



14 January 2015

## TECHNICAL MEMORANDUM

**TO:** Andrew Fan (EPA)  
Barbara Brown (MDE)  
Madi Novak (Maul Foster & Longi, Inc.)  
Dan Silver (Sparrows Point Environmental Trust)

**FROM:** John Morris, Field Lead  
Samantha Saalfield, Project Geologist  
Frank Barranco, Project Manager

**SUBJECT: Round 1 Sediment Investigation and Plan for Round 2 Investigation  
Sparrows Point Phase I Area**

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### Background

The Sparrows Point Environmental Trust (the Trust) has contracted EA Engineering, Science, and Technology, Inc., PBC (EA) to plan and implement the Offshore Investigation of the Phase I, Northwest Shoreline study area, adjacent to the Sparrows Point Facility. The first round of sampling for the Offshore Investigation consisted of sediment sampling conducted on 13 and 14 October 2014. All work was conducted in accordance with the *Work Plan for Offshore Investigation of the Phase I Area of the Sparrows Point Site*, dated September 2014, with minor exceptions noted below.

The Phase I area is located approximately 6 miles southeast of Baltimore, Maryland, in the vicinity of I-695 and Bear Creek. The Round 1 sediment investigation included sampling within approximately 1,000 feet of the shoreline in the Phase I area.

### Sampling Locations

During the first round of the offshore investigation, surface sediment was collected from 20 locations, along eight transects (A-H) oriented perpendicular to the shoreline. The locations, chosen to provide good spatial coverage of the Phase I area, are listed on **Table 1** and illustrated on **Figure 1**. Note that for locations where more than one Ponar grab sample was needed to yield sufficient volume for the required analyses, **Table 1** presents the coordinates of each grab sample taken at the location. Duplicate grab samples were taken within 10 ft of the target location for each sample.

### Sediment Sampling and Analysis

A 23-ft Monark aluminum hull survey boat was launched from the Turner Station Park boat ramp, directly across Bear Creek from the Phase I area. This vessel was chosen for field sampling due to anticipated weather conditions and necessity for space to collect decontamination water and extra

sediment volume for proper disposal. The roving Trimble SPS 461 global positioning system (GPS) receiver was initialized and differential corrections for the satellite positioning data were loaded. The GPS system was connected through HYPACK, and Beacon Marker 5 location was collected as a daily check for the accuracy of the GPS unit.

The boat was navigated to each targeted sampling location and surface sediments were collected. Surface sediment samples were collected to approximately 6 inches below the sediment surface using a Ponar grab sampler. If needed, replicate grab samples were collected using the Ponar until adequate volume had been obtained for the required analysis (including volume required for quality control samples and for separate analysis by Chesapeake Bay Foundation [CBF]). Each grab sample was taken within 10 ft of the target location for the sample; **Table 1** presents the coordinates of each grab sample. The field logbook documenting the sampling is included in **Attachment A**, and a photographic log is included in **Attachment B**. Descriptions of the sediment grab samples collected are also recorded in **Table 1**.

Following collection of the required sample volume, the sample was homogenized using a decontaminated stainless steel spoon in a stainless steel pot and immediately sub-sampled for volatile organic compound (VOC) and simultaneously extracted metals/acid volatile sulfide (SEM/AVS) analysis (as applicable). Note that these sub-samples were not collected prior to homogenization, as indicated in the work plan, because of the heterogeneity within and between Ponar samples at many of the sites (see **Table 1** and photographic log, **Attachment B**). Rather, they were collected expediently following homogenization, and placed in laboratory-cleaned 4-ounce bottles with no headspace. The remainder of the sample was then sub-sampled into appropriate laboratory-cleaned containers using stainless steel sampling tools. Sample processing equipment that came into direct contact with the sediment (e.g., the Ponar sampler and stainless steel pot) was decontaminated according to the protocols specified in the Work Plan.

Additional sample volume for the CBF was collected in 2.5-quart plastic containers from the following 11 locations: SD-A02, SD-A03, SD-B02, SD-C02, SD-C03, SD-D02, SD-E02, SD-E03, SD-G02, SD-H01, and SD-H03. These containers were taped to prevent leaking, and stored in a separate cooler from project samples.

Unused sediment and decontamination water were containerized in 50-gallon drums, in accordance with the special condition included in Maryland Wetlands License No. 14-0543, under which the Maryland Board of Public Works authorized this sampling on 1 October 2014. The containerized material was drummed and transported to a secure offsite staging area. The results of the sediment sampling will be used to characterize the material for disposal.

Samples were placed in a cooler with ice to maintain a temperature of  $<4^{\circ}$  C, and stored in the cooler until delivery to the laboratory. Two field duplicate samples were collected, from locations SD-B02 and SD-F01, and a trip blank was included in each cooler containing bottles for analyses of VOCs. Two rinsate blanks were also collected after the sampling effort, one from the Ponar sampler and one from the stainless steel pot used to homogenize the samples (note that the analytical results from the rinsate blanks are not yet available).

Samples were packaged in bubble wrap, placed in an ice-filled cooler, and shipped via overnight delivery to TestAmerica–Pittsburgh in Pittsburgh, Pennsylvania on the day following collection. Coolers were sealed with packing tape and custody seals, and a completed chain-of-custody record representing the packaged samples was taped to the inside of the cooler lid. A representative from the CBF picked up CBF's samples, which had been kept in EA's walk-in refrigerator, on 15 October 2014.

TestAmerica analyzed sediment samples from each transect for the analytes specified in the Work Plan, with one addition (**Table 2**): the sample from location C-02 was also analyzed for grain size and moisture content due to the finding of unexpectedly coarse sediment, possibly associated with a washout from the shoreline. The suites of analytes for which samples were analyzed included the following:

- Priority pollutant list (PPL) VOCs by EPA Method 8260C
- Low-level (LL) PPL semivolatile organic compounds (SVOCs) by EPA Method 8270D LL
- Low-level polychlorinated biphenyl (PCB) Aroclors by EPA Method 8082A LL
- PPL metals by EPA Method 6020A
- Mercury by EPA Method 7471B
- Cyanide by EPA Method 9014
- Oil and Grease by EPA Method 9071B
- SEM/AVS by EPA Methods 6010B and 9034
- Total Solids by EPA Method SM 2540G
- Total Organic Carbon (TOC) by Lloyd Kahn
- Grain Size by ASTM D422
- Moisture Content by D2216-90.

## **Results**

**Tables 3 through 9** present the results of the sediment analyses. Analytical reports have been provided under separate cover and will be retained by EA.

Comparison of results for the field duplicates and their parent samples generally indicated acceptable agreement (within approximately 50 percent) when both results were detected. However, the reported concentrations of copper in the parent-duplicate pair from location SD-F01 differed by roughly 100 percent, a reflection of the potential for small-scale heterogeneity during sediment sampling. Contaminants of potential concern (COPCs) detected in laboratory method blanks included chromium, lead, zinc, oil and grease, and toluene. Results for associated samples have been B-qualified. Validated results, with any necessary changes or qualifications, will be used in the risk assessment.

Sediments from two transects (B and E), along with the sample from location SD-C02, underwent grain size analysis (**Table 3**). As expected, the near-shore samples (SD-B01, SD-E01, and SD-E-01) contained the highest percentages of sand (92.5 percent, 96.8 percent, and 83.4 percent, respectively). The samples from B-02 and E-03 were composed of approximately three-quarters silt and one-quarter sand, with no gravel and only trace amounts of clay. Sample SD-C02, which

was added to the grain size analysis due to its unexpectedly coarse composition, was composed of 28.7 percent gravel and 56.6 percent sand.

All samples were analyzed for TOC (**Table 3**), and concentrations ranged from 2,300 mg/kg in the sandy sediments from location E-01 to 180,000 mg/kg in the fine-grained sediments from locations SD-G02 and SD-H03.

**Figures 2 through 7** present the distribution of the concentrations of selected COPCs in the surface sediment, across the Phase I area. Note that in these figures, results are presented using color-coded concentration ranges to illustrate trends in relative concentrations. The data were also screened against risk-based criteria following review of the draft version of this memorandum by EPA and MDE. The screening methodology and results are summarized in the EPA comments provided in Attachment C.

Nickel and zinc were chosen to represent metals in the figures (**Figures 2 and 3, Table 4**), as they show spatial distribution similar to other metals. The highest concentrations of nickel and zinc (170 mg/kg and 10,000 mg/kg respectively) were reported in sample SD-H03, from the southern end of the Phase I area. Other samples from Transects G and H, as well as samples SD-A03, SD-B02, SD-C03, and SD-E03, also contained elevated metals concentrations. All of these samples were classified as fine-grained (silt and clay). Mercury, which was analyzed in samples from transects A, B, C, F, G, and H, showed the same general trend as other metals, with the highest concentrations in fine-grained sediments farther offshore, up to 0.83 mg/kg in sample SD-H03 (**Table 4**).

Cyanide concentrations showed a similar pattern to the metals (**Figure 4, Table 4**), with the highest concentration (21 mg/kg) in the sample from SD-G02, and concentrations over 1 mg/kg also in samples from SD-C03, SD-E03, SD-H01, and SD-H02.

PAH concentrations exceeded 1,000 µg/kg in at least one sample from each transect except for the D and E transects, with concentrations generally higher farther offshore, where sediment has higher clay and silt content. The highest concentrations of Total PAHs (**Figure 5, Table 5**) were reported in samples SD-E03, SD-G02, and SD-H03 (10,360, 14,330, and 11,600 µg/kg, respectively). SD-E03 was observed to have a slight odor, SD-G02 had a slight sheen, and SD-H03 had a heavy sheen and heavy petroleum odor. SD-G01 and SD-H01 were also observed to have a heavy petroleum odor with sheen, while SD-H02 had a slight odor with sheen, and SD-G02 had slight sheen but no observed odor. SD-F01 and SD-F02 contained sediment that appeared oily at depths greater than a few inches. A slight odor and sheen were also noted in SD-C03.

Bis(2-ethylhexyl)phthalate was the only SVOC detected. The sample from location SD-H03 contained the highest concentration of bis(2-ethylhexyl)phthalate (33,000 µg/kg) (**Figure 6, Table 6**). Concentrations exceeding 1,000 µg/kg were reported in all samples from the G and H transects, in one sample each from the E and F transects, and in none of the samples collected farther north (although for some samples the reporting limit for this compound exceeded 1,000 µg/kg).

Analysis of PCB Aroclors was performed only on samples from transects associated with active stormwater outfalls (B, C, F, G, and H). Concentrations were highest in the H transect and in the sample from SD-F01 (**Figure 7, Table 7**).

The following VOCs were detected in one or more samples (**Table 8**): 1,2-dichlorobenzene, benzene, chlorobenzene, ethylbenzene, and toluene. Toluene was detected in all samples; however, this analyte was also detected in the laboratory method blanks, at concentrations of a similar order of magnitude (1.17 µg/kg and 1.7 µg/kg). The sample from location SD-H03 was the only sample containing toluene at a concentration (16 µg/kg) approaching 10 times the method blank detections, and therefore the most likely to contain toluene. This sample also had the only detection of benzene (6.9 µg/kg) and the highest detected concentrations of chlorobenzene (250 µg/kg) and ethylbenzene (33 µg/kg).

All of the surface sediment samples collected were analyzed for AVS/SEM, to aid with assessment of bioavailability for toxicity (**Table 9**). Samples from the following locations did not have detectable AVS, so the SEM/AVS ratio could not be calculated: SD-A01, SD-B01, SD-C01, and all samples from the D and E transects. The SEM/AVS ratio for the following locations was equal to or greater than 1, indicating that the metals present in the sediment may be bioavailable: SD-C03, SD-F02, SD-G02, SD-H01, SD-H02, and SD-H03. The highest ratio was 21, in the sample from SD-H03. These results indicate that metals may be bioavailable in the sediments of the Phase I area.

To better assess which areas show impacts by groundwater COPCs, the metals and PAH data from Round 1 were normalized to TOC concentrations (**Figures 8, 9, and 10**). Because coarser-grained sediments, often located near-shore, tend to contain less organic carbon and also contain less surface area for adsorption of constituents such as metals and PAHs, the concentrations of contaminants in these sediments may be diluted out and appear less significant than they are. By normalizing to the TOC concentration, this effect is removed and the possibility of groundwater impacts can be better assessed.

In summary of the analytical results, the most elevated concentrations of metals, PAHs, Bis(2-ethylhexyl)phthalate, and PCBs were associated with sediments toward the southern end of the study area, adjacent to the outlet of the Tin Mill Canal. Additionally, an observable trend exists between the elevation of these constituents and grain size; higher concentration associated with finer grained sediments. Considering finer grained sediments are associated with samples further offshore, elevation in concentration of these constituents varies inversely with distance from the shoreline in certain cases.

### **Proposed Sampling Plan for Round 2 Sampling**

As stated in the Work Plan for the Offshore Investigation, the locations of pore water sampling and additional sediment sampling are to be determined based on the results from the Round 1 sediment investigation. The proposed sampling locations and rationale for their selection are presented below.

## Pore Water

The following criteria were identified for selection of pore water sampling locations:

- Locations near onshore areas where groundwater COPCs exceeding the BTAG surface water screening criteria by at least five-fold (or consistently exceeding the criteria by two-fold) have been identified (Attachment C). Note that if a chemical was not detected from 2010-2014, then any prior exceedances were excluded. However, prior exceedances were taken into account if there were no analyses for the chemical from 2010-2014.
- Sandy locations where pore water upwelling is thought to be likely.

The proposed locations for pore water sampling and the rationale for selecting each location are presented in **Table 10**. The proposed locations are shown on **Figure 11**. All except one of selected locations (F03) are within approximately 100 feet of the shoreline because this is thought to be the most likely location of groundwater upwelling. This interpretation is based on the underlying geology, which does not include prominent shallow confining layers, as well as the sandy sediment lithology in the near-shore area. The water depth at all of the selected locations is expected to be less than approximately 10 ft.

At each of these locations, a pore water sample will be collected using a push-point sampler, from approximately 1 ft below the sediment-water interface. Collection of pore water from this depth will produce data relevant to the biologically active zone for the risk assessment, while minimizing any possible intrusion of surface water from above the sediment-water interface. As stated in the Work Plan, *in situ* water quality measurements will be used to monitor for potential incursion of surface water, which must be avoided during sampling.

Each pore water sample will be analyzed for the COPCs identified in the associated monitoring wells identified in **Table 10**, and also for dissolved organic carbon (DOC) and magnesium and calcium (to allow calculation of surface water screening criteria) (**Table 11**). The analytical methods, total numbers of samples to be analyzed, and quality control samples are presented in **Table 12**.

## Sediment

The following criteria were identified for selection of additional sediment sampling locations:

- Locations identified for pore water sampling where no sediment sample was collected during Round 1.
- Locations in the vicinity of Transects G and H, where the lateral and vertical extent of contamination require delineation to support a future Corrective Measures Study for the Phase I area.

The proposed locations for Round 2 sediment sampling and the rationale for selecting each location are presented in **Table 13**. The proposed locations are shown on **Figure 11**.

Surface sediment will be collected from one location identified for pore water analysis, where no sediment sample was collected during Round 1. Surface sediment results from this location will be collected for comparison to pore water. The Round 2 surface sediment samples will be collected using the same methodology as were the Round 1 sediments.

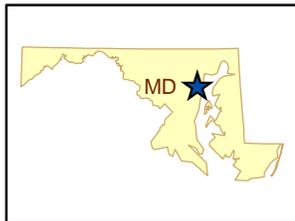
Up to 12 sediment cores will be collected from the area of the G and H transects, where high concentrations of oil and grease (up to 11%), observable sheen and petroleum odor, and metals concentrations exceeding sediment PECs were reported in surface sediment. Additionally, two cores, co-located with pore water analyses, will be collected from the F transect, where an oily black sediment layer with 1.5% oil and grease was observed near the shoreline. Although the Work Plan indicated that sediment cores, if required, would be collected using manual push cores to a depth of approximately 2 ft, it was determined based on the Round 1 data that deeper delineation is likely necessary to define the extent of contamination in the targeted area.

An electric vibrocorer will be deployed from a 28-ft aluminum-hull survey and research vessel and used to advance cores to a penetration depth of 5 to 6 feet below the sediment-water interface or refusal. Upon recovery, the cores will be held at 4°C, transferred to a processing facility, then split, described and photographed. Any observable impacts (sheen and/or odor) will be assessed and recorded. Generally, sediment sub-samples will be generated based on 2-foot intervals below the sediment-water interface (0-2 ft, 2-4 ft, 4-6 ft, etc.). A surface interval sample from every core will be submitted for analysis. If a core has no observable impacts, then the next deeper interval (2-4 ft) will also be submitted for analysis. Alternatively, if multiple intervals in the middle and bottom portions of a core contain observable impacts, then only the lowest of the impacted intervals, and any un-impacted intervals below the lowest impacted interval, will be submitted for laboratory analysis. Each interval will be homogenized using decontaminated stainless steel mixing equipment and transferred to pre-cleaned, 8 ounce jars for analytical testing.

Cores from locations F03, F04, G01, G01.5, G02, H01, H02.5, and H03 will be collected and sampled first, followed by cores from locations G03 and H04. If no contamination (sheen or petroleum odor) is apparent in cores G03 and H04 (at the edge of the subaqueous survey area), then no more cores will be sampled. However, if contamination is apparent in these cores, cores will be advanced at locations G04 and H05, and these cores will be sampled as described above. If no contamination (obvious sheen or petroleum odor) is apparent in these cores, then no more cores will be sampled. If contamination is apparent in cores from G04 and H05, then cores will be advanced at locations G05 and H06, and all four of these cores will be sampled as described above. Thus, up to 14 cores may be sampled. For planning purposes, it is assumed that an average of three samples will be collected from each core; however, as described above, only two samples may be required from some cores, based on field observations.

The sediment samples will be analyzed for the parameters indicated in **Table 14**. As in Round 1, the analytical parameters for the surface sediment grab samples are based on whether they are adjacent to an active stormwater outfall. Parameters to be analyzed in sediment core samples were selected based on the primary contaminants identified in the area of the G and H transects, based on Round 1 sampling, and potential historical releases from the Tin Mill Canal. The analytical methods, total numbers of samples to be analyzed, and quality control samples are presented in **Table 12**.

If the findings of the Data Gaps Report, which will be based on the Round 1 and Round 2 results, indicate that the Round 2 coring did not achieve delineation, further expansion of the investigation area and/or use of a barge with larger vibracorer may be considered to obtain deeper cores.



