41	ND	0.41						
PCB-87	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.25	ND	0.25	ND	0.25	ND	0.25	ND	0.25	ND	0.25	ND	0.25	ND	0.25						
Total PCBs, all congeners	ng/L	0.64	--	--	0.64	0.64	0.64	ND	0.25	4.81	0.25	0.34	0.25	ND	0.25	ND	0.25	ND	0.25	ND	0.25	1.6	0.25						
Total petroleum hydrocarbons (TPH)	mg/kg	10000	--	--	--	--	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA						
Total phenols (phenolic compounds)	µg/L	1	--	--	--	--	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA						
Towashene	µg/L	0.21	0.21	0.21	--	--	--	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05						
trans-1,2-Dichloroethylene	µg/L	140	--	--	--	--	140	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6	ND	0.6						
trans-1,3-Dichloropropene	µg/L	--	--	--	--	--	--	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3	ND	0.3						
Trichloroethylene	µg/L	25	--	--	25	300	25	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4						
Trichlorofluoromethane	µg/L	--	--	--	--	--	--	ND	0.8	ND	0.8	ND	0.8	ND	0.8	ND	0.8	ND	0.8	ND	0.8	ND	0.8						
Tributyltin	µg/L	0.46	0.46	--	--	--	0.46	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03						
Vinyl acetate	µg/L	0.46	0.46	--	--	--	0.46	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2						
Vinyl chloride	µg/L	0.46	0.46	--	0.25	24	0.46	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5						
Xylenes, Total	µg/L	--	--	--	--	--	--	ND	1	ND	1	ND	1	ND	1	ND	1	ND	1	ND	1	ND	1						
Zinc	µg/L	36	90	90	7400	26000	36	58.9	50	25.7	10	55.3	10	ND	50	ND	50	ND	50	ND	50	ND	13.9						

ND: Not Detected at Method Detection Limit  
 DL: Lower Detection Limit  
 NA: Not Analyzed

Table 7  
 HRBT Expansion  
 Summary of Analytical Results  
 River Water - Standard Chemistry

Parameter	Unit	Most Stringent	Saltwater Aquatic Life		Human Health		HRCP-L-ENV-RW 19E0007 4/30/2019			HRCP-L-ENV-RW 19E0462 5/9/2019		
			Acute	Chronic	Public Water Supply	All Other Surface Waters	Conc	Q	DL	Conc	Q	DL
1,1-Dichloroethylene	µg/L	330	--	--	330	7100	NA			ND		0.7
1,1,2,2-Tetrachloroethane	µg/L	1.7	--	--	1.7	40	NA			ND		0.3
1,1,2-Trichloroethane	µg/L	5.9	--	--	5.9	160	NA			ND		0.5
1,2-Dichloroethane	µg/L	3.8	--	--	3.8	370	NA			ND		0.7
1,2,4-Trichlorobenzene	µg/L	35	--	--	35	70	ND		4.30	ND		0.5
1,2-Dichlorobenzene	µg/L	420	--	--	420	1300	NA			ND		0.4
1,2-Dichloropropane	µg/L	5	--	--	5	150	NA			ND		0.4
1,2-Diphenylhydrazine	µg/L	0.36	--	--	0.36	2	ND		8.60			
1,2-trans-dichloroethylene	µg/L	140	--	--	140	10000	NA			ND		0.6
1,3-Dichlorobenzene	µg/L	96	--	--	320	96	NA			ND		0.3
1,3-Dichloropropene	µg/L	3.4	--	--	3.4	210	NA			ND		0.4
1,4-Dichlorobenzene	µg/L	63	--	--	63	190	NA			ND		0.4
13C-2,3,7,8-TCDD	pg/L	--	--	--	--	--	740		3.1	NA		
13C-2,3,7,8-TCDF	pg/L	--	--	--	--	--	770		5.4	NA		
2-(2,4,5-Trichlorophenoxy) propionic acid (	µg/L	50	--	--	50	--	NA			NA		
2,4,6-Trichlorophenol	µg/L	14	--	--	14	24	ND		3.23	NA		
2,3,7,8-TCDF	pg/L	--	--	--	--	--	ND		0.15	NA		
2,4-Dichlorophenol	µg/L	77	--	--	77	290	NA			NA		
2,4-Dichlorophenoxy acetic acid(2,4-D)	µg/L	100	--	--	100	--	NA			NA		
2,4-Dimethylphenol	µg/L	380	--	--	380	850	ND		0.54	NA		
2,4-Dinitrophenol	µg/L	69	--	--	69	5300	ND		8.60	NA		
2,4-Dinitrotoluene	µg/L	1.1	--	--	1.1	34	ND		2.69	NA		
2,4'-DDD	ug/L	--	--	--	--	--	ND		0.00084	NA		
2,4'-DDE	ug/L	--	--	--	--	--	ND		0.00055	NA		
2,4'-DDT	ug/L	--	--	--	--	--	ND		0.00055	NA		
2-Chloronaphthalene	µg/L	1000	--	--	1000	1600	ND		4.84	NA		
2-Chlorophenol	µg/L	81	--	--	81	150	ND		3.76	NA		
2-Methyl-4,6-Dinitrophenol	µg/L	13	--	--	13	280	ND		8.6	NA		
3,3-Dichlorobenzidine	µg/L	0.21	--	--	0.21	0.28	ND		4.30	NA		
37Cl4-2,3,7,8-TCDD	pg/L	--	--	--	--	--	170		0.41	NA		
Acenaphthene	µg/L	670	--	--	670	990	ND		0.22	NA		
Acrolein	µg/L	6.1	--	--	6.1	9.3	NA			NA		
Acrylonitrile	µg/L	0.51	--	--	0.51	2.5	NA			NA		
Aldrin	µg/L	0.00049	1.3		0.00049	0.0005	ND		0.00036	NA		
Alpha-Endosulfan	µg/L	0.0087	0.034	0.0087	62	89	ND		0.0007	NA		
Anthracene	µg/L	8300	--	--	8300	40000	ND		0.22	NA		
Antimony	µg/L	5.6	--	--	5.6	640	ND		30.0	NA		
Arsenic	µg/L	10	69	36	10	--	ND		10.0	NA		
Barium	µg/L	2000	--	--	2000	--	NA			NA		
Benzene	µg/L	22	--	--	22	510	NA			ND		0.4
Benzidine	µg/L	0.00086	--	--	0.00086	0.002	NA			NA		
Benzo (a) anthracene	µg/L	0.038	--	--	0.038	0.18	ND		0.22	NA		
Benzo (a) pyrene	µg/L	0.038	--	--	0.038	0.18	ND		0.22	NA		
Benzo (b) fluoranthene	µg/L	0.038	--	--	0.038	0.18	ND		0.22	NA		
Benzo (k) fluoranthene	µg/L	0.038	--	--	0.038	0.18	ND		0.22	NA		
Beta-Endosulfan	µg/L	0.0087	0.034	0.0087	62	89	ND		0.00032	NA		
Bis(2-Chloroethyl) Ether	µg/L	0.3	--	--	0.3	5.3	ND		3.76	NA		
Bis(2-Chloroisopropyl) Ether	µg/L	1400	--	--	1400	65000	NA			NA		
Bis(2-Ethylhexyl) Phthalate	µg/L	12	--	--	12	22	ND		6.45	NA		
Bromoform	µg/L	43	--	--	43	1400	NA			ND		0.4
Butyl benzyl phthalate	µg/L	1500	--	--	1500	1900	ND		7.53	ND		0.4
Cadmium	µg/L	8.8	40	8.8	43	1400	ND		2.0	NA		
Carbaryl	µg/L	1.6	1.6		--	--	NA			NA		
Chlordane	µg/L	0.004	0.09	0.004	0.008	0.0081	NA			NA		
Chlordane (technical)	ug/L	--	--	--	--	--	ND		0.0074	NA		
Chlorine Produced Oxidant	µg/L	7.5	13	7.5	--	--	NA			NA		
Chlorobenzene	µg/L	130	--	--	130	1600	NA			ND		0.4
Chlorodibromomethane	µg/L	4	--	--	4	130	NA			ND		0.35
Chloroform	µg/L	340	--	--	340	11000	NA			ND		0.5
Chlorpyrifos	µg/L	0.0056	0.011	0.0056	--	--	NA			NA		
Chromium III	µg/L	100	--	--	100	--	NA			NA		
Chromium VI	µg/L	50	1100	50	--	--	NA			NA		
Chrysene	µg/L	0.018	--	--	0.038	0.018	ND		0.22	NA		
Copper	µg/L	6	9.3	6	1300	--	4.6		3	NA		
Cyanide, Free	µg/L	1	1	1	140	16000	ND		10	NA		
DCB Decachlorobiphenyl (Surr)	ug/L	--	--	--	--	--	0.015			NA		
DCB Decachlorobiphenyl (Surr)	ug/L	--	--	--	--	--	0.016			NA		
DCCA	ug/L	--	--	--	--	--	ND		0.0002	NA		
DDD	µg/L	0.0031	--	--	0.0031	0.0031	ND		0.00054	NA		
DDE	µg/L	0.0022	--	--	0.0022	0.0022	ND			0.0003		
DDT	µg/L	0.001	0.13	0.001	0.0022	0.0022	ND			0.0003		
delta-BHC	ug/L	--	--	--	--	--	ND			0.00066		
Demeton	µg/L	0.1	--	0.1	--	--	NA			NA		
Diazinon	µg/L	0.82	0.82	0.82	--	--	ND		0.22	NA		
Dibenz (a, h) anthracene	µg/L	0.038	--	--	0.038	0.18	NA			NA		
Dichlorodibromomethane	µg/L	5.5	--	--	5.5	170	NA			ND		0.35
Dieldrin	µg/L	0.00052	0.71	0.0019	0.00052	0.00054	ND			0.00028		
Diethyl Phthalate	µg/L	17000	--	--	17000	44000	ND		3.23	NA		
Dimethyl Phthalate	µg/L	270000	--	--	270000	1100000	ND		3.76	NA		
Di-n-Butyl Phthalate	µg/L	2000	--	--	2000	4500	ND		4.3	NA		
Dioxin 2, 3, 7, 8- tetrachlorodibenzo-p-dioxin	µg/L	5.0 E-8	--	--	5.0 E-8	5.1 E-8	ND		2.40E-07	NA		
Endosulfan Sulfate	µg/L	62	--	--	62	89	ND			0.00065		
Endrin Aldehyde	µg/L	0.29	--	--	0.29	0.3	ND			0.00053		
Endrin	µg/L	0.0023	0.037	0.0023	0.059	0.06	ND			0.00023		
Ethylbenzene	µg/L	530	--	--	530	2100	NA			ND		0.4
Fluoranthene	µg/L	130	--	--	130	140	ND		0.22	NA		

Table 7  
 HRBT Expansion  
 Summary of Analytical Results  
 River Water - Standard Chemistry

Parameter	Unit	Most Stringent	Saltwater Aquatic Life		Human Health		HRCP-L-ENV-RW			HRCP-L-ENV-RW		
			Acute	Chronic	Public Water Supply	All Other Surface Waters	19E0007			19E0462		
							4/30/2019			5/9/2019		
							Conc	Q	DL	Conc	Q	DL
Fluorene	µg/L	1100	--	--	1100	5300	ND		0.22	NA		
Foaming Agents	µg/L	500	--	--	500	--	NA			NA		
Guthion	µg/L	0.1	--	0.01	--	--	NA			NA		
Heptachlor	µg/L	0.00079	0.053	0.0036	0.00079	0.00079	ND		0.00046	NA		
Heptachlor Epoxide	µg/L	0.00039	0.053	0.0036	0.00039	0.00039	ND		0.00035	NA		
Hexachlorobenzene	µg/L	0.0028	--	--	0.0028	0.0029	ND		1.08	NA		
Hexachlorobutadiene	µg/L	4.4	--	--	4.4	180	ND		4.84	NA		
Hexachlorocyclohexane (Lindane)	µg/L	0.16	0.16	--	0.98	1.8	ND		0.0003	NA		
Hexachlorocyclohexane Alpha- BHC	µg/L	0.026	--	--	0.026	0.049	ND		0.00012	NA		
Hexachlorocyclohexane Beta- BHC	µg/L	0.091	--	--	0.091	0.17	ND		0.00037	NA		
Hexachlorocyclopentadiene	µg/L	40	--	--	40	1100	ND		1.08	NA		
Hexachloroethane	µg/L	14	--	--	14	33	ND		3.76	NA		
Hydrogen sulfide	µg/L	2	--	2	--	--	NA			NA		
Indeno (1,2,3-cd) pyrene	µg/L	0.038	--	--	0.038	0.18	ND		0.22	NA		
Iron	µg/L	300	--	--	300	--	579		5.0	NA		
Isophorone	µg/L	350	--	--	350	9600	ND		2.69	NA		
Lead	µg/L	8.8	20	8.8	15	--	ND		6.0	NA		
Malathion	µg/L	0.1	--	--	0.1	--	NA			NA		
Mercury	µg/L	1.8	1.8	9.4	--	--	ND		0.2	NA		
Methoxychlor	µg/L	0.3	--	0.3	100	--	ND		0.00079	NA		
Methyl Bromide	µg/L	47	--	--	47	1500	NA			ND		0.8
Methyl Mercury	µg/L	0.3	--	--	0.3	0.3	NA			NA		
Methylene Chloride	µg/L	46	--	--	46	5900	NA			ND		1
Mirex	ug/L	--	--	--	--	--	ND		0.00021	NA		
Nickel	µg/L	8.2	74	8.2	610	4600	ND		2	NA		
Nitrate as N	µg/L	1000	--	--	10000	--	ND		110	NA		
Nitrobenzene	µg/L	17	--	--	17	690	ND		3.23	NA		
N-Nitrosodimethylamine	µg/L	0.069	--	--	0.0069	30	ND		3.23	NA		
N-Nitrosodi-n-propylamine	µg/L	0.05	--	--	0.05	5.1	ND		3.76	NA		
N-Nitrosodiphenylamine	µg/L	33	--	--	33	60	ND		3.23	NA		
Nonylphenol	µg/L	7	7	1.7	--	--	NA			NA		
PCB Total	ng/L	0.64	--	30	0.64	0.64	2.2		0.26	NA		
PCB-101	ng/L	0.64	--	30	0.64	0.64	ND		0.28	NA		
PCB-105	ng/L	0.64	--	30	0.64	0.64	ND		0.51	NA		
PCB-118	ng/L	0.64	--	30	0.64	0.64	ND		0.76	NA		
PCB-126	ng/L	0.64	--	30	0.64	0.64	ND		0.74	NA		
PCB-128	ng/L	0.64	--	30	0.64	0.64	ND		0.25	NA		
PCB-138	ng/L	0.64	--	30	0.64	0.64	ND		0.51	NA		
PCB-153	ng/L	0.64	--	30	0.64	0.64	ND		0.54	NA		
PCB-156	ng/L	0.64	--	30	0.64	0.64	ND		0.68	NA		
PCB-169	ng/L	0.64	--	30	0.64	0.64	ND		0.71	NA		
PCB-170	ng/L	0.64	--	30	0.64	0.64	ND		0.35	NA		
PCB-18	ng/L	0.64	--	30	0.64	0.64	2.2		0.26	NA		
PCB-180	ng/L	0.64	--	30	0.64	0.64	ND		0.71	NA		
PCB-183	ng/L	0.64	--	30	0.64	0.64	ND		0.66	NA		
PCB-184	ng/L	0.64	--	30	0.64	0.64	ND		0.26	NA		
PCB-187	ng/L	0.64	--	30	0.64	0.64	ND		0.66	NA		
PCB-195	ng/L	0.64	--	30	0.64	0.64	ND		0.37	NA		
PCB-206	ng/L	0.64	--	30	0.64	0.64	ND		0.9	NA		
PCB-209	ng/L	0.64	--	30	0.64	0.64	ND		0.85	NA		
PCB-28	ng/L	0.64	--	30	0.64	0.64	ND		0.51	NA		
PCB-44	ng/L	0.64	--	30	0.64	0.64	ND		0.28	NA		
PCB-49	ng/L	0.64	--	30	0.64	0.64	ND		0.35	NA		
PCB-52	ng/L	0.64	--	30	0.64	0.64	ND		0.48	NA		
PCB-66	ng/L	0.64	--	30	0.64	0.64	ND		0.62	NA		
PCB-77	ng/L	0.64	--	30	0.64	0.64	ND		0.72	NA		
PCB-8	ng/L	0.64	--	30	0.64	0.64	ND		0.42	NA		
PCB-87	ng/L	0.64	--	30	0.64	0.64	ND		0.26	NA		
Pentachlorophenol	µg/L	2.7	13	7.9	2.7	30	ND		6.54	NA		
Phenol	µg/L	10000	--	--	10000	860000	ND		2.69	NA		
Phosphorus Elemental	µg/L	0.1	--	0.1	--	--	ND		10	NA		
Selenium	µg/L	71	290	71	170	4200	ND		40	NA		
Silver	µg/L	1.9	1.9	--	--	--	ND		5	NA		
Sulfate	µg/L	250000	--	--	250000	--	NA			NA		
Tetrachloroethylene	µg/L	6.9	--	--	6.9	33	NA			ND		0.4
Tetrachloro-m-xylene	ug/L	--	--	--	--	--	0.017			NA		
Tetrachloro-m-xylene	ug/L	--	--	--	--	--	0.016			NA		
Tetrachloro-m-xylene (Surr)	ng/L	--	--	--	--	--	16			NA		
Tetrachloro-m-xylene (Surr)	ng/L	--	--	--	--	--	13			NA		
Tetrachloro-m-xylene (Surr)	ng/L	--	--	--	--	--	11			NA		
Tetrachloro-m-xylene (Surr)	ng/L	--	--	--	--	--	12			NA		
Thallium	µg/L	0.24	--	--	0.24	0.47	ND		9	NA		
Toluene	µg/L	510	--	--	510	6000	NA			ND		0.5
Total Chromium	?	--	--	--	--	--	6J		4	NA		
Total Dissolved Solids	µg/L	500000	--	--	--	500000	NA			NA		
Toxaphene	µg/L	0.0002	0.21	0.0002	0.0028	0.0028	ND		0.05	NA		
Tributyltin	µg/L	0.0074	0.42	0.0074	--	--	ND		0.03	NA		
Trichloroethylene	µg/L	25	--	--	25	300	NA			ND		0.4
Vinyl Chloride	µg/L	0.25	--	--	0.25	24	NA			ND		0.5
Zinc	µg/L	81	90	81	7400	26000	ND		10	NA		