**Legend**

- - - Phase 1 Northwest Shoreline
- ~ Perennial Creek/Stream
- Boundary between Sand and Fine Grained Sediment
- Sediment Sampling Location
- Approximate Location of Active Stormwater Outfall
- ⊗ Approximate Location of Inactive Stormwater Outfall
- ◆ Greys Landfill Well
- ◆ Groundwater Well Sampled in June 2014

0 300 600 1,200  
 Feet  
 1 inch = 1,200 feet

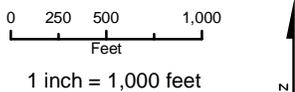
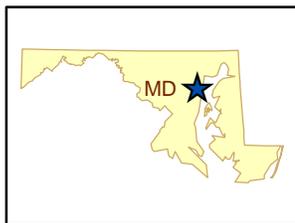
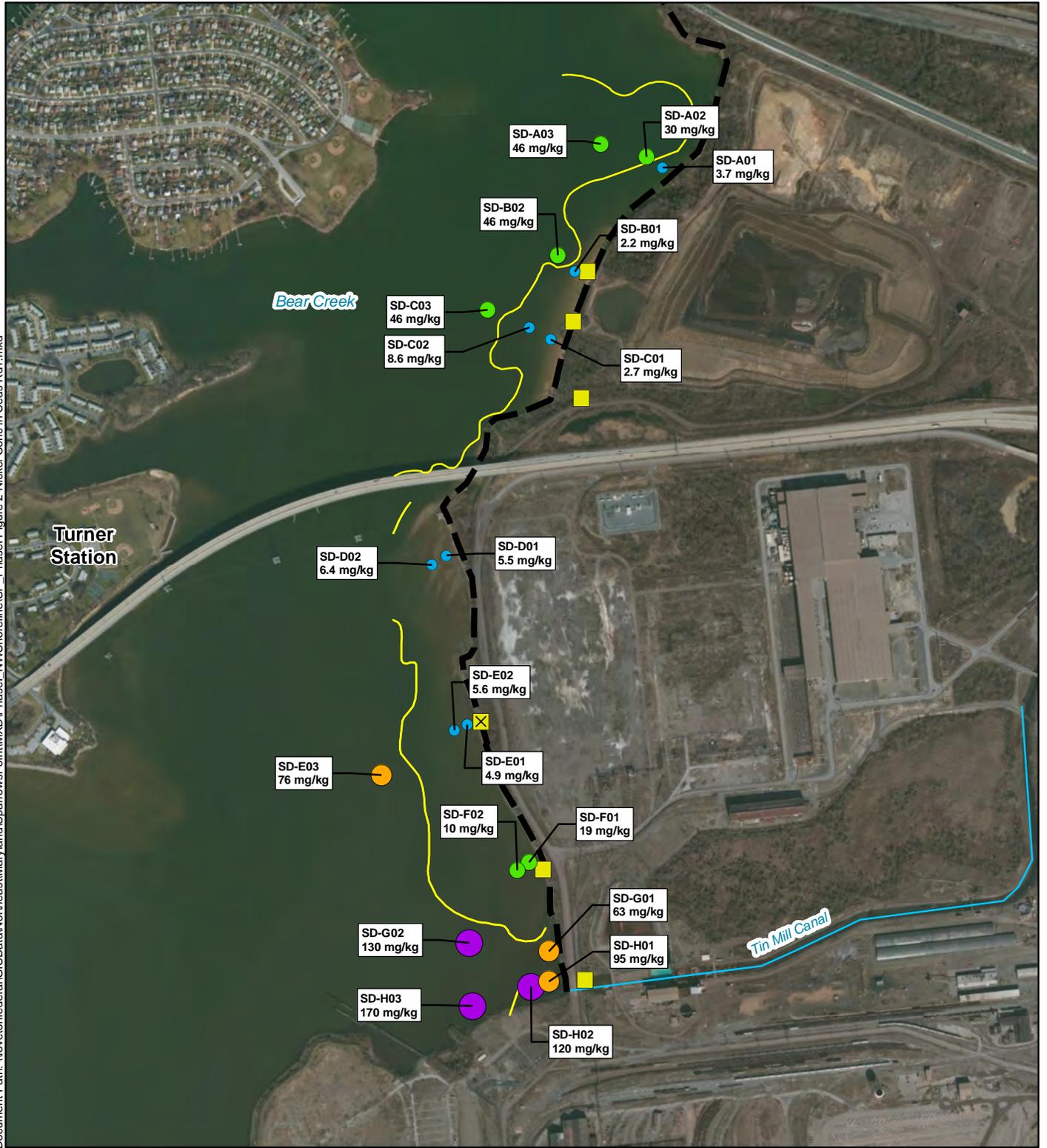


Figure 1  
 Sampling Locations  
 for the First Round of the  
 Offshore Investigation  
 Phase I Northwest Shoreline  
 Baltimore, Maryland

Map Date: January 2015  
 Image Source: ESRI 2011  
 Projection: NAD 1983 StatePlane  
 Maryland FIPS 1900 (US Feet)



Document Path: \\lovetofederal\GISData\NorthEast\Maryland\SparrowsPoint\MXD\PhaseI\SP\_PhaseI\Figure 2 Nickel Conc in Seds Rd1.mxd



**Legend**

- Phase 1 Northwest Shoreline
- ~ Perennial Creek/Stream
- Boundary between Sand and Fine Grained Sediment
- Approximate Location of Active Stormwater Outfall
- ⊠ Approximate Location of Inactive Stormwater Outfall

**Nickel in Sediments**

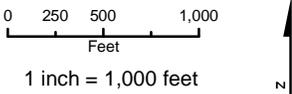
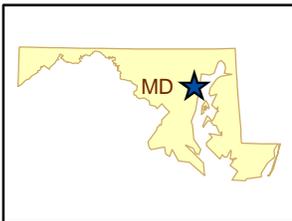
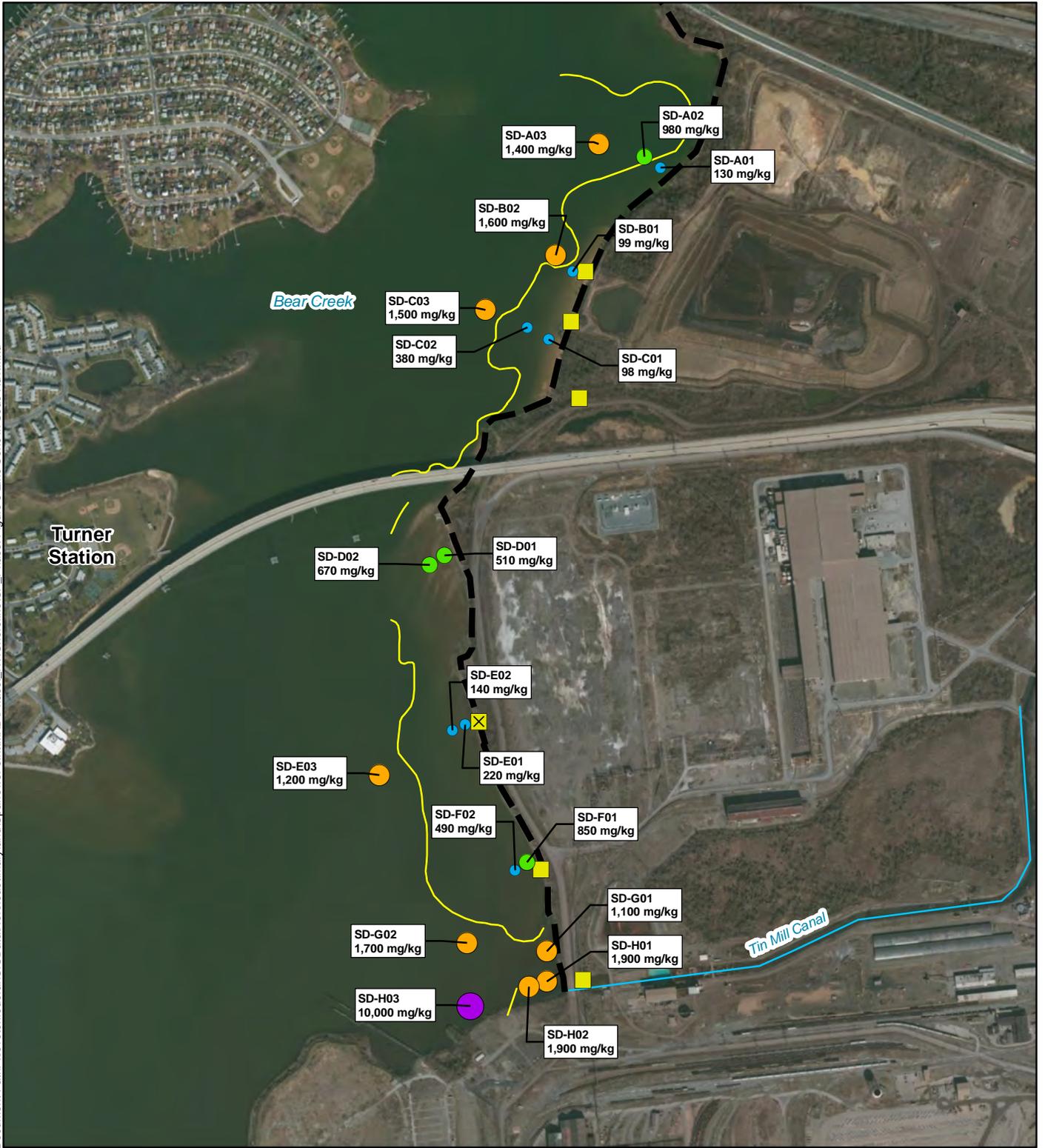
- <10 mg/kg
- 10-50 mg/kg
- 50-100 mg/kg
- >100 mg/kg

Figure 2  
Nickel Concentrations in Sediments  
from Round 1 Sampling  
Phase I Northwest Shoreline  
Baltimore, Maryland

Map Date: January 2015  
Image Source: ESRI 2011  
Projection: NAD 1983 StatePlane  
Maryland FIPS 1900 (US Feet)



Document Path: \\lovetofederal\GISData\NorthEast\Maryland\SparrowsPoint\MXD\Phase1\_NWS\Shoreline\SP\_Phase1\Figure 3 Zinc Conc in Seds Rd1.mxd



**Legend**

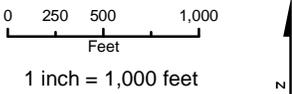
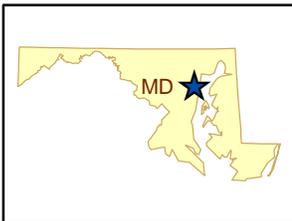
- Phase 1 Northwest Shoreline
  - ~ Perennial Creek/Stream
  - Boundary between Sand and Fine Grained Sediment
  - Approximate Location of Active Stormwater Outfall
  - ⊗ Approximate Location of Inactive Stormwater Outfall
- Zinc in Sediments**
- <500 mg/kg
  - 500-1,000 mg/kg
  - 1,000-2,000 mg/kg
  - >2,000 mg/kg

Figure 3  
Zinc Concentrations in Sediments  
from Round 1 Sampling  
Phase I Northwest Shoreline  
Baltimore, Maryland

Map Date: January 2015  
Image Source: ESRI 2011  
Projection: NAD 1983 StatePlane  
Maryland FIPS 1900 (US Feet)



Document Path: \\lovetofederal\GISData\NorthEast\Maryland\SparrowsPoint\MXD\PhaseI\_NWS\Shoreline\SP\_PhaseI\Figure 4\_Cyanide Conc in Seds Rd1.mxd



- Legend**
- Phase 1 Northwest Shoreline
  - ~ Perennial Creek/Stream
  - Boundary between Sand and Fine Grained Sediment
  - Approximate Location of Active Stormwater Outfall
  - ⊗ Approximate Location of Inactive Stormwater Outfall
- Total Cyanide in Sediments**
- ND
  - <1 mg/kg
  - 1-10 mg/kg
  - >10 mg/kg

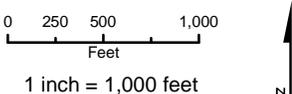
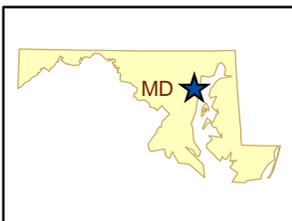
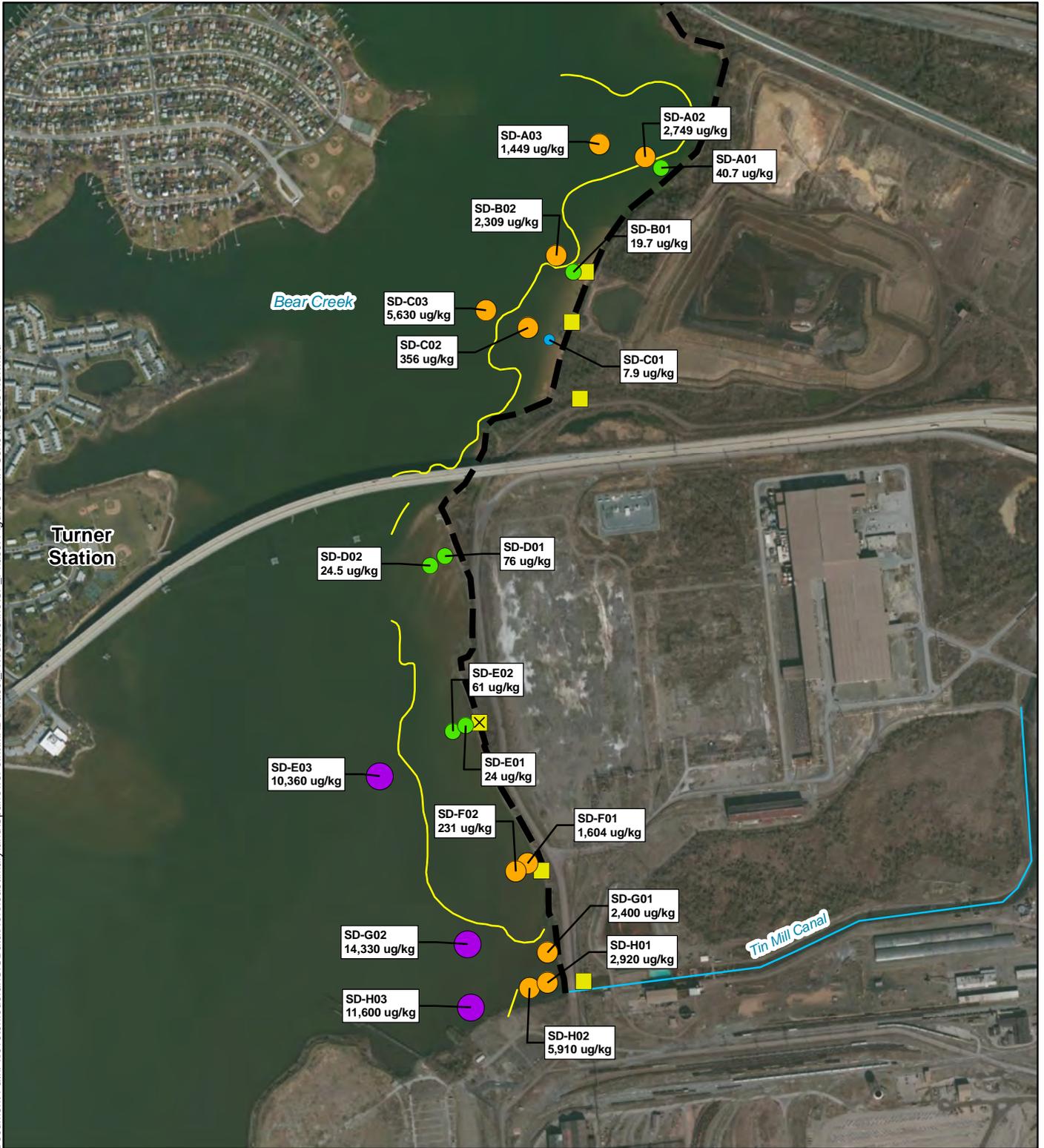
Figure 4  
Total Cyanide Concentrations in Sediments from Round 1 Sampling Phase I Northwest Shoreline Baltimore, Maryland

Note: U = Compound was not detected. Value is the reporting limit.

Map Date: January 2015  
Image Source: ESRI 2011  
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)



Document Path: \\lovetofederal\GISData\NorthEast\Maryland\SparrowsPoint\MXD\PhaseI\_NWS\Shoreline\SP\_PhaseI\Figure 5 PAH Conc in Sediments Rcd1.mxd



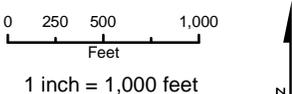
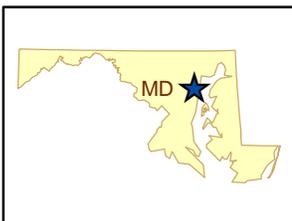
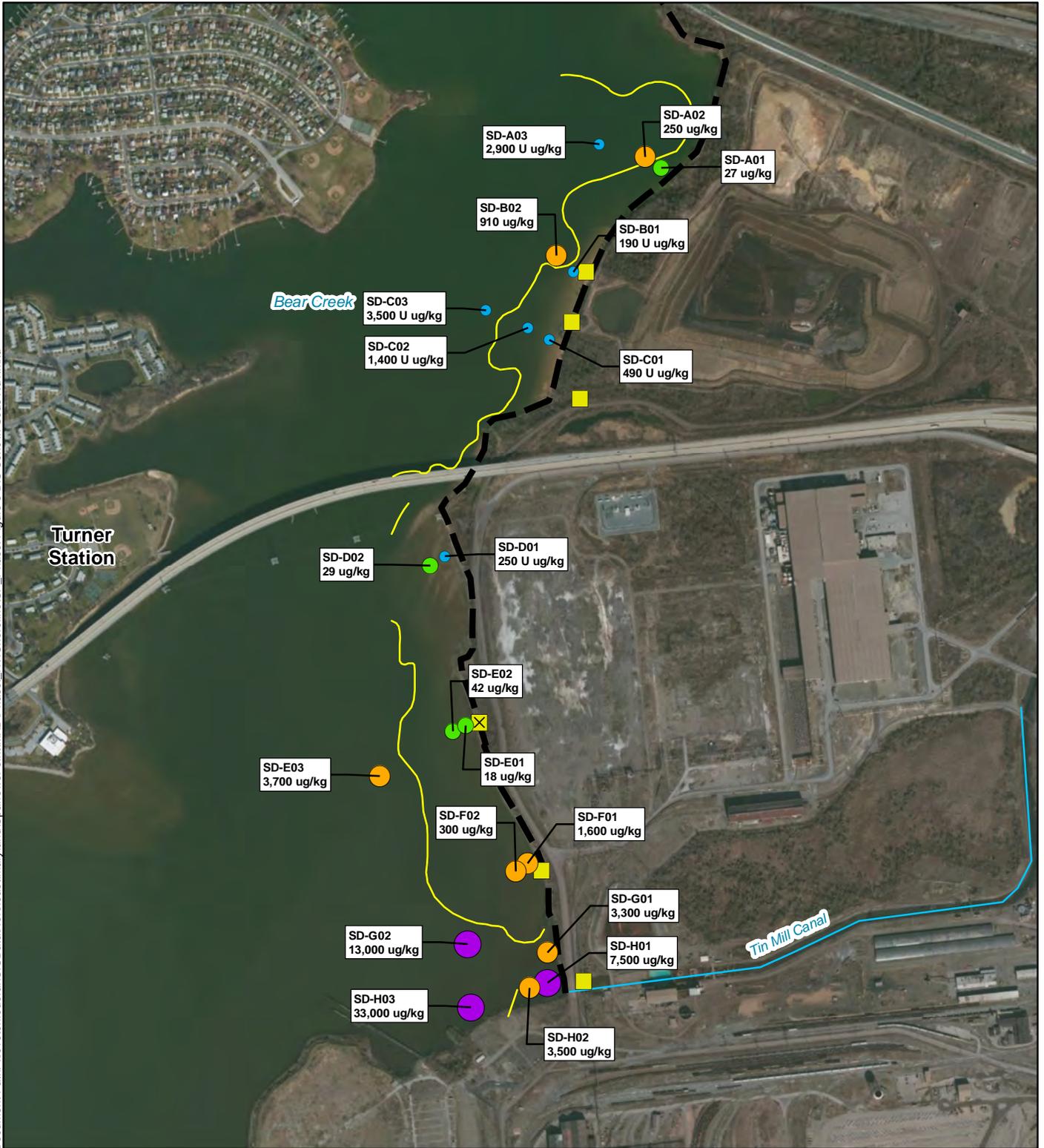
- Legend**
- Phase 1 Northwest Shoreline
  - ~ Perennial Creek/Stream
  - Boundary between Sand and Fine Grained Sediment
  - Approximate Location of Active Stormwater Outfall
  - ⊗ Approximate Location of Inactive Stormwater Outfall
- Total PAHs in Sediments**
- <10 ug/kg
  - 10-100 ug/kg
  - 100-6,000 ug/kg
  - >6,000 ug/kg