ND: Not Detected at Method Detection Limit  
 DL: Lower Detection Limit  
 NA: Not Analyzed



Table 8  
HRBT Expansion  
Summary of Analytical Results  
Groundwater - Standard Chemistry

Parameter	Type	Units	Most Stringent	Groundwater Standard	Saltwater Aquatic Life		Human Health		ENV-081-GW (30)			ENV-081-GW (127)		
					Acute	Chronic	Public Water Supply	All Other Surface Water	5/10/2019			5/10/2019		
									Result	Q	DL	Result	Q	DL
1,1,1-Trichloroethane	Total	µg/L	--	--	--	--	--	--	ND	0.6	ND	0.6	ND	0.6
1,1,2,2-Tetrachloroethane	Total	µg/L	1.7	--	--	--	1.7	40	ND	0.3	ND	0.3	ND	0.3
1,1,2-Trichloro-1,2,2-trifluoroethane	Total	µg/L	--	--	--	--	--	--	ND	5	ND	5	ND	5
1,1,2-Trichloroethane	Total	µg/L	5.9	--	--	--	5.9	160	ND	0.5	ND	0.5	ND	0.5
1,1-Biphenyl	Total	µg/L	--	--	--	--	--	--	ND	8.42	ND	8.7	ND	8.7
1,1-Dichloroethane	Total	µg/L	--	--	--	--	--	--	ND	0.6	ND	0.6	ND	0.6
1,1-Dichloroethylene	Total	µg/L	330	--	--	--	330	7100	ND	0.7	ND	0.7	ND	0.7
1,2,3-Trichlorobenzene	Total	µg/L	--	--	--	--	--	--	ND	0.7	ND	0.7	ND	0.7
1,2,4-Trichlorobenzene	Total	µg/L	35	--	--	--	35	70	ND	0.5	ND	0.5	ND	0.5
1,2,4-Trimethylbenzene	Total	µg/L	--	--	--	--	--	--	ND	0.4	ND	0.4	ND	0.4
1,2-Dibromo-3-chloropropane (DBCP)	Total	µg/L	--	--	--	--	--	--	ND	0.6	ND	0.6	ND	0.6
1,2-Dibromoethane (EDB)	Total	µg/L	--	--	--	--	--	--	ND	0.4	ND	0.4	ND	0.4
1,2-Dichlorobenzene	Total	µg/L	420	--	--	--	420	1300	ND	0.4	ND	0.4	ND	0.4
1,2-Dichloroethane	Total	µg/L	3.8	--	--	--	3.8	370	ND	0.7	ND	0.7	ND	0.7
1,2-Dichloropropane	Total	µg/L	5	--	--	--	5	150	ND	0.4	ND	0.4	ND	0.4
1,2-Diphenylhydrazine	Total	µg/L	0.36	--	--	--	0.36	2	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	Total	µg/L	320	--	--	--	320	960	ND	0.3	ND	0.3	ND	0.3
1,3-Dichloropropene	Total	µg/L	3.4	--	--	--	3.4	210	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	Total	µg/L	63	--	--	--	63	190	ND	0.4	ND	0.4	ND	0.4
2-(2,4,5-Trichlorophenoxy) propionic acid (Silvex)	Total	µg/L	50	--	--	--	50	--	NA	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	Total	µg/L	--	--	--	--	--	--	ND	1.05	ND	1.09	ND	1.09
2,4-Dichlorophenoxy acetic acid(2,4-D)	Total	µg/L	100	--	--	--	100	--	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	Total	µg/L	--	--	--	--	--	--	ND	1.05	ND	1.09	ND	1.09
2,4,6-Trichlorophenol	Total	µg/L	14	--	--	--	14	24	ND	3.16	ND	3.26	ND	3.26
2,4-Dichlorophenol	Total	µg/L	77	--	--	--	77	290	ND	3.16	ND	3.26	ND	3.26
2,4-Dimethylphenol	Total	µg/L	380	--	--	--	380	850	ND	0.53	ND	0.54	ND	0.54
2,4-Dinitrophenol	Total	µg/L	69	--	--	--	69	5300	ND	8.42	ND	8.7	ND	8.7
2,4-Dinitrotoluene	Total	µg/L	1.1	--	--	--	1.1	34	ND	2.63	ND	2.72	ND	2.72
2,6-Dinitrotoluene	Total	µg/L	--	--	--	--	--	--	ND	4.21	ND	4.35	ND	4.35
2-Butanone (MEK)	Total	µg/L	--	--	--	--	--	--	ND	3	ND	3	ND	3
2-Chloronaphthalene	Total	µg/L	1000	--	--	--	1000	1600	ND	4.74	ND	4.89	ND	4.89
2-Chlorophenol	Total	µg/L	81	--	--	--	81	150	ND	3.68	ND	3.8	ND	3.8
2-Hexanone (MBK)	Total	µg/L	--	--	--	--	--	--	ND	2.2	ND	2.2	ND	2.2
2-Methylnaphthalene	Total	µg/L	--	--	--	--	--	--	ND	0.21	ND	0.22	ND	0.22
2-Methylphenol	Total	µg/L	--	--	--	--	--	--	ND	8.42	ND	8.7	ND	8.7
2-Nitroaniline	Total	µg/L	--	--	--	--	--	--	ND	2.11	ND	2.17	ND	2.17
2-Nitrophenol	Total	µg/L	--	--	--	--	--	--	ND	3.16	ND	3.26	ND	3.26
3,3'-Dichlorobenzidine	Total	µg/L	0.21	--	--	--	0.21	0.28	ND	4.21	ND	4.35	ND	4.35
3-Nitroaniline	Total	µg/L	--	--	--	--	--	--	ND	2.11	ND	2.17	ND	2.17
4,4'-DDD	Total	µg/L	0.0031	--	--	--	0.0031	0.0031	ND	0.005	ND	0.006	ND	0.006
4,4'-DDE	Total	µg/L	0.0022	--	--	--	0.0022	0.0022	ND	0.005	ND	0.006	ND	0.006
4,4'-DDT	Total	µg/L	0.001	0.001	0.13	0.001	0.0022	0.0022	ND	0.005	ND	0.006	ND	0.006
4,6-Dinitro-2-methylphenol	Total	µg/L	--	--	--	--	13	280	ND	8.42	ND	8.7	ND	8.7
4-Bromophenyl phenyl ether	Total	µg/L	--	--	--	--	--	--	ND	3.68	ND	3.8	ND	3.8
4-Chloro-3-methylphenol	Total	µg/L	--	--	--	--	--	--	ND	3.16	ND	3.26	ND	3.26
4-Chloroaniline	Total	µg/L	--	--	--	--	--	--	ND	2.11	ND	2.17	ND	2.17
4-Chlorophenyl phenyl ether	Total	µg/L	--	--	--	--	--	--	ND	3.68	ND	3.8	ND	3.8
4-Methyl-2-pentanone (MIBK)	Total	µg/L	--	--	--	--	--	--	ND	1.5	ND	1.5	ND	1.5
4-Methylphenol	Total	µg/L	--	--	--	--	--	--	ND	1.05	ND	1.09	ND	1.09
4-Nitroaniline	Total	µg/L	--	--	--	--	--	--	ND	2.11	ND	2.17	ND	2.17
4-Nitrophenol	Total	µg/L	--	--	--	--	--	--	ND	2.11	ND	2.17	ND	2.17
Acenaphthene	Total	µg/L	670	--	--	--	670	990	ND	0.21	ND	0.22	ND	0.22
Acenaphthylene	Total	µg/L	--	--	--	--	--	--	ND	0.21	ND	0.22	ND	0.22
Acetone	Total	µg/L	--	--	--	--	--	--	24.6	7	167	7	167	7
Acetophenone	Total	µg/L	--	--	--	--	--	--	ND	2.11	ND	2.17	ND	2.17
Acryolein	Total	µg/L	6.1	--	--	--	6.1	9.3	NA	NA	NA	NA	NA	NA
Acrylonitrile	Total	µg/L	0.51	--	--	--	0.51	2.5	NA	NA	NA	NA	NA	NA
Aldrin	Total	µg/L	0.00049	0.003	1.3	--	0.00049	0.0005	ND	0.005	ND	0.006	ND	0.006
alpha-BHC	Total	µg/L	0.026	--	--	--	0.026	0.049	ND	0.005	ND	0.006	ND	0.006
Aluminum	Total	mg/L	--	--	--	--	--	--	1.18	0.095	6.85	0.095	6.85	0.095
Aluminum, Dissolved	Dissolved	mg/L	--	--	--	--	--	--	ND	0.019	ND	0.019	ND	0.019
Anthracene	Total	µg/L	8300	--	--	--	8300	40000	ND	0.21	ND	0.22	ND	0.22
Antimony	Total	µg/L	5.6	--	--	--	5.6	640	1.21	1	ND	1	ND	1
Antimony, Dissolved	Dissolved	µg/L	5.6	--	--	--	5.6	640	1.86	1	ND	1	ND	1
Arsenic	Total	µg/L	10	50	69	36	10	10	2.3	0.5	23	0.5	23	0.5
Arsenic, Dissolved	Dissolved	µg/L	10	50	69	36	10	10	1.09	0.5	0.726	0.5	0.726	0.5
Atrazine	Total	µg/L	--	--	--	--	--	--	ND	2.63	ND	2.72	ND	2.72
Barium	Total	µg/L	1000	1000	--	--	2000	--	23.1	1	980	1	980	1
Barium, Dissolved	Dissolved	µg/L	2000	--	--	--	2000	--	13.9	1	526	1	526	1
Benzaldehyde	Total	µg/L	--	--	--	--	--	--	ND	2.63	ND	2.72	ND	2.72
Benzene	Total	µg/L	22	--	--	--	22	510	ND	0.4	ND	0.4	ND	0.4
Benzidine	Total	µg/L	0.00086	--	--	--	0.00086	0.002	NA	NA	NA	NA	NA	NA
Benzo (a) anthracene	Total	µg/L	0.038	--	--	--	0.038	0.18	ND	0.21	ND	0.22	ND	0.22
Benzo (a) pyrene	Total	µg/L	0.038	--	--	--	0.038	0.18	ND	0.21	ND	0.22	ND	0.22
Benzo (b) fluoranthene	Total	µg/L	0.038	--	--	--	0.038	0.18	ND	0.21	ND	0.22	ND	0.22
Benzo (g,h,i) perylene	Total	µg/L	--	--	--	--	--	--	ND	0.21	ND	0.22	ND	0.22
Benzo (k) fluoranthene	Total	µg/L	0.038	--	--	--	0.038	0.18	ND	0.21	ND	0.22	ND	0.22
Beryllium	Total	mg/L	--	--	--	--	--	--	ND	0.01	ND	0.01	ND	0.01
Beryllium, Dissolved	Dissolved	µg/L	--	--	--	--	--	--	ND	0.2	ND	0.2	ND	0.2
beta-BHC	Total	µg/L	0.091	--	--	--	0.091	0.17	ND	0.005	ND	0.006	ND	0.006
bis (2-Chloroethoxy) methane	Total	µg/L	--	--	--	--	--	--	ND	3.68	ND	3.8	ND	3.8
bis (2-Chloroethyl) ether	Total	µg/L	0.3	--	--	--	0.3	5.3	ND	3.68	ND	3.8	ND	3.8
bis (2-chloroisopropyl) ether	Total	µg/L	1400	--	--	--	1400	65000	ND	3.16	ND	3.26	ND	3.26
bis (2-Ethylhexyl) phthalate	Total	µg/L	12	--	--	--	12	22	ND	6.32	ND	6.52	ND	6.52
Bromochloromethane	Total	µg/L	--	--	--	--	--	--	ND	0.5	ND	0.5	ND	0.5
Bromodichloromethane	Total	µg/L	5.5	--	--	--	5.5	170	7.72	0.4	1.44	0.4	1.44	0.4
Bromofom	Total	µg/L	43	--	--	--	43	1400	ND	0.4	ND	0.4	ND	0.4
Bromomethane	Total	µg/L	47	--	--	--	47	1500	ND	0.8	ND	0.8	ND	0.8
Butyl benzyl phthalate	Total	µg/L	1500	--	--	--	1500	1900	ND	0.23	ND	0.24	ND	0.24
Cadmium	Total	µg/L	0.4	0.4	40	8.8	43	1400	ND	0.1	189	0.1	189	0.1
Cadmium, Dissolved	Dissolved	µg/L	8.8	--	40	8.8	43	1400	ND	0.1	189	0.1	189	0.1
Calcium	Total	mg/L	--	--	--	--	--	--	23.2	0.2	712	0.2	712	0.2
Calcium, Dissolved	Dissolved	mg/L	--	--	--	--	--	--	20.1	0.4	273	0.4	273	0.4
Caprolactam	Total	µg/L	--	--	--	--	--	--	ND	2.63	ND	2.72	ND	2.72
Carbaryl	Total	µg/L	1.6	--	1.6	--	--	--	NA	NA	NA	NA	NA	NA
Carbazole	Total	µg/L	--	--	--	--	--	--	ND	2.63	ND	2.72	ND	2.72
Carbon disulfide	Total	µg/L	--	--	--	--	--	--	ND	1	ND	1	ND	1
Carbon tetrachloride	Total	µg/L	--	--	--	--	--	--	ND	0.5	ND	0.5	ND	0.5
Chlordane	Total	µg/L	0.004	0.01	0.09	0.004	0.008	0.0081	ND	0.208	ND	0.222	ND	0.222
Chlorine Produced Oxidant	Total	µg/L	7.5	--	13	7.5	--	--	NA	NA	NA	NA	NA	NA
Chlorobenzene	Total	µg/L	130	--	--	--	130	1600	ND	0.4	ND	0.4	ND	0.4
Chlorodibromomethane	Total	µg/L	4	--	--	--	4	130	1.24	0.35	ND	0.35	ND	0.35
Chloroethane	Total	µg/L	--	--	--	--	--	--	ND	0.7	ND	0.7	ND	0.7
Chloroform	Total	µg/L	340	--	--	--	340	11000	33.2	0.5	14	0.5	14	0.5
Chloromethane	Total	µg/L	--	--	--	--	--	--	ND	0.95	ND	0.95	ND	0.95
Chlorpyrifos	Total	µg/L	0.0056	--	0.011	0.0056	--	--	NA	NA	NA	NA	NA	NA
Chromium	Total	µg/L	100	--	--	--	100	--	6.72	0.4	83.6	0.4	83.6	0.4
Chromium III (Trivalent)	Total	µg/L	--	--	--	--	--	--	NA	NA	NA	NA	NA	NA
Chromium, Dissolved	Dissolved	µg/L	50	50	--	--	--	--	ND	0.4	ND	0.4	ND	0.4
Chromium, Hexavalent	Total	mg/L	50000	--	1100000									