Figure 5  
Total PAH Concentrations in Sediments from Round 1 Sampling Phase I Northwest Shoreline Baltimore, Maryland

Map Date: January 2015  
Image Source: ESRI 2011  
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)



Document Path: \\lovetofederal\GISData\NorthEast\Maryland\SparrowsPoint\MXD\PhaseI\_NWS\Shoreline\SP\_PhaseI Figure 6 BIS Conc in Sed. Rd1.mxd



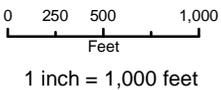
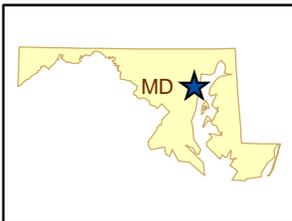
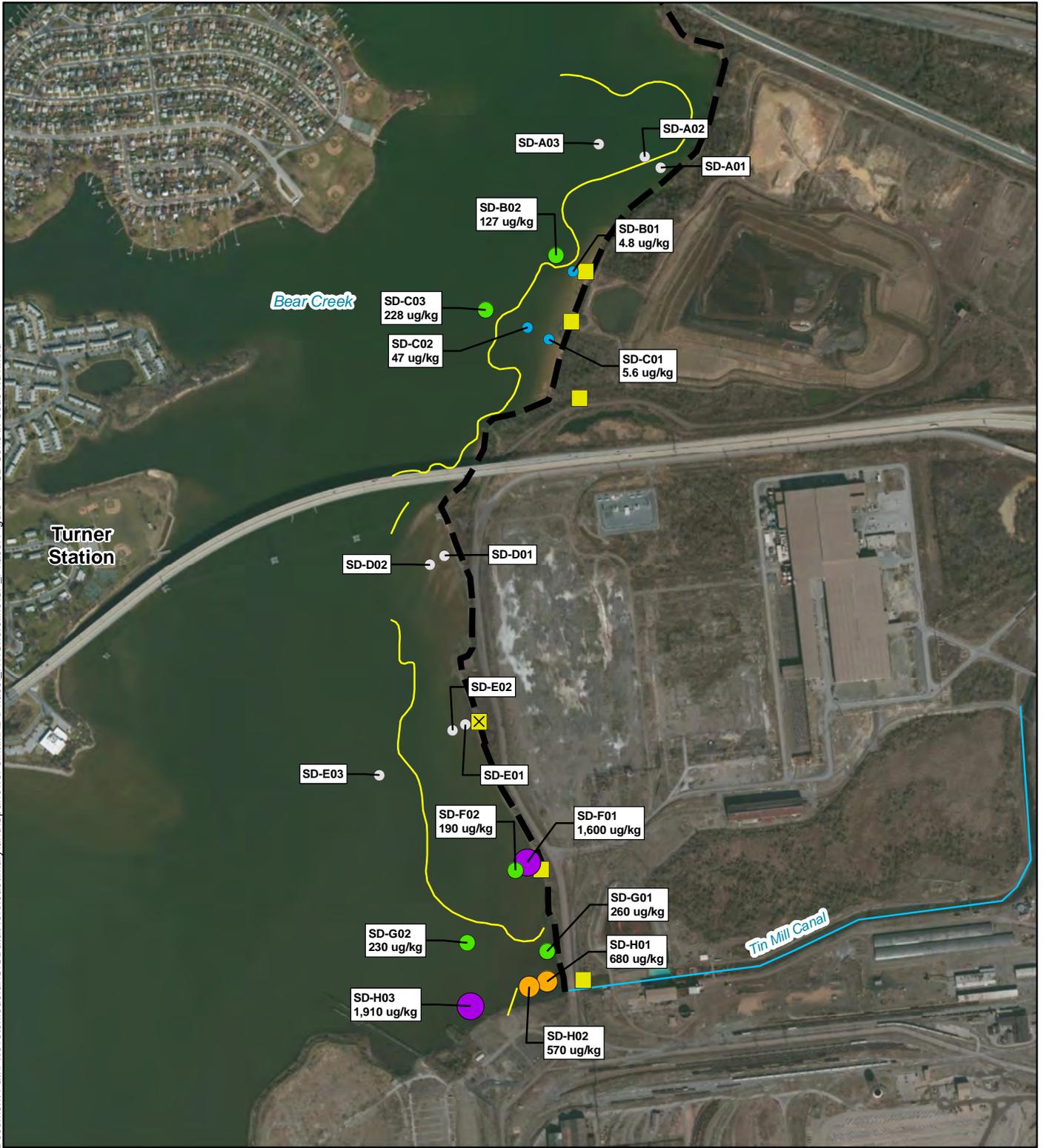
- Legend**
- Phase 1 Northwest Shoreline
  - ~ Perennial Creek/Stream
  - Boundary between Sand and Fine Grained Sediment
  - Approximate Location of Active Stormwater Outfall
  - ⊗ Approximate Location of Inactive Stormwater Outfall
- Bis(2-ethylhexyl)phthalate in Sediments**
- ND
  - <100 ug/kg
  - 100-4,000 ug/kg
  - >4,000 ug/kg

Figure 6  
Bis(2-ethylhexyl)phthalate  
Concentrations in Sediments from  
Round 1 Sampling  
Phase I Northwest Shoreline  
Baltimore, Maryland

Note: U = Compound was not detected.  
Value is the reporting limit.  
Map Date: January 2015  
Image Source: ESRI 2011  
Projection: NAD 1983 StatePlane  
Maryland FIPS 1900 (US Feet)



Document Path: \\lovetofederal\GISData\NorthEast\Maryland\SparrowsPoint\MXD\Phase1\_NWS\Shoreline\SP\_Phase1\Figure 7\_PCB Conc in Seds Rcd1.mxd



**Legend**

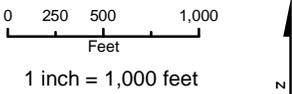
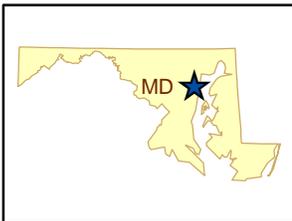
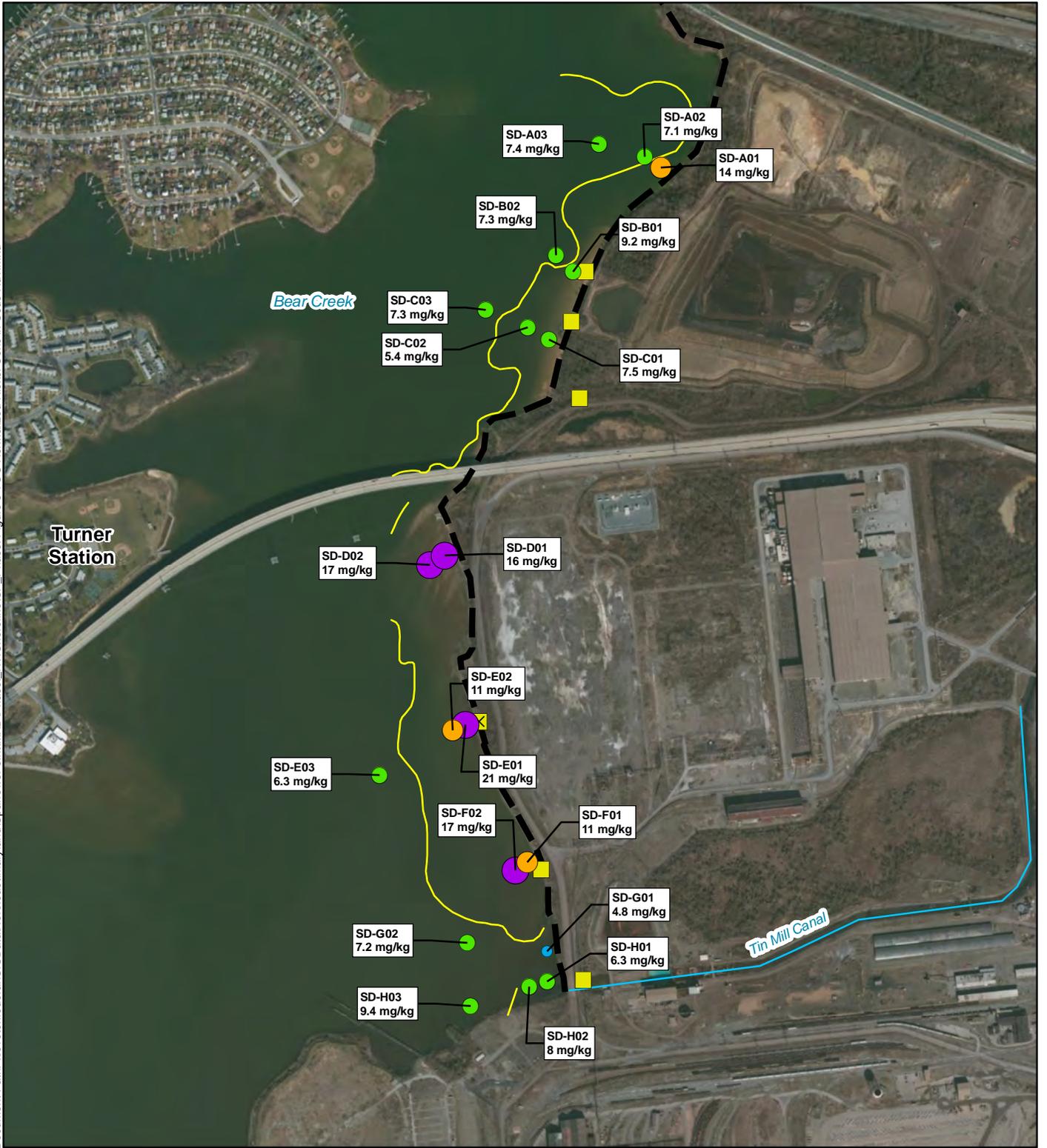
- Phase 1 Northwest Shoreline
  - ~ Perennial Creek/Stream
  - Boundary between Sand and Fine Grained Sediment
  - Not Sampled for PCBs
  - Approximate Location of Active Stormwater Outfall
  - ⊗ Approximate Location of Inactive Stormwater Outfall
- | Total PCBs in Sediments |                 |
|-------------------------|-----------------|
| ●                       | <50 ug/kg       |
| ●                       | 50-500 ug/kg    |
| ●                       | 500-1,000 ug/kg |
| ●                       | >1,000 ug/kg    |

Figure 7  
Total PCB Concentrations in Sediments from Round 1 Sampling Phase I Northwest Shoreline Baltimore, Maryland

Map Date: January 2015  
Image Source: ESRI 2011  
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)



Document Path: \\lovetofederal\GISData\NorthEast\Maryland\SparrowsPoint\MXD\Phase1\_NWS\Shoreline\SP\_PhaseI Figure 8 TOC Normalized Nickel Conc in Seds Rf1 .mxd



**Legend**

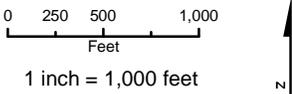
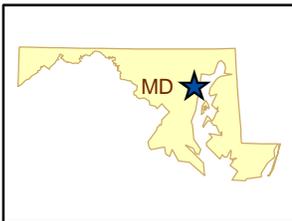
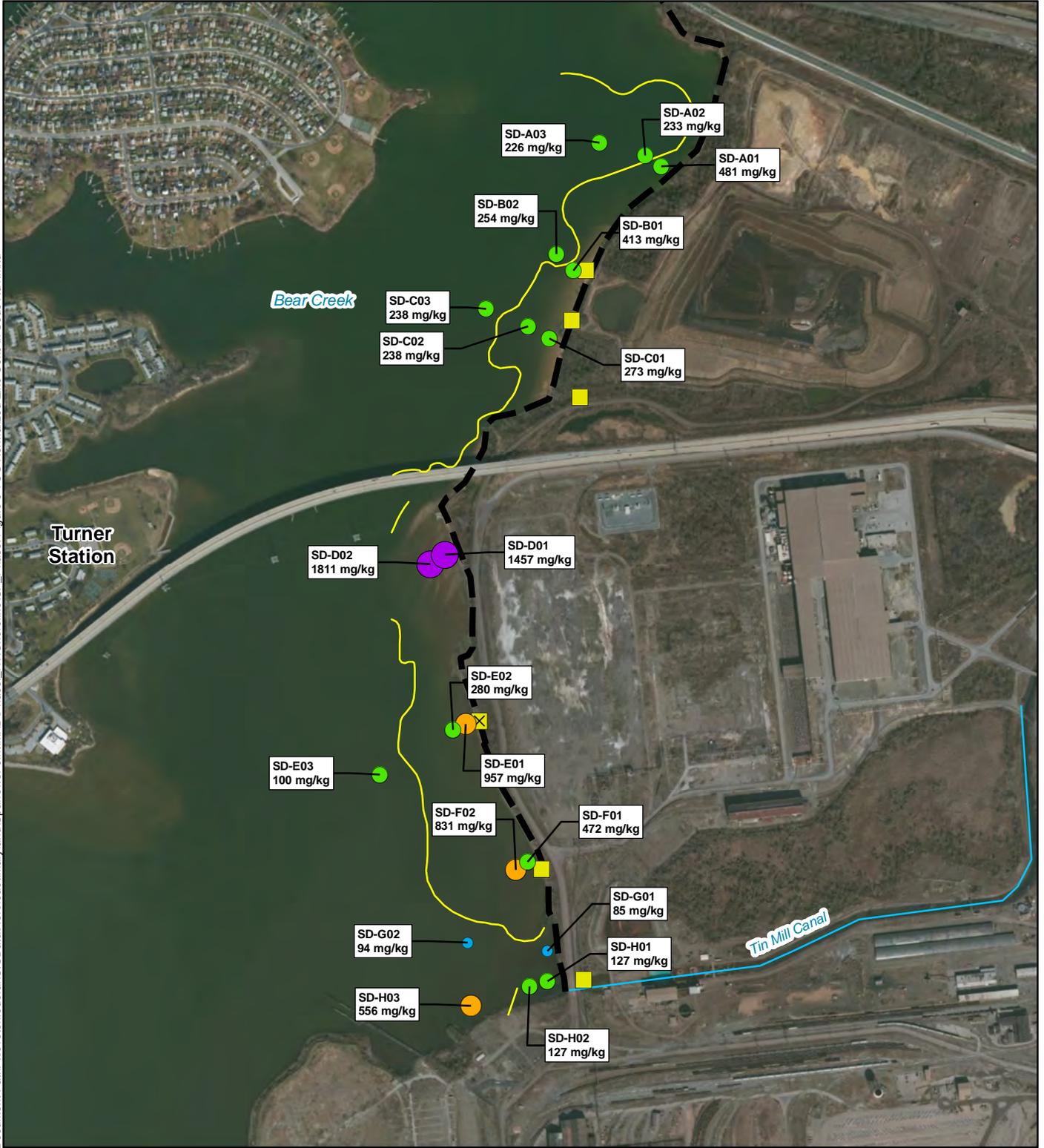
- Phase 1 Northwest Shoreline
  - ~ Perennial Creek/Stream
  - Boundary between Sand and Fine Grained Sediment
  - Approximate Location of Active Stormwater Outfall
  - ⊠ Approximate Location of Inactive Stormwater Outfall
- 
- Nickel in Sediments**
- <5 mg/kg
  - 5-10 mg/kg
  - 10-15 mg/kg
  - >15 mg/kg

Figure 8  
TOC-Normalized Nickel Concentrations  
in Sediments from Round 1 Sampling  
Phase I Northwest Shoreline  
Baltimore, Maryland

Note: Data for each sample were normalized by dividing the data by the Total Organic Carbon concentration in the sample (in g/kg divided by 10).

Map Date: January 2015  
Image Source: ESRI 2011  
Projection: NAD 1983 StatePlane  
Maryland FIPS 1900 (US Feet)





**Legend**

- Phase 1 Northwest Shoreline
  - ~ Perennial Creek/Stream
  - Boundary between Sand and Fine Grained Sediment
  - Approximate Location of Active Stormwater Outfall
  - ⊠ Approximate Location of Inactive Stormwater Outfall
- 
- Zinc in Sediments**
- <100 mg/kg
  - 100-500 mg/kg
  - 500-1,000 mg/kg
  - >1,000 mg/kg

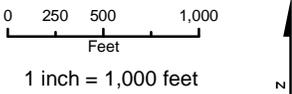
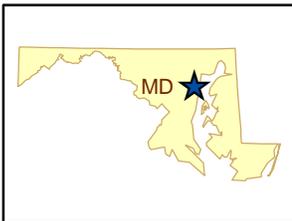
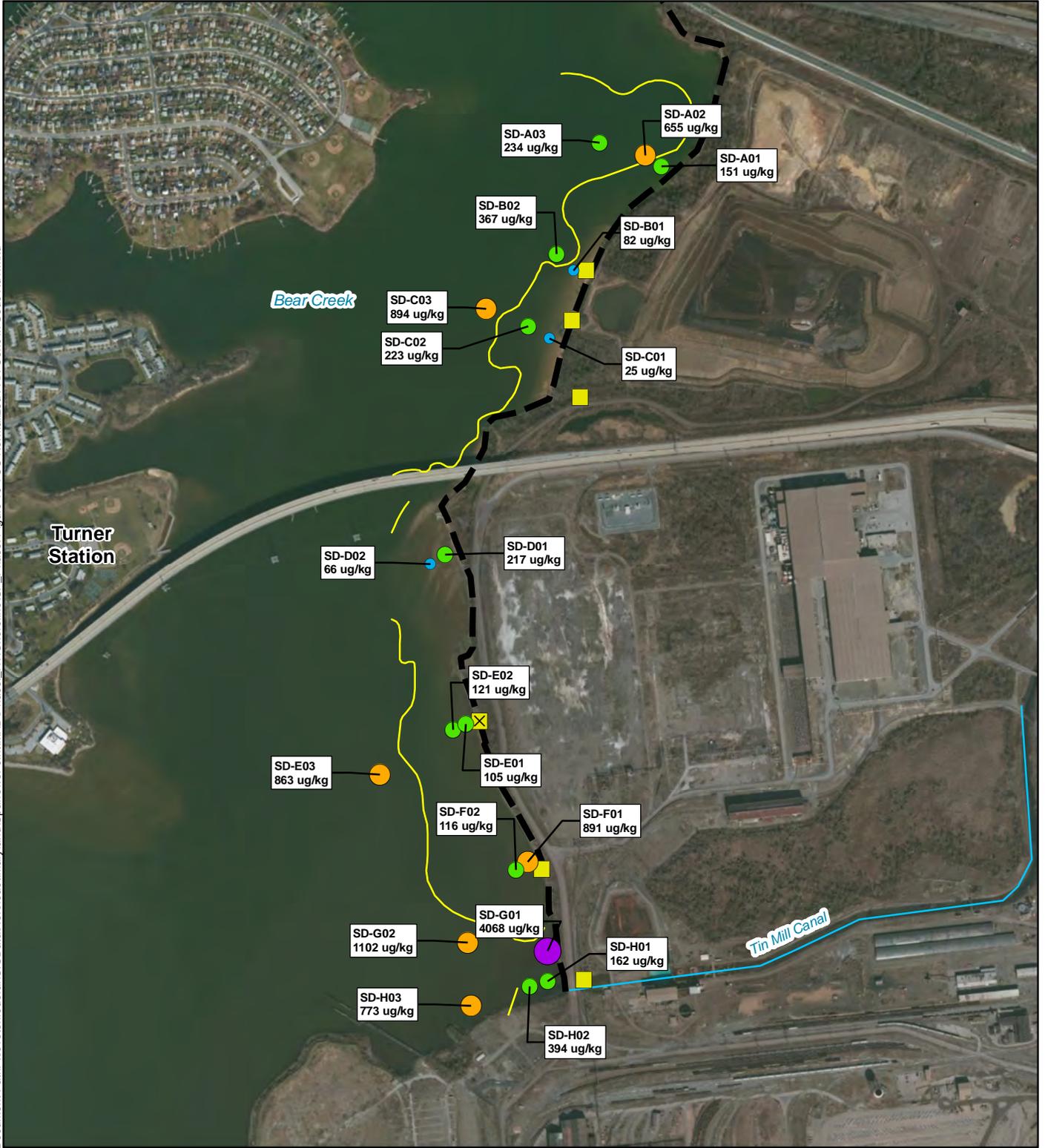
Figure 9  
TOC-Normalized Zinc Concentrations  
in Sediments from Round 1 Sampling  
Phase I Northwest Shoreline  
Baltimore, Maryland

Note: Data for each sample were normalized by dividing the data by the Total Organic Carbon concentration in the sample (in g/kg divided by 10).

Map Date: January 2015  
Image Source: ESRI 2011  
Projection: NAD 1983 StatePlane  
Maryland FIPS 1900 (US Feet)



Document Path: \\lovetofederal\GISData\NorthEast\Maryland\SparrowsPoint\MXD\Phase1\_NWS\Shoreline\SP\_Phase1\Figure 10 TOC Normalized PAH Conc in Seds Rd1.mxd



**Legend**

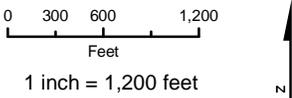
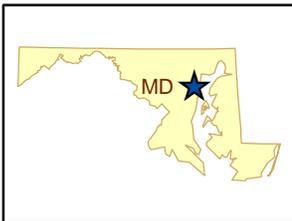
- Phase 1 Northwest Shoreline
  - ~ Perennial Creek/Stream
  - Boundary between Sand and Fine Grained Sediment
  - Approximate Location of Active Stormwater Outfall
  - ⊠ Approximate Location of Inactive Stormwater Outfall
- Total PAH in Sediments**
- <100 ug/kg
  - 100-500 ug/kg
  - 500-1,500 ug/kg
  - >1,500 ug/kg

Figure 10  
TOC-Normalized Total PAH Concentrations  
in Sediments from Round 1 Sampling  
Phase I Northwest Shoreline  
Baltimore, Maryland

Note: Data for each sample were normalized by dividing the data by the Total Organic Carbon concentration in the sample (in g/kg divided by 10).

Map Date: January 2015  
Image Source: ESRI 2011  
Projection: NAD 1983 StatePlane  
Maryland FIPS 1900 (US Feet)





**Legend**

- Phase 1 Northwest Shoreline
- ~ Perennial Creek/Stream
- Boundary between Sand and Fine Grained Sediment
- Round 1 Sediment Sampling Location
- Proposed Surface Sediment Sampling Location
- Proposed Sediment Coring Location
- Proposed Sediment Coring Contingency Location
- ▲ Proposed Pore Water Sampling Location
- ◆ Greys Landfill Well
- ◆ Groundwater Well Sampled in June 2014
- Approximate Location of Active Stormwater Outfall
- ⊗ Approximate Location of Inactive Stormwater Outfall

Figure 11  
Proposed Sampling Locations  
for the Second Round of the  
Offshore Investigation  
Phase I Northwest Shoreline  
Baltimore, Maryland

Map Date: January 2015  
Image Source: ESRI 2011  
Projection: NAD 1983 StatePlane  
Maryland FIPS 1900 (US Feet)



**Table 1. Sampling Locations and Sediment Descriptions, Round 1 Sediment Sampling  
Phase I Offshore Investigation**

Transect	Location	Ponar Replicate	Target Sampling Coordinates (Maryland State Plane North American Datum 1983, feet)		Description
			Northing	Easting	
<b>Sediment Samples</b>					
A	SD-A01	1	574690.52	1457218.52	Tan/brown sand with limited silt; live <i>Rangia</i>
		2	574691.32	1457220.22	
	SD-A02	1	574761.03	1457115.22	Soft black silty clay or clayey silt; natural woody debris; thin RPD
		2	574762.83	1457100.44	
	SD-A03	1	574856.16	1456789.55	Soft black silty clay or clayey silt; thin RPD
		2	574855.50	1456792.20	
3		574860.25	1456784.19		
B	SD-B01	1	573948.43	1456594.99	Medium brown sand with limited silt
	SD-B02	1	574072.49	1456481.57	Soft black silty clay or clayey silt; live <i>Macoma</i>
		2	574064.85	1456482.79	
		3	574066.08	1456475.66	
4	574065.18	1456477.74			
C	SD-C01	1	573470.89	1456425.63	Fine to medium brown sand with silt; live <i>Macoma</i>
		2	573467.02	1456427.87	
	SD-C02	1	573679.97	1455991.59	Soft black sediment; surface mussel bed; rocks
		2	573557.24	1456289.81	
		3	573554.97	1456284.44	
		4	573551.03	1456286.54	
	5	1456284.89	573558.49		
SD-C03	1	573685.25	1455990.90	Black silty clay or clayey silt; diffusional RPD; slight odor and sheen noted	
D	SD-D01	1	571951.83	1455699.33	Brown fine to medium sand with limited silt; live <i>Rangia</i> ; woody debris
	SD-D02	1	571880.12	1455597.76	Brown fine to medium sand with limited silt; live <i>Rangia</i>
		2	571881.24	1455593.22	
E	SD-E01	1	570752.56	1455847.24	Fine to medium brown sand with limited silt; live <i>Rangia</i>
	SD-E02	1	570703.47	1455752.80	Brown fine to medium sand; pebbles; live <i>Rangia</i> ; mussel shell fragments
		2	570699.22	1455751.79	
		3	570703.79	1455755.97	
		4	570701.13	1455756.97	
		5	570701.83	1455752.39	
	6	570701.52	1455750.93		
	SD-E03	1	570393.30	1455242.98	Soft black silty clay or clayey sily; live <i>Macoma</i> ; slight petroleum odor
2		570392.45	1455232.98		
3		570393.77	1455229.48		
F	SD-F01	1	569781.52	1456283.64	Fine to medium brown sand (2-3 inch) at surface; black impacted (oily) sediments at lower depth; live <i>Rangia</i> in clean sediments; shell fragments; clean horizon between two layers
	SD-F02	1	569718.72	1456202.64	Fine to medium brown sand at surface; black impacted silty sediment at depth; live <i>Rangia</i> in clean sediments; clean horizon between two layers.
G	SD-G01	1	569145.01	1456413.15	Diffusional RPD; shells; heavy sheen upon recovery with oily runoff; black silty clay or clayey silt; heavy odor
	SD-G02	1	569208.68	1455854.34	Black silty clay or clayey silt; diffusional RPD; shell fragments; slight sheen
H	SD-H01	1	568923.83	1456418.11	RPD layer; heavy oil based odor; surface sheen on sediments
	SD-H02	1	568894.52	1456300.10	RPD layer; some shells; slight oil based odor and sheen (Note: methane release when weight hit sediment surface)
	SD-H03	1	568750.80	1455879.69	Diffusional RPD; black silty clay or clayey silt; heavy sheen upon recovery and heavy petroleum odor

Notes:  
*Macoma* = genus of clams  
*Rangia* = genus of clams  
 RPD = Redox potential discontinuity (vertical boundary between oxidized and reduced sediments)

**Table 2 Analytical Program for the First Round Sediment Sampling by Transect  
Sparrows Point Offshore Investigation**

Transect	Category	VOCs	PAHs	SVOCs (w/PAHs)	DEHP only	PCBs	Metals	Mercury	Cyanide	Oil & Grease	SEM/AVS	Percent Solids	TOC	Grain Size	Moisture Content
A	non-SW	--	3	--	3	--	3	3	3	--	3	3	3	--	--
B	SW	2	--	2	--	2	2	2	2	2	2	2	2	2	2
C	SW	3	--	3	--	3	3	3	3	3	3	3	3	1 (C-02)	1 (C-02)
D	non-SW	--	2	--	2	--	2	--	2	--	2	2	2	--	--
E	non-SW	--	3	--	3	--	3	--	3	--	3	3	3	3	3
F	SW	2	--	2	--	2	2	2	2	2	2	2	2	--	--
G	SW	2	--	2	--	2	2	2	2	2	2	2	2	--	--
H	SW	3	--	3	--	3	3	3	3	3	3	3	3		
Total		12	8	12	8	12	20	15	20	12	20	20	20	5	5

Notes:

SW = sediment transect located adjacent to an active stormwater outfall

non-SW = sediment transect not located adjacent to an active stormwater outfall

AVS = Acid Volatile Sulfide

DEHP = bis(2-ethylhexyl)phthalate (an SVOC)

PAH = Polycyclic Aromatic Hydrocarbon

PCB = Polychlorinated Biphenyl

SEM = Simultaneously Extracted Metals

SVOC = Semivolatile Organic Compound

TOC = Total Organic Carbon

VOC = Volatile Organic Compound

**Table 3  
Sediment Chemical and Physical Parameters**

ANALYTE	UNITS	AVG RL	SD-B01	SD-B02	SD-C02	SD-E01	SD-E02	SD-E03
<b>Hydrometer Analysis</b>								
GRAVEL	%	---	0	0	28.7	0	1.7	0
SAND	%	---	92.5	22.6	56.6	96.8	83.4	26.3
SILT	%	---	5.4	73.90	10.5	1.8	10	68.2
CLAY	%	---	2.1	3.5	4.2	1.4	4.9	5.6
SILTCLAY	%	---	7.5	77.4	14.7	3.2	14.9	73.8

General Chemistry	UNITS	AVG RL	SD-A01	SD-A02	SD-A03	SD-B01	SD-B02	SD-B02-FD	SD-C01	SD-C02	SD-C03	SD-D01	SD-D02
MOISTURE CONTENT	%	---	---	---	---	36.6	228.7	---	---	49.6	---	---	---
PERCENT MOISTURE	%	0.1	32	66	77	29	76	73	32	42	77	34	27
TOTAL ORGANIC CARBON	MG/KG	2509.1	2700	42000	62000	2400	63000	55000	3100	16000	63000	3500	3700

General Chemistry	UNITS	AVG RL	SD-E01	SD-E02	SD-E03	SD-F01	SD-F01-FI	SD-F02	SD-G01	SD-G02	SD-H01	SD-H02	SD-H03
MOISTURE CONTENT	%	---	29.5	29.1	312.6	---	---	---	---	---	---	---	---
PERCENT MOISTURE	%	0.1	20	35	77	39	33	31	62	75	57	59	74
TOTAL ORGANIC CARBON	MG/KG	2509.1	2,300	5,000	120,000	18,000	20,000	5,900	130,000	180,000	150,000	150,000	180,000

B = compound was detected in the method blank

**Table 4**  
**Concentrations of Inorganic Constituents in Sediment**

ANALYTE	UNITS	AVG RL	SD-A01	SD-A02	SD-A03	SD-B01	SD-B02	SD-B02-FD	SD-C01	SD-C02	SD-C03	SD-D01	SD-D02
ANTIMONY	MG/KG	0.77	0.17	1.500	2.5	0.12 J	2.7	2.5	0.13	0.41	2.6	0.27 B	0.36 B
ARSENIC	MG/KG	0.12	1.8	17	26	1.7	27	24	1.6	7.1	28	4.8	5.4
BERYLLIUM	MG/KG	0.38	0.082	0.72	1	0.053 J	1	0.94	0.056 J	0.24	1	0.15	0.13
CADMIUM	MG/KG	0.42	0.94	5.4	7.1	0.78	9.2	8.3	0.73	3	8.5	4.4	4.8
CHROMIUM	MG/KG	0.77	46 B	400 B	760 B	33 B	790 B	710 B	32 B	130 B	800 B	44 B	170 B
COPPER	MG/KG	1.54	8.7	98.00	160	5.5	160	140	5.6	28	170	11	19
LEAD	MG/KG	1.92	13 B	160 B	240 B	9.7 B	260 B	230 B	11 B	51 B	250 B	16	25
MERCURY	MG/KG	0.04	0.018 J	0.26	0.36	0.0096 J	0.46	0.36	0.0079 J	0.086	0.42	NA	NA
NICKEL	MG/KG	7.10	3.7	30	46	2.2	46	41	2.7	8.6	46	5.5	6.4
SELENIUM	MG/KG	1.92	0.17 J	2.00	2.8	0.12 J	3.1	2.6	0.12 J	0.77	3.1	0.22 J	0.25 J
SILVER	MG/KG	0.38	0.047 J	0.86	1.6	0.026 J	1.7	1.5	0.03 J	0.23	1.7	0.071 J	0.16
THALLIUM	MG/KG	0.38	0.047 J	0.40	0.55	0.033 J	0.58	0.52	0.034 J	0.11	0.54	0.039 J	0.062 J
ZINC	MG/KG	8.36	130 B	980 B	1400 B	99 B	1600 B	1500 B	98 B	380 B	1500 B	510	670

CYANIDE, TOTAL	MG/KG	0.62	0.12 J	0.73 U	1.1 U	0.35 U	1 U	0.95 U	0.37 U	0.36 J	1.5	0.38 U	0.66
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ANALYTE	UNITS	AVG RL	SD-E01	SD-E02	SD-E03	SD-F01	SD-F01-FI	SD-F02	SD-G01	SD-G02	SD-H01	SD-H02	SD-H03
ANTIMONY	MG/KG	0.77	0.27 B	0.22 B	4.1 B	1.1 B	1.1 B	0.68 B	7.8 B	7 B	6.1 B	6.6 B	6.8 B
ARSENIC	MG/KG	0.12	3.5	2.8	25	9.7	10	6.1	17	23	20	23	27
BERYLLIUM	MG/KG	0.38	0.082	0.15	0.92	0.18	0.16	0.13	0.24 J	0.46 J	0.35 J	0.31 J	0.29 J
CADMIUM	MG/KG	0.42	0.97	0.72	5.3	4	4.1	2.5	2.5	5.7	4.9	4.5	45
CHROMIUM	MG/KG	0.77	97 B	66 B	1400 B	530 B	530 B	250 B	800 B	2700 B	1400 B	1700 B	2600 B
COPPER	MG/KG	1.54	9.1	11	190	77	80	29	110	260	180	190	470
LEAD	MG/KG	1.92	16	16	190	110	110	46	67	130	110	120	260
MERCURY	MG/KG	0.04	NA	NA	NA	0.26	0.17	0.072	0.26	0.53	0.38	0.36	0.83
NICKEL	MG/KG	7.10	4.9	5.6	76	19	19	10	63	130	95	120	170
SELENIUM	MG/KG	1.92	0.14 J	0.22 J	2.6	0.54	0.56	0.3 J	6 U	8.7 U	5.2 U	4.9 U	7.7 U
SILVER	MG/KG	0.38	0.063	0.075 J	2.5	1.1	1	0.28	0.89 J	5.4	1.9	2	4.8
THALLIUM	MG/KG	0.38	0.032 J	0.054 J	0.49	0.12	0.11	0.079	0.14 J	0.3 J	0.3 J	0.27 J	0.2 J
ZINC	MG/KG	8.36	220	140	1200	850	850	490	1100	1700	1900	1900	10000

CYANIDE, TOTAL	MG/KG	0.62	0.21 J	0.18 J	7.3	0.4	0.22 J	0.31 J	0.37 J	21	2.8	1.2	12
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**NOTES:** Bold values represent detected concentrations. RL is reported for non-detected constituents

NA = Not Analyzed

RL = reporting limit

B = compound was detected in the method blank

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

**Table 5**  
**Concentrations of Polycyclic Aromatic Hydrocarbons and Oil and Grease in Sediment**

ANALYTE	UNITS	AVG RL	SD-A01	SD-A02	SD-A03	SD-B01	SD-B02	SD-B02-FD	SD-C01	SD-C02	SD-C03	SD-D01	SD-D02
ACENAPHTHENE	UG/KG	399.19	20 U	49 U	300 U	19 U	350 U	310 U	49 U	140 U	360 U	25 U	18 U
ACENAPHTHYLENE	UG/KG	399.19	20 U	<b>76</b>	<b>110 J</b>	19 U	<b>89 J</b>	310 U	49 U	140 U	<b>120 J</b>	25 U	18 U
ANTHRACENE	UG/KG	399.19	20 U	<b>73</b>	<b>79 J</b>	19 U	<b>110 J</b>	310 U	49 U	<b>28 J</b>	<b>140 J</b>	25 U	18 U
FLUORENE	UG/KG	399.19	20 U	<b>29 J</b>	300 U	19 U	350 U	310 U	49 U	140 U	360 U	25 U	18 U
NAPHTHALENE	UG/KG	399.19	<b>8.7 J</b>	<b>200</b>	<b>310</b>	<b>4.1 J</b>	<b>380</b>	<b>330</b>	<b>7.9 J</b>	<b>74 J</b>	<b>560</b>	25 U	<b>4.2 J</b>
PHENANTHRENE	UG/KG	399.19	20 U	<b>120</b>	<b>180 J</b>	19 U	<b>220 J</b>	310 U	49 U	<b>54 J</b>	<b>200 J</b>	25 U	18 U
BENZO[A]ANTHRACENE	UG/KG	399.19	20 U	<b>160</b>	300 U	19 U	<b>280 J</b>	<b>210 J</b>	49 U	140 U	<b>270 J</b>	<b>14 J</b>	18 U
BENZO[A]PYRENE	UG/KG	399.19	20 U	<b>210</b>	300 U	19 U	350 U	<b>380</b>	49 U	140 U	<b>500</b>	25 U	18 U
BENZO[B]FLUORANTHENE	UG/KG	399.19	20 U	<b>310</b>	300 U	19 U	350 U	310 U	49 U	140 U	<b>690</b>	<b>11 J</b>	18 U
BENZO[G,H,I]PERYLENE	UG/KG	399.19	20 U	<b>260</b>	300 U	19 U	350 U	310 U	49 U	140 U	<b>670</b>	25 U	18 U
BENZO[K]FLUORANTHENE	UG/KG	399.19	20 U	<b>110</b>	300 U	19 U	350 U	310 U	49 U	140 U	<b>280 J</b>	25 U	18 U
CHRYSENE	UG/KG	399.19	20 U	<b>210</b>	300 U	19 U	<b>250 J</b>	<b>260 J</b>	49 U	140 U	<b>360</b>	<b>13 J</b>	18 U
DIBENZ(A,H)ANTHRACENE	UG/KG	399.19	20 U	<b>61</b>	300 U	19 U	350 U	310 U	49 U	140 U	360 U	25 U	18 U
FLUORANTHENE	UG/KG	399.19	<b>18 J</b>	<b>410</b>	<b>390</b>	<b>7.7 J</b>	<b>490</b>	<b>430</b>	49 U	<b>110 J</b>	<b>680</b>	<b>22 J</b>	<b>14 J</b>
INDENO[1,2,3-CD]PYRENE	UG/KG	399.19	20 U	<b>250</b>	300 U	19 U	350 U	310 U	49 U	140 U	<b>470</b>	25 U	18 U
PYRENE	UG/KG	399.19	<b>14 J</b>	<b>270</b>	<b>380</b>	<b>7.9 J</b>	<b>490</b>	<b>440</b>	49 U	<b>90 J</b>	<b>690</b>	<b>16 J</b>	<b>6.3 J</b>
TOTAL PAHs ND=0	UG/KG	---	<b>40.7</b>	<b>2,749</b>	<b>1449</b>	<b>19.7</b>	<b>2309</b>	<b>2050</b>	<b>7.9</b>	<b>356</b>	<b>5630</b>	<b>76</b>	<b>24.5</b>