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Parameter	Type	Units	Most Stringent	Groundwater Standard	Saltwater Aquatic Life		Human Health		ENV-081-GW (30')			ENV-081-GW (127')		
					Acute	Chronic	Public Water Supply	All Other Surface Water	5/10/2019			5/10/2019		
									Result	Q	DL	Result	Q	DL
Cyanide	Total	µg/L	1000	5	1000	1000	140000	16000000	ND		0.01	ND	0.01	
Cyclohexane	Total	µg/L	--	--	--	--	--	--	ND		0.5	ND	0.5	
delta-BHC	Total	µg/L	--	--	--	--	--	--	ND		0.005	ND	0.006	
Demeton	Total	µg/L	0.1	--	--	0.1	--	--	NA		NA	NA	NA	
Diazinon	Total	µg/L	0.82	--	0.82	0.82	--	--	NA		NA	NA	NA	
Dibenz (a,h) anthracene	Total	µg/L	0.038	--	--	--	0.038	0.18	ND		0.21	ND	0.22	
Dibenzofuran	Total	µg/L	--	--	--	--	--	--	ND		2.11	ND	2.17	
Dichlorodifluoromethane	Total	µg/L	--	--	--	--	--	--	ND		0.95	ND	0.95	
Dieldrin	Total	µg/L	0.00052	--	0.71	0.0019	0.00052	0.00054	ND		0.005	ND	0.006	
Diethyl phthalate	Total	µg/L	17000	--	--	--	17000	44000	ND		3.16	ND	3.26	
Dimethyl phthalate	Total	µg/L	270000	--	--	--	270000	1100000	ND		3.68	ND	3.8	
Di-n-butyl phthalate	Total	µg/L	2000	--	--	--	2000	4500	ND		4.21	ND	4.35	
Di-n-octyl phthalate	Total	µg/L	--	--	--	--	--	--	ND		8.42	ND	8.7	
Dioxin 2, 3, 7, 8- tetrachlorodibenzo-p- dioxin	Total	µg/L	0.00000005	--	--	--	0.00000005	0.0000051	NA		NA	NA	NA	
Endosulfan I	Total	µg/L	0.0087	--	0.034	0.0087	62	89	ND		0.005	0.156	0.006	
Endosulfan II	Total	µg/L	0.0087	--	0.034	0.0087	62	89	ND		0.005	ND	0.006	
Endosulfan sulfate	Total	µg/L	62	--	--	--	62	89	ND		0.005	ND	0.006	
Endrin	Total	µg/L	0.0023	0.004	0.037	0.0023	0.059	0.06	ND		0.005	ND	0.006	
Endrin aldehyde	Total	µg/L	0.29	--	--	--	0.29	--	ND		0.005	ND	0.006	
Endrin ketone	Total	µg/L	--	--	--	--	--	--	ND		0.005	ND	0.006	
Ethylbenzene	Total	µg/L	530	--	--	--	530	2100	ND		0.4	ND	0.4	
Fluoranthene	Total	µg/L	130	--	--	--	130	140	ND		0.21	ND	0.22	
Fluorene	Total	µg/L	1100	--	--	--	1100	5300	ND		0.21	ND	0.22	
Foaming Agents	Total	µg/L	500	--	--	--	500	--	NA		NA	NA	NA	
gamma-BHC (Lindane)	Total	µg/L	0.01	0.01	0.16	--	--	1.8	ND		0.005	ND	0.006	
Guthion	Total	µg/L	0.1	--	--	0.01	--	--	NA		NA	NA	NA	
Heptachlor	Total	µg/L	0.00079	0.001	0.053	0.0036	0.00079	0.00079	ND		0.005	ND	0.006	
Heptachlor epoxide	Total	µg/L	0.00039	0.001	0.053	0.0036	0.00039	0.00039	ND		0.005	ND	0.006	
Hexachlorobenzene	Total	µg/L	0.0028	--	--	--	0.0028	0.0029	ND		1.05	ND	1.09	
Hexachlorobutadiene	Total	µg/L	4.4	--	--	--	4.4	180	ND		4.74	ND	4.89	
Hexachlorocyclopentadiene	Total	µg/L	40	--	--	--	40	1100	ND		1.05	ND	1.09	
Hexachloroethane	Total	µg/L	14	--	--	--	14	33	ND		3.68	ND	3.8	
Hexanal	Total	µg/L	--	--	--	--	--	--	NA		NA	9.74		
Hydrogen sulfide	Total	µg/L	2	--	--	2	--	--	NA		NA	NA	NA	
Indeno (1,2,3-cd) pyrene	Total	µg/L	0.038	--	--	--	0.038	0.18	ND		0.21	ND	0.22	
Iron	Total	mg/L	300000	--	--	--	300000	--	4.25		0.025	143	0.25	
Iron, Dissolved	Dissolved	mg/L	300000	--	--	--	300000	--	ND		0.005	0.223	0.005	
Isothorone	Total	µg/L	350	--	--	--	350	9600	ND		2.63	ND	2.72	
Isopropylbenzene	Total	µg/L	--	--	--	--	--	--	ND		0.5	ND	0.5	
Lead	Total	µg/L	8.8	50	20	8.8	15	--	8.3		1	12.4	1	
Lead, Dissolved	Dissolved	µg/L	8.8	50	20	8.8	15	--	ND		1	ND	1	
mmp-xylenes	Total	µg/L	--	--	--	--	--	--	ND		0.6	ND	0.6	
Magnesium	Total	mg/L	--	--	--	--	--	--	21.2		0.05	227	0.5	
Magnesium, Dissolved	Dissolved	mg/L	--	--	--	--	--	--	17.1		0.1	117	0.1	
Malathion	Total	µg/L	0.1	--	--	--	0.1	--	NA		NA	NA	NA	
Manganese	Total	µg/L	--	--	--	--	--	--	213		15	2810	150	
Manganese, Dissolved	Dissolved	µg/L	--	--	--	--	--	--	91.4		1.5	845	15	
Mercury	Total	µg/L	0.5	0.5	1800	9400	--	--	ND		0.2	0.25	0.2	
Mercury, Dissolved	Dissolved	µg/L	0.5	0.5	1800	9400	--	--	ND		0.2	ND	0.2	
Methoxychlor	Total	µg/L	0.03	0.03	--	0.3	100	--	ND		0.005	ND	0.006	
Methyl acetate	Total	µg/L	--	--	--	--	--	--	ND		1	ND	1	
Methyl cyclohexane	Total	µg/L	--	--	--	--	--	--	ND		0.5	ND	0.5	
Methyl Mercury (fish tissue criterion)	Total	µg/L	0.3	--	--	--	0.3	0.3	NA		NA	NA	NA	
Methylene chloride	Total	µg/L	46	--	--	--	46	5900	ND		1	ND	1	
Methyl-t-butyl ether (MTBE)	Total	µg/L	--	--	--	--	--	--	ND		0.6	ND	0.6	
Naphthalene	Total	µg/L	--	--	--	--	--	--	ND		0.21	ND	0.22	
Nickel	Total	µg/L	8.2	--	74	8.2	610	4600	4.023		1	78.01	1	
Nickel, Dissolved	Dissolved	µg/L	8.2	--	74	8.2	610	4600	1.164		0.3	13.47	0.3	
Nitrate as N	Total	µg/L	1000	5000	--	--	10000	--	NA		NA	NA	NA	
Nitrobenzene	Total	µg/L	17	--	--	--	17	690	ND		3.16	ND	3.26	
n-Nitrosodimethylamine	Total	µg/L	0.069	--	--	--	0.0069	30	ND		3.16	ND	3.26	
n-Nitrosodi-n-propylamine	Total	µg/L	0.05	--	--	--	0.05	5.1	ND		3.68	ND	3.8	
n-Nitrosodiphenylamine	Total	µg/L	33	--	--	--	33	60	ND		3.16	ND	3.26	
Nonanal	Total	µg/L	--	--	--	--	--	--	NA		NA	8.69		
Nonylphenol	Total	µg/L	7	--	7	1.7	--	--	NA		NA	NA	NA	
Oxacyclotetradecan-2-one, 13-methyl-	Total	µg/L	--	--	--	--	--	--	6.23			NA	NA	
o-Xylene	Total	µg/L	--	--	--	--	--	--	ND		0.4	ND	0.4	
PCB as Aroclor 1016	Total	µg/L	--	--	--	--	--	--	ND		0.005	ND	0.006	
PCB as Aroclor 1221	Total	µg/L	--	--	--	--	--	--	ND		0.04	ND	0.04	
PCB as Aroclor 1232	Total	µg/L	--	--	--	--	--	--	ND		0.003	ND	0.003	
PCB as Aroclor 1242	Total	µg/L	--	--	--	--	--	--	ND		0.009	ND	0.009	
PCB as Aroclor 1248	Total	µg/L	--	--	--	--	--	--	ND		0.01	ND	0.01	
PCB as Aroclor 1254	Total	µg/L	--	--	--	--	--	--	ND		0.007	ND	0.008	
PCB as Aroclor 1260	Total	µg/L	--	--	--	--	--	--	ND		0.007	ND	0.008	
PCB as Aroclor 1262	Total	µg/L	--	--	--	--	--	--	ND		0.006	ND	0.006	
PCB as Aroclor 1268	Total	µg/L	--	--	--	--	--	--	ND		0.005	ND	0.006	
PCB Total	Total	µg/L	0.0064	--	--	0.03	0.00064	0.00064	NA		NA	NA	NA	
Pentachlorophenol	Total	µg/L	2.7	--	13	7.9	2.7	30	ND		6.32	ND	6.52	
Phenanthrene	Total	µg/L	--	--	--	--	--	--	ND		0.21	ND	0.22	
Phenol	Total	µg/L	1	1	--	--	10000	860000	ND		2.63	ND	2.72	
Phosphorus Elemental	Total	µg/L	0.1	--	--	0.1	--	--	NA		NA	NA	NA	
Potassium	Total	mg/L	--	--	--	--	--	--	11		2.5	37.5	2.5	
Potassium, Dissolved	Dissolved	mg/L	--	--	--	--	--	--	11.1		0.5	44.5	0.5	
Pyrene	Total	µg/L	--	--	--	--	--	--	ND		0.21	ND	0.22	
Selenium	Total	µg/L	10	10	290	71	170	4200	ND		0.85	17.2	0.85	
Selenium, Dissolved	Dissolved	µg/L	10	10	290	71	170	4200	ND		0.85	ND	0.85	
Silver	Total	µg/L	1.9	--	1.9	--	--	--	ND		0.06	ND	0.06	
Silver, Dissolved	Dissolved	µg/L	1.9	--	1.9	--	--	--	ND		0.06	ND	0.06	
Sodium	Total	mg/L	--	--	--	--	--	--	173		2.5	991	2.5	
Sodium, Dissolved	Dissolved	mg/L	--	--	--	--	--	--	172		0.5	1060	5	
Styrene	Total	µg/L	--	--	--	--	--	--	ND		0.4	ND	0.4	
Sulfate	Total	µg/L	250000	--	--	--	250000	--	NA		NA	NA	NA	
Tentatively Identified Compounds	Total	µg/L	--	--	--	--	--	--	10.9		0	16.5	0	
Tertiary Butyl Alcohol	Total	µg/L	--	--	--	--	--	--	ND		50	ND	50	
Tetrachloroethylene (PCE)	Total	µg/L	6.9	--	--	--	6.9	33	ND		0.4	ND	0.4	
Thallium	Total	µg/L	0.24	--	--	--	0.24	0.47	ND		1	ND	1	
Thallium, Dissolved	Dissolved	µg/L	0.24	--	--	--	0.24	0.47	ND		1	ND	1	
Toluene	Total	µg/L	510	--	--	--	510	6000	ND		0.5	ND	0.5	
Total Dissolved Solids	Total	µg/L	500000	--	--	--	--	--	500000		NA	NA	NA	
Toxaphene	Total	µg/L	0.0002	--	0.21	0.0002	0.0028	0.0028	ND		0.208	ND	0.222	
trans-1,2-Dichloroethylene	Total	µg/L	140	--	--	--	140	10000	ND		0.6	ND	0.6	
trans-1,3-Dichloropropene	Total	µg/L	--	--	--	--	--	--	ND		0.3	ND	0.3	
Tributyltin	Total	µg/L	0.0074	--	0.42	0.0074	--	--	NA		NA	NA	NA	
Trichloroethylene	Total	µg/L	25	--	--	--	25	300	ND		0.4	ND	0.4	
Trichlorofluoromethane	Total	µg/L	--	--	--	--	--	--	ND		0.8	ND	0.8	
Vanadium	Total	µg/L	--	--	--	--	--	--	10.3		2.5	74.8	2.5	
Vanadium, Dissolved	Dissolved	µg/L	--	--	--	--	--	--	ND		2.5	ND	2.5	
Vinyl chloride	Total	µg/L	0.25	--	--	--	0.25	24	ND		0.5	ND	0.5	
Xylenes, Total	Total	µg/L	--	--	--	--	--	--	ND		1	ND	1	
Zinc	Total	µg/L	50	50	90	81	7400	26000	334		25	15100	250	
Zinc, Dissolved	Dissolved	µg/L	50	50	90	81	7400	26000	19.7		2.5	4760	250	