HEM (OIL AND GREASE)	MG/KG	445.4	---	---	---	260 B	12000 B	12000 B	310 B	1600 B	18000 B	---	---
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ANALYTE	UNITS	AVG RL	SD-E01	SD-E02	SD-E03	SD-F01	SD-F02	SD-G01	SD-G02	SD-H01	SD-H02	SD-H03
ACENAPHTHENE	UG/KG	399.19	17 U	26 U	730 U	82 U	48 U	880 U	660 U	1200 U	1200 U	1900 U
ACENAPHTHYLENE	UG/KG	399.19	17 U	<b>8.5 J</b>	<b>320 J</b>	82 U	48 U	880 U	660 U	1200 U	1200 U	1900 U
ANTHRACENE	UG/KG	399.19	17 U	26 U	730 U	82 U	48 U	880 U	660 U	1200 U	1200 U	1900 U
FLUORENE	UG/KG	399.19	17 U	26 U	730 U	82 U	48 U	880 U	660 U	1200 U	1200 U	1900 U
NAPHTHALENE	UG/KG	399.19	17 U	<b>17 J</b>	<b>530 J</b>	<b>34 J</b>	<b>16 J</b>	<b>200 J</b>	<b>430 J</b>	<b>220 J</b>	<b>210 J</b>	<b>4000</b>
PHENANTHRENE	UG/KG	399.19	17 U	26 U	730 U	82 U	48 U	880 U	660 U	1200 U	1200 U	1900 U
BENZO[A]ANTHRACENE	UG/KG	399.19	17 U	26 U	<b>610 J</b>	<b>130</b>	48 U	880 U	<b>2300</b>	1200 U	1200 U	1900 U
BENZO[A]PYRENE	UG/KG	399.19	17 U	26 U	<b>1300</b>	82 U	48 U	880 U	<b>1700</b>	1200 U	1200 U	1900 U
BENZO[B]FLUORANTHENE	UG/KG	399.19	17 U	26 U	<b>1700</b>	82 U	48 U	880 U	660 U	1200 U	1200 U	1900 U
BENZO[G,H,I]PERYLENE	UG/KG	399.19	17 U	26 U	<b>1000</b>	82 U	48 U	880 U		1200 U	1200 U	1900 U
BENZO[K]FLUORANTHENE	UG/KG	399.19	17 U	26 U	<b>280 J</b>	82 U	48 U	880 U	660 U	1200 U	1200 U	1900 U
CHRYSENE	UG/KG	399.19	17 U	26 U	<b>720 J</b>	<b>240</b>	48 U	880 U	<b>2200</b>	1200 U	1200 U	1900 U
DIBENZ(A,H)ANTHRACENE	UG/KG	399.19	17 U	26 U	730 U	82 U	48 U	880 U	660 U	1200 U	1200 U	1900 U
FLUORANTHENE	UG/KG	399.19	<b>17</b>	<b>17 J</b>	<b>1900</b>	<b>450</b>	<b>75</b>	<b>1200</b>	<b>4900</b>	<b>1400</b>	<b>3200</b>	<b>2600</b>
INDENO[1,2,3-CD]PYRENE	UG/KG	399.19	17 U	26 U	730 U	82 U	48 U	880 U	660 U	1200 U	1200 U	1900 U
PYRENE	UG/KG	399.19	<b>7.1 J</b>	<b>18 J</b>	<b>2000</b>	<b>750</b>	<b>140</b>	<b>1000</b>	<b>2800</b>	<b>1300</b>	<b>2500</b>	<b>5000</b>
TOTAL PAHs ND=0	UG/KG	---	<b>24.1</b>	<b>60.5</b>	<b>10360</b>	<b>1604</b>	<b>231</b>	<b>2400</b>	<b>14330</b>	<b>2920</b>	<b>5910</b>	<b>11600</b>

HEM (OIL AND GREASE)	MG/KG	445.4	---	---	---	15000 B	2500 B	89000 B	95000 B	90000 B	110000 B	110000 B
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**NOTES:** Bold values represent detected concentrations. RL is reported for non-detected constituents

**RL** = reporting limit

**J** = compound was detected, but below the reporting limit (value is estimated)

**U** = compound was analyzed, but not detected

**Table 6**  
**Concentrations of Semivolatile Organic Compounds in Sediment**

ANALYTE	UNITS	AVG RL	SD-A01	SD-A02	SD-A03	SD-B01	SD-B02	SD-B02-FD	SD-C01	SD-C02	SD-C03	SD-D01	SD-D02	SD-E01	SD-E02	SD-E03	SD-F01	SD-F01-FD	SD-F02	SD-G01	SD-G02	SD-H01	SD-H02	SD-H03
1,2,4-TRICHLOROBENZENE	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
1,2-DIPHENYLHYDRAZINE(AS AZOBENZENE)	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
2,2'-OXYBIS[1-CHLOROPROPANE]	UG/KG	553.69	---	---	---	19 U	350 U	310 U	49 U	140 U	360 U	---	---	---	---	---	82 U	---	48 U	880 U	660 U	1200 U	1200 U	1900 U
2,4,6-TRICHLOROPHENOL	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
2,4-DICHLOROPHENOL	UG/KG	553.69	---	---	---	19 U	350 U	310 U	49 U	140 U	360 U	---	---	---	---	---	82 U	---	48 U	880 U	660 U	1200 U	1200 U	1900 U
2,4-DIMETHYLPHENOL	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
2,4-DINITROPHENOL	UG/KG	14098.46	---	---	---	480 U	8800 U	7800 U	1200 U	3700 U	9000 U	---	---	---	---	---	2100 U	---	1200 U	22000 U	17000 U	30000 U	31000 U	49000 U
2,4-DINITROTOLUENE	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
2,6-DINITROTOLUENE	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
2-CHLORONAPHTHALENE	UG/KG	553.69	---	---	---	19 U	350 U	310 U	49 U	140 U	360 U	---	---	---	---	---	82 U	---	48 U	880 U	660 U	1200 U	1200 U	1900 U
2-CHLOROPHENOL	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
2-NITROPHENOL	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
3,3'-DICHLOROBENZIDINE	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
4,6-DINITRO-2-METHYLPHENOL	UG/KG	14098.46	---	---	---	480 U	8800 U	7800 U	1200 U	3700 U	9000 U	---	---	---	---	---	2100 U	---	1200 U	22000 U	17000 U	30000 U	31000 U	49000 U
4-BROMOPHENYL PHENYL ETHER	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
4-CHLORO-3-METHYLPHENOL	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
4-CHLOROPHENYL PHENYL ETHER	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
4-NITROPHENOL	UG/KG	14098.46	---	---	---	480 U	8800 U	7800 U	1200 U	3700 U	9000 U	---	---	---	---	---	2100 U	---	1200 U	22000 U	17000 U	30000 U	31000 U	49000 U
BENZIDINE	UG/KG	55369.23	---	---	---	1900 U	35000 U	31000 U	4900 U	14000 U	36000 U	---	---	---	---	---	8200 U	---	4800 U	88000 U	66000 U	120000 U	120000 U	190000 U
BENZOIC ACID	UG/KG	14098.46	---	---	---	480 U *	8800 U *	7800 U *	1200 U *	3700 U *	9000 U *	---	---	---	---	---	2100 U	---	1200 U	22000 U	17000 U	30000 U	31000 U	49000 U
BIS(2-CHLOROETHOXY)METHANE	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
BIS(2-CHLOROETHYL)ETHER	UG/KG	553.69	---	---	---	19 U	350 U	310 U	49 U	140 U	360 U	---	---	---	---	---	82 U	---	48 U	880 U	660 U	1200 U	1200 U	1900 U
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	3981.90	<b>27 J</b>	<b>250 J</b>	2900 U	190 U	<b>910 J</b>	3100 U	490 U	1400 U	3500 U	250 U	<b>29 J</b>	<b>18 J</b>	<b>42 J</b>	<b>3700 J</b>	<b>1600</b>	---	<b>300 J</b>	<b>3300 J</b>	<b>13000</b>	<b>7500 J</b>	<b>3500 J</b>	<b>33000</b>
BUTYL BENZYL PHTHALATE	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
DIETHYL PHTHALATE	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
DIMETHYL PHTHALATE	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
DI-N-BUTYL PHTHALATE	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
DI-N-OCTYL PHTHALATE	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
HEXACHLOROBENZENE	UG/KG	553.69	---	---	---	19 U	350 U	310 U	49 U	140 U	360 U	---	---	---	---	---	82 U	---	48 U	880 U	660 U	1200 U	1200 U	1900 U
HEXACHLOROBUTADIENE	UG/KG	553.69	---	---	---	19 U	350 U	310 U	49 U	140 U	360 U	---	---	---	---	---	82 U	---	48 U	880 U	660 U	1200 U	1200 U	1900 U
HEXACHLOROCYCLOPENTADIENE	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
HEXACHLOROETHANE	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
ISOPHORONE	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
NITROBENZENE	UG/KG	5529.23	---	---	---	190 U	3500 U	3100 U	490 U	1400 U	3500 U	---	---	---	---	---	820 U	---	480 U	8800 U	6600 U	12000 U	12000 U	19000 U
N-NITROSODIMETHYLAMINE	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
N-NITROSODI-N-PROPYLAMINE	UG/KG	553.69	---	---	---	19 U	350 U	310 U	49 U	140 U	360 U	---	---	---	---	---	82 U	---	48 U	880 U	660 U	1200 U	1200 U	1900 U
N-NITROSODIPHENYLAMINE	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
PENTACHLOROPHENOL	UG/KG	2722.54	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	---	240 U	4300 U	3300 U	5800 U	5900 U	9400 U
PHENOL	UG/KG	553.69	---	---	---	19 U	350 U	310 U	49 U	140 U	360 U	---	---	---	---	---	82 U	---	48 U	880 U	660 U	1200 U	1200 U	1900 U

NOTES: Bold values represent detected concentrations. RL is reported for non-detected constituents

RL = reporting limit

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

**Table 7**  
**Concentrations of Polychlorinated Biphenyl Aroclors in Sediment**

ANALYTE	UNITS	AVG RL	SD-B01	SD-B02	SD-B02-FD	SD-C01	SD-C02	SD-C03	SD-F01	SD-F02	SD-G01	SD-G02	SD-H01	SD-H02	SD-H03
PCB-1016	UG/KG	14.77	5.9 U	17 U	15 U	6.1 U	7.2 U	18 U	6.8 U	6 U	22 U	17 U	19 U	20 U	32 U
PCB-1221	UG/KG	14.77	5.9 U	17 U	15 U	6.1 U	7.2 U	18 U	6.8 U	6 U	22 U	17 U	19 U	20 U	32 U
PCB-1232	UG/KG	14.77	5.9 U	17 U	15 U	6.1 U	7.2 U	18 U	6.8 U	6 U	22 U	17 U	19 U	20 U	32 U
PCB-1242	UG/KG	14.77	5.9 U	17 U	15 U	6.1 U	7.2 U	18 U	6.8 U	6 U	22 U	17 U	19 U	20 U	32 U
PCB-1248	UG/KG	14.77	5.9 U	<b>78</b>	<b>130</b>	6.1 U	<b>26</b>	<b>140</b>	<b>1600</b>	<b>190</b>	<b>260</b>	<b>230</b>	<b>680</b>	<b>570</b>	<b>910</b>
PCB-1254	UG/KG	14.77	<b>2.9 J</b>	17 U	15 U	<b>3.7 J</b>	7.2 U	18 U	6.8 U	6 U	22 U	17 U	19 U	20 U	32 U
PCB-1260	UG/KG	14.77	<b>1.9 J</b>	<b>49</b>	<b>84</b>	<b>1.9 J</b>	<b>21</b>	<b>88</b>	6.8 U	6 U	22 U	17 U	19 U	20 U	<b>1000</b>
Total PCBs ND=0	UG/KG	---	4.8	127	214	5.6	47	228	1600	190	260	230	680	570	1910

**NOTES:** Bold values represent detected concentrations. RL is reported for non-detected constituents

**RL** = reporting limit

**J** = compound was detected, but below the reporting limit (value is estimated)

**U** = compound was analyzed, but not detected

**Table 8**  
**Concentrations of Volatile Organic Compounds in Sediment**

ANALYTE	UNITS	AVG RL													
			SD-B01	SD-B02	SD-B02-FD	SD-C01	SD-C02	SD-C03	SD-F01	SD-F02	SD-G01	SD-G02	SD-H01	SD-H02	SD-H03
1,1,1-TRICHLOROETHANE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
1,1,2,2-TETRACHLOROETHANE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
1,1,2-TRICHLOROETHANE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
1,1-DICHLOROETHANE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
1,1-DICHLOROETHENE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
1,2-DICHLOROENZENE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	<b>8.8 J</b>	12 U	12 U	19 U
1,2-DICHLOROETHANE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
1,2-DICHLOROPROPANE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
1,3-DICHLOROENZENE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
1,4-DICHLOROENZENE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
2-CHLOROETHYL VINYL ETHER	UG/KG	26.85	14 U	42 U	37 U	15 U	17 U	43 U	16 U	14 U	26 U	40 U	23 U	24 U	38 U
ACROLEIN	UG/KG	268.46	140 U	420 U	370 U	150 U	170 U	430 U	160 U	140 U	260 U	400 U	230 U	240 U	380 U
ACRYLONITRILE	UG/KG	268.46	140 U	420 U	370 U	150 U	170 U	430 U	160 U	140 U	260 U	400 U	230 U	240 U	380 U
BENZENE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	<b>6.9 J</b>
BROMOFORM	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
BROMOMETHANE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
CARBON TETRACHLORIDE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
CHLOROENZENE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	<b>16 J</b>	12 U	<b>2.4 J</b>	<b>250</b>
CHLORODIBROMOMETHANE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
CHLOROETHANE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
CHLOROFORM	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
CHLOROMETHANE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
CIS-1,3-DICHLOROPROPENE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
DICHLOROBROMOMETHANE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
ETHYLBENZENE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	<b>2.1 J</b>	<b>5.8 J</b>	12 U	12 U	<b>33</b>
METHYLENE CHLORIDE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
TETRACHLOROETHENE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
TOLUENE	UG/KG	13.42	<b>1.7 J B</b>	<b>5.1 J B</b>	<b>4.2 J B</b>	<b>1.9 J B</b>	<b>2.2 J B</b>	<b>5.7 J B</b>	<b>1.8 J</b>	<b>1.6 J</b>	<b>3.6 J</b>	<b>5.3 J</b>	<b>2.6 J</b>	<b>3.3 J B</b>	<b>16 J B</b>
TRANS-1,2-DICHLOROETHENE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
TRANS-1,3-DICHLOROPROPENE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
TRICHLOROETHENE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U
VINYL CHLORIDE	UG/KG	13.42	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	13 U	20 U	12 U	12 U	19 U

NOTES: Bold values represent detected concentrations. RL is reported for non-detected constituents

RL = reporting limit

B = compound was detected in the method blank

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

**Table 9**  
**Acid Volatile Sulfides and Simultaneously Extracted Metals in Sediment**

ANALYTE	UNITS	AVG RL	SD-A01	SD-A02	SD-A03	SD-B01	SD-B02	SD-B02-FD	SD-C01	SD-C02	SD-C03	SD-D01	SD-D02
CADMIUM SEM	UMOL/G	0.00	<b>0.0082</b>	<b>0.034</b>	<b>0.057</b>	<b>0.0072</b>	<b>0.073</b>	<b>0.063</b>	<b>0.0058</b>	<b>0.025</b>	<b>0.07</b>	<b>0.032</b>	<b>0.026</b>
COPPER SEM	UMOL/G	0.03	<b>0.11 B</b>	<b>0.62 B</b>	<b>1.8 B</b>	<b>0.075 B</b>	<b>1.8 B</b>	<b>1.5 B</b>	<b>0.067 B</b>	<b>0.37 B</b>	<b>0.86 B</b>	<b>0.094</b>	<b>0.14</b>
LEAD SEM	UMOL/G	0.01	<b>0.049</b>	<b>0.41</b>	<b>0.79</b>	<b>0.037</b>	<b>0.85</b>	<b>0.73</b>	<b>0.035</b>	<b>0.18</b>	<b>0.84</b>	<b>0.043</b>	<b>0.052</b>
NICKEL SEM	UMOL/G	0.07	<b>0.033</b>	<b>0.26</b>	<b>0.49</b>	<b>0.029</b>	<b>0.5</b>	<b>0.47</b>	<b>0.027</b>	<b>0.13</b>	<b>0.55</b>	<b>0.047</b>	<b>0.047</b>
ZINC SEM	UMOL/G	0.11	<b>2 B</b>	<b>10 B</b>	<b>18 B</b>	<b>1.6 B</b>	<b>21 B</b>	<b>19 B</b>	<b>1.4 B</b>	<b>5.5 B</b>	<b>20 B</b>	<b>5.9</b>	<b>6.2</b>
ACID VOLATILE SULFIDES (AVS)	MG/KG	55	22 U	720	1300	21 U	1200	990	22 U	330	700	23 U	21 U
SEM/AVS RATIO	NONE		NC	<b>0.52</b>	<b>0.54</b>	NC	<b>0.64</b>	<b>0.69</b>	NC	<b>0.6</b>	<b>1</b>	NC	NC

ANALYTE	UNITS	AVG RL	SD-E01	SD-E02	SD-E03	SD-F01	SD-F01-F	SD-F02	SD-G01	SD-G02	SD-H01	SD-H02	SD-H03
CADMIUM SEM	UMOL/G	0.00	<b>0.0071</b>	<b>0.015</b>	<b>0.11</b>	<b>0.085</b>	<b>0.027</b>	<b>0.062</b>	<b>0.072</b>	<b>0.11</b>	<b>0.11</b>	<b>0.1</b>	<b>0.81</b>
COPPER SEM	UMOL/G	0.03	<b>0.078</b>	<b>0.28</b>	<b>4.2</b>	<b>1.7</b>	<b>0.45</b>	<b>1.4</b>	<b>3.6</b>	<b>5</b>	<b>4.7</b>	<b>5.2</b>	<b>7.2</b>
LEAD SEM	UMOL/G	0.01	<b>0.047</b>	<b>0.13</b>	<b>1.5</b>	<b>0.84</b>	<b>0.21</b>	<b>0.62</b>	<b>0.73</b>	<b>1.1</b>	<b>1.1</b>	<b>1.1</b>	<b>2.2</b>
NICKEL SEM	UMOL/G	0.07	<b>0.041</b>	<b>0.13</b>	<b>2.2</b>	<b>0.48</b>	<b>0.14</b>	<b>0.35</b>	<b>2.3</b>	<b>3.5</b>	<b>2.8</b>	<b>3.5</b>	<b>5.6</b>
ZINC SEM	UMOL/G	0.11	<b>2.6</b>	<b>5.1</b>	<b>40</b>	<b>26</b>	<b>9.2</b>	<b>21</b>	<b>37</b>	<b>41</b>	<b>56</b>	<b>46</b>	<b>280</b>
ACID VOLATILE SULFIDES (AVS)	MG/KG	55	19 U	47 U	2700	1000	810	500	1600	1600	1000	1100	470
SEM/AVS RATIO	NONE		NC	NC	<b>0.58</b>	<b>0.92</b>	<b>0.4</b>	<b>1.5</b>	<b>0.87</b>	<b>1</b>	<b>2</b>	<b>1.7</b>	<b>21</b>

**NOTES:** Bold values represent detected concentrations. RL is reported for non-detected constituents

**B** = compound was detected in the method blank

**NC** = not calculated

**RL** = reporting limit

**Table 10 Pore Water Sampling Locations and Rationale**

<b>Location</b>	<b>Associated Monitoring Well(s)</b>	<b>Rationale</b>
A01	GL16, GL02, TS01	Near GL16, GL02, and TS01 well clusters, where copper, nickel, zinc, and bis(2-ethylhexyl)phthalate were identified as groundwater COPCs
B01	GL05, GL15	Near GL05 and GL15 well clusters, where chromium, copper, nickel, zinc, and bis(2-ethylhexyl)phthalate were identified as groundwater COPCs
C01	GL12	Near GL12 well cluster, where mercury, zinc, and bis(2-ethylhexyl)phthalate were identified as groundwater COPCs
D01	RW18-20, TS04	Near RW18, RW19, RW20, and TS04 well clusters, where cadmium, copper, lead, nickel, zinc, cyanide, PAHs, and bis(2-ethylhexyl)phthalate were identified as groundwater COPCs
DE01	RW18-20, TS04	Near RW18, RW19, RW20, and TS04 well clusters, where cadmium, copper, lead, nickel, zinc, cyanide, PAHs, and bis(2-ethylhexyl)phthalate were identified as groundwater COPCs
E01	RW18-20, TS04	South of RW18, RW19, RW20, and TS04 well clusters, where cadmium, copper, lead, nickel, zinc, cyanide, PAHs, and bis(2-ethylhexyl)phthalate were identified as groundwater COPCs
F01	HI08	Near well HI08, where copper, lead, cyanide, PAHs, and bis(2-ethylhexyl)phthalate were identified as groundwater COPCs
F03	HI08	Offshore of well HI08, where copper, lead, cyanide, PAHs, and bis(2-ethylhexyl)phthalate were identified as groundwater COPCs; assess changes in pore water composition with distance from shore and along a depth gradient, relative to F01
F04	HI08	Directly offshore from impacted well HI08, where copper, lead, cyanide, PAHs, and bis(2-ethylhexyl)phthalate were identified as groundwater COPCs

**Table 11 Analytical Program for the Second Round Pore Water Sampling by Transect  
Sparrows Point Offshore Investigation**

Location	PAHs	DEHP	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Cyanide	DOC	Hardness (Ca+Mg)
A01		1			1			1	1		1	1
B01		1		1	1			1	1		1	1
C01		1					1		1		1	1
D01	1	1	1		1	1		1	1	1	1	1
DE01	1	1	1		1	1		1	1	1	1	1
E01	1	1	1		1	1		1	1	1	1	1
F01	1	1			1	1				1	1	1
F03	1	1			1	1				1	1	1
F04	1	1			1	1				1	1	1
Total	6	9	3	1	8	6	1	5	6	6	9	9

Notes:  
 DEHP = bis(2-ethylhexyl)phthalate (an SVOC)  
 DOC = Dissolved Organic Carbon  
 PAH = Polycyclic Aromatic Hydrocarbon

**Table 12 Analytical Summary for the Second Round of Phase I Offshore Sampling**  
**Sparrows Point Offshore Investigation**

<b>Parameter</b>	<b>Method</b>	<b>Sediment Grab Samples</b>	<b>Sediment Core Samples<sup>1</sup></b>	<b>Field Duplicates</b>	<b>Rinsate Blanks</b>	<b>Trip Blanks</b>	<b>Total Sediment<sup>1</sup></b>	<b>Pore Water</b>	<b>Rinsate Blanks</b>	<b>Field Duplicates</b>	<b>Total Pore Water</b>
VOCs	SW846 8260C	--	30	3	3	3	<b>39</b>	--	--	--	--
PPL PAHs	SW846 8270D Low-Level	1	--	--	--	--	<b>1</b>	6	1	1	<b>8</b>
PPL SVOCs (including PAHs)	SW846 8270D Low-Level	--	30	3	3	--	<b>36</b>	--	--	--	--
SVOCs (bis(2-ethylhexyl)phthalate only)	SW846 8270D Low-Level	1	--	--	--	--	<b>1</b>	9	1	1	<b>11</b>
PCB Aroclors	SW846 8082A	--	30	3	3	--	<b>36</b>	--	--	--	--
PPL Metals	SW846 6020A	1	30	3	3	--	<b>37</b>	9	1	1	<b>11</b>
Mercury	SW846 7470A/7471B	--	30	3	3	--	<b>36</b>	1	--	--	<b>1</b>
Cyanide	EPA 9014	1	30	3	3	--	<b>37</b>	6	1	1	<b>8</b>
Oil and Grease	SW846 1664B/9071B	--	30	3	3	--	<b>36</b>	--	--	--	--
SEM/AVS	SW846 6010B/9034	1	10	--	--	--	<b>11</b>	--	--	--	--
Percent Solids	SW846 2540G	1	30	--	--	--	<b>31</b>	--	--	--	--
Total Organic Carbon	Lloyd Kahn	1	30	--	--	--	<b>31</b>	--	--	--	--
Dissolved Organic Carbon	SM 5310C	--	--	--	--	--	<b>--</b>	9	1	1	<b>11</b>

Sample number is approximate, and may change based on field observations. Approximately 12 additional samples may be collected from sediment cores, in addition to those indicated, based on field evidence of contamination along the G and H transects. The quantities of quality control samples will be adjusted as needed to maintain a rate of approximately 10 percent.

Notes:

AVS = Acid Volatile Sulfide

PAH = Polycyclic Aromatic Hydrocarbon

PCB = Polychlorinated Biphenyl

PPL = Priority Pollutant List

SEM = Simultaneously Extracted Metals

SVOC = Semivolatile Organic Compound

VOC = Volatile Organic Compound

**Table 13 Round 2 Sediment Sampling Locations and Rationale**

<b>Transect</b>	<b>Location</b>	<b>Type</b>	<b>Rationale</b>
DE	DE01	Surface Grab	Co-located surface sediment for correlation with pore water
F	F03	Vibracore	Co-located surface sediment for correlation with pore water and horizontal and vertical delineation of contaminated sediments north of the G transect.
	F04	Vibracore	
G	G01	Vibracore	Horizontal and vertical delineation of contaminated sediments along the G and H transects.
	G01.5	Vibracore	
	G02	Vibracore	
	G03	Vibracore	
	G04	Vibracore (contingency)	
	G05	Vibracore (contingency)	
H	H01	Vibracore	
	H02.5	Vibracore	
	H03	Vibracore	
	H04	Vibracore	
	H05	Vibracore (contingency)	
	H06	Vibracore (contingency)	

**Table 14 Analytical Program for the Second Round Sediment Sampling by Transect  
Sparrows Point Offshore Investigation**

Transect	Category	VOCs	PAHs	SVOCs (w/PAHs)	DEHP only	PCBs	Metals	Mercury	Cyanide	Oil & Grease	SEM/AVS	Percent Solids	TOC
<b>Surface Sediment Grab Samples</b>													
DE	non-SW	--	1	--	1	--	1	--	1	--	1	1	1
Total		0	1	0	1	0	1	0	1	0	1	1	1
<b>Sediment Core Samples <sup>1</sup></b>													
F	SW	6	--	6	--	6	6	6	6	6	2	6	6
G	SW	12	--	12	--	12	12	12	12	12	4	12	12
H	SW	12	--	12	--	12	12	12	12	12	4	12	12
Total <sup>2</sup>		30	0	30	0	30	30	30	30	30	10	30	30
<sup>1</sup> Estimates of sample numbers for cores are approximate and are based on an average core depth of 5-6 ft, yielding an average of 3 samples (each on a 2-ft interval) per core. <sup>2</sup> Approximately 12 additional samples may be collected (from up to 4 cores from contingency locations), in addition to the 30 indicated, based on field evidence of contamination along the G and H transects. Notes: SW = sediment transect located adjacent to an active stormwater outfall non-SW = sediment transect not located adjacent to an active stormwater outfall AVS = Acid Volatile Sulfide DEHP = bis(2-ethylhexyl)phthalate (an SVOC) PAH = Polycyclic Aromatic Hydrocarbon PCB = Polychlorinated Biphenyl SEM = Simultaneously Extracted Metals SVOC = Semivolatile Organic Compound TOC = Total Organic Carbon VOC = Volatile Organic Compound													

**ATTACHMENT A  
FIELD LOGBOOK**

17:00 Arrive @ GENT benchmark and  
establish URS - corrected GPS setup  
Trimble SPS 461  
Keynet URS  
HYPACK

Gent Position  $39^{\circ} 28' 38.28085''$  N  
 $76^{\circ} 42' 33.05493''$  W  
State Plane  
Feet  
NAD 83  
 $659560.73$  N  
 $1394427.89$  E

HYPACK Position  $39^{\circ} 28.6380'$  N  
 $76^{\circ} 42.5509'$  W  
 $659560.71$  N  
 $1394428.01$  E  
~~0.6~~ 0.164 ft  
offset

HYPACK Position  $39^{\circ} 28' 38.2818''$  N  
#2  $76^{\circ} 42' 33.0534''$  W  
 $1394428.01$  E  
 $659560.83$  N  
0.153 ft  
offset

18:00 System checks out and do emp.  
Break down and return to office



Continued on Page



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10/10/14

Date

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Date

07:00 Personnel ~~with~~ @ EA Lab in Hunt Valley for final prep work

07:30 Underway to Turner Station Park boat ramp

08:15 Arrive @ Turner Station Park and receive Chesapeake Bay Foundation (CBF) bottles from P. Small.

09:00 and Brandon prepped and labeled

09:35 Underway to Transect A station

Personnel

EA

J. Morris

C. Brown

WK

Overcast

Light southerly wind

Seas ~ 1 ft

09:45 H + S briefing

Justin - Standard approach

- PPE

Christy Brown - Work site

- Emergency Comms.

10:00 Arrive @ Daymark #5 for NAV system verification

10:20 Anchor down at SD-A03

water depth: 11.8 ft

Replicate grab samples

A - soft black silty clay or clayey silt <sup>thin</sup> ~~REP~~ photo

1456789.55 E 574856.16 N

B - soft black silty clay or clayey silt.

1456792.20 E 574855.50 N

C - soft black silty clay or clayey silt.

1456784.19 E 574860.25

Homogenized grab samples and took samples.

2 - 8oz glass

1 - 4oz glass

1 - CBF 2 1/2 quart plastic. photo

Continued on Page \_\_\_\_\_

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10/13/14

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*Justin*

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10/15/14

Date

1115 on site SD-A02  
Water depth: 10.5 ft  
Replicate Grab samples.  
A - no sediment  
B - 50ft black silty clay or clayey silt with natural woody debris, thin FD  
1457100.44 E 574762.83 N photo   
Homogenized sample and prepared jars.  
2 - 8oz glass  
1 - 4oz glass  
1 - CBF 2 1/2 quart plastic photo

1149 on site SD-A01  
Water depth: 5.3 ft  
Replicate Grab samples  
A - ~~gray~~ sand, tan/brown, limited silt, live rangia  
1457218.52 E 574690.52 N  
B - tan/brown sand, limited silt  
1457220.22 E 574691.32 N photo   
homogenized sample - took 2-8oz glass, 1-4oz glass

1210 on site SD-B02  
Water depth: 10.7 ft  
Replicate grab samples  
A - soft black silty clay or clayey silt photo   
live macoma  
1456481.57 E 574072.49 N  
B - no sediment  
C - no sediment  
D - soft black silty clay or clayey silt, live macoma  
1456477.74 E 574065.18 N photo   
homogenized sample  
took SD-B02 took SD-B02-FD took CBF sample  
3 - 4oz glass 3 - 4oz glass 2 1/2 quart plastic  
2 - 8oz glass 1 - 8oz glass  
2 - 16oz glass

Continued on Page \_\_\_\_\_

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1250 on site SD-B01

water depth: 3.8 ft

Replicate grab samples

A - medium brown sand with limited silt  photo

1456594.99 E 573948.43 N

B - medium brown sand with limited silt

1456595.61 E 573955.90 N

Homogenized sample:

took SD-B01

3-4oz glass

2-8oz glass

2-16oz glass

took SD-B01-MS

3-4oz glass

2-8oz glass

took SD-B01-MSD

3-4oz glass

1-8oz glass

1340 offload waste sediment and rinse water at boat ramp  
into drums on truck.

1430 on site SD-C03

water depth: 11.4 ft

Replicate Grab samples

A - little return.

1455990.90 E 573685.25 N

B - Black, diffusal RPD, slight odor, silty clay / clayey silt, firmer than <sup>SD</sup>  photo <sup>start</sup>  silt noted.

1455991.59 E 573679.97 N

Homogenized sample and jarred samples.

collected 3-4oz glass, 2-8oz glass, and 1 CBF- 2 1/2 quart plastic

1450 on site SD-C02

water depth: 5.7 ft

Replicate grab samples

A - soft sediment, rock, mussel bed

1456281.70 E 573553.13 N

B - surface mussel bed with soft sediments

1456289.81 E 573557.24 N  photo

C - surface mussel bed with soft black sediment

1456284.44 E 573554.97 N

D - surface mussel bed with soft sediments

1456286.54 E 573551.03 N

Continued on Page \_\_\_\_\_

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Chucky Brown

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10/15/14

Date

E - Surface mussel bed with soft sediments

1456281.89 E 57355849 N

homogenized sample - shell fragmented silt and clay and pea gravel

this station ~~is~~ corresponds with potential gravel outwash from shoreline.

IT photo of shoreline area.

samples collected

3 - 4oz samples (glass)

2 - 8oz glass

1 - 2 1/2 quart CPF plastic

2 - 16 oz glass (Additional grain size taken at this station)

1530 site SD-C01

water depth: 3.1 ft

Replicate samples

A - fine to medium brown sand with silt

IT photo

1456425.63 E 573470.89

B - Fine to medium brown sand with silt and macoma

1456427.87 E 573467.02

homogenized sample and collected jars

3 - 4oz glass

2 - 8oz glass

1606 pulled boat from water.

offload waste sediment and water into drums on truck.

16:45 Underway to FEA Labs @ Hunt Valley

Continued on Page

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10/13/14

Date

[Signature]

Signed

10/15/14

Date

- 06:30 Personnel meet @ EA Labs in Hunt Valley for daily prep.
- 07:00 Hook up on m/v Brenda and underway to Turner Station Park
- 08:00 Arrive Turner Station Park for loading and prep of m/v Brenda for sampling operations

PersonnelEA

J. Morris  
C. Brown

WX

Clear skies  
SE wind ~ 10 knots  
Sens 1 ft.

H&S Meeting

- sea conditions  
- PPE - boat safety  
- sediment safety

- 0900 Arrive @ Dayman #5 for NAV system verification.

0920 SD-D02

Water depth: 3.1 ft

Replicate grab samples

A - brown fine to medium sand limited silt, live Rangia.

1455597.76 E 571880.12 N

☒ photo on Nikon camera

B - same as above.

1455593.22 E 571881.24 N

homogenized and jarred samples.

1 - 4 oz glass

2 - 8 oz glass

1 - 2 1/2 quart plastic CBF

0950 SD-D01

Water depth: 2.6 ft

Replicate grab samples

A - brown fine to medium sand limited silt, live Rangia, woody debris

1455699.33 E 571951.83 N

☒ photo

homogenized sample and jarred samples.

1 - 4 oz glass

2 - 8 oz glass

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20 SD-E03

Water depth: 10.0 Ft

Replicate Samples (Grab)

A - soft black silty clay or clayey silt, Macoma, slight odor (petroleum)

1455242.98 E 570393.30 N

 photo

B - ponar did not close

C - same as A

1455229.48 E 570393.77 N

Homogenized sediments and jarred samples

2 - 16 oz glass

2 - 8 oz glass

1 - 4 oz glass

1 - 2 1/2 quart plastic CBF

   Three photos of stormwater outfall

1055 SD-E02

Water depth: 4.4 Ft

Replicate grab samples.

A - Brown fine to medium sand, pebbles, live Rangia, shell fragments

1455752.80 E 570763.47 N

B - same as Rep A with some more mussels/shells (but not mussel bed), <sup>slightly more</sup> clay than Rep A

1455751.79 E 570699.22 N

C - grab drained out, saw mussels in grab.

1455755.97 E 576703.79 N

D - same as A

1455756.97 E 570701.13 N

E - same as A

1455752.39 E 570701.83 N

Homogenized sediments and jarred samples.

F - same as A

2 - 16 oz glass

2 - 8 oz glass

1 - 4 oz glass

1 - 2 1/2 quart plastic CBF

1455750.93 E 570701.52 N

 photo of composite before homogen.  
  photo of composite after homogenized.  
  photo of all jars killed

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1155 SD-E01

water depth: 3.4 ft

Replicate grab samples.

A - fine to medium brown sand, limited silt, Rangia.

1455847.24 E 570752.56

photo

Homogenized sediment and jarred samples.

2- 16 oz glass

2- 8 oz glass

1- 4 oz glass

1220 SD-H01

water depth: 3.6 ft

Replicate grab samples:

A: surface oxidized layer (RPD), firmer than upstream, heavy oil based odor  
14564118.11 E 568923.83 N

surface sheen on sed.

homogenized sediment and jarred samples.

photo

2- 8 oz glass

1- 2 1/2 quart plastic CBF

3- 4 oz glass

1255 SD-H02

Water depth: 3.5 methane release when weight hit sed surface.

Replicate grab samples:

A - RPD layer, same as SD-H01 with less of a sheen. slight odor. some shells

1456300.10 E 568894.52 N

photo

Homogenized sediment and jarred samples.

2- 8 oz glass

3- 4 oz glass

1315 SD-G01

Water depth: 3.8 ft

Replicate grab samples

A - heavy sheen upon recovery. shells, diffusional RPD. oily runoff.

black silty clay clayey silt. heavy creosote odor.

photo

1456413.15 E 569145.01 N

Homogenized sediments and jarred.

2- 8 oz glass

3- 4 oz glass

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Date

1345 SD-H03  
 Water depth: 4.8 ft  
 Replicate grab samples.  
 A - heavy sheen on recovery, diffusional RPD, black silty clay/clayey silt, heavy petroleum color  
 1455879.69 E 518750.80 N  
 photo  
 Homogenized sed and jarred samples.  
 3 - 4 oz glass  
 2 - 8 oz glass  
 1 - 2 1/2 quart plastic CBF

1415 offload waste to truck. Met M. Durban who switched out sample coolers and extra bottles.