ND: Not detected at Method Detection Limit  
DL: Lower Detection Limit  
NA: Not Analyzed

**ATTACHMENT L-9: SAMPLING AND  
ANALYSIS PLAN  
(AUGUST 15, 2019)**

<b>Project</b>	I-64 Hampton Roads Bridge-Tunnel
<b>To</b>	Hampton Roads Connector Partners (HRCP)
<b>From</b>	Mott MacDonald
<b>Subject</b>	Baseline Characterization Environmental Sampling and Analysis Plan- Phase I - On Island Source Materials for On-site Reuse and/or Off-site Disposal and Phase II – Marine Source Materials for Beneficial Reuse and/or Offsite Disposal
<b>Date</b>	August 15, 2019 (revised)
<b>Attachments</b>	Table 1 – Analytical Parameters  Figure 1 – Sample Location Plan- North Island Figure 2 – Sample Location Plan- South Island Figure 3 – Bored Tunnel South Island Plan and Profile Figure 4 – Marine Environmental Boring Locations – Overview Index Map Figure 5 – Marine Environmental Boring Locations – North Trestle Area Figure 6 – Marine Environmental Boring Locations – North Island Area Figure 7 – Marine Environmental Boring Locations – Channel Area Figure 8 – Marine Environmental Boring Locations – South Island Area Figure 9 – Marine Environmental Boring Locations – South Trestle Area  Attachment 1 – Proposed Environmental Boreholes Cross Section – Phase I Attachment 2 – Addendum to the Baseline Characterization Environmental Sampling and Analysis Plan – Phase I On Island Source Materials for On-Site Reuse and/or Off-site Disposal – Upland Characterization

## 1. PROJECT SCOPE OF WORK – BASELINE CHARACTERIZATION

The scope of work addressed in this Baseline Characterization Environmental Sampling and Analysis Plan (Phase I and Phase II sampling plan) consists of the sampling and analysis of materials expected to be encountered during the I-64 Hampton Roads Bridge Tunnel Project (HRBT). On-island construction activities will generate materials (approximately 860,000 cubic yards) which will require management through disposal or reuse. On-site beneficial reuse is being considered for 206,000 cubic yards of clean sand excavated from the South Island Entrance portal. On-island activities include the excavation of the entry portal and tunnel and portal approach on the South Island and the jet grouting of material to stabilize said entry portal. Dredging activities will generate additional materials (between approximately 480,000 to 648,000 cubic yards, and up to 718,000 cubic yards with the addition of armor stone) which will also require management through disposal or reuse. This sampling plan has been generated and updated to outline the sampling strategy and analytical parameters proposed for a baseline characterization and evaluation of the following:

- On-island source materials for re-use for the North Island Expansion or for disposal at an off-site upland location(s).
- Dredge materials for reuse as beach nourishment, and/or disposal at an off-site upland source or recycling facility;
- Tunnel boring machine (TBM) additive testing to determine appropriate means of disposal (off-site upland disposal or recycling).
- Jet grout residuals (not in this document).
- Upland soil characterization related to road construction (appended to this document).

It should be noted that this Phase I sampling plan is being generated to provide a baseline characterization of the materials and based on the results of this effort, recommendations for the end use of the materials will be developed. A Material Management Plan (MMP) will be generated which will outline additional sampling requirements required prior to movement of materials. This materials management plan will be implemented at the initiation of physical excavation activities, prior to management and placement of the material and will be developed and updated (as necessary) with the input and guidance of all relevant regulatory agencies to ensure that an appropriate sampling frequency is implemented.

Please note: This sampling plan addresses the on-island, dredging, upland soil characterization related to road construction activities (appended) and TBM characterization of the I-64 Hampton Roads Bridge Tunnel Project related to identifying the potential options for re-use or disposal. Additional components of the sampling plan will be generated at a later date to address jet grout residuals. Additional sampling of this material will be included in the materials management plan.

Preliminary characterization of upland soils, expected to be excavated during roadway expansion, will be performed in conjunction with geotechnical borings. Samples will be collected from geotechnical borings where areas of proposed excavation are located in or adjacent to areas of Potential Environmental Concern (PEC) as identified in the Hazardous Materials Technical Memorandum (July, 2016), Updated Hazardous Materials Technical Memorandum (June, 2018), and Phase II Environmental Site Assessment (ESA) for the Willoughby Spit Property - Norfolk, Virginia (July, 2018). The preliminary characterization of upland soils was addressed in a separate submission, which has been appended to this SAP.

Geotechnical investigation activities are not included in this Environmental Sampling and Analysis Plan, however, this report is to augment the March 2019 HRBT Geotechnical Exploration Plan.

### **Beneficial Reuse Baseline Characterization Sampling**

Soil and sediment baseline characterization sampling will be conducted in order to identify if select soils and sediment have the potential to be utilized for tunnel construction (as ballast) and/or island expansion, inclusive of in-water placement of said materials.

### **Material Disposal Sampling**

Soil, sediment and water sampling will be conducted in order to identify the appropriate end use method(s) of disposal that could be implemented for excess material generated during construction activities (inclusive of dredging and jet grout residuals), and for water generated from dewatering activities.

### **Tunnel Boring Machine Additive Sampling**

Soil and sediment sampling will be conducted to determine the appropriate course of action (disposal or reuse) of the Tunnel Boring Machine (TBM) materials generated during construction activities.

### **Beach Nourishment Sampling**

The Commonwealth of Virginia requires that beach nourishment be given priority consideration for the disposal of dredged material determined to be suitable as beach fill material. If interest in utilizing dredged material for beach nourishment is expressed by a local municipality, Hampton Roads Connector Partners will coordinate with the Virginia Marine Resources Commission to determine the appropriate sampling procedures for the dredged material. The City of Virginia Beach has declined interest in accepting dredged material from the project as beach nourishment material. HRCP will inquire with the Cities of Hampton and Norfolk regarding the utilization the dredged material for beach nourishment.

## 2. PROJECT QUALITY OBJECTIVES – SCREENING CRITERIA

### Data Quality Objectives

Data Quality Objectives (DQOs) are part of a systematic process that establishes the quantity and quality of the data needed to define the nature and extent of environmental problems. DQOs confirm the collection of the appropriate quantity of samples and the need to develop a reasonable baseline conceptual model. DQOs were developed utilizing the seven-step process outlined in the United States Environmental Protection Agency's (USEPA) *Guidance on Systematic Planning Using the Data Quality Objective Process* Document, dated February 2006. The seven step DQO process is as follows:

#### Step 1- State the Problem

Materials generated during construction activities for the HRBT project need to be characterized in order to generate recommendations for the end use of the materials.

#### Step 2- Goal of the Study

The goal of the study is to characterize materials expected to be generated during construction activities in order to determine reuse and disposal options for material, and to gather information to develop a material management plan.

#### Step 3- Information Inputs

Soil/sediment samples will be collected from soil borings and analysed for disposal and reuse parameters identified by USEPA, VA DEQ, and potential disposal facilities. Soil/sediment sample locations and depths will be selected to be representative of the materials expected to be generated during construction. The sample collection plan is discussed in **Section 3**.

#### Step 4- Define Boundaries of Study

Sampling is being conducted for baseline materials characterization purposes only. The data generated will be utilized to identify potential end uses for the material. Additional sampling may be required to fulfil regulatory and facility requirements for materials at the time of reuse and/or disposal.

#### Step 5- Develop Analytic Approach

Soil/sediment, elutriate, and water samples will be collected from soil borings in order to characterize the material expected to be generated during construction activities. Samples will be analysed for the parameters identified on **Table 1**, based on potential end use.

Additional Tunnel boring material (TBM) additive testing will be performed in order to simulate the anticipated material generation streams from the tunnel boring procedure. Analytical results from the TBM additive testing will be compared to parameters identified on **Table 1**, based on potential end use.

The analytical approach is discussed in detail in **Section 3**.

### Step 6- Specify Performance Criteria

All samples will be analysed by a VDEQ certified laboratory. All analytical reporting limits from the material characterization analytical reports will be at or below the applicable screening criteria, as feasible. The raw QA/QC data, case narratives, and non-conformance summaries for the analytical data will be reviewed to ensure all analytical data generated is valid and does not need to be qualified. A third-party data validation will be performed in accordance with contract documents. The applicable screening criteria is as follows:

#### **On-Site Reuse**

Soil and sediment analytical data collected to determine if the materials are suitable for reuse as part of the North Island Expansion will be compared to the marine sediment quality guidelines (specifically Threshold Effect Levels (TEs) and Probable Effect Levels (PEs) (MacDonald et al. 1996), and the Estuarine NOAA-based Effects Range-Median (ER-M) Sediment Screening Values (Buchanan, M.F. 1999)). Elutriate analytical data will be compared to USEPA and Commonwealth of Virginia saltwater acute water quality criteria (WQC).

#### **Off-site Upland Disposal**

Materials that will be evaluated to determine the potential suitability for placement or disposal at offsite upland locations will be compared to the following criteria:

- The Virginia Department of Environmental Quality (VDEQ) state-wide variance criteria (VDEQ 2012);
- U.S. Environmental Protection Agency (USEPA) residential and industrial soil Regional Screening Levels (RSL) (USEPA 2016);
- The Exclusion Criteria for placement at Weanack (VDEQ 2014), the Toxicity Characteristic Leaching Procedure (TCLP) regulatory criteria (40 Code of Federal Regulations [CFR] 261.24); and
- The Commonwealth of Virginia disposal criteria for soil contaminated with petroleum products (9 Virginia Administrative Code [VAC] 20-81-660).

#### **Beach Nourishment**

The Commonwealth of Virginia "Criteria for the Placement of Sandy Dredged Material along Beaches in the Commonwealth" (4 VAC 20-400-10) requires that grain size analysis be conducted to determine if dredged material is suitable for beach nourishment.

If interest in utilizing the dredged material for beach nourishment is expressed by a local municipality, Hampton Roads Connector Partners will coordinate with the Virginia Marine Resources Commission to determine the specific additional sampling requirements for the dredged material.

### Step 7- Develop a Plan for Obtaining Data

The plan for obtaining data is outlined in Section 3.

#### Data Management

Analytical data will be compiled and maintained by Mott MacDonald.



### 3. SAMPLE COLLECTION PLAN

Sonic drilling (vibracoring) will be utilized to install a total of 65 borings from on-island and marine locations to collect samples for environmental testing. Approximately 15 borings (eight of which will be installed within the entry portal/excavation area on the North Island) will be installed on the North and South Islands to depths ranging from 45 feet below surface grade to 185 feet below surface grade. These depths correspond to the maximum depth of excavation within the entry portal area and/or to the deepest depth of the proposed tunnel invert. The maximum boring depths are included below:

Location	Boring ID	Maximum Depth (Feet)	Lexan Liner Interval (depth bgs)	Purpose
South Island	HRCP-L-ENV-023	100	Bagged	Reuse & Disposal Testing
South Island	HRCP-L-ENV-024	90	Bagged	Reuse & Disposal Testing
South Island	HRCP-L-ENV-025	90	Bagged	Reuse & Disposal Testing
South Island	HRCP-L-ENV-026	70	Bagged	Reuse & Disposal Testing
South Island	HRCP-L-ENV-027	55	Bagged	Reuse & Disposal Testing
South Island	HRCP-L-ENV-078	200	25-200	TBM Additive Testing
South Island	HRCP-L-ENV-079	200	25-200	TBM Additive Testing
South Island	HRCP-L-ENV-081	200	25-200	TBM Additive Testing
South Island	HRCP-L-ENV-082	200	25-200	TBM Additive Testing
South Island	HRCP-L-ENV-083	60	Bagged	Reuse & Disposal Testing
South Island	HRCP-L-ENV-084	45	Bagged	Reuse & Disposal Testing
South Island	HRCP-L-ENV-085	45	Bagged	Reuse & Disposal Testing
North Island	HRCP-M-ENV-013	100	25-100	TBM Additive Testing
North Island	HRCP-M-ENV-072	75	0-75	TBM Additive Testing
North Island	HRCP-M-ENV-077	200	25-200	TBM Additive Testing

Bgs = below grade surface

Please Note: Boring locations and designations are also subject to change based on site/field conditions.