1610 SD-F01    photos of outfall near "F" stations @ 1513  
 Water depth: 3.4 ft  
 Replicate grab samples:  
 A: Fine to medium brown sand with black <sup>(oily)</sup> impacted sediments at depth, silty sand  
 1456283.64 E ~~518~~ 518781.52 N  photo  
 Homogenized sediment and jarred samples.  
 SD-F01 SD-F01-FD  
 3 - 4 oz 1 - 4 oz  
 2 - 8 oz 1 - 8 oz  
 2-3 inch layer of clean sed over impacted sed.  
 Rangia living in clean sediments.  
 shell fragments.  
 clean horizon between two layers.

Took four photos of the clean/impacted sediment interface.

1546 SD-F02  
 Water depth: 3.7 ft  
 Replicate grab samples: similar to SD-F01  
 A - fine to medium brown sand w/ black impacted <sup>silty</sup> sed at depth. Rangia live on top.  
 1456202.64 E 518716.72 N  photo  photo of interface.  
 Homogenized sample and jarred sample.  
 3 - 4 oz glass  
 2 - 8 oz glass

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 Date

1620 SD-602  
 water depth: 5.7 ft  
 Replicate grab samples:  
 A - black silty clay/clayey silt. Diffusional RPD. shells & fragments. Slight  
 1455854.34 E 569208.68 N photo sinter.  
 Homogenized sediment & jarred sample.  
 3- 4 oz jars  
 2- 8 oz jars  
 1- 2 1/2 quart CBF plastic

1700 pulled boat from water and offloaded waste sediments  
 after taking additional outfall and setup photographs. Prepared  
 boat for towing to office.

1745 Underway to EA labs

1830 Arrive at EA labs/warehouse to drop off boat,  
 secured samples in walk in refrigerator and removed  
 extra equipment from truck.

1915 Personnel left EA.

Continued on Page

Christy Brenn

Signed

10/14/14

Date

Read and Understood By

Signed

10/15/14

Date

**ATTACHMENT B  
PHOTOGRAPHIC LOG**

# Photographic Record

Offshore Shallow Sediment Sampling  
Sparrows Point, MD  
October 2014



Sediment sample from SD-A01



Sediment sample from SD-A02



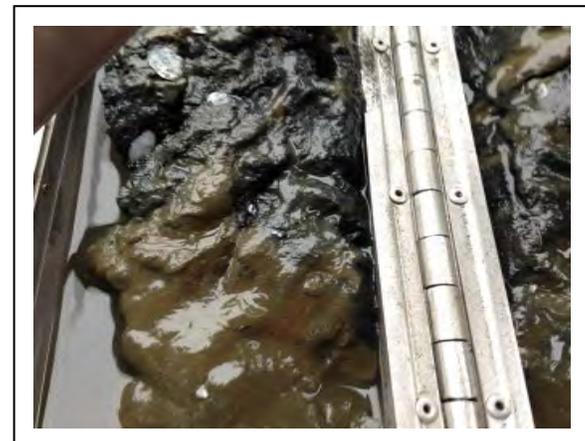
Sediment sample from SD-A03



Sediment sample from SD-B01



Sediment sample from SD-B02, first grab



Sediment sample from SD-B02, second grab

# Photographic Record

Offshore Shallow Sediment Sampling  
Sparrows Point, MD  
October 2014



Shoreline near transect C



Sediment sample from SD-C01



Sediment sample from SD-C02



Sediment sample from SD-C03



Sediment sample from SD-D01



Sediment sample from SD-D02

# Photographic Record

Offshore Shallow Sediment Sampling  
Sparrows Point, MD  
October 2014



Sediment sample from SD-D02



Sediment sample from SD-E01



Sediment sample from SD-E01 (zoomed in view)



Sediment sample from SD-E02



Sediment sample from SD-F01



Sediment interface from SD-F01

# Photographic Record

Offshore Shallow Sediment Sampling  
Sparrows Point, MD  
October 2014



Sediment interface from SD-F01



Sediment interface from SD-F01



Sediment sample from SD-F02



SD-F02 interface



SD-F02 Interface



Sediment sample from SD-G01

# Photographic Record

Offshore Shallow Sediment Sampling  
Sparrows Point, MD  
October 2014



Sediment sample from SD-G01



Sediment sample from SD-G02



Sediment sample from SD-G02



Sediment sample from SD-H01



Sediment sample from SD-H02



Sediment sample from SD-H03

# Photographic Record

Offshore Shallow Sediment Sampling  
Sparrows Point, MD  
October 2014



Sample collected in stainless steel pot



Homogenized sediment sample in stainless steel pot



Homogenized sediment sample



Samples collected for sample location SD-E02



Sampling area with rinsate collection tub



Five gallon buckets for collection of extra volume of sediments to be transferred to 55 gallon drums

# Photographic Record

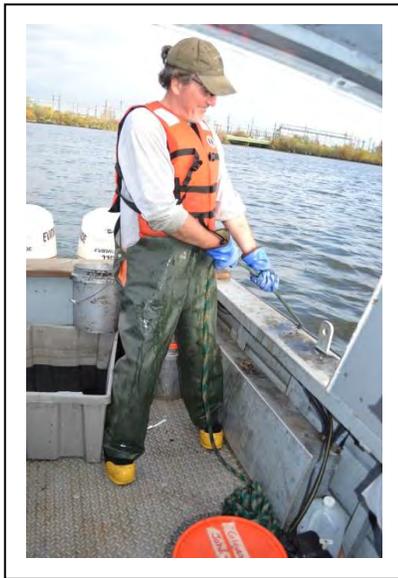
Offshore Shallow Sediment Sampling  
Sparrows Point, MD  
October 2014



Rinsate water collection at back of boat



Ponar deployment



Ponar deployment

**ATTACHMENT C**  
**EPA AND MDE COMMENTS ON THE DRAFT MEMORANDUM**

December 5, 2014 Review of Sparrows Point Offshore Investigation Round 1 Sediment Investigation and Plan for Round 2 Investigation Technical Memorandum dated November 25, 2014

Ruth Prince, Toxicologist  
Land and Chemicals Division  
EPA Region III

Mark Mank, Toxicologist  
Land Management Administration  
Maryland Department of the Environment

EPA and MDE have reviewed the Offshore Investigation Technical Memorandum, and have the following comments on the Plan for Round 2:

First, it is unclear how EA could have formulated plans for additional sediment sampling without screening the initial sediment data. This was, therefore, a deficiency of this Technical Memorandum that the Agencies had to make up for in order to review and comment on the Round 2 locations. Sediment results were initially screened with the BTAG marine sediment screening benchmarks. For final screening, the Probable Effect Concentrations (PECs) were used from *Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems*, MacDonald et al, 2000, Arch. Environ. Contam. Toxicol. 39:20-31. It should be noted that a 1996 MacDonald et al publication for coastal sediment entitled *Development and Evaluation of Sediment Quality Guidelines for Florida Coastal Waters* is available. While these values (which are similar to the 2000 PECs) may be better suited to estuarine sediment, they are not consensus-based and thus are less widely applicable. Therefore, the 2000 consensus-based PECs were used for final screening.

There is no need to revise the Technical Memorandum to demonstrate this screening. Instead, it is recommended that this comment letter be attached to the final Technical Memorandum for documentation purposes. This screening method will be expected in the Offshore Investigation risk assessment.

#### Table 10, Pore Water Sampling Locations and Rationale

The criteria described in this Technical Memorandum for selection of pore water sampling locations includes “locations where sediments were found to be impacted by groundwater COPCs (PAHs, metals, cyanide, bis[2-ethylhexyl]phthalate).” However, there appeared to be no discrimination regarding the particular well contaminant compared to adjacent sediment locations, such that EA proposes to sample all pore water locations for all potential groundwater COPCs. This does not satisfy the goal of this investigation, which is to track contaminants from on-site sources to the offshore environment. In addition, by not screening the sediment results, erroneous statements were made regarding sediment impacts in Table 10.

For proposed pore water locations A02, B01, and C02, there are no groundwater-related sediment PEC exceedances. The wells in these areas (GL16, GL05, and GL12) only had nickel

and bis(2-ethylhexyl)phthalate groundwater exceedances. None of the sediment concentrations approach the sediment bis(2-ethylhexyl)phthalate or nickel PECs. The only sediment location in the near-shore area that approaches the nickel PEC is B02, which is in fine-grained sediment. Therefore, only the B01 sandy location will be retained for pore water sampling, for nickel analysis only.

The proposed pore water locations D01, DE01, and E01 will be acceptable. Wells RW18 - RW20 and TS04 had cadmium, zinc, cyanide and PAH groundwater exceedances. Locations D01 and E01 had elevated TOC-normalized zinc sediment concentrations. These pore water locations will be analyzed for cadmium, zinc, cyanide and PAHs only.

The proposed pore water locations F01 – F03 are acceptable in concept, since the HI08 well cluster has PAH groundwater exceedances, as well as copper, lead, bis(2-ethylhexyl)phthalate and cyanide, and the F01 and FO2 sediment results included elevated TOC-normalized total PAH concentrations. The F01 and F03 locations will be acceptable, but the F02 location will be shifted to directly offshore of the HI08 well cluster, to better capture potential groundwater discharge. These locations will be analyzed for PAHs, bis(2-ethylhexyl)phthalate, copper, lead, and cyanide only.

The proposed pore water location G01 does not appear to be a wise location for pore water sampling. Table 1 of the Technical Memorandum describes the sediment sampled from this location as follows: “heavy sheen upon recovery with oily runoff.” This sample also had 89,000 mg/kg oil and grease. Any attempt to sample pore water in this material will undoubtedly sample some oil directly, which is not a component of groundwater originating from the HI08 well cluster. Therefore, this location will not be acceptable for pore water analysis.

It should be noted that the pore water results may necessitate additional follow-up sampling.

Finally, the December 3<sup>rd</sup> email from EA proposed moving the F01 sandy pore water sampling location out into the fine-grained offshore area to E03 or H03. This will not be acceptable, since the goal is to sample discharging groundwater which is far more likely in near shore sand.

#### Table 12 Round 2 Sediment Sampling Locations and Rationale

As a general statement in reply to the second bullet of the December 3<sup>rd</sup> email from EA and as guidance in Round 2 sediment sampling, additional samples are necessary only when Round 1 results exceed PEC screening levels for site-related COPCs as found in nearby groundwater and stormwater samples. Unfortunately, there are currently no stormwater results to use. Since the Table 12 rationales were not consistent with this procedure, the proposed locations are generally unacceptable and the majority will not be sampled for sediment.

Viewed in combination, the sediment results reveal one area that will require lateral and vertical definition, which is the mouth of Outfall 014, as currently characterized by transects G and H. Although total PAH concentrations did not exceed the sediment PEC at any location, the highest concentrations occurred at these transects, accompanied by extremely high

concentrations of oil and grease, up to 11%. All site-related metals (zinc, cadmium, nickel, copper), cyanide, and bis[2-ethylhexyl]phthalate also exceeded sediment PECs on these transects. While chromium is currently not a site-related COPC, since it is not found in any perimeter wells, the highest chromium sediment concentrations also occurred at transects G and H, possibly representing historical Outfall 014 discharge. The defining characteristic of this area is the very elevated oil and grease, and so oil and grease will also be used as the bounding analyte for lateral and vertical extent. Round 2 sediment samples for this area will include oil and grease, PAHs, bis(2-ethylhexyl)phthalate, metals, and cyanide.

Tables 10 – 12 and Figure 11 should be revised according to the comments above. For Round 2 sediment sampling, Figure 11 should only show the additional sediment sample locations necessary to fill in the Outfall 014 mouth currently characterized by the G and H transects. It is also recommended that the actual field sampling include visual assessment of each sample for oil and grease presence, to be used for both lateral and vertical characterization. This method will reduce, if not eliminate, the need for another round of sediment sampling following Round 2.

Sparrows Point Offshore Investigation Round 1 Sediment Investigation and Plan for Round 2 Investigation: Re-screening based on EA comments emailed 12/9/14  
December 12, 2014

Ruth Prince, Toxicologist  
Land and Chemicals Division  
EPA Region III

Mark Mank, Toxicologist  
Land Management Administration  
Maryland Department of the Environment

This review is in response to the 12/9/14 email from Samantha Saalfield, EA to Ruth Prince, EPA, in which Samantha re-screened the groundwater and sediment data following the process we briefly outlined. She was correct in assuming we originally only considered the groundwater results that exceeded screening criteria by at least 10-fold. This is a common practice to take into account the attenuation and dilution that occurs as groundwater travels through substrate prior to potential discharge to surface waters. Samantha's re-screening took into account all groundwater exceedances since 2009.

In order to apply a more conservative approach, we re-screened the groundwater results at a five-fold factor to take into account attenuation and dilution. Additional screening considerations included excluding prior exceedances if not detected from 2010 – 2014. However, prior exceedances were taken into account if there were no analyses for those chemicals from 2010 – 2014. Also, there were a few instances of including groundwater chemicals that did not exceed screening criteria by five-fold, yet were consistently detected greater than two-fold screening criteria in every sampling event. Sediment PEC exceedances were only identified if the chemical was screened in from nearby groundwater, and if the PEC exceedance was at least two-fold.

Samantha included a screening summary table documenting her re-screening in the 12/9/14 email. Footnotes to this table brought up the following issues. It was noted that there are no sediment PECs for cyanide or DEHP. For cyanide, the only available value is the freshwater sediment BTAG value of 0.1 mg/kg, which is used with great uncertainty. For DEHP, the 1996 MacDonald et al coastal sediment quality guideline reference provides a PEC of 2,647 ug/kg. PAHs were identified as sediment PEC exceedances because it was noted that "at least one PAH exceeded the HHRA screening criteria presented in Appendix E of the Work Plan." However, the only PAHs detected in any well were benzo(a)anthracene, chrysene, and naphthalene. No transect D, E or F sediment concentration for these chemicals exceeded the HHRA screening values in Appendix E.

Below are EPA and MDE's re-screening results compared to Samantha's results.

### Screening Summary Table

Sediment Sample/Associated Wells	Groundwater COPC	Not a Groundwater COPC	Sediment PEC Exceedance
A01-A03 GL16, GL02, TS01	copper, DEHP, nickel, zinc	cyanide, lead, silver, thallium	zinc
B01-B02 GL05, GL15	chromium, copper, DEHP, nickel, zinc	arsenic, lead, silver	chromium, zinc
C01-C03 GL12	DEHP, mercury, zinc	copper, nickel, silver	zinc
D01-D02, E01-E03 RW18-20, TS04	cadmium, copper, cyanide, DEHP, lead, nickel, PAHs, zinc	arsenic	zinc
F01-F02 HI08	copper, cyanide, DEHP, lead, PAHs	chromium, nickel, zinc	----

Based on this re-screening, below is a correction to the Porewater Analytical Summary table included in the 12/9/14 email. Note we prefer the sample label F04 instead of FG01 for the new transect F porewater sample location directly offshore of well HI08.

### Porewater Analytical Summary

Location	Cd	Cr	Cu	CN	DEHP	Hg	Pb	Ni	PAHs	Zn
A01			1		1			1		1
B01		1	1		1			1		1
C01					1	1				1
D01	1		1	1	1		1	1	1	1
DE01	1		1	1	1		1	1	1	1
E01	1		1	1	1		1	1	1	1
F01			1	1	1		1		1	
F03			1	1	1		1		1	
F04			1	1	1		1		1	
Total	3	1	8	6	9	1	6	5	6	6

Please incorporate this information into the revised Technical Memorandum for Round 2 sampling. The Round 2 sediment sampling will not include follow-up to the PEC exceedances shown in the revised Screening Summary Table above. Rather, follow-up sampling for those locations are dependent upon the pore water results.

Finally, EPA and MDE would like to point out that pore water results are often not straight forward. The in situ water quality measurements in Section 5.5.1 of the Work Plan for the Offshore Investigation must show a distinct difference between the pore water samples and surface water samples to demonstrate that discharging groundwater is actually being sampled. Otherwise, it will be assumed that the sample represents surface water.

**From:** [Prince, Ruth](#)  
**To:** [Saalfeld, Samantha](#); [Barbara Brown -MDE-](#); [Fan, Andrew](#); [pizarro, luis](#); [Mark Mank -MDE-](#)  
**Cc:** [Barranco, Frank](#); [Madi Novak](#); [Dan Silver](#)  
**Subject:** RE: Comments on Sparrows Point Trust Off-Shore Work Plan  
**Date:** Tuesday, December 23, 2014 9:57:21 AM

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Hi again Samantha – we found an inconsistency in the sampling tables you emailed to us on 12/18. Table 14 categorizes the G and H transects as SW, which is correct, but does not include all SW analytes (essentially a full scan). The Table 12 Analytical Summary does the same. Please revise.

Ruth Prince, PhD Toxicologist  
3LC10  
Land and Chemicals Division  
U.S. Environmental Protection Agency Region III  
1650 Arch St.  
Philadelphia, PA 19103-2029  
215-814-3118  
[prince.ruth@epa.gov](mailto:prince.ruth@epa.gov)

---

**From:** Prince, Ruth  
**Sent:** Tuesday, December 23, 2014 9:33 AM  
**To:** 'Saalfeld, Samantha'; Barbara Brown -MDE-; Fan, Andrew; pizarro, luis; Mark Mank -MDE-  
**Cc:** Barranco, Frank; Madi Novak; Dan Silver  
**Subject:** RE: Comments on Sparrows Point Trust Off-Shore Work Plan

Hi Samantha – EPA and MDE have one last revision for Round 2. The Agencies would like to see a little more coring for lateral definition of the oil and grease area. Cores should be collected at Fo3 and Fo4 (note Fo1 had an oily black sediment layer with 1.5% oil and grease) instead of the surface grabs. The agencies would also like to see two additional cores midway between Go1 and Go2, and Ho1 and Ho3.

Ruth Prince, PhD Toxicologist  
3LC10  
Land and Chemicals Division  
U.S. Environmental Protection Agency Region III  
1650 Arch St.  
Philadelphia, PA 19103-2029  
215-814-3118  
[prince.ruth@epa.gov](mailto:prince.ruth@epa.gov)

---

**From:** Saalfield, Samantha [<mailto:ssaalfield@eaest.com>]  
**Sent:** Friday, December 19, 2014 11:59 AM  
**To:** Prince, Ruth; Barbara Brown -MDE-; Fan, Andrew; pizarro, luis; Mark Mank -MDE-  
**Cc:** Barranco, Frank; Madi Novak; Dan Silver  
**Subject:** RE: Comments on Sparrows Point Trust Off-Shore Work Plan

Thank you for sending the preliminary comments, Ruth.

The equipment that EA has available is typically only capable of advancing cores to 5-6 ft. In order to achieve a greater depth of coring, we would likely need to obtain a larger boat or barge with a larger vibracorer. This could be done if the findings of the Data Gaps Report indicate that the initial characterization with our equipment does not fully delineate the contamination.

We will plan to deliver the revised Technical Memorandum by next Tuesday if possible.

thanks,  
Samantha

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**From:** Prince, Ruth [<mailto:Prince.Ruth@epa.gov>]  
**Sent:** Friday, December 19, 2014 11:53 AM  
**To:** Saalfield, Samantha; Barbara Brown -MDE-; Fan, Andrew; pizarro, luis; Mark Mank -MDE-  
**Cc:** Barranco, Frank; Madi Novak; Dan Silver  
**Subject:** RE: Comments on Sparrows Point Trust Off-Shore Work Plan

Samantha – one more preliminary comment – EA is proposing a vertical depth of 5-6 ft for the transect G and H characterization. Should we consider having a contingency to extend to a greater depth if visual assessment continues to show obvious oil and grease at 5-6 ft?

Ruth Prince, PhD Toxicologist  
3LC10  
Land and Chemicals Division  
U.S. Environmental Protection Agency Region III  
1650 Arch St.  
Philadelphia, PA 19103-2029  
215-814-3118  
[prince.ruth@epa.gov](mailto:prince.ruth@epa.gov)

---

**From:** Saalfield, Samantha [<mailto:ssaalfield@eaest.com>]  
**Sent:** Thursday, December 18, 2014 10:54 AM  
**To:** Prince, Ruth; Barbara Brown -MDE-; Fan, Andrew; pizarro, luis; Mark Mank -MDE-; Horacio Tablada -MDE-  
**Cc:** Barranco, Frank; Madi Novak; Dan Silver  
**Subject:** RE: Comments on Sparrows Point Trust Off-Shore Work Plan

Hello all -

Attached are the revised sampling tables for pore water and sediment, based on EPA and MDE comments and clarifications received on the draft memo. A figure illustrating the sampling locations is also attached. The pore water and co-located surface sediment sampling locations are as discussed in previous communications. The proposed approach for the subsurface sediment investigation is discussed below.

As shown in the tables, we propose that up to 10 sediment cores be collected from the area of the G and H transects, where high concentrations of oil and grease (up to 11%), observable sheen and petroleum odor, and metals concentrations exceeding sediment PECs were reported in surface sediment. Although the Work Plan indicated that sediment cores, if required, would be collected using manual push cores to a depth of approximately 2 ft, the Round 1 data indicate that deeper delineation is likely necessary to define the extent of contamination in the targeted area.

An electric vibracorer will be deployed from a 28-ft aluminum-hull survey and research vessel and used to advance cores to a penetration depth of 5 to 6 feet below the sediment-water interface or refusal. Cores will be split, described and photographed, and sediment sub-samples will be generated based on 2-foot intervals below the sediment-water interface (0-2 ft, 2-4 ft, 4-6 ft, etc.). Each interval will be homogenized using decontaminated stainless steel mixing equipment and transferred to pre-cleaned jars for analytical testing.

Cores from locations G01, G02, H01, and H03 will be collected and sampled first, followed by cores from locations G03 and H04. If no contamination (sheen or petroleum odor) is apparent in cores G03 and H04 (at the edge of the subaqueous survey area), then these cores will also be sampled for laboratory analyses as described above, and no more cores will be collected. The absence of contamination at these locations will be interpreted as the western limit of oil and grease impacts. However, if contamination is apparent in these cores, they will be logged, described, and retained but not sampled, and cores will be advanced at step-out locations G04 and H05. If no contamination (obvious sheen or petroleum odor) is apparent in these cores, then these cores will also be sampled at the described intervals, and no additional step-out cores will be collected. If contamination is apparent in cores from G04 and H05, these cores will be logged, described, and retained but not sampled, and step-out cores will be advanced at locations G05 and H06. If these step-out locations are advanced, the cores from G05 and H06 will be sampled on the intervals described above, regardless of the presence or absence of contamination. Thus, up to ten cores may be collected, but only six cores will be sampled for laboratory analyses. Because oil and grease impacts are readily apparent, field observations will be used to delineate impacts in the absence of analytical data. For planning purposes, it is assumed that an average of three samples will be collected from each core.

Note that the contingency step-out locations (G04, G05, H05, H06) would extend the delineation to approximately 2,000 offshore from the Phase I area. If this coring effort does not achieve delineation, EA would need to discuss further expansion of the investigation area and/or whether use of a barge with larger vibracorer to obtain deeper cores. Additionally, we targeted the coring

locations on the G and H transects, as requested in the EPA and MDE comments on the draft memo. However, petroleum odor was noted during sampling of location E03 (the only other fine-grained sediment location sampled in the southern area during Round 1). Based on this, it is possible that the oil and grease contamination extends north toward the Key Bridge.

Please let us know if the plans for pore water and co-located surface sediment grab samples (as discussed previously) are acceptable, and whether you would recommend any revisions to the proposed approach to sediment coring.

We are planning to begin sampling as soon as December 27, so are hoping to have by then an approved sampling approach as well as CBF feedback on where they require samples.

thank you,  
Samantha

Review of Sparrows Point Offshore Investigation Revised December 30, 2014 Technical Memorandum Round 1 Sediment Investigation and Plan for Round 2 Investigation  
January 2, 2015

Ruth Prince, Toxicologist  
Land and Chemicals Division  
EPA Region III

Mark Mank, Toxicologist  
Land Management Administration  
Maryland Department of the Environment

1. Results, p. 4

The paragraph on PAHs does not include complete information on the odor and sheen results, only highlighting samples E03, G02, and H03. Please revise to include that G01, H01, and H03 had heavy petroleum odor, H02 and G02 had slight sheen and no odor, and E03 had a slight odor with no sheen.

2. Proposed Sampling Plan for Round 2 Sampling, Pore Water, p. 5 and Table 10

The second bulleted criterion listed in this section for pore water selection is incorrect. Only groundwater results exceeding screening criteria were considered in pore water location and COPC selection. The criterion stated here for sediment PEC exceedances applies to potential future sediment characterization only, pending stormwater and/or pore water results that indicate the site is a source of that chemical. Please correct this section and Table 10 accordingly. Also, for transparency purposes, please include in this section the groundwater screening information provided in the December 12 EPA and MDE comments regarding how groundwater results over time were handled.

3. Proposed Sampling Plan for Round 2 Sampling, Pore Water, p. 6, and Figures 8, 9, and 10

The top paragraph on this page describing the TOC-normalized sediment results illustrated in Figures 8, 9, and 10 was not actually utilized to select pore water sample locations and so is not relevant to this section. This paragraph may be moved to the Results section.

4. Proposed Sampling Plan for Round 2 Sampling, Sediment, p. 6 - 7

- a) This section states on p. 6 that the rationale for sediment sampling locations is in Table 12. Please revise to correct to Table 13.
- b) On p. 7, this section states that sampling will not occur in cores G03 and H04, and G04 and H05, if contamination is apparent, and instead they will be described and retained. However, since the goal of Round 2 sediment sampling is delineating the lateral and vertical extent of the transect G-H contamination, it would appear that sampling and analysis of these cores should they be visually contaminated would be useful. Please revise accordingly.
- c) On p. 7, this section states that parameters to be analyzed in the sediment core samples were selected based on the primary contaminants identified in the area of the G and H

transects in Round 1. Please revise to add that parameters were also selected based upon potential historical Tin Mill Canal releases.

5. All Site Figures

The site figures all label the Tin Mill Canal as Humphrey's Creek. Please revise to correctly label the Tin Mill Canal.

**From:** [Prince, Ruth](#)  
**To:** [Saalfield, Samantha](#); [Barranco, Frank](#); [Barbara Brown -MDE-](#); [Fan, Andrew](#); [pizarro, luis](#); [Mark Mank -MDE-](#)  
**Cc:** [Madi Novak](#); [Dan Silver](#); [Morris, John](#); [Corum, Sanita](#)  
**Subject:** RE: Comments on Sparrows Point Trust Off-Shore Work Plan  
**Date:** Tuesday, January 13, 2015 10:20:23 AM

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Hi Samantha – I think I may be over-thinking at this point, and we haven't established any action levels. See my strikethrough below, let's just leave it that for cores with no observable impacts, only the surface interval and the interval directly below that will be analyzed.

Please go ahead and send the revised memo.

Ruth Prince, PhD Toxicologist  
3LC10  
Land and Chemicals Division  
U.S. Environmental Protection Agency Region III  
1650 Arch St.  
Philadelphia, PA 19103-2029  
215-814-3118  
[prince.ruth@epa.gov](mailto:prince.ruth@epa.gov)

---

**From:** Saalfield, Samantha [mailto:[ssaalfield@eaest.com](mailto:ssaalfield@eaest.com)]  
**Sent:** Tuesday, January 13, 2015 10:02 AM  
**To:** Prince, Ruth; Barranco, Frank; Barbara Brown -MDE-; Fan, Andrew; pizarro, luis; Mark Mank -MDE-  
**Cc:** Madi Novak; Dan Silver; Morris, John; Corum, Sanita  
**Subject:** RE: Comments on Sparrows Point Trust Off-Shore Work Plan

Ruth –

Thank you for your reply. The revised language below reflects your requested change. It may also be worth creating a flow chart to convey the various analytical scenarios.

Samantha

An electric vibracorer will be deployed from a 28-ft aluminum-hull survey and research vessel and used to advance cores to a penetration depth of 5 to 6 feet below the sediment-water interface or refusal. Upon recovery, the cores will be held at 4°C, transferred to a processing facility, then split, described and photographed. Any observable impacts (sheen and/or odor) will be assessed and recorded. Generally, sediment sub-samples will be generated based on 2-foot intervals below the sediment-water interface (0-2 ft, 2-4 ft, 4-6 ft, etc.). A surface interval sample from every core will be submitted for analysis. **If a core has no observable impacts, then the next deeper interval (2-4 ft) will also be submitted for**

analysis, and the lower intervals will be submitted to the laboratory for possible contingency analysis. If the 2-4 ft interval is found through laboratory analyses to contain one or more contaminants at concentrations exceeding action levels, then the lower intervals will also be analyzed; if laboratory analyses indicate that the 2-4 ft interval does not exceed action levels, then the bottom intervals will not be analyzed. (Note that under a scenario in which the bottom intervals are analyzed on a timeframe that exceeds holding times for one or more analyses, affected analyses will not be performed. This is not expected to affect Oil and Grease, which has a 28 day holding time.) Alternatively, if multiple intervals in the middle and bottom portions of a core contain observable impacts, then only the lowest of the impacted intervals, and any un-impacted intervals below the lowest impacted interval, will be sampled for laboratory analysis. Each interval will be homogenized using decontaminated stainless steel mixing equipment and transferred to pre-cleaned, 8 ounce jars for analytical testing.

---

**From:** Prince, Ruth [<mailto:Prince.Ruth@epa.gov>]

**Sent:** Tuesday, January 13, 2015 9:01 AM

**To:** Saalfeld, Samantha; Barranco, Frank; Barbara Brown -MDE-; Fan, Andrew; pizarro, luis; Mark Mank -MDE-

**Cc:** Madi Novak; Dan Silver; Morris, John; Corum, Sanita

**Subject:** RE: Comments on Sparrows Point Trust Off-Shore Work Plan

Hi Samantha – the new text below includes “Additionally, if a core has no observable impacts, all intervals will be submitted for analysis.” Analyzing the potential three intervals for bounding purposes does not seem necessary. Instead, the surface interval and interval directly below that should first be analyzed for delineation purposes. The lowest interval can be retained for potential analysis should unexpected contamination be found in the lower interval.

Ruth Prince, PhD Toxicologist

3LC10

Land and Chemicals Division

U.S. Environmental Protection Agency Region III

1650 Arch St.

Philadelphia, PA 19103-2029

215-814-3118

[prince.ruth@epa.gov](mailto:prince.ruth@epa.gov)

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**From:** Saalfeld, Samantha [<mailto:ssaalfeld@eaest.com>]

**Sent:** Friday, January 09, 2015 2:56 PM

**To:** Prince, Ruth; Barranco, Frank; Barbara Brown -MDE-; Fan, Andrew; pizarro, luis; Mark Mank -MDE-

**Cc:** Madi Novak; Dan Silver; Morris, John; Corum, Sanita

**Subject:** RE: Comments on Sparrows Point Trust Off-Shore Work Plan

Ruth –

We have revised the description of sediment core sampling in the memo, in accordance with your comments. The revised text is below. Highlighted portions were added or substantially changed.

Please let us know if this revised text is acceptable, and we will issue the revised memo.

thank you,  
Samantha

Revised text:

An electric vibracorer will be deployed from a 28-ft aluminum-hull survey and research vessel and used to advance cores to a penetration depth of 5 to 6 feet below the sediment-water interface or refusal. Upon recovery, the cores will be held at 4°C, transferred to a processing facility, then split, described and photographed. **Any observable impacts (sheen and/or odor) will be assessed and recorded.** Generally, sediment sub-samples will be generated based on 2-foot intervals below the sediment-water interface (0-2 ft, 2-4 ft, 4-6 ft, etc.). **A surface interval sample from every core will be submitted for analysis. Additionally, if a core has no observable impacts, all intervals will be submitted for analysis. However, if there are multiple impacted intervals in the middle and bottom portions of a core, then only the lowest of the impacted intervals, and any un-impacted intervals below the lowest impacted interval, will be sampled for laboratory analysis. Each interval will be homogenized using decontaminated stainless steel mixing equipment and transferred to pre-cleaned, 8 ounce jars for analytical testing.**

Cores from locations F03, F04, G01, G01.5, G02, H01, H02.5, and H03 will be collected and sampled first, followed by cores from locations G03 and H04. If no contamination (sheen or petroleum odor) is apparent in cores G03 and H04 (at the edge of the subaqueous survey area), then no more cores will be collected. However, if contamination is apparent in these cores, cores will be advanced at locations G04 and H05, and **these cores will be sampled as described above.** If no contamination (obvious sheen or petroleum odor) is apparent in these cores, then no more cores will be collected. If contamination is apparent in cores from G04 and H05, then cores will be advanced at locations G05 and H06, and **all four of these cores will be sampled as described above.** Thus, up to 14 cores may be collected and sampled. For planning purposes, it is assumed that an average of three samples will be collected from each core; **however, as described above, fewer samples may be required if contamination is observed in multiple intervals in the cores.**

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**From:** Prince, Ruth [<mailto:Prince.Ruth@epa.gov>]

**Sent:** Wednesday, January 07, 2015 2:14 PM

**To:** Saalfeld, Samantha; Barranco, Frank; Barbara Brown -MDE-; Fan, Andrew; pizarro, luis; Mark Mank -MDE-

**Cc:** Madi Novak; Dan Silver; Morris, John; Corum, Sanita

**Subject:** RE: Comments on Sparrows Point Trust Off-Shore Work Plan

Hi Samantha – the responses are acceptable excepting of course 4(b).

We would still like the surface interval only analyzed for those potential interim contaminated core locations. It also does not seem necessary to assume that every core will require three intervals for analyses. For delineation purposes, if the middle interval of the core has observable sheen/odor, then analysis of that interval does not really provide any necessary information, since the lowest interval would then be analyzed for vertical delineation. Analysis of mid-core contamination would not provide us information necessary for either risk assessment or vertical delineation, so we recommend elimination of those proposed analyses.

Ruth Prince, PhD Toxicologist  
3LC10  
Land and Chemicals Division  
U.S. Environmental Protection Agency Region III  
1650 Arch St.  
Philadelphia, PA 19103-2029  
215-814-3118  
[prince.ruth@epa.gov](mailto:prince.ruth@epa.gov)

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**From:** Saalfeld, Samantha [<mailto:ssaalfeld@eaest.com>]  
**Sent:** Wednesday, January 07, 2015 12:59 PM  
**To:** Prince, Ruth; Barranco, Frank; Barbara Brown -MDE-; Fan, Andrew; pizarro, luis; Mark Mank - MDE-  
**Cc:** Madi Novak; Dan Silver; Morris, John; Corum, Sanita  
**Subject:** RE: Comments on Sparrows Point Trust Off-Shore Work Plan

Below are our responses to the EPA and MDE comments provided last Friday. If you can provide feedback this week, that would be much appreciated. When we have concurrence, we will issue another revised version of the memo.

thank you,  
Samantha

Responses to EPA and MDE Comments Provided on 2 January 2015

1. The referenced paragraph has been revised as requested, to reflect all reported occurrences of sheen and/or odor in the Round 1 sediment samples.
2. The second bulleted criterion listed for the selection of pore water sampling locations has been removed, and references to sediment results have been removed from Table 10. Text has been added to the first bulleted criterion, regarding how groundwater results over time were handled in the screening.
3. The paragraph regarding TOC-normalized sediment results has been moved to the Results

section.

4. a. The text has been corrected to reference Table 13.
  - b. Oil and grease contamination is observable in the field, as was confirmed during Round 1. All samples with a detected concentration of oil and grease exceeding 1.5% were observed to have an observed sheen and/or odor. Given that oil and grease has been identified as the bounding analyte for lateral and vertical extent, and given that the primary goal of the coring is to support selection of remedial options in the future CMS, the sampling plan for the sediment cores has been designed to omit laboratory analysis of sediment that is observed in the field to be contaminated with oil and grease. Therefore, we propose that if cores G03, H04, G04, and/or H05 are found to be visually contaminated, it is not necessary to sample these cores for laboratory analysis in order to meet the goals of the delineation. An additional rationale for omitting analyses of samples from sediment cores at locations exhibiting visual signs of oil and grease relates to cost savings and budgetary limitations.
  - c. The referenced sentence was revised to indicate that parameters for sediment analysis were also selected based upon potential historical Tin Mill Canal releases.
5. The site figures have been revised by replacing the “Humphrey’s Creek” label with a “Tin Mill Canal” label.

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**From:** Prince, Ruth [<mailto:Prince.Ruth@epa.gov>]

**Sent:** Friday, January 02, 2015 10:39 AM

**To:** Barranco, Frank; Barbara Brown -MDE-; Fan, Andrew; pizarro, luis; Mark Mank -MDE-

**Cc:** Madi Novak; Dan Silver; Saalfield, Samantha; Morris, John; Corum, Sanita

**Subject:** RE: Comments on Sparrows Point Trust Off-Shore Work Plan

Hi Frank – attached please find EPA and MDE review comments on the revised Technical Memo. We will be available next week with the exception of Monday should you have any questions.

Ruth Prince, PhD Toxicologist  
3LC10  
Land and Chemicals Division  
U.S. Environmental Protection Agency Region III  
1650 Arch St.  
Philadelphia, PA 19103-2029  
215-814-3118  
[prince.ruth@epa.gov](mailto:prince.ruth@epa.gov)

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**From:** Barranco, Frank [<mailto:fbarranco@eaest.com>]

**Sent:** Tuesday, December 30, 2014 2:05 PM

## Saalfield, Samantha

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**From:** Barbara Brown -MDE- <barbara.brown1@maryland.gov>  
**Sent:** Wednesday, January 14, 2015 2:46 PM  
**To:** Saalfield, Samantha  
**Cc:** Prince, Ruth; Barranco, Frank; Fan, Andrew; pizarro, luis; Mark Mank -MDE-; Madi Novak; Dan Silver; Morris, John; Corum, Sanita  
**Subject:** Re: Comments on Sparrows Point Trust Off-Shore Work Plan

Hello Samantha

EPA and MDE have reviewed the Jan 13 revised work plan and it is approved with the following revisions:

1. Pg. 4, Results – Please delete the last sentence in the PAH paragraph regarding the correlation of high PAH concentrations with oil and grease concentrations exceeding 80,000 mg/kg. A review of the PAH results shows that those “high” concentrations are actually a broad range - 2,400 to 14,330 ug/kg – the lower end of which also occurs with low concentrations of oil and grease.
2. Pg. 5, Results – Please revise Humphrey’s Creek in the last paragraph to Tin Mill Canal.

Please provide a final version with the corrections both electronically and in hard copy to the Agencies.

Once MDE receives the final version we will provide to CBF for them to determine in a reasonable period of time if they wish to split soil or pore water samples.

If you have any questions please contact either Andrew Fan, EPA region III or myself

Regards

Barbara Brown

MDE Project Coordinator

On Tue, Jan 13, 2015 at 1:50 PM, Saalfield, Samantha <[ssaalfield@eaest.com](mailto:ssaalfield@eaest.com)> wrote:

Thank you, Ruth.

Attached is the revised memo, reflecting all revisions required based on EPA and MDE comments.