Approximately 45 marine borings will be installed along the project route. Marine borings will be installed to depths ranging from 20 feet to 110 feet below the river bottom. The boring depths are included below:

Location	Boring ID	Depth	Lexan Liner Interval	Purpose
Marine	HRCP-M-ENV-008	50		Shallow (N. Trestle)
Marine	HRCP-M-ENV-011	45		Shallow (N. Trestle)
Marine	HRCP-M-ENV-012	45		Spoils Disposal/Reuse
Marine	HRCP-M-ENV-014	20		Spoils Disposal/Reuse
Marine	HRCP-M-ENV-015	110		Bench Scale Testing
Marine	HRCP-M-ENV-016	115		Bench Scale Testing
Marine	HRCP-M-ENV-017	125		Bench Scale Testing
Marine	HRCP-M-ENV-018	130		Bench Scale Testing
Marine	HRCP-M-ENV-019	125		Bench Scale Testing
Marine	HRCP-M-ENV-020	120		Bench Scale Testing
Marine	HRCP-M-ENV-022	115		Bench Scale Testing
Marine	HRCP-M-ENV-038	20		Testing (S. Trestle)
Marine	HRCP-M-ENV-039	20		Testing (S. Trestle)
Marine	HRCP-M-ENV-040	20		Testing (S. Trestle)
Marine	HRCP-M-ENV-041	20		Testing (S. Trestle)
Marine	HRCP-M-ENV-042	20		Testing (S. Trestle)
Marine	HRCP-M-ENV-043	20		Testing (S. Trestle)
Marine	HRCP-M-ENV-044	20		Testing (S. Trestle)
Marine	HRCP-M-ENV-045	20		Testing (S. Trestle)
Marine	HRCP-M-ENV-046	20		Testing (S. Trestle)
Marine	HRCP-M-ENV-047	20		Testing (S. Trestle)
Marine	HRCP-M-ENV-048	20		Testing (S. Trestle)
Marine	HRCP-M-ENV-058	45		Shallow (N. Trestle)
Marine	HRCP-M-ENV-059	45		Shallow (N. Trestle)
Marine	HRCP-M-ENV-060	45		Shallow (N. Trestle)
Marine	HRCP-M-ENV-063	20		Spoils Disposal/Reuse
Marine	HRCP-M-ENV-064	25		Spoils Disposal/Reuse
Marine	HRCP-M-ENV-065	20		Spoils Disposal/Reuse
Marine	HRCP-M-ENV-066	20		Spoils Disposal/Reuse
Marine	HRCP-M-ENV-067	20		Spoils Disposal/Reuse
Marine	HRCP-M-ENV-068	45		Spoils Disposal/Reuse
Marine	HRCP-M-ENV-070	110		Bench Scale Testing
Marine	HRCP-M-ENV-071	45		Spoils Disposal/Reuse
Marine	HRCP-M-ENV-073	40		Spoils Disposal/Reuse
Marine	HRCP-M-ENV-074	35		Spoils Disposal/Reuse
Marine	HRCP-M-ENV-075	20		Spoils Disposal/Reuse
Marine	HRCP-M-ENV-076	35		Spoils Disposal/Reuse
Marine	HRCP-M-ENV-131	20		Dredging
Marine	HRCP-M-ENV-132	20		Dredging
Marine	HRCP-M-ENV-133	20		Dredging
Marine	HRCP-M-ENV-134	20		Dredging
Marine	HRCP-M-ENV-135	20		Dredging
Marine	HRCP-M-ENV-136	20		Dredging
Marine	HRCP-M-ENV-137	20		Dredging
Marine	HRCP-M-ENV-138	20		Dredging

All borings will be advanced in 5-foot intervals. Soil/sediment cores will be field screened with a photoionization detector (PID) and logged by I-64 Design Joint Venture personnel (as appropriate, based on coring procedure). The boring locations are depicted on **Figures 1 through 9**.

On-site Beneficial Reuse and Off-site Upland Disposal Sampling

Soil and sediment samples from borings HRCP-L-ENV-023 through HRCP-L-ENV-027, and borings HRCP-L-ENV-083 through HRCP-L-ENV-085, located on the South Island, will be collected and analysed in order to assess if those materials have the potential to be utilized for tunnel construction and/or island expansion. Based on proposed construction, materials encountered from depths of surface grade to -125 bgs (or approximately 110 feet below grade) will be characterized and evaluated to determine potential end-uses including onsite reuse, off-site upland placement or disposal. No materials from the North Island or from beneath the river are proposed to be utilized for onsite reuse/in-water placement.

Recent discussions with the regulatory agencies have noted that although there are specific sampling frequencies for the management of soil and hazardous waste for upland areas, there is no set frequency for materials proposed for beneficial reuse for in-water placement. As the sampling proposed herein is to generate baseline characterization data to evaluate proposed end use options, a custom sampling regime has been developed. Based on the selection of an end use, a pre-construction sampling plan will be developed to meet regulatory requirements which will be implemented during excavation or tunnel boring activities and prior to exporting materials for placement/disposal. The following sampling frequencies and associated end use analysis are proposed:

- Fill Material – Fill material is defined as the top 25 feet of soils at the South Island location, which were imported as part of island development, and would also be most susceptible to contamination due to being located at or near the surface. It is proposed to collect a total 8 composite samples, one from each applicable boring (specifically soil borings HRCP-L-ENV-023 through HRCP-L-ENV-027, and HRCP-L-ENV-083 through HRCP-L-ENV-085). Composites will consist of soils from surface grade to 25 feet bgs. Fill material samples will be analysed for the parameters listed in **Table 1** for on or off-site reuse in addition to disposal characterization.
- Soils/sediment located at depths from 25 feet bgs to 115 feet bgs at the South Island location that are not anticipated to be impacted (considered “native” to the area). - It is proposed to collect one composite sample from each of the eight borings located within the area of proposed excavation (specifically soil borings HRCP-L-ENV-023 through HRCP-L-ENV-027, and HRCP-L-ENV-083 through HRCP-L-ENV-085) for this baseline characterization, which will assist in identifying potential end uses of the excavated material. (reuse, offsite upland placement or disposal). Currently, it is estimated that 206,000 CY of material will be needed for fill at the North Island expansion. Composite samples will consist of a whole core composite of the entire boring, which will be representative of the materials encountered during excavation activities. Samples will be analysed for the parameters in **Table 1** for on or off-site reuse.
- Sediment located at depths up to 20 feet below the river bottom will be collected from proposed dredging areas. - It is proposed to collect one composite sample from depths corresponding with proposed dredging or temporary works activities from designated marine borings for the baseline characterization of sediment, which will assist in identifying potential end uses of the material (reuse, offsite upland placement or disposal). Samples will be analysed for the parameters in **Table 1** for disposal characterization. If interest in

utilizing the dredged material for beach nourishment is expressed by a local municipality, HRCP will coordinate with the Virginia Marine Resources Commission to determine the specific additional sampling requirements for the dredged material.

- Elutriate preparation water will be collected from one location within the James River at the North Island; sampling of the elutriate preparation water and standard elutriates will also be performed.
- TBM additive testing (bench scale testing) will be performed in order to simulate the anticipated material generation streams from the tunnel boring procedure. A total of 15 borings, collected from the land and marine boring installations, will be utilized to produce samples for the TBM bench scale testing program. Of those 15 borings, 8 will be installed during the upcoming marine boring mobilization within the tunnel alignment from which soils will be utilized to prepare samples for the TBM bench scale testing program. The total number of samples that will be analyzed will be dependent on the number of selected additives. Please note, the TBM additives have not been selected at this time. At a minimum, one sample per additive will be collected and submitted for analysis (resulting in the testing of four waste streams per additive). Samples will be composited from materials at elevations corresponding to the anticipated elevation of the tunnel boring activities. The composites will be representative of the various strata encountered during tunnel boring activities.

Samples will be analysed for the parameters on **Table 1** for placement at Port Tobacco at Weanack, Dominion Recycling, or at other upland placement/regional landfill sites. Elutriate analysis will also be performed on the soil/sediment samples. TBM additive water samples will be analysed for the reuse parameters on **Table 1**, in order to characterize decant water created by the tunnel boring process. Toxicity testing will also be performed on the soil/sediment and water samples. An additional sample may be collected from each soil/sediment strata to be utilized as a control (non-TBM additive) sample.

Samples will be transported to a VDEQ certified laboratory for analysis. Samples will be analysed for the parameters in **Table 1**.

*Soil/Sediment Sample Collection – On-site Reuse, Off-site Upland Placement or Disposal*

Soil/sediment will be retrieved from the ground through the use of vibracoring. Samples will be collected with pre-dedicated stainless-steel trowels and transferred to clean, decontaminated containers/drums for mixing of the composite samples.

Samples will be cut open and field screened for lithology, and evidence of contamination. Multi-point composite samples will be collected from each soil/sediment strata encountered to generate a representative sample. All samples will be collected in accordance with the applicable VDEQ and USEPA regulations. Elutriate samples will be prepared by a VDEQ certified laboratory under the direction of the I-64 Design Joint Venture.

### Elutriate Preparation Water Sample Collection

A surface water sample will be collected from the James River utilizing a Teflon bailer, in compliance with the VDEQ's June 2017 Standard Operating Procedure Manual for the Department of Environmental Quality Water Quality Monitoring document. The following water quality measurements will be obtained for the in-situ elutriate preparation water:

- Elutriate water collection depth (in feet);
- pH;
- Dissolved oxygen (mg/L);
- Water temperature (°C);
- Salinity (ppt); and
- Turbidity (NTU).

### Tunnel Boring Machine (TBM) Additive Testing

Soil/sediment borings will be obtained from the North and South Islands and the marine boring program at the depth of the tunnel horizon for TBM additive testing. Soil/sediment cores will be collected from the borings utilizing Lexan liners. The Lexan liners will then be capped, labelled, and transported to refrigerated storage for subsequent TBM additive testing. A total of 15 soil/sediment borings will be utilized for the preparation of TBM additive samples.

The Lexan liners will be opened and screened for lithology. The encountered lithology will be documented. Soil/sediment samples will then be collected from each strata of soil/sediment expected to be encountered during tunnel construction activities. It is anticipated that one composite sample will be generated for each TBM additive selected and based on the maximum amounts of additives required to effectively operate the TBM through the various strata encountered within the tunnel horizon; resulting in the highest potential for contaminant loading. The composite sample will yield a total of four waste stream samples to be analysed. An additional sample may be collected from each soil/sediment strata to be utilized as a control (non-TBM additive) sample. Please note, an explanation of the strata abbreviations is included in the geotechnical report.

A slurry consisting of water, bentonite, and the TBM additive will be generated to simulate the slurry utilized by the TBM. The slurry will then be added to each soil/sediment sample at a volumetric ratio of X gallons of slurry per Y gallons of soil/sediment, as recommended by the manufacturer of each additive. The slurry/sample mixture will then be agitated until the mixture forms a homogeneous puree. The mixture will then be screened on site or transported to a VDEQ certified laboratory for further processing and analysis under the direction of the I-64 Design Joint Venture.

### Bench-Scale Testing

The mixture will be processed in a manner that replicates the TBM sequence at bench scale.

1. The mixture will be screened through a 6 millimeter screen in order to separate coarse sand, pebbles, and shell fragments, as this represents a separate material generation stream from the TMB. The separated coarse sand, pebbles, and shell fragments will be assessed for

placement at Port Tobacco at Weanack or at other upland placement/regional landfill sites. Toxicity testing will also be conducted on these samples.

2. The mixture will then be centrifuged (or screened) in order to separate fine sands and fine silts greater than 70-80 micrometers, as this represents a separate material generation stream from the TMB. The separated fine sands and fine silts will be analysed for placement at Port Tobacco at Weanack or at other upland placement/regional landfill sites. Elutriate analysis and toxicity testing will also be conducted on these samples.
3. The TBM slurry and the remaining soil/sediment will then be run through a filter press to remove water from the soil/sediment. The water will be analysed in order to characterize decant water created by the tunnel boring process. Decant water from the tunnel boring process will be treated on-site prior to discharge. The simulated decant water from the TBM additive testing will inform the design of the on-Site treatment system and associated VPDES permitting. Whole effluent toxicity testing will also be conducted on the decant (simulated effluent) water.
4. The remaining soil/sediment (filter cake) will then be analysed for placement at Port Tobacco at Weanack, Dominion Recycling or at other upland placement/regional landfill sites. Elutriate analysis and toxicity testing will also be conducted on these samples.

The sample collection plan is summarized in the following table.

Test Material		Source	Disposal/reuse	Analysis Preparation	Analysis
Dredged Material		Top 5-20 feet	Disposal		Standard Chemistry
Jet Grout Material	High pH Water	Not in this plan	Water Treatment/VPDES	N/A	Not included in this plan
	Solids	Not in this plan	Disposal	N/A	Not included in this plan
TBM Material	Screened	Coarse Sand >6mm	Disposal/reuse	Bench Scale Test	Standard Chemistry, + Toxicity
	Hydrocyclone (fines)	>70 µm	Disposal		Standard Chemistry, Toxicity, + Elutriate
	Filter cake	<70 µm	Disposal		Standard Chemistry, Toxicity, + Elutriate
	Filtrate (water)		Water Treatment/VPDES		Standard chemistry
Excavated Sand					Standard chemistry

		Portal Entry/Approach Excavation	Disposal/Reuse/ North Island Expansion		Elutriate
		Roadway/Utility Excavation	Disposal/Upland Reuse		TCLP
Excavated Fill/Soil					Standard chemistry

Analytical Parameters

**Table 1** identifies the required sampling parameters for each end use (onsite reuse, placement at Port Tobacco at Weanack, Dominion Recycling or at other upland placement/regional landfill sites). Soil/sediment and water samples will be analysed for the parameters outlined in **Table 1**. Toxicity testing of the simulated effluent (decant) water from the TBM bench-scale test will be conducted in accordance with the USEPA EPA-821-R-02-012 method for acute whole effluent toxicity. Toxicity testing of the simulated sediment waste streams from the TBM bench-scale test will be conducted in accordance with an USEPA approved bulk sediment toxicity testing method. Toxicity testing of the simulated effluent (decant) water will provide a basis of design for the water treatment system. Toxicity testing of the simulated sediment waste streams will inform the management and disposal of the sediment waste streams. Toxicity testing will also provide information for emergency response and clean-up activities in the event of an inadvertent discharge. If additional compounds not listed in the SAP are identified during the toxicity testing, or any other phase of sampling, the additional compounds will be identified and analyzed for.

Quality Control Samples and Blanks

Quality control samples will be collected and analysed as presented in the following table.

QC Sample	Frequency
Method Blanks (Field/Trip)	1 per every 20 samples analysed
Laboratory Control Sample (LCS)	1 per every 20 samples analysed
Surrogates	Spiked into all field and QC samples (organic analyses)
Sample Duplicates	1 per every 20 samples analysed (inorganic analyses)
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	1 per every 20 samples analysed

Field and trip blanks must travel with sample containers and arrive on site within one day of their preparation in the laboratory.

Laboratory control samples is a fortified method blank consisting of reagent water or solid fortified with the analyses of interest for single-analyte methods and selected analytes for multi-analyte methods according to the appropriate analytical method. LCS will be prepared and analysed with each analytical batch, with analyte recoveries utilized to monitor the analytical accuracy and precision of the instrument.

Collection of duplicate samples provides for the evaluation of the laboratory’s and sampler’s performance by comparing the analytical results of two samples from the same location. The

sample name must not indicate which sample has been duplicated. Duplicate requirements may be waived or expanded depending on the particular regulatory program.

A matrix spike/matrix spike duplicate is an aliquot of a field sample that is fortified with the analyte(s) of interest and analysed to monitor matrix effects associated with a particular sample. Samples to be spiked will be determined in advance to allow for collection and submittal of additional volume samples.

### **3.2. Sampling Equipment Decontamination**

Sample collection and compositing equipment must be decontaminated if it will be reused to maintain the integrity of the sample and avoid cross-contamination between samples. In the majority of the instances, stainless-steel trowels and mixing bowls will be dedicated per sample. Larger mixing devices will be decontaminated as follows:

- Rinse with deionized (DI) water
- Rinse with 10 percent nitric acid (HNO<sub>3</sub>)
- Rinse with distilled or DI water
- Rinse with methanol followed by hexane
- Rinse with DI water
- Air dry (area away from decontamination area)

All sample collection devices/storage containers will be laboratory cleaned, packaged, and dedicated for exclusive use at one sampling location for that day.

Decontamination will occur between marine borings on the vessels and will consist of a steam cleaning procedure. Materials not sampled will be returned to the bore-hole or disposed of as investigation derived waste.

### **3.3. Documentation**

Field notebooks will be bound with numbered pages. Any pertinent information regarding the site and the sampling procedures will be documented. Entries made in these notebooks must note the date and time. Information recorded in these notebooks will include:

- Name of the individual making the entry;
- Date and time of arrival and departure at the site;
- Location of the samples taken;
- The method of collection;
- Numbers of samples taken;
- Date and time of collection;
- Sample identification number(s);
- Any field instrument calibration performed and/or instrument readings; and,
- Weather conditions on the day of sampling and any field observations.

For soil sampling, the following additional information will be entered into the field book:

- Boring ID number;



- Soil Recovery;
- Photo-ionization detector (PID) readings for volatile organic compounds; and,
- Description of lithology.

Photo documentation will be made of all core bags/liners with description, time and date photo was taken, specific location, and direction (as applicable. All photo information will be recorded in the field notebook.

### 3.4. Field Instrumentation

Field instrumentation will be operated in accordance with Mott MacDonald’s January 2013 field sampling Standard Operating Procedures. Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer’s specifications. The calibration and internal standards shall meet all criteria specified in the referenced instrumentation specifications.

Calibration of field instruments and equipment will be performed as specified by the manufacturer or more frequently as conditions dictate. The minimum calibration of field instrumentation is once at the beginning of each day, as necessary.

Records of calibration, repair or replacement will be filed and maintained by the designated field personnel. Calibration procedures, calibration check procedures, proper usage, data recording, preventative maintenance are provided in the specified manufacturer’s operation manual.

<b>Instrument</b>	<b>Activity</b>	<b>Frequency</b>	<b>Accuracy</b>	<b>Corrective Action</b>
RAE Systems MiniRAE 3000 Photo Ionization Detector (PID)	Calibration on-site	Beginning and end of day, and as needed.	±3%	Re-calibrate using manufacturer’s instructions and recheck with isobutylene gas; replace if faulty

<b>Instrument</b>	<b>Activity</b>	<b>Frequency</b>	<b>Accuracy</b>	<b>Corrective Action</b>
Horiba U-52 Water Quality Meter or Yellow-Springs Instrument Water Quality Probe	Auto-calibrate on-site with manufacturer specific calibration solutions	Beginning and end of each day, and as needed.	<ul style="list-style-type: none"> <li>•pH: ±0.1 pH</li> <li>•water temperature</li> <li>•dissolved oxygen: ±0.2 mg/L</li> <li>•salinity</li> <li>•Turbidity: ±5%</li> </ul>	Re-calibrate using manufacturer’s instructions; replace if faulty

Field sampling data will be evaluated by the Field Team Leader and or the Project Manager Coordinator, based on their judgment for the determination and verification of the representativeness of sample, maintenance and cleanliness of the sampling equipment and adherence to the approved collection procedure.

### **3.5. Sample Quality Assurance**

The purpose of sample quality assurance is to verify and document quality aspects for the sampling process where the identity of the sample and its handling from collection to delivery at the laboratory meets specific sample collecting process criteria. Upon arrival at the laboratory under chain of custody, the laboratory's internal quality assurance procedures are then implemented. All materials such as field and laboratory notebooks and logbooks, field and laboratory data records, correspondence, reports, chain of custody records and instrument printouts will be clearly labelled and filed in accordance with Mott MacDonald's standard operating procedures.

#### Sample Identification

Each sample will be identified using a sample label marked on the container in permanent marker containing the following information:

- Project name and number;
- Sample number;
- Sample depth;
- Analysis;
- Preservative;
- Date;
- Time; and,
- Sampler's name / initials.

Prior to going into the field, this sample identification procedure will be further refined (if needed), so that a sample is accurately and easily identified.

The sample label contains the authoritative information for the sample. Inconsistencies with other documents will be settled in favor of the vial or container label unless otherwise corrected in writing by the person who collected the samples.

#### Sample Handling

Sample containers or capped Lexan liners will be placed in a secured refrigerated truck (cooled to 4°C) immediately following collection and labelling. Samples will then be transferred to a refrigerated storage until processing for the bench scale testing samples occurs. Samples, upon shipment to the laboratory, will be packed to prevent containers and liners from breaking. Blanks and their associated samples may be held on-site for no longer than two calendar days and must arrive back in the laboratory within on day of shipment from the field unless the specific analytical holding times are less. This constitutes a 4-day maximum handling time.

### Chain-of-Custody

The objective of the chain-of-custody procedure is to document the history of each sample and its handling. Custody records trace a sample from its collection through all transfers of custody until it is transferred to the laboratory. Samples are considered to be in custody if they are within sight of the individual responsible for their security or locked in a secure location. Each person who takes possession of the samples is responsible for sample integrity and safekeeping.

Chain-of-custody procedures are provided below:

- The chain-of-custody form is completed at the time of sample collection. The sample identification number, sampling location, depth, date, time and analysis requested are recorded on the form;
- The sampling team will check the sample numbers on the individual jars against the chain of custody form; and,
- Field samplers are responsible for the care and custody of the samples collected until the samples are transferred to another party.

Samples are packaged for shipment and delivered to the VADEQ-certified laboratory within two days of sampling. A copy of the chain-of-custody form is retained by the sampling team for the project file and the original is sent with the samples. Internal laboratory records then document the custody of the sample through its final deposition.

### Sample Storage

Standard procedures are employed both in the field and in the laboratory to maintain the integrity of the sample custody. Such procedures include the tagging of all sample containers, the use of custody seals where applicable, the use of chain of custody forms and standard schedule, and control and security procedures within the laboratory.

#### **4. LABORATORY OPERATIONS AND DATA DELIVERABLES**

Soil/sediment, standard elutriate and elutriate preparation water samples will be analysed by a VDEQ certified laboratory (Air, Water & Soil Laboratories and Central Soil and Water Lab, Virginia Tech). The VDEQ certified laboratory that will perform the toxicity testing has not been identified at this time.

The laboratory will report all non-conformance results and the reason for the non-conformance so that a determination may be made as to the reliability of the data. Mott MacDonald will confirm that deliverables from the laboratory will be sufficient for data validation at another date, if needed. The data packages will be reviewed for completeness.

Validation may be performed on the data but will be limited to holding times and QC results, as summarized on the forms from the laboratory. If required, validation actions will be in accordance with the EPA Region III data validation protocol.

The results of the data usability assessment will be discussed in Mott MacDonald's project report. This discussion will include an assessment of measurement error with respect to either field sampling or analytical testing activities. This will be accomplished by performing a cursory scan of critical data quality parameters such as cooler temperatures, sample holding times, surrogate recovery, etc. An opinion statement will be included describing whether identified problems have a major or minor impact on data usability and whether or not DQOs were achieved. A discussion will be included in the final report that will assess precision, accuracy and completeness, as well as how this parameter affects the usability of the data.

## 5. KEY STAFF

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- Environmental Testing Manager: Ellen K. Moore  
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ellen.moore@mottmac.com

As previously noted throughout this document, sampling proposed in this sampling plan is being performed to obtain baseline characterization data from material that will be excavated or generated as part of the construction of the entry portals on the North and South Islands, as well as dredging and TBM activities. The data will be utilized to identify potential end uses for the material which could include, but may not be limited to, onsite beneficial reuse (in-water placement), offsite upland placement or disposal at a landfill. This plan is solely meant to assist in future planning and based on the results, may require additional sampling to fulfil regulatory requirements. Upon the receipt of the data, and once an end use is selected, a meeting with the regulatory agencies will be held to provide the background data generated and to obtain guidance from those agencies for the need for additional sampling, associated sample frequency and required analyses.

**Table 1- Analytical Parameters**

Parameters	Method	On or Off-site Reuse	Port Tobacco at Weanack (c)	Other Upland Placement and/or Regional Landfills (b) (c)
Metals (ITM List)	SW846 6020	S(a), W, E	S	
Mercury	SW846 7471A	S(a), W, E	S	
Butyltins	Unger Method / Rice 1987	S, W, E	S	
PCB Congeners	SW846 8082	S, W, E	S	
PCB Aroclors	SW846 8082A	S(a), W, E	S	
Semi volatile Organic Compounds	SW846 8270C	S(a), W, E	S	
Polynuclear Aromatic Hydrocarbons (PAHs)		S(a), W, E	S	
Cyanide	SW846 9012A	S, W, E	S	
pH	EPA 9054D	W,E	S	S
Nitrate/Nitrite	EPA 353.2	S, W, E		
Chlorinated Pesticides	SW846 8081A	S(a), W, E	S	
Herbicides	SW846 8151A	S(a), W, E		
Volatile Organic Compounds	SW846 8260C	S(a), W, E		
Dioxins/Furans (2,3,7,8-TCDD and 2,3,7,8-TCDF only)	EPA 1613B	S(a), W, E	S	
Extractable Organic Halides (EOX)	SW846 9023	S	S	S
TPH - DRO/ORO (C10 to C34)	SW846 8015 D	S	S	S
TPH - GRO (C6 to C10)		S	S	S
Ammonia (as N)	EPA 350.1	S, W, E		
Total Kjeldahl Nitrogen (TKN)	SM 4500 Norg_C	S, W, E		
Total Phosphorus	SM4500_P_E	S, W, E		
Sulfide	EPA 9030B/9034	S, W, E	S	
Potential Acidity	VA Tech method		S	
Neutralization Potential	Neutralization Potential		S	
Acid Base Accounting	Calculation		S	
Calcium Carbonate Equivalence	AOAC 955.01		S	
Pyritic Sulfur (Fizz Rating)	Calculation		S	
Saturated Paste pH & Conductivity	Saturated paste extract		S	
Flashpoint	7.1.2		S	S
Paint Filter Test	SW846 9095A			S*
Total Organic Carbon	Lloyd Kahn	S, W, E	S	
Total Solids	SM 2540G	S	S	S
Atterberg Limits	ASTM D4381	S	S	S
Specific Gravity	ASTM D854	S	S	S
Grain Size(Sieve and Hydrometer)	ASTM D422	S	S	S
TCLP Analysis (Includes Volatiles, Semi volatiles, Pesticides, Herbicides, Metals, Mercury, and TCLP)	SW846,8260B,8270C,8081A,8151A, 6010B, 7470A, 1311			S

Notes: S = Soil/Sediment; E = Elutriate, W = Site Water (elutriate preparation water)

- (a) Required for off-site placement as specified in VDEQ 2012.
- (b) Regional landfills may have additional site-specific testing requirements.
- (c) Not required for landfill disposal. Only required for Weanack “Clean Fill” designation or in-water placement.

\*Only run on fill material (0-20’ below grade) samples



## FIGURES



**LEGEND:**  
 ● Proposed environmental boring

Scale: 1" = 100'

FINAL PLAN REVISIONS SUBMITTAL DATE:							
NO.	DATE	AUTH.	DESCRIPTION	NO.	DATE	AUTH.	DESCRIPTION



Designed: ..E.L.S.  
 Drawn: .....CEM.  
 Checked: ...EKM.

STRUCTURE AND BRIDGE DIVISION  
 DATE: March 15, 2019.

TWIN BORED TUNNEL  
 NORTH ISLAND  
 ENVIRONMENTAL BORING LOCATION PLAN

FIGURE  
 1

Sheet No.  
 ENV(001)





**LEGEND:**  
 ● Proposed environmental boring

Scale: 1" = 100'

FINAL PLAN REVISIONS SUBMITTAL DATE:							
NO.	DATE	AUTH.	DESCRIPTION	NO.	DATE	AUTH.	DESCRIPTION

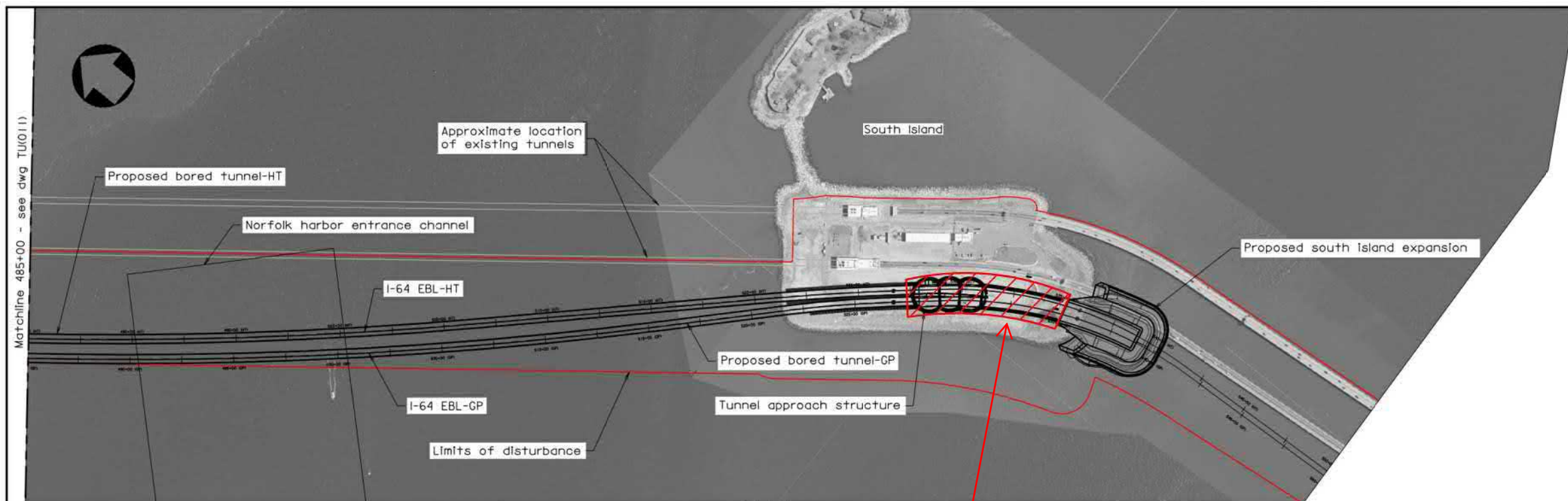


Designed: ...E.L.S.  
 Drawn: .....CEM.  
 Checked: ...E.K.M.

STRUCTURE AND BRIDGE DIVISION  
 DATE: March 15, 2019.

TWIN BORED TUNNEL  
 SOUTH ISLAND  
 ENVIRONMENTAL BORING LOCATION PLAN

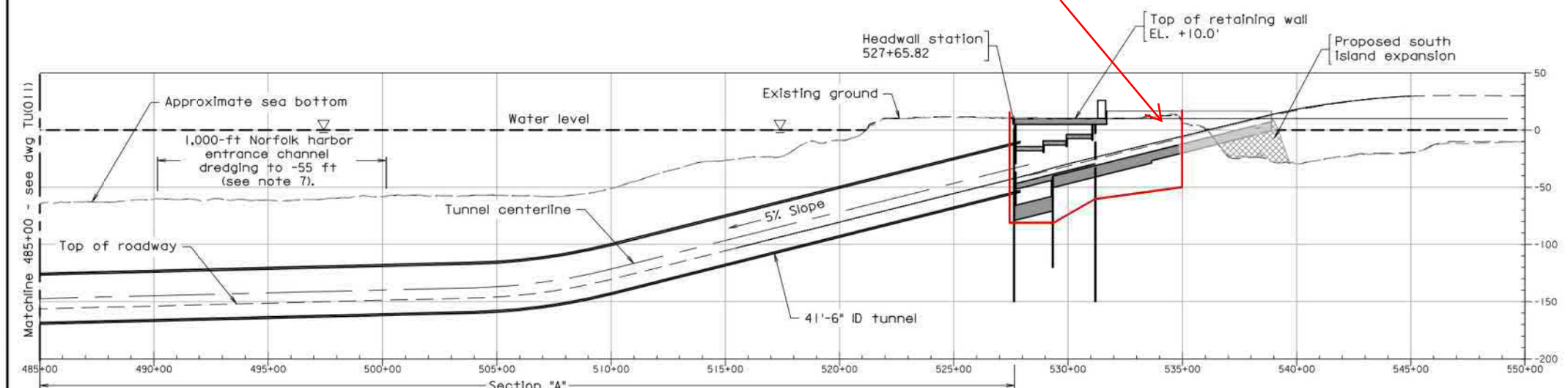
FIGURE 2  
 Sheet No. ENV(002)



PLAN

Scale: 1" = 300'

Approximate Limits of Excavation



PROFILE

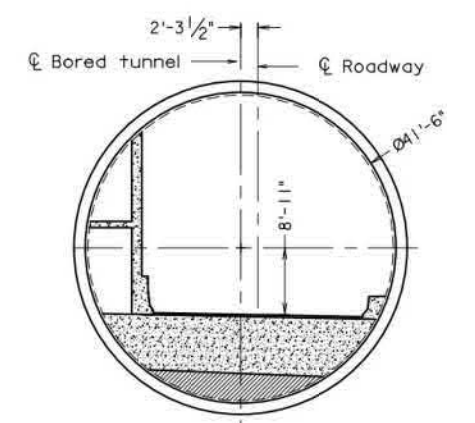
Scale: 1" = 300' Horizontal 1" = 60' Vertical

NOTES:

1. Stations per roadway geometric design.
2. Bored tunnel alignment defined by roadway alignment and geometry combined with the offsets presented on this drawing. Applicability of sections is approximately as follows: Section "A" STA:483+30 to south approach structure.
3. Tunnel profile is cut along the centerline of the east roadway lane (I-64 EBL-HT). The profile of west roadway lanes (I-64 EBL-GP) to be similar.
4. Proposed bored tunnel-GP to be driven first (SI to NI) followed by proposed bored tunnel-HT (NI to SI).
5. Refer to AL and PL drawings for precise highway geometry.
6. Refer to TS drawing subset for details related to tunnel approach structure.
7. Recommended Norfolk harbor entrance channel depth is -55 ft and minimum width is 1000-ft per Table 5-1 of Norfolk harbor navigational Improvements - General Reevaluation Report and Environmental Assessment.

RFP PART I REQUIREMENTS:

- This drawing has been provided to meet the following RFP Part I Requirements:
- 4.7.1.2.a(i)
  - 4.7.1.2.a(ii)
  - 4.7.1.2.a(iii)
  - 4.7.1.2.a(iv)
  - 4.7.1.2.a(v)
  - 4.7.1.2.a(vi)
  - 4.7.1.2.a(vii)
  - 4.7.1.2.a(viii)
  - 4.7.1.2.a(ix)
  - 4.7.1.2.a(x)
  - 4.7.1.2.a(xi)
  - 4.7.1.2.a(xii)



TYPICAL SECTION "A"  
- TUNNEL ALIGNMENT OFFSETS

Not to scale

\*Please note, the final footprint, geometry, and extents are represented in this drawing at the conceptual level from the proposal, and are subject to change as part of the I-64 DJV's design development process, which may impact final quantities.

**PURSUIT PLANS**  
THESE PLANS NOT TO BE USED FOR CONSTRUCTION

**-- RESTRICTED --**  
CRITICAL INFRASTRUCTURE INFORMATION  
Sensitive Security Information

Scale: As noted

FINAL PLAN REVISIONS SUBMITTAL DATE:							
NO.	DATE	AUTH.	DESCRIPTION	NO.	DATE	AUTH.	DESCRIPTION

Designed: AN....	STRUCTURE AND BRIDGE DIVISION
Drawn: .....RGR..	DATE: JANUARY 15, 2019
Checked: ..BB.....	

**BORED TUNNEL SOUTH ISLAND PLAN AND PROFILE**

FIGURE	Sheet No.
3	TU(012)

12121000

12128000

12135000

3536000

3536000

3527000

3527000

3518000

3518000

12121000

12128000

12135000

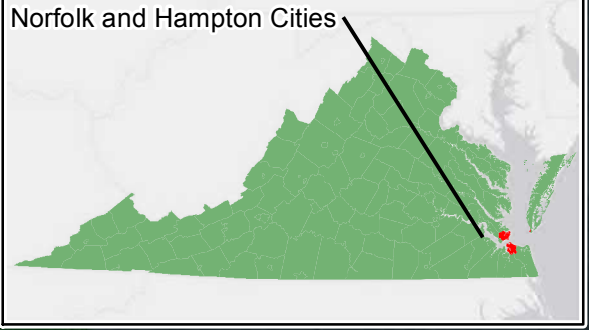


Figure 5 - North Trestle Area

Fort Monroe

Figure 6 - North Island Area

Fort Monroe

Figure 7 - Channel Area

Figure 8 - South Island Area

Figure 9 - South Trestle Area

North End

Willoughby Bay

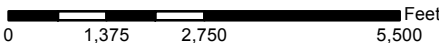
Willoughby Bay

Norfolk Naval Base

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Legend

- Marine Boring Figure Extents
- Limits Of Disturbance

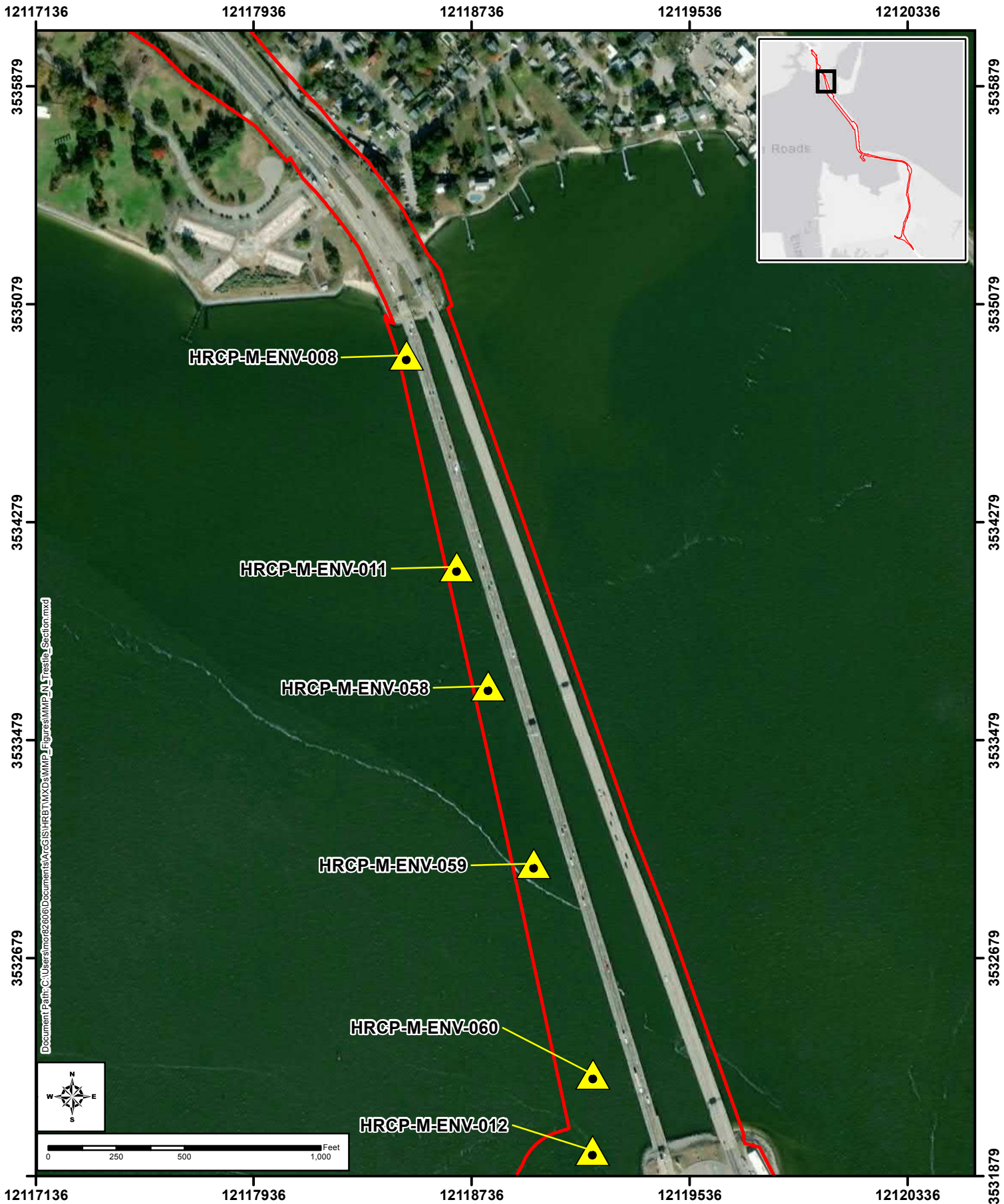


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I-64 HRBT EXPANSION				
NORFOLK & HAMPTON CITIES, VIRGINIA				
MARINE ENVIRONMENTAL BORING LOCATIONS				
FIGURE 4 OVERVIEW INDEX MAP				
Designed XXX	Drawn	Checked	Approved	Date 7/23/2019



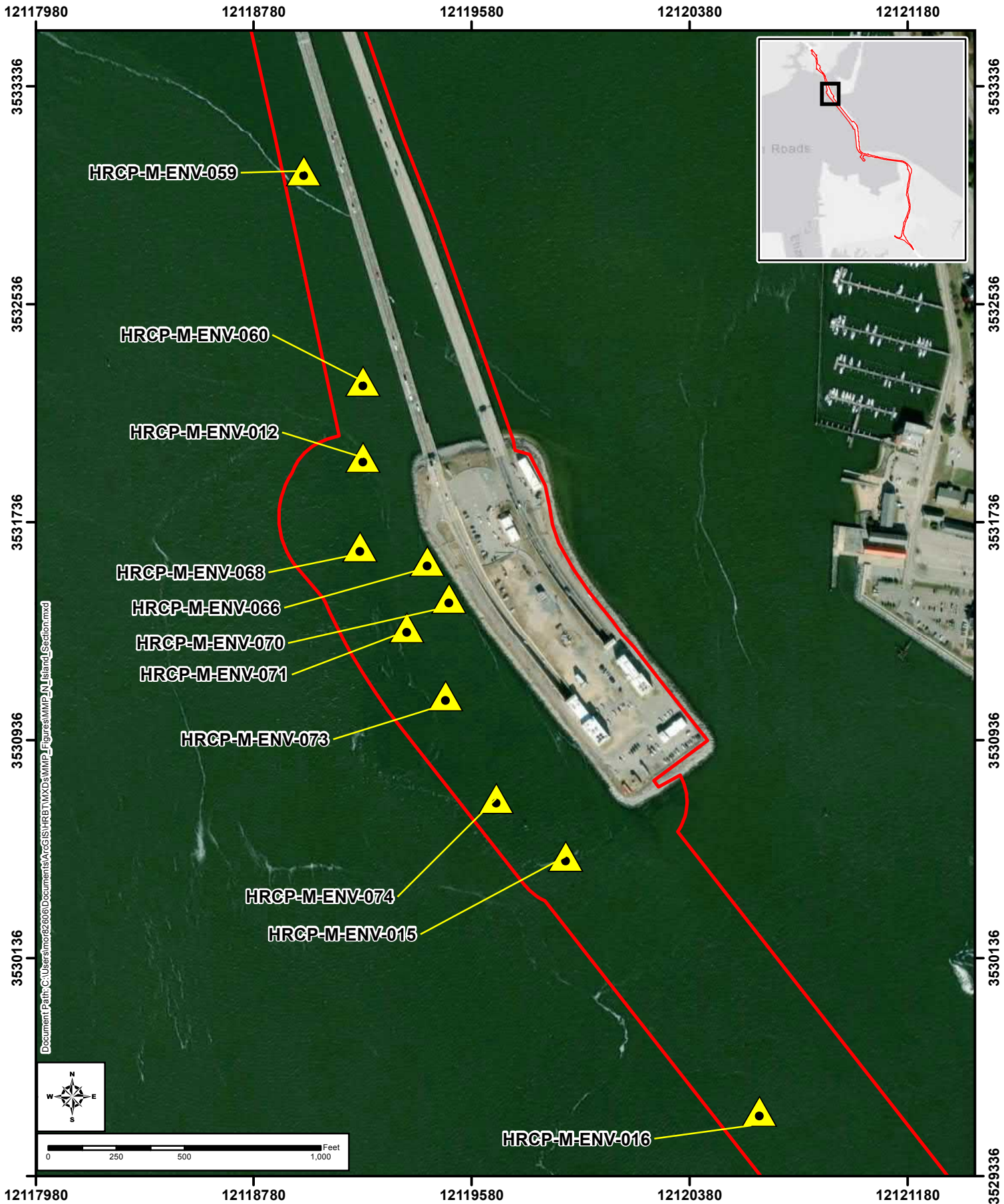
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This map was developed using publicly-available digital data, but his secondary product has not been verified by regulatory authorities and is not state-authorized.

**Legend**

- Marine Borings
- Limit Of Disturbance

			<p>I-64 HRBT EXPANSION NORFOLK &amp; HAMPTON CITIES, VIRGINIA MARINE ENVIRONMENTAL BORING LOCATIONS FIGURE 5 NORTH TRESTLE AREA</p>					
<p>249 Central Park Ave Suite 201, Virginia Beach, VA 23462</p>			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="font-size: 8px;">Designed XXX</td> <td style="font-size: 8px;">Drawn</td> <td style="font-size: 8px;">Checked</td> <td style="font-size: 8px;">Approved</td> <td style="font-size: 8px;">Date 7/23/2018</td> </tr> </table>	Designed XXX	Drawn	Checked	Approved	Date 7/23/2018
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**Legend**

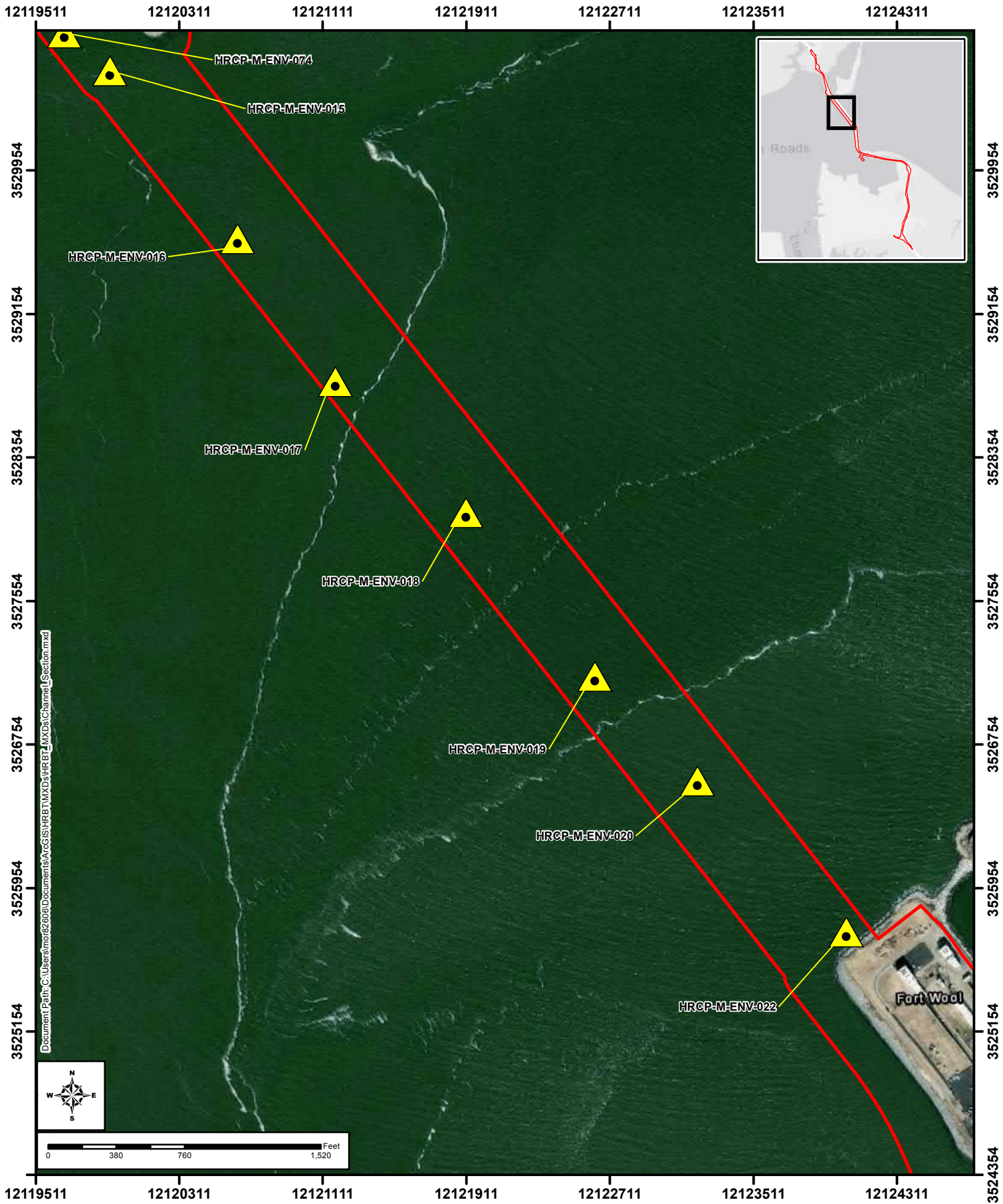
-  Marine Borings
-  Limit Of Disturbance



I-64 HRBT EXPANSION  
 NORFOLK & HAMPTON CITIES, VIRGINIA  
 MARINE ENVIRONMENTAL BORING  
 LOCATIONS  
 FIGURE 6 NORTH ISLAND AREA

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**Legend**

-  Marine Borings
-  Limit Of Disturbance



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 NORFOLK & HAMPTON CITIES, VIRGINIA  
 MARINE ENVIRONMENTAL BORING  
 LOCATIONS  
 FIGURE 7 CHANNEL AREA

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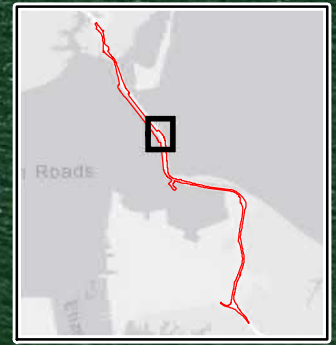
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HRCP-M-ENV-020



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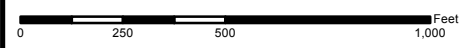
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**Legend**



Marine Borings



Limit Of Disturbance

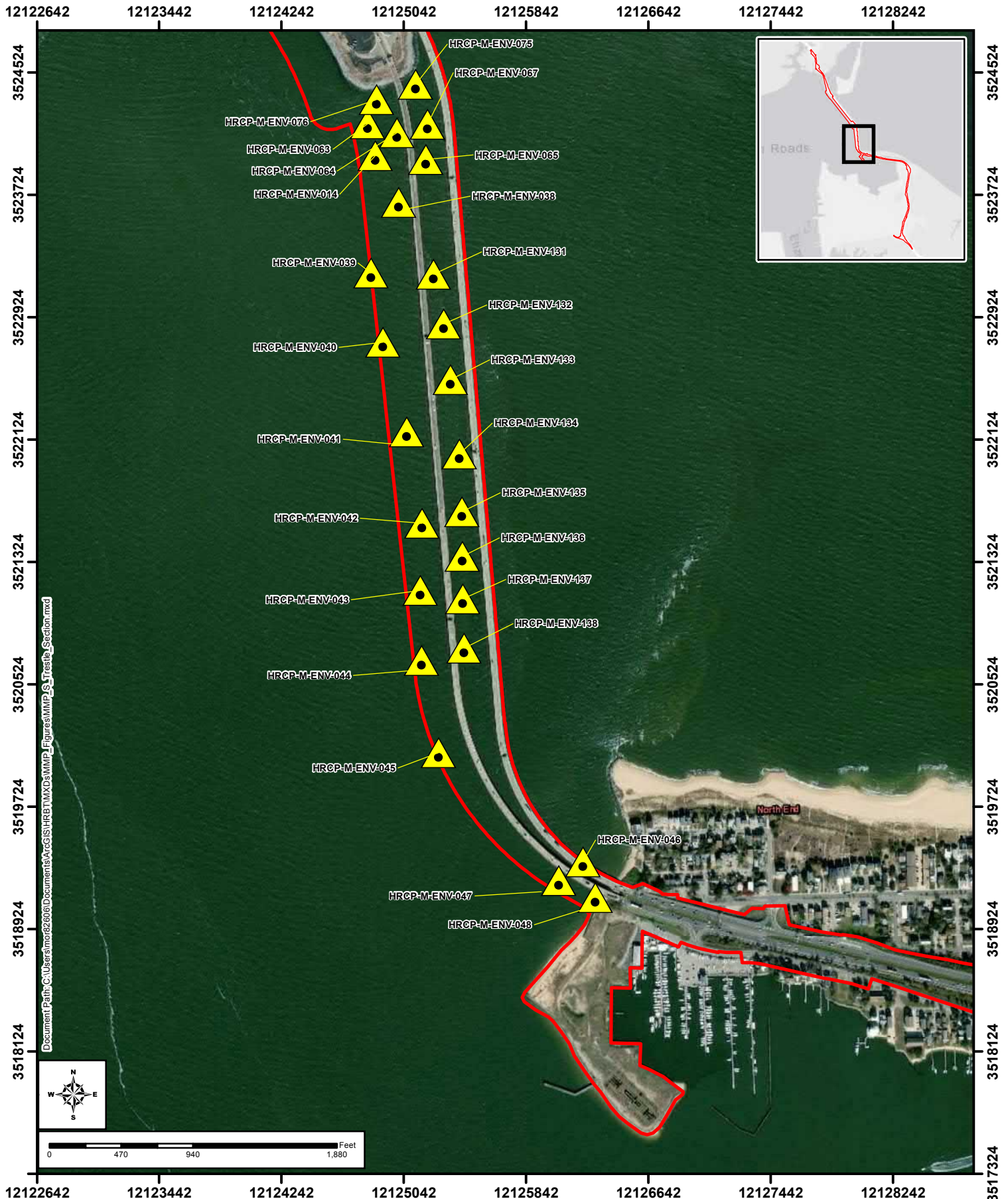
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I-64 HRBT EXPANSION  
NORFOLK & HAMPTON CITIES, VIRGINIA  
MARINE ENVIRONMENTAL BORING  
LOCATIONS  
FIGURE 8 SOUTH ISLAND AREA

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**Legend**

-  Marine Borings
-  Limit Of Disturbance

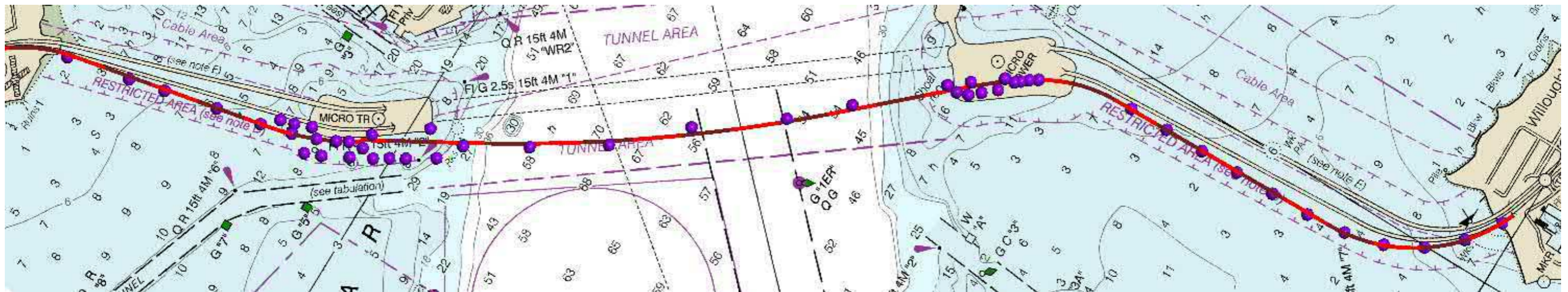
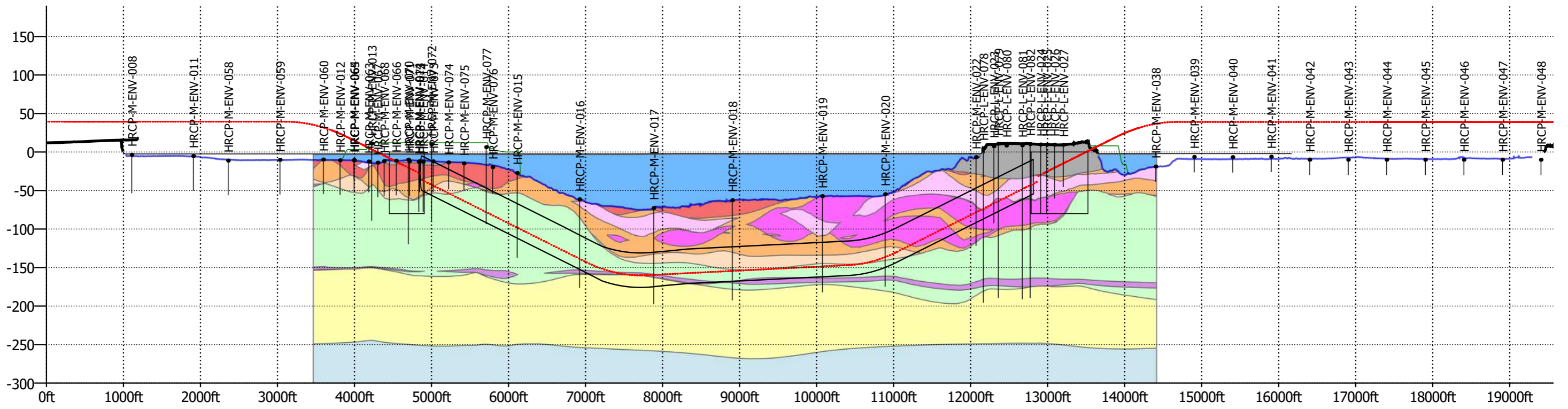
This map was developed using publicly-available digital data, but his secondary product has not been verified by regulatory authorities and is not state-authorized.

			<p>I-64 HRBT EXPANSION NORFOLK &amp; HAMPTON CITIES, VIRGINIA MARINE ENVIRONMENTAL BORING LOCATIONS</p> <p>FIGURE 9 SOUTH TRESTLE AREA</p>										
<p>249 Central Park Ave Suite 201, Virginia Beach, VA 23462</p>			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="font-size: 8px;">Designed</td> <td style="font-size: 8px;">Drawn</td> <td style="font-size: 8px;">Checked</td> <td style="font-size: 8px;">Approved</td> <td style="font-size: 8px;">Date</td> </tr> <tr> <td style="font-size: 8px;">XXX</td> <td></td> <td></td> <td></td> <td style="font-size: 8px;">7/23/2018</td> </tr> </table>	Designed	Drawn	Checked	Approved	Date	XXX				7/23/2018
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XXX				7/23/2018									





**ATTACHMENT I**



Responsible dept.	Technical reference	Creator DC	Approved by
Legal owner Mott MacDonald	Document type MM Ground Model	Document status Draft for discussion	Identification number 507408486
	Title Proposed ENV BHs	Rev.	Date of issue 2019/05/16
			Sheet